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January 26, 2009

File No. 036182-0005

**VIA HAND DELIVERY AND U.S. MAIL**

Dr. Richard Wright
Chairman
San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, CA. 92123-4340

Re: February 11, 2009 San Diego Regional Board Meeting, Item 6 - Poseidon Resources Corporation, Proposed Carlsbad Desalination Project (Order No. R9-2006-0065, NPDES No. CA0109223)

Dear Chairman Wright:

On behalf of the Poseidon Resources Corporation, we are submitting the enclosed public comment ("Comment Letter") to the California Regional Water Quality Control Board, San Francisco Bay Region ("RWQCB") and Appendix, in response to the RWQCB's January 2, 2009 Notice of Public Hearing, Item 6 – Poseidon Resources Corporation, Proposed Carlsbad Desalination Project. Additional copies of the Comment Letter and Appendix follow via hand delivery. Supporting Declarations by Peter MacLaggan, David Mayer, Dr. Scott Jenkins, and Chris Nordby will arrive under separate cover.

We respectfully request that the Comment Letter, Appendix, and other materials submitted under separate cover, be given appropriate consideration, be placed in the administrative record and be maintained in RWQCB's records.

2009 JAN 29 P 4:51

SAN DIEGO REGIONAL
WATER QUALITY
CONTROL BOARD

Sincerely,

Amanda Halter
of LATHAM & WATKINS LLP

Enclosures

SAN DIEGO REGIONAL
WATER QUALITY
CONTROL BOARD

2009 JAN 26 P 3:54

# COMMENTS ON CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD'S REVIEW OF POSEIDON RESOURCES CORPORATION'S MARINE LIFE MITIGATION PLAN FOR COMPLIANCE WITH RESOLUTION NO. R9-2008-0039

Submitted by:

Date: January 26, 2009

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ORIGINAL

On behalf of Poseidon Resources Corporation ("Poseidon"), we appreciate the opportunity to submit public comment to the California Regional Water Quality Control Board, San Diego Region ("Regional Board"), in preparation for the Regional Board's February 11, 2009 meeting, where it will consider whether Poseidon's Marine Life Mitigation Plan[1] ("MLMP") meets the requirements of Resolution No. R9-2008-0039 (the "April Resolution")[2]. The MLMP supplements and amends Poseidon's *Flow, Entrainment and Impingement Minimization Plan* ("Minimization Plan"), which the Regional Board conditionally approved on April 9, 2008.

## I. EXECUTIVE SUMMARY

The MLMP presents the culmination of a comprehensive, interagency planning process involving extensive scientific study and public involvement aimed to ensure that potential entrainment and impingement ("E&I") impacts to marine resources from the proposed Carlsbad Desalination Project (the "Project") will be mitigated. The California Coastal Commission already has evaluated these very same impacts and has determined that:

> **"implementation of the [Marine Life Mitigation] Plan will ensure the project's entrainment-related impacts will be fully mitigated and will enhance and restore the marine resources and biological productivity of coastal waters . . . ."** (Emphasis in original.)[3]

In its current form before the Regional Board providing for up to 55.4 acres of wetlands in two phases, the MLMP contains a much more developed and robust mitigation proposal than the one for 37 acres presented in the Minimization Plan considered by the Regional Board in April 2008. In April 2008, the Regional Board directed Poseidon to subject its mitigation planning to an interagency process, which had a significant positive influence on the plan. The term "MLMP" was coined by the Coastal Commission, which ordered its preparation in November 2007 as a condition of the coastal development permit for the Project. Poseidon submitted the MLMP to Coastal Commission staff on July 3, 2008, which distributed it to other interested state and federal agencies for comment, including the Regional Board. After receiving

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1 Appendix A, Tab 1.

2 We respectfully request that these public comments, and related expert reports, appendices, and attachments submitted under separate cover be given appropriate consideration, be placed in the administrative record for Resolution No. R9-2008-0039 and the related NPDES Permit for the Carlsbad Desalination Project, Order No. R9-2006-0065, NPDES No. CA0109223, and be maintained in the agency's records.

In addition, the Regional Board should be aware that it has all of the correspondence and data cited herein in its possession currently but that certain items have been reproduced in the appendices to this letter for ease of reference.

3 California Coastal Commission Revised Condition Compliance Fidings (Item W16a). Condition Compliance for CDP No. E-06-013 – Poseidon Resources (Channelside), LLC; Special Condition 8: Submittal of a Marine Life Mitigation Plan, November 21, 2008.

expert review of the MLMP from Dr. Peter Raimondi, who is considered by the Coastal Commission a leader in this field, and the Commission's Scientific Advisory Panel, the Commission approved the MLMP on August 6, 2008.

The mitigation to be implemented under the MLMP is not needed today, as construction of the Project has not yet begun. The mitigation is relevant only after Poseidon begins to operate the Project in late 2011 or early 2011, and only when Poseidon cannot get sufficient feedstock water from the Encina Power Station ("Encina"), with which it is co-located. Failure to approve the MLMP at this time, however, may jeopardize Poseidon's orderly planning and implementation of the mitigation proposal, placing an unnecessary cloud over Poseidon's ability to deliver the Project's much-needed potable water supply.

The MLMP conservatively provides for Poseidon to construct enough wetlands to offset *all* entrainment[4] impacts associated with the intake system, that is, even if Encina shuts down. Because the MLMP provides mitigation to offset all entrainment impacts associated with intake, it essentially provides for *over*-mitigation unless or until Encina is no longer operating.

As proposed, the MLMP will:

- Avoid or mitigate to less-than-significant levels all impacts to marine resources associated with potential E&I from the Project's water intake;
- Create or restore up to 55.4 acres of high-quality estuarine wetland habitat based on the best science available to mitigate Project-related impacts and likely result in a net biological benefit to the Southern California Bight;
- Establish monitoring protocols and empower the Regional Board and the California Coastal Commission with enforcement mechanisms to ensure potential E&I impacts are accurately measured over time and that mitigation success targets consistently are achieved;
- Establish an enforceable schedule for completion of site selection (nine months), environmental review and permitting of the site(s) (24 months) and the start of construction (six months after approval of the permits);
- Provide for significant, continuing agency oversight during the selection, development and performance monitoring of the final mitigation site(s), including by the Executive Officer if the Regional Board approves the MLMP (as the MLMP would then be equally enforceable by the Regional Board); and,
- Authorize enforcing agencies to order remediation in the event the rigorous performance criteria are not met.

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[4] As is explained in Section V, infra, impingement impacts are de minimis and will be reduced further via application of best available technology, obviating the need for mitigation to offset impingement-related marine life mortality.

The MLMP, in combination with the Minimization Plan and related correspondence, fully addresses the concerns raised by the April Resolution and Regional Board staff, including the following:

- *Compliance with Water Code Section 13225* – The successful interagency process subsequent to the Regional Board's April 9, 2008 meeting complied fully with the Water Code, resulting in a consensus mitigation plan that reflects recommendations from regulatory agencies and extensive agency coordination to verify scientific soundness, environmental integrity, and compliance with applicable laws, regulations, and policies designed to protect marine resources.

- *Compliance with Water Code Section 13142.5* – The adequacy of mitigation has been vetted fully, resulting in a robust plan based on sound data and conservative resource-protective methodologies approved by the appropriate regulatory agencies (including the Regional Board and the Coastal Commission).

- *Sound Data* – The underlying data upon which the MLMP is based were collected in 2004 – 2005 under a Regional Board-approved work plan and reviewed by the agency's third-party consultant, Tetra Tech. The data are representative, adequate, and appropriate for assessment of potential E&I effects during both co-located and stand-alone operations.

- *Sound Calculations* – Working with Regional Board staff subsequent to the April 9, 2008 meeting, the impingement calculations were refined, and were found to be slightly more than as presented at the April 9, 2008 meeting (about 1.5 kg/day instead of 0.9 kg/day). Entrainment calculations were made using agency-accepted models (the Entrainment Transport Model and the Area of Production Foregone approach). The entrainment calculations were subject to rigorous peer review by the Coastal Commission.

- *Conservative Results* – The Coastal Commission required Poseidon to incorporate into the MLMP mitigation acreages that are based on high levels of confidence regarding the amount of entrainment not typically imposed (80 percent), and including acreage to account for attenuated impacts to open ocean species. These strict requirements are what resulted in the acreage increasing from 37 (before the Regional Board in April 2008) to 55.4.

- *Not Tied to One Site; Not Disregarding Agua Hedionda Lagoon* - The actual mitigation site(s), which will be selected this year, will not be locked in to San Dieguito Lagoon or other pre-determined outcome as staff was concerned in April 2008, and will be at location(s) acceptable to the Executive Officer of the Regional Board, and the Executive Director of the Coastal Commission.

- *Strict Success Criteria* – The MLMP incorporates strict criteria against which the success of mitigation will be measured, which were developed for the highly successful San Dieguito restoration project that Southern California Edison has underway. By accepting these strict performance measures, Poseidon is demonstrating its commitment to mitigation, and these criteria also enable the Regional Board and the other agencies to continue to consider several sites, since they know they will be provided with a thriving wetlands project at any one of these locations, as measured by the criteria.

- *Poseidon's Commitment* – Poseidon is subject to multiple process checks from multiple agencies, any of which could result in adverse consequences to Poseidon should it not implement the MLMP as proposed. For example, on April 1, 2011 Poseidon will be submitting a Report of Waste Discharge to the Regional Board, starting the process of permit renewal. No doubt the Regional Board will be evaluating Poseidon's progress on mitigation at that time. Permit reopener provisions contained in Poseidon's existing permit give the Regional Board atypical authorities to reopen the NPDES process and reexamine permit conditions, including the one requiring mitigation through the Minimization Plan. Further, Poseidon very likely will need additional Regional Board approval (e.g., WDRs and/or Section 401 Water Quality Certification) for its mitigation site(s). Poseidon's commitment to mitigation has been inextricably bound by the agencies to its entitlements to operate the Project.

After repeated attempts to identify any additional, specific concerns that staff may have, we are aware of none, except for a minor issue regarding the timing of the submittal of the MLMP, which timely was received in draft form in July, months before the deadline, and in final form as soon as possible to accommodate the Resolution-directed interagency agency process with the knowledge and permission of staff.

The Regional Board's approval of the MLMP will put Poseidon on schedule to begin construction of the Project mid-year 2009, while enabling Poseidon to begin securing entitlements for the wetlands restoration in the MLMP that will result in net biological benefits to coastal Southern California. In short, we believe that a robust, science-based MLMP that complies fully with all legal requirements is before you today, and we urge your approval of it so that we may proceed to the implementation phase of mitigation planning.

## II. BACKGROUND

### A. The Facility

Poseidon plans to construct and operate the Carlsbad Desalination Project, which will convert approximately 104 million gallons per day ("MGD") of salt water into 50 MGD of fresh, potable water for 300,000 San Diego County residents in this water-starved region. The Project will be located alongside the Encina Power Station so that it can use the discharge water from Encina's cooling system as its feedstock water. Encina's source water is Agua Hedionda Lagoon, which opens into the Pacific Ocean. The Project will use Encina's intake system even when Encina is not operating. Currently, Poseidon expects to begin construction of the plant in June 2009. Commercial operations are to commence approximately 2.5 years later, in approximately December 2011.

### B. Regional Board Order No. R9-2006-0065, NPDES No. CA 0109223

On August 16, 2006, the Regional Board unanimously adopted Order No. R9-2006-0065, granting Poseidon a National Pollutant Discharge Elimination System ("NPDES") permit pursuant to its authority under the federal Clean Water Act ("CWA"). The permit allows the Project to discharge up to 57 MGD of combined concentrated saline wastewater and filter

backwash wastewater into the Pacific Ocean via Encina's cooling discharge channel. The permit expires October 1, 2011, months before Poseidon is likely to begin commercial operations. Poseidon, will therefore, need to come before the Regional Board to secure a permit renewal before any discharges will have occurred.

C. NPDES Tentative Order Altered in Response to Public Comment

The Regional Board had initially held a hearing to consider adopting Tentative Order No. R9-2006-0065 granting Poseidon the NPDES permit two months earlier, on June 14, 2006. At the June 14, 2006 hearing, the Regional Board elected to postpone adopting a final order so that it could revise the tentative order to include the following provision[5]:

> The discharger shall submit a Flow, Entrainment and Impingement Minimization Plan within 180 days of adoption of the Order. The plan shall assess the feasibility of site-specific plans, procedures, and practices to be implemented and/or mitigation measures to minimize the impacts to marine organisms when the Project intake requirements exceed the volume of water being discharged by the Encina Power Station. The plan shall be subject to the approval of the Regional Water Board and shall be modified as directed by the Regional Water Board.[6]

The Regional Board's stated rationale for the provision is that "[t]he Regional Water Board recognizes that future Encina flows may not follow historical trends.[7]" That is, the Regional Board required the development of the Minimization Plan to account for a scenario in which Encina's outflows are insufficient to satisfy the Project's feedstock needs.

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5 Responding to comments from interested parties, the Regional Board, pursuant to its authority as an administrator of California's Porter-Cologne Water Quality Control Act, amended the original tentative order to include within the Special Provisions, section VI.B., a requirement that Poseidon submit a "Flow, Entrainment and Impingement Minimization Plan", VI.B.2.e. The Regional Board has noted that approval of a Minimization Plan is not a condition for commencement of discharge. April Resolution at ¶¶ 3-4.

6 The Regional Board noted that the Project's operations are not subject to the statutory requirements of Section 316(b) of the CWA, as that section pertains only to impacts from intake of seawater for the purpose of power generation, but that the Project is a "new industrial installation" subject to California Water Code Section 13142.5, which requires the use of best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life. Resolution at ¶¶ 3-4.

7 Add cite NPDES rationale §.

One month after the Regional Board adopted Order No. R9-2006-0065, Poseidon's NPDES permit, Surfrider Foundation and Coastkeeper filed a petition to the State Water Resources Control Board ("State Board") on the basis that the permit's reopener provision was inadequate, the permit failed to adequately address the impacts of the Project when Encina is not operational, and that the permit conflicted with the federal Clean Water Act by not following proper procedures for establishing water quality-based effluent limits. On June 5, 2007, the State Board rejected the challenge on the ground that Petitioners had failed to raise substantial issues that were appropriate for review. Petitioners did not seek a writ of mandate challenging the State Board's denial of review. On October 1, 2006, the NPDES permit became effective.

Poseidon submitted the first draft of its proposed Minimization Plan to Regional Board staff for its review on February 12, 2007. After time for public comment, Poseidon submitted a substantially revised second draft on June 29, 2007. On February 19, 2008, Regional Board staff sent Poseidon a letter identifying concerns with the second draft of the Minimization Plan.

Poseidon responded to staff's concerns by requesting a meeting to review the letter and better understand staff's needs, which appeared to be concerned primarily with insufficiency of supporting data. Then, on March 7, 2008, Poseidon submitted a third draft of the Minimization Plan, which included over three hundred pages of scientific support for the proposal. Submitted concurrently with the revised Minimization Plan was a detailed response to the February 19, 2008 letter, which addressed how the Minimization Plan and supporting scientific material responded to the Regional Board's concerns as articulated in the letter and refined in the subsequent meeting with staff.[8]

D. Minimization Plan is Conditionally Approved

Regional Board consideration of Poseidon's Minimization Plan was set for a public meeting on April 9, 2008. During that meeting, staff's comments, as well as comments from the public, were addressed by Poseidon's Project Manager Peter MacLaggan and three experts, Dr. Scott Jenkins from Scripps Institute of Oceanography, David Mayer of Tenera Consulting, the foremost expert on the West Coast on entrainment and impingement studies, and Chris Nordby, an environmental wetlands restoration specialist.

After considering testimony, the Minimization Plan, and Poseidon's extensive supporting submittal, the Regional Board conditionally approved the Minimization Plan, adopting the April Resolution. The April Resolution required Poseidon to submit within six months an amendment to the Minimization Plan that included a specific proposal for mitigation of the impacts, by impingement and entrainment, upon marine organisms resulting from the intake of seawater

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[8] Consistent with the interagency exchange of information on this Project, Regional Board staff member Eric Becker then sent Poseidon's March 7, 2008 response to several other interested agencies, including the Coastal Commission, the U.S. Department of Fish & Wildlife, and National Marine Fisheries Service. Email from E. Becker to several others, March 7, 2008.

from Agua Hedionda Lagoon, i.e., a mitigation plan, just as the Coastal Commission had required Poseidon to generate as a condition to its coastal development permit.

E. Interagency Coordination to Develop Minimization Plan Amendment – Data and Modeling are Subjected to Additional Expert Review

The Regional Board directed Poseidon to resolve the conditions of the April Resolution through an interagency review and approval process. The Coastal Commission staff retained Dr. Pete Raimondi to examine the Tenera study provided by Poseidon to the Regional Board and the Coastal Commission in March 2008 submitted as part of the Minimization Plan supporting materials.

1. Late April Follow-up to Regional Board Staff Questions

On April 17, 2008, Mr. MacLaggan received an email from Senior Regional Board Scientist Chiara Clemente indicating that perhaps a meeting with Regional Board staff would not be necessary to obtain clarifications staff sought but that it would be most helpful to receive via email answers to several specific questions.[9] On April 30, 2008, Mr. MacLaggan provided responses to Ms. Clemente's emailed questions and invited her to contact him should she have any questions.[10]

2. May 1-2 Interagency Meetings

On April 10, 2008, just two days after the conditional approval of the Minimization Plan, Peter MacLaggan sent the Executive Officer a list of confirmed attendees for interagency meetings set for May 1-2, 2008, as well as the original invitation to the meeting, receipt of which the Executive Officer acknowledged.[11]

On May 1, 2008, the Coastal Commission hosted an interagency meeting on the MLMP at the Agua Hedionda Lagoon Discovery Center. The agenda notes that it was an "interagency working group meeting...to address potential mitigation options for impacts to marine life from impingement and entrainment by the Carlsbad Desalination Project." Thirteen state and federal agencies were invited to attend. Both the Executive Officer and Senior Scientist Chiara Clemente attended on behalf of the Regional Board. At the conclusion of the May 1, 2008 meeting, Mr. MacLaggan asked the Executive Officer whether Poseidon's April 30, 2008 submittal, coupled with the Coastal Commission's independent expert review of Poseidon's entrainment study, adequately addressed Poseidon's obligations under the April Resolution to identify potential impacts from impingement and entrainment, and establish the adequacy of the monitoring data to support such a determination. Mr. Robertus responded that the Regional Board had no further questions regarding the identification of impacts or the adequacy of the monitoring data.[12]

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9 Email from C. Clemente to P. MacLaggan, April 17, 2008, Appendix A, Tab 13.

10 Email from P. MacLaggan to C. Clemente, April 30, 2008, Appendix A, Tab 16.

11 Email from P. MacLaggan to J. Robertus, April 10, 2008, Appendix A, Tab 12.

12 MacLaggan Declaration (submitted under separate cover), ¶ 33.

3. Scientific Advisory Panel Advises Coastal Commission on MLMP

In June, Coastal Commission staff asked the Commission's Scientific Advisory Panel ("SAP") to review Dr. Raimondi's conclusions and make further recommendations to Poseidon to include in its soon-to-be-proposed MLMP.

4. Poseidon Submits MLMP

On July 3, 2008, Poseidon submitted the first draft of its MLMP to Coastal Commission staff.[13] Poseidon's draft closely followed the SCE model that had been provided by the Coastal Commission. The next day Coastal Commission staff member Sara Townsend sent an email to the various interested agencies, including the Executive Officer of the Regional Board, attaching Poseidon's MLMP for review. The email indicated that the MLMP would be brought before the Coastal Commission in August and asked that comments from the other agencies be submitted within the next two weeks.[14] Thus, the Regional Board received the first draft of Poseidon's MLMP on July 8, 2008. We are not aware that the Regional Board staff expressed any concerns to Coastal Commission staff. On August 2, 2008, Poseidon submitted a revised version of the MLMP.

5. Coastal Commission and State Lands Commission Approvals Reflect Input Received from Agency Staff

On August 6, 2008, at a public meeting, the Coastal Commission approved Poseidon's MLMP with certain non-substantive modifications delegated to the Executive Director to resolve with Poseidon. It appears the Executive Officer attended this meeting.

The State Lands Commission ("SLC") also approved the MLMP when it incorporated it as an amendment to the Lease for the intake system. The SLC lease requires, among other things, that at all times during the term of the lease, Poseidon shall comply with the MLMP as adopted by the Coastal Commission on August 6, 2008.[15]

6. Poseidon and Coastal Commission Staff Work Together to Finalize Language - Regional Board Staff Elects to Wait for Final Language

Over the next several months, Poseidon continued to work at the direction of the Coastal Commission staff on revisions to the August 2, 2008 draft MLMP to make it consistent with the Coastal Commission's August 6, 2008 approval. On September 17, 2008, Mr. MacLaggan advised the Executive Officer in an in-person meeting that he was continuing to work with the Coastal Commission to finalize that language but that final language was unlikely to be available before October 8, 2008, the deadline set by the April Resolution for submittal of the MLMP.

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13 MacLaggan Declaration, Exh. D.

14 Email from S. Townsend to various people, including J. Robertus, July 8, 2008, Appendix A, Tab __.

15 State Lands Commission, Amendment of Lease PRC 8727.1, Appendix A, Tab 21.



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Mr. MacLaggan and the Executive Officer discussed the substance of the MLMP as it had been approved by the Coastal Commission on August 6, 2008, and Mr. MacLaggan brought a draft of the MLMP with the anticipated Coastal Commission language changes. Mr. MacLaggan offered the Executive Officer the option to receive the draft, anticipated language or wait to receive the final language. The Executive Officer advised Mr. MacLaggan that he preferred to wait to receive the final language.[16]

On October 15, 2008, Mr. MacLaggan emailed Ms. Clemente at the Regional Board advising her that he had a meeting with Coastal Commission staff on October 28, 2008 to finalize the text of the MLMP and that he would forward her the final language when received. Ms. Clemente responded, "Thank you for the 'head's up.' We will plan accordingly."[17]

At the November 12, 2008 Regional Board meeting, the Executive Officer advised the Regional Board that flexibility in the October 8, 2008 deadline was being allowed to accommodate the involvement of the other agencies participating in the interagency process required by the April Resolution. The Regional Board's attorney also noted that the other agencies' approvals may have been impacted by litigation initiated by groups opposing the Project.[18]

In response to an email from Regional Board staffer Mike Porter on November 13, 2008 inquiring as to the status of the final language, Mr. MacLaggan responded that an agreement had been reached with Coastal Commission staff on November 7, 2008 and that he would be forwarding the final language the next day. On November 14, 2008, Mr. MacLaggan submitted the final MLMP to the Regional Board. On November 17, 2008, the Executive Officer acknowledged receipt.[19]

7. Regional Board Staff's Participation in the Interagency Process

In sum, the Regional Board staff participated in the process but looked to the Coastal Commission staff to largely coordinate it after the May 1, 2008 interagency meeting.[20] The Regional Board was kept informed by other agencies and the public record. To Poseidon's knowledge, Regional Board staff never objected to or asked questions about the process or the way the MLMP was developing into the plan that was ultimately approved by the Coastal Commission on August 6, 2008. By its participation in the interagency process and failure to voice any continuing concerns, staff's conduct led Poseidon to reasonably believe that that any concerns it had had already been addressed or were being addressed during the process.

8. Staff Responds to MLMP and Ceases Communicating with Poseidon

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16 MacLaggan Declaration ¶ 41.

17 MacLaggan Declaration ¶ 43, Exh. G9.

18 Recording of November 12, 2008 Regional Board meeting (submitted under separate cover).

19 MacLaggan Declaration, ¶ 45, Exh. G12-13.

20 Email from G. Newton to J. Brown, August 5, 2008, appendix A, Tab 18.

On December 2, 2008, Regional Board staff sent a letter to Mr. MacLaggan criticizing the MLMP. This appears to be the first time Regional Board staff indicated any concerns regarding the MLMP, despite having received it 5 months earlier when the Coastal Commission was reviewing it. The December 2, 2008 letter asserts that Poseidon has failed to address staff's February 19, 2008 letter regarding the Minimization Plan, which letter was submitted, responded to, and discussed, all prior to the April 9, 2008 meeting at which the Regional Board approved the Minimization Plan.[21] Mr. MacLaggan responded to staff's December 2, 2008 letter one week later, on December 9, 2008, reiterating that staff's concerns had been addressed and inviting staff to meet with Poseidon to discuss any outstanding, specific questions it felt were unresolved. The Executive Officer responded that he would have staff review the materials. Mr. MacLaggan received no further response from Regional Board staff.[22]

9. Notice of February 11, 2009 Regional Board Public Hearing is Posted

On December 30, 2008, Regional Board staff posted a notice of public hearing for the Regional Board's February 11, 2009 meeting indicating that the Regional Board would be considering rescission of the April Resolution.[23] On January 2, 2009, the Regional Board issued a corrected notice of public hearing stating that it would instead be considering whether the MLMP meets the conditions of the April Resolution. No indication has been given as to why the Regional Board may have been considering rescission of the April Resolution.[24]

10. Poseidon Attempts Communication with Regional Board Staff

On January 5, 2009, Mr. MacLaggan telephoned the Executive Officer and inquired as to whether Poseidon's December 9, 2008 letter was responsive for the purposes of the February 11, 2009 public hearing. The Executive Officer responded that his counsel had advised him not to speak with Mr. MacLaggan about the February 11, 2009 hearing and referred me to staff.[25] Mr. MacLaggan also telephoned staffer Mike Porter and left a voicemail inquiring as to whether the Regional Board needed anything from Poseidon. Mr. Porter responded via email on January 7, 2009, stating that he did not know whether anything was needed but that staff would be done with their evaluation shortly and would let Mr. MacLaggan know either way.[26] The Regional Board has made no requests for additional information or specific indications of how Poseidon's voluminous submittals, including the materials before the Coastal Commission, fall short of staff's needs.

Regardless, the several-month interagency process resulted in a comprehensive mitigation plan providing for the selection and development of a mitigation wetlands project to mitigate for potential impacts to marine life caused by the Project when it takes in water in

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21 MacLaggan Declaration ¶ 47.

22 MacLaggan Declaration ¶¶ 47-49.

23 MacLaggan Declaration ¶ 50.

24 MacLaggan Declaration ¶ 51.

25 MacLaggan Declaration ¶ 52.

26 MacLaggan Declaration ¶ 53.

excess of the cooling water needs of Encina. Thus, the MLMP before the Regional Board directly addresses the mitigation directives set forth by the Regional Board in the April Resolution.

## III. FRUIT OF THE INTERAGENCY PROCESS - HOW THE MLMP WORKS

### A. How the MLMP Works

In total, the MLMP provides for up to 55.4 acres of mitigation to offset any marine life mortality associated with entrainment at the intake system that will be implemented in two phases. Within two years of the issuance of the Project's coastal development permit, Poseidon must submit a complete coastal development permit application for a proposed restoration project that provides at least 37 acres of estuarine wetland restoration.[27] The coastal development permit application must include CEQA documentation and any necessary local or state approvals to use the site for wetlands restoration.[28] Within five years of the issuance of the coastal development permit for the first 37 acres, Poseidon must submit a complete coastal development permit application proposing up to 18.4 acres of additional restoration, unless it can demonstrate that additional technology measures at the intake structure obviate the need for more mitigation or receives credit for dredging in Agua Hedionda Lagoon.

The MLMP provides that within 9 months of the effective date of the Project's coastal development permit, Poseidon shall submit its selection of site(s) along with a preliminary wetland restoration plan, which will provide the technical and logistical details of exactly how the site is to be developed and turned into functional wetlands.[29] The site selection and preliminary wetland restoration plan will then be subject to review and approval by the Coastal Commission, and if the Regional Board similarly approves the MLMP, it will also be subject to review and approval by the Regional Board.[30]

Within six months of approval of the Phase I restoration plan, subject to Poseidon's obtaining the necessary permits for the site, Poseidon is to begin construction of the wetland restoration project.[31] The following chart provides the timelines in graphical form:

| | **Poseidon must submit the following…** | *How soon after the Project's coastal development permit issuance by Coastal Commission?* |
|---|---|---|
| **Phase I** | 1. Proposed site(s)<br>2. Preliminary restoration plan | 10 months |

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27 MLMP § 1.0, Appendix A, Tab 1.

28 MLMP § 4.1, Appendix A, Tab 1.

29 MLMP § 2.0, Appendix A, Tab 1.

30 *Id.*

31 MLMP § 4.2, Appendix A, Tab 1.

| | | |
|---|---|---|
| | Complete coastal development permit application<br><br>Restoration plan to restore **37 acres**<br><br>(Poseidon must begin constructing the wetland within 6 months of the Coastal Commission's approval of the restoration plan.) | 2 years |
| **Phase II** | Complete coastal development permit application<br><br>Final restoration plan to either<br>a. Restore 18.4 more acres;<br>b. Implement technologies not currently available or feasible that would reduce entrainment levels below anticipated levels; or<br>a. Dredge Agua Hedionda Lagoon in a manner that warrants mitigation credit | 5 years |

The following chart details the requirements of the wetlands restoration plan for the selected site(s) prescribed by the MLMP.

| Additional Elements to which Poseidon's restoration plan must conform |
|---|
| a. Detailed review of existing physical, biological, and hydrological conditions; ownership, land use and regulation;<br>b. Evaluation of site-specific and regional restoration goals and compatibility with the goal of mitigating for Poseidon's marine life impacts;<br>c. Identification of site opportunities and constraints;<br>d. Schematic restoration design, including:<br>1. Proposed cut and fill, water control structures, control measures for stormwater, buffers and transition areas, management and maintenance requirements;<br>2. Planting program, including removal of exotic species, sources of plants and or seeds (local, if possible), protection of existing salt marsh plants, methods for preserving top soil and augmenting soils with nitrogen and other necessary soil amendments before planting, timing of planting, plans for irrigation until established, and location of planting and elevations on the topographic drawings;<br>3. Proposed habitat types (including approximate size and location);<br>4. Assessment of significant impacts of design (especially on existing habitat values) and net habitat benefits;<br>5. Location, alignment and specifications for public access facilities, if feasible;<br>6. Evaluation of Encina for implementation e.g. permits and approvals, development agreements, acquisition of property rights;<br>7. Cost estimates;<br>8. Topographic drawings for final restoration plan at 1" = 100 foot scale, one foot contour interval; and<br>9. Drawings shall be directly translatable into final working drawings.<br>g. Detailed information about how monitoring and maintenance will be implemented; |

h. Detailed information about construction methods to be used;
i. Defined final success criteria for each habitat type and methods to be used to determine success;
j. Detailed information about how Poseidon will coordinate with the Scientific Advisory Panel including its role in independent monitoring, contingency planning review, cost recovery, etc.
k. Detailed information about contingency measures that will be implemented if mitigation does not meet the approved goals, objectives, performance standards, or other criteria; and,
l. Submittal of "as-built" plans showing final grading, planting, hydrological features, etc. within 60 days of completing initial mitigation site construction.

B. The Site(s) Will Be Selected Using Strict Standards and Will Be Subject to Coastal Commission and Regional Board Approval

The site(s) selected must be within the Southern California Bight. No more than two sites will be selected, unless approved.[32] During the interagency process to develop the MLMP, a specific list of sites emerged as those preferred by contributing agencies, including Tijuana Estuary, San Dieguito River Valley, Agua Hedionda Lagoon, San Elijo Lagoon, Buena Vista Lagoon, Huntington Beach Wetland, Anaheim Bay, Santa Ana River, Los Cerritos Wetland, Ballona Wetland, and Ormond Beach.[33] The MLMP lists these specific sites and indicates that Poseidon may also consider other sites recommended by the California Department of Fish & Game as high priority wetlands restoration projects.[34]

The following chart indicates the slate of sites contemplated in the MLMP, subject to agency approval of actual selection.

| **Identified Mitigation Sites (MLMP § 2.0)** | |
|---|---|
| San Diego County | 1. Tijuana Estuary<br>2. San Dieguito River Valley<br>3. Agua Hedionda Lagoon<br>4. San Elijo Lagoon<br>5. Buena Vista Lagoon |
| Orange County | 6. Huntington Beach Wetland<br>7. Anaheim Bay<br>8. Santa Ana River |
| Los Angeles County | 9. Los Cerritos Wetland<br>10. Ballona Wetland |
| Ventura County | 11. Ormond Beach |
| • The permittee may also consider any sites that may be recommended by the California Department of Fish & Game as | |

32 MLMP § 2.0, Appendix A, Tab 1.

33 *Id.*

34 *Id.*

high priority wetlands restoration projects.

- Other sites proposed by the permittee may be added to this list with the Executive Director's approval.

The basis for selection of the site(s) is prescribed in the MLMP in detail, which sets out an extensive list of minimum standards and objectives for the site(s) and restoration plan.

Minimum standards include the requirement that the site(s) must provide at least 37 acres of habitat similar to the affected areas in the Agua Hedionda Lagoon, have a buffer zone to ensure protection of the wetland, be free of any contamination problems, would not result in net loss of existing wetlands, and could be preserved in perpetuity for wetlands purposes.[35] The site(s) must incorporate as many objectives as possible, which include, among other things, providing substantial fish habitat compatible with other wetland values, provide rare or endangered species habitat, and is such that restoration can be accomplished in a timely fashion.

| **§ 3.1 Minimum Standards** (Restoration plan must satisfy) | **§ 3.2 Objectives** (Plan must incorporate to the extent feasible) |
|---|---|
| a. Location within Southern California Bight;<br>b. Potential for restoration as tidal wetland, with extensive intertidal and subtidal areas;<br>c. Creates or substantially restores **a minimum of 37 acres and up to at least 55.4 acres of habitat** similar to the affected habitats in Agua Hedionda Lagoon, excluding buffer zone and upland transition area;<br>d. Provides a buffer zone of a size adequate to ensure protection of wetland values, and at least 100 feet wide, as measured from the upland edge of the transition area;<br>e. Any existing site contamination problems would be controlled or remediated and would not hinder restoration;<br>f. Site preservation can be guaranteed in perpetuity (through appropriate public agency or nonprofit ownership, or other means approved by the Executive Director), to protect against future degradation or incompatible land use;<br>g. Feasible methods are available to protect the long-term wetland values at the site(s), in perpetuity;<br>h. Does not result in a net loss of existing wetlands; and<br>i. Does not result in an adverse impact on | a. Provides maximum overall ecosystem benefits, e.g. maximum upland buffer, enhancement of downstream fish values, provides regionally scarce habitat, potential for local ecosystem diversity;<br>b. Provides substantial fish habitat compatible with other wetland values at the site(s);<br>c. Provides a buffer zone of an average of at least 300 feet wide, and not less than 100 feet wide, as measured from the upland edge of the transition area;<br>d. Provides maximum upland transition areas (in addition to buffer zones);<br>e. Restoration involves minimum adverse impacts on existing functioning wetlands and other sensitive habitats;<br>f. Site selection and restoration plan reflect a consideration of site specific and regional wetland restoration goals;<br>g. Restoration design is that most likely to produce and support wetland-dependent resources;<br>h. Provides rare or endangered species habitat;<br>i. Provides for restoration of reproductively isolated populations of native California species;<br>j. Results in an increase in the aggregate |

[35] MLMP § 3.0, Appendix A, Tab 1.

| | |
|---|---|
| endangered animal species or an adverse unmitigated impact on endangered plant species. | acreage of wetland in the Southern California Bight;<br>k. Requires minimum maintenance;<br>l. Restoration project can be accomplished in a reasonably timely fashion; and,<br>m. Site(s) in proximity to the Carlsbad desalination facility. |

C. The MLMP Provides for Rigorous Performance Standards to Measure and Ensure Success

Poseidon is committed to full mitigation of all marine life impacts from the Project operations, as demonstrated by the MLMP's incorporation of strict, measurable performance standards, which are an important component of satisfying the April Resolution's stated requirement of a "specific proposal for mitigation of impacts by impingement and entrainment upon marine organisms resulting from the intake of seawater from the Agua Hedionda Lagoon."[36]

These standards include: (a) specific timelines for submittal of proposed site(s) and a Preliminary Restoration Plan for Coastal Commission review and approval (MLMP § 2.0); (b) identification of 11 pre-approved candidate mitigation sites (MLMP § 2.0); (c) minimum standards and objectives for the mitigation site selection (MLMP §§ 3.1 and 3.2); (d) detailed restoration plan requirements (MLMP § 4.1); (e) specific monitoring, maintenance and remediation standards to be conducted over the "full operating life" of the Project including, but not limited to, long-term physical standards, biological performance standards and suggested sampling locations (MLMP § 5.0); and (f) a comprehensive administrative and procedural structure (Condition B).

Additionally, these strict standards establish specific criteria for effectively measuring the success of the mitigation project, e.g., within five years of the start of construction, the constructed wetlands must match habitat values within a 95% confidence level for four undisturbed wetlands identified in the MLMP.

The MLMP's specific biological performance standards, which are used to determined whether the restoration project is successful, are catalogued in the following chart:

| **Biological performance standards**<br><br>Poseidon's mitigation project is only deemed successful if the variation between Poseidon's mitigation site and baseline average is less than 5%. |
|---|
| 1. Biological Communities. Within 4 years of construction, the total densities and number of species of **fish, macroinvertebrates and birds** shall be similar to the densities and number of species in similar habitats in the reference wetlands; |

36 April Resolution, Section II.3.

2. Vegetation. The proportion of total **vegetation cover** and open space in the marsh shall be similar to those proportions found in the reference sites. The percent cover of algae shall be similar to the percent cover found in the reference sites;

3. Spartina Canopy Architecture. The restored wetland shall have a **canopy architecture** that is similar in distribution to the reference sites, with an equivalent proportion of stems over 3 feet tall;

4. Reproductive Success. Certain plant species, as specified in the work program, shall have demonstrated **reproduction** (i.e. seed set) at least once in three years;

5. **Food Chain** Support. The food chain support provided to birds shall be similar to that provided by the reference sites, as determined by feeding activity of the birds; and

6. Exotics. The important functions of the wetland shall not be impaired by **exotic species**.

1. The MLMP Incorporates Performance Standards of the San Onofre Nuclear Generating Station Mitigation Plan

As required by the Regional Board in the April Resolution, the MLMP represents the culmination of extensive state, local and federal agency coordination, including input from the Regional Board, Coastal Commission, State Lands Commission, Department of Fish and Game, California Department of Transportation, U.S. Fish and Wildlife Service, City of Carlsbad and City of Vista. In addition, the MLMP was peer reviewed by the Coastal Commission's Marine Science Advisory Panel, which consists of eight scientists affiliated with universities across California.

One of the many results of this comprehensive interagency collaboration was the MLMP's incorporation of the performance standards and conditions approved by the Regional Board for the mitigation of marine life impacts from Southern California Edison's ("SCE") San Onofre Nuclear Generating Station ("SONGS"). In June 2008, Coastal Commission staff provided Poseidon with the conditions the Coastal Commission required SCE to meet for conducting its site selection, construction, monitoring, and other aspects of its restoration plan, and offered its recommendation that Poseidon include these conditions as part of its MLMP. *See* Coastal Commission Staff Report, Condition Compliance for the Project No. E-06-013, July 24, 2008 ("Staff Report"), at 14. This recommendation culminated in the incorporation of MLMP performance standards and conditions strikingly similar to those required of SCE at its San Dieguito Restoration Project.[37]

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[37] *See* Coastal Commission Reporter's Transcript of Proceedings, August 6, 2008, Agenda Item 5.a., at 313:4-9 ("Environmental Specialist Luster: Yes, staff's recommendation in Exhibit 2, those are the conditions that the Commission required of SONGS. Staff modified some of those conditions to reflect some updates, and mitigation approaches,

The determination to adopt the SONGS performance standards as part of the MLMP has been strongly supported by Coastal Commission staff throughout the MLMP approval process.[38]

Therefore, the final determination of the MLMP performance standards and conditions lies largely with Coastal Commission staff. Accordingly, by incorporating the SONGS performance standards and conditions into the MLMP, Poseidon was properly complying with the Executive Officer's remarks at the April 9, 2008 hearing in which he emphasized that the Regional Board intended to be a participant in an interagency process, guided largely by the Coastal Commission. *See* Regional Board Reporter's Transcript of Proceedings, April 9, 2008, at 11:12-19.

2. The Inclusion of the SONGS Performance Standards Ensures That the MLMP Represents a "Very Carefully Designed" Mitigation Plan

Additionally, through the incorporation of the SONGS performance standards and conditions, the MLMP is implementing the standards of a mitigation project that has long been highly-regarded in the environmental community for its strict environmental protection standards. Public commentators remarking on the San Dieguito Wetland Restoration Project have called the plan both "a fabulous project" which has been "very carefully designed." James Steinberg, *Forward, Marsh*, San Diego Union-Tribune, March 19, 2006 (quoting Craig Adams, executive director of the San Dieguito Valley Conservancy). Through the incorporation of the SONGS performance standards and conditions, the MLMP will now encompass these same rigorous success measures which have met with high praise from the environmental community.

Furthermore, with the inclusion of the SONGS performance standards and conditions, the MLMP now encompasses performance standards which have already been proven successful in a practical scenario. As documented by both SCE and local media, the SONGS performance standards have resulted in the successful implementation of key milestones in the overall completion of the 150-acre restoration project. *See* Southern California Edison, San Dieguito

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and you know, removed references to SONGS and Edison and replaced them with Poseidon."), Appendix A, Tab 20.

38 Coastal Commission Reporter's Transcript of Proceedings, August 6, 2008, Agenda Item 5.a., at 307:4-10 ("Environmental Specialist Luster: The conditions that the Commission imposed on Edison for the San Dieguito site, those were issued before Edison has selected its site, and so we feel that if Poseidon meets the same conditions that Edison was held to, and selects a site within the Southern California bit, that would provide adequate assurance that subsequent plans that come to you would be sufficient."); *Id*, at 313-14 ("Commissioner Hueso: Why are we referencing SONGS, specifically, because of their approval to the mitigation? What you are doing is recommending that exact same approach? Environmental Specialist Luster: Yes[....w]e believe the conditions that SONGS was held to would be applicable to Poseidon if they did estuarine restoration somewhere in the Southern California bite.") Appendix A, Tab 20.

Lagoon Restoration (available at http://www.sce.com/PowerandEnvironment/PowerGeneration/MarineMitigation/SanDieguitoLagoonRestoration.htm) (stating that SCE submitted a Preliminary Restoration Plan in September 1997, certified a Final Environmental Impact Report for the project in September 2000, submitted a Final Restoration Plan in November 2005, and began construction in Fall 2006); Matthew Rodriguez, *Tidal Basin Opens to Ocean*, San Diego Union-Tribune, January 24, 2008 (stating that a 40-acre tidal basin opened to the public in January 2008).

Thus, the inclusion of the SONGS performance standards and conditions ensures that the mitigation required by the MLMP will be as effectively and timely implemented as the well-regarded and successfully implemented San Dieguito Wetland Restoration Project.

3. The MLMP Incorporates Continuous Monitoring Performance Standards to Achieve Effective and Successful Implementation of the Restoration Project

In addition to the safeguards found through the inclusion of the already-proven SONGS performance standards, the MLMP incorporates a series of detailed and rigorous continuous monitoring standards to ensure the successful mitigation of all the Project marine resources impacts. Under the terms of Section 5.0 of the MLMP, these monitoring standards will be conducted over the "full operating life" of the Project. The MLMP provides for three separate monitoring phases: pre-restoration site monitoring (MLMP § 5.2), construction monitoring (MLMP § 5.3), and post-restoration monitoring and remediation (MLMP § 5.4). During each of these phases, independent scientific and administrative support staff (hired by the Executive Director) will conduct the field work, analyze and interpret the data, and report to the Executive Director. Charged with overseeing the mitigation and monitoring functions, the independent scientists and staff will ensure that these MLMP provisions are implemented competently and objectively.

Oversight by the Coastal Commission's respected Scientific Advisory Panel (SAP) will also ensure the quality of Poseidon's mitigation efforts. The Commission's Executive Director will convene a special panel of recognized scientists in the fields of marine biology, ecology, statistics, and physical science. The SAP will provide scientific advice on the design, implementation and monitoring of the wetland restoration. The Coastal Commission has used a similar team of scientists to provide guidance and oversight on ecological issues associated with the San Dieguito Restoration Project.[39] The inclusion of the SAP, therefore, represents yet another instance in which Poseidon's mitigation project will be modeled after the successful SONGS mitigation work at San Dieguito Lagoon.

Through the implementation of these monitoring standards, and the availability of the SAP to provide the Executive Director with scientific advice throughout the course of the design, implementation and monitoring process, the wetlands restoration project required by the MLMP will be subject to continuous and ongoing oversight by respected scientific and technical

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[39] Recommended Revised Condition Compliance Findings November 21, 2008, page 7, n. 6, Appendix A, Tab 22.

personnel under the direction of the Executive Director of the Coastal Commission. MLMP, Condition B, § 1.0

In addition, monitoring data are to be made available for public review via the Internet. The Coastal Commission also will receive annual written project status reports and convene periodic public hearings to assess progress and success of the project. MLMP, Condition B, § 3.0. If necessary, the Executive Director, and therefore the Executive Officer if the Regional Board adopts the MLMP, is authorized to order remediation to correct any deficiencies in achieving the MLMP's extensive performance criteria. *Id.*

D. Because the MLMP is Modeled After and Nearly Identical to Performance Standards Upon Which the Successful SONGS Mitigation Project is Based, the MLMP Provides a High Degree of Certainty Regarding the Final Success of Poseidon's Mitigation Plan

The success of the San Dieguito Restoration Project contributed to the Coastal Commission's recommendation that Poseidon adopt the SONGS performances standards during the interagency coordination process that produced the MLMP. *See* California Coastal Commission Staff Report, July 24, 2008, pg. 14. The Coastal Commission staff advocated for the Poseidon's adoption of the SONGS performance standards because of their proven success. *See* California Coastal Commission Staff Report, July 24, 2008, pg. 2 ("The second recommendation is meant to ensure that mitigation is timely and successful. It would require Poseidon to implement its mitigation subject to the conditions similar to those the Commission required of Southern California Edison at its San Dieguito Restoration Project. [ ] Staff recommends the two projects be held to similar standards.")

Once the other participating agencies—including the Regional Board—approved of the adoption of these standards, Poseidon agreed to draft its own MLMP modeled after the SONGS restoration plan. As a result, the provisions in the MLMP are virtually identical to those that form the basis for the SONGS mitigation plan (e.g., both include sections pertaining to site selection, minimum standards, objectives, plan implementation, monitoring and management, etc.).

These precise procedural safeguards, along with the inclusion of the successful SONGS performance standards and conditions, work to make the MLMP a mitigation plan that will fully mitigate all marine life impacts from the Project operations.

## IV. POSEIDON'S IMPINGEMENT AND ENTRAINMENT DATA ARE TECHNICALLY SOUND

Poseidon prepared a Minimization Plan, the purpose of which is to minimize marine life mortality caused by the impingement and entrainment of marine organisms in the intake structure it will share with Encina.

1. Origins of Impingement and Entrainment Data

As a fossil-fueled power generating station that draws water from the Pacific Ocean via the Agua Hedionda Lagoon to cool its facilities, Encina was required to perform an impingement

and entrainment study to comply with the United States Environmental Protection Agency's ("EPA") CWA Section 316(b) regulations. In 2004-2005, Encina hired Tenera Consultants to gather the necessary impingement and entrainment data that would be used to assess the adverse impacts associated with Encina's intake, known as an Impingement Mortality and Entrainment Characterization ("IM&E") Study.

2004-2005 happened to be an abnormally rainy year. Although Regional Board staff suggested at one point that the heavy rainfall skewed the sampling data by reducing the salinity in the water to a point that drove away marine species, Dr. Jenkins explained at the April 9, 2008 hearing that because the Agua Hedionda Lagoon is a small watershed that holds a large volume of seawater, its salinity levels were not depressed by the rains to a point that would have changed the mix of species in the lagoon. Therefore, the sampling conducted pursuant to Tenera's impingement and entrainment study did not under-represent impingeable or entrainable marine organisms.

2. The IM&E Study Was Conducted In Conformity with a Study Plan that Was Reviewed and Approved by the Regional Board

Per the EPA's 316(b) regulations, Encina produced a "Study Plan" before conducting the IM&E Study. The Study Plan was submitted to the Regional Board for its review and approval pursuant to the terms of Encina's NPDES permit. Regional Board staff reviewed the plan with the assistance of Tetra Tech, its third-party consultant. Under the direction of a Technical Advisory Group comprised of staff from the Regional Board, state and federal resources agencies, Encina and Tenera revised the Study Plan and submitted its final report to the Regional Board in January 2008. Tenera's IM&E study for Encina used sampling methodologies and analysis techniques from other recent impingement and entrainment studies, including those conducted for the AES Huntington Beach Generating Station and Duke Energy South Bay Power Plant.

Since the Project uses Encina's intake structure, when it was required to produce a Minimization Plan to account for its entrainment and impingement impacts, it used the Encina data approved by the Regional Board in order to support its Minimization Plan, so the data are necessarily compliant with EPA regulations and consistent with Regional Board standards.

3. Pursuant to Condition 8 of Poseidon's Coastal Development Permit, Poseidon Submitted the Encina Data to the Coastal Commission, Where It Was Again Reviewed and Endorsed Through a Peer Review Process

In March 2008, Poseidon provided data from the IM&E study to the Coastal Commission in order to satisfy the terms of Condition 8 in Poseidon's coastal development permit for the Project, which had been granted on November 15, 2007. The Coastal Commission retained Dr. Pete Raimondi—an independent scientist described by the Coastal Commission as "California's leading expert on entrainment analysis"—to review Poseidon's impingement and entrainment data. Dr. Raimondi, who has been a key participant and reviewer of most of the entrainment studies done along the California coast during the past decade, including those done for the AES Huntington Beach Generating Station, the Morro Bay Power Plant, and Moss Landing Plant, endorsed Tenera's IM&E study.

At the August 6, 2008 Coastal Commission hearing to review the first draft of the MLMP, which Poseidon had submitted July 3, 2008, the Coastal Commission heard testimony from Dr. Raimondi about the data. Dr. Raimondi explained to the Commission that the study's sampling methods were consistent with other recent entrainment studies and applauded the work performed by Tenera.[40] Dr. Raimondi's review and endorsement of the Tenera data, and the Coastal Commission's subsequent approval of the MLMP based thereupon, provide further indications of the validity of the data underlying the MLMP now before the Regional Board.

4. The Regional Board Has Before It All of the Necessary Information to Conclude that the Impingement and Entrainment Data Are Technically Sound

In his PowerPoint to the Coastal Commission, Dr. Raimondi describes the basis of his analysis. Poseidon has introduced into the administrative record all of the information upon which Dr. Raimondi relied in endorsing the entrainment study, including (1) "relevant Poseidon documents" that the Regional Board received with the March 6, 2008 Minimization Plan and related correspondence (2) "documents from the associated power plant's entrainment study," and (3) information generated "by working with the [Tenera] consultants."[41]

Items (1) and (3)—i.e., "relevant Poseidon documents" and information generated "by working with the [Tenera] consultants"—are embodied in two emails. The first email represents a communication between two scientists with Tenera Consultants that took place on April 4, 2008. In this email, John Steinbeck memorializes a telephone conversation that he had with Dr. Raimondi during which Mr. Steinbeck provided Dr. Raimondi with data that Dr. Raimondi needed to input into the Entrainment Effects Model ("EEM")—a model that is used by the U.S. Fish and Wildlife Service to estimate mortality rates resulting from cooling water withdrawals by

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40 Dr. Raimondi stated, "This is characteristic of Tenera International, which did the work, and that work was done very well." Coastal Commission transcript, August 6, 2008 hearing, p. 242:5-8, Appendix A, Tab 20.

41 Mayer Declaration (submitted under separate cover).

power plants.[42] In the second email of April 22, 2008, Mr. Steinbeck explains to Dr. Raimondi how certain EEM variances were calculated in the Encina study.[43]

Item (2)—i.e., "documents from the associated power plant's entrainment study"—refers to the final version of Encina's 316(b) entrainment study, which was not complete until January 2008.[44]

## V. THE PROJECT'S IMPINGEMENT EFFECTS WILL BE DE MINIMIS AND EVEN FURTHER REDUCED BY TECHNOLOGY

### 1. Factors Affecting Impingement Effects

The impingement effect of any intake structure is caused by its screens and is associated with two parameters: the intake flow and the velocity of this flow through the screens. For the purposes of this analysis, the impingement effect is assumed proportional to the intake flow at velocities above 0.5 feet per second ("fps").

### 2. Methodology for Impingement Assessment

The impingement assessment provided herein is based on the analysis of the most recent data that Tenera Consultants collected at the Encina intake facilities during the period June 1, 2004 to May 31, 2005. Although Tenera initially collected the data for Encina, Tenera has been able to use these data to project the impingement impacts that will be associated with the Project's standalone operations.

To isolate the impingement impacts associated with the Project's stand-alone intake operations, Tenera conducted a regression analysis that factored in Encina's historical flow rates and impingement effects. Figure 1 shows the average daily flow rate and impinged biomass for each of the 50 (out of 52) weekly surveys collected during the impingement survey period.[45]

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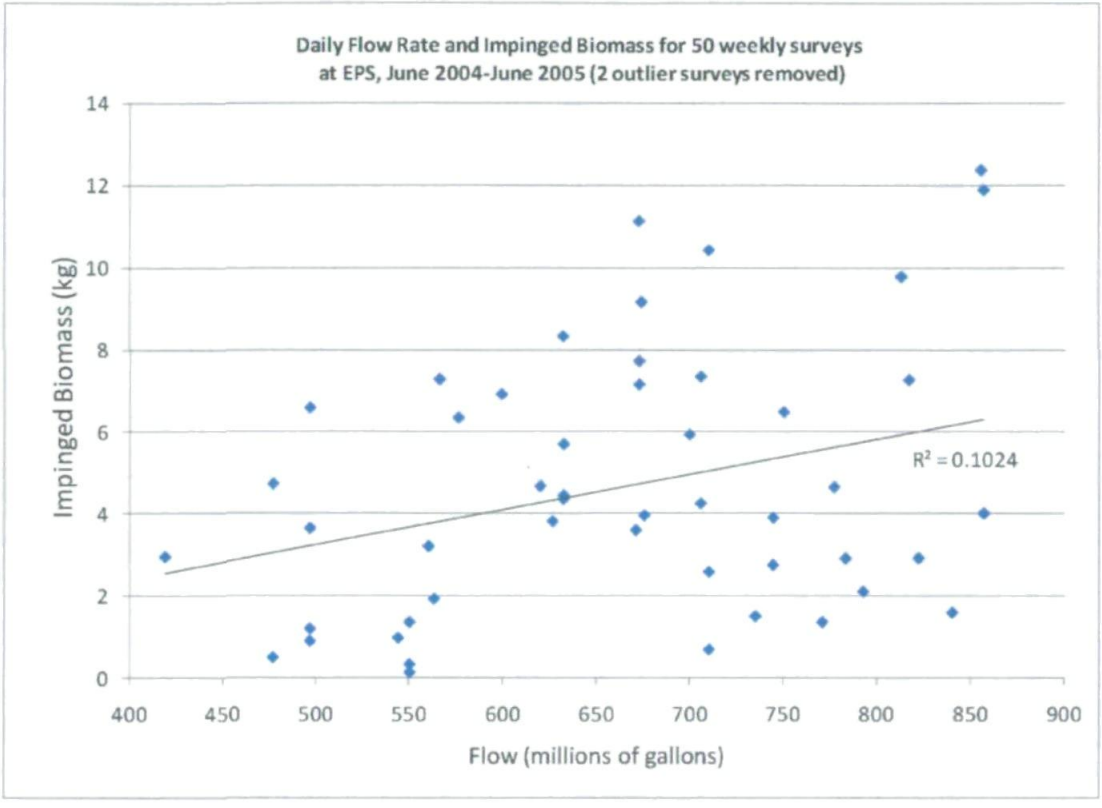
42 Email from J. Steinbeck to D. Mayer, April 24, 2008, Mayer Declaration, Attachment B.

43 Email from J. Steinbeck to P. Raimondi, April 22, 2008, Mayer Declaration, Attachment B.

44 Clean Water Act Section 316(b) Impingement Mortality and Entrainment Characterization Study, Cabrillo Power I LLC, Encina Power Station, January 2008. Tenera Environmental, Appendix A, Tab 3.

45 The two other samples were outliers and, therefore, were removed in order to get more accurate statistical correlation of the impingement results.




Whereas Encina's average intake flow during the 2004/2005 sampling period was 632.6 MGD,[46] the Project's maximum intake flow will be only 304 MGD. Because the Project's flow volumes will be less than Encina's, its impingement impacts are also proportionally less than the Project's projected impacts.

3. Tenera's Study Indicates that the Project's Impingement Effect Will Be 1.56 kg/day

Using the statistically significant relationship between the impingement effects and flows measured under normal power plant operations that occurred during the June 2004 to June 2005 impingement survey, Tenera concluded that the Project's stand-alone operations will result in an average daily impingement effect of 1.56 kg (3.45 lbs).

4. As a Stand-alone Facility, the Project Will Reduce its Intake Flow Rate to 0.5 Feet Per Second or Below, Thereby Further Reducing its Impingement Impacts

As noted above, Encina's daily water requirements are approximately twice those projected for the Project. To satisfy Encina's water demands, the power plant draws water in at a flow rate that exceeds the Project's projected flow rate. When the Project operates in stand-alone mode, therefore, it will be able to operate the existing intake facilities at a reduced flow

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46 March 6, 2008 Minimization Plan, pp 5-3.

rate and use fewer pumps to collect the water.[47] By lowering its flow rate below the 0.5 fps level, the Project "will reduce the impingement impacts associated with the desalination plant operations to a level that the Coastal Commission acknowledged is 'a de minimis impact.'"[48]

The EPA has recognized that a water intake flow rate equivalent to the Project's (0.5 ft/s) would minimize impingement impacts to insignificant levels. Specifically, in the context of establishing the "best technology available" under Section 316(b) of the federal Clean Water Act for new facilities utilizing cooling water intake structures (Phase I Rule), the EPA determined – based on substantial scientific evidence – that a maximum intake velocity of 0.5 ft/s or less minimizes adverse environmental impacts associated with impingement mortality to acceptable levels.[49] Similarly, for existing facilities (Phase II Rule), the EPA promulgated a regulation that an intake velocity of 0.5 ft/s or less minimizes impingement impacts to such an extent that no further technological or mitigation measures are necessary to protect fish species.[50] It should be noted that the EPA's Phase II Rule has been suspended pending ongoing litigation, but the litigation and subsequent regulatory suspension were not related to this issue and do not undermine the scientific basis of the EPA's determinations on this issue.

In developing the Phase I Rule, the EPA found that an approach velocity of 0.5 fps to protect fish species from impingement previously was used as guidance in at least three federal agency reports,[51] which were based in part on a study of fish swimming speeds and endurance performed by Sonnichsen et al. (1973).[52] To include an additional layer of conservatism for the Phase I Rule, the EPA prepared an additional analysis that concluded "thresholds should be based on the fishes' swimming speeds (which are related to the length of the fish) and endurance

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47 March 6, 2008 Minimization Plan, § 4.3 "Alternative Power Plant Intake & Screening Technologies"

48 *Id.*

49 *See* 66 Fed. Reg. 65274; *see also* 40 C.F.R. 125.84(b)(2), 125.84(c)(1).

50 40 C.F.R. 125.94(a)(1)(ii).

51 66 Fed. Reg. 65274 (citing Boreman, J. 1977. Impacts of power plant intake velocities on fish. Power Plant Team, U.S. Fish and Wildlife Service; 33 Christianson, A. G., F. H. Rainwater, M.A. Shirazi, and B.A. Tichenor. 1973. Reviewing environmental impact statements: power plant cooling systems, engineering aspects, U.S. Environmental Protection Agency (EPA), Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon, Technical Series Report EPA–660/2–73–016; King, W. Instructional Memorandum RB–44: Review of NPDES (National Pollutant Discharge Elimination System) permit applications processed by the EPA (Environmental Protection Agency) or by the State with EPA oversight.'' In: U.S. Fish and Wildlife Service Navigable Waters Handbook.)

52 Sonnichsen, J.C., Bentley, G.F. Bailey, and R.E. Nakatani. 1973. A review of thermal power plant intake structure designs and related environmental considerations. Hanford Engineering Development Laboratory, Richland, Washington, HEDL–TME 73– 24, UC–12.

(which varies seasonally and is related to water quality)."[53] This analysis demonstrated that "the species and life stages evaluated could endure a velocity of 1.0 ft/s."[54] However, to "develop a threshold that could be applied nationally and is effective at preventing impingement of most species of fish at their different life stages, EPA applied a safety factor of two to the 1.0 ft/s threshold to derive a threshold of 0.5 ft/s. This safety factor, in part, is meant to ensure protection when screens become partly occluded by debris during operation and velocity increases through portions of the screen that remain open."[55] Further, "EPA compiled the data from three studies[56] on fish swim speeds ...[which] suggest that a 0.5 ft/s velocity would protect 96 percent of the tested fish."

In a similar fashion, the Coastal Commission independently determined that the Project's intake flow rate would help reduce impingement impacts to insignificant levels under the Coastal Act. Specifically, the Coastal Commission found that

> "Water velocities at the intake...would be less than 0.5 fps, which would conform to the U.S. EPA's "Best Technology Available" standard for minimizing impingement impacts...[and with] these low velocities, the already *de minimis* impingement impacts that Poseidon's project may cause are expected to be further reduced and thus mitigated to an insignificant level and consistent with Coastal Act Sections 30230 and 30231."[57]

Tenera's conclusion that the Project's stand-alone operations will result in an average daily impingement of 1.56 kg (3.45 lbs) of fish, sharks and rays does not account for the fact that the Project will be able to reduce the intake flow rate to 0.5 fps or that the Project will use fewer pumps. Therefore, the Project's impingement effects will actually be less than the already insignificant figure of 1.56 kg/day.

5. <u>The Project Will Install Variable Frequency Drives That Will Reduce Impingement</u>

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53 66 Fed. Reg. 65274.

54 *Id.*

55 *Id.*

56 *Id.* (citing "University of Washington study" [Smith, L.S., L.T. Carpenter, *Salmonid Fry Swimming Stamina Data for Diversion Screen Criteria*; Final Report (Fisheries Research Institute, University of Washington, Dec. 1987], "Turnpenny" [A.W.H. Turnpenny, *The Behavioral Basis of Fish Exclusion from Coastal Power Station Cooling Water Intakes.* Central Elec. Generating Bd. Central Elec. Research Labs., 1988], and EPRI [C.C. Countant et al., *Technical Evaluation of the Utility of Intake Approach Velocity As an Indicator of Potential Adverse Impact Under Clean Water Act Section 316(b)* (Electric Power Research Institute, 2001])

57 Coastal Commission's Final Adopted Findings, August 6, 2008, p. 56, Appendix A, Tab 19.

Poseidon previously has notified the Regional Board of its commitment to incorporate variable frequency drives to reduce the total intake flow for the desalination facility to no more than that needed at any given time.[58] The desalination plant intake pump station will be equipped with a variable frequency drive system to closely control the volume of the collected seawater. As water demand decreases during certain periods of the day and the year, the variable frequency drive system will automatically reduce the intake pump motor speed and decrease intake pump flow to the minimum level needed for water production.[59] By reducing the intake pump flow below EPA approved velocities, the Project will further minimize impingement.

## VI. METHODOLOGY FOR ASSESSMENT OF THE PROJECT'S ENTRAINMENT IMPACT

### 1. The Empirical Transport Model Calculates APF

The Empirical Transport Model ("ETM") is a widely used model to estimate mortality rates resulting from water intake systems. The ETM calculates what is known as the Area of Production Foregone (APF)—a value that represents the number of acres of habitat that must be created or restored to mitigate for the small marine organisms (e.g., fish larvae) that pass through the intake screens and become entrained in a water intake system.

### 2. Model: *APF = SWB x Pm*

The ETM is an algebraic model that incorporates two basic variables: Source Water Body (SWB) and Proportional Mortality (Pm).

The Source Water Body (SWB) represents the number of acres in which egg and larvae populations are subject to entrainment. The SWB value is limited to the area in which mature fish produce eggs and larvae. If mature fish do not spawn in a given area, that area will contain no entrainable organisms—i.e., no eggs or larvae to be drawn into and entrained by the intake system.

Proportional Mortality (Pm) represents the percentage of the population of a marine species in a given water body that will be drawn in and entrained by a water intake system. The Pm ratio is calculated by dividing (a) the number of marine organisms that are entrained in a water intake system by (b) the number of marine organisms in the same water body that are subject to entrainment (i.e., entrainable).[60]

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[58] March 6, 2008 Minimization Plan, § 4.1 "Feasibility Considerations", p. 4-3.

[59] March 6, 2008 Minimization Plan, § 4.4.1 "Installation of Variable Frequency Drives on Desalination Plant Intake Pumps", p. 4-26.

[60] Hypothetical illustration:

*Pm Quantity Entrained / Quantity Entrainable*

3. Entrainment Sampling is Conducted to Estimate Pm and APF

The example described above uses given SWB and Pm values to calculate the APF. It assumes that we can precisely identify both the size of the source water body and the rate of entrainment.

In the real world, however, scientists must make estimates with respect to these values—the ultimate goal being to provide an APF estimate that closely approximates the actual APF. For instance, in this case, Tenera Environmental ("Tenera") collected samples throughout the Agua Hedionda Lagoon in order to generate Encina's Impingement & Entrainment Study Plan, which the Regional Board approved in 2004, see Section V. 2, infra. Because of variation in the sampling data, each sample collected by Tenera represents an estimate of the actual Pm—i.e., the actual percentage of the population that becomes entrained through the intake system.

4. Confidence Levels for APF Estimates Are Reached Using Statistical Theory

In addition to producing SWB and Pm value estimates, entrainment sampling produces standard error estimates. Scientists apply these standard error estimates to the SWB and Pm values and, using basic statistics principles, calculate confidence intervals to indicate the reliability of the APF estimates. The following example illustrates these principles:

| | |
|---|---|
| Assume: Pm = 0.1, SWB = 500 acres; SE = 5%; SE/Pm = 0.5 | The graph represents the cumulative probability function for a set of normally distributed data with a |

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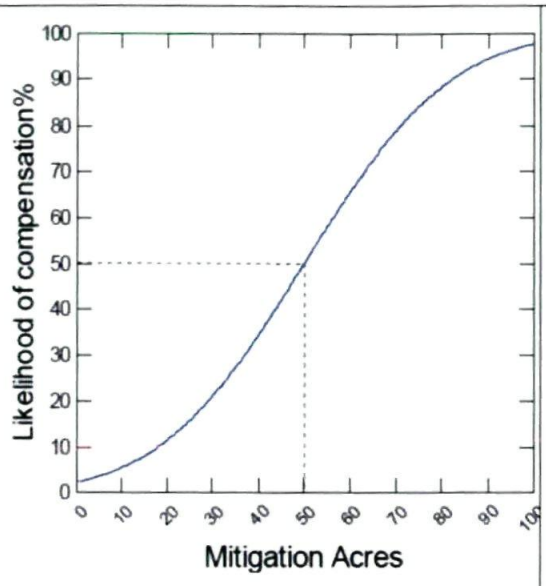
To illustrate the ETM's application, assume that the sampling conducted pursuant to an entrainment study demonstrates that a desalination plant's intake system draws in and entrains 100 anchovy larvae from a water body that contains 1000 anchovy larvae. In this case, Pm = 10% (i.e., 100 anchovies / 1000 anchovies). Next, assume that the intake system withdraws water from a 500-acre water body that contains mature anchovies; SWC = 500 acres. Based on this entrainment data, a straightforward application of the ETM calculates an APF of 50 acres (i.e., 500 acres x 10%).

This means that in order to mitigate for the entrainment losses caused by its intake system, the desalination plant would need to create or restore 50 acres of habitat similar to that of the source water body. These 50 acres of restored habitat would support the existence of the same number of larvae entrained by the desalination plant's operations.




mean of 50 and a given standard error.

The curve shows the probability (on the y-axis) that a value less than or equal to the corresponding APF value on the x-axis would occur from a sample of normally distributed data with the given mean and standard error.

The distribution represents the corresponding values that would define the upper and lower limits for a confidence interval based on a given probability level. For example, a 50% confidence interval (5% - 50% on the curve) would range from ~ 10 to 50 acres.

In this example, one can say—with a 50% level of confidence—that the ETM identifies the full extent of the entrainment impact.

5. Background Data Used for Preparation of Entrainment Assessment

Tenera Environmental collected entrainment data pursuant to Encina's Regional Board-approved IM&E study from June 2004 to May 2005. These data were provided to the Regional Board with Poseidon's March 2008 submittal.[61] All samples used for the entrainment assessment were collected in front of the Encina intake with a boat-towed plankton net.[62]

Based on these entrainment data, Tenera estimated the proportional entrainment mortality (Pm) of the most commonly entrained larval fish living in Agua Hedionda Lagoon by applying the ETM to the complete data. The potential entrainment contribution of the desalination facility operations was computed based on a total flow of 304 MGD (104 MGD flow to the desalination facility and 200 MGD for dilution of concentrated seawater).

In March 2008, Poseidon presented its ETM results to the Regional Board in preparation for its upcoming April 9, 2008 meeting. The ETM results were included as part of Poseidon's Minimization Plan. Attached to its Minimization Plan, Poseidon also submitted documentation containing impingement and entrainment data that Tenera had used to calculate the ETM results.[63]

Using the entrainment data that it collected during 2004 and 2005, Tenera concluded that the entrainment effect of the Project's stand-alone operation would extend over 36.8 acres of Agua Hedionda Lagoon (i.e., APF = 36.8 acres).

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61 March 6, 2008 Minimization Plan.

62 This is the standard protocol. Mayer Declaration, § 313.

63 March 6, 2008 Minimization Plan, Attachment 2-5.

6. To Arrive at an APF of 36.8 Acres, the Revised Plan Estimated the APF by Incorporating a Number of Very Conservative Assumptions While Entirely Discounting the Substantial Additional Ecological Benefits Associated with Poseidon's Mitigation

The ETM results presented in the Minimization Plan incorporated the following assumptions, which contributed to the conservative estimation of the APF value supporting the mitigation requirements set forth in the MLMP. Importantly, the ETM results in the MLMP continue to rely on the following specific, conservative assumptions:

a. Assumes 100% mortality of all marine organisms entering the intake. The ETM does not take into consideration any of the design and technology features that would be incorporated in the project to avoid impact to marine life (e.g., variable frequency drives, reduced flow rate velocities, etc.). The actual impact to marine life is expected to be substantially lower given these improvements.

b. Assumes 100% survival of all fish larvae in their natural environment. In fact, over 90% of the fish larvae are lost to predators and do not ever reach adulthood.

c. Assumes species are evenly distributed throughout the entire depth and volume of the water body. This assumption is very conservative for the site-specific conditions of Agua Hedionda Lagoon because it is well known that some impacted species (e.g., garibaldi) mainly inhabit the rocky area in immediate proximity to the entrance to the power plant intake while source water is drawn from a broader area. The assumption that the species are evenly distributed results in a higher SWB value, which, in turn, results in an overestimation of the APF.

d. Assumes the entire habitat from which the entrained fish larvae may have originated is destroyed. This approach to identifying the restoration requirement for the stand-alone desalination facility assumes that the area of production foregone (APF) is an area of lost habitat for all marine species inhabiting this area.

Moreover, the entrainment model does not account for the significant environmental benefits that extend well beyond compensating for the entrainment impacts. For example, the APF calculation does not take into account the tremendous ecological value of the restored acreage that will accrue to the valuable wetland species that are completely unaffected by the intake, such as the numerous riparian birds, reptiles, benthic organisms and mammals that will utilize the habitat for foraging, cover and nesting. Nor does the calculation consider the myriad phytoplankton, zooplankton and invertebrate species that are largely unaffected by the intake operations and benefit directly from the restored wetlands.

### 7. By Accounting for Ocean Species and Using an 80% Confidence Level, the MLMP Applies Additional Conservative Assumptions to the ETM

In March 2008, Poseidon provided a copy of its entrainment study to the Coastal Commission as required by Special Condition 8 of the Project's coastal development permit. Coastal Commission staff forwarded the study to Dr. Pete Raimondi for his review and recommendations. Dr. Raimondi provided the initial results of his review and recommendations to the Coastal Commission in April 2008.

During the course of his review of Tenera's entrainment study, Dr. Raimondi made two important revisions that resulted in his upward revision of the APF estimate to 55.4 acres from Tenera's 36.8 acres.

First, Dr. Raimondi added open ocean water species (e.g., the northern anchovy) to the entrainment model, even though he recognized that the water intake system's intake system's entrainment impact on ocean species is very small.[64] By adding ocean species, Dr. Raimondi's approach forces Poseidon to mitigate for a number of species that will be only minimally affected by the Project's operations. The addition of ocean species to the entrainment model adds an extra layer of resource protection to the Project's mitigation obligation.

Second, Dr. Raimondi applied an 80% confidence level APF as the basis for mitigation. This approach represents a significant departure from the way that entrainment studies have been conducted in the past and ensures that the MLMP plan will fully account for the Project's entrainment impacts. Whereas Tenera based its APF calculation on a 50% confidence interval—i.e., the level of confidence that past entrainment studies have generally used[65]—Dr. Raimondi used the higher 80% figure. Thus, to an 80% degree of certainty, the mitigation plan comprehensively identifies and accounts for any entrainment impacts.

### 8. Layering Conservative Assumptions Over an 80% Confidence Level Entrainment Model the MLMP Calculates a High APF Value, Ensuring Entrainment Impacts Will Be Fully Mitigated

As discussed above, the MLMP conservatively estimates Poseidon's mitigation burden by making two conservative adjustments regarding ocean species and confidence levels. When these adjustments are combined with all of the conservative assumptions that Tenera had already incorporated in arriving at the 36.8-acre figure, the entrainment model generates a final APF that ensures resource protection and promotes excess mitigation.

## VII. THE MLMP COMPLIES WITH THE APRIL RESOLUTION

The April Resolution required that Poseidon's amendment address the Regional Board staff's February 19, 2008 letter indicating its concerns with the second draft of the Minimization

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64 Dr. Raimondi's PowerPoint Presentation; Presented to Coastal Commission Staff and Poseidon on April 25, 2008 in San Francisco. Mayer Declaration, Attachment C.

65 Mayer Declaration, V E..

Plan (without clarifying how Poseidon's March 7, 2008 submittal did not already resolve the Regional Board's concerns), as well as the following items:

- Identification of impacts from impingement and entrainment;
- Adequate monitoring data to determine the impacts from impingement and entrainment;
- Coordination among participating agencies for the amendment of the Plan as required by Section 13225 of the California Water Code;
- Adequacy of mitigation; and
- Commitment to fully implement the amendment to the Plan.

A. Staff Concerns Have Been Addressed[66]

1. Interagency Input and Approval[67]

As described in Sections II E, III supra, the MLMP was developed in a months-long interagency process and will continue to engage the agencies in site selection, restoration plan development, and performance monitoring.

2. Adequacy of the Underlying Data and Modeling[68]

The underlying impingement and entrainment data and calculations are representative, adequate, and sound for both co-located and stand-alone operations. As detailed in Sections II, the MLMP has benefited from development in an interagency process involving independent scientific review in which the data and modeling were fully vetted.

3. Mitigation Will Fully Offset Impacts[69]

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66 Staff concerns have been identified in the February 19, 2008 letter, the April 4, 2008 Technical Report, and the April 17, 2008 email correspondence from Chiara Clemente to Peter MacLaggan. Concerns not summarized here have been mooted either by the third draft of the Minimization Plan conditionally approved at the April 9, 2008 meeting or the MLMP. For example, in point 1 of its February 19, 2008 letter, staff expressed concern that the second draft of the Minimization Plan did not include technology measures. Technology was addressed in the third draft of the Minimization Plan. See also Section V, supra, describing technology measures to reduce impingement.

67 February 19, 2008 letter, concern 7; April 4, 2008 Technical Report, concern 1, 2.

68 February 19, 2008 letter, concerns 2, 3, 8, 9, 10, 13, 14; April 4, 2008 Technical Report, concern 3; April 17, 2008 email correspondence from Chiara Clemente to Peter MacLaggan.

69 February 19, 2008 letter, concerns 4, 6, 11, 12, 15, 17

As explained in Sections V, supra, the entrainment modeling fully captures impacts for stand-alone operations using conservative, resource-protective assumption to arrive at a mitigation acreage amount, and is calculated to produce an anticipated loss rate rather than converted to a fixed dollar amount of loss.

4. Site Selection[70]

The actual mitigation site(s), which will be selected this year, will not be locked in to San Dieguito Lagoon or other pre-determined outcome as staff were concerned in April 2008, and will be at location(s) acceptable to the Executive Officer of the Regional Board, and the Executive Director of the Coastal Commission.

5. Presentation of a Single Site at this Site Was Not Anticipated, Required, or Feasible at this Juncture[71]

a. *Staff Course of Conduct Indicated that Poseidon Was to Consider Multiple Sites*

Consistent with the April Resolution, Poseidon submitted eleven specific mitigation sites determined during the interagency process and submitted a specific proposal for mitigation at these identified sites. In its December 2, 2008 letter to Poseidon, staff indicated that "the MLMP does not propose a specific mitigation site or a specific proposal for mitigation at an identified site." This letter is not clear in indicating staff's concern with the MLMP.

In the April 4, 2008 Technical Report, staff faulted Poseidon's mitigation planning for seeming to "favor a pre-determined outcome (i.e., mitigation in San Dieguito Lagoon)." In that same Technical Report, and with apparent approval, staff acknowledged that Poseidon was considering mitigation at several possible sites, including Frazee State Beach, Loma Alta Lagoon and Buena Vista Lagoon, in addition to Agua Hedionda Lagoon and San Dieguito Lagoon. The April 4, 2008 Technical Report stated that the adoption of the Minimization Plan was premature because it did not "clearly identify the method for the final selection and agency concurrence of the preferred mitigation alternative." In fact, both prior to the April 9, 2008 conditional approval, and during the interagency process, Poseidon was led to believe that staff viewed a short list of potential sites coupled with a rigorous screening, selection and implementation process that is evaluated against a comprehensive set of objective performance criteria a strength of an appropriate mitigation plan.

To the extent staff is concerned that Poseidon is not bringing to the Regional Board a single site for consideration, the concern is belated to the point of prejudice to Poseidon and is in contrast to its course of conduct.

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70 February 19, 2008 letter, concern 5; April 4, 2008 Technical Report, concern 4.

71 Letter from J. Robertus to Poseidon, December 2, 2008.

As an additional matter, at the May 1, 2008 interagency meeting, the Executive Officer indicated that the focus should not be on Agua Hedionda.[72] Thus, an staff concern that mitigation Agua Hedionda should be selected as the mitigation site is contrary to the guidance staff has provided Poseidon, to Poseidon's prejudice.

b. *The April Resolution Did Not Require the Presentation of a Single Site*

To the extent staff feels that Poseidon should have presented a single site for the Regional Board's approval, this position is not supported by the April Resolution.

c. *Selection of a Single Site at this Juncture Would Have Been Infeasible, Contrary to Water Code Section 13142.5*

Water Code Section 13142.5 requires that an "industrial installation using seawater for...industrial processing [employ] the best available site, design, technology, and mitigation measures feasible...to minimize the intake and mortality of all forms of marine life.".

A "single-site" plan would have been infeasible in the six-month time frame allotted by the April Resolution. In order to generate such a plan, Poseidon would have need to identify and acquire a site (without the benefit of prior agency approval as is being sought here), conduct the necessary engineering and environmental review (CEQA), secure multiple entitles including a RWQCB 401 Water Quality Certification, Dewatering Permit, Army Corps Sections 10 and 404 permits, a coastal development permit, a State Lands Commission Encroachment Permit, a Department of Fish & Game Streambed Alteration Agreement, etc., and negotiate any contractual issues associated with the acquisition of a selected site.

The Coastal Commission recognized this infeasibility when it directed staff to design a MLMP that will maintain, restore and enhance the marine environment without causing significant delays to the start of construction of a critically needed water supply facility in the midst of a water supply emergency. The San Diego County Water Authority in its April 2007 Updated 2005 Urban Water Management Plan relies upon the Project for the delivery of 56,000 acre-feet of local seawater desalination in 2011 in order to meet its overall water supply goals.[73] An unreasonable insistence that the MLMP be presented to the Regional Board within six months of the conditional approval of the Minimization Plan as a single-site plan (in addition to being in contradiction to the interagency process and the April Resolution) would derail the Project, whereas adopting the current MLMP will get the Project, including the development of the extensive mitigation wetlands, underway.

B. Resolution's Additional Concerns Have Been Addressed

1. Identification of Impacts from Impingement and Entrainment

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72 MacLaggan Declaration.

73 April 2007 Updated 2005 Urban Water Management Plan , p 4-6, Section 4.3.1 Appendix A, Tab 24.

See Sections IV-VI, supra, for discussion on how the impact data was gathered and vetted.

2. Adequate Monitoring Data to Determine Impacts from Impingement and Entrainment

See Sections IV-VI supra, for a discussion of the adequacy of the monitoring data supporting the MLMP.

3. Coordination Among Participating Agencies as Required by Water Code Section 13225

See Section II, supra, for a discussion of the interagency process to develop the MLMP.

4. Adequacy of Mitigation

See Section V, supra, describing the modeling resulting in the mitigation computation.

5. Commitment to Implement the MLMP

See Sections III, VIII, supra, describing the MLMP standards, agency enforcement mechanisms, and safeguards.

## VIII. SAFEGUARDS

### A. The MLMP Will Be Enforced by the Coastal Commission and the Regional Board

The MLMP includes several enforcement mechanisms. In particular, it provides for approval of the site selection, performance, and remediation by the Executive Director of the Coastal Commission. If approved by the Regional Board as well, it will be equally enforceable by the Executive Officer. The Executive Director and the Executive Officer will be authorized to order remediation to correct any deficiencies perceived in meeting the MLMP's rigorous performance standards.

### B. Poseidon Will Be Required to Seek Renewal of the NPDES Permit from the Regional Board

Poseidon will also be required seek renewal of its NPDES permit in order to begin commercial operations. Poseidon's Report of Waste Discharge is due April 1, 2011, and the current permit will expire October 1, 2011, and Poseidon is unlikely to have begun operations until months later. The Regional Board at that time will once again have the opportunity to examine the project and make adjustments if necessary.

### C. Regional Board May Reopen the Permit

As an additional safeguard, the Regional Board may choose to reopen the NPDES Permit. Specifically, the Permit provides that, "This Order may be modified, revoked and

reissued, or termination for cause including, but not limited to...Failure to comply with any condition of this Order[.]"[74] This reopener provision provides the Regional Board with complete control over activities authorized or contemplated by the NPDES permit.

D. Poseidon is Obligated to Comply With Progress Reporting Requirements Under the MLMP and the NPDES Permit

The MLMP provides that the Coastal Commission (and the Regional Board) will receive annual written project status reports and convene periodic public hearings to assess the progress and success of the project. Poseidon must make monitoring data available to the public on the Internet. In addition, Poseidon must comply with monitoring requirements for the Project established by the Regional Board in the NPDES permit.

E. Poseidon is Obligated to Comply with the MLMP Under the Terms of the Intake System Lease as Approved by the State Lands Commission

The State Lands Commission approved Poseidon's lease for the intake system August 22, 2008, incorporating MLMP compliance as an amendment. Among other enforcement conditions, under the terms of the lease, Poseidon must provide copies of all monitoring reports to the State Lands Commission.[75] The SLC lease also requires that Poseidon shall comply with the MLMP as adopted by the Coastal Commission on August 6, 2008; comply with the post restoration monitoring and remediation requirements set forth in the MLMP Section 5.4 for ensuring the success of the wetlands restoration site(s), provided that the standards include success criteria from four existing relatively undisturbed sites and that Poseidon achieve a 95% confidence level of success for the restoration required. Should the Coastal Commission amend Section 5.4 at any time, Poseidon shall request an amendment to the lease. Within ten years from the effective date of the lease, or upon such earlier time as agreed to by the State Lands Commission, or upon notice by the owner of Encina that it will no longer require the use of the intake and outfall that are the subject of the lease for the purposes of generating electrical power, the State Lands Commission will undertake an environmental review of eh ongoing impacts of operation of the desalination facility to determine if additional requirements are required. Finally, Poseidon shall provide the State Lands Commission a performance bond in the amount of $3,700,000 prior to commencement of operation of the desalination facility to ensure the implementation of compensatory mitigation, monitoring and maintenance as described in the MLMP.

F. Poseidon's MLMP Embodies the Recommendations Set Forth in the Regional Board's "Lessons Learned" Memorandum, Demonstrating Poseidon's Dedication Implementing the MLMP

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74 Order No. R9-2006-0065, VI.B.1.

75 State Lands Commission, Amendment of Lease PRC 8727.1, ¶¶11-24, Appendix A, Tab 2.

On March 12, 2008, the Regional Board staff issued a report to the Regional Board titled "Lessons Learned From the State Route 125" ("Report"), which provides guidance to the Regional Board on how to ensure discharger compliance in large multi-phase construction projects. Generally speaking, the Report recommends that, when issuing permits, the Regional Board should include specific requirements, clear expectations, and mechanism to enforce those requirements. The following points illustrate how the MLMP incorporates the Report's policy recommendation, demonstrating Poseidon's commitment to developing and implementing a successful mitigation plan.

1. Poseidon's MLMP Contains Specific Language Prescribing Performance Measures, Timelines and Requirements

In the Report, the Regional Board staff recommends that Regional Board directives include specific language describing performance measures, timelines, and requirements to ensure the discharger's compliance. Poseidon's MLMP embodies these recommendations. As discussed previously, the MLMP contains specific language describing performance measures, timelines and requirements. The MLMP's embodiment of the Report's recommendations demonstrates Poseidon's dedication to meeting Regional Board directives, including the minimization of marine life mortality.

2. The Regional Board Has Enforcement Tools to Ensure Poseidon Implements Fully Functional and Complete Mitigation Site(s)

In the Report, the Regional Board staff discusses how a discharger's failure to comply with Regional Board mandates can result in harmful effects to marine life. To ensure compliance in future projects, the Report advises the Regional Board that permit requirements should be accompanied by meaningful enforcement mechanisms.

Poseidon's commitment to implement the MLMP will be enforced by the Regional Board through the requirements of Poseidon's NPDES permit and Resolution R9-2008-00398, and by the Coastal Commission through Condition 8 of Poseidon's coastal development permit. Furthermore, by the time the Project begins commercial operations in late 2011 or early 2012, Poseidon will have to seek renewal of its NPDES permit before the Regional Board.

## IX. THE MLMP WAS NOT UNTIMELY SUBMITTED

Regional Board staff have indicated they believe the MLMP was untimely submitted to the Regional Board. As described in Section II, Regional Board staff received the draft MLMP on July 8, 2008 and again on September 17, 2008. Therefore, the Regional Board received the MLMP long before the October 8, 2009 deadline provided by the April Resolution.

Final language for the MLMP was submitted to the Regional Board on November 14, 2008, which was timely in light of the flexibility required to accomplish the Regional Board's directive that Poseidon participate in an interagency process to develop the MLMP. As detailed in Section II, Poseidon apprised the Regional Board of the delay in the Regional Board's receipt of the final MLMP language caused by the interagency process, and staff understood that

flexibility in the deadline was necessary, as evidenced in the Executive Officer's comments to that effect at the Regional Board's November 12, 2008 meeting.

## X. DENIAL OF THE MLMP WOULD BE ARBITRARY AND CAPRICIOUS

At a minimum, the Regional Board's review of the MLMP and subsequent decision regarding its adequacy must satisfy the arbitrary and capricious standard under California law. Denial of the MLMP on the basis of untimeliness would be arbitrary and capricious under the circumstances. The MLMP, received by the Regional Board on July 8, 2008, months before the deadline was not untimely. To the extent the Regional Board would wish to base a finding of untimeliness on the November 14, 2008 date on which it received the final language decided by Coastal Commission staff, this, too, would be arbitrary and capricious since Poseidon's submission would not have been untimely but for the tension with the deadline created by the April Resolution's directive to engage in the interagency process to develop the MLMP, which did not conclude until *after* the deadline.

In addition, it would be arbitrary and capricious to deny the MLMP or rescind the April Resolution on any substantive basis, as the Regional Board has participated in the interagency process without expressing unresolved concerns.

## XI. CONCLUSION

Poseidon respectfully urges the Regional Board to approve the MLMP. As comprehensively explained above and in Poseidon's prior submittals, the MLMP is the result of rigorous scientific review and extensive interagency collaboration. It sets strict performance standards and provides for agency checks that will ensure the creation of up to 55.4 acres of highly productive wetlands habitat that will completely offset any marine life mortality associated with the Project's operations, whether when operating jointly with Encina or when operating alone. If the Regional Board approves the MLMP, and allows Poseidon to proceed to the site selection process, Poseidon will be able to begin the process of securing entitlements for the mitigation site(s). This will allow Poseidon to break ground on schedule with the Project construction schedule, and provide prime estuarine wetland habitat, along with much needed drinking water to the region.

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# COMMENTS ON CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD'S REVIEW OF POSEIDON RESOURCES CORPORATION'S MARINE LIFE MITIGATION PLAN FOR COMPLIANCE WITH RESOLUTION NO. R9-2008-0039

Submitted by:

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## APPENDIX VOLUME 1, Tabs 1 - 10

# APPENDIX A

# EXHIBITS TO COMMENTS ON CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD'S REVIEW OF POSEIDON RESOURCES CORPORATION'S MARINE LIFE MITIGATION PLAN FOR COMPLIANCE WITH RESOLUTION NO. R9-2008-0039

## Comments Submitted by Latham & Watkins LLP, January 26, 2009 – February 11, 2009 San Diego Regional Board Meeting, Item 6 - Poseidon Resources Corporation, Proposed Carlsbad Desalination Project (Order No. R9-2006-0065, NPDES No. CA0109223)

## Volume 1

| Tab No. | Date | Description |
|---|---|---|
| 1. | November 14, 2008 | Poseidon Resources Marine Life Mitigation Plan |
| 2. | n/a | PowerPoint Presentation Prepared by Dr. Raimondi: Review of Carlsbad Seawater Desalinization Project (CDP) |
| 3. | January 2008 | Clean Water Act Section 316(b) Impingement Mortality and Entrainment Characterization Study, Cabrillo Power I LLC, Encina Power Station, January 2008. Tenera Environmental. |
| 4. | February 19, 2008 | Regional Board Comment Letter on 2/12/07 Revised Plan |
| 5. | March 6, 2008 | Revised Flow, Entrainment, and Impingement Minimization Plan |
| 6. | March 7, 2008 | Poseidon Response to February 19, 2008 Regional Board Comments |
| 7. | March 7, 2008 | Email from Eric Becker to Tom Luster; wpaznokas@dfg.ca.gov; Sharon_Taylor@fws.gov; Peter MacLaggan; bruce@sdcoastkeeper.org; gabe@sdcoastkeeper.org; Judy Brown; rwilson@surfrider.org, copied to John Odermatt; Mike McCann. Subject: Poseidon Revised Flow, Entrainment, & Impingement Plan & Response to Regional Board Comments |
| 8. | April 2, 2008 | Email from S. Townsend to various people, including E. Becker. Subject: Marine Life Mitigation Plan Meeting for Poseidon Desla Plant |
| 9. | April 4, 2008 | RWQCB Technical Report, Review of Carlsbad Seawater Desalination Plant Flow, Entrainment, and Impingement Minimization Plan |
| 10. | April 9, 2008 | Reporter's Transcript of Proceedings, California Regional Waater Quality Control Board, San Diego Region, Partial Transcript of Proceedings, Public Hearing |

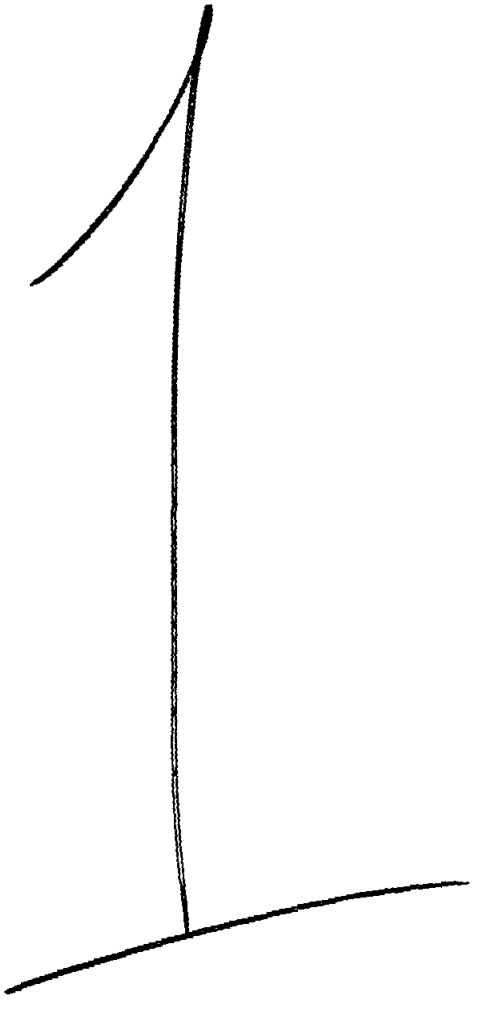
# APPENDIX A

## Volume 2

| Tab No. | Date | Description |
|---|---|---|
| 11. | April 10, 2008 | Email from P. MacLaggan to J. Robertus. Subject: Re: Update on Attendees for May 1-2 Meetings |
| 12. | April 10, 2008 | Email from P. MacLaggan to J. Robertus. Subject: Subject: May 1 Desal Mitigation Meeting |
| 13. | April 17, 2008 | Email from C. Clemente to P. MacLaggan. Subject: Poseidon's CDP Plan - questions regarding IM & E assessments |
| 14. | April 22, 2008 | Email from J. Steinbeck to P. Raimondi |
| 15. | April 24, 2008 | Email from J. Steinbeck to D. Mayer |
| 16. | April 30, 2008 | Email from P. MacLaggan to C. Clemente, copied to Brian Kelley; David Barker; Deborah Woodward; Mike McCann. Subject: Re: Poseidon's CDP Plan – questions regarding IM & E assessments |
| 17. | July 8, 2008 | Email from S. Townsend to various people, including J. Robertus. Subject: Poseidon' Marine Life Mitigation Plan |
| 18. | August 5, 2008 | Email from G. Newton to J. Brown. Subject: Fwd: RE: Coordination re: Poseidon? |
| 19. | August 6, 2008 | California Coastal Commission Final Adopted Findings (Item W4a). Application File No. E-06-013. Permittee: Poseidon Resources (Channelside) LLC / Cabrillo Power II LLC |
| 20. | August 6, 2008 | Reporter's Transcript of Proceedings, California Coastal Commission Meeting, Agenda Items Nos. 4.a., 5.a., 5.b., Vol. 2 of 2, pgs 163 – 347. |
| 21. | August 22, 2008 | State Lands Commission Final Lease Amendment No. PRC 8727.1 |
| 22. | November 21, 2008 | California Coastal Commission Recommended Revised Condition Compliance Findings (Item W16a). Condition Compliance for CDP No. E-06-013 – Poseidon Resources (Channelside), LLC; Special Condition 8: Submittal of a Marine Life Mitigation Plan |
| 23. | December 2, 2008 | Letter from RWQCB to Poseidon re: Review of Proposed Poseidon Resources Carlsbad Desalination Plant Marine Life Mitigation Plan, Resolution No. R9-2008-0039 |
| 24. | April 2007 | Updated 2005 Urban Water Management Plan, San Diego County water Authority. |
| 25. | December 18, 2001 | National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities, Final Rule. 66 Fed. Reg. 65256 |

# APPENDIX A

| Tab No. | Date | Description |
|---|---|---|
| 26. | July 9, 2004 | National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, Final Rule. 69 Fed. Reg. 41576 |
| 27. | July 9, 2007 | National Pollutant Discharge Elimination System—Suspension of Regulations Establishing Requirements for Cooling Water Intake Structures at Phase II Existing Facilities. 72 Fed. Reg. 37107 |
| 28. | n/a | 40 C.F.R. 125.84 |
| 29. | n/a | 40 C.F.R. 125.94 |



## POSEIDON RESOURCES MARINE LIFE MITIGATION PLAN

### INTRODUCTION

Poseidon's Carlsbad desalination facility will be co-located with the Encina Power Station and will use the power plant's once-through cooling intake and outfall structures. The desalination facility is expected to use about 304 million gallons per day (mgd) of estuarine water drawn through the structure. The facility will operate both when the power plant is using its once-through cooling system and when it is not.

This Marine Life Mitigation Plan (the Plan) will result in mitigation necessary to address the entrainment impacts caused by the facility's use of estuarine water. The Plan includes two phases of mitigation – Poseidon is required during Phase I to provide at least 37 acres of estuarine wetland restoration, as described below. In Phase II, Poseidon is required to provide an additional 18.4 acres of estuarine wetland restoration. However, as described below, Poseidon may choose to provide all 55.4 acres of restoration during Phase I. Poseidon may also choose during Phase II to apply for a CDP to reduce or eliminate the required 18.4 acres of mitigation and instead conduct alternative mitigation by implementing new entrainment reduction technology or obtaining mitigation credit for conducting dredging.

### CONDITION A: WETLAND RESTORATION MITIGATION

The permittee shall develop, implement and fund a wetland restoration project that compensates for marine life impacts from Poseidon's Carlsbad desalination facility.

### 1.0 PHASED IMPLEMENTATION

Phase I: Poseidon is to provide at least 37 acres of estuarine wetland restoration. Within two years of issuance of the desalination facility's coastal development permit (CDP), Poseidon is to submit a complete CDP application for a proposed restoration project, as described below.

Phase II: Poseidon is to provide an additional 18.4 acres of estuarine wetland restoration. Within five years of issuance of the Phase I CDP, Poseidon is to submit a complete CDP application proposing up to 18.4 acres of additional restoration, subject to reduction as described below.

### 2.0 SITE SELECTION

In consultation with Commission staff, the permittee shall select a wetland restoration site or sites for mitigation in accordance with the following process and terms.

Within 9 months of the effective date of this permit, the permittee shall submit the proposed site(s) and preliminary wetland restoration plan to the Commission for its review and approval or disapproval.

The location of the wetland restoration project(s) shall be within the Southern California Bight. The permittee shall select from sites including, but not limited to, the following eleven sites: Tijuana Estuary in San Diego County; San Dieguito River Valley in San Diego County; Agua Hedionda Lagoon in San Diego County; San Elijo Lagoon in San Diego County; Buena Vista Lagoon in San Diego County; Huntington Beach Wetland in Orange County, Anaheim Bay in

Orange County, Santa Ana River in Orange County, Los Cerritos Wetland in Los Angeles County, Ballona Wetland in Los Angeles County, and Ormond Beach in Ventura County. The permittee may also consider any sites that may be recommended by the California Department of Fish & Game as high priority wetlands restoration projects. Other sites proposed by the permittee may be added to this list with the Executive Director's approval.

The basis for the selection shall be an evaluation of the site(s) against the minimum standards and objectives set forth in subsections 3.1 and 3.2 below. The permittee shall take into account and give serious consideration to the advice and recommendations of the Scientific Advisory Panel (SAP) established and convened by the Executive Director pursuant to Condition B.1.0. The permittee shall select the site(s) that meets the minimum standards and best meets the objectives.

## 3.0 PLAN REQUIREMENTS

In consultation with Commission staff, the permittee shall develop a wetland restoration plan for the wetland site(s) identified through the site selection process. The wetland restoration plan shall meet the minimum standards and incorporate as many as feasible of the objectives in subsections 3.1 and 3.2, respectively.

### 3.1 Minimum Standards

The wetland restoration project site(s) and preliminary plan(s) must meet the following minimum standards:

a. Location within Southern California Bight;

b. Potential for restoration as tidal wetland, with extensive intertidal and subtidal areas;

c. Creates or substantially restores a minimum of 37 acres and up to at least 55.4 acres of habitat similar to the affected habitats in Agua Hedionda Lagoon, excluding buffer zone and upland transition area;

d. Provides a buffer zone of a size adequate to ensure protection of wetland values, and at least 100 feet wide, as measured from the upland edge of the transition area.

e. Any existing site contamination problems would be controlled or remediated and would not hinder restoration;

f. Site preservation is guaranteed in perpetuity (through appropriate public agency or nonprofit ownership, or other means approved by the Executive Director), to protect against future degradation or incompatible land use;

g. Feasible methods are available to protect the long-term wetland values on the site(s), in perpetuity;

h. Does not result in a net loss of existing wetlands; and

i. Does not result in an adverse impact on endangered animal species or an adverse unmitigated impact on endangered plant species.

**3.2 Objectives**

The following objectives represent the factors that will contribute to the overall value of the wetland. The selected site(s) shall be determined to achieve these objectives. These objectives shall also guide preparation of the restoration plan.

a. Provides maximum overall ecosystem benefits, e.g. maximum upland buffer, enhancement of downstream fish values, provides regionally scarce habitat, potential for local ecosystem diversity;

b. Provides substantial fish habitat compatible with other wetland values at the site(s);

c. Provides a buffer zone of an average of at least 300 feet wide, and not less than 100 feet wide, as measured from the upland edge of the transition area.

d. Provides maximum upland transition areas (in addition to buffer zones);

e. Restoration involves minimum adverse impacts on existing functioning wetlands and other sensitive habitats;

f. Site selection and restoration plan reflect a consideration of site specific and regional wetland restoration goals;

g. Restoration design is that most likely to produce and support wetland-dependent resources;

h. Provides rare or endangered species habitat;

i. Provides for restoration of reproductively isolated populations of native California species;

j. Results in an increase in the aggregate acreage of wetland in the Southern California Bight;

k. Requires minimum maintenance;

l. Restoration project can be accomplished in a reasonably timely fashion; and,

m. Site(s) in proximity to the Carlsbad desalination facility.

**3.3 Restrictions**

a. The permittee may propose a wetland restoration project larger than the minimum necessary size specified in subsection 3.1(c) above, if biologically appropriate for the site(s), but the additional acreage must (1) be clearly identified, and (2) must not be the portion of the project best satisfying the standards and objectives listed above.

b. If the permittee jointly enters into a restoration project with another party: (1) the permittee's portion of the project must be clearly specified, (2) any other party involved cannot gain mitigation credit for the permittee's portion of the project, and (3) the permittee may not receive mitigation credit for the other party's portion of the project.

c. The permittee may propose to divide the mitigation requirement between a maximum of two wetland restoration sites, unless there is a compelling argument, approved by the Executive Director, that the standards and objectives of subsections 3.1 and 3.2 will be better met at more than two sites.

## 4.0 PLAN IMPLEMENTATION

### 4.1 Coastal Development Permit Applications

The permittee shall submit complete Coastal Development Permit applications for the Phase I and Phase II restoration plan(s) that shall include CEQA documentation and local or other state agency approvals. The CDP application for Phase I shall be submitted within 24 months following the issuance of the Coastal Development Permit for the Carlsbad desalination facility. The CDP application for Phase II shall be submitted within 5 years of issuance of the CDP for Phase I. The Executive Director may grant an extension to these time periods at the request of and upon a demonstration of good cause by the permittee. The restoration plans shall substantially conform to Section 3.0 above and shall include, but not be limited to the following elements:

a. Detailed review of existing physical, biological, and hydrological conditions; ownership, land use and regulation;

b. Evaluation of site-specific and regional restoration goals and compatibility with the goal of mitigating for Poseidon's marine life impacts;

c. Identification of site opportunities and constraints;

d. Schematic restoration design, including:

1. Proposed cut and fill, water control structures, control measures for stormwater, buffers and transition areas, management and maintenance requirements;
2. Planting program, including removal of exotic species, sources of plants and or seeds (local, if possible), protection of existing salt marsh plants, methods for preserving top soil and augmenting soils with nitrogen and other necessary soil amendments before planting, timing of planting, plans for irrigation until established, and location of planting and elevations on the topographic drawings;
3. Proposed habitat types (including approximate size and location);
4. Assessment of significant impacts of design (especially on existing habitat values) and net habitat benefits;
5. Location, alignment and specifications for public access facilities, if feasible;
6. Evaluation of steps for implementation e.g. permits and approvals, development agreements, acquisition of property rights;
7. Cost estimates;

8. Topographic drawings for final restoration plan at 1" = 100 foot scale, one foot contour interval; and
9. Drawings shall be directly translatable into final working drawings.

g. Detailed information about how monitoring and maintenance will be implemented;

h. Detailed information about construction methods to be used;

i. Defined final success criteria for each habitat type and methods to be used to determine success;

j. Detailed information about how Poseidon will coordinate with the Scientific Advisory Panel including its role in independent monitoring, contingency planning review, cost recovery, etc.;

k. Detailed information about contingency measures that will be implemented if mitigation does not meet the approved goals, objectives, performance standards, or other criteria; and,

l. Submittal of "as-built" plans showing final grading, planting, hydrological features, etc. within 60 days of completing initial mitigation site construction.

### 4.2 Wetland Construction Phase

Within 6 months of approval of the Phase I restoration plan, subject to the permittee's obtaining the necessary permits, the permittee shall commence the construction phase of the wetland restoration project. The permittee shall be responsible for ensuring that construction is carried out in accordance with the specifications and within the timeframes specified in the approved final restoration plan and shall be responsible for any remedial work or other intervention necessary to comply with final plan requirements.

### 4.3 Timeframe for Resubmittal of Project Elements

If the Commission does not approve any element of the project (i.e. site selection, restoration plan), the Commission will specify the time limits for compliance relative to selection of another site or revisions to the restoration plan.

## 5.0 WETLAND MONITORING, MANAGEMENT AND REMEDIATION

Monitoring, management (including maintenance), and remediation shall be conducted over the "full operating life" of Poseidon's desalination facility, which shall be 30 years from the date "as-built" plans are submitted pursuant to subsection 4.1(1).

The following section describes the basic tasks required for monitoring, management and remediation. Condition B specifies the administrative structure for carrying out these tasks, including the roles of the permittee and Commission staff.

### 5.1 Monitoring and Management Plan

A monitoring and management plan will be developed in consultation with the permittee and appropriate wildlife agencies, concurrently with the preparation of the restoration plan to provide an overall framework to guide the monitoring work. It will include an overall description of the studies to be conducted over the course of the monitoring program and a description of management tasks that are anticipated, such as trash removal. Details of the monitoring studies and management tasks will be set forth in a work program (see Condition B).

**5.2 Pre-restoration site monitoring**

Pre-restoration site monitoring shall be conducted to collect baseline data on the wetland attributes to be monitored. This information will be incorporated into and may result in modification to the overall monitoring plan.

**5.3 Construction Monitoring**

Monitoring shall be conducted during and immediately after each stage of construction of the wetland restoration project to ensure that the work is conducted according to plans.

**5.4 Post-Restoration Monitoring and Remediation**

Upon completion of construction of the wetland(s), monitoring shall be conducted to measure the success of the wetland(s) in achieving stated restoration goals (as specified in the restoration plan(s)) and in achieving performance standards, specified below. The permittee shall be fully responsible for any failure to meet these goals and standards during the facility's full operational years. Upon determining that the goals or standards are not achieved, the Executive Director shall prescribe remedial measures, after consultation with the permittee, which shall be immediately implemented by the permittee with Commission staff direction. If the permittee does not agree that remediation is necessary, the matter may be set for hearing and disposition by the Commission.

Successful achievement of the performance standards shall (in some cases) be measured relative to approximately four reference sites, which shall be relatively undisturbed, natural tidal wetlands within the Southern California Bight. The Executive Director shall select the reference sites. The standard of comparison, i.e., the measure of similarity to be used (e.g., within the range, or within the 95% confidence interval) shall be specified in the work program.

In measuring the performance of the wetland project, the following physical and biological performance standards will be used:

a. **Longterm Physical Standards.** The following long-term standards shall be maintained over the full operative life of the desalination facility:

   1. ***Topography.*** The wetland(s) shall not undergo major topographic degradation (such as excessive erosion or sedimentation);
   2. ***Water Quality.*** Water quality variables to be specified shall be similar to reference wetlands;
   3. ***Tidal prism.*** If the mitigation site(s) require dredging, the tidal prism shall be maintained and tidal flushing shall not be interrupted; and,

4. ***Habitat Areas.*** The area of different habitats shall not vary by more than 10% from the areas indicated in the restoration plan(s).

b. **Biological Performance Standards.** The following biological performance standards shall be used to determine whether the restoration project is successful. Table 1, below, indicates suggested sampling locations for each of the following biological attributes; actual locations will be specified in the work program:

1. ***Biological Communities.*** Within 4 years of construction, the total densities and number of species of fish, macroinvertebrates and birds (see Table 1) shall be similar to the densities and number of species in similar habitats in the reference wetlands;
2. ***Vegetation.*** The proportion of total vegetation cover and open space in the marsh shall be similar to those proportions found in the reference sites. The percent cover of algae shall be similar to the percent cover found in the reference sites;
3. ***Spartina Canopy Architecture.*** The restored wetland shall have a canopy architecture that is similar in distribution to the reference sites, with an equivalent proportion of stems over 3 feet tall;
4. ***Reproductive Success.*** Certain plant species, as specified by in the work program, shall have demonstrated reproduction (i.e. seed set) at least once in three years;
5. ***Food Chain Support.*** The food chain support provided to birds shall be similar to that provided by the reference sites, as determined by feeding activity of the birds; and
6. ***Exotics.*** The important functions of the wetland shall not be impaired by exotic species.

**Table 1: Suggested Sampling Locations**

| | Salt Marsh | | | Open Water | | | Tidal |
|---|---|---|---|---|---|---|---|
| | Spartina | Salicornia | Upper | Lagoon | Eelgrass | Mudflat | Creeks |
| 1) Density/spp: | | | | | | | |
| – Fish | | | | X | X | X | X |
| – Macroinvert-ebrates | | | | X | X | X | X |
| – Birds | X | X | X | X | | X | X |
| 2) % Cover | | | | | | | |
| Vegetation | X | X | X | | X | | |
| algae | X | X | | | | X | |
| 3) Spartina architecture | X | | | | | | |
| 4) Reproductive success | X | X | X | | | | |
| 5) Bird feeding | | | | X | | X | X |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6) Exotics | X | X | X | X | X | X | X |

## 6.0 ALTERNATIVE MITIGATION

As part of Phase II, Poseidon may propose in its CDP application alternatives to reduce or eliminate the required 18.4 acres of mitigation. The alternative mitigation proposed may be in the form of implementing new entrainment reduction technology or may be mitigation credits for conducting dredging, either of which could reduce or eliminate the 18.4 acres of mitigation.

## CONDITION B: ADMINISTRATIVE STRUCTURE

## 1.0 ADMINISTRATION

Personnel with appropriate scientific or technical training and skills will, under the direction of the Executive Director, oversee the mitigation and monitoring functions identified and required by Condition A. The Executive Director will retain scientific and administrative support staff needed to perform this function, as specified in the work program.

This technical staff will oversee the preconstruction and post-construction site assessments, mitigation project design and implementation (conducted by permittee), and monitoring activities (including plan preparation); the field work will be done by contractors under the Executive Director's direction. The contractors will be responsible for collecting the data, analyzing and interpreting it, and reporting to the Executive Director.

The Executive Director shall convene a Scientific Advisory Panel to provide the Executive Director with scientific advice on the design, implementation and monitoring of the wetland restoration. The panel shall consist of recognized scientists, including a marine biologist, an ecologist, a statistician and a physical scientist.

## 2.0 BUDGET AND WORK PROGRAM

The funding necessary for the Commission and the Executive Director to perform their responsibilities pursuant to these conditions will be provided by the permittee in a form and manner reasonably determined by the Executive Director to be consistent with requirements of State law, and which will ensure efficiency and minimize total costs to the permittee. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution.

The budget to be funded by the permittee will be for the purpose of reasonable and necessary costs to retain personnel with appropriate scientific or technical training and skills needed to assist the Commission and the Executive Director in carrying out the mitigation and lost resource compensation conditions. In addition, reasonable funding will be included in this budget for necessary support personnel, equipment, overhead, consultants, the retention of contractors

needed to conduct identified studies, and to defray the costs of members of any scientific advisory panel(s) convened by the Executive Director for the purpose of implementing these conditions.

Costs for participation on any advisory panel shall be limited to travel, per diem, meeting time and reasonable preparation time and shall only be paid to the extent the participant is not otherwise entitled to reimbursement for such participation and preparation. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution. Total costs for such advisory panel shall not exceed $100,000 per year adjusted annually by any increase in the consumer price index applicable to California.

The work program will include:

a. A description of the studies to be conducted over the subsequent two year period, including the number and distribution of sampling stations and samples per station, methodology and statistical analysis (including the standard of comparison to be used in comparing the mitigation project to the reference sites);

b. A description of the status of the mitigation projects, and a summary of the results of the monitoring studies to that point;

c. A description of four reference sites;

d. A description of the performance standards that have been met, and those that have yet to be achieved;

e. A description of remedial measures or other necessary site interventions;

f. A description of staffing and contracting requirements; and,

g. A description of the Scientific Advisory Panel's role and time requirements in the two year period.

The Executive Director may amend the work program at any time, subject to appeal to the Commission.

## 3.0 ANNUAL REVIEW AND PUBLIC WORKSHOP REVIEW

The permittee shall submit a written review of the status of the mitigation project to the Executive Director no later than April 30 each year for the prior calendar year. The written review will discuss the previous year's activities and overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next year's program.

To review the status of the mitigation project, the Executive Director will convene and conduct a duly noticed public workshop during the first year of the project and every other year thereafter unless the Executive Director deems it unnecessary. The meeting will be attended by the contractors who are conducting the monitoring, appropriate members of the Scientific Advisory Panel, the permittee, Commission staff, representatives of the resource agencies (CDFG, NMFS, USFWS), and the public. Commission staff and the contractors will give presentations on the previous biennial work program's activities, overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next upcoming period's biennial work program.

The public review will include discussions on whether the wetland mitigation project has met the performance standards, identified problems, and recommendations relative to corrective measures necessary to meet the performance standards. The Executive Director will use information presented at the public review, as well as any other relevant information, to determine whether any or all of the performance standards have been met, whether revisions to the standards are necessary, and whether remediation is required. Major revisions shall be subject to the Commission's review and approval.

The mitigation project will be successful when all performance standards have been met each year for a three-year period. The Executive Director shall report to the Commission upon determining that all of the performance standards have been met for three years and that the project is deemed successful. If the Commission determines that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission. A public review shall thereafter occur every five years, or sooner if called for by the Executive Director. The work program shall reflect the lower level of monitoring required. If subsequent monitoring shows that a standard is no longer being met, monitoring may be increased to previous levels, as determined necessary by the Executive Director.

The Executive Director may make a determination on the success or failure to meet the performance standards or necessary remediation and related monitoring at any time, not just at the time of the workshop review.

## 4.0 ADDITIONAL PROCEDURES

### 4.1 Dispute Resolution

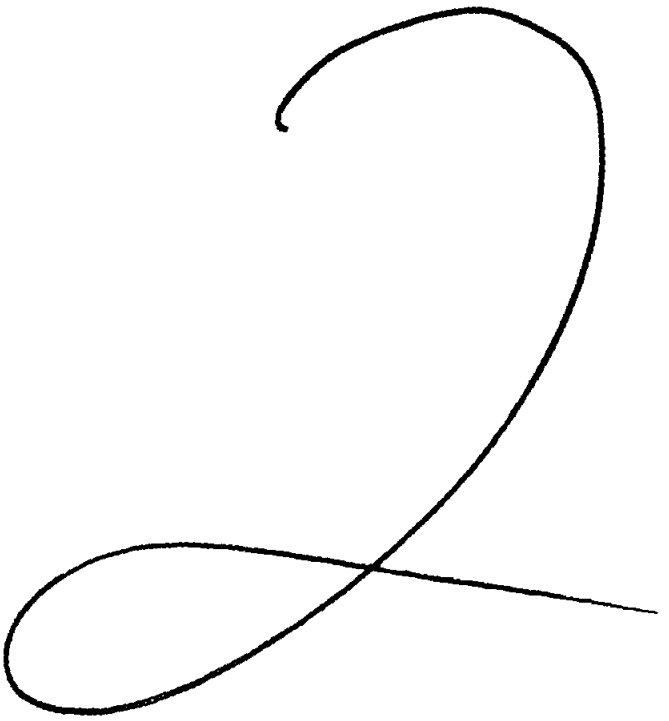
In the event that the permittee and the Executive Director cannot reach agreement regarding the terms contained in or the implementation of any part of this Plan, the matter may be set for hearing and disposition by the Commission.

### 4.2 Extensions

Any of the time limits established under this Plan may be extended by the Executive Director at the request of the permittee and upon a showing of good cause.

## CONDITION C: SAP DATA MAINTENANCE

The permittee shall make available on a publicly-accessible website all scientific data collected as part of the project. The website and the presentation of data shall be subject to Executive Director review and approval.



# Review of Carlsbad Seawater Desalinization Project (CDP)

- General comments on report
- Assessment of calculations of Pm
  - Estuarine species
  - Open water species
- Assessment of mitigation alternative using APF calculations
  - Math
  - Habitats

# General Comments

1) As written, the report could not be evaluated for the technical merits of the entrainment study or estimation of APF
   a) Tenera provided both a meeting to discuss the report and also provided the material needed to assess the entrainment study and APF calculations.
2) My assessment is based in part on calculations I did using material from the CDP report, the 316B report from Encina Power plant and from direct communication with Tenera
   a) Such calculations include: uncertainty analysis and APF for open coast species
3) The study design for entrainment sampling including source water sampling is consistent with recent entrainment studies conducted under 316B rules

# General Comments

4) Calculations of Pm, SWB and APF are generally consistent with recent studies
   a) Note additional calculations shown in this presentation for uncertainty and open water species
5) Proposed mitigation at San Dieguito is the most likely alternative to lead to compensation for losses of estuarine larvae due to entrainment – if habitat created more closely mimics source water body
6) No mitigation was proposed for losses of larvae from open water habitats
   a) APF is small but non-zero
   b) Mitigation options with direct nexus to impact are difficult

# Review of Carlsbad Seawater Desalinization Project (CDP)

- Assessment of calculations of Pm
  - Estuarine species
  - Open water species

# Assessment of calculations of Pm

- Proportional mortality (Pm) estimates are calculated using standard methodology
- Source water estimation is complicated for estuarine species (but in my opinion – correct)
- Source water estimation is standard for open water species
- Estimation of error rates is mathematically correct but, in my opinion, not appropriate for use in APF calculations
  - More about this later
- Uncertainty of estimates, particularly as they affect APF calculations is not adequately discussed
  - More about this later

# Understanding Proportional Mortality (Pm)

- Pm is the proportion of larvae at risk that are estimated to die as a result of entrainment
- Larvae at risk is determined by source water body (SWB) which differs for estuarine vs open water species
  - For estuarine species, it is generally the area of Agua Hediondo Lagoon that could produce larvae entrained
  - For open water species, it is the area from which larvae could have traveled from and then be entrained
    - Based on age of larvae entrained

# Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

| Species | Pm | Calcuated SE | Ratio SE/ Pm | Source water body * | Units |
|---|---|---|---|---|---|
| **Estuarine** | | | | | |
| Blennies | 0.08635 | 0.1347 | 1.56 | 302 | Acres |
| Gobies | 0.21599 | 0.3084 | 1.43 | 302 | Acres |
| Garibaldi | 0.06484 | 0.1397 | 2.15 | 302 | Acres |
| **Open Water** | | | | | |
| White Croaker | 0.00138 | 0.0028 | 2.04 | 45 | Km along shore |
| Northern Anchovy | 0.00165 | 0.0026 | 1.56 | 21 | Km along shore |
| California Halibut | 0.00151 | 0.0024 | 1.58 | 37 | Km along shore |
| Queenfish | 0.00365 | 0.0049 | 1.33 | 27 | Km along shore |
| Spotfin Croaker | 0.00634 | 0.0153 | 2.41 | 19 | Km along shore |

*The source water body for estuarine species is actually different from this value, however it is assumed that larval production is primarily from 302 acres in Agua Hediondo Lagoon

# Review of Carlsbad Seawater Desalinization Project (CDP)

- Assessment of mitigation alternative using APF calculations
  - Math
  - Habitats

# Use of Area of Production Foregone (APF) to estimate mitigation required to mitigate entrainment losses

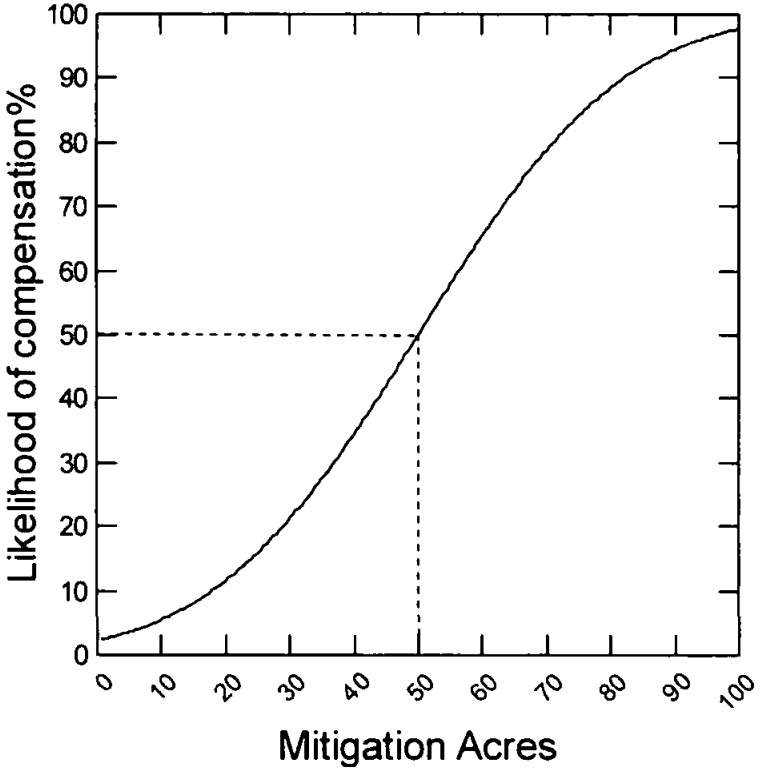
- Goal is to determine area required to provide sufficient habitat to produce larvae lost to entrainment
  - This area is the product of Pm and SWB
  - For example if the source water body (SWB) = 500 acres and Pm is 0.1 then the APF is

500 acres x 0.1 = 50 acres

  - This means that 50 new acres ***having a similar habitat mix as that in the SWB*** would produce larvae sufficient to make up for those lost to entrainment
  - This assumes no uncertainty in the estimation of Pm and SWB
    - The major issue is the error rate associated with estimation of Pm

# Understanding uncertainty of compensation through mitigation using APF (direct impacts only)

*For example: assume 500 acre SWB, Pm = 0.1, Standard Error / Pm = 0.5*




For average likelihood (50%) , Acres ~ 50. This means that with the uncertainty associated with sampling, there is a 50% or greater likelihood that 50 new acres will provide full compensation for lost larval resources.

This assumes:

1. Mitigation acres are similar to those in SWB
2. Restoration is successful

# Understanding uncertainty of compensation through mitigation using APF (direct impacts only)

Uncertainty in estimating compensation value of proposed mitigation is primarily related to error in estimation of Pm:

1)What is correct estimate of error?

a) Sampling error associated with estimation of Pm – *as shown in report*
   i. Source water concentrations of larvae – calculated error rates are very high and **probably not realistic** for use with respect to Pm
   ii. Entrainment concentrations of larvae – error rates are low and **probably not realistic** for use with respect to Pm

b) Error assuming each species' Pm is an independent replicate
   i. The most appropriate calculation of error, given the standard logic behind the use of APF

*Now – consider the ratio of SE/Pm – which expresses uncertainty in terms of units of impact*

# Use of error in calculations

- Use of error to calculate cumulative confidence curves relies on decision as to which estimate of error is appropriate.
- I used a normal cumulative function to generate confidence curves.
  - This relies on mean value and estimate of the standard deviation of the population of means.
  - I concluded that sample standard deviation was inappropriate for use using this function and instead used the sample standard error as an estimate of the standard deviation of the population of means. Hence the calculation was:
    - Prob = ZCF((acres – mean acres)/calculated SE)
    - Where ZCF is the normal cumulative function
  - The use of SE led to more conservative (lower) estimate of (eg) 80% confidence limit than would have been the case if standard deviation was used.
  - This was evaluated using resampling approaches where possible (which make no assumptions about normality).

# Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

| Species | Pm | Calcuated SE | Ratio SE/ Pm | Source water body | Units |
|---|---|---|---|---|---|
| **Estuarine** | | | | | |
| Blennies | 0.08635 | 0.1347 | 1.56 | 302 | Acres |
| Gobies | 0.21599 | 0.3084 | 1.43 | 302 | Acres |
| Garibaldi | 0.06484 | 0.1397 | 2.15 | 302 | Acres |
| **Open Water** | | | | | |
| White Croaker | 0.00138 | 0.0028 | 2.04 | 45 | Km along shore |
| Northern Anchovy | 0.00165 | 0.0026 | 1.56 | 21 | Km along shore |
| California Halibut | 0.00151 | 0.0024 | 1.58 | 37 | Km along shore |
| Queenfish | 0.00365 | 0.0049 | 1.33 | 27 | Km along shore |
| Spotfin Croaker | 0.00634 | 0.0153 | 2.41 | 19 | Km along shore |

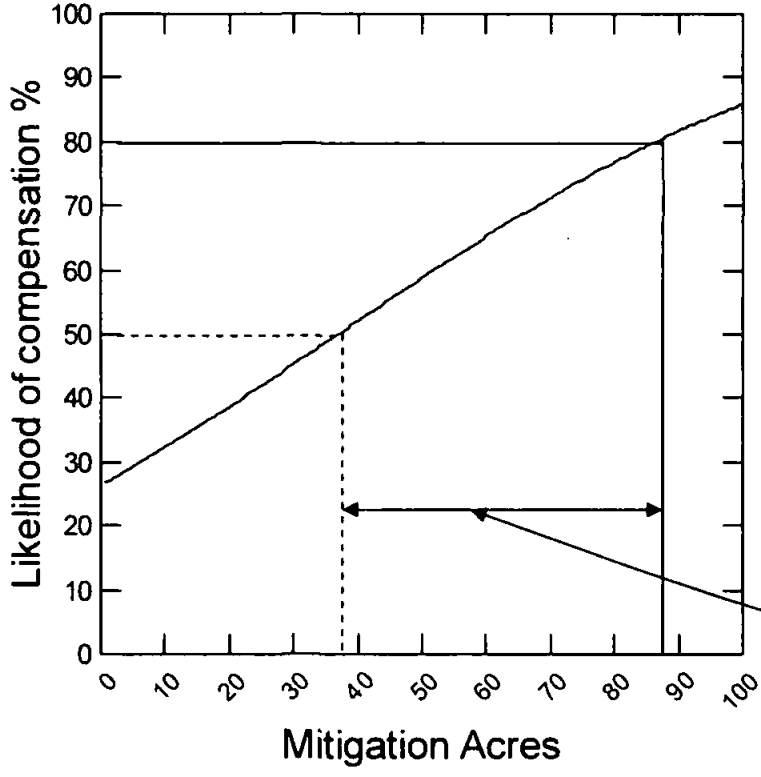


***These are huge***

# Uncertainty of compensation through mitigation using APF

**Estuarine** Species (direct impacts only)

**Case 1:** using error rate calculated in report (SE dominated by source water concentration of larvae)




For average likelihood (50%)
Acres ~ 37

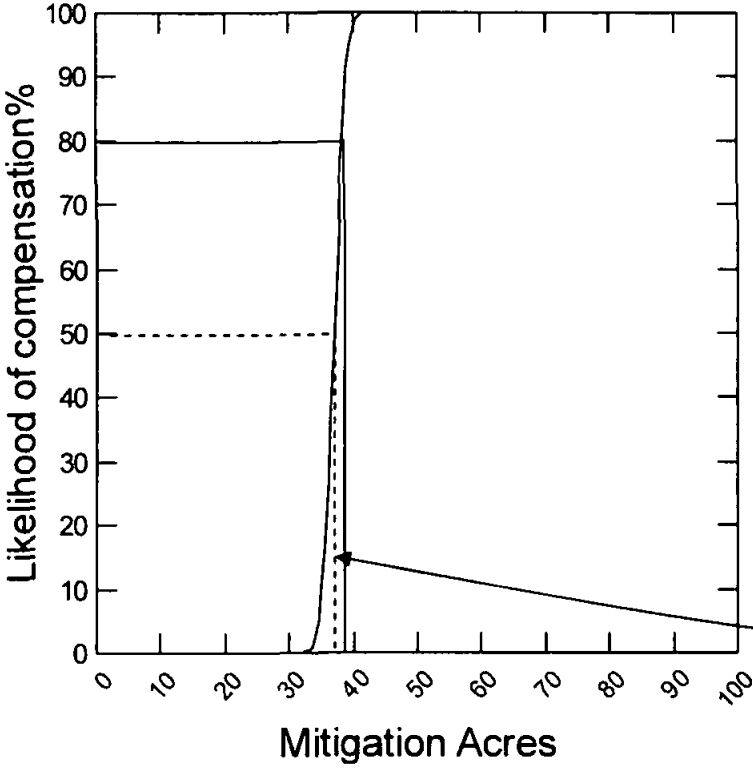
For 80% confidence level
Acres ~ 87

Big difference due to
Large SE/Pm ratio

# Uncertainty of compensation through mitigation using APF

**Estuarine** Species (direct impacts only)

**Case 2:** using error rate calculated from entrainment estimates only (SE very low)




For average likelihood (50%)
Acres ~ 37

For 80% confidence level
Acres ~39

Small difference due to
Small SE/Pm ratio

# Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

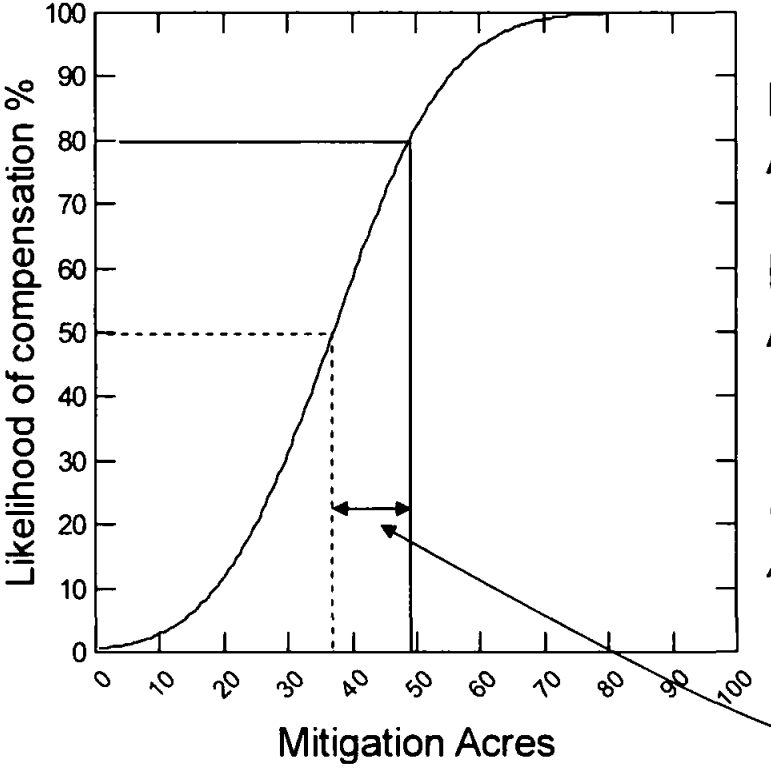
| Species | Pm | Calcuated SE | Ratio SE/ Pm | Source water body | Units | APF | Source water body | Units | APF |
|---|---|---|---|---|---|---|---|---|---|
| **Estuarine** | | | | | | | | | |
| Blennies | 0.08635 | 0.1347 | 1.56 | 302 | Acres | 26.0777 | | | |
| Gobies | 0.21599 | 0.3084 | 1.43 | 302 | Acres | 65.2290 | | | |
| Garibaldi | 0.06484 | 0.1397 | 2.15 | 302 | Acres | 19.5817 | | | |
| **Average** | **0.12239** | 0.1942 | | | | **36.9628** | | | |
| **SE** | | | | | | **14.2570** | | | |
| **Ratio SE/Pm** | | | | | | **0.3857** | | | |
| **Open Water** | | | | | | | | | |
| White Croaker | 0.00138 | 0.0028 | 2.04 | 45 | Km along shore* | 0.0621 | 33365 | Acres | 46.0440 |
| Northern Anchovy | 0.00165 | 0.0026 | 1.56 | 21 | Km along shore* | 0.0347 | 15570 | Acres | 25.6912 |
| California Halibut | 0.00151 | 0.0024 | 1.58 | 37 | Km along shore* | 0.0560 | 27477 | Acres | 41.4907 |
| Queenfish | 0.00365 | 0.0049 | 1.33 | 27 | Km along shore* | 0.1000 | 20309 | Acres | 74.1289 |
| Spotfin Croaker | 0.00634 | 0.0153 | 2.41 | 19 | Km along shore* | 0.1175 | 13739 | Acres | 87.1029 |
| **Average** | | | | | | **0.0740** | | | **54.8916** |
| **SE** | | | | | | **0.0151** | | | **11.2209** |
| **Ratio SE/Pm** | | | | | | **0.2044** | | | **0.2044** |

*** to a depth of 75 meters - average about 3 Km offshore**

# Uncertainty of compensation through mitigation using APF

**Estuarine Species** (direct impacts only)

**Case 3:** using error rate calculated from species Pm estimates (*probably most accurate*)




For average likelihood (50%)
Acres ~ 37

For 80% confidence level
Acres ~49,

*Using resampling*
*80% confidence level*
*Acres ~ 50*

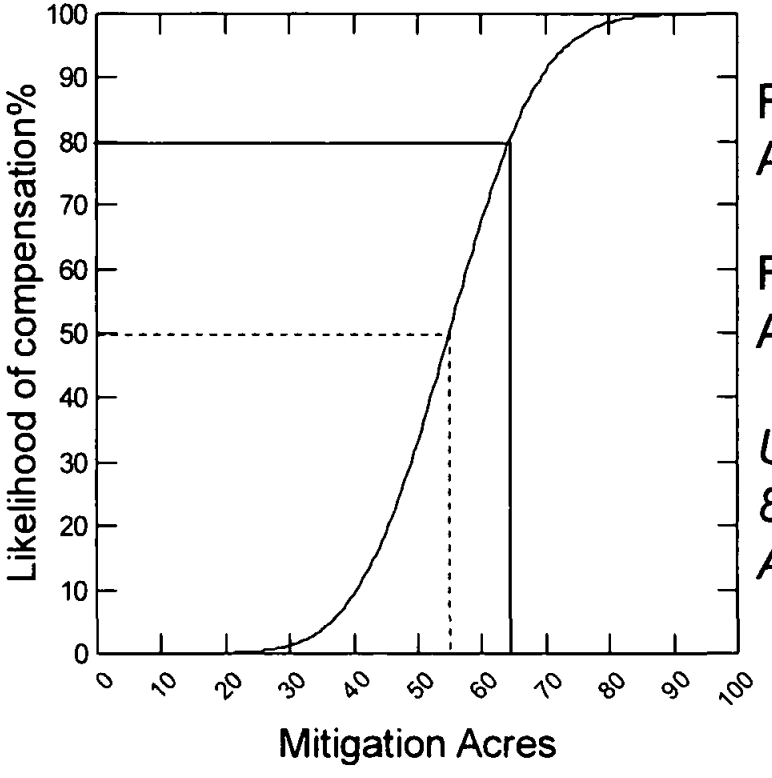
Relatively small difference due to appropriate SE/Pm ratio

# Calculated Pm, Standard Errors (SE) and Source water body (SWB) estimates

| Species | Pm | Calcuated SE | Ratio SE/ Pm | Source water body | Units | APF | Source water body | Units | APF |
|---|---|---|---|---|---|---|---|---|---|
| **Estuarine** | | | | | | | | | |
| Blennies | 0.08635 | 0.1347 | 1.56 | 302 | Acres | 26.0777 | | | |
| Gobies | 0.21599 | 0.3084 | 1.43 | 302 | Acres | 65.2290 | | | |
| Garibaldi | 0.06484 | 0.1397 | 2.15 | 302 | Acres | 19.5817 | | | |
| **Average** | **0.12239** | 0.1942 | | | | **36.9628** | | | |
| **SE** | | | | | | **14.2570** | | | |
| **Ratio SE/Pm** | | | | | | **0.3857** | | | |
| | | | | | | | | | |
| **Open Water** | | | | | | | | | |
| White Croaker | 0.00138 | 0.0028 | 2.04 | 45 | Km along shore* | 0.0621 | 33365 | Acres | 46.0440 |
| Northern Anchovy | 0.00165 | 0.0026 | 1.56 | 21 | Km along shore* | 0.0347 | 15570 | Acres | 25.6912 |
| California Halibut | 0.00151 | 0.0024 | 1.58 | 37 | Km along shore* | 0.0560 | 27477 | Acres | 41.4907 |
| Queenfish | 0.00365 | 0.0049 | 1.33 | 27 | Km along shore* | 0.1000 | 20309 | Acres | 74.1289 |
| Spotfin Croaker | 0.00634 | 0.0153 | 2.41 | 19 | Km along shore* | 0.1175 | 13739 | Acres | 87.1029 |
| **Average** | | | | | | **0.0740** | | | **54.8916** |
| **SE** | | | | | | **0.0151** | | | **11.2209** |
| **Ratio SE/Pm** | | | | | | **0.2044** | | | **0.2044** |

*** to a depth of 75 meters - average about 3 Km offshore**

# Uncertainty of compensation through mitigation using APF
## **Open Coast** Species (direct impacts only)
## Using error rate calculated from species Pm estimates
## (*probably most accurate*)




For average likelihood (50%)
Acres ~ 55

For 80% confidence level
Acres ~ 64

*Using resampling*
*80% confidence level*
*Acres ~ 63*

# APF summary

1) APF for estuarine species
    1) Mean APF = 37 acres
    2) 80% confidence limit = 49 acres
    3) Habitat mix for mitigation should include mudflat / tidal channel and open water habitat
2) APF for open coast species
    1) Mean APF = 55 acres
    2) 80% confidence limit = 64 acres
    3) Habitat is primarily open water, sandy bottom
    4) Relatively small area
    5) No mitigation options discussed
        a) Options that could lead to direct compensation are difficult

# Proposed Wetland Mitigation

1) Logic of APF as applied to wetland mitigation is appropriate for estuarine species losses
2) In my opinion the most appropriate mitigation discussed is offsite wetland creation at San Dieguito
   a) The mix of habitats should mirror those used in calculating APF at Agua Hediondo – currently they do not (use of salt marsh at San Dieguito)
   b) The ongoing restoration at San Dieguito, along with inlet maintenance and required monitoring make this the area most likely to be successfully used for compensatory mitigation
   c) Mitigation at Agua Hediondo as described, is unlikely to provide direct compensation for lost larval resources

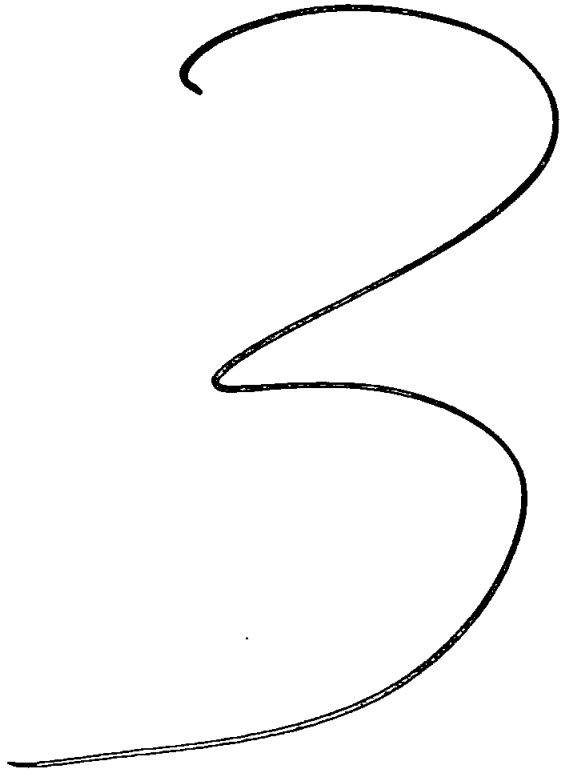
# Comments on discussion of "conservative assumptions" for APF

1) "Assumes 100% mortality of all marine organisms entering the intake"
   a) This is true but it is the same assumption that is made in all recent entrainment determinations. Moreover there is no study of post-entrainment larval survival that has been conducted in field conditions
2) "Assumes 100 % survival of all fish larvae in their natural environment"
   a) No such assumption is made. The only assumption concerning survival is that there is no compensatory mortality that affects Pm calculations.

# Comments on discussion of "conservative assumptions" for APF

3) "Assumes species are evenly distributed throughout the entire depth and volume of the water body"
   a) No such assumption is made. The major assumption is that creation of a similar mix of habitats to that found in the source water body will lead to compensation for all species lost due to entrainment.

4) "Assumes the entire habitat from which the entrained fish larvae may have originated is destroyed"
   a) No such assumption is made concerning the source water body. APF calculations are based on the idea of estimating the area that would need to be added in order to lead to the compensatory production of larvae lost to entrainment. Other features of the source water body are assumed not to have been damaged.



*Cabrillo Power I LLC*
*Encina Power Station*

# CLEAN WATER ACT SECTION 316(b) IMPINGEMENT MORTALITY AND ENTRAINMENT CHARACTERIZATION STUDY

## Effects on the Biological Resources of Agua Hedionda Lagoon and the Nearshore Ocean Environment

January 2008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# Executive Summary

The Encina Power Station (EPS) is a fossil-fueled steam electric power generating station that began operation in 1954. EPS is located in the City of Carlsbad, California, adjacent to Agua Hedionda Lagoon on the Pacific Ocean and approximately 30 miles north of the City of San Diego (**Figure S-1**). Cooling water is withdrawn from the Pacific Ocean via the Agua Hedionda Lagoon and circulated through the EPS cooling water system (CWS) to condense freshwater steam used in power production. The combined cooling and service water design flow is 857 million gallons per day (mgd) at full operating capacity. After passing through the plant, the warmed seawater is discharged to the ocean through a shoreline forebay and conveyance channel.

This report presents data from in-plant and source water field surveys performed for the EPS Impingement Mortality and Entrainment (IM&E) Characterization Study. This study was designed and performed to comply with EPA's 2004 316(b) Phase II regulations. Originally, results from the study were to be used in determining impingement mortality and entrainment from once-through cooling, evaluating potential fish protection technologies and operational measures at the facility, scaling potential restoration projects, and/or evaluating the benefits achieved in reducing IM&E at the facility. However, in March 2007, EPA suspended the Phase II regulations and directed administrators to determine compliance with 316(b) on a best professional judgment (BPJ) basis.

This report is being submitted to provide the San Diego Regional Water Quality Control Board (SDRWQCB) with information that it can use in its determination in regards to 316(b) issues for EPS. Prior to the Phase II Rule, 316(b) decisions were based on precedents from case law and on USEPA's (1977) draft "Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) P.L. 92-500." As Section 316(b) requires that an intake technology employs the 'best technology available' (BTA) for minimizing 'adverse environmental impacts' (AEI) there are two steps in determining compliance:

1. Whether or not an AEI is caused by the intakes and, if so,
2. What intake structure represents BTA to minimize that impact.

The usual approach for a 316(b) demonstration would be to consider the question of BTA only if a determination has been made that a facility is causing an AEI. The purpose of this report is to assess the potential for AEI from the operation of the EPS cooling water intake system (CWIS). The two primary impacts of a once-through power plant CWIS are impingement of juvenile and adult life stages of fishes, shellfishes, and other organisms on screens at the openings to the CWIS, and entrainment of smaller organisms, usually larval forms of fishes and shellfishes, and other forms of plankton, through the CWIS. This report provides a characterization of the fish and invertebrate species subject to entrainment and impingement at the EPS, information on the levels of IM&E at the EPS, and a discussion on the level of significance of the IM&E losses.

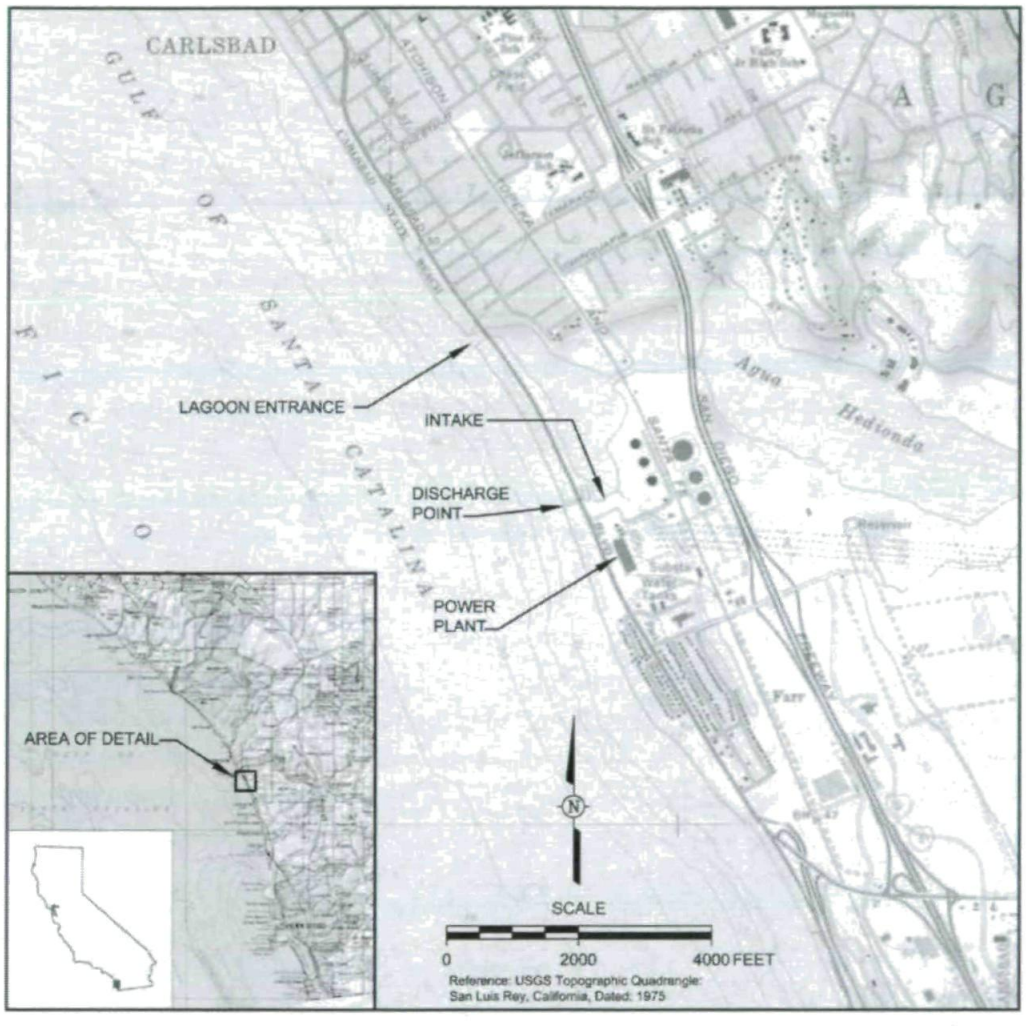



**Figure S-1**. Encina Power Station location map

A detailed IM&E sampling plan was developed for these IM&E studies and was previously submitted to the SDRWQCB in August 2004. The sampling plan was approved by the SDRWQCB and the sampling was conducted for one year starting in June 2004 and continuing to June 2005. The study included the following elements:

- Taxonomic identifications of all life stages of fishes, shellfishes, and any threatened or endangered species collected in the vicinity of the CWIS and are susceptible to IM&E.
- Characterization of all life stages of the target taxa in the vicinity of the CWIS and a description of the annual, seasonal, and diel variations in IM&E.
- Documentation of the current level of IM&E of all life stages of the target taxa.

The sampling methodologies and analysis techniques were derived from recent impingement and entrainment studies conducted for the AES Huntington Beach Generating Station (MBC and Tenera 2005), and the Duke Energy South Bay Power Plant (Tenera 2004).

The information in this report is being submitted to assist in the evaluation of fish protection technologies and operational measures for EPS so that when the issues with the Phase II Rule are resolved, the plant will be prepared to move forward in a timely manner to comply with the Rule. The information is also important in evaluating the potential for adverse environmental impacts (AEI) potentially caused by impingement and entrainment. In support of this approach to compliance, the assessment of the IM&E study focuses on determining if impingement and entrainment losses pose any significant risk of AEI to the species and life stages of fish and shellfish impinged or entrained.

Detailed summaries of each component of the study are presented in the following sections. The following are brief summaries of the major findings of the study:

- The preliminary results from the IM&E sampling were used to identify 14 taxonomic groups or species of fishes and four taxonomic groups or species of shellfishes that were analyzed in greater detail in this report based on their abundances in the samples or importance to commercial or recreational fisheries. The process of identifying the group of fishes and shellfishes was done collaboratively with staff from the San Diego Regional Water Quality Control Board, California Department of Fish and Game, and National Marine Fisheries Service.
- The biological data and the actual cooling water flows measured from June 2004 through May 2005 from Units 1–5 were used to estimate that 3.63 billion fish larvae, and 162,000 target invertebrate larvae were entrained during the year. Two groups of fishes, gobies and blennies, comprised over 91% of the total entrainment.
- Data from sampling in the source waters of Agua Hedionda Lagoon and the nearshore areas around EPS were used to determine the potential effects on larval populations using a model that estimates the additional mortality on a population caused by entrainment. Except for the fishes that primarily inhabit the bay and harbor habitat of Agua Hedionda Lagoon where the intake is located, the estimated effects were very low and would not present any risk of AEI because these fishes are primarily associated with other habitats not affected by EPS entrainment.
- Due to the high estimated entrainment mortality for fishes resident in Agua Hedionda Lagoon, a series of special studies were done to determine the status of the adult populations. The results of the studies, comparisons with data from other similar lagoon habitats, and comparisons with previous entrainment data at EPS all indicated that the levels of entrainment were not resulting in AEI to these fish populations. In general, these fish groups are limited by available adult and not larval supply that is affected by entrainment.
- A total of 101 species of fishes, sharks and rays was impinged, with the top five species by numbers being topsmelt, shiner surfperch, deepbody anchovy, queenfish, and silversides. The top five species by weight were California butterfly ray, topsmelt, shiner surfperch, round stingray, and white seabass.



- The survey estimates from normal operations sampling and the samples collected during heat treatment operations were used to calculate that 4,358 kg (9,607 lb) of fishes were impinged during the June 2004 through May 2005 period with almost half of the biomass (2,035 kg [4,486 lb]) collected during the six heat treatments.
- The low level of impingement at EPS would not represent an AEI to fish or shellfish populations as the total losses are small relative to the total populations. Direct impingement losses (fish and macroinvertebrates) from both normal operations and tunnel heat treatments were equivalent to $4,749–$6,189 using 2005 commercial value data.
- No threatened or endangered fish or shellfish were collected during this or previous IM&E sampling at EPS.

## Effects of Impingement and Entrainment

The withdrawal of water by once-through circulating water systems can affect biological resources of the source water body through two processes: impingement and entrainment. Most circulating water systems, including EPS, employ a primary screening device ('bar rack') to block larger objects from entering the circulating water system. A secondary screening system consists of an array of rotating screens with a mesh size of approximately 0.95 cm (⅜ inch). Fishes and other aquatic organisms large enough to be blocked by these screens become impinged if the intake velocity exceeds their ability to move away, or if they become entangled in debris that may be present in front of the CWIS. These organisms remain impinged until the screens are rotated and backwashed to remove them into a collection basket for disposal. Small planktonic organisms, including early life stages of larger organisms, pass through the screen mesh and are entrained into the circulating water flow. These organisms are exposed to velocity and pressure changes due to the circulating water pumps, increased temperatures and, in some cases, chlorine exposure through the plant's condenser tubes. Although most individual organisms are killed by passage through the cooling water system (CWS), the goal of the studies is to determine if effects are significant at the population level for the affected species. The additional mortality rates imposed by the CWS on the high natural mortality rates of early life stages in most species typically cannot be measured directly in the natural population due to high natural variability in the ecosystem and must be modeled mathematically to estimate the potential impacts.

Entrainment and source water plankton net sampling was conducted monthly from June 2004 to June 2005 at both the intake station and at an array of source water stations. These entrainment and source water studies were designed to measure monthly variation in the species composition and abundance of larval fishes, cancer crabs, and spiny lobsters entrained by EPS and are used to estimate the source water populations at risk of entrainment.

The purpose of the impingement study was to characterize the juvenile and adult fishes and selected shellfishes (e.g., shrimps, crabs, lobsters, squid, and octopus) impinged by the power



plant's CWIS. The sampling program was designed to provide current estimates of the abundance, taxonomic composition, diel periodicity, and seasonality of organisms impinged at EPS. In particular, the study focused on the rates (i.e., number or biomass of organisms per cubic meter of water flowing per time into the plant) at which various species of fishes and shellfishes were impinged. Impingement rates are subject to tidal and seasonal influences that vary on several temporal scales (e.g., hourly, daily, and monthly), while the rate of circulating water flow varies with power plant operations and can change at any time.

The species analyzed in this report are limited to those that were sufficiently abundant to provide reasonable assessment of impacts. For the purposes of this study, assessments were generally limited to the most abundant fishes and shellfishes that together comprised 90% of all larvae entrained and/or juveniles and adults impinged by the generating station. However, certain species that were not abundant in the samples but had particular fishery value, such as California halibut and California spiny lobster, were also reviewed.

## Entrainment Results

A total of 20,601 larval fishes representing 41 taxa was collected from the EPS entrainment station during 13 monthly surveys in the 2004–2005 sampling period. Gobies (CIQ goby complex) and blennies comprised over 90% of all specimens collected, with anchovy larvae the third most abundant taxon at approximately 4%. The greatest concentrations of larval fishes, primarily gobies, occurred during the August 2004 survey and the fewest occurred in December 2004. Larvae tended to be more abundant in samples collected at night than those collected during the day. Target shellfishes collected included only a single *Cancer* crab megalops and no larvae of spiny lobster, octopus or market squid.

Total annual entrainment was estimated to be $3.63 \times 10^9$ fish larvae from June 2004 through May 2005 using actual EPS cooling water flow for the calculations and $4.49 \times 10^9$ fish larvae during the 12 months using the maximum design flow for the EPS CWS. This equates to a 23.9% difference between the estimated entrainment using actual and design power plant intake flows. A summary of the annual numbers of the common larvae entrained by EPS, standardized by the actual volumes of cooling water utilized, are presented in **Table S-1**.

The highest entrainment occurred for larvae of lagoon species. Gobies and blennies, both small bottom-dwelling forms common in southern California lagoons, comprised the vast majority of entrained fish larvae at EPS. Entrainment losses represented nearly forty percent of the source water population of goby larvae and twenty percent of the blenny larvae ($P_M$ value in **Table S-1**). These two species primarily inhabit the sheltered waters inside Aqua Hedionda Lagoon. The high losses result from the large volume of the water used by the CWIS relative to the volume of the lagoon. Despite these high losses other sampling associated with the study showed that adults of these species were abundant in the lagoon.

In contrast with these small, non-fishery species, that are primarily associated with the habitat inside Agua Hedionda Lagoon, species of fishery interest that are more broadly distributed



across several habitats such as white croaker, white seabass, queenfish, and halibut had relatively few or no larvae entrained. As a result, these fishes incurred only small fractional losses (<2%) compared to source water populations or when projected to equivalent adults using demographic-based models.

**Table S-1**. Estimated numbers of common larval and post-larval fishes entrained and impinged at EPS based on actual cooling water flows from June 2004 through May 2005, and calculated equivalent adults or proportions of source water populations. Taxa include those that together comprised over 90% of individuals entrained or impinged, or were selected for fishery interest.

| Taxon | Common name | Entrainment Estimate (Annual # Larvae) | *AEL* Estimate (Annual # Adults) | *FH* Estimate (Annual # Adults) | $P_M$ (%) | Impingement (Annual #, All sources) | Impingement (Annual Biomass kg, All sources) |
|---|---|---|---|---|---|---|---|
| Fishes | | | | | | | |
| Atherinopsidae | silversides | 7,936,121 | – | – | – | 68,519 | 449.74 |
| *Atractoscion nobilis* | white seabass | 0 | – | – | – | 2,102 | 408.12 |
| *Clevelandia ios, Ilypnus gilberti, Quietula y-cauda* | CIQ goby complex | 2,215,477,217 | 1,632,666 | 1,881,458 | 39.80 | 0 | 0.00 |
| *Cymatogaster aggregata* | shiner surfperch | n/a | – | – | – | 37,664 | 393.84 |
| Engraulidae | anchovies | 120,661,087 | 15,546 | 3,089 | 0.35 | 46,262 | 354.74 |
| *Genyonemus lineatus* | white croaker | 6,924,470 | – | – | 0.29 | 86 | 1.28 |
| *Hyperprosopon argenteum* | walleye surfperch | n/a | – | – | – | 5,586 | 248.55 |
| *Hypsoblennius* spp. | blennies | 1,098,083,615 | 2,450,084 | 575,354 | 19.40 | 807 | 4.69 |
| *Hypsypops rubicundus* | garibaldi | 29,287,646 | – | – | 14.42 | 5 | 1.90 |
| *Paralabrax* spp. | sand basses | 2,520,619 | – | – | – | 7,968 | 198.81 |
| *Paralichthys californicus* | California halibut | 3,752,551 | – | 4 | 0.32 | 612 | 15.44 |
| *Roncador stearnsii* | spotfin croaker | 9,554,139 | – | – | 1.57 | 1,351 | 80.76 |
| *Sardinops sagax* | Pacific sardine | 2,484,208 | – | – | – | 8,313 | 35.36 |
| *Seriphus politus* | queenfish | 6,746,448 | – | – | 0.90 | 9,479 | 70.43 |
| Shellfishes | | | | | | | |
| *Cancer* spp. | Cancer crabs | 162,150 | – | – | – | 961 | 5.22 |
| *Panulirus interruptus* | Cal. spiny lobster | 0 | – | – | – | 22 | 1.86 |
| *Loligo opalescens* | market squid | 0 | – | – | – | 0 | 0.00 |
| *Octopus* spp. | octopus | 0 | – | – | – | 497 | 69.46 |

## Impingement Results

A total of 19,408 fishes representing 96 taxa was collected during normal operation impingement sampling at the EPS traveling screens during 52 weekly surveys in the 2004–2005 sampling period. These fishes had a combined weight of 351.7 kg (775 lb) which, when projected over a one-year period based on actual power plant flow rates, equaled losses of 2,323 kg (5,123 lb) of biomass for fish collected from both the traveling screens and bar racks. Coupled with a nearly equal amount of fish biomass collected during six tunnel shock treatments over the study, the total fish biomass from all plant mortality sources was estimated at 4,358 kg (9,608 lb) annually.

The highest impingement rates were for open-water fish species and least for bottom-dwelling species. The numerically most abundant fishes collected during the normal operations impingement sampling included topsmelt, shiner surfperch, deepbody anchovy, queenfish,

salema, and slough anchovy. These six species comprised about 70% of all the fishes impinged during normal operations. Round stingray, bat ray and California butterfly ray were not abundant compared to other impinged species, comprising approximately 1% of the individuals, but they accounted for nearly 30% of the biomass due to their large individual size. Impingement rates for most species were generally higher during nighttime.

The numerically most abundant fishes collected during the tunnel shock sampling included deepbody anchovy, shiner surfperch, topsmelt, California grunion, Pacific sardine, and jacksmelt. These six species comprised about 80% of the total number of fishes collected during the tunnel shock surveys. The fishes with the greatest weight impinged during the tunnel shocks were white seabass, round stingray, deepbody anchovy, shiner surfperch, walleye surfperch, and spotted sand bass. The impingement of white seabass during heat shocks occurs due to releases of fishes from the Hubbs Sea World Research Institute in the days or weeks prior to the procedure. The impingement of these fishes has been significantly reduced by coordinating the releases so they do not occur in the period (2-3 weeks) directly before a tunnel shock.

## Impact Analysis

The operation of the cooling water intake system during the 2004–2005 12-month study period resulted in an annual estimated impingement of 120,354 fish weighing 2,168 kg (4,780 lb), and an estimated 13,083 macroinvertebrates weighing 117 kg (258 lb) collected from the traveling screens during normal operations. In addition there were numerous "non-shellfish" invertebrate taxa such as small mollusks, hydroids, and other categories of non-edible invertebrates that were impinged mainly as a result of detachment from the bar racks and tunnel walls. Periodic heat treatment operations used to control the growth of fouling organisms on the tunnel walls resulted in losses of 94,991 fish weighing 2,034 kg (4,484 lb), and 1,384 shellfish weighing 19 kg (42 lb) during the study period. There are no source population estimates for impinged species with which to compare losses on a population level.

Impacts to SCB fish and invertebrate populations caused by the entrainment of planktonic larvae through the EPS CWIS can only be assessed indirectly through modeling. These impacts are additive with the direct impingement losses. Two taxa, CIQ goby complex and combtooth blennies, comprised 90% of all entrained fish larvae. Of the ten most abundant fish species entrained at EPS, only one (anchovies) has any direct commercial or recreational fishery value. All of the abundantly entrained species with the possible exception of garibaldi, *Hypsypops rubicundus*, can be considered forage species for larger predatory fishes, sea birds, or marine mammals. Approximately 40% of the 38 different fish taxa entrained belonged to species with some direct fishery value (e.g., anchovies, croakers, sand basses, California halibut) even though most of those were very infrequent in the samples. Because of their low abundance in the samples, most of these taxa were not modeled for potential impacts. An exception was California halibut, which was addressed because of its commercial and recreational fishery importance. Even with a total estimated annual entrainment of nearly 4 million larvae the power plant



impacts to this species were negligible, amounting to a mean of four to six females at an age of 2.5 years.

The *ETM* procedure estimates the annual probability of mortality due to entrainment ($P_M$). It puts the entrainment estimate into context by comparing it with a known source population at risk of entrainment. The greatest $P_M$ estimate for a target taxon was for the CIQ goby complex with a predicted fractional larval loss of 39.8%. The next greatest probabilities of mortality were for combtooth blennies (19.4%) and garibaldi (14.4%). The distance of shoreline potentially affected by entrainment is directly proportional to the estimate of time that the larvae are exposed to entrainment. All three of these species had local populations primarily located in the habitats of Agua Hedionda Lagoon, and most larvae were entrained at sizes that indicated they were recently hatched. Other modeled species with primarily nearshore (non-lagoon) distributions, such as white croaker and queenfish, had $P_M$ estimates below 2%. Even in a heavily exploited commercial species these levels of additional mortality would be considered very low, especially when the populations of these species extend over a much larger geographic range than the extrapolated source water bodies. No invertebrate taxa were modeled for entrainment impacts due to the low abundance of the target taxa (e.g., spiny lobsters, *Cancer* crabs).

Compared to the IM&E study at EPS conducted by SDG&E in 1979–1980, goby larvae were approximately five times more abundant in the recent entrainment samples while combtooth blenny larvae were nearly twenty times more abundant. This may be attributed to a greater area of shallow mudflat habitat in AHL due to watershed erosion and sedimentation, and the addition of aquaculture float structures that provide potential habitat for combtooth blennies. Anchovy and croaker larvae were significantly more abundant in the earlier study, probably due to a cooler water climatic regime in the Southern California Bight (SCB) that favored increased populations of these taxa. Surfperches, topsmelt and anchovies were the most vulnerable taxa for impingement during both studies. Annual impingement of fish biomass (normal operations and heat treatments) was similar in both studies—approximately 4,202 kg (9,263 lb) in 2004–2005 compared to approximately 3,820 kg (8,421 lb) in 1979–1980.

The conclusion that the levels of entrainment and impingement at EPS are not resulting in any AEI to fish or shellfish populations is consistent with a recent review on population-level effects on harvested fish stocks (Newbold and Iovanna 2007). They modeled the potential effects of entrainment and impingement on populations of fifteen fish stocks that are targeted by either commercial or recreational fisheries using empirical data on entrainment and impingement, life history, and stock size. Their model indicated that the effects of theoretically removing all of the sources of power plant entrainment and impingement were very low for most species. They attributed the absence of large effects for most species to compensatory mechanisms that are probably acting on the populations at some level. If there is strong density dependence acting on these populations during the life stages from the period when they are vulnerable to entrainment as larvae through the age of maturity, then they concluded that there should be very little potential for population-level effects due to entrainment and impingement. The results for gobies from the studies conducted in AHL provide evidence of strong density dependence at



recruitment which helps explain the apparent absence of any effects on local populations of this group despite the high levels of entrainment mortality.



# 1.0 Introduction

The Encina Power Station (EPS) is a fossil-fueled steam electric power generating station that began operation in 1954. EPS has been owned and operated by Cabrillo Power I LLC (Cabrillo Power) since May 22, 1999 and was previously owned by San Diego Gas and Electric Company (SDG&E). EPS is located in the City of Carlsbad, California, adjacent to the Agua Hedionda Lagoon on the Pacific Ocean and approximately 30 miles north of the City of San Diego. **Figure 1-1** depicts the location of the facility and the cooling water intake and discharge points relative to the shoreline. Cooling water is withdrawn from the Pacific Ocean via the Agua Hedionda Lagoon and circulated once through the EPS CWS to condense freshwater steam used in power production. The combined cooling and service water design flow is 857 million gallons per day (mgd) at full operating capacity. After passing through the plant, the heated seawater is discharged to the ocean through a shoreline forebay and conveyance channel.

Cooling water intake systems are regulated under Section 316(b) of the federal Clean Water Act. The U.S. Environmental Protection Agency (EPA) established new regulations for Section 316(b) that were published in the Federal Register on July 9, 2004 and became effective on September 7, 2004. The new regulations were applicable to large existing power plants (Phase II facilities) with daily cooling water volumes in excess of 50 mgd. Due to the design, location, operating characteristics of the EPS, and cooling water volume capacity that exceeds 50 mgd it is subject to these new regulations. The new regulations were challenged by a coalition of environmental groups and the case was heard by the Second U.S. Circuit Court of Appeals. The court rendered a decision in January 2007 that remanded several key components of the regulations back to the EPA. In March 2007 the EPA issued a memorandum suspending the rule and directing that all permits for Phase II facilities implement 316(b) on a case-by-case basis using "best professional judgment" (BPJ). The language of the memorandum was expanded and published in the Federal Register in July 2007 (Volume 72, 130:37107-37109).

The studies presented in this report were conducted in partial fulfillment of the requirements of the new regulations. With the suspension of the Phase II regulations, the results of the studies will be used to determine if impingement and entrainment losses pose any significant risk of adverse environmental impact (AEI) to the species and life stages of fish and shellfish impinged or entrained. The absence of any significant impacts would be a technically sound basis under BPJ for determining that the cooling water intake structure represents the best technology available for minimizing adverse environmental impacts. This would allow any additional requirements to further reduce impingement and/or entrainment to be deferred until issues with the Phase II Rule are resolved.

# 1.1 Background

## 1.1.1 Section 316(b) of the Clean Water Act

Section 316(b) of the Clean Water Act (CWA) requires that the location, design, construction, and capacity of cooling water intake structures (CWIS) reflect the best technology available (BTA) to minimize adverse environmental impacts (AEI) due to the impingement (IM) of aquatic organisms (i.e., fish, shellfish, and other forms of aquatic life) on intake structures and the entrainment (E) of eggs and larvae through cooling water systems. On July 9, 2004, the U.S. Environmental Protection Agency published the second phase of new regulations under §316(b) of the Clean Water Act (CWA) for cooling water intake structures (CWIS) that apply to existing facilities (Phase II facilities). The Phase II Final Rule went into effect in September 2004, and applies to existing generating stations with CWIS that withdraw at least 50 million gallons per day (mgd) from rivers, streams, lakes, reservoirs, oceans, estuaries, or other waters of the United States. The regulations required all large existing power plants to reduce impingement mortality by 80–95% and to reduce the number of smaller aquatic organisms drawn through the cooling system by 60–90% when compared against a "calculation baseline". The water body type on which the facility is located, the capacity utilization rate, and the magnitude of the design intake flow relative to the waterbody flow determine whether a facility will be required to meet the performance standards for only impingement or both impingement and entrainment (IM&E). The final rule allowed these performance standards to be met through using the existing intake design, additional intake technologies, operational modifications, and restoration measures.

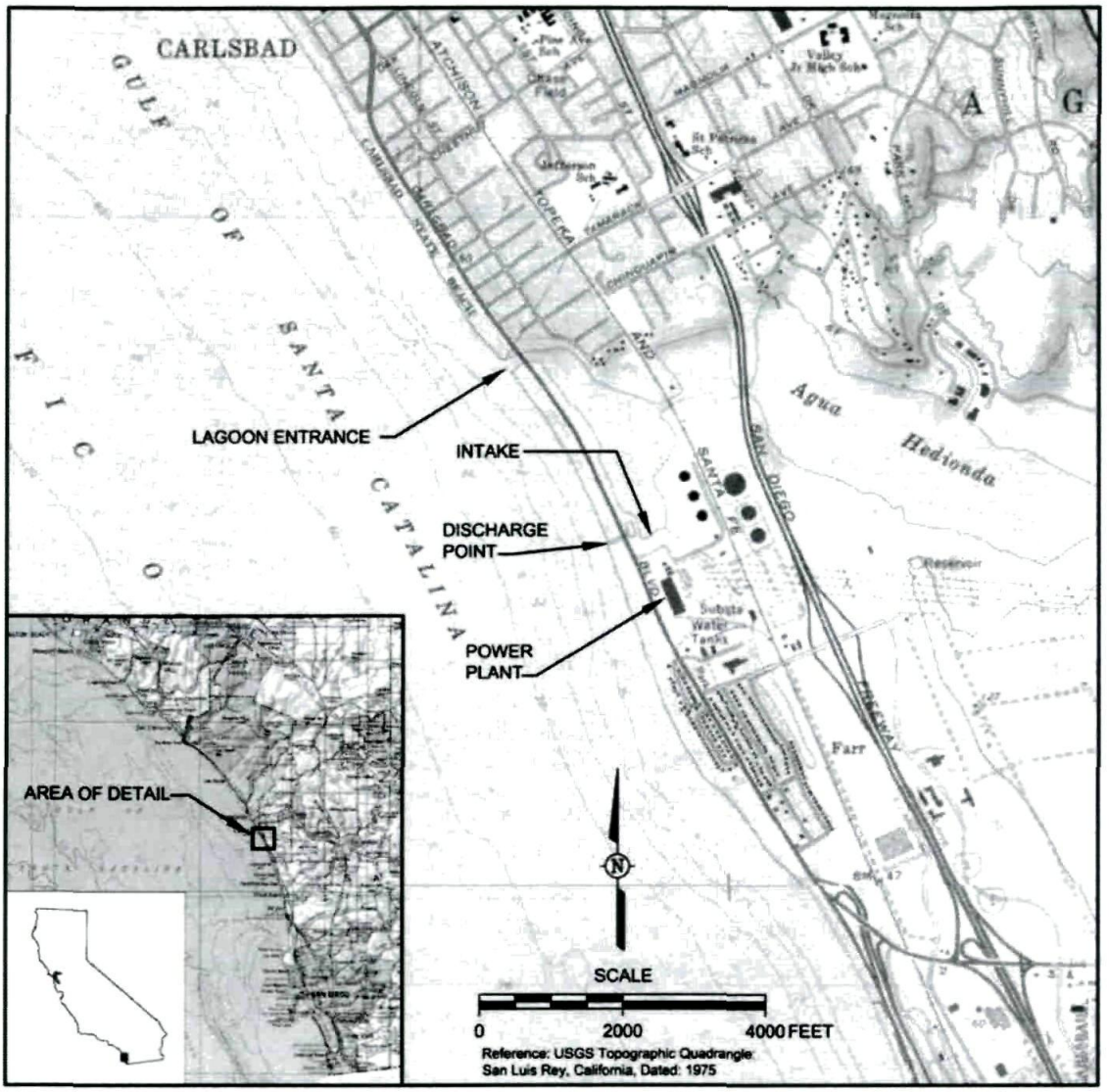



**Figure 1-1**. Encina Power Station location map

The Phase II regulations provided power plants with five options for meeting the performance standards, but unless a facility could show that it could meet the standards using the existing intake design or were installing one of the approved EPA technologies for IM&E reduction, it was required to submit information documenting its existing levels of IM&E. Existing data that may have previously been collected at the facility or a similar facility nearby could be used to document the levels of IM&E. The data were required to be submitted in an IM&E Characterization Study that was one component of the 316(b) Comprehensive Demonstration Study (CDS) required under the Phase II regulations. The impingement mortality component of the studies was not required if the through-screen intake velocity for a plant is less than or equal to 0.5 feet per second (ft/s) (15 centimeters [cm] per second). The entrainment characterization component was not required if a facility:

1. Has a capacity utilization rate of less than 15%;

2. Withdraws cooling water from a lake or reservoir, excluding the Great Lakes; or
3. Withdraws less than 5% of the mean annual flow of a freshwater river or stream.

Based on previously collected intake velocity measurements and plant operating characteristics, both of the IM&E components of the study were required at the EPS. Previous 316(b) entrainment and impingement studies were done at EPS (SDGE 1980) that are described in Section 1.2. Due to the time period since the original data were collected, a Study Plan for new IM&E studies was developed and submitted to the San Diego Regional Water Quality Control Board (SDRWQCB) in September 2004 (**Appendix A**). The sampling plan was approved by the SDRWQCB and the sampling was done for one year starting in June 2004 and continuing to June 2005. The study included the following elements:

- Taxonomic identifications of all life stages of fishes, shellfishes, and any threatened or endangered species collected in the vicinity of the CWIS and are susceptible to IM&E.
- Characterization of all life stages of the target taxa in the vicinity of the CWIS and a description of the annual, seasonal, and diel variations in IM&E.
- Documentation of the current level of IM&E of all life stages of the target taxa.

The goal of the study was to characterize the fishes and shellfishes affected by impingement and entrainment by the EPS CWIS. The studies examined losses at the EPS resulting from impingement of juvenile and adult fishes and shellfishes on traveling screens during normal operations and during heat treatment operations, and entrainment of ichthyoplankton and shellfishes into the cooling water intake system. The sampling methodologies and analysis techniques were derived from recent impingement and entrainment studies conducted for the AES Huntington Beach Generating Station (MBC and Tenera 2005), and the Duke Energy South Bay Power Plant (Tenera 2004).

The study was completed prior to the publication of the Second U.S. Circuit Court of Appeals Decision on the 316(b) Phase II regulations issued on January 25, 2006. The Court decision was the result of a lawsuit brought against the EPA by several states, environmental groups, and power companies challenging multiple aspects of EPA's final Phase II rule. The decision supported the petitioners contention that EPA exceeded its authority in rejecting closed-cycle cooling, and selecting instead a range of technologies as BTA that were based on the agency's use of improper cost-benefit analysis. Nevertheless, the Court found that EPA may consider costs to determine what technologies are reasonably available. The Court also criticized the EPA's selection of the suite of technologies as BTA, remanding to the EPA the provision establishing BTA and requiring more explanation on the basis for the agency's decision or a new determination of BTA based on appropriate considerations. The Court also remanded to EPA certain provisions in the Phase II rule that set performance standards to be achieved through compliance measures, and provisions that allowed compliance through the use of restoration measured in lieu of BTA.



The EPA issued a memorandum to its Regional Offices dated March 20, 2007. This memorandum announced that EPA was withdrawing the 316(b) Phase II Rule for existing steam electric generating stations in its entirety based on the Court decision. The memorandum further directed EPA Regional Offices to implement 316(b) in NPDES permits on a "Best Professional Judgment" (BPJ) basis until the issues raised by the Court decision are resolved. EPA is currently considering several alternatives for responding to the Court decision and it may be several years before it is resolved either through further litigation and/or Rulemaking. The guidance in this memorandum was published in the Federal Register on July 9, 2007 (Volume 72, 130:37107-37109).

The information in this report is being submitted to assist in the evaluation of fish protection technologies and operational measures for EPS so that when the issues with the Phase II Rule are resolved, the plant will be in a position to move forward in a timely manner to comply with the Rule. The information is also important in evaluating the potential for AEI potentially caused by impingement and entrainment. In support of this approach to compliance, the assessment of the IM&E study focuses on determining if impingement and entrainment losses pose any significant risk of AEI to the species and life stages of fish and shellfish impinged or entrained. The AEI assessment in this report is based on previous EPA guidance on 316(b) (EPA 1977) and focuses on evaluating the following:

- Potential impacts that could pose a risk to populations of any impinged or entrained species.
- Impacts to the local commercial or recreational fishery.
- Any impacts to a protected species.

For entrained and juvenile species the analysis will provide estimates of adult losses for a representative set of commercial and recreational species. For forage species, estimates of the reductions to commercial and recreational species will be made due to the reduction in biomass as a result of impingement and entrainment. Demonstrating no significant risk of AEI would be a technically sound basis to defer requirements for reducing impingement and/or entrainment until issues with the Phase II Rule are resolved. The rationale and approach for the impact assessment in this report and the results and conclusions from our analysis are provided in Section 5.0.

## 1.2 Effects of Impingement and Entrainment: Overview

The withdrawal of water by once-through circulating water systems affects biological resources of the source water body through two processes: impingement and entrainment. Most circulating water systems employ some type of primary screening device ('bar rack') to block larger objects from entering the circulating water system. Smaller secondary screening systems generally consist of an array of rotating screens with a mesh size of approximately 0.95 cm (⅜ in) to 1.6 cm (⅝ in). Fishes and other aquatic organisms large enough to be blocked by these screens may become impinged on the screens if the intake velocity exceeds their ability to move away, or if



they become entangled in debris that may be present in front of the CWIS. These organisms will remain impinged against the screens until the intake velocity is reduced so the organisms can move away or the screen is rotated and backwashed to remove them into a collection basket for disposal. Small planktonic organisms, including early life stages of larger organisms, pass through the screen mesh and are entrained into the circulating water flow. These organisms are exposed to velocity and pressure changes due to the circulating water pumps, increased temperatures and, in some cases, chlorine exposure through the plant's condenser tubes. Although most individual organisms are killed by passage through the CWIS, the ultimate goal of the studies is to determine if effects are significant at the population level for the affected species. The additional mortality rates imposed by the CWIS on the high natural mortality rates of early life stages in most species typically cannot be measured directly due to the high natural variability of the populations and the marine environment.

In 1980, San Diego Gas and Electric (SDGE) owned and operated the EPS. A 316(b) demonstration was conducted for the facility (SDGE 1980) as required at the time by the SDRWQCB. The study included descriptions of the facility, descriptions of the physical and biological environment of Agua Hedionda Lagoon and surroundings, studies of entrainment, impingement, and entrainment survival at the plant, and an environmental impact assessment that also evaluated the feasibility of alternative intake technologies to reduce IM&E.

A list of taxa ("critical species") that included 16 adult/juvenile fishes, 11 larval fishes, and one invertebrate zooplankton species, were selected based on six criteria and approved by the SDRWQCB for detailed study during the program. Some additional species that were found to be common in the subsequent sampling were also added to the list. The report reviewed the life histories of the critical species.

### 1.2.1 Entrainment

A one-year entrainment and source water characterization study was conducted beginning in 1979 as part of the 316(b) demonstration studies at the EPS. Plankton samples were collected monthly at five offshore stations using 505 and 335 micron mesh nets attached to a 2 ft diameter bongo net system. Collections were also made monthly in the Middle and Upper Lagoon segments and every two weeks in the Outer Lagoon using 1.6 ft diameter nets (505 and 335 micron mesh size). Entrainment samples were also collected every two weeks using a plankton pumping system in front of the intakes. Although most samples were collected during daylight hours some samples were occasionally taken in the evening or early morning hours.

Anchovies (primarily deep body and northern) were the most abundant larval forms in both the source water and entrainment samples, followed by croakers and sanddabs (**Table 1-1**). There were fewer fish eggs and more goby larvae in the entrainment samples whereas kelp and sand bass larvae were substantially more abundant in the combined source water samples from the Lagoon and offshore. Overall the average composition between the entrainment and source water



data sets were very similar for the ten most abundant taxa. Only English sole, *Parophrys vetulus*, larvae were among the top ten entrainment taxa not represented in the top ten source water taxa.

**Table 1-1**. Average annual densities during 1979 of the ten most abundant larval fish taxa in source water and entrainment collections (335μ mesh nets).

| Common Name | Taxon | Source Water concentration (mean per 100 $m^3$) | Entrainment concentration (mean per 100 $m^3$) |
|---|---|---|---|
| anchovies | Engraulidae | 952.7 | 855.2 |
| croakers | Sciaenidae | 341.7 | 400.6 |
| speckled sanddab | *Citharichthys* spp. | 73.2 | 82.7 |
| fish eggs | unidentified fish egg | 33.8 | 20.2 |
| gobies | Gobiidae | 29.2 | 42.9 |
| silversides | Atherinopsidae | 8.3 | 10.8 |
| wrasses | Labridae | 6.4 | 4.0 |
| combtooth blennies | *Hypsoblennius* spp. | 6.1 | 5.7 |
| sea basses | Serranidae | 5.1 | 0.9 |
| rockfishes | *Sebastes* spp. | 2.8 | 2.5 |
| English sole | *Parophrys vetulus* | 0 | 1.9 |

Entrainment losses were calculated for each two-week sampling interval by multiplying the average plankton densities at the intake by the volume of cooling water drawn through the plant during that period. Annual, monthly, and daily rates were estimated by averaging the entrainment estimates for all sampling periods and calculating values for the indicated duration. Annual estimates for total zooplankton entrainment were $7.4 \times 10^9$ (505 μ net data) and $30.9 \times 10^9$ (335 μ net data) individuals. The copepod *Acartia tonsa* was the most abundant species in the entrainment collections.

Annual estimates of the abundance of ichthyoplankton entrained through the power plant were $4.15 \times 10^9$ (505μ net data) and $6.66 \times 10^9$ (335μ net data) individuals per year. Fish eggs comprised 98% and 86% of the total annual ichthyoplankton entrainment using the 505μ and 335μ net estimates, respectively. Through-plant entrainment mortality was assumed to be 100% for larvae and 60% for eggs based on survival experiments that were conducted. The report presented average annual densities of the critical species by net type and daily entrainment estimates for selected plankton groups.

Entrainment impacts were assessed by qualitative comparisons of entrainment losses to the estimated numbers of larvae in nearby source waters, comparisons of additional power plant mortality to natural mortality rates, entrainment probabilities based on current studies, and primary productivity studies. It was concluded that the entrainment of $1.82 \times 10^7$ fish larvae and eggs daily was small compared to the egg and larval concentrations measured in monthly plankton tows in the source water body. It was estimated that average daily losses of planktonic organisms amounted to about 0.2% of the plankton available within one day's travel time from the power plant by current transport. At the seaward entrance to Agua Hedionda Lagoon, a water parcel was estimated to have a 34% probability of entering the lagoon. The isopleth representing



10% probability of daily entrainment was calculated to lie near the northern and eastern extremities of Agua Hedionda Lagoon, and the 70% and 90% entrainment probability isopleths were calculated to be near the intakes and well within the southern third of the Outer Lagoon. The modeled isopleths shifted toward the seaward entrance on a flood tide and toward the Middle Lagoon on an ebb tide. Using the 70% entrainment probability isopleth to define intake effects, it was shown that the maximum extent of intake effects was about 305 m (1,000 ft) into the southern end of the Outer Lagoon segment. With natural mortality rates assumed to be 99% for egg and larval stages of most marine fish species it was concluded that additional mortality from the EPS was not significant. There was no modeling of entrainment impacts on larvae using demographic or proportional loss models. It was also concluded, based on results of light-dark bottle experiments, that entrainment effects on source water primary productivity were negligible.

## 1.2.2 Impingement

Impingement of fishes and shellfishes on the traveling screens and bar rack system of the EPS were monitored daily during normal operations for 336 consecutive days in 1979. The main method was to obtain abundance and weights from samples accumulated over two 12-hr periods (daylight and night) each day for all three screening systems at the plant. During this period there were a total of 79,662 fishes from 76 taxonomic categories weighing a total of 1,395 kg (3,076 lb) collected. The six highest-ranking fishes by numbers impinged were queenfish, deepbody anchovy, topsmelt, California grunion, northern anchovy, and shiner surfperch. These are all open water forms that occur in schools. These six species represented 82% of all fishes impinged during normal operations sampling.

There were also seven heat treatments conducted during the study period. Heat treatments are operational procedures designed to eliminate mussels, barnacles, and other fouling organisms growing in the cooling water conduit system. During a heat treatment, heated effluent water from the discharge is redirected to the intake conduit via cross-connecting tunnels until the water temperature rises to approximately 40.4°C (105°F) in the screenwell area. This water temperature is maintained for at least one hour, during which time all biofouling organisms, as well as fishes and shellfishes living within the CWS, succumb to the heated water. During heat treatment surveys, all material impinged onto the traveling screens is removed from the forebay. During the 1979 studies, the total weight of fishes impinged during these operations was 2,422 kg (5,340 lb). Over 90% of the fishes collected consisted of nine species: deepbody anchovy, topsmelt, northern anchovy, shiner surfperch, California grunion, walleye surfperch, queenfish, round stingray, and giant kelpfish. The numbers of fishes resident in the tunnels during heat treatments was greatest in winter and least in summer.

Shellfishes that ranked high in the total numbers impinged included yellow crab (*Cancer anthonyi*) with 2,540 individuals, swimming crab (*Portunus xantusii*) with 884, lined shore crab (*Pachygrapsus crassipes*) with 866, and market squid (*Loligo opalescens*) with 522. The yellow



crab and market squid both have commercial fishery value whereas the other two species are small and are not fished commercially. California spiny lobster, the most valuable invertebrate in the local commercial fishery, was rare in the samples with only two individuals impinged during the entire year-long study period.

Most of the species removed by the power plant were widely distributed along the southern California and Baja California coasts and losses were considered small relative to these populations. On a local scale, it was calculated that the average daily power plant removal, including normal operations and heat treatment operations averaged throughout the year, was about 0.02% of the estimated standing crop in the local study area that extended along a shoreline distance of 3.6 miles out to a depth of 60 ft, comprising 1,211 acres. The removals also represented about 0.07% of local commercial fish landings by weight (excluding tuna) from the area between San Clemente and the Mexican border, and less than 7% of the recreational fishing landings by numbers annually in the area between Dana Point and the Mexican border.

### 1.2.3 Supplemental 316(b) Assessment Report–1997

The SDRWQCB issued Order 94-58 in 1994 requiring SDG&E to conduct additional analyses of data from the 316(b) study conducted in 1979–1980 (EA Science and Technology 1997). The supplemental analyses were completed in 1997. The purpose of the study was to further evaluate the effects of the EPS cooling water intake on the designated beneficial uses of Agua Hedionda Lagoon and the Southern California Bight using additional analysis methods.

Estimates of loss were calculated for 17 selected species that included the original 16 "critical species" identified in the original 316(b) report and also tidewater goby, the only endangered aquatic species likely to occur in the area. Estimates of adult equivalent loss were calculated for the three representative species with the highest estimates of entrainment or impingement loss: northern anchovy, topsmelt, and queenfish. The modeling used life stage-specific estimates of total mortality to calculate estimates of the number of individual adult fishes which would have resulted from the young lost to entrainment and impingement under the conservative assumption of equal survival.

In order to put the entrainment losses in perspective and evaluate the magnitude of potential impacts, the report considered the life history characteristics of each target species (reproductive ability, geographic distribution, migratory capabilities) as well as estimates of current population size or harvest by commercial or sport fishermen. Although the original report touched on these topics, the 1997 report went into greater detail to evaluate potential impacts. Impacts were considered at three levels: individual population, overall community, and designated beneficial uses of the source waterbody.

The report concluded that the potential for adverse impacts from the EPS CWIS on individual target species was small compared to the sizes of the existing populations and the effects of fisheries. It similarly concluded that operation of the EPS cooling water intake had not, and



would not, adversely affect the continued maintenance of balanced aquatic communities or designated beneficial uses of AHL or the Pacific Ocean in the vicinity of the EPS. Finally, the report stated that since the existing intake was not causing any adverse environmental impacts as defined under the CWA 316(b) guidelines that were in effect in 1997, it should be designated as best technology available.

## 1.3 Study Design

A plan for IM&E studies that directly addressed the requirement of 316(b) was submitted to the SDRWQCB in September 2004 following the final publication of the new Rules in July 2004. The IM&E study plan was submitted as a first step in the facility's compliance with the new Phase II rule. The study plan was reviewed by the Board staff and their consultants, Tetra Tech Inc., and was approved contingent on responding to comments and questions submitted to EPS by the Board. Comments on the study plan were resolved and the studies continued through June 2005 under the direction of a Technical Advisory Group comprised of staff from the Board, state and federal resource agencies, EPS, and their consultants. The study design was based on a survey and compilation of available background literature, results of previously completed 316(b) intake studies, and circulating water system studies at other power plants.

Entrainment and source water plankton net sampling was conducted monthly from June 2004 to June 2005 at both the intake station and at an array of source water stations. These entrainment and source water studies were designed to measure monthly variation in the species composition and abundance of larval fishes, cancer crabs, and spiny lobsters entrained by EPS and were used to estimate the source water populations at risk of entrainment.

The purpose of the impingement study was to characterize the juvenile and adult fishes and selected shellfishes (e.g., shrimps, crabs, lobsters, squid, and octopus) impinged by the power plant's CWIS. The sampling program was designed to provide current estimates of the abundance, taxonomic composition, diel periodicity, and seasonality of organisms impinged at EPS. In particular, the study focuses on the rates (i.e., number or biomass of organisms per cubic meter of water flowing per time into the plant) at which various species of fishes and shellfishes are impinged. The impingement rate is subject to tidal and seasonal influences that vary on several temporal scales (e.g., hourly, daily, and monthly), while the rate of circulating water flow varies with power plant operations and can change at any time.

The organisms analyzed in this report are limited to those that were sufficiently abundant to provide reasonable assessment of impacts. For the purposes of this study, assessments were generally limited to the most abundant fish taxa that together comprised 90% of all larvae entrained and/or juveniles and adults impinged by the generating station. However, certain species that were not abundant in the samples but had particular fishery value, such as California halibut and California spiny lobster, were also reviewed.



## 1.4 Report Organization

Section 2 of this report describes the operational characteristics of EPS in greater detail, and provides an overview of the physical and biological environments in the vicinity of the power station. Methods and results of the entrainment and source water larval study are presented in Section 3 including assessments for each of the target taxa in separate subsections. A similar treatment of the impingement studies is presented in Section 4. Finally, a circulating water system impact assessment is presented in Section 5 that interprets the IM&E results in the context of resource populations. Seven appendices are also included with the report that include details on special support studies, sampling and processing procedures, and summarized data files.



# 2.0 Description of the Encina Power Station and Characteristics of the Source Water Body

The Encina Power Station (EPS) consists of five steam turbine generating units and a small gas turbine unit. The steam turbines units are primarily fueled by natural gas, but have the capability to be powered by fuel oil. Net generating capacity of the individual steam turbine units ranges from 104 megawatts (MW) to 315 MW (**Table 2-1**). The gas turbine has a net generating capacity of 16 MW. Units 1–3 began operating in the 1950s, the gas turbine was added in 1968, and Units 4 and 5 went on line in 1973 and 1978, respectively.

## 2.1 Description of the Encina Power Station Cooling Water System

Cooling water for each of the five steam electric generating units is supplied by two circulating water pumps (CWP) that range in capacity from 24,000 to 104,000 gallons per minute (gpm) (90.85–393.68 $m^3$/min) depending on the unit's generating potential and the associated cooling requirements. This water is primarily used to cool the plant's steam condensers, where steam is condensed back to water as part of the power production cycle. Each unit is also equipped with a number of smaller saltwater service pumps (SWSP) that supply water for a variety of purposes (cooling of small capacity heat exchangers, lubrication of rotating equipment, etc.). The quantity of cooling water circulated through the plant is dependent upon the number of units in operation. With all units in full operation, the cooling water flow through the plant is 2,253 $m^3$/min (595,200 gallons per minutes [gpm]) or 3,244,140 $m^3$/day (857 mgd) based on the manufacturer ratings for the circulating water and saltwater service pumps (**Table 2-1**).

**Table 2-1**. Encina Power Station generation capacity and cooling water flow volume.

| Unit | Net Generating Capacity (MWe) | Circulating Water Flow $m^3$/min (gpm) | Service Water Flow $m^3$/min (gpm) | Daily Flow $m^3$/day (mgd)[1] |
|---|---|---|---|---|
| 1 | 107 | 182 (48,000) | 11 (3,000) | 278,000 (73) |
| 2 | 104 | 182 (48,000) | 11 (3,000) | 278,000 (73) |
| 3 | 110 | 182 (48,000) | 23 (6,000) | 294,320 (78) |
| 4 | 287 | 757 (200,000) | 49 (13,000) | 1,160,940 (307) |
| 5 | 315 | 787 (208,000) | 69 (18,200) | 1,232,880 (326) |
| Gas Turbine[2] | 16 | – | – | – |
| **Total** | **939** | **2,090 (552,000)** | **163 (43,200)** | **3,244,140 (857)** |

[1] Total flow including circulating water and saltwater service pumps.
[2] Gas turbine units do not utilize once-through cooling water sources.



### 2.1.1 Intake System

Cooling water for all five steam-generating units is supplied through a common intake structure located at the southern end of the outer segment of Agua Hedionda Lagoon, approximately 915 m (3,000 ft) from the opening of the lagoon to the ocean (**Figure 2-1**). Seawater entering the cooling water system passes through metal trash racks on the intake structure, with vertical bars that are spaced about 8.9 cm (3½ in) apart (**Figure 2-2**). The bars prevent large debris that could potentially clog or damage plant equipment from entering the system. The trash racks are cleaned periodically to remove impinged debris. Water velocity approaching the trash racks varies with the number of pumps that are in operation, water depth (tide level), and the quantity of debris impinged on the racks (percent occlusion). Approach velocity is measured annually as required by the power station's National Pollutant Discharge Elimination System (NPDES) Permit CA0001350. Most recently the approach velocity was measured on November 16, 2005. Average approach velocity at that time was 43 cm/sec (1.4 ft/sec). Tide level was 2.2 meters (7.1 feet) above MLLW at the time the measurements were made and eight of the ten CWP were in operation (Unit 4 was in the midst of an outage and its two pumps were shutdown). The cleanliness of the trash racks (percentage of the openings between bars occluded by debris) at that time is not known. Using the measured velocity and adjusting the flow volume to simulate maximum flow (all CWP and SWSP in operation) yields a calculated maximum approach velocity of 67.1 cm/sec (2.2 ft/sec) at the same tide height. Adjusting the tide height to mean sea level (MSL) provides a calculated approach velocity of 88.4 cm/sec (2.9 ft/sec) at maximum flow volume.

Behind the trash racks the intake tapers into two 3.7 m (12 ft) wide tunnels that further split into four 1.8 m (6 ft) wide inlet tunnels (**Figure 2-3**). Inlet tunnels 1 and 2 provide cooling water for Units 1, 2 and 3, while inlet tunnels 3 and 4 supply cooling water to Units 4 and 5, respectively. Vertical traveling water screens (TWS) are positioned immediately upstream of the CWP and SWSP to prevent fish and debris from entering the CWS and potentially clogging the condensers. There are two traveling screens for Units 1, 2 and 3, two screens for Unit 4, and three screens for Unit 5.

Each TWS consists of a continuous vertical belt of wire mesh panels through which the cooling water flows (**Figure 2-4**). The mesh size of the screens for Units 1–4 is 0.95 cm (⅜ in), while the mesh size for Unit 5 is 1.6 cm (⅝ in). Debris larger than the mesh is sieved from the flow stream and held on the screen panels until the TWS is placed in motion. The screens can be operated manually or activated automatically when a specified pressure differential is detected across the screens due to the accumulation of debris. When the specified pressure is detected, the screens rotate upward and the material on the screen is lifted out of the cooling water flow stream. A screen wash system (70–100 psi), located at the head of the screen, washes the debris from each screen panel into a trough, which empties into collection baskets where it is accumulated prior to disposal.

The velocity of the water as it approaches the traveling screens has a large effect on impingement and entrainment and varies depending on the number of pumps operating, tidal level, and cleanliness of the screen faces. Maximum approach velocities were calculated at high and low tide, with all pumps operating and clean screens, during the previous 316(b) study conducted in 1979 and 1980, and are presented in **Table 2-2**.

**Table 2-2**. Calculated maximum approach velocities in front of the Encina Power Station traveling screens with all CWP and SWSP in operation and 100 percent clean screens.

| | Calculated Maximum Approach Velocity (cm/sec) [ft/sec] | |
|---|---|---|
| **Unit Screen** | **High Tide** | **Low Tide** |
| 1 | 21.3 [0.7] | 36.6 [1.2] |
| 2 | 21.3 [0.7] | 36.6 [1.2] |
| 3 | 21.3 [0.7] | 36.6 [1.2] |
| 4 | 30.5 [1.0] | 48.8 [1.6] |
| 5 | 21.3 [0.7] | 33.5 [1.1] |

## 2.1.2 Discharge System

After passing through the traveling screens, the cooling water is pumped through the condensers of the individual generation units. At the condensers, heat is transferred from the steam exiting the plant's turbines (passing over the outside of the condenser tubes) to the seawater (passing through the inside of the condenser tubes), condensing the steam back to water (condensate). Units 1–3 have dual-pass condensers (U-shaped tubes that pass through the condenser twice) made up of numerous aluminum-brass condenser tubes, each with an inside diameter (ID) of about 2.2 cm (⅞ in). Units 4 and 5 have single-pass condensers with 2.5 cm (1 in) ID tubes made of copper-nickel alloy.

When operating at full power, Units 1–5 transfer approximately 4,805 x $10^6$ Btu/hr into the cooling water with a resultant temperature increase (delta-T) of about 10°C (18°F). Delta-T can vary, however, depending upon the individual units that are in operation (heat transfer characteristics differ between units), ambient seawater temperature, fluctuations in cooling water flow (due to tidal influences and debris clogging), and the cleanliness of each unit's condenser. A maximum delta-T of 11°C (20°F) can be experienced under certain conditions.

Heated seawater exiting the condensers flows into a common discharge conduit that empties into an open discharge pond located to the west of the intake structure (**Figure 2-3**). Water from the discharge pond flows through a culvert under Carlsbad Blvd. and a discharge canal that leads across the beach and out into the ocean. The temperature of the cooling water discharged from Encina Power Station is regulated under the specifications of NPDES permit. The permit places limits on the chemical constituents and thermal characteristics of the plant's discharge plume.



The terms of the permit specify that the temperature of the combined discharge shall not average more than 11.1°C (20°F) above that of the incoming water during any 24-hour period, and the combined discharge shall not, at any time, exceed 13.9°C (25°F) above that of the incoming lagoon water. A special provision to these discharge limitations is made to accommodate the higher discharge temperatures that result during heat treatment of the cooling water intake conduits (Section 2.1.3–*Biofouling Control*). The permit specifies that during heat treatment, heat added to the cooling water shall not cause the temperature of the combined discharge to the ocean to exceed 48.9°C (120°F), and that this maximum temperature shall not be maintained for more than two hours.

## 2.1.3 Biofouling Control

Cooling water entering the power plant contains a myriad of planktonic organisms that are too small to be filtered from the water flow by either the trash racks or the traveling screens. Some of these organisms can cause problems that, at a minimum, reduce the operating efficiency of the power plant and, at their worst, can require that the power plant be taken off line and shut down for maintenance. These organisms can be divided into two major groups, microfouling organisms, such as bacteria, fungi, and algae, and larger macrofouling organisms including barnacles, mussels (and other bivalves), and hydroids.

The primary problem caused by the microfouling organisms is the formation of a slime layer on the inner surface of the condenser tubes. This insulating microfouling layer interferes with heat transfer between the condenser tube and the cooling water flow. This decreases the efficiency of the condenser and degrades the power production capabilities of the plant. EPS uses periodic injections of the oxidizing biocide sodium hypochlorite (chlorine bleach) to control slime in the condenser tubes. Sodium hypochlorite is produced electrolytically at the plant from sodium chloride in the seawater. Seawater from the intake is pumped through each of two hypochlorinators, which are comprised of electrolytic cell modules arranged in series. The hypochlorite produced is fed into a holding tank where it is diluted with intake water. When needed, the sodium hypochlorite solution is injected to the cooling water conduit immediately upstream of the cooling water and saltwater service pump suctions for each unit. Each injection point is individually controlled, which allows each generating unit to be treated separately while the other units provide diluting water flow to the chlorinated discharge. Chlorination is conducted each day on a timed cycle for about five minutes per hour per unit. This method of chlorination results in a minimal chlorine residual in the cooling water being discharged to the ocean. In addition to the chlorine treatment, sodium bromide may be used as a chlorine enhancer.

Larger macrofouling organisms usually enter the CWS as larvae. Included within this group are a number of encrusting species, including barnacles and mussels that can attach themselves to the walls of the cooling water conduits. Once attached, they transform into a sessile stage and begin to feed and grow. These are hard-shelled animals that filter their food from the water that is passing by. The cooling water flow provides a continuous supply of food and the growth rates of



these organisms within the CWS often far exceed the growth of the same species in the natural environment. If left unchecked, the biofouling layer formed by the aggregation of these organisms on the conduit walls and other submerged plant equipment can impede water flow within the system and interfere with the operation of pumps, valves, and other plant apparatus. In addition, as these macrofouling organisms increase in size, the force of the cooling water flow on their shells can detach them from the walls and carry them downstream to the condenser. Mussel and barnacle shells that exceed the 2.22–2.54 cm (⅞–1 inch) diameter of the condenser tubes can become lodged at the inlet ends of the tubes thereby blocking water flow through the tubes. As the number of clogged tubes increases, condenser performance decreases and, as a result, condenser operating temperatures and the temperatures of the discharged cooling water also increase. If the influx of tube-clogging debris continues, the condenser must be removed from service and cleaned.

Chlorination used at the concentration and duration applied by EPS to control microfouling is ineffective in the control of macrofouling organisms. Macrofouling organisms tend to be much more tolerant of chlorine than microfouling organisms. Mussels also have the ability to tightly close their shells if they detect harmful substances in the water and can remain closed for hours, or days. Chlorination at higher doses and/or applied continuously can effectively eliminate macrofouling but presents serious regulatory and environmental problems if the chlorine is not subsequently removed or deactivated prior to its discharge into the ocean.

As an alternative to chemical treatment, EPS uses heat treatments to control macrofouling. Heat treatment is performed by restricting the inlet cooling water flow and recirculating the condenser discharge water through the conveyance tunnels and condensers until the inlet water temperature has increased to the targeted treatment temperature. Recirculation of the cooling water is accomplished through a cross-over tunnel located approximately 36.6 m (120 ft) from the discharge, adjacent to the intake channel. The temperature is raised to 40.5°C (105°F) in the intake tunnels and then maintained for approximately two hours. This has proven to be adequate in killing the encrusting macrofouling organisms. Each time the cooling water passes through the condensers it picks up additional heat rejected from the steam cycle. Because the cooling water continues to circulate and the generating units continue to operate, the temperature in the discharge channel can reach 48.9°C (120°F). To maintain the treatment temperature at 40.5°C during the treatment, and to prevent the continued build-up of heat in the system, additional lagoon water is blended into the recirculating flow as a corresponding volume of heated water is discharged to the Pacific Ocean. The targeted heat treatment duration is two hours while maintaining a treatment temperature of 48.9°C in the intake conduits. This does not include the time required to reach the target temperature or the time necessary to return to a normal operating configuration. The total time required for the heat treatment procedure, including temperature buildup and cool-down, is approximately seven to nine hours. Because the input of cooling water is reduced during heat treatment due to recirculation, the plant's discharge flow rate is likewise reduced to approximately 7–45% of the maximum volume discharged during normal operation.



Following heat treatment some shells of the dead encrusting organisms begin to detach from the walls of the conduits and are carried downstream. Most mussels will lose their attachment over a period of days following treatment but barnacle shells are firmly attached and can take weeks or months to deteriorate and break away from the conduit walls. Shells smaller than the condenser tube diameter will pass through the system and be discharged into the ocean. Larger shells may be retained and removed by the traveling screens or, as in the case of fouling that occurs between the TWS and the condensers, may end up in the condensers where they are subsequently removed by cleaning. To reduce the need for condenser cleaning, heat treatments are optimally performed every five to eight weeks. This short growth period prevents most macrofouling organisms from attaining a size that will not allow them to pass through the condensers.



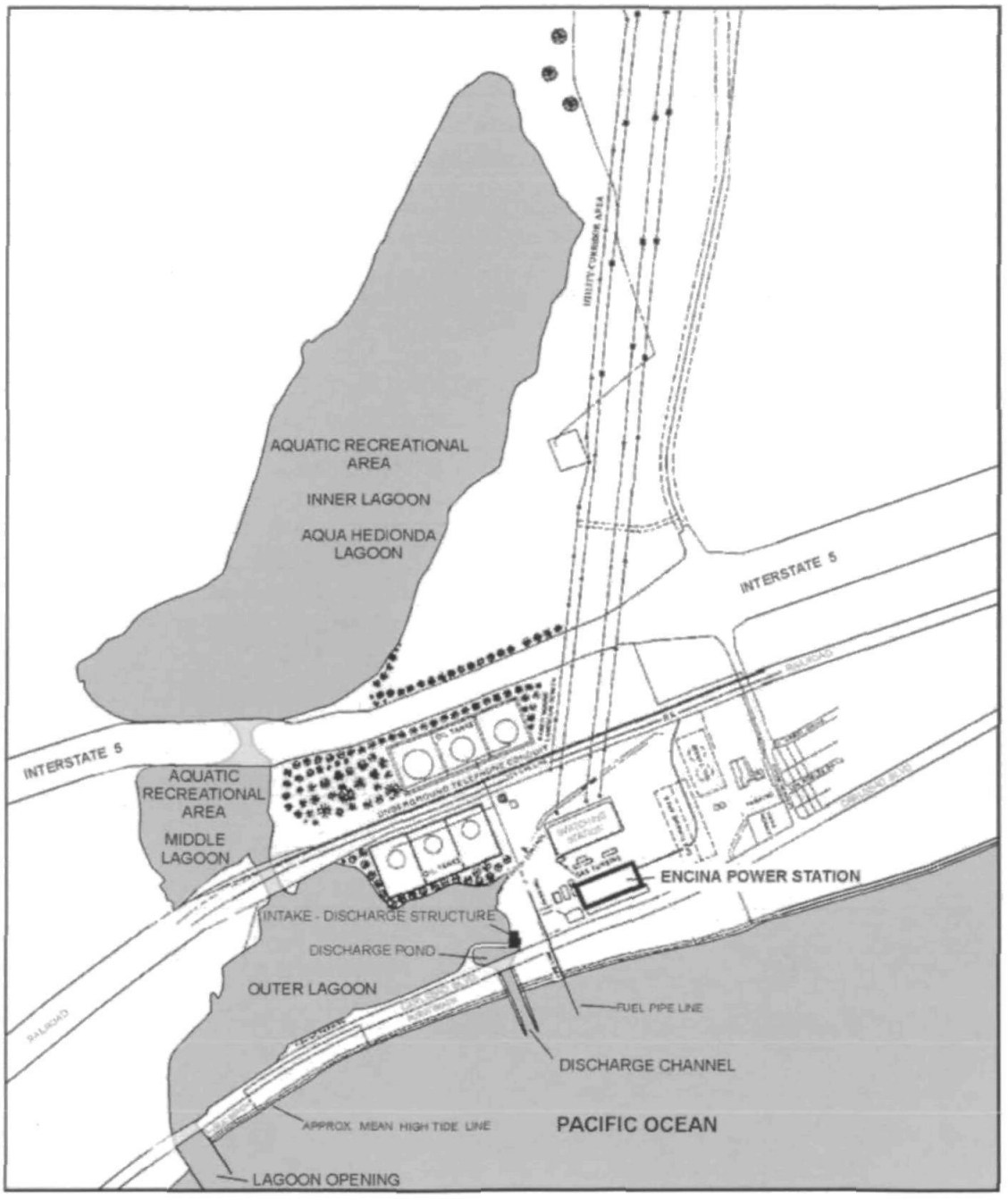



**Figure 2-1**. Location of Encina Power Station CWS in relation to Agua Hedionda Lagoon source water.

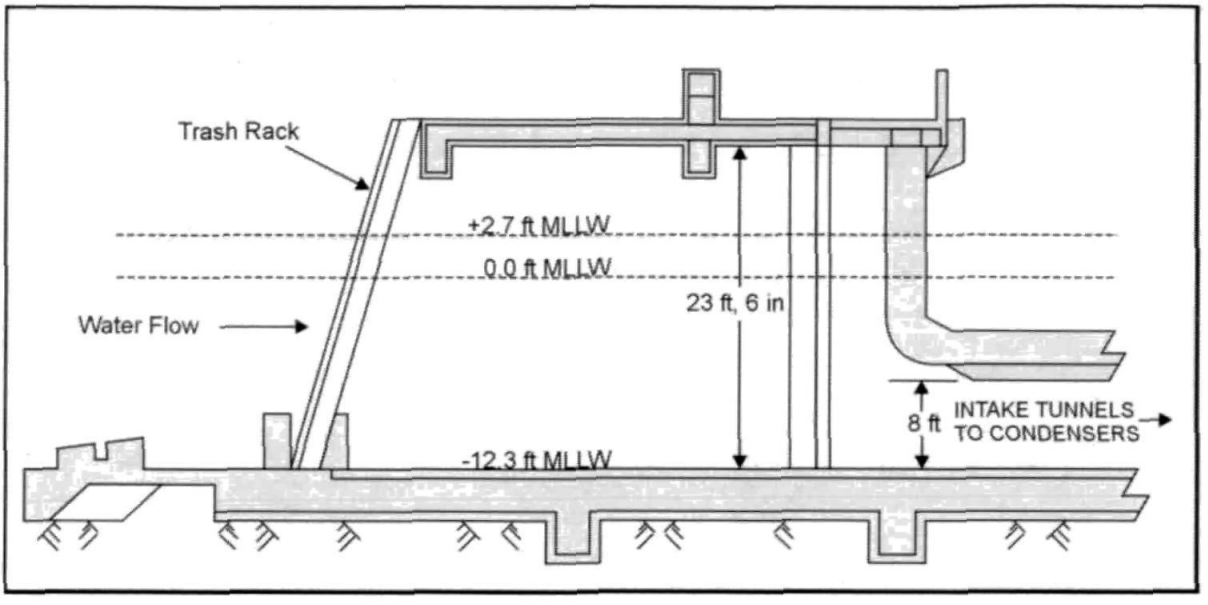



**Figure 2-2**. Longitudinal cross-section of Encina Power Station intake structure.

*Note: No metric conversions provided for figure.*

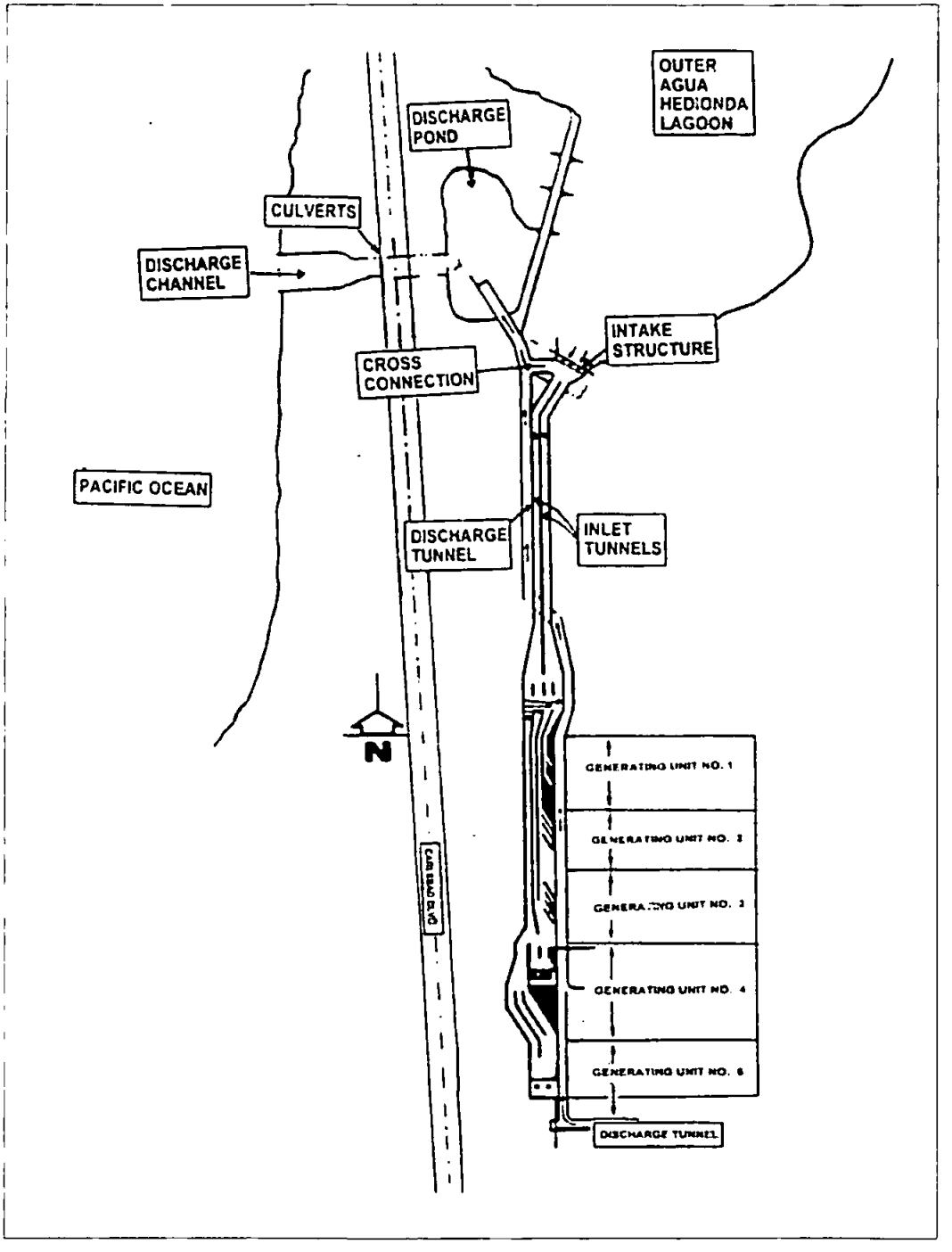



**Figure 2-3**. Schematic of Encina Power Station cooling water intake system.

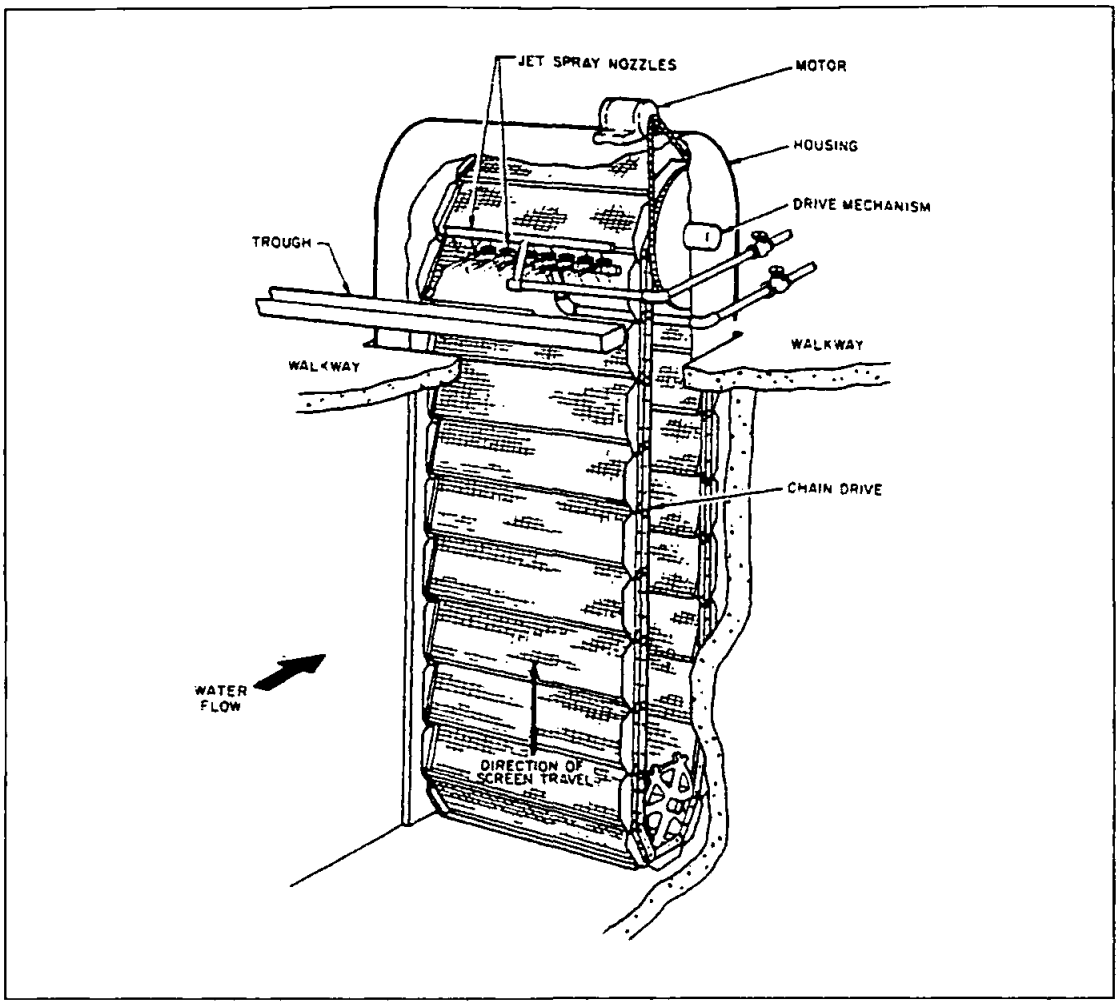



**Figure 2-4**. Diagram of traveling water screen similar to those in use at the Encina Power Station. Illustration from EPRI.

## 2.2 Environmental Setting

The aquatic environment surrounding EPS consists of Agua Hedionda Lagoon and its seasonal tributaries, and the open coastal waters of the Pacific Ocean. In the following description of the environmental setting, the physical environment will be characterized in terms of water body currents and tidal volumes relevant to the analysis of entrainment impacts, and the biological characteristics will be generally described with reference to previous environmental studies done at EPS.

## 2.2.1 Physical Description

Agua Hedionda Lagoon (AHL) is a coastal lagoon system consisting of three interconnected segments situated at the seaward end of the Agua Hedionda Creek drainage. It is located within the city limits of Carlsbad, California. It is one of several lagoons that are located along the southern California bight of the Pacific Ocean. Historically, AHL was a natural, seasonal estuary characterized by frequent closings of the lagoon mouth, especially in summer months. Wet and dry time periods play an important role in opening and closing southern California coastal lagoons (Elwany et al. 1999). Under normal conditions, floods control the opening of these lagoons. After large floods, lagoons stay open from one to three years. In the absence of floods, lagoons will remain closed unless their inlets are excavated. According to Bradshaw et al. (1976) AHL was first dredged from 1952 to 1954 in order to increase the lagoon volume to provide a cooling water source for EPS, thereby establishing a permanent opening and tidal connection with the nearshore coastal waters. In 1954, two rip-rap lined channels were completed that provided permanent connection with the ocean: a northernmost entrance channel over 91 m (300 ft) long with depth of 1.5 m (5 ft) below mean lower low water (MLLW), and a southern channel used to discharge water from the EPS.

The present lagoon system consists of three segments, the Outer, Middle, and Inner Lagoons (**Figure 2-5**). The Outer Lagoon is connected to the Pacific Ocean through an inlet channel formed by two jetties. The jetties are located west of the Coast Highway bridge and have lengths of about 107 m (350 ft) and 112 m (368 ft), north and south respectively. The distance between the centerline of the two jetties is about 74 m (243 ft). The lengths of the north and south discharge channel jetties are about 100 m (327 ft) and 115 m (376 ft), respectively. The absolute distance that the intake and discharge jetties extend from the shoreline varies somewhat with the changing location of the shoreline due to seasonal erosion and accretion of sand.

The coastal region of AHL is part of the Southern California Bight (SCB) whose nearshore is punctuated by headlands and submarine canyons. The SCB extends from Point Conception south to Cabo Colonet in Baja California about 120 miles south of the U.S.-Mexico border. The shelf in the vicinity of San Diego to AHL is relatively narrow, but widens somewhat off San Onofre, north of AHL. The headlands of Dana Point lie 31 mi northward, while Point Loma and the entrance to San Diego Bay is about 21 mi to the south, forming the continental landward extremes of the Gulf of Catalina part of the SCB. Further offshore, roughly 60 mi, Santa Catalina and San Clemente Islands delineate the westward boundary of the Gulf of Santa Catalina. Two submarine canyons are found nearby, the Carlsbad Canyon about one mi south and the La Jolla Canyon 16 mi south.

Ocean currents over the nearshore continental shelf are influenced by the poleward flow of the Southern California Countercurrent, a branch of the equatorward flowing California Current (Hickey 1993). The countercurrent is strongest in summer and winter, but either weak or absent in spring when flows of the California Current enter the SCB but turn equatorward rather than

poleward. A detailed discussion of current patterns in the vicinity of AHL and EPS are presented in Section 2.2.1.3–*Coastal Source Water*.

### 2.2.1.1 Summary of Previous AH Studies

Several studies have previously been conducted to determine the effect of the operation of the cooling system of Encina Power Station on lagoon sedimentation (Ellis 1954, Bhogal and Costa 1989, EA Engineering Science and Technology 1997, Jenkins and Wasyl 2001). Studies to determine the impact on marine environments have been presented by Jenkins and Skelly (1998) and Jenkins et al. (1989). Elwany et al. (1999) described the oceanographic conditions (waves and tides) at Agua Hedionda Lagoon in detail. A bibliography of pertinent research on existing conditions and monitoring studies in the vicinity of Agua Hedionda Lagoon is given in Coastal Environments (1998).

The tidal prisms of the lagoon segments and volumes of water flowing through the AHL inlet were estimated by SDG&E (1980). The estimated flood volume was $2.0 \times 10^6$ $m^3$ (1,600 acre-ft) comprised of the tidal prism of $1.25 \times 10^6$ $m^3$ (1,000 acre-ft) and $0.75 \times 10^6$ $m^3$ (600 acre-ft) of cooling water. The resulting ebb volume was calculated as $0.50 \times 10^6$ $m^3$ (400 acre-ft).

As part of this 316(b) study, Dr. H. Elwany and other researchers at Coastal Environments determined the hydrodynamics of AHL, including estimates of inflow and outflow volumes, tidal prism, and residence time (**Appendix B**). Their estimates of inflow and outflow, corresponding to maximum power plant cooling volume, are similar to those measured by SDG&E (1980). They describe the dynamics of the flow in AHL during a period of over a month, June and early July 2005. Their measurements are used to estimate the inflows and outflows during the period of the present 316(b) study and the data are used in modeling potential impacts to fish and invertebrate populations.

### 2.2.1.2 Agua Hedionda Lagoon

The inlet to Agua Hedionda Lagoon serves as the source of coastal oceanic water for cooling the EPS. In general, this water flows through the Outer Lagoon to the power plant and to the Middle and Inner Lagoons of AHL during flood tide, while AHL itself is the source of cooling water during slack and ebb tidal conditions. Despite the relatively short residence time of "old water" in AHL, large populations of resident fishes are present.

SDG&E (1980) described the flood circulation into the lagoon at the entrance and measured velocities as high as 90 cm/s. As water enters the Outer Lagoon it flows clockwise along the northern bank and divides into three components: 1) a semi-permanent eddy responsible for sediment build-up, 2) a flow south towards the power plant intake and 3) a current that turns toward the Middle Lagoon. On ebb tide, currents coming out of the Inner Lagoon bifurcate at the entrance and flow toward the northern and southern ends. Ebb flows out of AHL were reported to be slower than inflows at 10 cm/s.



Elwany et al. (2005) measured changes in water level, velocity, salinity, and temperature in AHL between June 1, 2005 and July 7, 2005. The main purposes for this study were to determine the volumes of the three lagoon segments at mean sea level and to determine the volume of water that entered and left the lagoon daily, on average. In addition, the study described the general hydrodynamics of AHL, the volumes of the three lagoon segments at various elevations, the tidal prism, and the residence time of water in the three lagoon segments. The tidal prism was defined in this study as the volume of water in the lagoon between maximum and minimum water level per tidal cycle.

Bathymetric surveys of the Outer, Middle, and Inner Lagoons were conducted by the EPS in March 2005, November 2004, and May 2005, respectively. **Figure 2-5** shows the resulting bathymetric map of the lagoon. Additional figures in **Appendix B** (Appendix Figures B-1 through B-4) show the bathymetry of the Outer, Middle and Inner Lagoons. Lagoon depths ranged from about –12.8 m (–42 ft) (NGVD 29)[1], in the deepest portion of the Outer and Middle Lagoons, to about +3.0 m (+10 ft) NGVD along the shoreline of the Inner Lagoon. The channel leading from the Outer Lagoon to the Inner Lagoon was the deepest area of the lagoon.

The bathymetry of AHL in each lagoon segment was used to calculate the surface area, water volume and potential tidal prism at various elevations using ESRI ArcGIS® (**Table 2-3**). The surface area of the lagoon at +1.83 m (+6 ft) NGVD is about 144 ha (356 ac). The surface area of the lagoon is reduced to about 107 ha (264 ac) at mean low lower water (MLLW). At MLLW, the volume of water in the lagoon is about 2.16 million $m^3$ (1,750 acre-ft). The majority of the area and volume come from the large Inner Lagoon (**Figure 2-5** and **Appendix B**). The volume of AHL at mean sea level was estimated as 3.145 x $10^6$ $m^3$ (2,550 acre-ft) for the three lagoon segments. The Outer, Middle and Inner Lagoon volumes were 1.247x$10^6$ $m^3$ (1,011 acre-ft), 0.350 x$10^6$ $m^3$ (284 acre-ft) and 1.547 x$10^6$ $m^3$ (1,255 acre-ft), respectively.

The potential tidal prism of the lagoon is defined as the volume of water in the lagoon between the maximum and minimum water levels, assuming the minimum water level to be –0.30 m (–1 ft) NGVD. The potential tidal prism definition assumes that the water level in the entire lagoon is the same, with no friction losses (i.e., no tidal muting). The potential tidal prism at mean sea level was estimated as approximately 370,000 $m^3$ (300 acre-ft), while at +1.83 m (+6 ft) NGVD it was nearly 2.59 million $m^3$ (2,100 acre-ft) (**Appendix B**). The tidal prism of the Inner Lagoon constituted the largest portion of the lagoon tidal prism.

In order to estimate the inflow, outflow and tidal prism (per tidal-cycle and daily) of AHL, four temporary data collection stations were established for a period of approximately one month from June 1, 2005 to July 7, 2005. Station S0 was located at the inlet to the Outer Lagoon, Station S2A was located in the northern portion of the Inner Lagoon, Station S2B was located at

[1] NGVD 29 (National Geodetic Vertical Datum 1929) measurements are +2.5 ft (0.7 m) MLLW in the vicinity of AHL.

the inlet to the Inner Lagoon, and Station S3 was located in the southeastern portion of the Inner Lagoon. Water level measurements were acquired at all four locations at five-minute intervals. Water velocities, temperature and conductivity were measured at Stations S0 and S2B (**Appendix B**).

The water level measurements showed only small variations between water level elevations at the four stations during neap tide; however there was a time lag between water level at the inlet and water level at the Inner Lagoon (<1 hour). During spring and mean tides, there is a short time lag and a variation in water elevation (~.08 m [0.25 ft]) between the inlet to the lagoon (Station S0) and the interior stations.

The highest water velocity measurements at Station S0 were +1.52 m/s (5 ft/sec) and –0.91 m/s (–3 ft/sec) during spring tide. Conductivity and temperature measurements showed little difference between Stations S0 and salinity fluctuated between about 31.5 and 34.0 PSU. During the first two weeks of June 2005 the temperature was about 20–22°C (68.0–71.6°F). In late June to early July, the temperature decreased and fluctuated significantly, ranging between 14 and 20°C (57.2–68.0°F). During the study, the cumulative tidal prism for the lagoon ranged from 215,860 $m^3$ (175 acre-ft) to 2.56 million $m^3$ (2,075 acre-ft). Water in the Middle and Outer Lagoons had fewer fluctuations and a much smaller tidal prism (about 61,000 to 370,000 $m^3$ [50 to 300 acre-ft]) than water in the large Inner Lagoon as it contains the majority of water in the lagoon. The tidal prism of the lagoon during the time period of the measurements varied from approximately 1.23 million $m^3$ (1,000 acre-ft during neap tide, 2.62 million $m^3$ (2,125 acre-ft) during spring tide, and 2.10 million $m^3$ (1,700 acre-ft) during mean tide.

A mathematical model was designed to compute the residence time of 'old' water in the lagoon during a tidal cycle. In the lagoon (total) after 5.0 tidal cycles or 2.6 days, the 'old' water is essentially flushed out of the lagoon. In the Inner Lagoon, 6.27 tidal cycles, or 3.2 days, are required to flush out the 'old' water. Due to water intake by the cooling system of the EPS, the outgoing flow through the inlet is less than the incoming flow through the inlet. **Appendix B** (Appendix Figures D-3 and D-4) show the lagoon inflow and outflow during the study period of June 1 through July 7, 2005. The mean reduction of the outflow water from the lagoon with respect to incoming water was about 51% per tidal cycle and 48% per day during the time period of the measurements.

As part of the description of the flow of water through the AHL, Elwany et al. (2005) estimated the incoming and outgoing water volumes at the major inlet of AHL for the period June 1, 2004 to May 31, 2005. Water level measurements conducted in the lagoon between June 1 and July 7, 2005 were used to establish the relationships of maximum and minimum water levels per tidal cycle, measured in feet, between the ocean at Scripps Pier, La Jolla, CA and the lagoon using linear regression analysis.

The relationships between lagoon and ocean water levels, shown in **Figure 2-6,** were as follows:

$$Wl_{max} = 0.97\ Wo_{max} + 0.0076 \quad (1)$$



$$Wl_{min} = 0.69\ Wo_{min} - 0.37 \quad (2)$$

where $Wl_{max}$ and $Wl_{min}$ are the maximum and minimum water levels in the lagoon, respectively, and $Wo_{max}$ and $Wo_{min}$ are the maximum and minimum water levels in the ocean per tidal cycle, respectively.

The measured ocean tides at Scripps Pier in La Jolla, CA, between June 1, 2004 and May 31, 2005 were used to estimate the maximum and minimum water levels in the lagoon using Equations 1 and 2, respectively. Using Equations 3 and 4 presented in **Appendix B** and the reported EPS cooling system hourly intake flows during the same time period (**Figure 2-7**), estimates were made regarding the incoming (inflow) and outgoing (outflow) flow rates per tidal cycle from the lagoon's major inlet (**Figure 2-8**). The length of a tidal cycle was variable depending on the tide phase.

The average daily estimated inflow and outflow through the lagoon's inlet between June 1, 2004 and May 31, 2005 was $4.11 \times 10^6$ m$^3$ ($1.09 \times 10^9$ gal) and $1.80 \times 10^6$ m$^3$ ($0.48 \times 10^9$ gal) corresponding to an average daily power plant intake flow of $2.31 \times 10^6$ m$^3$. A maximum daily inflow and outflow can be estimated, using these averages and the maximum power plant intake flow of $3.24 \times 10^6$ m$^3$ ($1.09 \times 10^9$ gal) as $4.58 \times 10^6$ m$^3$ ($1.09 \times 10^9$ gal) and $1.33 \times 10^6$ m$^3$ ($1.09 \times 10^9$ gal).

### 2.2.1.3 Coastal Source Water

SDG&E (1980) reported an analysis of data from two current meters stationed offshore from the inlet to AHL in June, August and November 1979 that recorded currents at a depth of 3 m (10 ft) every 30 min. The two current meters were positioned 0.426 km (0.26 mi) and 1.036 km (0.64 mi) offshore. Median current speed at the offshore station was 10 cm/sec. Closer to shore, speeds were slower. Current directions at both stations showed reversals at tidal frequencies but a greater downcoast current was observed further offshore. Drifter studies showed a dominant trajectory of water directed towards the AHL inlet from the northwest (at an angle between 30 and 60 degrees toward the coastline).

During the present 316(b) study, a Sontek 1 MHz acoustic Doppler current meter (**Figure 2-9**) was deployed 0.8 km (0.5 mi) offshore from the entrance to AHL (33°08.5012'N, 117°21.1734'W) at a bottom depth of –15.8 m (–52 ft) MLLW, over the time period July 7, 2004 to July 12, 2005. The instrument was mounted in an anchored triangular frame with the instrument's reference point (piezoelectric ceramics) located about 0.5 m (1.6 ft) above the bottom and pointing upward. Data were collected for two minutes every half-hour in 20-1 m (0.3 ft) depth bins starting 0.7 m (2.3 ft) above the instrument. Water column average velocities were calculated every half-hour over the first 13 bins and represented average velocities from –0.610 m (–2 ft) MLLW to –14.1 m (–46.2 ft) MLLW.

Over the study period the average water column speed was 5.7 cm/sec (0.19 ft/sec). Cumulative water velocities were examined from July 2004 to June 2005 in units of km per month for 20

compass directions (**Figure 2-10**). The dominant current directions over the time period were parallel to the coastline that runs approximately 328° to 148° T near EPS. Average water column velocities were rotated so that components orthogonal to the coastline could be estimated. These cumulative velocity components show a general downcoast and onshore displacement (**Figure 2-11**). The largest displacement occurred during November and the smallest during June (**Figure 2-12**).

The presentation of water current velocities as displacements per time period (e.g., per month) is relevant in the context of this 316(b) study of the entrainment of aquatic organisms. Larval transport to the power plant at AHL is estimated over the time period that the larvae of a particular species are floating in the plankton which is assumed to move at the same rate as the water mass.

The results of the present study showed predominately downcoast (equatorward) flow over the 15.9 m (52 ft) bottom depth. However, net upcoast flow occurred in April, June, July and December. Larger downcoast flows occurred during the fall 2004 and spring 2005 (March). These results are consistent with previous studies. Hickey (1993) reported a generally downcoast flow from a number of studies performed in the vicinity. Winant and Bratkovich (1981) measured equatorward flow in all seasons on the shelf (15 m [49.2 ft] to 60 m [197 ft] bottom depths) seaward of nearby Del Mar. Strongest downcoast flow occurred off Del Mar in winter (over 60 m bottom depth) or spring (15 m and 30 m bottom depths).




**Figure 2-5**. Bathymetry of Agua Hedionda Lagoon from a study by Elwany et al. (2005).

*Note: Metric conversions not provided for figure.*

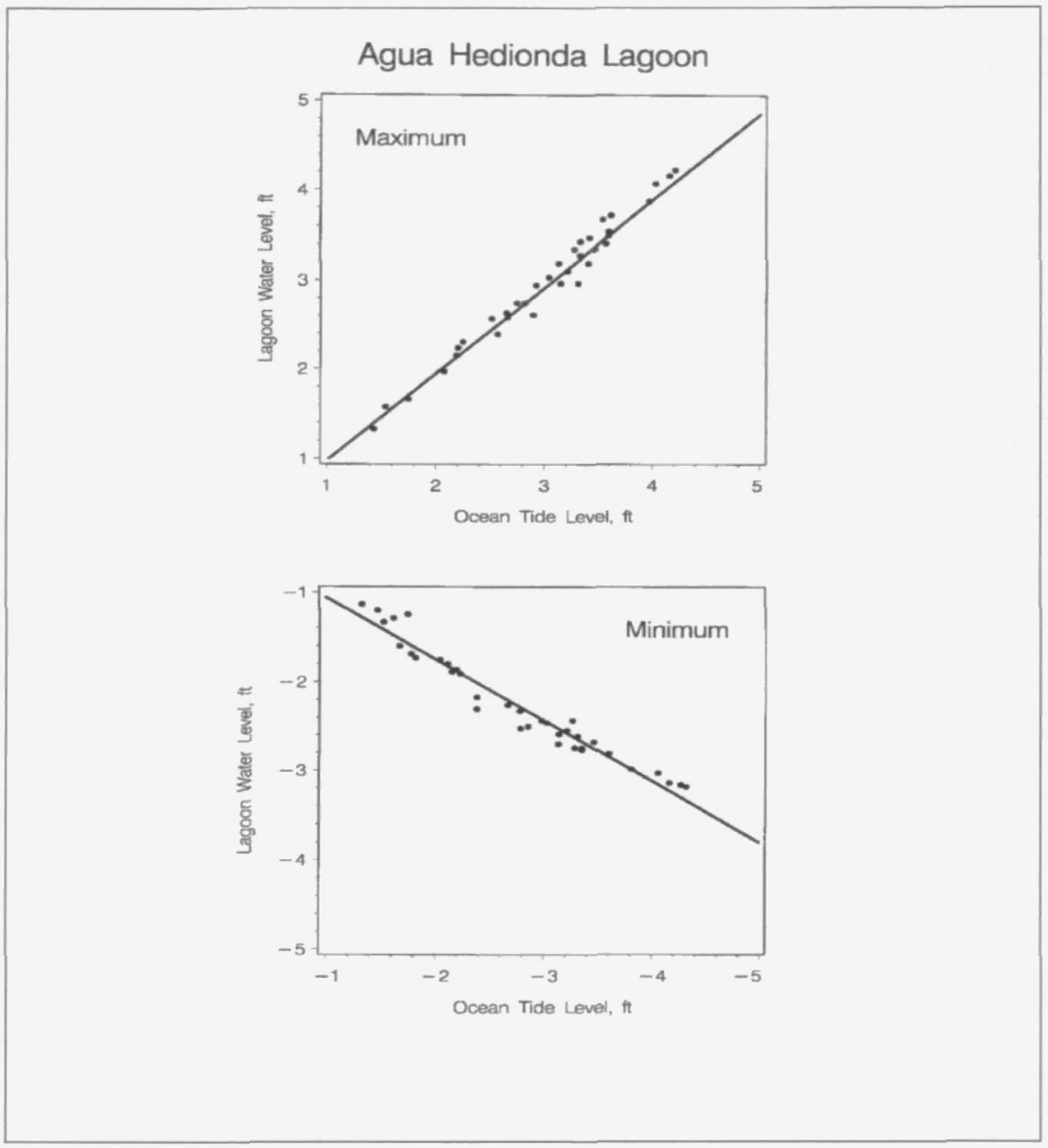



**Figure 2-6**. Relationship between maximum water level in the ocean and lagoon per tidal cycle (upper) and between minimum water level in the ocean at Scripps Pier, La Jolla, California and Agua Hedionda Lagoon (lower). Data from June 1 to July 7, 2005.

*Note: Metric conversions not provided for figure.*

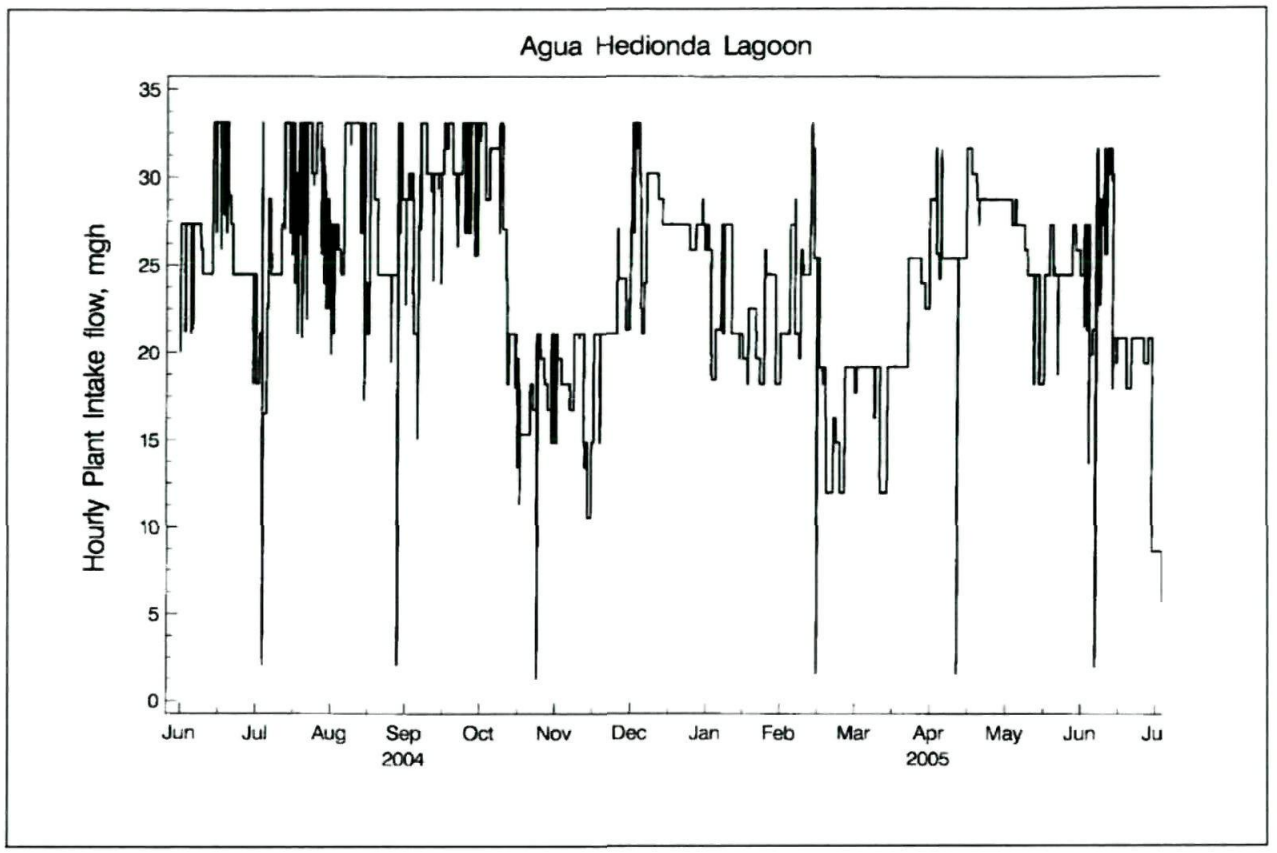



**Figure 2-7**. Hourly Encina Power Station intake flow (million gallons per hour) for the time period between June 1, 2004 and July 1, 2005.

*Note: Metric conversions not provided for figure.*

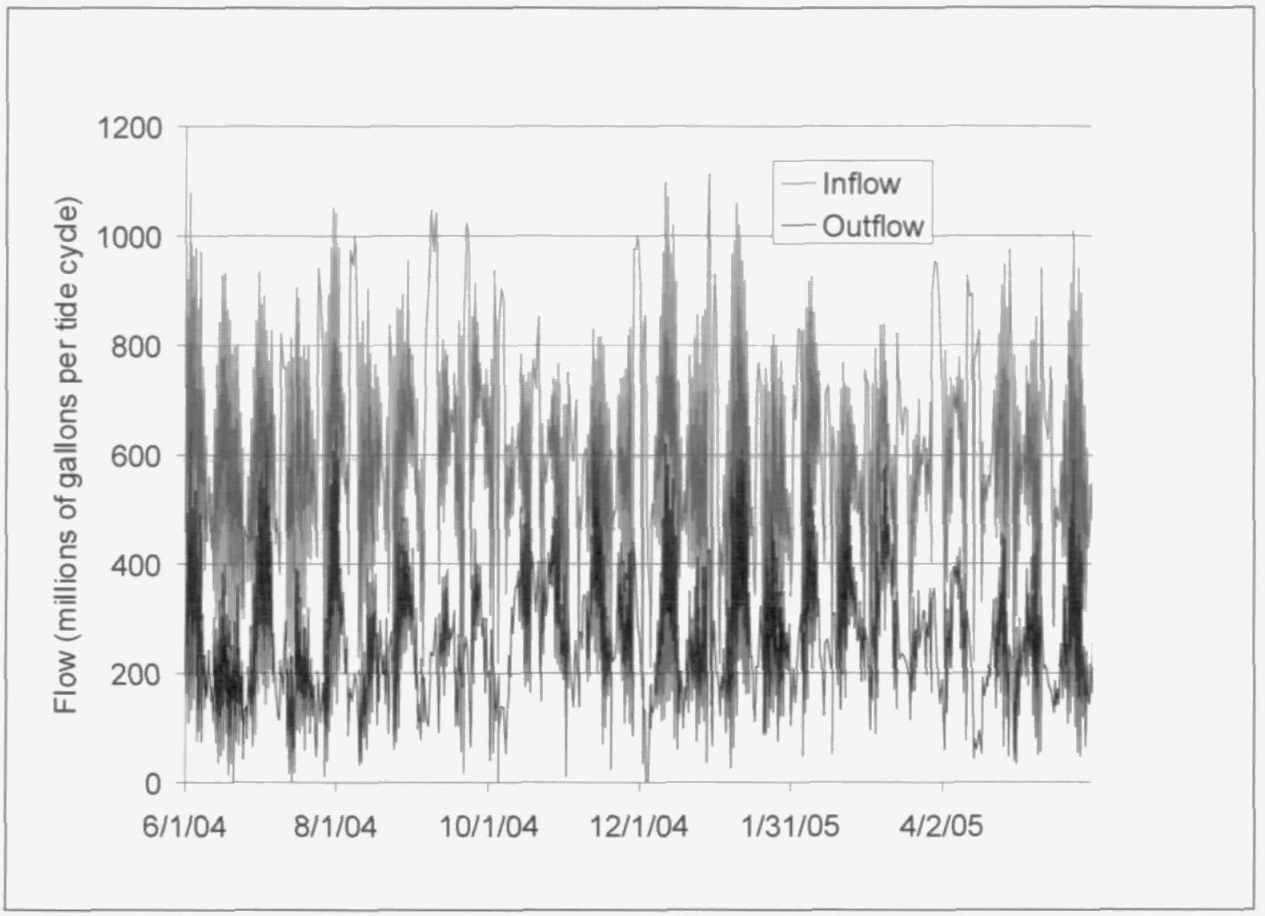
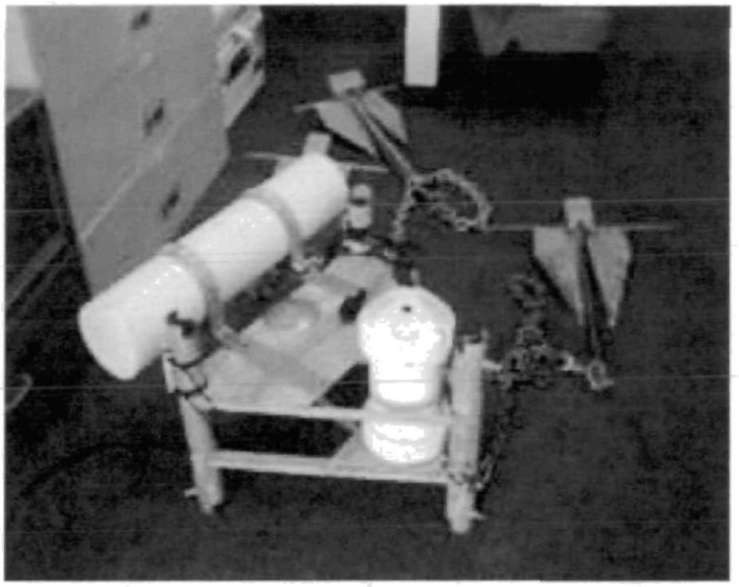



**Figure 2-8**. Estimated inflow and outflow through the Agua Hedionda Lagoon north jetty, June 1, 2004 through May 31, 2005.



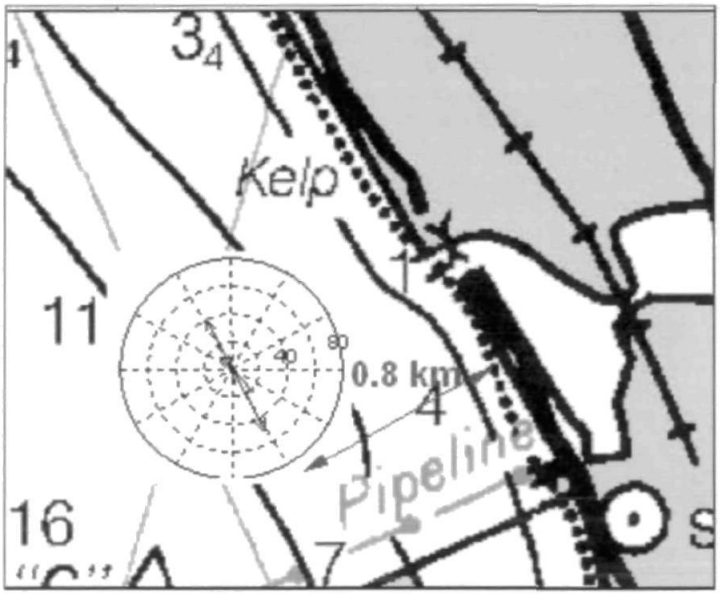



**Figure 2-9**. Acoustic Doppler current meter and battery in deployment frame (above) was positioned on the seafloor at –15.8 m (–52 ft) MLLW 0.8 km (0.5 mi) offshore the inlet to Agua Hedionda Lagoon, July 7, 2004 to July 12, 2005. The lower figure depicts an example of current velocities measured by the instrument over one month.

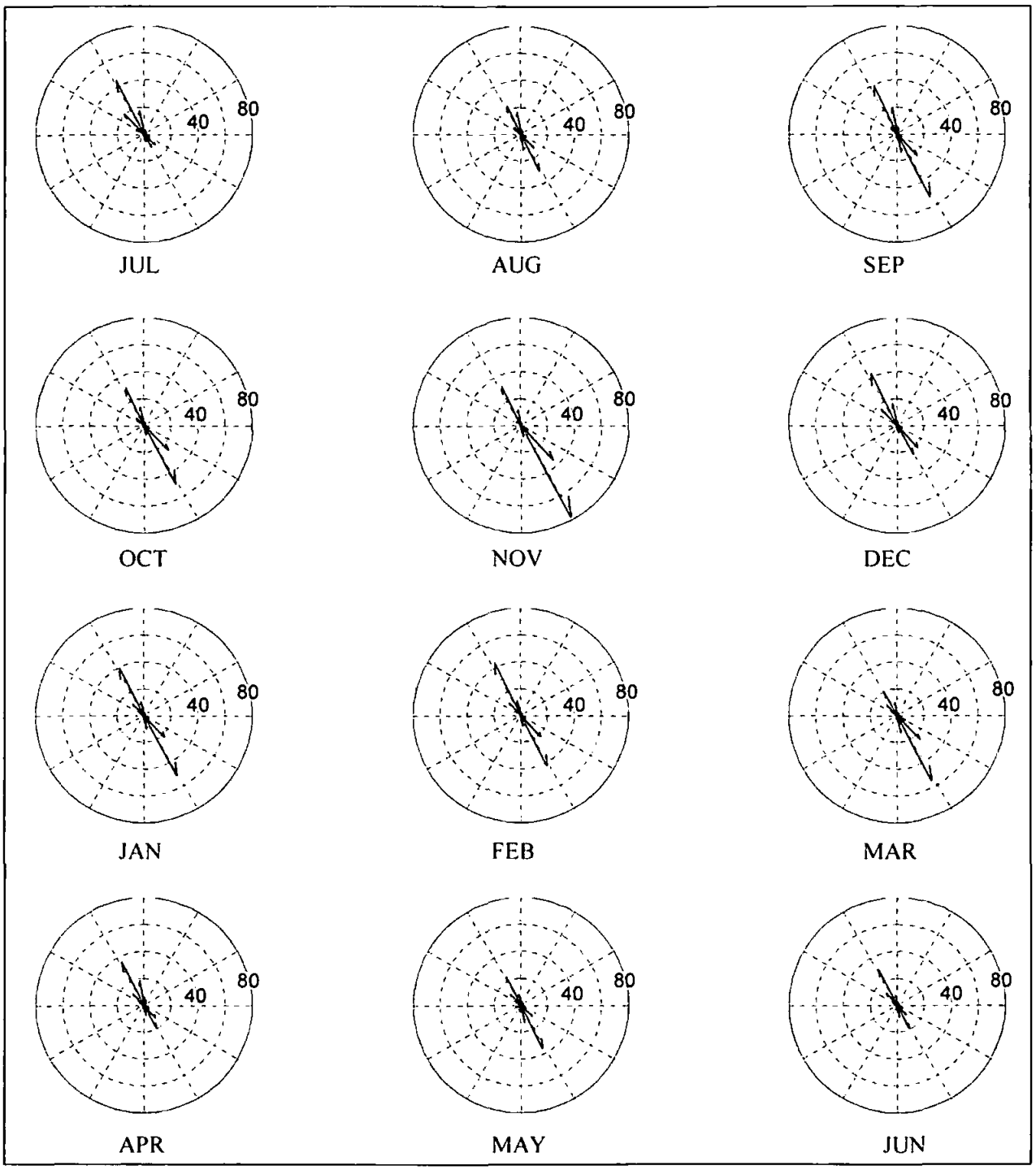



**Figure 2-10**. Cumulative excursions of water measured from July 2004 to June 2005 in km per month and by 20 compass directions. In each current rose, true north is upward; the coastline runs approximately 328° to 148° T near the Encina Power Station.

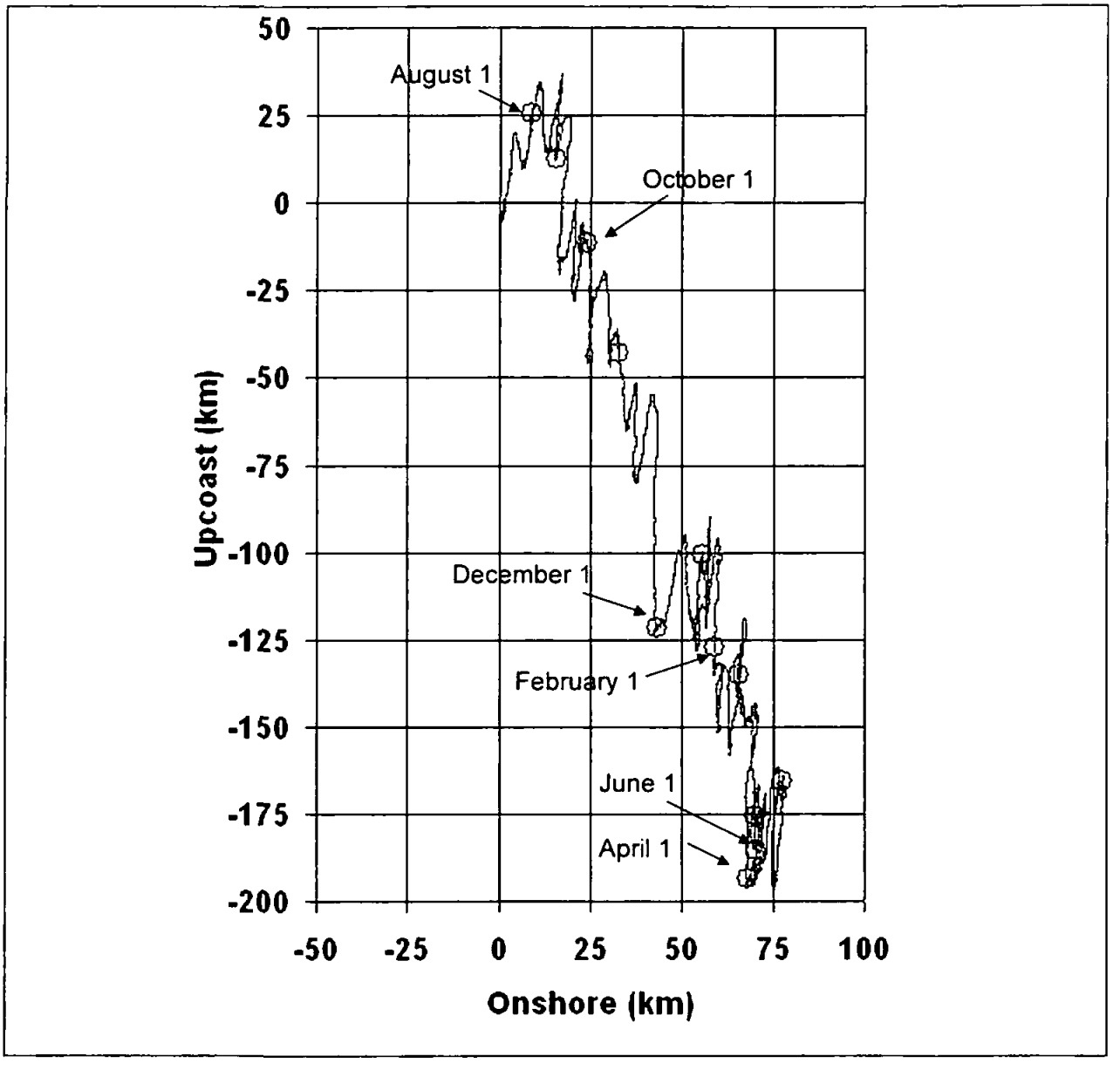



**Figure 2-11**. Cumulative current displacement measured by an uplooking acoustic Doppler current meter 0.5 mi (800 m) offshore the Encina Power Station, 33°08.5012'N 117°21.1734'W, −15.2 m (−50 ft) MLLW depth, 7 July 2004 (1000 hr) to 12 July 2005 (1000 hr).

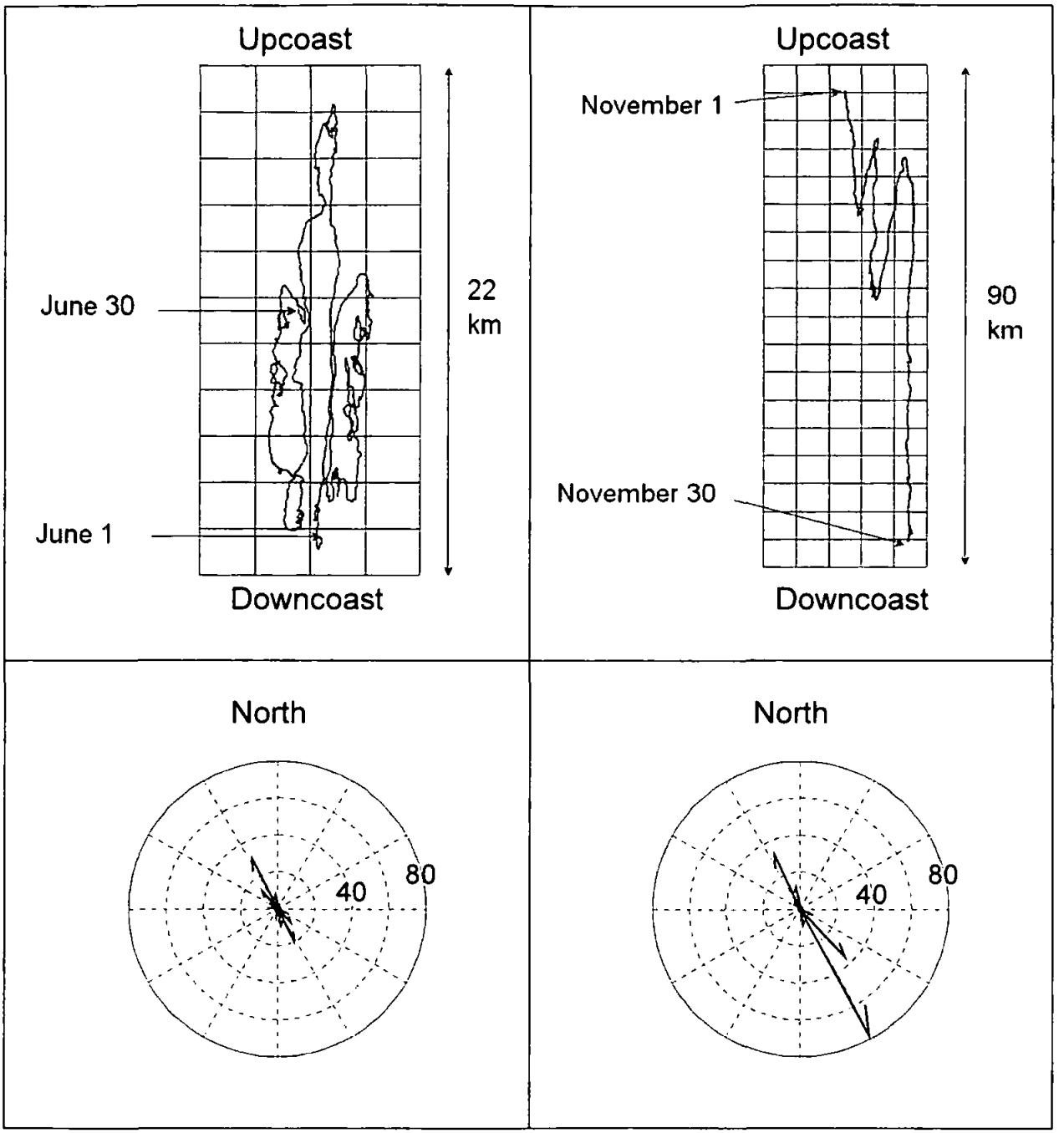



**Figure 2-12**. Cumulative monthly water column currents in June (2005) (left) and November 2004 (right) and 0.8 km offshore the inlet to Agua Hedionda Lagoon. Upper view is onshore and alongshore displacement orthogonal to the coastline. Below are corresponding compass roses, each divided into 20 bin directions.

**Table 2-3.** Surface area and volumes at contour lines, Agua Hedionda Lagoon. Reference elevation datum is NGVD29. Mean sea level (+0.06 m NGVD) areas and volumes are shaded.

| Elevation (m) | Surface Area (hectares) | | | | Volume ($m^3$ x $10^6$) | | | |
|---|---|---|---|---|---|---|---|---|
| | Total | Outer | Mid | Inner | Total | Outer | Mid | Inner |
| 1.83 | 144.417 | 22.646 | 10.771 | 111.000 | 5.323 | 1.636 | 0.531 | 3.156 |
| 1.68 | 141.139 | 22.503 | 10.677 | 107.959 | 5.105 | 1.602 | 0.514 | 2.989 |
| 1.52 | 138.632 | 22.377 | 10.583 | 105.672 | 4.892 | 1.568 | 0.498 | 2.826 |
| 1.37 | 135.692 | 22.262 | 10.487 | 102.943 | 4.683 | 1.534 | 0.482 | 2.667 |
| 1.22 | 130.224 | 22.156 | 10.390 | 97.678 | 4.480 | 1.500 | 0.466 | 2.514 |
| 1.07 | 122.552 | 22.054 | 10.291 | 90.207 | 4.288 | 1.466 | 0.450 | 2.371 |
| 0.91 | 118.547 | 21.952 | 10.190 | 86.405 | 4.104 | 1.433 | 0.435 | 2.236 |
| 0.76 | 116.144 | 21.851 | 10.084 | 84.209 | 3.925 | 1.399 | 0.419 | 2.106 |
| 0.61 | 112.623 | 21.749 | 9.973 | 80.901 | 3.751 | 1.366 | 0.404 | 1.981 |
| 0.46 | 110.520 | 21.646 | 9.855 | 79.020 | 3.581 | 1.333 | 0.389 | 1.859 |
| 0.30 | 109.559 | 21.538 | 9.736 | 78.285 | 3.413 | 1.300 | 0.374 | 1.739 |
| 0.15 | 108.545 | 21.425 | 9.615 | 77.506 | 3.247 | 1.267 | 0.359 | 1.620 |
| 0.06 | 107.748 | 21.350 | 9.539 | 76.859 | 3.145 | 1.247 | 0.350 | 1.547 |
| 0.00 | 107.260 | 21.304 | 9.493 | 76.463 | 3.082 | 1.235 | 0.345 | 1.503 |
| -0.15 | 104.923 | 21.173 | 9.354 | 74.396 | 2.921 | 1.202 | 0.330 | 1.388 |
| -0.30 | 102.915 | 21.027 | 9.223 | 72.665 | 2.762 | 1.170 | 0.316 | 1.276 |
| -0.46 | 100.832 | 20.869 | 9.099 | 70.864 | 2.607 | 1.138 | 0.302 | 1.167 |
| -0.61 | 98.456 | 20.699 | 8.976 | 68.782 | 2.455 | 1.107 | 0.289 | 1.060 |
| -0.76 | 96.011 | 20.522 | 8.853 | 66.635 | 2.307 | 1.075 | 0.275 | 0.957 |
| -0.91 | 93.748 | 20.342 | 8.733 | 64.674 | 2.162 | 1.044 | 0.262 | 0.857 |
| -1.07 | 91.459 | 20.156 | 8.611 | 62.691 | 2.021 | 1.013 | 0.248 | 0.760 |
| -1.22 | 89.753 | 19.962 | 8.493 | 61.297 | 1.883 | 0.983 | 0.235 | 0.665 |
| -1.37 | 88.057 | 19.746 | 8.376 | 59.935 | 1.748 | 0.952 | 0.222 | 0.573 |
| -1.52 | 86.292 | 19.507 | 8.257 | 58.527 | 1.615 | 0.922 | 0.210 | 0.483 |
| -1.68 | 84.283 | 19.272 | 8.137 | 56.874 | 1.485 | 0.893 | 0.197 | 0.395 |
| -1.83 | 80.937 | 19.025 | 8.015 | 53.897 | 1.359 | 0.864 | 0.185 | 0.310 |
| -1.98 | 71.619 | 18.774 | 7.890 | 44.955 | 1.243 | 0.835 | 0.173 | 0.235 |
| -2.13 | 65.128 | 18.534 | 7.761 | 38.834 | 1.139 | 0.806 | 0.161 | 0.171 |
| -2.29 | 56.589 | 18.084 | 7.626 | 30.879 | 1.046 | 0.779 | 0.149 | 0.118 |
| -2.44 | 42.916 | 17.675 | 7.482 | 17.759 | 0.970 | 0.751 | 0.138 | 0.081 |
| -2.59 | 35.645 | 17.326 | 7.351 | 10.969 | 0.910 | 0.725 | 0.126 | 0.059 |
| -2.74 | 31.208 | 16.972 | 7.208 | 7.028 | 0.859 | 0.699 | 0.115 | 0.045 |
| -2.90 | 27.864 | 16.609 | 6.972 | 4.283 | 0.814 | 0.673 | 0.105 | 0.037 |
| -3.05 | 26.349 | 16.295 | 6.548 | 3.506 | 0.773 | 0.648 | 0.094 | 0.031 |

## 2.3 Biological Description

The primary source water body for extracting cooling water for EPS is the Outer Lagoon in Agua Hedionda Lagoon. However, because of the large tidal exchange rate between the Outer Lagoon and the nearshore coastal waters off the Carlsbad area, and also the contiguous tidal connections with the Middle and Inner Lagoons, these waters must also be considered as part of the greater source water body for EPS. One of the most recent comprehensive studies on the biological characteristics of AHL was done by MEC Analytical (1995) in preparation for potential dredging within the lagoons. An earlier comprehensive study of lagoon and nearshore biological resources was done by SDG&E (1980) for the initial EPS 316(b) demonstration. A summary of the lagoon description and results of these studies are summarized in the following section. Tenera Environmental conducted additional sampling in 2005 in habitats of the lagoon that had not been adequately sampled for fishes in the previous studies, including the rock revetment around the margin of the Outer Lagoon and the intertidal mudflat habitats in the Middle and Inner Lagoons. The results of these studies are summarized in Section 2.3.1.2 and presented in full in Appendix C.

### 2.3.1.1 Summary of Previous AHL Biological Studies

Agua Hedionda Lagoon contains several specialized habitats, which are ideal for early stages of fish and invertebrate development. Habitats include open water, sand and mud substrates, eelgrass, rock revetment, pilings, and aquaculture grow-out floats. The lagoon environment offers calmer waters and higher productivity than adjacent coastal areas. Utilization of the lagoon is variable among species. There are permanent residents that utilize particular habitats in the lagoon for resting, feeding and spawning throughout their lifetime. There are also transient species whose adults use the lagoon for spawning seasonally and whose young subsequently utilize the area as a nursery ground. Habitat maps have been prepared for the lagoon environment (MEC 1993) and a reconnaissance survey in 1994 (MEC 1995) indicated that the previous maps were still generally valid.

Although this review concentrates mainly on finfishes due to their relevance to entrainment and impingement issues, other groups of organisms have been examined in previous studies. For example, Bradshaw et al. (1976) studied plankton populations in AHL and found zooplankton composition to be fairly uniform throughout the three sections of the lagoon. Density and distribution of zooplankton may be more closely influenced by tidal cycles than any other factors in this type of water system.

Saltmarsh vegetation and seasonal bird populations around AHL were also documented in earlier studies (MEC 1995). Salt marsh and tidal flats occur along the shores of the Middle and Inner Lagoons. The Middle Lagoon has narrow tidal flats along each shore; the widest flats occur along the north shore and at the eastern end of the south shore. The north shore has narrow tidal flats, and pickleweed occurred above mean high water in the northwest and northeast corners,



and in scattered, small patches in between. The east shore has a narrow bank, and scattered small patches of pickleweed were scattered along this shore.

Mudflats were best developed at the east end of the Inner Lagoon, and have expanded in recent years due to extreme sedimentation. Sandy flats occur at the Bayshore Drive public access, and there are two beach areas along the southern shore of the Inner Lagoon that have expanded in size since the 1970s. The most extensive salt marsh occurred east of the Bayshore Drive public access and extended to the eastern end of the lagoon. This area is dominated by pickleweed, mudflat, tidal creeks, and non-tidal flats.

Eelgrass (*Zostera marina*) distribution was mapped by MEC (1995) and in the Outer Lagoon occurred primarily along the shoreline. Its distribution in the Outer Lagoon is largely controlled by the agency-approved limits of maintenance dredging in that section of the lagoon. Little eelgrass occurs near the inlet to the ocean, but it does occur, first in patches and then in larger beds, along the west and northeast shores. Eelgrass was well developed along the southeast shore. Eelgrass occurred to depths of −5.5 m (−18.0 ft) MSL in the Outer Lagoon. Eelgrass was found throughout most of the Middle Lagoon with the exception of the top of the sandbar, and in most of the channel between the Outer and Inner Lagoons. Substantial eelgrass occurred on the sandbars of the west Inner Lagoon, and in narrow bands along the shoreline. Similar to the Middle Lagoon, maximum depths in the west Inner Lagoon were about −2.4 to −2.7 m (−8 to −9 ft) MSL. However, the lower limit of eelgrass in the west Inner Lagoon only extended to about −1.2 to −1.5 m (−4 to −5 ft) MSL. Continuing further east, eelgrass thinned to non-continuous, patchy beds and no eelgrass was observed at the far eastern end of the lagoon.

Bradshaw et al. (1976) indicated that the distribution of eelgrass in Agua Hedionda Lagoon appears to be controlled by depth, substrate stability, and light availability. Light levels were considered the primary factor controlling the density of eelgrass relative to depth in the Middle Lagoon by Backman and Barilotti (1976). Because of the changes that have occurred in the lagoon due to sediment infilling over the last twenty years, it is reasonable that depth, substrate stability, and light all have contributed to the present distribution of eelgrass.

The eelgrass beds provide a valuable habitat for benthic organisms that are fed upon by birds and fishes. Although eelgrass beds were less well developed in areas of the Inner Lagoon, it was found to provide a wider range of habitats, including mud flats, salt marsh, and seasonal ponds than elsewhere in AHL. As a result, bird and fish diversity was highest in the Inner Lagoon.

The number of fish species in AHL was similar to that of other embayments examined by Horn and Allen (1978) with 55 fish species within a 120 hectare subtidal area. In the SDG&E (1980) impingement study, additional collections at the adjacent CWIS within EPS and lagoon collections by otter trawl yielded a total of 79 fish species. Other bays examined by Horn and Allen (1978) were: Anaheim Bay with 59 species in 53.0 ha (131.0 ac), Alamitos Bay with 43 species in 67.2 ha (166.1 ac), Elkhorn Slough with 69 species in 87.4 ha (216.0 ac), Bolinas Lagoon with 41 species in 109.3 ha (270.1 ac), and Newport Bay with 78 species in 175.2 ha



(432.9 ac). A positive linear logarithmic relationship of surface area to fish species diversity was indicated for all 13 embayments.

Lagoons provide important habitat for coastal marine and resident fishes. An important aspect of bays and estuaries is that they serve as nursery habitat for commercially and recreationally important coastal species such as California halibut (*Paralichthys californicus*) and diamond turbot (*Hypsopsetta guttulata*) (Allen 1982, 1988). AHL is primarily a marine lagoon but can be influenced by seasonal freshwater inflows from December through April. The southern end of the Inner Lagoon is influenced by runoff from Agua Hedionda Creek. Euryhaline species such as the California killifish (*Fundulus parvipinnis*), western mosquitofish (*Gambusia affinis*), and striped mullet (*Mugil cephalus*) occur in the Inner Lagoon. These waters may provide a necessary gradation from fresh to brackish water for some winter spawning fishes such as topsmelt that require variable salinities for normal egg and larval development.

The fish surveys during the MEC (1995) study were conducted during spring and summer. Temperatures ranged from 14.8 to 16.9°C (58.6–62.4°F) during the spring and 20.8 to 24.8°C (69.4–76.6°F) in the summer. Summer temperatures were up to 4°C (7.2°F) warmer in the Inner Lagoon than in the Outer Lagoon. Surface salinities ranged from 23 to 32.7 ppt, with the lower values in spring due to seasonal rainfall. Visibility ranged from approximately 2 to 4 ft (0.75 to 1.25 m) during the spring but was generally higher in the summer. Occasional phytoplankton blooms in nearshore and lagoon waters can severely decrease water clarity and deplete dissolved oxygen concentrations. Such conditions were particularly severe in AHL throughout much of summer 2005 (S. LePage, M-REP Consultants, pers. comm.).

Several types of fish sampling gear were used during the MEC (1995) study including otter trawl, beam trawl, and beach seine. A total of 35 species of fishes was found during the 1994 and 1995 sampling. The Middle and Inner Lagoons had more species and higher abundances than the Outer Lagoon. During the 1995 survey, only four species were collected in the Outer Lagoon, compared to 14 and 18 species in the Middle and Inner Lagoons. The sampling did not include any surveys of the rocky revetment lining the Outer Lagoon that would have increased the abundance and number of species collected (see following section). Silversides (Atherinopsidae) and gobies (Gobiidae) were the most abundant fishes collected. Silversides, including jacksmelt and topsmelt, that occur in large schools in shallow waters where water temperatures are warmest were most abundant in the shallower Middle and Inner Lagoons. Gobies were most abundant in the Inner Lagoon, which has large shallow mudflat areas that are their preferred habitat. The species composition generally reflected the open tidal exchange conditions with nearshore coastal waters, especially in the Outer Lagoon, with some of the more abundant marine species including the spotted sand bass (*Paralabrax maculatofasciatus*), barred sand bass (*P. nebulifer*), queenfish (*Seriphus politus*), shiner surfperch (*Cymatogaster aggregata*), giant kelpfish (*Heterostichus rostratus*), California halibut (*Paralichthys californicus*), and diamond turbot (*Hypsopsetta guttulata*).



No tidewater gobies (*Eucyclogobius newberryi*) were found during the study. This is a federally endangered species that was once recorded as occurring in the lagoon prior to lagoon modifications in the early 1950s. The present marine-influenced environment in the lagoon would not tend to support tidewater gobies because they prefer brackish water habitats. No other listed fish species were collected in the study.

The outer coast has a diversity of marine habitats and includes zones of intertidal sandy beach, subtidal sandy bottom, rocky shore, subtidal cobblestone, subtidal mudstone and water column. Organisms typical of sandy beaches include polychaetes, sand crabs, isopods, amphipods, and clams. California grunion utilize the beaches around EPS during spawning season from March through August. Numerous infaunal species occur in subtidal sandy bottoms with mollusks, polychaetes, arthropods, and echinoderms comprising the dominant invertebrate fauna. Sand dollars can reach densities of 1,200/$m^2$. Typical fishes in the sandy subtidal include queenfish, white croaker, several surfperch species, speckled sanddab, and California halibut. Also, California spiny lobster (*Panulirus interruptus*) and *Cancer* spp. crabs forage over the sand. Many of the typically outer coast species can occasionally occur within AHL, carried by incoming tidal currents.

The rocky habitat at the discharge canal and on offshore reefs supports various kelps and invertebrates including barnacles, snails, sea stars, limpets, sea urchins, sea anemones, mussels, crabs and spiny lobsters. Giant kelp (*Macrocystis*) forests are an important habitat-forming community in the area offshore from AHL and provide habitat for a wide variety of invertebrates and fishes. The kelp forests in coastal southern California support many fish species, including northern anchovy, jack smelt, queenfish, white croaker, garibaldi, rockfishes, surfperches, and halibut (North 1968). A 2004 study of the kelp forest habitat 2 km (1.2 mi) south of AHL quantified the abundances of 14 species of fishes and 13 species of macroinvertebrates (T. Anderson, SDSU, pers. comm.). Common fish species included jack mackerel (*Trachurus symmetricus*), señorita (*Oxyjulis californica*), shiner perch (*Cymatogaster aggregata*), and black surfperch (*Embiotoca jacksoni*). Common macroinvertebrate species included gorgonian (*Muricea californica*), purple sea urchin (*Strongylocentrotus purpuratus*), California spiny lobster, white sea urchin (*Lytechinus anamesus*).

Marine-associated wildlife that occur in the Pacific waters off Agua Hedionda Lagoon are numerous and include brown pelican, surf scoter, cormorants, western grebe, gulls, terns and loons. Marine mammals, including coastal bottlenose dolphin, harbor seals, California sea lions, and gray whales, also frequent the adjacent coastal area.

### 2.3.1.2 Summary of Special Studies

The following studies were conducted by Tenera Environmental to provide additional interpretive data for the 2004-2005 larval fish entrainment studies at EPS. This section summarizes these studies—a complete data presentation can be found in **Appendix C**. The supplemental studies on fish in AHL were short-term in nature and the information was used to improve knowledge of adult/juvenile fish abundance, distribution and size composition that can

be related to the source of entrained larvae. The studies were designed to sample specific habitats in the lagoon that were not sampled during earlier comprehensive fish studies by MEC Analytical (1995).

Gobies and blennies produce large numbers of larvae in AHL, yet the survey methods used in earlier studies likely underestimated their local adult population densities because the sampling equipment targeted larger fishes over soft substrates and seagrass habitats. Accurate density information on small cryptic fishes requires the use of enclosure sampling and/or the use of anesthetic solutions to ensure that all individuals are collected within a sampled area. Also, the earlier methods did not sample artificial habitats such as the breakwater areas along the western edge of the Outer Lagoon or aquaculture mussel floats below the tank farm.

In the present study, four methods were used to sample fishes in specific habitats (**Figure 2-13**). In the first method, divers counted fishes along 30 m x 2 m (98.4 ft x 6.6 ft) replicate transects at four rocky reef (rock shoreline armoring) sites around the perimeter of the Outer Lagoon. In order to conduct surveys during periods of best underwater visibility, counts were done within 2 hours of the maximum high tide for that day, or as long as current speed and visibility would allow data to be collected. A second survey method was used to sample cryptic fishes at the same sites. Using the measuring tape deployed for the visual counts, five 1.0 $m^2$ (10.8 $ft^2$) quadrats were randomly positioned along a transect. Quinaldine solution contained in 500 ml squirt bottles was injected into crevices and beneath cobbles to anesthetize any fishes within the quadrat area. Specimens were collected with hand nets and preserved for later identification and measurement in the laboratory.

Using a third method, cryptic fishes that reside within the aquaculture mussel floats in the Outer Lagoon were censused. A diver carrying a cylindrical net (6.4 mm [¼ inch] mesh) with a closed end encapsulated thirteen 2.4 m (8 ft) long mussel strands along with the associated float apparatus prior to harvest. Once the nets were in position, a harvesting barge lifted the mussel grow-out line out of the water and the netted strands were removed. The netted strands and float apparatus were checked for the presence of cryptic fish. All fish found were identified to species, counted, measured and returned.

Finally, a fourth sampling method targeted gobies and other small fishes that typically reside on the substrate or in burrows on intertidal mud and sandflat habitats. At each of nine sites around the Middle and Inner Lagoons, a circular enclosure (0.43 $m^2$ [4.6 $ft^2$]) constructed of plastic sheeting was used to sample the fishes during low tide periods. An average of five replicates was sampled parallel to shore at each site. A hinged sweep net with the hinge positioned in the center of the enclosure was unfolded through the enclosure to capture any fish using multiple passes. All fish captured were preserved for later identification and measurement in the laboratory.

The results of these studies were as follows: Along the rocky shoreline around the margin of the Outer Lagoon 17 species of fish were observed in the visual transects. The most abundant species observed, in order of decreasing density, were silversides (topsmelt), salema, barred sand



bass, kelp bass, blacksmith, opaleye, northern anchovy, garibaldi, and black surfperch. The highest density of fishes (133 per transect) and the greatest number of species (12) occurred along the east channel separating the Outer and Middle Lagoons (Station F3). This station also had the deepest transect at 7.0 m (23 ft). The lowest density and fewest number of species occurred at the North Jetty. Barred sand bass were present at all stations and were equally abundant at the North Jetty and East Channel stations.

Five species of cryptic fishes were collected with mussel blennies (*Hypsoblennius jenkinsi*) being the most abundant species. The highest density of cryptic fishes ($3.2/m^2$) was found along the North Jetty breakwater (Station F1) and none was found near the power plant intakes on the east side of the lagoon (Station F4). This lack of cryptic, sedentary fishes in the southern end of the Outer Lagoon may have been due to the persistent phytoplankton blooms that occurred in AHL during summer 2005 that severely depleted dissolved oxygen. Examination of the aquaculture float lines revealed no cryptic fishes, although some blennies were present on collector lines brought ashore for processing. Although the aquafarm floats appear to be an excellent habitat for mussel blennies in particular, the prolonged low-oxygen conditions in summer months prior to sampling may have reduced blenny abundance.

Densities of gobies in the mudflat areas of the Middle and Inner Lagoons were higher in spring than in fall due to a greater abundance of newly settled individuals less than 25 mm (1 in) total length. Arrow goby (*Clevelandia ios*) was the most abundant species with densities of over $7/m^2$ in the eastern end of the Inner Lagoon (Station E9) in spring. Juvenile diamond turbot and California halibut were also captured during the intertidal study demonstrating the importance of the lagoon mudflats as nursery habitat.

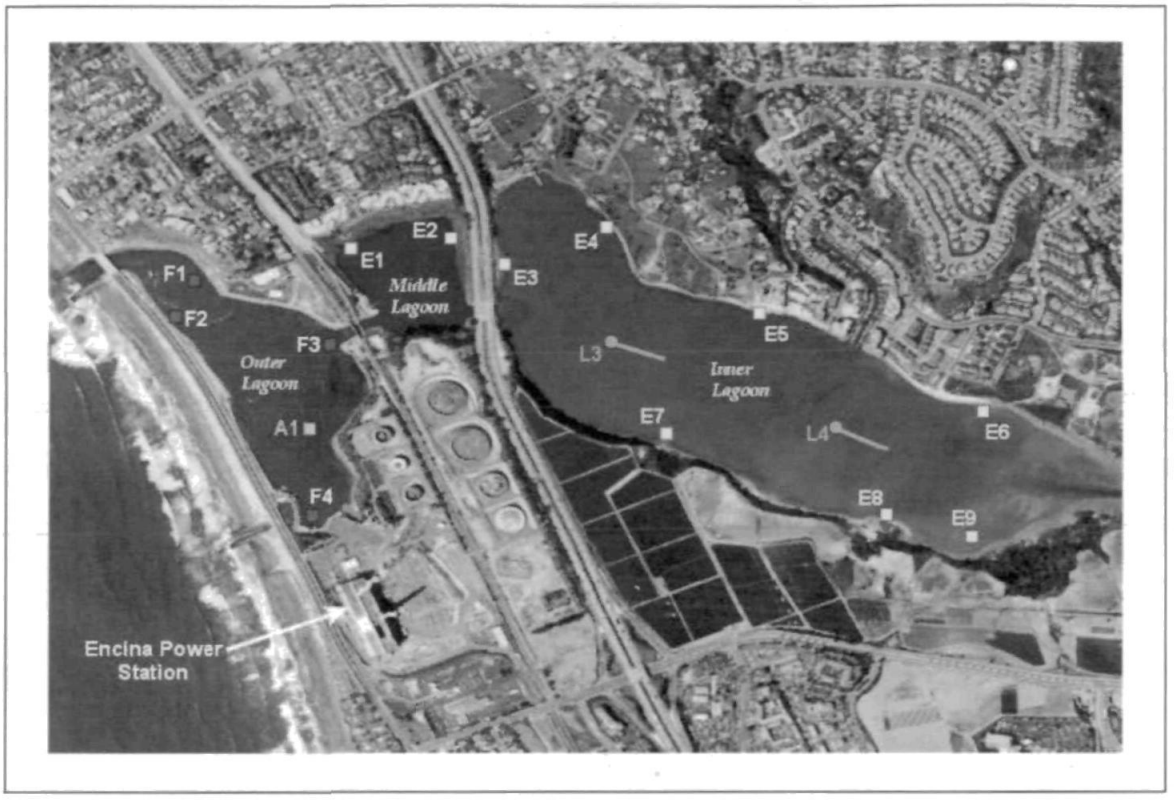



**Figure 2-13**. Locations of visual fish transects and fish quadrat collections (F1–F4), aquaculture float sampling (A1), and intertidal enclosures (E1–E9). Epibenthic/surface larval fish tows (L3, L4) were conducted to measure potential differences in larval density as a function of water depth.

# 3.0 Entrainment and Source Water Larval Study Results

## 3.1 Introduction

The purpose of the EPS entrainment and source water studies was to evaluate the potential impacts of the circulating water intake system to the beneficial uses of the marine environment as required under 316(b) of the CWA (USEPA 1977, 2004). The data from the study will also be used in calculating baseline levels of entrainment that will be used to measure compliance with performance standards established in the Phase II regulations that became effective in September 2004. The SDRWQCB discussed the need for the additional information with a group of agency representatives and consultants who provided input on the design and implementation of the 316(b) studies at SBPP. It was agreed that the entrainment portion of the study should focus on the larval life stages of fishes, *Cancer* crabs, and California spiny lobster (*Panulirus interruptus*) that could pass through the 9 mm (⅜ in) mesh traveling screens of the EPS cooling water intakes and be entrained by the power plant's CWIS.

The entrainment study was designed to specifically address the following questions:

- What are the species composition and abundance of the larval fishes, *Cancer* crabs, and spiny lobster ("target species") entrained by EPS?
- What are the local species composition and abundance of the entrainable target species in the cooling water sources of Agua Hedionda Lagoon and the nearshore area adjacent to EPS?
- What are the potential environmental impacts of entrainment losses of target species populations due to operation of the CWIS?

Plankton samples collected in the intake channel near the EPS intake structures provided an estimate of the total number and types of the target organisms passing through the power plant's CWIS. Data collected from source water surveys were used to estimate the abundance of the larval populations at risk of entrainment. The estimates were used to provide an estimate of the fractional loss due to entrainment that can be translated into potential impacts on local fisheries or fish populations. The data used to calculate the volume of the source water in Agua Hedionda Lagoon is presented in **Appendix B**.

Many marine organisms have planktonic stages that can be entrained in circulating water intake systems. Particular taxa were selected in this study for further analyses based on their sampled abundance or economic or recreational value. Several approaches, where possible, were used in assessing the CWIS impacts on each taxon to yield more robust and comparable estimates of effects. The three assessment modeling techniques used were Adult Equivalent Loss (*AEL*), Fecundity Hindcasting (*FH*), and Empirical Transport Modeling (*ETM*), which are described in Section 3.2.3 below. For the purposes of modeling and calculations, through-plant mortality was

assumed to be 100%. Although many marine organisms have planktonic eggs that are also entrained by the power plant's CWIS these were not counted in our samples. Egg mortality was considered in the *FH* assessment model for fishes with planktonic eggs. It was also factored into the *ETM* calculations by adding the duration of the egg stage to the duration of entrainment exposure calculated from the lengths of entrained larvae (see Section 3.2.3–*Data Analysis*).

Typically, local population estimates for small, non-use (fishes without commercial or recreational fishery value) fishes are not available. The assessments in this study benefited from a study on the fishes of Agua Hedionda Lagoon completed by MEC Analytical Systems (1995) and supplemental fish studies done by Tenera Environmental in conjunction with the present study (**Appendix C**). The information was used to assess effects on local populations and compare the results among models. For species with fishery value, commercial and recreational fishery data from the San Diego region was also used to evaluate potential entrainment and impingement effects.

## 3.1.1 Review of Previous Entrainment Study

In 1979, San Diego Gas and Electric (SDGE) owned and operated EPS. A 316(b) demonstration was conducted for the facility (SDGE 1980) as required at the time by the SDRWQCB. The study, done by Woodward-Clyde Consultants, included descriptions of the facility, descriptions of the physical and biological environment of Agua Hedionda Lagoon and surroundings, studies of entrainment, impingement, and entrainment survival at the plant, and an environmental impact assessment that also evaluated the feasibility of alternative intake technologies to reduce IM&E.

A list of selected taxa ('critical species') included 16 fish, 11 ichthyoplankton, and one zooplankton (**Table 3-1**) that were based on six criteria and approved by the SDRWQCB for detailed study during the program. Some additional species that were found to be common in the subsequent sampling were also added to the list. The report reviewed the life histories of the critical species.

### 3.1.1.1 Entrainment Study Procedures

A one-year entrainment and source water characterization study was conducted in 1979 as part of the 316(b) demonstration studies at EPS. Plankton samples were collected monthly at five offshore stations using 505 and 335 micron nets attached to a 61 cm (23.62 in) bongo net system. Collections were also made monthly in the Middle and Inner Lagoon and every two weeks in the Outer Lagoon using 0.5 meter (1.64 ft) diameter nets (505 µm and 335 µm). The procedures specified the use of a depressor weight connected to the towing apparatus but there was no indication at what depths the plankton samples were typically taken. Tows were targeted at 10 minutes at a speed of 2.8–3.7 km/h (1.5–2.0 kts). Entrainment samples were collected concurrently every two weeks using a plankton pumping system in front of the intakes. Although most samples were collected during daylight hours some were occasionally taken in the evening or early morning hours.



**Table 3-1**. 'Critical species' studied in 1979–1980 Encina 316(b) study.

| 'Critical Species' | Common Name |
|---|---|
| **Adult fish** | |
| *Engraulis mordax* | northern anchovy |
| *Atherinops affinis* | topsmelt |
| *Paralabrax clathratus* | kelp bass |
| *Paralabrax maculatofasciatus* | spotted sand bass |
| *Paralabrax nebulifer* | barred sand bass |
| *Cynoscion nobilis* | white seabass |
| *Menticirrhus undulatus* | California corbina |
| *Seriphus politus* | queenfish |
| *Amphistichus argenteus* | barred surfperch |
| *Hyperprosopon argenteum* | walleye surfperch |
| *Semicossyphus pulcher* | California sheephead |
| *Mugil cephalus* | striped mullet |
| *Citharichthys sordidus* | Pacific sanddab |
| *Paralichthys californicus* | California halibut |
| *Pleuronichthys verticalis* | hornyhead turbot |
| *Heterostichus rostratus* | giant kelpfish |
| **Ichthyoplankton** | |
| *Anchoa compressa* | deepbody anchovy |
| *Engraulis mordax* | northern anchovy |
| Cottidae | sculpins |
| Serranidae | sea basses |
| Sciaenidae | croakers |
| *Rhinogobiops nicholsii* | blackeye goby |
| Gobiidae | gobies |
| *Citharichthys stigmaeus* | spotted sanddab |
| *Paralichthys californicus* | California halibut |
| Pleuronectidae | righteye flounders |
| *Hypsopsetta guttulata* | diamond turbot |
| Atherinopsidae | topsmelts |
| **Zooplankton** | |
| *Acartia tonsa* | copepod |

### 3.1.1.2 Entrainment Study Results

Anchovies (primarily deepbody and northern) were the most abundant larval forms in both the source water and entrainment samples, followed by croakers and sanddabs (**Table 3-2**). There were fewer fish eggs and more goby larvae in the entrainment samples as compared to source water samples whereas kelp and sand bass larvae were substantially more abundant in the source water samples. Only English sole, *Parophrys vetulus*, was among the top ten entrainment taxa not represented in the top ten source water taxa. Overall the average composition between the two data sets was very similar when comparing the ten most abundant taxa.

**Table 3-2.** Average annual densities of the ten most abundant ichthyoplankton taxa per 100 $m^3$ (3,531 $ft^3$) in source water (lagoon and offshore stations combined) and entrainment (pump sampling) collections for 335 µm mesh nets during the 1979 316(b) study.

| Taxon | Common Name | Source Water | Entrainment |
|---|---|---|---|
| Engraulidae | anchovies | 952.7 | 855.2 |
| Sciaenidae | croakers | 341.7 | 400.6 |
| *Citharichthys* spp. | speckled sanddab | 73.2 | 82.7 |
| unid. fish eggs | fish eggs | 33.8 | 20.2 |
| Gobiidae | gobies | 29.2 | 42.9 |
| Atherinopsidae | silversides | 8.3 | 10.8 |
| Labridae | wrasses | 6.4 | 4.0 |
| *Hypsoblennius* spp. | combtooth blennies | 6.1 | 5.7 |
| Serranidae | sea basses | 5.1 | 0.9 |
| *Sebastes* spp. | rockfishes | 2.8 | 2.5 |
| *Parophrys vetulus* | English sole | – | 1.9 |

Entrainment losses were calculated for each two-week sampling interval by multiplying the average plankton densities at the intake by the volume of cooling water drawn through the plant during that period. Annual, monthly, and daily rates were estimated by averaging the entrainment estimates for all sampling periods and calculating value for the indicated duration. Annual estimates for total zooplankton entrainment were $7.4 \times 10^9$ (505 µm net data) and $30.9 \times 10^9$ (335 µm net data) individuals. The copepod *Acartia tonsa* was the most abundant species in the entrainment collections (**Table 3-3**).

Annual estimates of the abundance of ichthyoplankton entrained through the power plant were $4.15 \times 10^9$ (505 µm net data) and $6.66 \times 10^9$ (335 µm net data) individuals per year. Fish eggs comprised 98% and 86% of the total annual ichthyoplankton entrainment using the 505 µm and 335 µm net estimates, respectively. Through-plant entrainment mortality was assumed to be 100% for larvae and 60% for eggs based on survival experiments that were conducted. The report presented average annual densities of the critical species by net type and daily entrainment estimates for selected plankton groups. The daily entrainment estimates by net type are listed in the **Table 3-3**.

Entrainment impacts were assessed by qualitative comparisons of entrainment losses to the estimated numbers of larvae in nearby source waters, comparisons of additional power plant mortality to natural mortality rates, entrainment probabilities based on current studies, and primary productivity studies. It was concluded that the entrainment of $1.82 \times 10^7$ fish larvae and eggs daily was small compared to the egg and larval concentrations measured in monthly plankton tows in the source water body. It was estimated that average daily losses of planktonic organisms amounted to about 0.2% of the plankton available within one day's travel time from the power plant by current transport. Water at the seaward entrance to Agua Hedionda Lagoon was estimated to have a 34% probability of entering the lagoon. The 10% probability of entrainment isopleth was calculated to lie near the northern and eastern extremities of Agua

Hedionda Lagoon, and the 70% and 90% entrainment probability isopleths were calculated to be near the intakes and well within the southern third of the Outer Lagoon. The modeled isopleths shifted toward the seaward entrance on a flood tide and toward the Middle Lagoon on an ebb tide. Using the 70% entrainment probability isopleth to define intake effects, it was shown that the maximum extent of intake effects was about 304 m (1,000 ft) into the southern end of the Outer Lagoon segment. With natural mortality rates assumed to be 99% for egg and larval stages of most marine fish species it was concluded that additional mortality from EPS was not significant. There was no modeling of entrainment impacts on larvae using demographic models (Adult Equivalent Loss [*AEL*] and Fecundity Hindcasting [*FH*]), or proportional loss modeling (Entrainment Transport Modeling [*ETM*]). It was also concluded, based on light-dark bottle experiments, that entrainment effects on source water primary productivity were negligible.

**Table 3-3**. EPS daily entrainment estimates for two net sizes, 1979. Calculated using a daily plant cooling water capacity of 795 mgd.

| | Daily Entrainment | | Mean Percent |
|---|---|---|---|
| **Plankton Group** | **335 µm** | **505 µm** | **of Total** |
| *Acartia tonsa* (copepod) | $4.77 \times 10^7$ | $7.63 \times 10^6$ | 41.2% |
| Fish eggs | $1.57 \times 10^7$ | $1.11 \times 10^7$ | 19.9% |
| Decapoda | $1.32 \times 10^7$ | $4.44 \times 10^6$ | 13.1% |
| Other Copepoda | $8.47 \times 10^6$ | $2.16 \times 10^6$ | 7.9% |
| Other Crustacea | $6.95 \times 10^6$ | $2.70 \times 10^6$ | 7.2% |
| Other Zooplankton | $5.68 \times 10^6$ | $4.55 \times 10^5$ | 4.6% |
| Chaetognatha | $1.83 \times 10^6$ | $1.56 \times 10^6$ | 2.5% |
| Fish larvae | $2.52 \times 10^6$ | $2.46 \times 10^5$ | 2.1% |
| Mysidacea | $6.70 \times 10^5$ | $1.34 \times 10^6$ | 1.5% |
| | | | 100.0% |

## 3.2 Methods and Station Locations

Data collection and analysis consisted of bi-weekly or monthly zooplankton sampling, the laboratory sorting and identification of collected specimens, and data analysis methods to compare larval densities among sites, calculate numbers of target organisms entrained through the EPS CWIS, and calculate effects on source water populations. The following sections describe the methods employed for each of these tasks.

### 3.2.1 Field Sampling

Entrainment and source water sampling was conducted monthly from June 2004 through May 2005 except that two surveys were done in June 2004 separated by a two-week interval. The thirteen surveys provided a complete year of seasonal data for 2004–2005. The entire set of entrainment and source water stations (**Figure 3-1**; **Table 3-4**) was sampled during each study period.



### 3.2.1.1 Entrainment Sampling

Sample collection methods and equipment were similar to those developed and used by the California Cooperative Oceanic and Fisheries Investigation (CalCOFI) in their offshore larval fish studies (Smith and Richardson 1977). Entrainment samples were collected from a single station (E1; **Figure 3-1**) located in front of the EPS intakes. They were collected using a bongo frame with paired 0.71 m (2.33 ft) diameter openings each equipped with 335 µm (0.013 in) mesh plankton nets and codends. The sampling platform was a 24-ft research vessel (*R/V M-REP*) with a side-mounted davit positioned for towing the nets. The start of each tow began approximately 30 m (98 ft) in front of the intake structure and proceeded in a northwesterly direction against the prevailing intake current, ending approximately 150 m (492 ft) from the intake structure. Because of the narrow constriction of the lagoon near the intakes there was a constant current flow toward the intake structure when pumps were operational and it was assumed that all of the water sampled at the entrainment station would have been drawn through the EPS CWS. Samples were collected over a 24-hour period divided into four 6-hour cycles. Two replicate tows were collected consecutively at the entrainment station during each cycle. Concurrent surface water temperatures and salinities were measured with a digital probe (YSI Model 30).

Sampling began by lowering the bongo nets as close to the bottom as practical without contacting the substrate. Once the nets were near the bottom, the boat was moved forward, generally into any water currents, and the nets retrieved at an oblique angle (winch cable at approximately a 45° angle) to sample the widest strata of water depths possible at the station. The winch retrieval speed was maintained at approximately 0.3 m/sec (1 ft/sec). Total time of each tow was approximately two minutes at a speed of approximately 0.5 m/s (1 knot) during which a combined volume of approximately 60 $m^3$ (15,851 gal) of water was filtered through both nets.

The water volume filtered was measured by calibrated flowmeters (General Oceanics Model 2030R) mounted in the openings of the nets. Flowmeters were maintained before and after each survey, and checked periodically during a survey to ensure that the impeller assembly was spinning freely. Flowmeters were calibrated quarterly by averaging the readings from ten replicate trials over a measured distance of 10 m (33 ft) and applying conversion factors supplied by the manufacturer. Accuracy of individual instruments differed by less than 5% between calibrations.

Once the nets were retrieved from the water, all of the collected material was rinsed into the codend. The contents of both nets were combined into one sample immediately after collection. Samples from the paired nets were not kept separate because they were not statistically independent samples and could not be used as replicates for analysis. The use of a bongo frame design minimizes disturbance from the tow bridle compared to a three-point attachment design and allows each net to collect an unobstructed sample. The combined sample was placed into a labeled jar and preserved in 10% formalin. Each sample was given a unique serial number based on the location, date, time, and depth of collection, and all information was recorded on a

sequentially numbered data sheet. The serial number was used to track the sample through the laboratory processing, data analysis, and reporting phases.

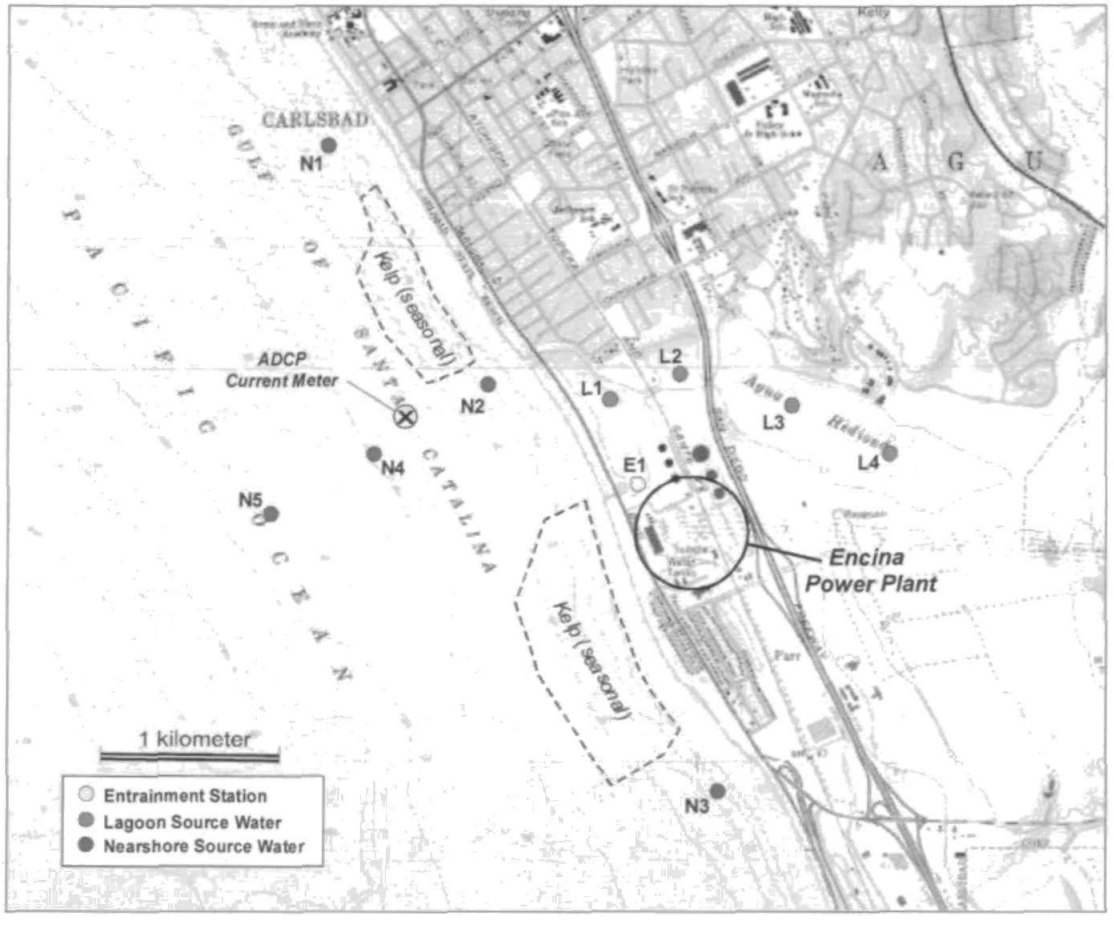



**Figure 3-1**. Location of Encina Power Station entrainment (E1) and source water (L1–L4; N1–N5) plankton stations.

### 3.2.1.2 Source Water Sampling

Plankton samples were collected monthly at four source water stations in Agua Hedionda Lagoon and five nearshore stations adjacent to the EPS (**Figure 3-1**). The source water stations ranged in depth from approximately –1.8 m (–5.9 ft) MLLW at L3 and L4 in the Inner Lagoon to -34.1 m (–111.9 ft) MLLW at N5. The stations were stratified to include stations in the Inner, Middle and Outer Lagoon, and at varying distances upcoast, downcoast, and offshore from the lagoon mouth lagoon. This station array was chosen to include a range of depths and adjacent habitats that would characterize the larval fish composition in the source waters.

**Table 3-4**. Locations and depths of entrainment and source water plankton stations.

| Station | Location | Latitude (N) | Longitude (W) | Depth below MLLW in meters (ft) |
|---|---|---|---|---|
| E1 | EPS Intake – Outer AHL | 33° 08.328 | 117° 20.283 | 3.4 (11.2) |
| L1 | Outer AHL | 33° 08.639 | 117° 20.422 | 3.0 (9.8) |
| L2 | Middle AHL | 33° 08.658 | 117° 20.105 | 6.1 (20.0) |
| L3 | Inner AHL | 33° 08.581 | 117° 19.725 | 1.8 (5.9) |
| L4 | Inner AHL | 33° 08.441 | 117° 19.391 | 1.8 (5.9) |
| N1 | Nearshore | 33° 09.376 | 117° 21.501 | 6.0 (19.7) |
| N2 | Nearshore | 33° 08.594 | 117° 20.994 | 8.8 (28.9) |
| N3 | Nearshore | 33° 07.430 | 117° 20.150 | 7.2 (23.6) |
| N4 | Nearshore | 33° 08.443 | 117° 21.269 | 17.6 (57.7) |
| N5 | Nearshore | 33° 08.245 | 117° 21.723 | 34.1 (111.9) |

Source water sampling was conducted using the same methods and during the same time period described above for entrainment sampling, except that the stations sampled in the Middle and Inner Lagoons were sampled with a single 0.71 m (2.32 ft) diameter push net rather that the standard bongo net apparatus. The push net apparatus was used because of the shallow depths of the Middle and Inner Lagoons where a larger towed net was not practical. In both procedures, however, the target volumes for the oblique tows were 60 $m^3$ (2,119 $ft^3$) (2 minute tow at approximately 0.5 m/s (1 kt) for bongo and 4 minute tow for push net). A single tow was completed at each of the source water stations during each of the four 6-hr cycles. Entrainment samples at Station E1 were collected from the same vessel during sampling of the Outer Lagoon. Concurrent surface water temperatures and salinities were measured with a digital probe (YSI Model 30).

## 3.2.2 Laboratory Analysis

Laboratory processing consisted of sorting (removing), identifying, and enumerating all larval fishes, megalopal stages of *Cancer* spp. crabs, and spiny lobster larvae (puerulus and phyllosome stages) from the samples. Juvenile specimens (not susceptible to entrainment) that were collected incidentally in the plankton sampling were separated in the laboratory from the samples but not included in the analysis. (A total of ten juvenile specimens of six species were collected from seven source water samples and none from any entrainment samples).

Sorting and identification accuracy was verified and maintained by Tenera Environmental's quality control (QC) program, which specified a minimum accuracy level of 90% for sorting and 95% for identification (**Appendix D**). A total of eight sorters and three taxonomists were involved in the processing of field samples. Mr. W. Watson of the Southwest Fisheries Science Center checked identifications of problematic specimens. The primary reference for identifications was Moser et al. (1996). All field and laboratory data were entered into a computer database which was verified for accuracy against the original data sheets.

Myomere counts and pigmentation patterns were used to identify larval fishes to the lowest taxonomic classification possible, which was usually the species level, but sometimes the genus or family level for certain groups. For example, many species of the family Gobiidae share morphologic and meristic characters during early life stages (Moser et al. 1996) making accurate identifications to the species level questionable. These include early larvae of the arrow goby (*Clevelandia ios*), cheekspot goby (*Ilypnus gilberti*), and shadow goby (*Quietula y-cauda*). These three species were combined into an unidentified goby category referred to as the 'CIQ goby complex'. Larval combtooth blennies (*Hypsoblennius* spp.) can be easily distinguished from other larval fishes (Moser et al. 1996). However, the larvae of the three sympatric species that could occur in AHL cannot be distinguished from each other on the basis of morphometrics or meristics for some of the smaller sizes common in the samples. These combtooth blennies were grouped into an "unidentified combtooth blennies" category (i.e., *Hypsoblennius* spp.). Larvae from the three members of the silversides (family Atherinopsidae) that can occur in AHL (California grunion *Leuresthes tenuis*, jacksmelt *Atherinopsis californiensis*, and topsmelt *Atherinops affinis*) also cannot be easily distinguished at the smallest larval sizes and were therefore treated as a single group. Similarly, larvae for the deepbody anchovy *Anchoa compressa*) and slough anchovy (*Anchoa delicatissima*) are also very difficult to distinguish and were therefore combined into one group *Anchoa* spp. Also combined into this *Anchoa* spp. group were all small (2–3 mm [0.08-0.12 in]) Engraulidae (anchovy) individuals, as there were very few other species of this fish family identified from these samples.

Larvae were measured (notochord/standard lengths) to determine their length ranges in the entrainment samples. These estimates were used to calculate the time that the larvae were subject to entrainment. Up to 50 larvae from each survey of the most abundant taxa, or species with recreational or commercial fishery importance, were measured using a video capture system and Optimus™ image analysis software from each survey. Descriptive statistics on a random sample of 200 larvae were calculated from taxa with over 200 measurements and for all of the measurements from less abundant taxa. The statistics from these data were used to estimate the minimum, average, and maximum lengths of entrained larvae.

### 3.2.3 Data Analysis

Estimates of daily larval entrainment for the sampling from June 2004 through May 2005 at EPS were calculated from data collected at the entrainment station. Assessment of entrainment effects were limited to the most abundant fish taxa (target taxa) that together comprised 90% of all larvae entrained. Estimates of entrainment loss, in conjunction with demographic data collected from the fisheries literature, were used in modeling entrainment effects on target taxa using adult equivalent loss (*AEL*) and fecundity hindcasting (*FH*). Data for the same target taxa from sampling of the entrained larvae and potential source populations of larvae was used to calculate estimates of proportional entrainment (*PE*) that were used to estimate the probability of mortality ($P_M$) due to entrainment using the Empirical Transport Model (*ETM*). In the EPS entrainment

study each approach (e.g., *AEL*, *FH*, and *ETM*), as appropriate for each target taxon, was used to assess effects of power plant losses.

### 3.2.3.1 Demographic Approaches

Adult equivalent loss models evolved from impact assessments that compared power plant losses to commercial fisheries harvests and/or estimates of the abundance of adults. In the case of adult fishes impinged by intake screens, the comparison was relatively straightforward. To compare the numbers of impinged sub-adults and juveniles and entrained larval fishes to adults, it was necessary to convert all these losses to adult equivalents. Horst (1975) and Goodyear (1978) provided early examples of the equivalent adult model (*EAM*) to convert numbers of entrained early life stages of fishes to their hypothetical adult equivalency.

Demographic approaches, exemplified by the *EAM*, produce an absolute measure of loss beginning with simple numerical inventories of entrained or impinged individuals and increasing in complexity when the inventory results are extrapolated to estimate numbers of adult fishes or biomass. We used two different but related demographic approaches in assessing entrainment effects at EPS: *AEL*, which expresses effects as absolute losses of numbers of adults, and *FH*, which estimates the number of adult females at the age of maturity whose reproductive output has been eliminated by entrainment of larvae. Both approaches require an estimate of the age at entrainment. These estimates were obtained by measuring a representative number of larvae of each of the target taxa from the entrainment samples and using published larval growth rates to estimate the age at entrainment. The age at entrainment was calculated by dividing the difference between the size at hatching and the average size of the larvae from entrainment by a larval growth rate obtained from the literature. The size at hatching was estimated using the length at the 25$^{th}$ percentile. This value was used because of the large variation in size among larvae smaller than the average length. The large variation in hatch size justified using the length at the 25$^{th}$ percentile rather than the minimum length.

Age-specific survival and fecundity rates are required for *AEL* and *FH*. Adult-equivalent loss estimates require survivorship estimates from the age at entrainment to adult recruitment; *FH* requires egg and larval survivorship up to the age of entrainment plus estimates of fecundity. Furthermore, to make estimation practical, the affected population is assumed to be stable and stationary, and age-specific survival and fecundity rates are assumed to be constant over time. Each of these approaches provides estimates of adult fish losses, which ideally need to be compared to standing stock estimates of adult fishes.

Species-specific survivorship information (e.g., age-specific mortality) from egg or larvae to adulthood is limited for many of the taxa considered in this assessment. These rates, when available, were inferred from the literature along with estimates of uncertainty. Uncertainty surrounding published demographic parameters is seldom known and rarely reported, but the likelihood that it is very large needs to be considered when interpreting results from the demographic approaches for estimating entrainment effects. For some well-studied species (e.g., northern anchovy), portions of early mortality schedules and fecundity have been reported.



Because the accuracy of the estimated entrainment effects from *AEL* and *FH* will depend on the accuracy of age-specific mortality and fecundity estimates, lack of demographic information may limit the utility of these approaches.

The precursor to the *AEL* and *FH* calculations is an estimate of total annual larval entrainment. Estimates of larval entrainment at EPS were based on monthly sampling where $E_T$ is the estimate of total entrainment for the study period and $E_i$ is the monthly entrainment estimate. Estimates of entrainment for the study period were based on two-stage sampling designs, with days within periods, and cycles (four six-hour collection periods per day) within days. The within-day sampling was based on a stratified random sampling scheme with four temporal cycles and two replicates per cycle. Estimates of variation for each survey were computed from the four temporal cycles.

There were usually no estimates of variation available for the life history information used in the models. The ratio of the mean to standard deviation (coefficient of variation) was assumed to be 50% for all life history parameters used in the models.

### *Adult Equivalent Loss (AEL)*

The *AEL* approach uses estimates of the abundance of the entrained or impinged organisms to project the loss of equivalent numbers of adults based on mortality schedules and age-at-recruitment. The primary advantage of this approach is that it translates power plant-induced early life-stage mortality into numbers of adult fishes that are familiar units to resource managers. Adult equivalent loss does not require source water estimates of larval abundance in assessing effects. This latter advantage may be offset by the need to gather age-specific mortality rates to predict adult losses and the need for information on the adult population of interest for estimating population-level effects (i.e., fractional losses).

Starting with the number of age class $j$ larvae entrained $E_j$, it is conceptually easy to convert these numbers to an equivalent number of adults lost *AEL* at some specified age class from the formula:

$$AEL = \sum_{j=1}^{n} E_j S_j \qquad (1)$$

where

$n$ = number of age classes from the average age at entrainment to adult recruitment;

$E_j$ = estimated number of larvae lost in age class $j$; and

$S_j$ = survival probability for the $j$ th class to adulthood (Goodyear 1978).

Age-specific survival rates from the average age at entrainment to recruitment into the fishery must be included in this assessment method. We used a modified form of Equation 1 where the total entrainment was used having an average age $a$:

$$AEL = E_T \prod_{j=a}^{n} S_j \qquad (2)$$

where

$E_T$ = annual estimate of larvae lost in all age classes.

The average age at entrainment was estimated from lengths of a representative sample of larvae measured from the entrainment samples. Literature-based hatch length and growth rate were used to estimate age from average length. For some commercial species, natural survival rates are known after the fish recruit into the commercial fishery. For the earlier years of development, this information is not well known for commercial species and may not exist for some non-commercial species.

### *Fecundity Hindcasting (FH)*

The *FH* approach compares larval entrainment losses with adult fecundity to estimate the amount of adult female reproductive output eliminated by entrainment, hindcasting the numbers of adult females at the age of maturity effectively removed from the reproductively active population. The accuracy of these estimates of effects, as with those of the *AEL* above, is dependent upon accurate estimates of age-specific mortality from the egg and early larval stages to entrainment and accurate estimates of the total lifetime female fecundity. If it can be assumed that the adult population has been stable at some current level of exploitation and that the male:female ratio is constant and 50:50, then fecundity and mortality are integrated into an estimate of the loss of adults at the age of maturity by converting entrained larvae back into females (e.g., hindcasting) and multiplying by two.

A potential advantage of *FH* is that survivorship need only be estimated for a relatively short period of the larval stage (e.g., egg to larval entrainment). The method requires age-specific mortality rates and fecundities to estimate entrainment effects and some knowledge of the abundance of adults to assess the fractional losses these effects represent. This method assumes that the loss of the reproductive potential of a single female at the age of maturity is equivalent to the loss of two adult fish at the age of maturity, assuming a 50:50 male:female ratio.

In the *FH* approach, the total larval entrainment for a species, $E_T$, was projected backward from the average age at entrainment to estimate the number of females at the age of maturity that would produce over their lifetime the numbers of larvae seen in the entrainment samples. The estimated number of breeding females at the age of maturity, *FH*, whose fecundity is equal to the total loss of entrained larvae was calculated as follows:

$$FH = \frac{E_T}{TLF \bullet \prod_{j=1}^{n} S_j} \qquad (3)$$

where

$E_T$ = total entrainment estimate;

$S_j$ = survival rate from eggs to entrained larvae of the $j^{th}$ stage ;

$TLF$ = average total lifetime fecundity for females, equivalent to the average number of eggs spawned per female over their reproductive years.

The two key input parameters in Equation 3 are total lifetime fecundity $TLF$ and survival rates $S_j$ from spawning to the average age at entrainment. The average age at entrainment was estimated from lengths of a representative sample of larvae measured from the entrainment samples. Descriptions of these parameters may be limited for many species and are a possible limitation of the method. $TLF$ was estimated in these studies using survivorship and fecundity tables that account for changes in fecundity with age. The data used in calculating $TLF$ is described below for each taxon.

### 3.2.3.2 Empirical Transport Model (*ETM*)

The *ETM* calculations provide an estimate of the probability of mortality due to power plant entrainment. The calculations require not only the abundance of larvae entrained but also the abundance of the larval populations at risk of entrainment. Sampling at the cooling water intake is used to estimate the total number of larvae entrained for a given time period, while sampling in the lagoon and coastal waters around the EPS intake is used to estimate the source population for the same period.

On any one sampling day, the conditional entrainment mortality can be expressed as

$$PE_i = \frac{E_i}{N_i} \tag{4}$$

where

$E_i$ = total numbers of larvae entrained during the $i$ th survey; and

$N_i$ = numbers of larvae at risk of entrainment, i.e., abundance of larvae in source water.

The values used in calculating $PE$ are population estimates based on the respective larval concentrations and volumes of both the CWS flow and source water areas. The abundance of larvae at risk in various regions of the source water, $R$, summed over $k$ stations during the $i^{th}$ survey can be directly expressed as follows:

$$N_{R_i} = \sum_{k=1}^{n} V_{S_{Rk}} \cdot \overline{\rho}_{R_{ik}} \tag{5}$$

where $V_{S_{Rk}}$ is the static volume of the source water in region $R$ at station $k$, and $\overline{\rho}_{Rik}$ denotes an estimate of the average larval concentration in the source water in region $R$ for station $k$ during survey $i$.



Three source water components were identified for EPS: 1) AHL where the EPS intake is located, 2) nearshore coastal water that is transported into the lagoon on incoming tides, and 3) AHL water that is transported out of the lagoon into nearshore coastal waters on outgoing tides. Each of these source water components operates on the time scale that larvae are subject to entrainment. Because the spatial scales of the components vary, the conditional mortality due to entrainment, *PE*, could not be expressed simply as in Equation 3. The calculation of *PE* is incorporated into the *ETM* calculation for estimating the total annual proportional mortality due to entrainment, $P_M$ as follows:

$$P_M = 1 - \sum_{i=1}^{N} f_i \left( 1 - \left[ \frac{N_{E_i}}{\frac{N_{NS_i} - N_{NSOut_i}}{P_{S_i}} + N_{AH_i} + (N_{AHOut_i} \bullet q)} \right] \right)^q \qquad (6)$$

where

$f_i$ = estimated fraction of total source water larval population present during the $i^{th}$ survey;

$q$ = number of days the larvae are exposed to entrainment;

$N_{E_i}$ = the estimated number of larvae entrained during the $i^{th}$ survey;

$N_{NS_i}$ = the estimated number of larvae in the nearshore sampled during the $i^{th}$ survey;

$P_{S_i}$ = the ratio of the length of the sampled nearshore area sampled during the $i^{th}$ survey to the total alongshore current displacement over the period of $q$ days that the larvae could be exposed to entrainment;

$N_{NSOut_i}$ = an adjustment for the outflow from AHL calculated using the average concentration from the nearshore sampling during the $i^{th}$ survey and the outflow volume;

$N_{AH_i}$ = the estimated number of larvae in AHL during the $i^{th}$ survey; and

$N_{AHOut_i}$ = an adjustment for the outflow from AHL calculated using the average concentration from AHL sampling during the $i^{th}$ survey and the outflow volume.

The sizes of $N_{NS}$, $N_{AH}$, and $N_E$ were calculated as the product of larval concentration and volume as in Equation 5. The estimate $N_{NS}$ for the nearshore sampling area for each $i^{th}$ survey used in the *ETM* calculations included nine areas (**Figure 3-2**) with component densities and volumes. The densities in areas N1–N5 were sampled and the densities in areas SW1–SW4 were interpolated using the sampled larval densities weighted by the inverse of distance squared as measured from the center of an unsampled area to the centers of the sampled areas. This was done to create a rectangular-shaped source water area with constant length that could be extrapolated using alongshore current displacement, otherwise the layout of the sampling locations would have

required separate source water estimates for the offshore (N4 and N5) and alongshore station areas (N1, N2 and N3).

The sampled nearshore area, $N_{NS}$, for each $i^{th}$ survey represents a proportion of the total nearshore source water potentially affected by entrainment over the number of days, $q$, that the larvae are exposed to entrainment. The proportion of the sampled nearshore area to the total source water, $P_S$, was estimated for each $i^{th}$ survey using alongshore current displacement measured using a current meter deployed offshore from AHL (Section 2.2.1.3; Figures 2-9 through 2-12). The incorporation of $P_S$ into the *ETM* model is typically defined by the ratio of the area or volume of the study grid to a larger area or volume containing the population of inference (Parker and DeMartini 1989). However, if an estimate of the larval (or adult) population in the larger area is available, then $P_S$ can also be computed using an estimate of the proportion of the larval or adult population in the study area. If the distribution in the larger area is assumed to be uniform or the same as the nearshore sampling area, then the value of $P_S$ for the proportion of the population will be the same as the proportion computed using area or volume. The current displacement measured over $q$ days was used to estimate the distance alongshore that larvae could have been transported into the nearshore areas around AHL where they would be subject to entrainment. The ratio of the alongshore distance of the nearshore sampling area to the alongshore current displacement, $P_S$, was used to adjust the nearshore population estimate, $N_{NS}$, for the size of the total source water population.

The estimate of $P_S$, the proportion of the sampled source water population to the total source population did not include onshore current displacement that could result in the transport of larvae from offshore into the nearshore sampling area. Although this process does occur, as evidenced by the current data, a separate estimate of $P_S$ that would account for onshore transport was not calculated because the water depths offshore from EPS drop off much more rapidly than other nearshore areas in southern California. Typically, a depth of 75 m has been used in extrapolating source water offshore (Parker and DeMartini 1989, MBC and Tenera Environmental 2005). This depth was based on Lavenberg et al. (1986) showing that ichthyoplankton transects in southern California shoreward of the 75 m (246 ft) depth were representative of the coastal zone.

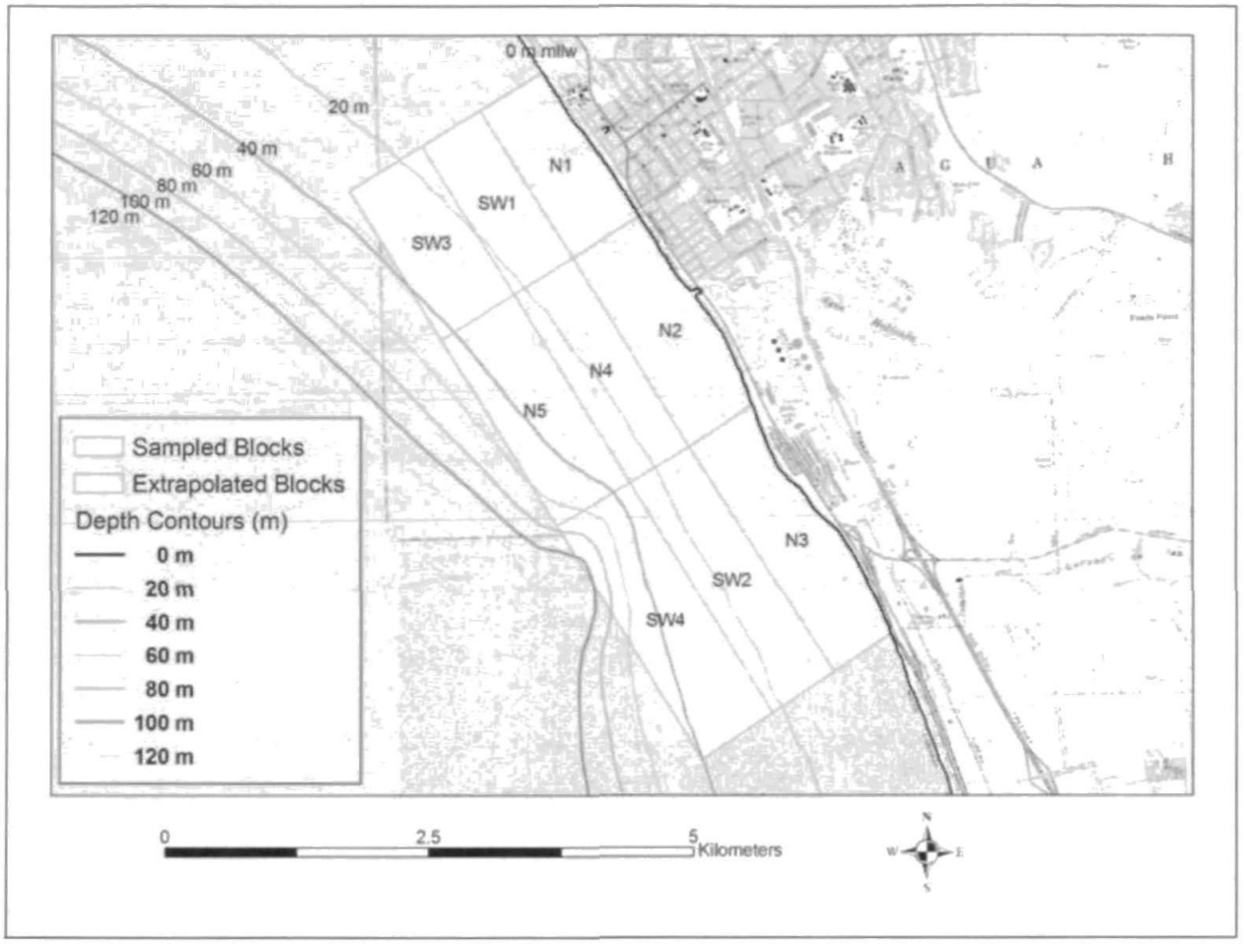



**Figure 3-2.** Bathymetry and boundaries of nearshore areas used in calculating average source water larval concentrations for the *ETM* analyses.

Larvae produced and resident in AHL that were potentially subject to entrainment, $N_{AH}$, were estimated for each $i^{th}$ survey by combining the estimates from four stations located in the three lagoon segments into a total estimate for AHL that also included the concentrations measured at the entrainment station. In addition to the larvae present in the lagoon on the day that entrainment, $N_E$, was measured, larvae are continually being produced in the lagoon and transported into the nearshore due to tidal outflow. The outflow volume was multiplied by the concentration measured in the source water ($N_{NSOut}$) to account for water transported out into the nearshore on the day that the sampling occurred. $N_{NSOu}$ was adjusted by $P_S$ to account for this amount over a larval duration and subtracted from the nearshore source water population estimate. The average concentration from the nearshore sampling was used and this number was replaced by outflow estimated using the concentrations measured from AHL. This outflow volume is multiplied by the average concentration from AHL to estimate outflow of larvae into the nearshore ($N_{AHOut}$) over the period of larval exposure, including the day that sampling occurred.

Therefore, using Equation 6 to represent all three components of the source water *PE* was calculated as follows:

$$PE_t = \frac{N_{E_t}}{\frac{N_{NS_t} - N_{NSOut_t}}{P_{S_t}} + N_{AH_t} + (N_{AHOut_t} \bullet q)}. \quad (7)$$

To establish independent survey estimates, it was assumed that during each survey a new and distinct cohort of larvae is subject to entrainment. The number of days a taxon was exposed to entrainment was estimated by dividing a larval growth rate into the difference between the 25$^{th}$ and 95$^{th}$ percentile values of length measurements from the entrainment samples. Each of the monthly surveys was weighted by $f_i$ and estimated as the proportion of the total population at risk during the $i^{th}$ survey period. The weights are calculated as follows:

$$f_t = \frac{N_t}{N_{Total}}, \quad (8)$$

where $N_i$ is the estimated fraction of the source population spawned during the $i^{th}$ survey period, and $N_{Total}$ is the total source population for the entire study period.

### 3.2.3.3 Dynamics of AHL Pertaining to Model

The numbers of fish larvae in the lagoon were estimated using the volume of the AHL at mean sea level. This volume was estimated from Elwany et al. (2005) and calculated in **Appendix B** as 3.148 x $10^6$ $m^3$ (2,552 acre-ft) for the three lagoon segments. The Outer, Middle and Inner Lagoon volumes were 1.247 x $10^6$ $m^3$ (1,011 acre-ft), 0.350 x $10^6$ $m^3$ (284 acre-ft), and 1.547 x $10^6$ $m^3$ (1,255 acre-ft) respectively.

As part of the description of the flow of water through AHL, Elwany et al. (2005) estimated the volume of the incoming and outgoing water at the AHL inlet for the period June 1, 2004 to May 31, 2005. Water level measurements conducted in the lagoon between June 1 and July 7, 2005 were used to establish the relationships of maximum and minimum water levels per tidal cycle, measured in feet, between the ocean at Scripps Pier, La Jolla, CA and the lagoon using linear regression analysis.

The relationships between lagoon and ocean water levels, shown in **Figure 2-6,** were as follows:

$$Wl_{max} = 0.97\ Wo_{max} + 0.0076 \quad (9a)$$

$$Wl_{min} = 0.69\ Wo_{min} - 0.37 \quad (9b)$$

where $Wl_{max}$ and $Wl_{min}$ are the maximum and minimum water levels in the lagoon respectively, and $Wo_{max}$ and $Wo_{min}$ are the maximum and minimum water levels in the ocean per tidal cycle respectively.

The measured ocean tides at Scripps Pier, La Jolla, CA, between June 1, 2004 and May 31, 2005 were used to estimate the maximum and minimum water levels in the lagoon using equations 9a and 9b, respectively. Using Equations 3 and 4 presented in **Appendix B** and the reported EPS cooling system hourly intake flow (**Figure 2-7**) during the same time period, estimates were made regarding the incoming (inflow) and outgoing (outflow) water from the lagoon's major inlet (**Figure 2-8**).

The average daily estimated inflow and outflow thru the lagoon's inlet between June 1, 2004 and May 31, 2005 was $4.11 \times 10^6$ $m^3$ (3,333 acre-ft) and $1.80 \times 10^6$ $m^3$ (1,459 acre-ft) corresponding to an average daily power plant intake flow of $2.31 \times 10^6$ $m^3$ (1,874 acre-ft). Maximum daily inflow and outflow corresponding to a maximum power plant intake flow of $3.24 \times 10^6$ $m^3$ (2,627 acre-ft) is estimated as $4.58 \times 10^6$ $m^3$ (3,713 acre-ft) and $1.33 \times 10^6$ $m^3$ (1,078 acre-ft).



# 3.3 Entrainment and Source Water Results

## 3.3.1 Community Overview

### 3.3.1.1 Entrainment Results

A total of 20,601 larval fishes representing 41 taxa was collected from the EPS entrainment station (E1) during 13 monthly surveys in the 2004–2005 sampling period (**Table 3-5** and **Appendix E**). Gobies (CIQ goby complex) and blennies comprised over 90% of all specimens collected, with anchovy larvae the third most abundant taxon at approximately 4%. The greatest concentrations of larval fishes, primarily gobies, occurred during the August 2004 survey and the fewest occurred in December 2004 (**Figure 3-3**). Larvae tended to be more abundant in samples collected at night than those collected during the day (**Figure 3-4**). Fish fragments and damaged fishes that could not be identified to species comprised a small fraction of the total catch. Of the target shellfishes sampled, only one *Cancer* crab megalopa and no spiny lobster larvae were collected at the entrainment station.

Total annual entrainment was estimated to be $4.49 \times 10^9$ fish larvae during the 12 months from June 2004 through May 2005 using the EPS CWIS maximum design flows as the basis for calculations, and $3.63 \times 10^9$ fish larvae during the 12-month period calculated using the actual EPS flow rates recorded during the study period (**Table 3-6**). This equates to a 23.9% difference between the estimated entrainment using maximum and actual power plant intake flows.

The following eight taxa were selected for detailed evaluation of entrainment effects based on their abundance in entrainment samples and/or importance as fishery species:

- CIQ goby complex (unidentified Gobiidae)
- combtooth blennies (*Hypsoblennius* spp.)
- anchovies (primarily *Engraulis mordax*)
- garibaldi (*Hypsypops rubicundus*)
- white croaker (*Genyonemus lineatus*)
- queenfish (*Seriphus politus*)
- spotfin croaker (*Roncador stearnsii*)
- California halibut (*Paralichthys californicus*)

The four most abundant taxa comprised over 95% of all entrained larvae (**Table 3-5**). Although the other four taxa were collected in relatively low numbers they represented species with recreational or commercial fishery value. In general, most of the larvae collected from the entrainment samples did not have any recreational or commercial fishery value, and those with fishery value were in low abundance. None of the target invertebrate taxa was evaluated for



entrainment effects because only a single *Cancer* crab megalops was identified from the entrainment samples.

**Table 3-5.** Average concentration of larval fishes and target shellfishes in entrainment samples collected in Agua Hedionda Lagoon (Station E1), June 2004–May 2005.

| Taxon | Common Name | Average Concentration (per 1,000 $m^3$) | Total Count | Percentage of Total | Cumulative Percentage |
|---|---|---|---|---|---|
| Gobiidae (ClQ complex) | Gobies | 2,222.93 | 12,763 | 61.95 | 61.95 |
| *Hypsoblennius spp.* | blennies | 1,107.67 | 5,838 | 28.34 | 90.29 |
| Engraulidae | Anchovies | 134.29 | 819 | 3.98 | 94.27 |
| *Hypsypops rubicundus* | garibaldi | 40.99 | 188 | 0.91 | 95.18 |
| *Typhlogobius californiensis* | blind goby | 24.65 | 148 | 0.72 | 95.90 |
| *Gibbonsia* spp. | clinid kelpfishes | 22.45 | 125 | 0.61 | 96.51 |
| Labrisomidae. | labrisomid kelpfishes | 17.65 | 81 | 0.39 | 96.90 |
| Syngnathidae | pipefishes | 16.06 | 83 | 0.40 | 97.30 |
| *Acanthogobius flavimanus* | yellowfin goby | 14.41 | 87 | 0.42 | 97.72 |
| larvae, unid. fish fragment | unidentified larval fishes | 9.65 | 56 | 0.27 | 98.00 |
| Atherinopsidae | silverside | 9.18 | 54 | 0.26 | 98.26 |
| larvae, unid. yolksac | unidentified yolksac larvae | 8.36 | 39 | 0.19 | 98.45 |
| *Roncador stearnsii* | spotfin croaker | 8.33 | 42 | 0.20 | 98.65 |
| *Rimicola* spp. | kelp clingfishes | 7.92 | 43 | 0.21 | 98.86 |
| *Genyonemus lineatus* | white croaker | 7.04 | 44 | 0.21 | 99.07 |
| *Seriphus politus* | queenfish | 5.50 | 29 | 0.14 | 99.21 |
| *Paraclinus integripinnis* | reef finspot | 4.95 | 31 | 0.15 | 99.36 |
| *Paralichthys californicus* | California halibut | 3.73 | 21 | 0.10 | 99.47 |
| *Sardinops sagax* | Pacific sardine | 2.66 | 16 | 0.08 | 99.54 |
| *Citharichthys* spp. | sanddabs | 2.24 | 14 | 0.07 | 99.61 |
| *Gillichthys mirabilis* | longjaw mudsucker | 2.14 | 13 | 0.06 | 99.67 |
| Sciaenidae | croakers | 1.86 | 11 | 0.05 | 99.73 |
| *Paralabrax* spp. | sand basses | 1.86 | 11 | 0.05 | 99.78 |
| *Hypsopsetta guttulata* | diamond turbot | 1.78 | 10 | 0.05 | 99.83 |
| larvae, unid. post-yolksac | larval fishes | 1.61 | 10 | 0.05 | 99.88 |
| Pleuronectiformes | flatfishes | 0.63 | 4 | 0.02 | 99.90 |
| *Heterostichus rostratus* | giant kelpfish | 0.54 | 3 | 0.01 | 99.91 |
| *Clinocottus analis* | wooly sculpin | 0.51 | 3 | 0.01 | 99.93 |
| *Stenobrachius leucopsarus* | northern lampfish | 0.37 | 2 | 0.01 | 99.94 |
| *Cheilotrema saturnum* | black croaker | 0.35 | 2 | 0.01 | 99.95 |
| *Scomber japonicus* | Pacific mackerel | 0.35 | 1 | <0.01 | 99.95 |
| Ophidiidae | cusk-eels | 0.21 | 1 | <0.01 | 99.96 |
| Gobiesocidae | clingfishes | 0.20 | 1 | <0.01 | 99.96 |
| *Diaphus theta* | California headlight fish | 0.19 | 1 | <0.01 | 99.96 |
| *Semicossyphus pulcher* | California sheephead | 0.19 | 1 | <0.01 | 99.97 |
| *Menticirrhus undulatus* | California corbina | 0.18 | 1 | <0.01 | 99.97 |
| Haemulidae | grunts | 0.18 | 1 | <0.01 | 99.98 |
| Labridae | wrasses | 0.17 | 1 | <0.01 | 99.98 |
| Myctophidae | lanternfishes | 0.16 | 1 | <0.01 | 99.99 |
| *Symbolophorus californiensis* | California lanternfish | 0.16 | 1 | <0.01 | 99.99 |
| *Oxyjulis californica* | señorita | 0.14 | 1 | <0.01 | 100.00 |
| | | | **20,601** | | |
| *Cancer* spp. (megalops) | cancer crabs | 0.17 | 1 | | |

**Table 3-6.** Calculated annual entrainment of larval fishes and target shellfishes based on EPS maximum design flows and actual recorded flows, June 2004–May 2005.

| Taxon | Common Name | Annual Entrainment (Maximum Flow) | Std. Error (Max Flow) | Annual Entrainment (Actual Flow) | Std. Error (Actual Flow) |
|---|---|---|---|---|---|
| Gobiidae (CIQ complex) | gobies | 2,767,198,570 | 101,030,008 | 2,215,477,217 | 86,364,408 |
| *Hypsoblennius spp.* | combtooth blennies | 1,312,458,555 | 72,049,342 | 1,098,083,615 | 62,379,799 |
| Engraulidae | anchovies | 157,019,892 | 8,097,477 | 120,661,087 | 6,551,786 |
| *Hypsypops rubicundus* | garibaldi | 36,328,962 | 2,872,086 | 29,287,646 | 2,349,174 |
| *Gibbonsia* spp. | clinid kelpfishes | 29,620,060 | 1,875,599 | 18,192,742 | 1,162,809 |
| *Typhlogobius californiensis* | blind goby | 28,988,077 | 2,437,683 | 20,324,124 | 1,700,727 |
| *Acanthogobius flavimanus* | yellowfin goby | 21,043,508 | 1,707,240 | 12,590,127 | 1,057,808 |
| Syngnathidae | pipefishes | 19,379,619 | 1,610,753 | 16,530,546 | 1,390,890 |
| Labrisomidae | labrisomid kelpfishes | 16,399,803 | 1,094,580 | 13,937,144 | 931,864 |
| Atherinopsidae | silverside | 12,654,500 | 664,630 | 7,936,121 | 419,868 |
| larvae, unid. fish fragment | unidentified larval fishes | 11,024,170 | 430,622 | 8,055,502 | 336,468 |
| *Roncador stearnsii* | spotfin croaker | 10,677,429 | 733,087 | 9,554,139 | 656,724 |
| *Rimicola* spp. | kelp clingfishes | 9,913,916 | 620,625 | 7,953,162 | 504,858 |
| *Genyonemus lineatus* | white croaker | 9,466,865 | 398,516 | 6,924,470 | 320,508 |
| *Paraclinus integripinnis* | reef finspot | 8,356,639 | 772,412 | 7,201,333 | 670,242 |
| larvae, unid. yolksac | unid. yolksac larvae | 8,000,516 | 445,456 | 6,578,080 | 370,110 |
| *Seriphus politus* | queenfish | 7,534,586 | 544,949 | 6,746,448 | 501,851 |
| *Paralichthys californicus* | California halibut | 4,879,725 | 263,926 | 3,752,551 | 223,985 |
| *Sardinops sagax* | Pacific sardine | 3,394,522 | 218,259 | 2,484,208 | 175,300 |
| *Gillichthys mirabilis* | longjaw mudsucker | 2,813,002 | 161,236 | 1,814,507 | 105,121 |
| *Paralabrax* spp. | sand basses | 2,775,286 | 105,724 | 2,520,619 | 94,986 |
| *Citharichthys* spp. | sanddabs | 2,650,151 | 220,150 | 1,855,512 | 155,988 |
| *Hypsopsetta guttulata* | diamond turbot | 2,471,214 | 150,706 | 1,770,451 | 100,989 |
| larvae, unid. post-yolksac | larval fishes | 2,302,748 | 179,221 | 1,760,888 | 135,949 |
| Sciaenidae | croakers | 2,164,020 | 166,322 | 1,695,162 | 141,027 |
| Pleuronectiformes | flatfishes | 744,368 | 106,852 | 519,811 | 72,825 |
| *Clinocottus analis* | wooly sculpin | 703,175 | 71,055 | 455,902 | 48,468 |
| *Heterostichus rostratus* | giant kelpfish | 596,406 | 67,172 | 393,522 | 45,546 |
| *Stenobrachius leucopsarus* | northern lampfish | 547,395 | 53,578 | 310,274 | 32,852 |
| *Cheilotrema saturnum* | black croaker | 464,305 | 57,915 | 392,460 | 49,352 |
| Haemulidae | grunts | 252,404 | 43,287 | 233,493 | 40,198 |
| Ophidiidae | cusk-eels | 246,537 | 46,591 | 149,892 | 28,997 |
| Labridae | wrasses | 241,401 | 41,400 | 223,314 | 38,446 |
| *Scomber japonicus* | Pacific mackerel | 234,086 | 58,521 | 193,720 | 48,676 |
| *Diaphus theta* | California headlight fish | 226,160 | 42,740 | 192,654 | 36,466 |
| *Semicossyphus pulcher* | California sheephead | 226,160 | 42,740 | 192,654 | 36,466 |
| Myctophidae | lantern fishes | 194,178 | 36,696 | 165,410 | 31,309 |
| *Symbolophorus californiensis* | California lantern fish | 194,178 | 36,696 | 165,410 | 31,309 |
| *Menticirrhus undulatus* | California corbina | 193,489 | 38,698 | 159,429 | 32,335 |
| *Oxyjulis californica* | señorita | 156,339 | 30,087 | 116,071 | 22,407 |
| Gobiesocidae | clingfishes | 112,198 | 31,118 | 90,331 | 25,219 |
| | | **4,494,849,115** | | **3,627,641,744** | |
| *Cancer* spp. (megalops) | cancer crabs | 200,698 | 37,928 | 162,150 | 31,311 |

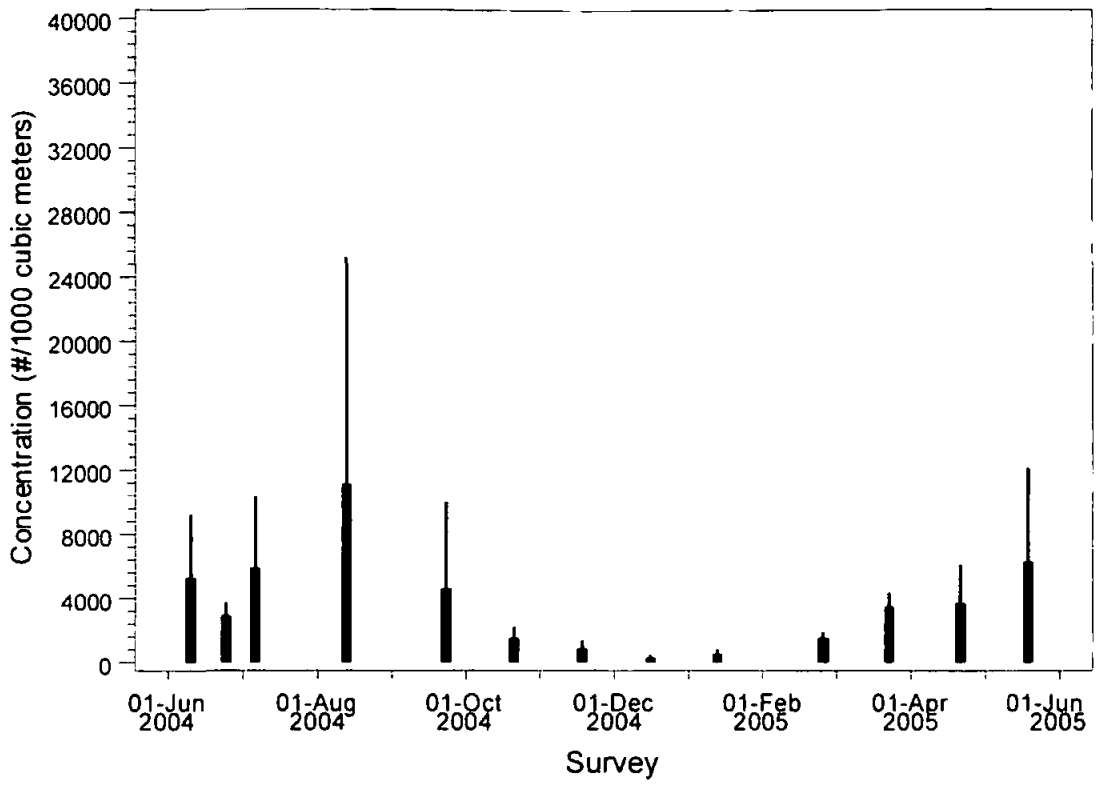



**Figure 3-3**. Mean concentration (# / 1,000 $m^3$ [264,172 gal]) and standard error of all larval fishes collected at EPS entrainment Station E1 during the 2004–2005 period.

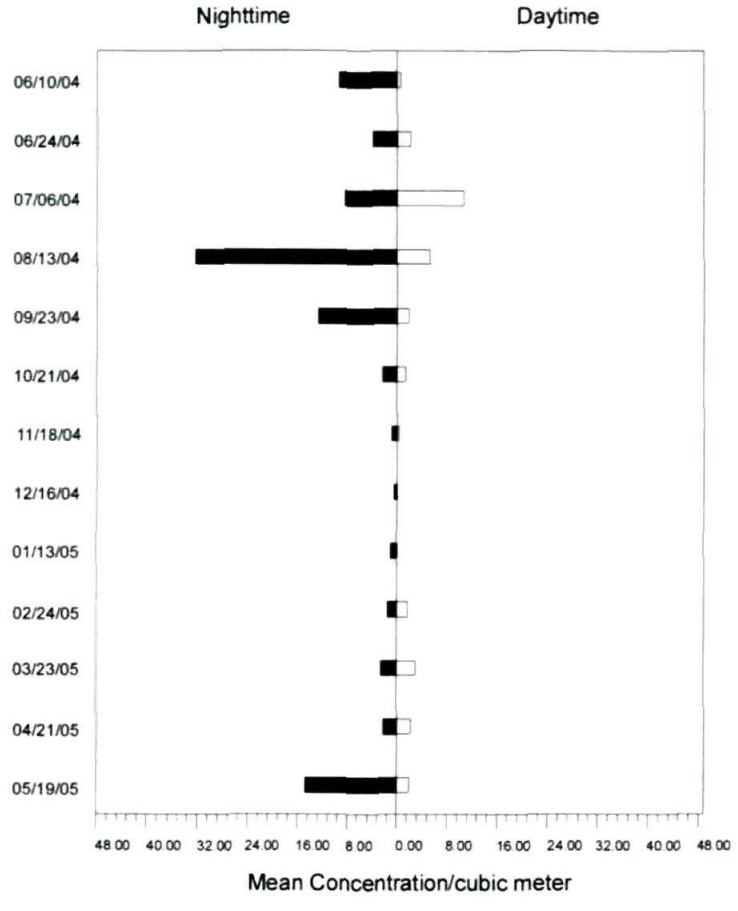



**Figure 3-4.** Mean concentration (#/1.0 $m^3$ [264 gal]) of all larvae at entrainment Station E1 during night (Cycle 3) and day (Cycle 1) sampling.

### 3.3.1.2 Source Water Results

A total of 55,635 larval fishes representing 89 taxa was collected from the source water stations in Agua Hedionda Lagoon and the nearshore area adjacent to EPS during 13 monthly surveys (**Table 3-7** and **Appendix E**). Approximately 70% of the source water larvae collected in the study came from the four stations in the Inner, Middle and Outer Lagoon with gobies (CIQ goby complex) comprising the bulk of those larvae. There were 47 taxa collected in the lagoon of which four were unique to the lagoon stations. The remaining 30% of the larvae were sampled at the five nearshore stations where anchovies (mainly *Engraulis mordax*) were the most abundant species. There were 85 taxa collected at the nearshore stations of which 42 were unique to the set of nearshore stations. Of the target shellfishes sampled, *Cancer* crab megalops and spiny lobster larvae were much more abundant at the nearshore stations than at the lagoon stations. Larval concentrations were highest in summer months and lowest in winter months, and generally

followed a gradient from highest concentrations in the Inner Lagoon (mostly shallow mud substrate) to lowest concentrations at the group of nearshore stations (kelp forest and sand substrate) (**Figure 3-5**).

**Table 3-7.** Average concentration of larval fishes and target shellfishes in source water samples collected at in Agua Hedionda Lagoon and nearshore stations, June 2004–May 2005.

| Taxon | Common Name | Nearshore | | Lagoon | |
|---|---|---|---|---|---|
| | | Average Concentration (per 1,000 $m^3$) | Total Count | Average Concentration (per 1,000 $m^3$) | Total Count |
| **Fishes** | | | | | |
| Engraulidae | anchovies | 525.48 | 7,631 | 103.41 | 1,210 |
| *Hypsoblennius* spp. | blennies | 137.56 | 1,966 | 467.32 | 4,725 |
| Gobiidae (CIQ complex) | gobies | 69.12 | 921 | 2,718.58 | 30,270 |
| *Genyonemus lineatus* | white croaker | 64.66 | 921 | 4.25 | 54 |
| larvae, unidentified yolksac | unid. yolksac larvae | 45.82 | 678 | 3.12 | 32 |
| *Paralichthys californicus* | California halibut | 42.91 | 601 | 1.93 | 22 |
| *Paralabrax* spp. | sand basses | 24.88 | 372 | 0.68 | 8 |
| *Seriphus politus* | queenfish | 23.79 | 365 | 2.40 | 26 |
| Sciaenidae | croaker | 22.55 | 306 | 6.56 | 73 |
| *Citharichthys* spp. | sanddabs | 21.70 | 334 | 1.14 | 15 |
| *Roncador stearnsii* | spotfin croaker | 20.17 | 286 | 6.82 | 74 |
| *Gibbonsia* spp. | clinid kelpfishes | 19.29 | 277 | 16.74 | 182 |
| Labrisomidae | labrisomid kelpfishes | 16.36 | 219 | 35.30 | 366 |
| *Sardinops sagax* | Pacific sardine | 13.21 | 202 | 0.74 | 9 |
| larval fish fragment | unid. larval fishes | 10.50 | 145 | 15.02 | 174 |
| Haemulidae | grunts | 8.80 | 116 | 0.17 | 2 |
| *Scomber japonicus* | Pacific mackerel | 7.07 | 110 | - | - |
| *Hypsypops rubicundus* | garibaldi | 7.03 | 110 | 35.12 | 352 |
| larval/post-larval fish unid. | larval fishes | 6.81 | 93 | 1.36 | 16 |
| *Oxyjulis californica* | senorita | 5.55 | 79 | 0.75 | 8 |
| *Paralabrax nebulifer* | barred sand bass | 5.08 | 82 | - | - |
| *Sphyraena argentea* | California barracuda | 3.74 | 59 | 0.17 | 2 |
| *Xenistius californiensis* | salema | 3.61 | 55 | 0.30 | 3 |
| *Lepidogobius lepidus* | bay goby | 3.59 | 56 | 0.09 | 1 |
| *Stenobrachius leucopsarus* | northern lampfish | 3.26 | 51 | - | - |
| Atherinopsidae | silversides | 3.09 | 39 | 29.73 | 348 |
| *Pleuronichthys verticalis* | hornyhead turbot | 2.79 | 43 | - | - |
| *Umbrina roncador* | yellowfin croaker | 2.62 | 39 | 0.09 | 1 |
| Ophidiidae | cusk-eels | 2.61 | 37 | 0.09 | 1 |
| *Pleuronichthys ritteri* | spotted turbot | 2.51 | 34 | 0.17 | 2 |
| Pleuronectidae unid. | flounders | 2.28 | 35 | 0.08 | 1 |
| *Xystreurys liolepis* | fantail sole | 1.97 | 27 | 0.21 | 2 |
| *Hypsopsetta guttulata* | diamond turbot | 1.97 | 30 | 0.55 | 7 |
| *Rimicola* spp. | kelp clingfishes | 1.79 | 22 | 3.28 | 34 |
| *Peprilus simillimus* | Pacific butterfish | 1.78 | 28 | - | - |
| *Cheilotrema saturnum* | black croaker | 1.71 | 24 | 0.36 | 4 |
| *Semicossyphus pulcher* | California sheephead | 1.49 | 21 | - | - |
| *Diaphus theta* | California headlight fish | 1.46 | 24 | - | - |
| *Acanthogobius flavimanus* | yellowfin goby | 1.46 | 22 | 38.98 | 499 |
| Pleuronectiformes | flatfishes | 1.25 | 21 | 0.07 | 1 |
| *Menticirrhus undulatus* | California corbina | 1.21 | 16 | 0.47 | 5 |
| *Atractoscion nobilis* | white seabass | 1.18 | 18 | 0.08 | 1 |
| *Sebastes* spp. | rockfishes | 1.09 | 18 | - | - |
| *Girella nigricans* | opaleye | 1.06 | 16 | - | - |
| Syngnathidae | pipefishes | 1.02 | 13 | 5.31 | 53 |
| *Typhlogobius californiensis* | blind goby | 0.99 | 15 | 9.63 | 118 |
| *Trachurus symmetricus* | jack mackerel | 0.96 | 17 | - | - |
| *Halichoeres semicinctus* | rock wrasse | 0.95 | 15 | - | - |
| Labridae | wrasses | 0.83 | 11 | - | - |
| *Paraclinus integripinnis* | reef finspot | 0.81 | 14 | 2.88 | 31 |
| *Symphurus atricaudus* | California tonguefish | 0.77 | 11 | - | - |
| *Triphoturus mexicanus* | Mexican lampfish | 0.73 | 12 | 0.16 | 2 |
| *Nannobrachium* spp. | lanternfishes | 0.57 | 9 | - | - |

*(table continued)*

**Table 3-7** (continued). Average concentration of larval fishes and target shellfishes in source water samples collected at in Agua Hedionda Lagoon and nearshore stations, June 2004-May 2005.

| Taxon | Common Name | Nearshore | | Lagoon | |
|---|---|---|---|---|---|
| | | Average Concentration (per 1,000 $m^3$) | Total Count | Average Concentration (per 1,000 $m^3$) | Total Count |
| *Medialuna californiensis* | halfmoon | 0.53 | 7 | - | - |
| *Gillichthys mirabilis* | longjaw mudsucker | 0.51 | 8 | 5.17 | 62 |
| *Chilara taylori* | spotted cusk-eel | 0.50 | 7 | - | - |
| *Heterostichus rostratus* | giant kelpfish | 0.50 | 7 | - | - |
| Paralichthyidae | lefteye flounders & sanddabs | 0.44 | 7 | - | - |
| *Parophrys vetulus* | English sole | 0.30 | 5 | - | - |
| Myctophidae | lanternfishes | 0.30 | 4 | - | - |
| *Hippoglossina stomata* | bigmouth sole | 0.29 | 5 | - | - |
| *Zaniolepis frenata* | shortspine combfish | 0.25 | 5 | - | - |
| *Ruscarius creaseri* | roughcheek sculpin | 0.22 | 3 | - | - |
| Clupeiformes | herrings and anchovies | 0.21 | 3 | - | - |
| Gobiesocidae | clingfishes | 0.18 | 3 | 0.64 | 7 |
| Clupeidae | herrings | 0.18 | 3 | - | - |
| *Lyopsetta exilis* | slender sole | 0.16 | 3 | - | - |
| Pomacentridae | damselfishes | 0.14 | 2 | - | - |
| *Rhinogobiops nicholsii* | blackeye goby | 0.14 | 2 | - | - |
| *Nannobrachium ritteri* | broadfin lampfish | 0.13 | 2 | - | - |
| *Cyclothone* spp. | bristlemouths | 0.13 | 2 | - | - |
| *Chromis punctipinnis* | blacksmith | 0.13 | 2 | - | - |
| *Icelinus* spp. | sculpins | 0.13 | 3 | - | - |
| *Anisotremus davidsonii* | sargo | 0.12 | 2 | - | - |
| *Sebastes jordani* | shortbelly rockfish | 0.10 | 2 | - | - |
| Blennioidei | blennies | 0.08 | 1 | 0.36 | 4 |
| Clinidae | clinid kelpfishes | 0.08 | 1 | - | - |
| Chaenopsidae | tube blennies | 0.07 | 1 | - | - |
| *Leptocottus armatus* | Pacific staghorn sculpin | 0.07 | 1 | 0.51 | 6 |
| Cynoglossidae | tongue soles | 0.07 | 1 | - | - |
| Kyphosidae | sea chubs | 0.07 | 1 | - | - |
| *Cyclothone acclinidens* | benttooth bristlemouth | 0.07 | 1 | - | - |
| Hexagrammidae | greenlings | 0.06 | 1 | - | - |
| *Bathylagus ochotensis* | popeye blacksmelt | 0.06 | 1 | - | - |
| *Hypsoblennius gentilis* | bay blenny | 0.05 | 1 | - | - |
| *Rimicola eigenmanni* | slender clingfish | - | - | 4.13 | 53 |
| *Clinocottus analis* | wooly sculpin | - | - | 0.31 | 4 |
| *Clinocottus* spp. | sculpins | - | - | 0.07 | 1 |
| *Semicossyphus pulcher* | California sheephead | - | - | 0.06 | 1 |
| | | | **16,763** | | **38,872** |
| **Shellfishes** | | | | | |
| *Cancer* spp. (megalops) | cancer crabs | 9.29 | 158 | 0.17 | 2 |
| *Panulirus interruptus* (phyllosome) | California spiny lobster | 7.04 | 98 | 0.21 | 2 |
| *Cancer gracilis* (megalops) | slender crab | 2.93 | 48 | | |

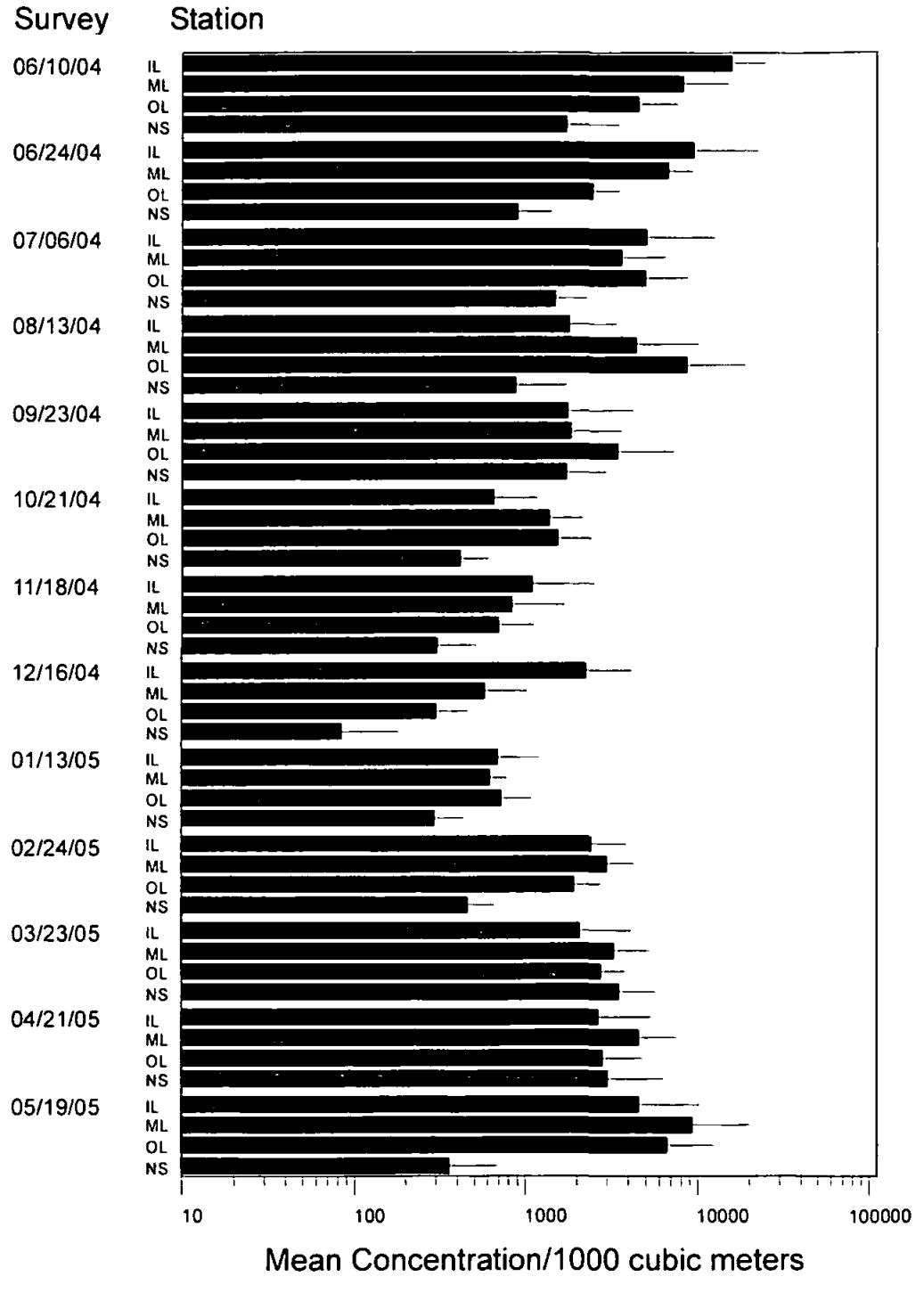
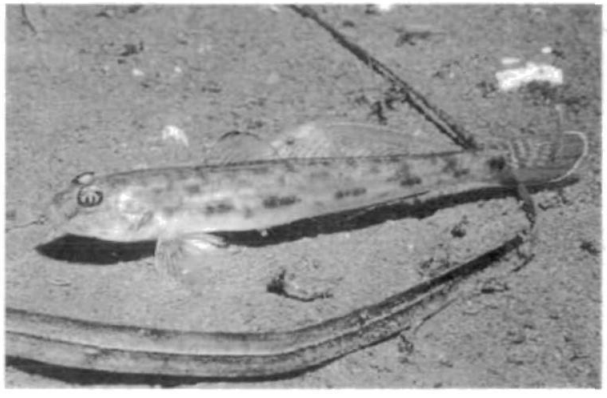



**Figure 3-5**. Mean concentration (# / 1,000 $m^3$ [264,172 gal]) and standard error of all larval fishes collected at source water stations in AHL and nearshore stations during the 2004–2005 period.

## 3.3.2 CIQ Goby complex (*Clevelandia ios, Ilypnus gilberti, Quietula y-cauda*)



***Range***: Vancouver Island, British Columbia to Gulf of California

***Life History***:

- Size up to 57 mm (2.1 in) (arrow goby); 64 mm (2.5 in) (cheekspot goby); 70 mm (2.75 in) (shadow goby)
- Age at maturity from 0.7–1.5 yr
- Life span ranges from <3 yr (arrow goby) to 5 yr (shadow goby)
- Spawns year-round in bays and estuaries; demersal, adhesive eggs with fecundity from 225–1,400 eggs per female with multiple spawning 2–5 per yr
- Juveniles from 14.0–29.0 mm (0.55-1.14 in) are less than 1 yr old

***Habitat***: Mud and sand substrates of bays and estuaries; commensally in burrows of shrimps and other invertebrates.

***Fishery***: None

Gobies are small, demersal fishes that are found worldwide in shallow tropical and subtropical environments. The family Gobiidae contains approximately 1,875 species in 212 genera (Nelson 1994, Moser 1996). Twenty-one goby species from 16 genera occur from the northern California border to south of Baja California (Moser 1996). In addition to the three species comprising the CIQ complex, there are at least five other common species in AHL and the adjacent nearshore waters: blackeye goby (*Rhinogobiops nicholsii*), yellowfin goby (*Acanthogobius flavimanus*), longjaw mudsucker (*Gillichthys mirabilis*), blind goby (*Typhlogobius californiensis*), and bay goby (*Lepidogobius lepidus*). The three species in the CIQ complex have been combined for analysis in the present study because it is not possible to distinguish between them at the small sizes typically collected in the plankton tows. The following section presents an overview of the family and life history characteristics of each of the three species.

### 3.3.2.1 Life History and Ecology

Members of the goby family share a variety of distinguishing characteristics. Their body shape is elongate and can be either somewhat compressed or depressed (Moser 1996). Most members of the family lack both a lateral line and swim bladder (Moyle and Cech 1988). Gobies generally have two dorsal fins, the first consisting of 2–8 flexible spines and the second containing a spine and several segmented rays. Their caudal fin is rounded and their pelvic fins are typically joined to form a cup-like disc (Moser 1996). The eyes of most gobies are relatively large and are a dominant feature of their blunt heads. Goby species are extremely variable in coloration. They range from the drab, cryptically colored species that inhabit mudflats to the striking, brightly colored species of tropical and subtropical reefs (Moser 1996).

One of the most important characteristics of the goby family is their small size. Due to their size and evolved tolerances for a variety of environmental conditions, gobies have been able to

colonize habitats that are inaccessible to most other fishes. These include cracks and crevices in coral reefs, invertebrate burrows, mudflats, mangrove swamps, freshwater streams on oceanic islands, and inland seas and estuaries (Moyle and Cech 1988).

Gobies generally occur in shallow marine habitats, however many members of the family are euryhaline and are able to tolerate very low salinities and even freshwater. A number of goby species also have the ability to survive out of the water by "breathing" air. The longjaw mudsucker can survive for days out of water if kept moist, and the mudskipper *Periopthalmus* spp. regularly leaves the water to forage for terrestrial insects among mangrove roots and exposed rocks (Moyle and Cech 1988). Gobies eat a variety of larval, juvenile, and adult crustaceans, mollusks, and insects. Many will also eat small fishes, fish eggs, and fish larvae.

Arrow goby *Clevelandia ios* occupy the most northerly range of the three species, occurring from Vancouver Island, British Columbia to Baja California (Eschmeyer et al. 1983). The reported northern range limits of both shadow goby *Quietula y-cauda* and cheekspot goby *Ilypnus gilberti* are in central California with southern ranges that extend well into the sub-tropical Gulf of California (Robertson and Allen 2002). Their physiological tolerances reflect their geographic distributions with arrow goby being less able to withstand warmer temperatures compared to cheekspot goby. When exposed to temperatures of 32.1°C (89.9°F) for three days in a laboratory experiment, no arrow goby survived, but 95% of cheekspot goby survived (Brothers 1975). Gobies exposed to warm temperatures on mudflats can seek refuge in their burrows where temperatures can be several degrees cooler than surface temperatures.

All three species have overlapping ranges in the San Diego region and occupy similar habitats. Arrow goby is the most abundant of the three species in bays and estuaries from Tomales Bay to San Diego Bay, including Elkhorn Slough (Cailliet et al. 1977), Anaheim Bay (MacDonald 1975) and Newport Bay (Allen 1982). It is also the most abundant of the three species in AHL. The life history of the arrow goby was reviewed by Emmett et al. (1991) and the comparative ecology and behavior of all three species were studied by Brothers (1975) in Mission Bay, approximately 43 km (26.7 mi) south of AHL. The species inhabits burrows of ghost shrimps *Neotrypnea* spp. and other burrowing invertebrates. In a 5-year study of fishes in San Diego Bay, approximately 75% of the estimated 4.5 million (standing stock) gobies were juveniles (Allen et al. 2002).

Myomere counts, gut proportions, and pigmentation characteristics can be used to identify most fish larvae to the species level. However, the arrow, cheekspot, and shadow gobies cannot be differentiated with complete confidence at most larval stages (Moser 1996). Therefore, larval gobies collected during entrainment sampling that could not be identified to the species level were grouped into the 'CIQ' goby complex (for *Clevelandia*, *Ilypnus* and *Quietula*), or the family level 'Gobiidae' if specimens were damaged but could still be recognized as gobiids. Some larger larval specimens with well-preserved pigmentation patterns could be identified to the species level (W. Watson, Southwest Fisheries Science Center, pers. comm.) but those that were speciated in this study were subsequently combined into the CIQ complex for analysis.



The reproductive biology of the three species in the CIQ complex is similar. Arrow goby typically mature sooner than the other two species, attaining 50% maturity in the population after approximately 8 mo as compared to 16–18 mo for cheekspot and shadow gobies. Mature females for all three of these species are oviparous and produce demersal eggs that are elliptical in shape, typically adhesive, and attached to a nest substratum at one end (Matarese et al. 1989, Moser 1996). Hatched larvae are planktonic and the duration of the planktonic stage was estimated at 60 days for populations in Mission Bay located south of EPS in San Diego County (Brothers 1975). Arrow gobies mature more quickly and spawn a greater number of eggs at a younger age than either the cheekspot or shadow gobies. As with most fishes, fecundity is dependent on age and size of the female. Fecundity of gobies in Mission Bay ranged from 225–750 eggs per batch for arrow gobies, 225–1,030 eggs for cheekspot, and 340–1,400 for shadow, for a mean value of 615 per batch for the CIQ complex. Mature females for the CIQ complex deposit 2–5 batches of eggs per year.

CIQ complex larvae hatch at a size of 2–3 mm (0.08–0.12 in) (Moser 1996). Data from Mission Bay from Brothers (1975) were used to estimate an average growth rate of 0.16 mm/d (0.006 in/d) for the approximately 60 days from hatching to settlement. Brothers (1975) estimated a 60-day larval mortality of 98.3% for arrow goby larvae, 98.6% for cheekspot, and 99.2% for shadow. These values were used to estimate average daily survival at 0.93 for the three species. Once the larvae transform at a size of approximately 10–15 mm SL (0.39-0.59 in), depending on the species (Moser 1996), the juveniles settle into the benthic environment. For the Mission Bay populations mortality following settlement was 99% per year for arrow goby, 66–74% for cheekspot goby, and 62–69% for shadow goby. Few arrow gobies in the Mission Bay study exceeded 3 yr of age based on otolith records, whereas cheekspot and shadow gobies commonly lived for 4 yr (Brothers 1975).

There is no fishery for CIQ gobies and therefore no records on adult population trends based on landings data.

### 3.3.2.2 Sampling Results

CIQ complex goby larvae was the most abundant taxon collected at the entrainment station (**Table 3-5**). It was also the most abundant taxon at the lagoon source water stations and the third most abundant taxon at the combined nearshore source water stations (**Table 3-6**). Entrainment estimates for each survey are presented in **Appendix F**. CIQ goby larvae were most abundant at the entrainment station during August and least abundant from December through January (**Figure 3-6**). Peak abundances at source water stations generally occurred in summer months with CIQ goby larvae having highest concentrations in the Inner Lagoon stations, followed by Middle Lagoon, Outer Lagoon, and nearshore stations (**Figure 3-7**). Variation in abundance not only reflected differences in the habitats sampled but also the spawning periods for the three species comprising the CIQ complex. Brothers (1975) indicated that the peak spawning period for arrow goby occurs from November through April, while spawning in cheekspot and shadow goby is more variable and can occur throughout the year.



There was no consistent relationship between daytime and nighttime larval abundances at the entrainment station, although overall concentrations tended to be higher at night (**Figure 3-8**). During July the larval concentrations were greater during daytime (Cycle 1, noon), but in the August survey they were greater at night (Cycle 3, midnight). The length-frequency distribution for a representative sample of CIQ goby larvae showed that the majority of the sampled larvae were recently hatched based on the reported hatch size of 2–3 mm (0.08-0.12 in) (Moser et al. 1996). A random sample of 200 CIQ goby larvae from all the surveys ranged in size from 1.9 to 6.4 mm (0.075 to 0.25 in) with a mean size of 2.8 mm (0.11 in) (**Figure 3-9**).

### 3.3.2.3 Modeling Results

The following sections present the results for demographic and empirical transport modeling of CWS effects on goby populations. A comprehensive comparative study of the three goby species in the CIQ complex by Brothers (1975) provided the necessary life history information for both the *FH* and *AEL* demographic models. Total annual entrainment of CIQ goby larvae at EPS was estimated to be 2.21 billion using measured cooling water flow and 2.77 billion larvae using maximum cooling water flow for the June 2004 through May 2005 period (**Table 3-6**).

#### *Fecundity Hindcasting (FH)*

Annual entrainment estimates for CIQ gobies were used to estimate the number of females at the age of maturity needed to produce the number of larvae entrained during their lifetime. No estimates of egg survival for gobies were available, but because gobies deposit demersal egg masses (Wang 1986) and exhibit parental care, usually provided by the adult male, egg survival is generally high and was conservatively assumed to be 100%. Estimates of larval survival for the three species from Brothers (1975) were used to compute an average daily survival of 0.93. A larval growth rate of 0.16 mm/d (0.006 in/d) was estimated from transformation lengths reported by Brothers (1975) for the three species and an estimated transformation age of 60 d. The mean length and the length of the 25$^{th}$ percentile (2.4 mm [0.09 in]) of entrained larvae were used with the calculated growth rate to estimate that the mean age at entrainment was 2.4 d. Survival to the average age at entrainment was then estimated as $0.93^{2.4} = 0.84$. A survivorship table was constructed using data from Brothers (1975) and was used to estimate a total lifetime fecundity of 1,400 eggs (**Table 3-8**). Ages of at least 50% maturity averaged 1.67 years.

The estimated numbers of female gobies at the age of maturity whose lifetime reproductive output was entrained through the EPS CWS for the 2004–2005 period ranged from a mean of 1,881,458 using the actual pump flow rates to 2,349,998 using a calculation based on maximum flows during the study period (**Table 3-9**).



**Table 3-8**. Total lifetime fecundity estimates for three goby species based on a life table in Brothers (1975).

| Species | Age | N | % Mature | Fecundity | Spawns | No. Eggs | Eggs per Spawner | TLF |
|---|---|---|---|---|---|---|---|---|
| *Clevelandia ios* | 0 | 500 | | | | | | |
| | 1 | 100 | 81 | 450 | 1.5 | 54,675 | 547 | |
| | 2 | 4 | 100 | 700 | 2.0 | 5,600 | 56 | **603** |
| *Ilypnus gilberti* | 0 | 500 | | | | | | |
| | 1 | 80 | 10 | 260 | 0 | 0 | | |
| | 2 | 51 | 71 | 480 | 1.5 | 26,071 | 511 | |
| | 3 | 14 | 99 | 720 | 3.0 | 29,938 | 587 | |
| | 4 | 2 | 100 | 900 | 3.0 | 5,400 | 106 | **1,204** |
| *Quietula y-cauda* | 0 | 500 | | | | | | |
| | 1 | 74 | 23 | 410 | 0 | 0 | | |
| | 2 | 50 | 87 | 620 | 1.5 | 4,0455 | 809 | |
| | 3 | 26 | 99 | 840 | 2.5 | 54,054 | 1081 | |
| | 4 | 7 | 100 | 1,200 | 3.0 | 25,200 | 504 | **2,394** |
| | | | | | | | **Mean** | **1,400** |

**Table 3-9**. Results of *FH* modeling for CIQ goby complex larvae based on a) actual flows and b) maximum flows. The upper and lower estimates are based on a 90% confidence interval of the mean. *FH* estimates were also calculated using the upper and lower confidence estimates from the entrainment estimates.

| Parameter | Mean | Std. Error | *FH* Lower Estimate | *FH* Upper Estimate | *FH* Range |
|---|---|---|---|---|---|
| **a) Actual Flows** | | | | | |
| *FH* Estimate | **1,881,458** | 1,631,040 | 452,030 | 7,831,086 | 7,379,057 |
| Total Entrainment | 2,215,477,217 | 86,364,408 | 1,760,808 | 2,002,108 | 241,300 |
| **b) Maximum Flows** | | | | | |
| *FH* Estimate | **2,349,998** | 2,036,966 | 564,699 | 9,779,533 | 9,214,834 |
| Total Entrainment | 2,767,198,570 | 101,030,008 | 2,208,860 | 2,491,136 | 282,276 |

## *Adult Equivalent Loss (AEL)*

The parameters required for formulation of *AEL* estimates include larval survival from entrainment to settlement and survival from settlement to the average age of reproduction for a mature female. Larval survival from entrainment through settlement was estimated as $0.93^{60\text{-}2.4} = 0.02$ using the same daily survival rate used in formulating *FH*. Brothers (1975) estimated that mortality in the first year following settlement was 99% for arrow, 66–74% for cheekspot, and 62–69% for shadow goby. These estimates were used to calculate a daily survival

of 0.995 that was used to estimate a finite survival of 0.21 for the first year following settlement. Daily survival through the average female age of 2.21 years from life table data for the three species was estimated as 0.994 and was used to calculate a finite survival of 0.21.

The estimated number of adult CIQ gobies equivalent to the number of larvae entrained through the EPS CWS for the sampling period was 1,632,666 based on actual flows and 2,039,250 based on maximum flows (**Table 3-10**).

**Table 3-10**. Results of *AEL* modeling for CIQ goby complex larvae based on a) actual flows and b) maximum flows. The upper and lower estimates are based on a 90% confidence interval of the mean. *AEL* estimates were also calculated using the upper and lower confidence estimates from the entrainment estimates.

| Parameter | Mean | Std. Error | *AEL* Lower Estimate | *AEL* Upper Estimate | *AEL* Range |
|---|---|---|---|---|---|
| **a) Actual Flows** | | | | | |
| *AEL* Estimate | **1,632,666** | 1,834,554 | 257,124 | 10,366,994 | 10,109,870 |
| Total Entrainment | 2,215,477,217 | 86,364,408 | 1,527,970 | 1,737,363 | 209,392 |
| **b) Maximum Flows** | | | | | |
| *AEL* Estimate | **2,039,250** | 2,291,244 | 321,199 | 12,946,922 | 12,625,723 |
| Total Entrainment | 2,767,198,570 | 101,030,008 | 1,916,775 | 2,161,725 | 244,949 |

### *Empirical Transport Model (ETM)*

The larval duration used to calculate the *ETM* estimates for CIQ gobies was based on the lengths of entrained larvae. The difference between the lengths of the 25$^{th}$ and 95$^{th}$ percentiles was used with a growth rate of 0.16 mm/d (0.006 in/d) to estimate that CIQ goby larvae were vulnerable to entrainment for a period of 11.5 days.

CIQ gobies larvae were present in the entrainment and source water samples throughout the year. The monthly estimates of proportional entrainment (*PE*) for the June 2004 – May 2005 period ranged from 0.00891to 0.10983 using the actual flows and from 0.01518 to 0.12744 using the maximum flows (**Table 3-11**). The largest estimates occurred during the August surveys with the largest proportion of the source population also occurring during that survey ($f_i$ = 0.186 or 18.6%). The values in the table were used to calculate a $P_M$ estimate of 0.3980 with a standard error of 0.2692 using the actual flows and an estimate of 0.4700 with a standard error of 0.3169 using the maximum flows.

**Table 3-11.** *ETM* data for CIQ goby larvae based on actual and maximum daily cooling water flows. The *PE* estimates incorporate all three components of the source water shown in Equation 7.

| | Actual Flows | | Maximum Flows | | |
|---|---|---|---|---|---|
| Survey Date | *PE* Estimate | *PE* Std. Err. | *PE* Estimate | *PE* Std. Err. | $f_i$ |
| 10-Jun-04 | 0.01884 | 0.07027 | 0.02277 | 0.08475 | 0.11600 |
| 24-Jun-04 | 0.02890 | 0.11076 | 0.03590 | 0.13735 | 0.03160 |
| 6-Jul-04 | 0.06809 | 0.27212 | 0.08262 | 0.32838 | 0.07955 |
| 13-Aug-04 | 0.10983 | 0.47389 | 0.12744 | 0.54871 | 0.18595 |
| 23-Sep-04 | 0.07170 | 0.24957 | 0.07750 | 0.26921 | 0.06335 |
| 21-Oct-04 | 0.03223 | 0.05658 | 0.05301 | 0.09253 | 0.04577 |
| 18-Nov-04 | 0.01958 | 0.05349 | 0.03101 | 0.08434 | 0.02347 |
| 16-Dec-04 | 0.01226 | 0.0383 | 0.01518 | 0.04709 | 0.02729 |
| 13-Jan-05 | 0.00891 | 0.01371 | 0.01571 | 0.02342 | 0.03878 |
| 24-Feb-05 | 0.00940 | 0.01556 | 0.01556 | 0.02564 | 0.14489 |
| 23-Mar-05 | 0.03661 | 0.08619 | 0.05419 | 0.1273 | 0.11674 |
| 21-Apr-05 | 0.08833 | 0.4196 | 0.10369 | 0.49206 | 0.03690 |
| 19-May-05 | 0.05236 | 0.19698 | 0.07051 | 0.26494 | 0.08971 |
| $P_M$ | **0.3980** | | **0.4700** | | |
| Std. Error | 0.2692 | | 0.3169 | | |

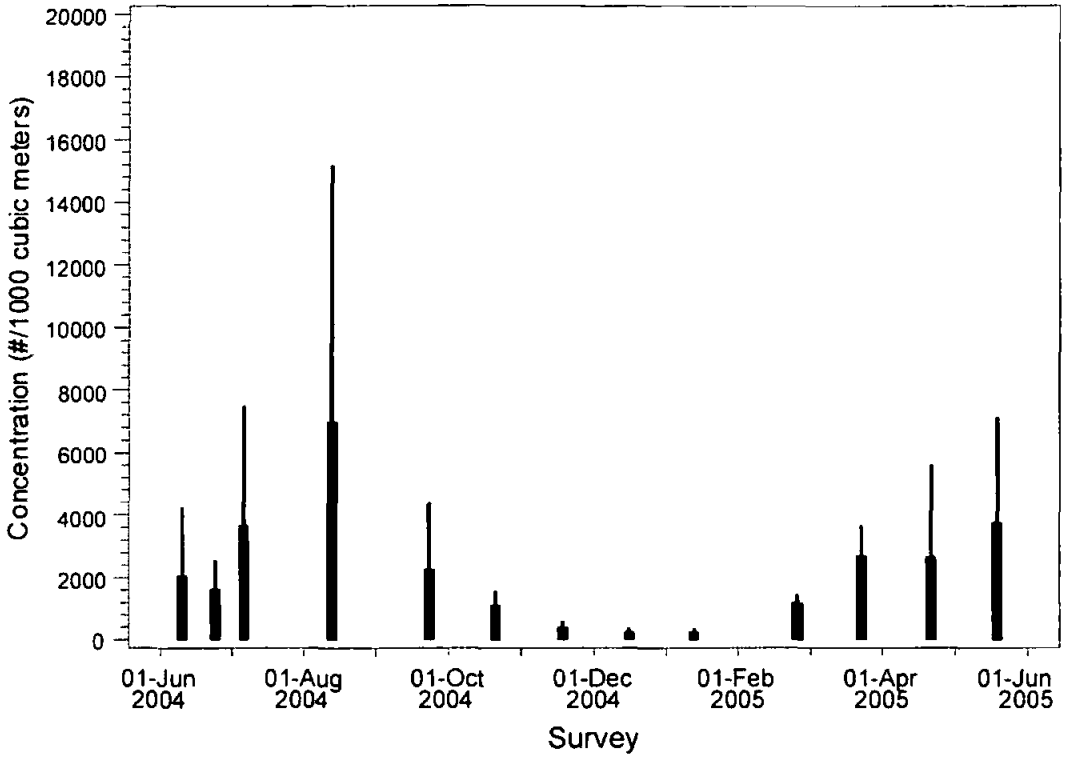



**Figure 3-6**. Comparison among surveys of mean concentration (#/1,000 $m^3$ [264,172 gal]) of CIQ goby complex larvae at entrainment Station E1.

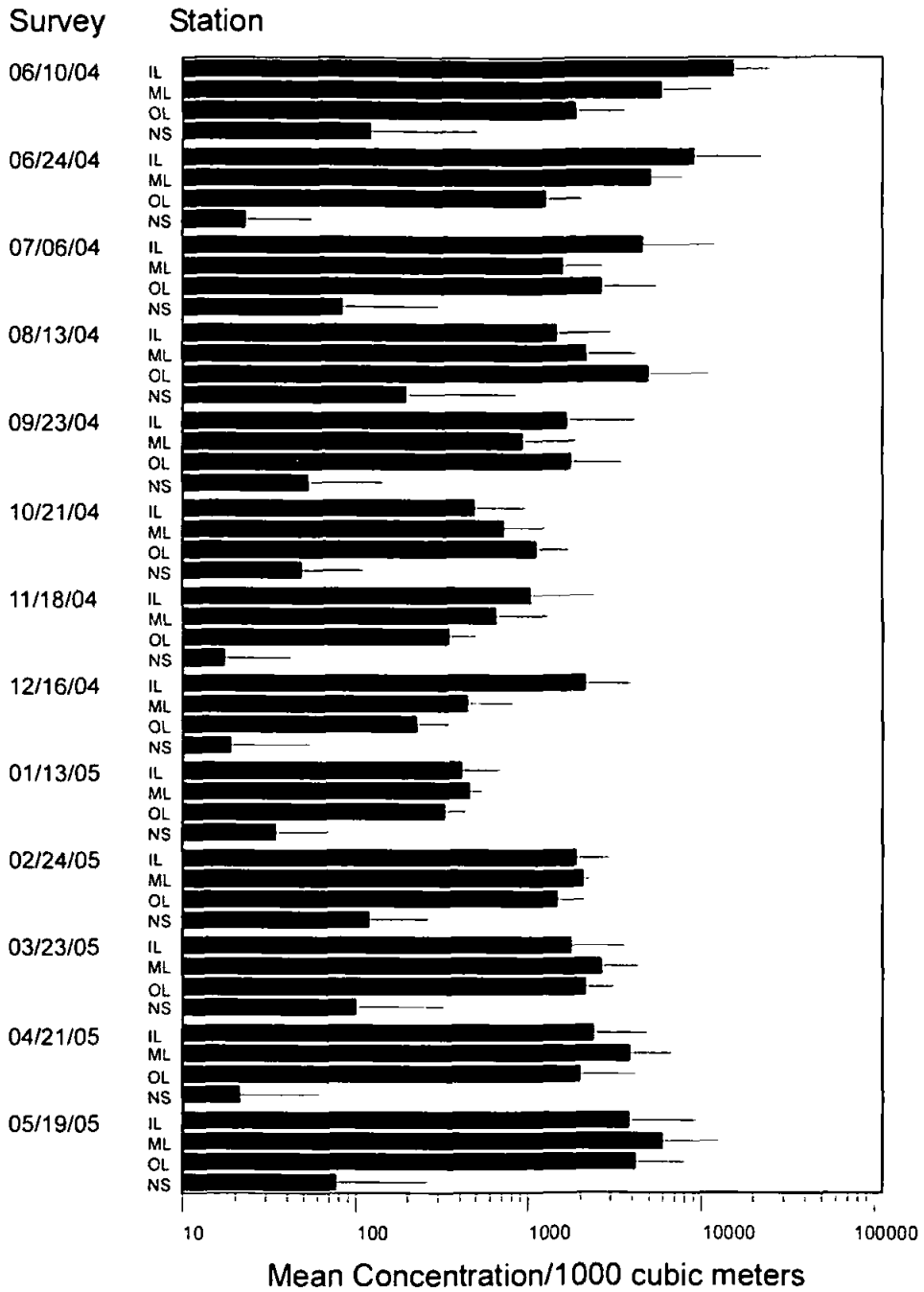



**Figure 3-7.** Mean concentration (#/1,000 $m^3$ [264,172 gal]) and standard error of CIQ goby complex larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods. Note logarithmic abundance scale.

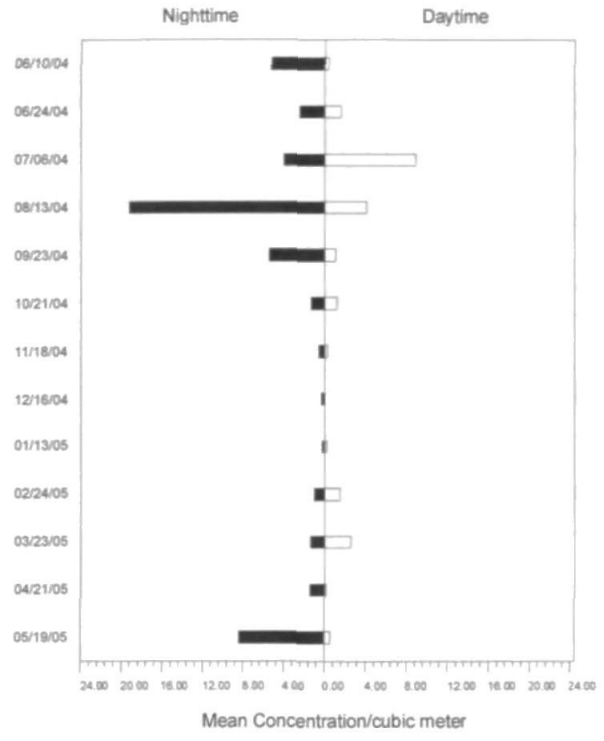



**Figure 3-8.** Mean concentration (#/1.0 $m^3$ [264 gal]) of CIQ goby complex larvae at entrainment Station E1 during night (Cycle 3) and day (Cycle 1) sampling.

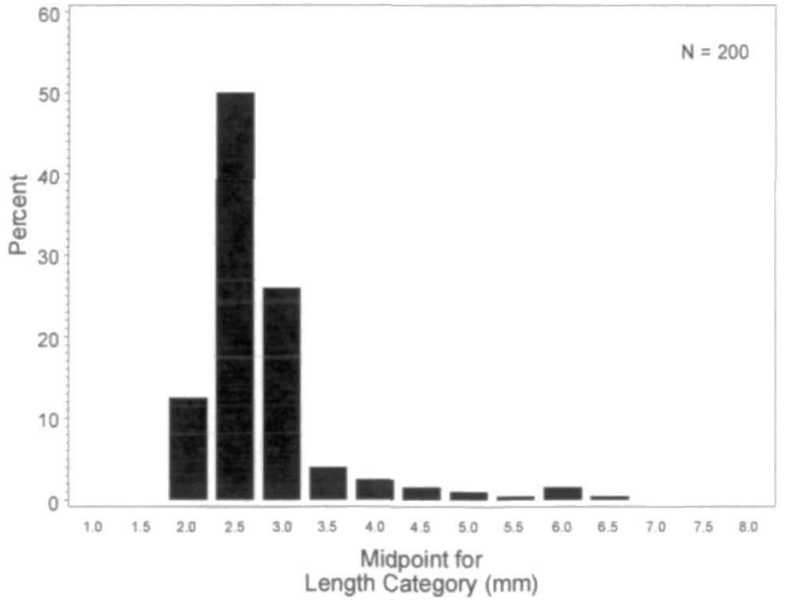
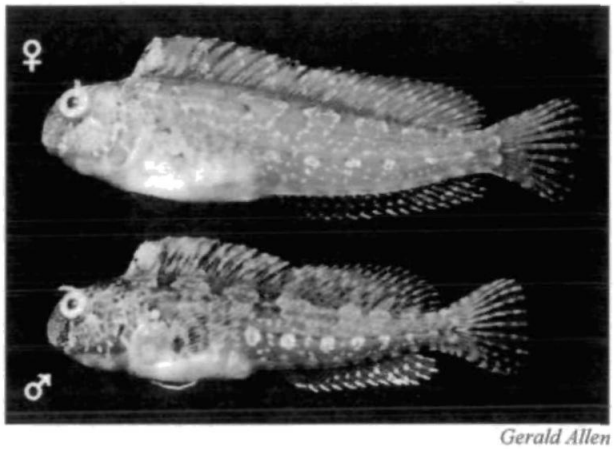



**Figure 3-9.** Length frequency of CIQ goby complex larvae at entrainment Station E1. Data from sub-samples of all surveys in 2004–2005.

## 3.3.3 Combtooth blennies (*Hypsoblennius* spp.)




*Gerald Allen*

***Range***:

- Bay blenny—Monterey Bay to Gulf of California.
- Mussel blenny—Morro Bay to Magdalena Bay Baja California and the northern Gulf of California
- Rockpool blenny—Morro Bay to Magdalena Bay

***Life History***:

- Size: bay blenny to 14.7 cm TL (5.8 in), mussel blenny to 13 cm (5.1 in), rockpool blenny to 17 cm (6.8 in)
- Age at maturity: all species ≈0.5 yr
- Life span: bay blenny ≈7 yr, mussel blenny <6 yr, rockpool blenny >8 yr
- Fecundity: bay blenny 500–1,500 eggs, mussel blenny 200–2,000 eggs, rockpool blenny 700-1,700 eggs

***Habitat***:

- Bay blenny—soft bottom in bays and estuaries, associated with submerged aquatic vegetation and mussels on mooring buoys; to 24 m (80 ft)
- Mussel blenny—empty worm tubes and barnacle tests on pilings, mussel beds, crevices in shallow rock reefs; to 21 m (70 ft)
- Rockpool blenny—under rocks, in crevices on shallow rock reefs; to 18 m (60 ft)

***Fishery:*** None

Combtooth blennies comprise a large group of subtropical and tropical fishes that inhabit inshore rocky habitats throughout much of the world. The family Blenniidae, the combtooth blennies, contains about 345 species in 53 genera (Nelson 1994, Moser 1996). They derive their common name from the arrangement of closely spaced teeth in their jaws. Three species of the genus *Hypsoblennius* occur in the vicinity of EPS: bay blenny (*H. gentilis)*, rockpool blenny (*H. gilberti*), and mussel blenny (*H. jenkinsi*). These species co-occur throughout much of their range although they occupy different habitats. The bay blenny is found along both coasts of Baja California and up the California coast to as far north as Monterey Bay, (Miller and Lea 1972, Robertson and Allen 2002). The rockpool blenny occurs from Magdalena Bay, Baja California to Point Conception, California (Miller and Lea 1972, Stephens et al. 1970). The range of the mussel blenny extends from Morro Bay to Magdalena Bay, Baja California and in the northern Gulf of California (Love et al. 2005).

### 3.3.3.1 Life History and Ecology

Combtooth blennies are all relatively small fishes that typically grow to a total length of less than 200 mm (7.9 in) (Moser 1996). Their bodies are generally elongate and without scales. Dorsal fins are often continuous and contain more soft rays than spines (Moyle and Cech 1988). Coloration in the group is quite variable, even among individuals of the same species (Stephens et al. 1970).

The three species of *Hypsoblennius* found in California waters are morphologically similar as early larvae (Moser 1996, Ninos 1984). For this reason most *Hypsoblennius* identified in the EPS 316(b) plankton collections were identified as *Hypsoblennius* spp. Certain morphological features (e.g., preopercular spines) develop at larger sizes and allow taxonomists to identify some older larvae to the species level. The mussel blenny is common in AHL and life history information for this species was used to model entrainment impacts on this group.

Blennies inhabit a variety of hard substrates in the intertidal and shallow subtidal zones of tropical and subtropical marine habitats throughout the world. They may occur to depths of 24 m (80 ft) but are more frequently found in water depths of less than 5 m (15 ft) (Love 1996). Combtooth blennies are common in rocky tidepools, reefs, breakwaters, and on pier pilings. They are also frequently observed on encrusted buoys and boat hulls.

The California blennies have different habitat preferences. The mussel blenny is only found subtidally and inhabits mussel beds, the empty drill cavities of boring clams, barnacle tests, or in crevices among the vermiform snail tubes *Serpulorbis* spp. (Stephens 1969, Stephens et al. 1970). They generally remain within one meter of their chosen refuge (Stephens et al. 1970). The bay blenny is usually found subtidally but appears to have general habitat requirements and may inhabit a variety of intertidal and subtidal areas (Stephens et al. 1970). They are commonly found in mussel beds and on encrusted floats, buoys, docks, and even fouled boat hulls (Stephens 1969, Stephens et al. 1970). Bay blennies are also typically found in bays as the common name implies and are tolerant of estuarine conditions (Stephens et al. 1970). They are among the first resident fish species to colonize new or disturbed marine habitats such as new breakwaters or mooring floats after the substrate is first colonized by attached invertebrates (Stephens et al. 1970, Moyle and Cech 1988). Rockpool blennies are mainly found along shallow rocky shorelines, along breakwaters, and in shallow kelp forests along the outer coast.

Female blennies mature quickly and reproduce within the first year reaching peak reproductive potential in the third year (Stephens 1969). The spawning season typically begins in the spring and may extend into September (Stephens et al. 1970). Blennies are oviparous and lay demersal eggs that are attached to the nest substrate by adhesive pads or filaments (Moser 1996). Males tend the nest and developing eggs. Females spawn 3–4 times over a period of several weeks (Stephens et al. 1970). Males guard the nest aggressively and will often chase the female away, however, several females may occasionally spawn with a single male. The number of eggs a female produces varies proportionately with size (Stephens et al. 1970). The mussel blenny spawns approximately 500 eggs in the first reproductive year and up to 1,500 eggs by the third year (Stephens et al. 1970).

Larvae are pelagic and average approximately 2.7 mm (0.11 in) in length two days after hatching (Stephens et al. 1970). The planktonic phase for *Hypsoblennius* spp. larvae may last for 3 months (Stephens et al. 1970, Love 1996). Captured larvae released by divers have been observed to use surface water movement and near-surface currents to aid swimming (Ninos 1984). After release the swimming larvae orient to floating algae, bubbles on the surface, or the bottoms of boats or

buoys. The size at settlement ranges from 12–14 mm (0.5–0.6 in). After the first year mussel and bay blenny averaged 40 and 45 mm (1.6 and 1.8 in) total length, respectively (Stephens et al. 1970). Bay blenny grow to a slightly larger size and live longer than mussel blenny, reaching a size of 15 cm (5.9 in) and living for 6–7 years (Stephens 1969, Stephens et al. 1970, Miller and Lea 1972). Mussel blennies grow to 13 cm (5.1 in) and have a life span of 3–6 years (Stephens et al. 1970, Miller and Lea 1972). Male and female growth rates are similar.

Juvenile and adult combtooth blennies are omnivores and eat both algae and a variety of invertebrates, including limpets, urchins, and bryozoa (Stephens 1969, Love 1996). They are preyed on by spotted sand bass, kelp bass, giant kelpfish, and cabezon (Stephens et al. 1970).

There is no fishery for combtooth blennies and therefore no records on adult population trends based on landings data.

### 3.3.3.2 Sampling Results

Combtooth blenny larvae were the second most abundant taxon collected in the entrainment samples and source water samples (**Tables 3-5** and **3-7**). They were most abundant from May through September and least abundant from October through April (**Figure 3-10**) with maximum concentrations at the entrainment station in August 2004 (3,900 per 1,000 $m^3$). Concentrations of larval blennies in the source water were generally greatest in the Outer and Middle Lagoon and least at the nearshore stations (**Figure 3-11**), and substantially greater in night samples than those collected during the day (**Figure 3-12**). The number of larval combtooth blennies collected during each entrainment and source water survey is presented in **Appendix E**.

The length frequency distribution for a random sample of 200 combtooth blenny larvae from all surveys ranged in size from 1.8 to 3.3 mm (0.07 to 0.13 in) with a mean size of 2.3 mm (0.09 in) (**Figure 3-13**). The size range for the entrainment samples indicate that the majority of the larvae were recently hatched based on a reported hatching size of 2.1 mm (0.08 in) (Moser 1996).

### 3.3.3.3 Modeling Results

The following sections present the results for demographic and empirical transport modeling of CWS effects on combtooth blennies. There was very little species-specific life history information available for combtooth blennies. Larval survival was estimated using data from Stephens (1969) and Stevens and Moser (1982), and there was enough other information on reproduction to calculate an *FH* estimate, but not to calculate an *AEL* estimate. Larval growth was estimated from information from Stevens and Moser (1982). Total annual entrainment of combtooth blenny larvae at EPS was estimated at 1.10 billion using measured cooling water flow and at 1.31 billion larvae using maximum cooling water flow for the June 2004 through May 2005 period (**Table 3-6**).

#### *Fecundity Hindcasting (FH)*

The annual entrainment estimates for combtooth blenny larvae were used to estimate the number of females at the age of maturity needed to produce this number of larvae over their lifetimes. No



estimates of egg survival for combtooth blenny were available, but because egg masses are attached to the substrate and guarded by the male (Stephens et al. 1970), egg survival is probably high and was conservatively assumed to be 100%. The mean length for larval combtooth blenny larvae in entrainment samples was 2.3 mm (0.09 in). A larval growth rate of 0.20 mm/day (0.008 in/d) was derived from growth rates using data in Stevens and Moser (1982). The mean length and the length at the 25th percentile (2.1 mm [0.08 in]) were used with the growth rate to estimate that the mean age at entrainment was 0.7 days. A daily survival rate of 0.89 computed from data in Stephens (1969) was used to calculate survival to the average age at entrainment as $0.89^{0.7} = 0.91$. A quadratic equation was used to estimated adult survival $S$ at age in days $x$ using Figure 17 in Stephens (1969):

$$S = 8.528\times10^{-8}x^2 - 3.918\times10^{-4}x + 0.4602 \qquad (10)$$

An adult survivorship table (**Table 3-12**) was constructed using the survival equation based on Stephens (1969) and information about eggs from Stephens (1969; Table 3) on *H. gentilis*, *H. gilberti* and *H. jenkinsi* to estimate a lifetime fecundity of 2,094 eggs.

**Table 3-12**. Survivorship table for adult combtooth blenny from data in Stephens (1969) showing spawners ($L_x$) surviving to the age interval and numbers of eggs spawned annually ($M_x$). The total lifetime fecundity was calculated as the sum of $L_xM_x$ divided by 1,000.

| Age (yr) | $L_x$ | $M_x$ | $L_xM_x$ |
|---|---|---|---|
| 0.5 | 1,000 | 367 | 366,667 |
| 1.5 | 693 | 633 | 438,624 |
| 2.5 | 443 | 1,067 | 472,794 |
| 3.5 | 252 | 1,533 | 386,465 |
| 4.5 | 119 | 2,000 | 237,915 |
| 5.5 | 44 | 2,500 | 109,973 |
| 6.5 | 27 | 3,000 | 81,415 |
| | | **TLF =** | **2,094** |

The estimated numbers of female combtooth blennies at the age of maturity (0.5 years) whose lifetime reproductive output was entrained through the EPS CWS for the June 2004 through May 2005 period was 573,354 based on actual flows and 685,288 based on maximum flows (**Table 3-13**). The range of estimates based on the 90% confidence intervals shows that the variation in the estimate of entrainment abundance had much less of an effect on the variation of the *FH* estimate, by an order of magnitude, than the life history parameters used in the model.

**Table 3-13**. Results of *FH* modeling for combtooth blenny larvae based on a) actual flows, and b) maximum flows. The upper and lower estimates are based on a 90% confidence interval of the mean. *FH* estimates were also calculated using the upper and lower confidence estimates from the entrainment estimates.

| Parameter | Mean | Std. Error | *FH* Lower Estimate | *FH* Upper Estimate | *FH* Range |
|---|---|---|---|---|---|
| **a) Actual Flows** | | | | | |
| *FH* Estimate | **573,354** | 497,606 | 137,528 | 2,390,306 | 2,252,778 |
| Total Entrainment | 1,098,083,615 | 62,379,799 | 519,775 | 626,933 | 107,159 |
| **b) Maximum Flows** | | | | | |
| *FH* Estimate | **685,288** | 594,668 | 164,411 | 2,856,379 | 2,691,968 |
| Total Entrainment | 1,312,458,555 | 72,049,342 | 623,403 | 747,172 | 123,769 |

## *Adult Equivalent Loss (AEL)*

The parameters required for formulation of *AEL* include larval survival from entrainment to settlement and survival from settlement to the average age of reproduction for a mature female. Larval survival from entrainment through settlement at 50 days was estimated as $0.89^{(50-0.7)} = 0.003$ using the same daily survival rate used in formulating *FH*. Juvenile and adult survival was calculated from observed age group abundances in Stephens (1969). Daily survival through the average female age of 2.7 years for the three species was estimated as 0.99 and was used to calculate a finite survival of 0.79.

The estimated number of adult combtooth blennies equivalent to the number of larvae entrained through the EPS CWS for the sampling period was 2,450,084 based on actual flows and 2,928,405 based on design maximum flows (**Table 3-14**).

**Table 3-14**. Results of *AEL* modeling for combtooth blenny larvae based on a) actual flows and b) maximum flows. The upper and lower estimates are based on a 90% confidence interval of the mean. *AEL* estimates were also calculated using the upper and lower confidence estimates from the entrainment estimates.

| Parameter | Mean | Std. Error | *AEL* Lower Estimate | *AEL* Upper Estimate | *AEL* Range |
|---|---|---|---|---|---|
| **a) Actual Flows** | | | | | |
| *AEL* Estimate | **2,450,084** | 3,003,954 | 326,035 | 18,411,836 | 18,085,800 |
| Total Entrainment | 1,098,083,615 | 62,379,799 | 2,221,126 | 2,679,042 | 457,916 |
| **b) Maximum Flows** | | | | | |
| *AEL* Estimate | **2,928,405** | 3,590,150 | 389,742 | 22,003,161 | 21,613,419 |
| Total Entrainment | 1,312,458,555 | 72,049,342 | 2,663,956 | 3,192,854 | 528,897 |

## *Empirical Transport Model (ETM)*

The larval duration used to calculate the *ETM* estimates for combtooth blenny was based on the lengths of entrained larvae. The difference between the lengths of the 25$^{th}$ and 95$^{th}$ percentiles was used with a growth rate of 0.20 mm/day (0.008 in/d) to estimate that combtooth blenny larvae were vulnerable to entrainment for a period of about 2.7 days.

The monthly estimates of proportional entrainment (*PE*) for combtooth blennies for the June 2004 – May 2005 period varied among surveys and ranged from 0 to 0.42268 using the actual flows and from 0 to 0.74564 using the maximum flows during the period (**Table 3-15**). The largest estimate was calculated for the January survey, but the largest proportion of the source population was present during the early June survey ($f_i$ = 0.299 or 29.9%). The values in the table were used to calculate a $P_M$ estimate of 0.1940 with a standard error of 0.1415 using the actual flows and an estimate of 0.2279 with a standard error of 0.1656 using the maximum flows.



**Table 3-15.** *ETM* data for combtooth blenny larvae based on actual and maximum daily cooling water flows. The *PE* estimates incorporate all three components of the source water shown in Equation 7.

| | Actual Flows | | Maximum Flows | | |
|---|---|---|---|---|---|
| **Survey Date** | ***PE* Estimate** | ***PE* Std. Err.** | ***PE* Estimate** | ***PE* Std. Err.** | $f_i$ |
| 10-Jun-04 | 0.05923 | 0.02255 | 0.07156 | 0.02716 | 0.29923 |
| 24-Jun-04 | 0.03048 | 0.01432 | 0.03786 | 0.01773 | 0.12245 |
| 6-Jul-04 | 0.03815 | 0.05152 | 0.04630 | 0.06220 | 0.13375 |
| 13-Aug-04 | 0.12766 | 0.12137 | 0.14813 | 0.14012 | 0.26395 |
| 23-Sep-04 | 0.15965 | 0.29549 | 0.17257 | 0.31857 | 0.05771 |
| 21-Oct-04 | 0.15218 | 0.37091 | 0.25027 | 0.60328 | 0.00319 |
| 18-Nov-04 | 0.09596 | 0.25147 | 0.15199 | 0.39395 | 0.00523 |
| 16-Dec-04 | 0.25382 | 0.32000 | 0.31413 | 0.39380 | 0.00035 |
| 13-Jan-05 | 0.42268 | 0.98886 | 0.74564 | 1.65570 | 0.00004 |
| 24-Feb-05 | 0 | 0 | 0 | 0 | 0.00001 |
| 23-Mar-05 | 0.08658 | 0.09164 | 0.12817 | 0.13460 | 0.00327 |
| 21-Apr-05 | 0.06001 | 0.09815 | 0.07043 | 0.11515 | 0.00885 |
| 19-May-05 | 0.06105 | 0.07780 | 0.08222 | 0.10456 | 0.10197 |
| $P_M$ | **0.1940** | | **0.2279** | | |
| Std. Error | 0.1415 | | 0.1656 | | |

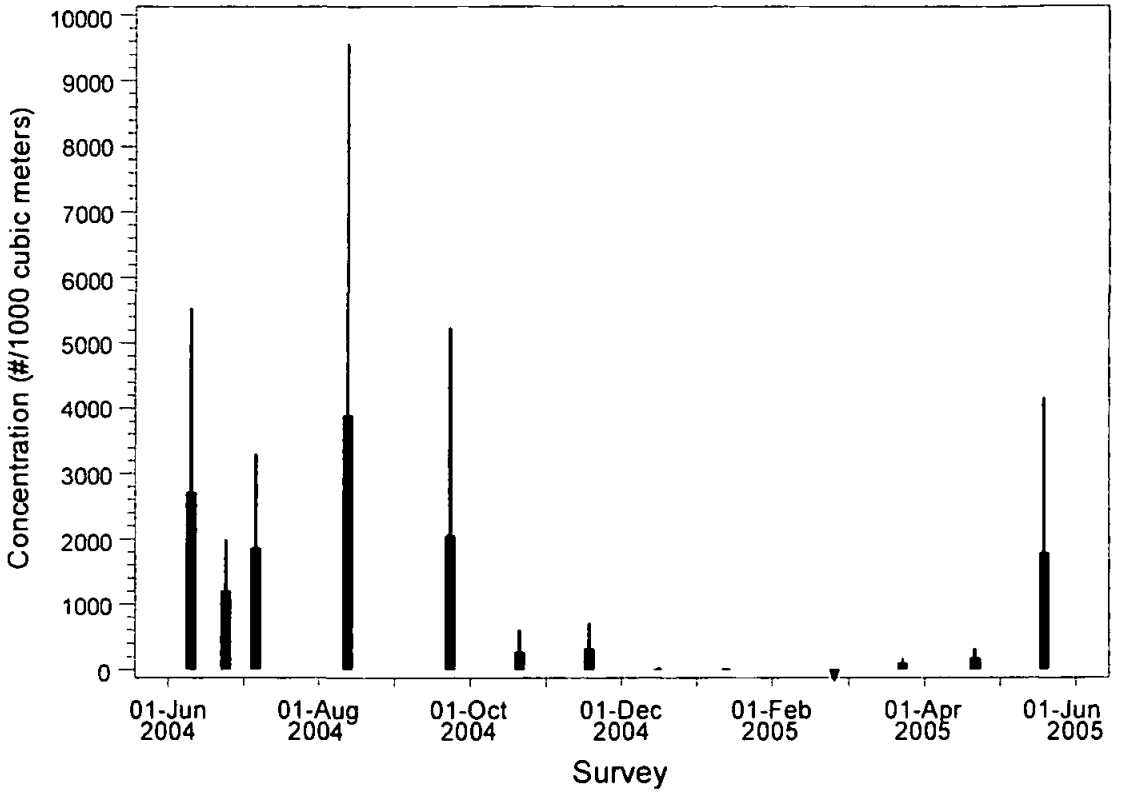



**Figure 3-10**. Comparison among surveys of mean concentration (#/1,000 $m^3$ [264.172 gal]) of combtooth blenny larvae at entrainment Station E1.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

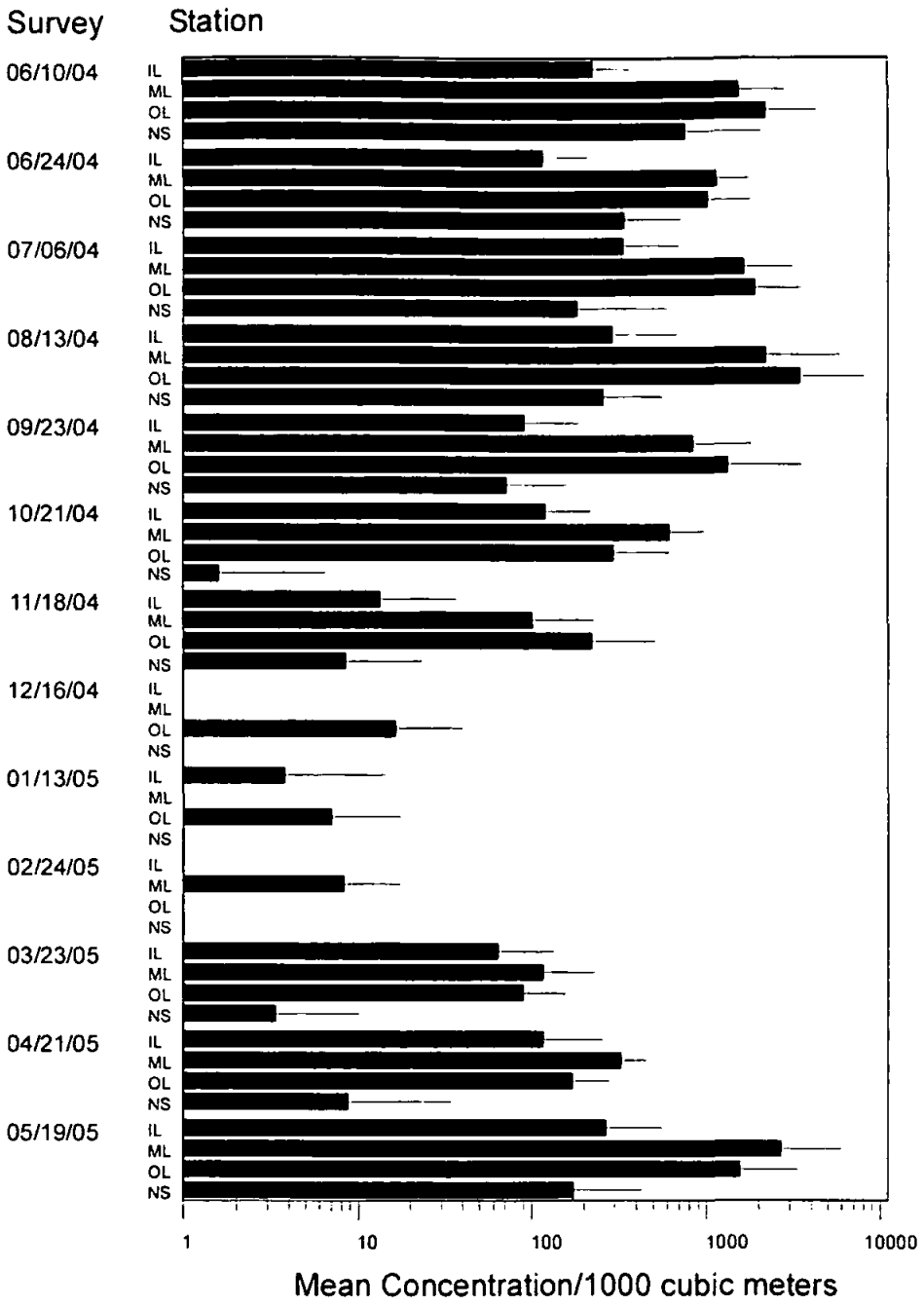



**Figure 3-11.** Mean concentration (#/1,000 $m^3$ [264,172 gal]) and standard error of combtooth blenny larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods.

*Note logarithmic scale for mean concentration.*

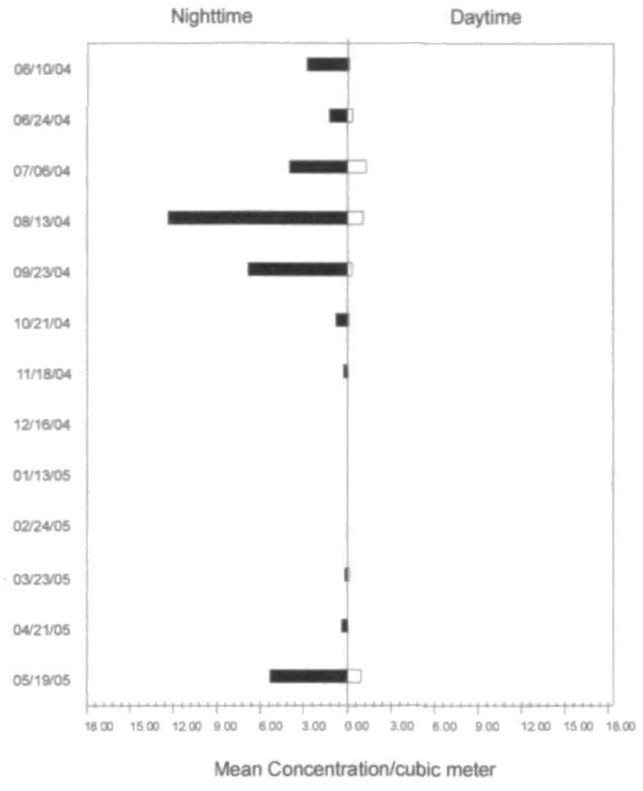



**Figure 3-12.** Mean concentration (#/1.0 $m^3$ [264 gal]) of combtooth blenny larvae at entrainment Station E1 during night (Cycle 3) and day (Cycle 1) sampling.

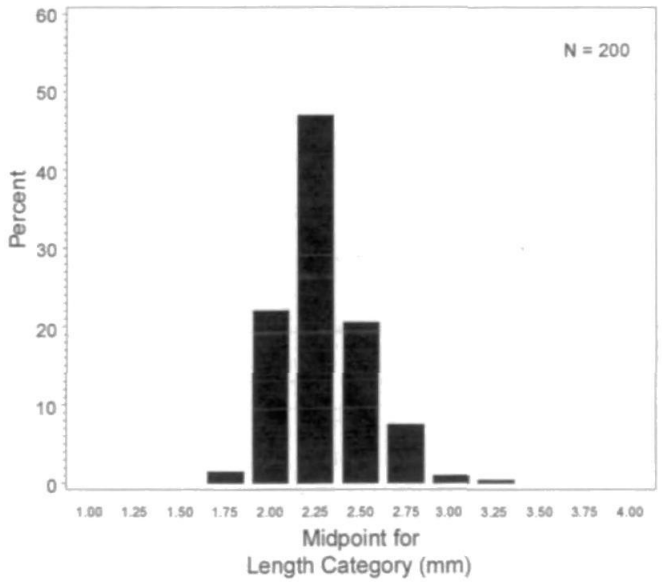
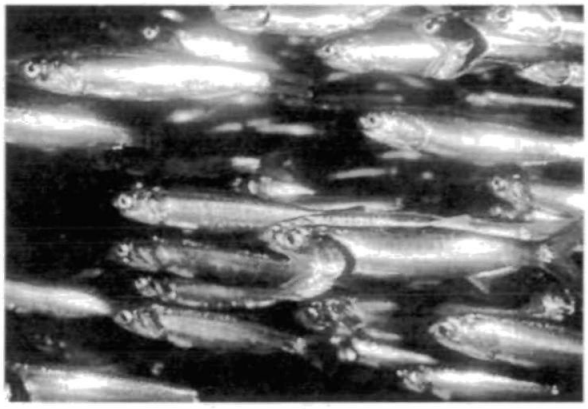



**Figure 3-13.** Length frequency of combtooth blenny larvae at entrainment and all source water stations combined. Data from sub-samples of all surveys in 2004–2005.

## 3.3.4 Anchovies (Engraulidae)



***Range***: British Columbia to southern Baja California

***Life History:***

- Size: to 248 mm (9.7 in.)
- Age at maturity: 1–2 yr
- Fecundity: multiple spawning at 6-10 day intervals peaking in late winter and spring, releasing from 2,700 to 16,000 eggs per batch;
- Life span: 4–5 yr (up to 7 yr)

***Habitat***: Pelagic from surface to depths of 310 m (1,017 ft)

***Fishery***: Commercial fishery for fish meal reduction, human consumption, and bait (live and frozen)

Three species of anchovy (Family Engraulidae) are known to inhabit AHL and EPS nearshore areas: northern anchovy (*Engraulis mordax*), deepbody anchovy (*Anchoa compressa*) and slough anchovy (*Anchoa delicatissima*). This analysis of entrainment effects on anchovies will concentrate on life history aspects of the northern anchovy because all of the Engraulid larvae collected that were large enough to be positively identified were northern anchovies. Almost half of the specimens could be identified only to the family level (Engraulidae) including very small specimens still in their recently-hatched yolk-sac stage and some specimens that were damaged to an extent that did not allow positive identification to the species level. No *Anchoa* larvae of any size were positively identified in the entrainment samples although adult deepbody anchovy were common in the EPS impingement samples.

Northern anchovy range from Cape San Lucas, Baja California to Queen Charlotte Island, British Columbia, and offshore to 480 km (298 miles) (Hart 1973). They are most common from Magdalena Bay, Baja California to San Francisco Bay and within 157 km (98 miles) of shore (Hart 1973; MBC 1987). Northern anchovy is one of four species of anchovies (Family Engraulidae) that occurs off California (Miller and Lea 1972). Deepbody anchovy and slough anchovy are found in the vicinity of EPS, while the anchoveta (*Cetengraulis mysticetus*) has been recorded from southern California but is considered rare north of Magdalena Bay, Baja California.

Three genetically distinct subpopulations are recognized for northern anchovy; (1) Northern subpopulation, from northern California to British Columbia; (2) Central subpopulation, off southern California and northern Baja California; and (3) Southern subpopulation, off southern Baja California (Emmett et al. 1991).

### 3.3.4.1 Life History and Ecology

The reported depth range of northern anchovy is from the surface to depths of 310 m (1,017 ft) (Davies and Bradley 1972). Juveniles are generally more common inshore and in estuaries. Eggs are elliptical and occur from the surface to about 50 m (164 ft), while larvae are found from the

surface to about 75 m (246 ft) in epipelagic and nearshore waters (Garrison and Miller 1982). Northern anchovy larvae feed on small planktonic organisms such as dinoflagellates, rotifers, and copepods (MBC 1987). Juveniles and adults feed mainly at night on zooplankton, including planktonic crustaceans and fish larvae (Fitch and Lavenberg 1971, Hart 1973, Allen and DeMartini 1983).

Northern anchovy spawn throughout the year off southern California, with peak spawning between February and May (Brewer 1978). Most spawning takes place within 100 km (62 miles) of shore (MBC 1987). On average, female anchovies off southern California spawn every 7–10 days during peak spawning periods, approximately 20 times per year (Hunter and Macewicz 1980, MBC 1987). Most spawning occurs at night and is completed by dawn (Hunter and Macewicz 1980). Anchovies are all sexually mature by age two, and the fraction of the population that is sexually mature at one year of age can range from 47 to 100% depending on the water temperature during development (Bergen and Jacobsen 2001). Love (1996) reported that they release 2,700–16,000 eggs per batch, with an annual fecundity of up to 130,000 eggs per year in southern California. Parrish et al. (1986) and Butler et al. (1993) stated that the total annual fecundity for one-year old females was 20,000-30,000 eggs, while a five-year old could release up to 320,000 eggs per year.

The northern anchovy egg hatches in two to four days, has a larval phase lasting approximately 70 days, and undergoes transformation into a juvenile at about 35-40 mm (Hart 1973, MBC 1987, Moser 1996). Larvae begin schooling at 11 to 12 mm SL (0.43 to 0.47 in) (Hunter and Coyne 1982). Northern anchovy reach 102 mm (4 in) in their first year, and 119 mm (4.7 in) in their second (Sakagawa and Kimura 1976). Larval survival is strongly influenced by the availability and density of appropriate phytoplankton species (Emmett et al. 1991). Storms and strong upwelling reduce larval food availability, and strong upwelling may transport larvae out of the Southern California Bight (Power 1986). However, strong upwelling may benefit juveniles and adults. Growth in length is most rapid during the first four months, and growth in weight is most rapid during the first year (Hunter and Macewicz 1980; PFMC 1983). They mature at 78 to 140 mm (3.1 to 5.5 in) in length, in their first or second year (Frey 1971, Hunter and Macewicz 1980). Maximum size is about 230 mm (9 in) and 60 g (2.1 ounces) (Fitch and Lavenberg 1971, Eschmeyer et al. 1983). Maximum age is about seven years (Hart 1973), though most live less than four years (Fitch and Lavenberg 1971).

Northern anchovy are random planktonic feeders, filtering plankton as they swim (Fitch and Lavenberg 1971). They feed mostly on larval crustaceans, but also on fish eggs and larvae (Fitch and Lavenberg 1971). Numerous fish and marine mammal species feed on northern anchovy. Elegant tern and California brown pelican reproduction is strongly correlated with the annual abundance of this species (Emmett et al. 1991). Temperatures above 25°C (77° Fare avoided by juveniles and adults (Brewer 1974).

### 3.3.4.2 Population Trends and Fishery

Northern anchovy are fished commercially for reduction (e.g., fish meal, oil, and paste) and live or frozen bait. This species is the most important bait fish in southern California, and is also used in Oregon and Washington as bait for sturgeon (*Acipenser* spp.), salmonids (*Oncorhynchus* spp.), and other species (Emmett et al. 1991). Northern anchovy populations increased dramatically following the collapse of the Pacific sardine (*Sardinops sagax*) fishery, suggesting competition between these two species (Smith 1972).

Estimates of the central subpopulation averaged about 325,679 metric tons (359,000 tons) from 1963 through 1972, then increased to over 1.54 metric tons (1.7 million tons) in 1974, then declined to 325,679 metric tons (359,000 tons) in 1978 (Bergen and Jacobsen 2001). Anchovy biomass in 1994 was estimated at 391,904 metric tons (432,000 tons). The stock is thought to be stable, and the size of the anchovy resource is largely dependent on natural influences such as ocean temperature. There have not been any landings of northern anchovy in San Diego County recorded in the PacFIN database since 1996 when 144,242 kg (318,000 lb) were landed. In 2004 there were 147,417 kg (325,000 lb) landed in the Los Angeles area, 2,753 metric tons (3,035 tons) in the Santa Barbara area, and 3,892 metric tons (4,290 tons) in the Monterey area for a total value of $750,000.

The anchovy live bait fishery is monitored by CDFG through the submission of Live Bait Logs. Live bait logs have been at different times either mandated by state law, or submitted to the CDFG on a voluntary basis. In the early 1990s sardine became more prevalent in the bait fishery, and quotas were imposed on their annual take pursuant to management efforts to recover the sardine population off California. In 1995, CDFG lifted quotas restricting the quantity of sardines that the live bait industry could harvest (PFMC 2005). The sardine population along the California Coast was increasing toward a "recovered" level, as anchovy showed a decline, and sardines became the preferred live bait over anchovy. With the sardine quota lifted, the level of scrutiny on the harvest of the live bait industry lessened. Accurate levels of harvest for northern anchovy alone are difficult to ascertain due to the multi-species nature of the live bait fishery.

The ratio of anchovy to sardine in the southern California live bait harvests shifts significantly as the populations of these two fish expand and contract over periods of years or decades (PFMC 2005). Much of the early reported harvest consisted of anchovy, following the collapse of the sardine fishery in the 1940s. Through the years 1994 to 2004 the proportion of anchovy in the total reported harvest ranged from a high of 58% in 1994 to a new low in 2004 of 5%. The proportion of sardine ranged from a low of 42% in 1994, to a new high of 95% in 2004.

### 3.3.4.3 Sampling Results

Engraulid larvae (predominantly northern anchovy) were the third most abundant taxon at the entrainment station with a mean concentration of 134 per 1,000 $m^3$ (264,172 gal) over all the surveys (**Table 3-5**). Although 61% of the engraulid larvae collected were positively identified as northern anchovy, the remaining specimens were newly hatched, or in some cases damaged to the extent that they could not be positively identified past the family level. Therefore, all



specimens were combined into the Engraulidae category for analysis. Their abundance was highly seasonal with over 90% of the larvae in the entrainment samples occurring from March through May (**Figure 3-14**). There was a broader temporal distribution of the larvae in the monthly source water samples than in the entrainment samples although peak abundances still tended to occur in March–May and lowest abundances in December (**Figure 3-15**). The nearshore station group generally had the highest concentrations of anchovy larvae compared to the lagoon stations. The number of larval anchovies collected during each entrainment and source water survey is presented in **Appendix E**.

The larvae tended to be more abundant in the day entrainment samples as compared to the night samples when comparing the concentrations in Cycle 1 (noon) to Cycle 3 (midnight) (**Figure 3-16**). The length frequency distribution of measured northern anchovy larvae show a distribution strongly skewed toward recently hatched larvae (**Figure 3-17**) based on the reported hatch length of 2–3 mm (0.08-0.12 in) (Moser 1996). There was a small proportion of larger larvae in the samples ranging from 5 to18 mm (0.19 to 0.7 in). A random sample of 200 anchovy larvae from the entrainment samples from all of the surveys ranged in size from 1.2 to 18.0 mm (0.05 to 0.7 in) with a mean size of approximately 2.9 mm (0.11 in).

### 3.3.4.4 Modeling Results

The following sections present the results for demographic and empirical transport modeling of CWS effects on Engraulidae (northern anchovy) larvae. Total annual entrainment at EPS was estimated at 120.7 million using measured cooling water flow and at 157.0 million larvae using maximum cooling water flow for the June 2004 through May 2005 period (**Table 3-6**).

#### *Fecundity Hindcasting (FH)*

The entrainment estimate for northern anchovy for the June 2004 through May 2005 sampling period was used to estimate the number of breeding females at the age of maturity needed to produce the estimated number of larvae entrained. Butler et al. (1993) modeled annual fecundity and egg and larval survivorship for northern anchovy. Their "best" estimate can be derived by fitting the range of mortality estimates from field collections to the assumption of a stable and stationary population age structure. Instantaneous daily mortality estimates from Butler et al. (1993) were converted, over their average stage durations, to finite survivorship rates for each developmental stage (**Table 3-16**). Fish at the mean age of entrainment include yolk sac, early and late stage larvae. Therefore, survival estimates for all three stages were combined to obtain a finite survival value of 0.47 up to the mean age at entrainment (2.1 days), which was calculated by dividing the difference between the mean length (2.9 mm [0.11 in]) and the value of the 25$^{th}$ percentile (2.1 mm [0.08 in]) using a larval growth rate of 0.41 mm $d^{-1}$ (0.02 in $d^{-1}$).



**Table 3-16.** Stage-specific life history parameters for northern anchovy (*Engraulis mordax*) modified from Butler et al. (1993). Z = instantaneous daily mortality; S = finite survival rate.

| Stage | $Z_{best}$ | Stage duration (d) | Age (d) | $S_{best}$ | $CV_{best}$ |
|---|---|---|---|---|---|
| Egg | 0.231 | 2.9 | | 0.512 | 0.142 |
| Yolk-sac larva | 0.366 | 3.6 | 6.5 | 0.093 | 0.240 |
| Early larva | 0.286 | 12 | 18.5 | 0.032 | 0.071 |
| Late larva | 0.0719 | 45 | 63.5 | 0.039 | 0.427 |
| Early juvenile | 0.0141 | 62 | 125.5 | 0.417 | 0.239 |
| Late Juvenile | 0.0044 | 80 | 205.5 | 0.703 | 0.033 |
| Pre-recruit | 0.0031 | 287 | 492.5 | 0.411 | 0.088 |

Clark and Phillips (1952) report age at sexual maturity as 1–2 years. Similarly, Leet et al. (2001) report that 47 to 100% of one-year olds may be mature in a given year while all are mature by two years. For modeling purposes we used a mid-value of 1.5 years. For longevity, Hart (1973) reports a value of seven years, but Leet et al. (2001) states that northern anchovy in the fished population rarely exceed four years of age. The survivorship table in **Table 3-17** was used to estimate an average annual fecundity of 163,090 over the seven-year period using the data presented in Butler et al. (1993).

**Table 3-17.** Survivorship table for adult northern anchovy (*Engraulis mordax*) from Butler et al. (1993) showing spawners ($L_x$) surviving at the start of age interval and numbers of eggs spawned annually ($M_x$). The total lifetime fecundity (TLF) was calculated as the sum of $L_xM_x$ divided by 1,000.

| Age (yr) | $L_x$ | $M_x$ | $L_xM_x$ |
|---|---|---|---|
| 1 | 1,000 | 22,500 | 22,500,000 |
| 2 | 468 | 93,500 | 43,800,000 |
| 3 | 216 | 195,000 | 42,000,000 |
| 4 | 102 | 280,000 | 28,600,000 |
| 5 | 48 | 328,000 | 15,700,000 |
| 6 | 22 | 328,000 | 7,210,000 |
| 7 | 10 | 328,000 | 3,280,000 |
| | | **TLF =** | **163,090** |

The estimated numbers of 1.5 year old adult female northern anchovies whose lifetime reproductive output was entrained through the EPS CWS for the June 2004 through May 2005 period was 3,089 based on actual flows and 4,019 based on design maximum flows (**Table 3-18**). The range of estimates based on the 90% confidence intervals show that the variation in our estimate of entrainment had much less of an effect on the variation of the FH estimate than the life history parameters used in the model.

**Table 3-18**. Results of *FH* modeling for anchovy larvae based on a) actual flows and b) maximum flows. The upper and lower estimates are based on a 90% confidence interval of the mean. *FH* estimates were also calculated using the upper and lower confidence estimates from the entrainment estimates.

| Parameter | Mean | Std. Error | *FH* Lower Estimate | *FH* Upper Estimate | *FH* Range |
|---|---|---|---|---|---|
| **a) Actual Flows** | | | | | |
| *FH* Estimate | **3,089** | 2,680 | 741 | 12,873 | 12,132 |
| Total Entrainment | 120,661,087 | 6,551,786 | 2,813 | 3,365 | 552 |
| **b) Maximum Flows** | | | | | |
| *FH* Estimate | **4,019** | 3,487 | 965 | 16,748 | 15,783 |
| Total Entrainment | 157,019,892 | 8,097,477 | 3,678 | 4,360 | 682 |

## *Adult Equivalent Loss (AEL)*

The parameters required for formulation of *AEL* estimates include larval survival from entrainment to settlement and survival from settlement to the average age of reproduction for a mature female. Instantaneous daily mortality estimates from Butler et al. (1993) were converted, over their average stage durations, to finite survivorship rates for each developmental stage (**Table 3-16**). The early larval stage survival was adjusted to the mean age at entrainment (2.1 days) and used to calculate a finite survival through age 12 d of 0.019 using the daily survival rates for yolk sac and early stage larvae. The other finite survival rates from Butler et al. (1993) were used to estimate the number of adults of age 3.03 years, the average age of a mature female in the population. The estimated number of adult northern anchovies equivalent to the number of larvae entrained through the EPS CWS for the sampling period was 15,456 based on actual flows and 20,113 based on design maximum flows (**Table 3-19**).



**Table 3-19**. Results of *AEL* modeling for anchovy larvae based on a) actual flows and b) maximum flows. The upper and lower estimates are based on a 90% confidence interval of the mean. *AEL* estimates were also calculated using the upper and lower confidence estimates from the entrainment estimates.

| Parameter | Mean | Std. Error | *AEL* Lower Estimate | *AEL* Upper Estimate | *AEL* Range |
|---|---|---|---|---|---|
| **a) Actual Flows** | | | | | |
| *AEL* Estimate | **15,456** | 17,897 | 2,300 | 103,840 | 101,540 |
| Total Entrainment | **120,661,087** | 6,551,786 | 14,075 | 16,836 | 2,761 |
| **b) Maximum Flows** | | | | | |
| *AEL* Estimate | **20,113** | 23,288 | 2,994 | 135,102 | 132,108 |
| Total Entrainment | **157,019,892** | 8,097,477 | 18,407 | 21,819 | 3,412 |

### *Empirical Transport Model (ETM)*

A larval growth rate of 0.41 mm/day (0.02 mm/day) for northern anchovies was estimated from Methot and Kramer (1979) and used with the difference in the lengths of the 25$^{th}$ and 95$^{th}$ percentiles of the measurements to estimate that the larvae were exposed to entrainment for a period of approximately 4.8 days. The duration of the planktonic egg stage, 2.9 d, was added to the period for the larvae to estimate a total period of exposure of 7.7 d.

The monthly estimates of proportional entrainment (*PE*) for anchovies for the June 2004 – May 2005 period ranged from 0 to 0.04037 using the actual flows and from 0 to 0.05437 using the maximum flow volumes (**Table 3-20**). The largest estimate was calculated for the May survey, but the largest proportion of the source population was present during the April survey ($f_i$ = 0.429 or 42.9%). The values in the table were used to calculate a $P_M$ estimate of 0.0035 with a standard error of 0.0025 using the actual flows and an estimate of 0.0045 with a standard error of 0.0032 using the maximum flows.

**Table 3-20.** *ETM* data for northern anchovy larvae based on actual and maximum daily cooling water flows. The *PE* estimates incorporate all three components of the source water shown in Equation 7.

| | Actual Flows | | Maximum Flows | | |
|---|---|---|---|---|---|
| **Survey Date** | ***PE* Estimate** | ***PE* Std. Err.** | ***PE* Estimate** | ***PE* Std. Err.** | $f_i$ |
| 10-Jun-04 | 0.00044 | 0.00054 | 0.00054 | 0.00065 | 0.02259 |
| 24-Jun-04 | 0.00048 | 0.00163 | 0.00059 | 0.00202 | 0.00187 |
| 6-Jul-04 | 0.00108 | 0.00206 | 0.00131 | 0.00248 | 0.02319 |
| 13-Aug-04 | 0.00070 | 0.00189 | 0.00081 | 0.00219 | 0.01464 |
| 23-Sep-04 | 0.00005 | 0.00017 | 0.00005 | 0.00018 | 0.03618 |
| 21-Oct-04 | 0.00008 | 0.00023 | 0.00014 | 0.00037 | 0.01157 |
| 18-Nov-04 | 0.00074 | 0.00305 | 0.00117 | 0.00477 | 0.01404 |
| 16-Dec-04 | 0 | 0 | 0 | 0 | 0.00011 |
| 13-Jan-05 | 0.00005 | 0.00032 | 0.00009 | 0.00053 | 0.00834 |
| 24-Feb-05 | 0.00070 | 0.00297 | 0.00117 | 0.00481 | 0.01230 |
| 23-Mar-05 | 0.00024 | 0.00050 | 0.00035 | 0.00072 | 0.42247 |
| 21-Apr-05 | 0.00042 | 0.00119 | 0.00049 | 0.00139 | 0.42965 |
| 19-May-05 | 0.04037 | 0.09825 | 0.05437 | 0.13220 | 0.00305 |
| $P_M$ | **0.0035** | | **0.0045** | | |
| Std. Error | 0.0025 | | 0.0032 | | |

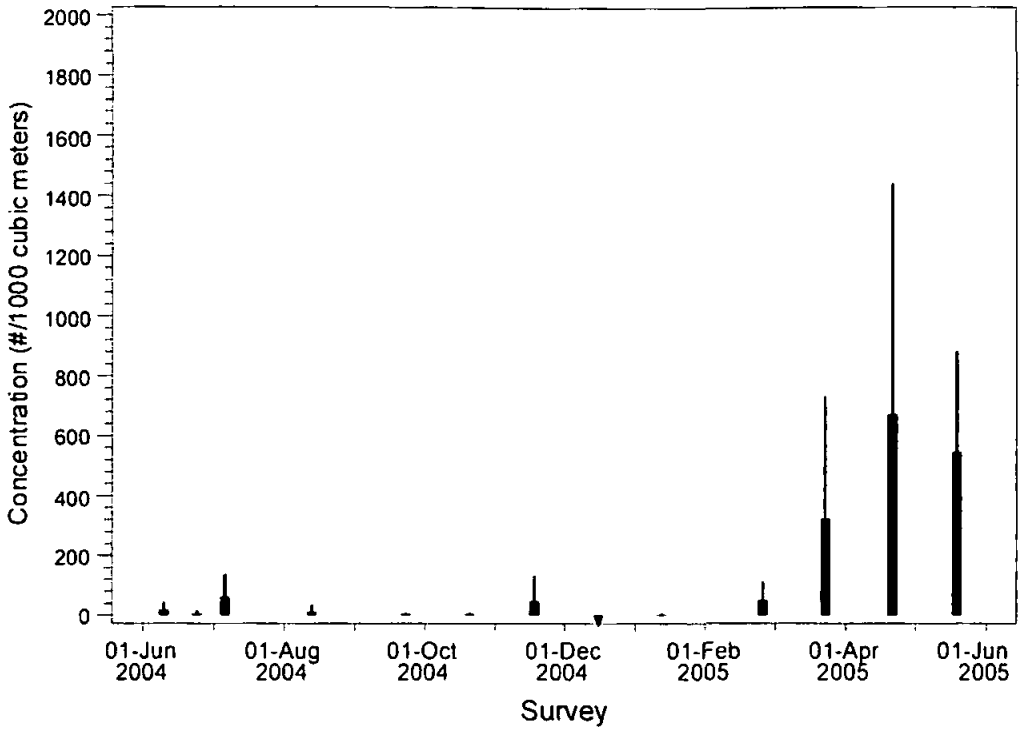



**Figure 3-14**. Comparison among surveys of mean concentration (#/1,000 $m^3$ [264,172 gal]) of anchovy larvae at entrainment Station E1.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

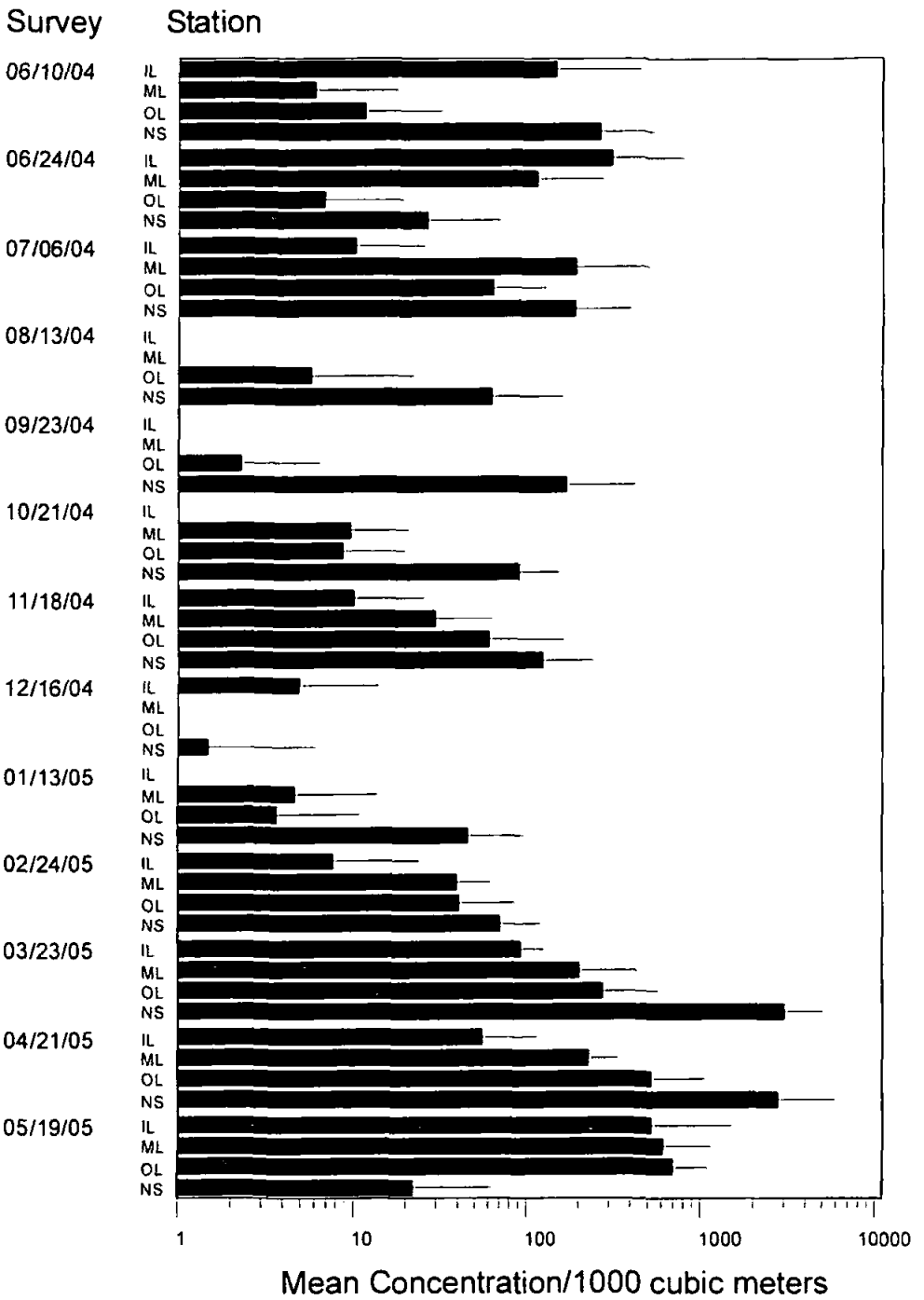



**Figure 3-15.** Mean concentration (#/1,000 $m^3$ [264,172 gal]) and standard error of anchovy larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods.

*Note logarithmic abundance scale.*

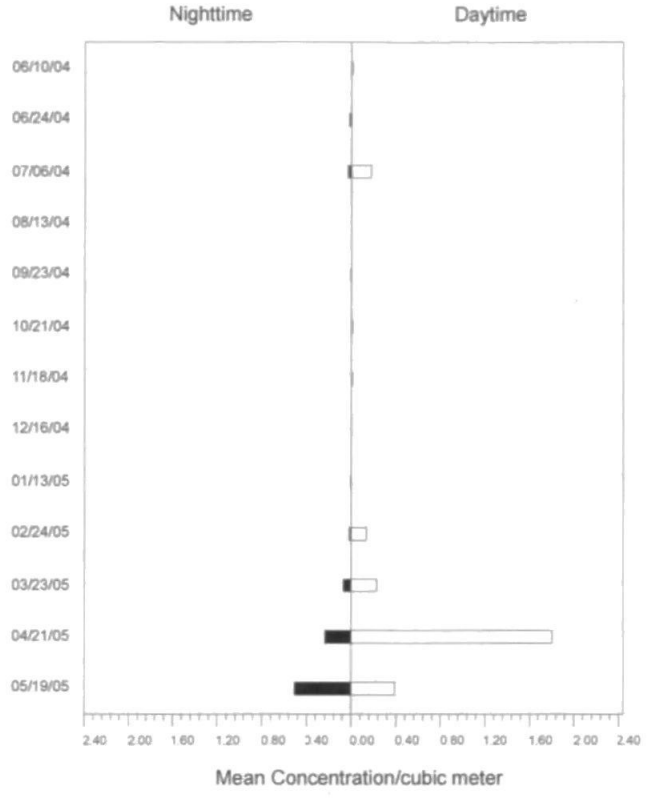



**Figure 3-16.** Mean concentration (#/1.0 $m^3$ [264 gal]) of anchovy larvae at entrainment Station E1 during night (Cycle 3) and day (Cycle 1) sampling.

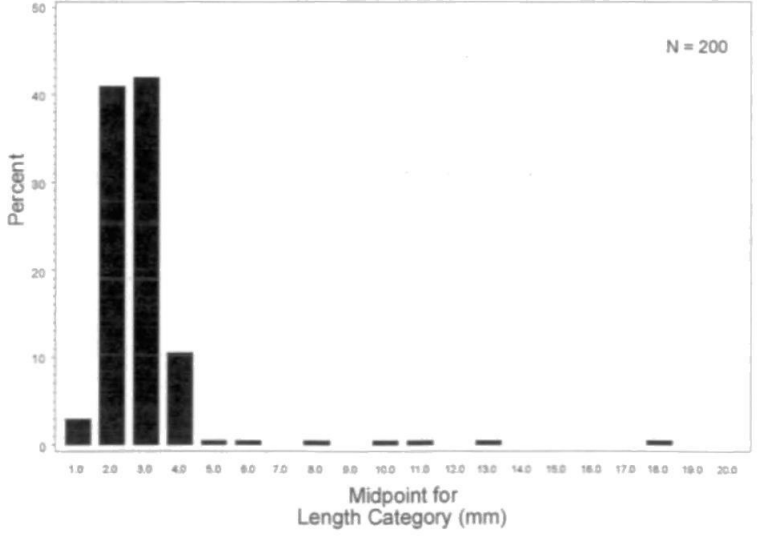



**Figure 3-17.** Length frequency of anchovy larvae at entrainment Station E1. Data from sub-samples of all surveys in 2004–2005.

## 3.3.5 Garibaldi (*Hypsypops rubicundus*)



*Jay Carroll*

***Range***: Monterey Bay, California, to southern Baja California and Guadalupe Island, Mexico.

***Life History***:

- Size up to 38.1 cm TL (15 in)
- Age at first maturity 3-6 yr in males and 6 yr in females
- Life span to 17 yr (29 yr in captivity)
- Spawns in spring and summer primarily in bays and shallow rocky areas; demersal, adhesive eggs with fecundity of 15,000-88,000 eggs per female

***Habitat***: Occurs over rocky bottoms in clear water, often near crevices, small caves, and in kelp; to 29 m (95 ft).

***Fishery***: None; protected by California state law.

Garibaldi (*Hypsypops rubicundus*) ranges from Monterey Bay, California to southern Baja California and Guadalupe Island (off northern central Baja California) in Mexico, but is not abundant north of Santa Barbara (Fitch and Lavenberg 1975). They are one of two common species of damselfishes (Family Pomacentridae) found off southern California, the other being the blacksmith (*Chromis punctipinnis*). Garibaldi is the California state marine fish and is fully protected by the State.

### 3.3.5.1 Life History and Ecology

Garibaldi occurs over rocky bottoms in clear water, often near crevices and small caves, from the intertidal zone (as juveniles) to depths of 29 m (95 ft). They occur on the outer coast, around islands, and in protected bays and harbors (Fitch and Lavenberg 1975), typically as individuals (adults defend a territory all year) but occasionally in loose aggregations. They attain a maximum length up to 38.1 cm TL (15 in) although few are larger than 30.5 cm (12 in). Males are larger than females at a given age (Limbaugh 1964). Males begin to mature at about 3 yr but females may not reproduce until age 5–6 yr.

Garibaldi spawn from March through October (Love 1996), and the female deposits demersal adhesive eggs in a nest that the male has prepared by clearing off all growth except calcareous tubes and filamentous red algae. Males defend algal nests within permanent territories (10–15 $m^2$ [107–161 $ft^2$]) on which females deposit eggs (Clarke 1970). Males that guard nesting areas with sparse algal cover tend to be less likely to court passing females (Sikkel 1995). DeMartini et al. (1994) measured mean batch fecundity at 12,546 eggs with an average of 35 eggs per gram of body weight. Some nests may contain up to 190,000 eggs deposited by several females (Fitch and Lavenberg 1975). Female garibaldi in southern California were estimated to spawn about 24 times during their 144-day spawning season (DeMartini et al. 1994). Females preferentially approach nests with eggs in the early stages of development prior to or in the absence of male courtship and are more likely to spawn in such nests than in empty nests or nests with only eggs

in the advanced stages of development (Sikkel 1989). Eggs in the early stages of development are bright yellow and turn gray as development proceeds. Eggs hatch in 12–23 days (Sikkel 1989) depending on temperature. Larvae are primarily neustonic, initially ca. 2.2 mm (0.09 in) in length and attain flexion at ca 3.5 mm (0.14 in) (Moser 1996). Transformation occurs at a length of ca 5–10 mm (0.19–0.39 in) and settlement has been noted to occur at approximately 20 mm SL (0.79 in). Larval duration ranges from 18–22 days (mean of 20 days) based on daily incremental marks on otoliths in recently settled individuals (Wellington and Victor 1989).

As juveniles garibaldi feed on planktonic crustaceans such as copepods, amphipods, and isopods (Clarke 1970). As adults they are typically carnivorous feeding a variety of invertebrates including sponges, sea anemones, bryozoans, worms, crustaceans, clams and mussels, snail eggs, and their own eggs. Field observations and experiments during the mating phase show that brood-guarding males usually cannibalize older clutches if the older eggs are exposed to empty nest space (Sikkel 1994a). Males nearly always cannibalize the entire brood when they receive only a single clutch, and the probability of cannibalism of last clutches increases with brood age (Sikkel 1994b). Garibaldi are only active during the day and shelter in holes in the reef at night (Clarke 1970). Juvenile garibaldi are preyed upon by larger fishes such as kelp bass, and adult garibaldi are preyed upon by sharks, giant sea bass, moray eels, and sea lions.

### 3.3.5.2 Sampling Results

Garibaldi larvae ranked as the fourth most abundant species of larvae entrained with an average concentration across all surveys of 41 per 1,000 $m^3$ (264,172 gal), but comprised less that 1% of all entrained larvae (**Table 3-5**). Garibaldi larvae were very seasonal in abundance at all stations and were present only from April through August (**Figure 3-18**). The greatest abundance at the entrainment station occurred during early June with mean concentrations of 275 larvae per 1,000 $m^3$ (264,172 gal). Source water larvae were typically most abundant at the Middle and Outer Lagoon sampling stations, but also occurred in the Inner Lagoon and at the nearshore stations (**Figure 3-19**). Larvae were significantly more abundant in the nighttime samples than in the daytime samples (**Figure 3-20**). A sample of 198 garibaldi larvae from all surveys ranged in size from 1.9 to 3.3 mm (0.075 to 0.13 in) with a mean size of approximately 2.6 mm (0.1 in) (**Figure 3-21**).

### 3.3.5.3 Modeling Results

The following section present the results for empirical transport modeling of CWS effects on garibaldi larvae. Total annual entrainment at EPS was estimated at 29 million using measured cooling water flows and at 36 million larvae using maximum cooling water flows for the June 2004 through May 2005 period (**Table 3-6**). Life history information on garibaldi was insufficient to parameterize the *AEL* or *FH* models.

#### *Empirical Transport Model (ETM)*

A larval growth rate of 0.29 mm/day (0.01 in/day) for garibaldi was estimated from Wellington and Victor (1989) and used with the difference in the lengths of the 25$^{th}$ (2.4 mm) and 95$^{th}$

percentiles (3.1 mm [0.12 in]) of the measurements to estimate that the larvae were exposed to entrainment for a period of approximately 2.2 days.

Garibaldi larvae were absent from entrainment samples from September through March. The monthly estimates of proportional entrainment (*PE*) for garibaldi for the June 2004 – May 2005 period ranged from 0 to 0.14528 using the actual flows and from 0 to 0.19366 using maximum flows (**Table 3-21**). The largest estimate was calculated for the April survey using actual flows and for the May survey using the maximum flows, but the largest proportion of the source population was present during the first survey in June 2004 ($f_i$ = 0.625 or 62.5%). Garibaldi larvae were present in six of the 12 surveys. The values in the table were used to calculate a $P_M$ estimate of 0.1442 with a standard error of 0.3115 using actual flows and an estimate of 0.1753 with a standard error of 0.3777 using the maximum flows.

**Table 3-21**. *ETM* data for garibaldi larvae based on actual and maximum daily cooling water flows. The *PE* estimates incorporate all three components of the source water shown in Equation 7.

| | Actual Flows | | Maximum Flows | | |
|---|---|---|---|---|---|
| **Survey Date** | ***PE* Estimate** | ***PE* Std. Err.** | ***PE* Estimate** | ***PE* Std. Err.** | $f_i$ |
| 10-Jun-04 | 0.06453 | 0.03775 | 0.07797 | 0.0455 | 0.62469 |
| 24-Jun-04 | 0.05705 | 0.02888 | 0.07085 | 0.03577 | 0.05168 |
| 6-Jul-04 | 0.03231 | 0.04608 | 0.03922 | 0.05558 | 0.17163 |
| 13-Aug-04 | 0.11489 | 0.12829 | 0.13331 | 0.14847 | 0.04004 |
| 23-Sep-04 | 0 | 0 | 0 | 0 | 0 |
| 21-Oct-04 | 0 | 0 | 0 | 0 | 0 |
| 18-Nov-04 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec-04 | 0 | 0 | 0 | 0 | 0 |
| 13-Jan-05 | 0 | 0 | 0 | 0 | 0 |
| 24-Feb-05 | 0 | 0 | 0 | 0 | 0 |
| 23-Mar-05 | 0 | 0 | 0 | 0 | 0 |
| 21-Apr-05 | 0.14528 | 0.3425 | 0.17053 | 0.40196 | 0.01825 |
| 19-May-05 | 0.14379 | 0.17011 | 0.19366 | 0.22888 | 0.09371 |
| **$P_M$** | **0.1442** | | **0.1753** | | |
| Std. Error | 0.1455 | | 0.1764 | | |

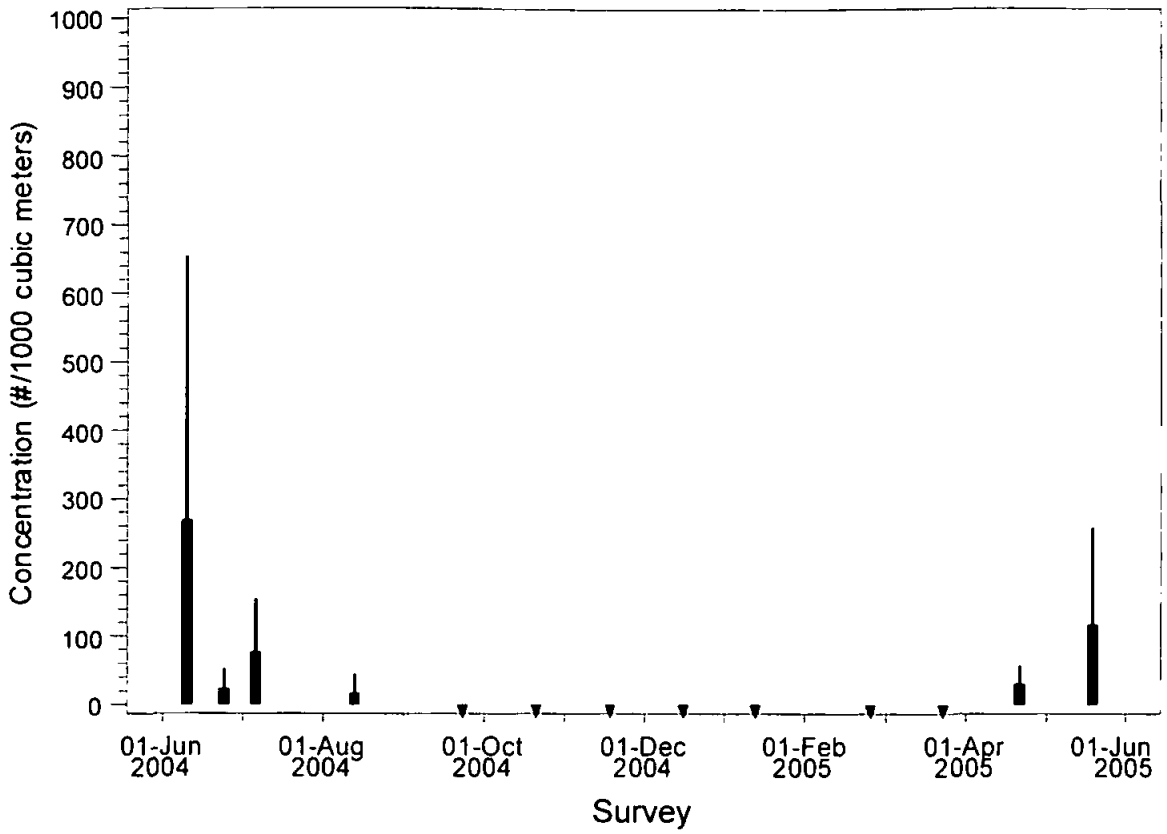



**Figure 3-18**. Comparison among surveys of mean concentration (#/1,000 $m^3$) of garibaldi larvae at entrainment Station E1.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

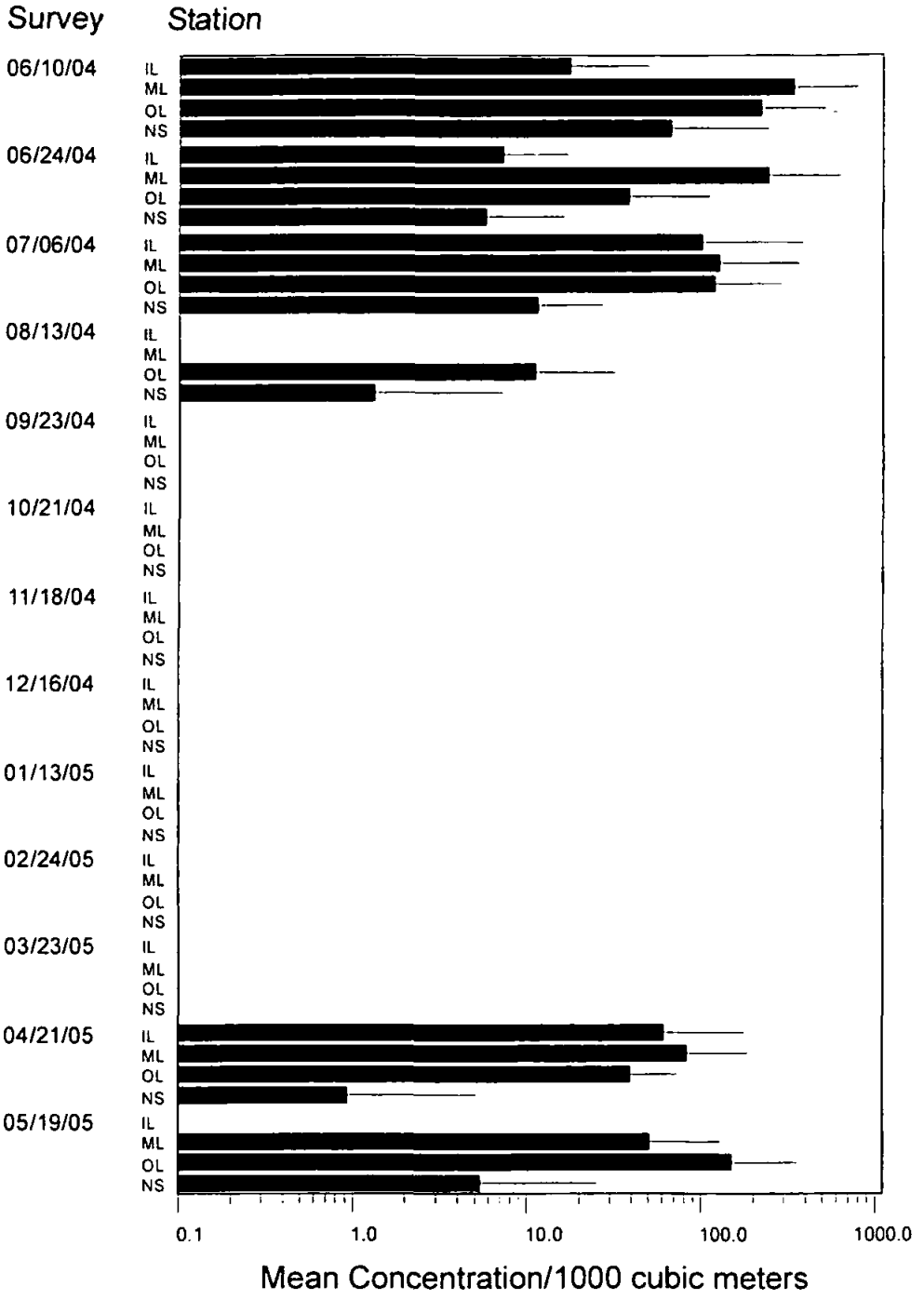



**Figure 3-19.** Mean concentration (#/1,000 $m^3$]) and standard error of garibaldi larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods.

*Note logarithmic abundance scale.*

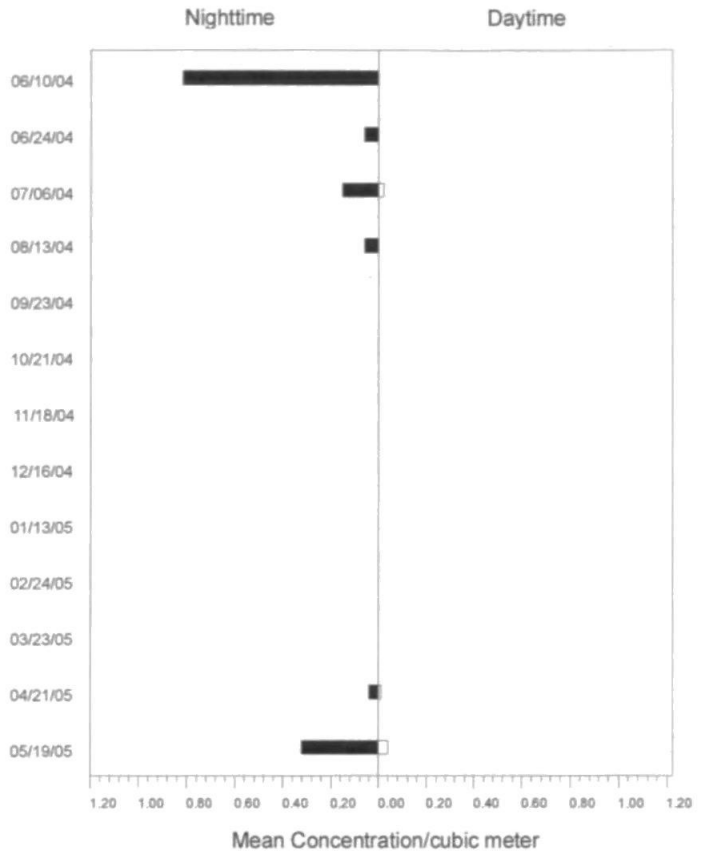



**Figure 3-20.** Mean concentration (#/1.0 $m^3$ [264 gal]) of garibaldi larvae at entrainment Station E1 during night (Cycle 3) and day (Cycle 1) sampling.

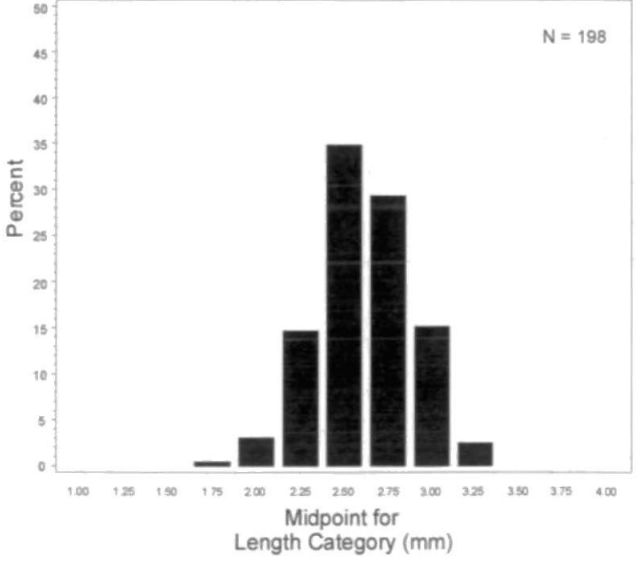



**Figure 3-21.** Length frequency of garibaldi larvae at entrainment Station E1. Data from sub-samples of all surveys in 2004–2005.

## 3.3.6 White croaker (*Genyonemus lineatus*)

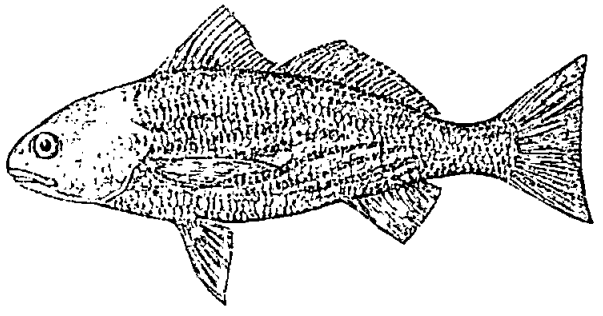


*Illustration from NOAA*

***Range***: British Columbia to southern Baja California

***Life History***:

- Size up to 41 cm SL (16.25 in)
- Age at maturity 1–4 yr
- Life span to 13 yr
- Spawns throughout the year with a peak season in January–March; multiple broadcast spawners with external fertilization; batch fecundity of 15-80 thousand eggs per female

***Habitat***: Sand and mud bottoms over the open coast from the surf zone to depths of 238 m (781 ft).

***Fishery***: Sport and commercial fishery.

White croaker (*Genyonemus lineatus*) range from Magdalena Bay, Baja California, north to Vancouver Island, British Columbia (Miller and Lea 1972). They are one of eight species of croakers (Family Sciaenidae) found off California. The other croakers include: white seabass (*Atractoscion nobilis*), black croaker (*Cheilotrema saturnum*), queenfish (*Seriphus politus*), California corbina (*Menticirrhus undulatus*), spotfin croaker (*Roncador stearnsii*), yellowfin croaker (*Umbrina roncador*), and shortfin corvina (*Cynoscion parvipinnis*). All but shortfin corvina are known to occur in AHL.

### 3.3.6.1 Life History and Ecology

The reported depth range of white croaker is from near the surface to depths of 238 m (781 ft) (Love et al. 2005); however, in southern California, Allen (1982) found *Genyonemus* over soft bottoms between 10 and 130 m (33 and 427 ft), and it was collected most frequently at 10 m (33 ft). It is nocturnally active, and is considered a benthic searcher that feeds on a wide variety of benthic invertebrate prey. Adults feed on polychaetes and crustaceans, while juveniles feed during the day in midwater on zooplankton (Allen 1982).

White croakers are oviparous broadcast spawners. They mature between about 130 and 190 mm TL (5.1 and 7.5 in), between their first to fourth year; approximately 50% spawn at age one year (Love 1996). About one-half of males mature by 140 mm TL (5.5 in), and one-half of females by 150 mm TL (5.9 in), and all fish are mature by 190 mm TL (7.5 in) in their third to fourth year (Love et al. 1984). Off Long Beach, white croaker spawn primarily from November through August, with peak spawning from January through March (Love et al. 1984). However, some spawning can occur year-round. Batch fecundities ranged from about 800 eggs in a 155 mm (6.1 in) female to about 37,200 eggs in a 260 mm (10.2 in) female, with spawning taking place as often as every five days (Love et al. 1984). In their first and second years, females spawn for three months for a total of about 18 times per season. Older fish spawn for about four months and about 24 times per season (Love et al. 1984). Some older fish may spawn for seven months. The nearshore waters from Redondo Beach to Laguna Beach are considered an important

spawning center for this species (Love et al. 1984). A smaller spawning center occurs off Ventura.

Newly hatched white croaker larvae are 1–2 mm SL (0.04-0.08 in) and not well developed (Watson 1982). Larvae are principally located within 4 km (2.5 miles) from shore, and as they develop tend to move shoreward and into the epibenthos (Schlotterbeck and Connally 1982). Murdoch et al. (1989b) estimated a daily larval growth rate of 0.20 mm/day (0.008 in/day). Maximum reported size is 414 mm (16.3 in) (Miller and Lea 1972), with a life span of 12–15 years (Frey 1971, Love et al. 1984). White croakers grow at a fairly constant rate throughout their lives, though females increase in size more rapidly than males from age 1 (Moore 2001). No mortality estimates are available for any of the life stages of this species.

White croaker are primarily nocturnal benthic feeders, though juveniles may feed in the water column during the day (Allen 1982). Important prey items include polychaetes, amphipods, shrimps, and chaetognaths (Allen 1982). In Outer Los Angeles Harbor, Ware (1979) found that important prey items included polychaetes, benthic crustaceans, free-living nematodes, and zooplankton. Younger individuals feed on holoplankonic crustaceans and polychaete larvae. White croaker may move offshore into deeper water during winter months (Allen and DeMartini 1983); however, this pattern is apparent only south of Redondo Beach (Herbinson et al. 2001).

### 3.3.6.2 Population Trends and Fishery

Annual relative abundance of white croaker in impingement samples at southern California power plants showed decreases during the strong El Niño events of 1982-83, 1986-87, and 1997-98 as compared with non-El Niño years (Herbinson et al. 2001).

White croaker is an important constituent of the commercial and sport fisheries of California. Prior to 1980, most of the croaker catch was in southern California. However, since 1980, the majority of the commercial catch occurred in central California, and has been attributed to the entrance of Southeast Asian refugees into the fishery (Moore and Wild 2001). Most of the recreational catch is still in southern California from piers, breakwaters, and private boats.

Before 1980, statewide white croaker landings averaged 685,000 lb annually, exceeding 1,000,000 lb in several years (Moore and Wild 2001). High landings in 1952 corresponded with the collapse of the Pacific sardine fishery. Since 1991, landings averaged 461,000 lb and steadily declined to an all-time low of 142,500 lb in 1998. State-wide landings by recreational fishermen aboard commercial passenger fishing vessels (CPFVs) averaged about 12,000 fish per year from 1990 to 1998, with most of the catch in southern California. Most white croaker are caught by gillnet and hook-and-line (Moore and Wild 2001). In 2005 there was a reported 0.33 MT landed in San Diego County for a value of $1,022 (PacFIN database).

### 3.3.6.3 Sampling Results

White croaker was the fifteenth most abundant taxon in the entrainment samples with a mean concentration of 7.0 larvae per 1,000 $m^3$ (264,172 gal), and comprised only about 0.2% of all of



the larvae collected at the entrainment station (**Table 3-5**). They were most abundant at the nearshore stations ranking fourth overall with a mean concentration of 64.7 larvae per 1,000 $m^3$ (264,172 gal) (**Table 3-7**). Peaks in abundance occurred during February and they were absent in the June and July surveys at the entrainment station (**Figure 3-22**). There was no consistent difference between daytime and nighttime abundance in the entrainment samples. Monthly concentrations in the source water were typically greatest at the nearshore stations with a gradient of declining abundance toward the Inner Lagoon (**Figure 3-23**). The number of larval white croaker collected during each entrainment and source water survey is presented in **Appendix E**.

The length frequency distribution of the 44 white croaker larvae collected from the entrainment samples (**Figure 3-24**) was skewed toward recently-hatched larvae based on the reported hatch length of 1–2 mm (0.04-0.08 in) (Watson 1982). The mean, maximum, and minimum sizes for the measurements were 2.0, 4.1, and 1.2 mm (0.08, 0.16, and 0.05 in), respectively.

### 3.3.6.4 Modeling Results

The following section presents the results for empirical transport modeling of CWS effects on white croaker larvae. No age-specific estimates of survival for later stages of development were available from the literature for white croaker, therefore no estimates of *FH* or *AEL* were calculated. Total annual entrainment at EPS was estimated at 6.92 million using measured cooling water flow and at 9.47 million larvae using maximum cooling water flow for the June 2004 through May 2005 period (**Table 3-6**).

#### *Empirical Transport Model (ETM)*

Only 44 white croaker larvae were collected and measured from the entrainment samples. In order to obtain a larger sample size to describe the sizes of entrained larvae, length frequency data on white croaker from entrainment samples collected for the Huntington Beach Generating Station between September 2003 and August 2004 (MBC and Tenera Environmental 2004) were used in estimating the period that the larvae are exposed to entrainment. The 25$^{th}$ (2.1 mm [0.08 in]) and 95$^{th}$ (7.0 mm [0.28 in]) percentile values from the measurements were used with a larval growth rate of 0.20 mm/day (0.008 in/day) from Murdoch et al. (1989b) to estimate that the larvae were exposed to entrainment for a period of approximately 24.3 days. The duration of the planktonic egg stage, 2.2 d, was added to the period for the larvae to estimate a total period of exposure of 26.5 d.

The monthly estimates of proportional entrainment (*PE*) for white croaker for the June 2004 – May 2005 period ranged from 0 to 0.00072 using the actual flows and from 0 to 0.00084 using the maximum flows (**Table 3-22**). The largest estimate was calculated for the April survey, but the largest proportion of the source population was present during the September survey ($f_i$ = 0.354 or 35.4%). The results show that while white croaker larvae were present in the source water during all of the surveys they only were collected during eight of the entrainment surveys. The values in the table were used to calculate a $P_M$ estimate of 0.0029 with a standard error of

0.0025 and an estimate of 0.0039 with a standard error of 0.0034 using the maximum flow volumes.

**Table 3-22.** *ETM* data for white croaker larvae based on actual and maximum daily cooling water flows. The *PE* estimates incorporate all three components of the source water shown in Equation 7.

| | Actual Flows | | Maximum Flows | | |
|---|---|---|---|---|---|
| **Survey Date** | ***PE* Estimate** | ***PE* Std. Err.** | ***PE* Estimate** | ***PE* Std. Err.** | $f_i$ |
| 10-Jun-04 | 0 | 0 | 0 | 0 | 0.00001 |
| 24-Jun-04 | 0 | 0 | 0 | 0 | 0.00187 |
| 6-Jul-04 | 0 | 0 | 0 | 0 | 0.00989 |
| 13-Aug-04 | 0.00028 | 0.00172 | 0.00033 | 0.00199 | 0.02103 |
| 23-Sep-04 | 0.00006 | 0.00055 | 0.00007 | 0.00059 | 0.35414 |
| 21-Oct-04 | 0 | 0 | 0 | 0 | 0.03043 |
| 18-Nov-04 | 0.00007 | 0.00087 | 0.00012 | 0.00137 | 0.07183 |
| 16-Dec-04 | 0.00032 | 0.00519 | 0.00040 | 0.00636 | 0.00574 |
| 13-Jan-05 | 0.00016 | 0.00082 | 0.00029 | 0.00138 | 0.04775 |
| 24-Feb-05 | 0.00017 | 0.00068 | 0.00028 | 0.00111 | 0.13805 |
| 23-Mar-05 | 0.00004 | 0.00022 | 0.00005 | 0.00032 | 0.26954 |
| 21-Apr-05 | 0.00072 | 0.00271 | 0.00084 | 0.00318 | 0.04449 |
| 19-May-05 | 0 | 0 | 0 | 0 | 0.00523 |
| $P_M$ | **0.0029** | | **0.0039** | | |
| Std. Error | 0.0025 | | 0.0034 | | |

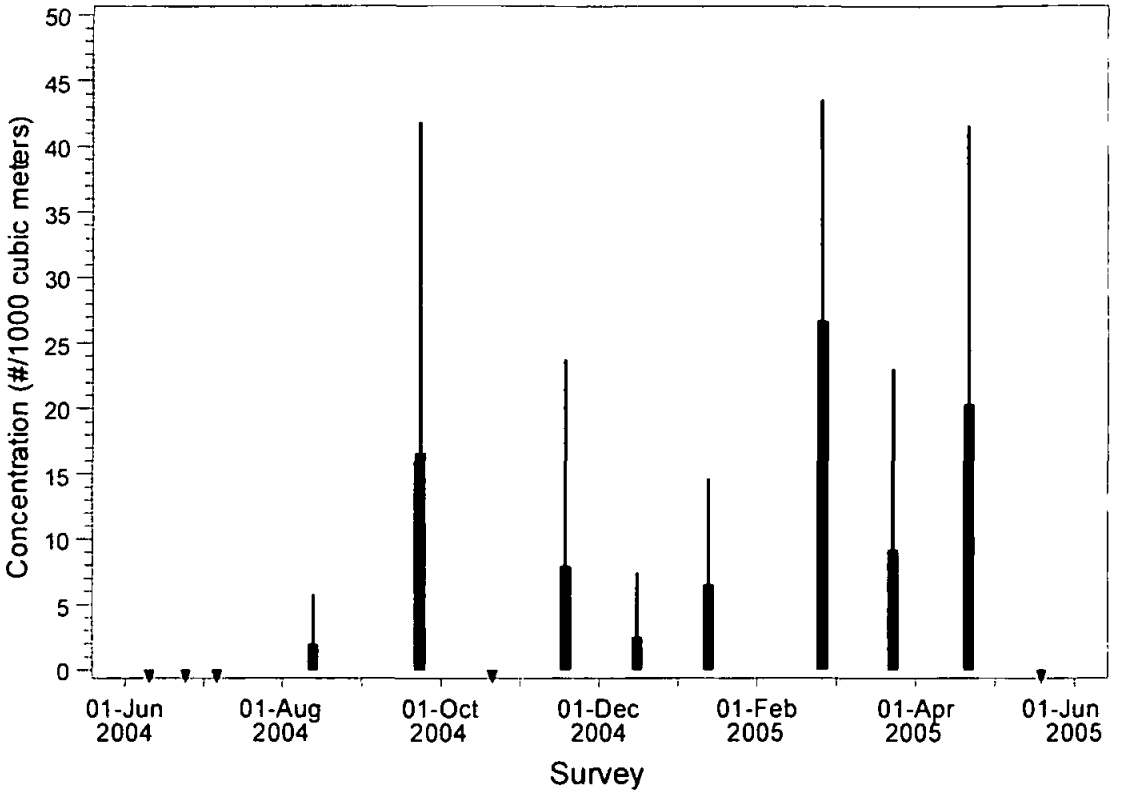



**Figure 3-22**. Comparison among surveys of mean concentration (#/1,000 $m^3$ [264.172 gal]) of white croaker larvae at entrainment Station E1.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

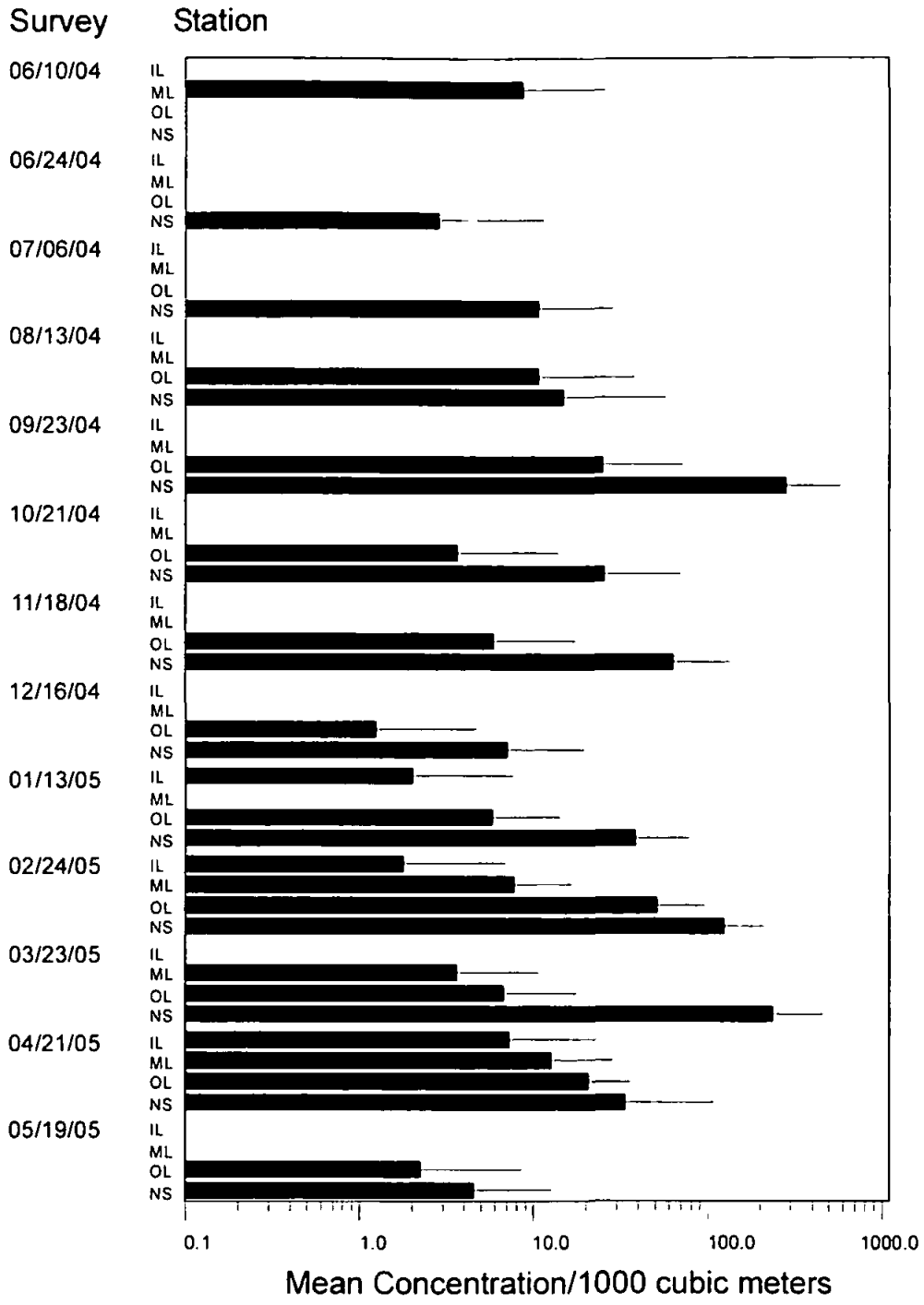



**Figure 3-23.** Mean concentration (#/1,000 $m^3$ [264,172 gal]) and standard error of white croaker larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods.

*Note logarithmic abundance scale.*

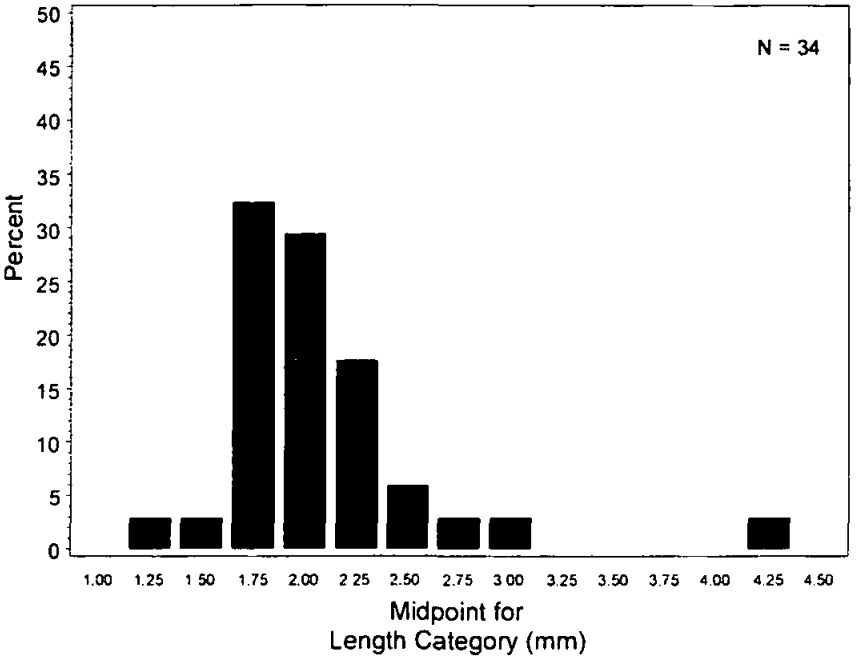
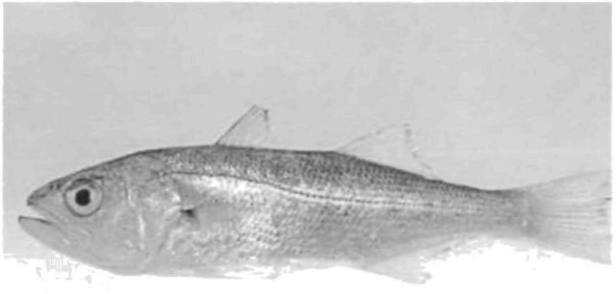



**Figure 3-24.** Length frequency of white croaker larvae at entrainment Station E1. Data from sub-samples of all surveys in 2004–2005.

## 3.3.7 Queenfish (*Seriphus politus*)



*Milton Love*

***Range***: British Columbia to southern Gulf of California

***Life History***:

- Size up to 30.5 cm TL (12 in)
- Age at maturity from 1–2 yrs
- Spawns multiple times March through October; pelagic eggs with annual fecundity ranging from 60,000 to 2.3 million eggs.

***Habitat***: Over sand and mud bottoms in bays and outer coast from the surf zone to depths of 181 m (594 ft).

***Fishery***: Recreational and commercial fisheries; recreational fishery landings averaged 311,000 per year 2000–2004.

Queenfish (*Seriphus politus*) range from Vancouver Island, British Columbia to southern Gulf of California (Love et al. 2005). Queenfish are common in southern California, but rare north of Monterey. They are one of eight species of croaker or 'drums' (Family Sciaenidae) found off California. The other croakers include: white seabass (*Atractoscion nobilis*), black croaker (*Cheilotrema saturnum*), white croaker (*Genyonemus lineatus*), California corbina (*Menticirrhus undulatus*), spotfin croaker (*Roncador stearnsii*), yellowfin croaker (*Umbrina roncador*), and shortfin corvina (*Cynoscion parvipinnis*). All but shortfin corvina are known to occur in AHL.

### 3.3.7.1 Life History and Ecology

The reported depth range of queenfish is from the surface to depths of about 181 m (594 ft) (Love et al. 2005). In southern California, Allen (1982) found queenfish mainly over soft bottoms at 10–70 m (33–230 ft), with highest abundance occurring at the 10 m stratum. Queenfish form dense, somewhat inactive, schools close to shore during the day, but disperse to feed in midwater after sunset (Hobson and Chess 1976). In a study of queenfish off northern San Diego County, DeMartini et al. (1985) found that adults of both sexes made onshore and offshore migrations, but immature fish generally remained within 2.5 km (1.5 miles) of shore at night. Queenfish are active throughout the night, feeding several meters off the seafloor either in small schools or individually.

Queenfish mature at 10.5–12.7 cm TL (4.1–5.0 in) (DeMartini and Fountain 1981, Love 1996), during their first spring or second summer. Maximum reported size is 30.5 cm TL (12 in) (Miller and Lea 1972). Immature individuals grow at a rate of about 2.5 mm/day, while early adults grow about 1.8 mm/day (0.07 in/day) (Murdoch et al. 1989a). Mortality rate estimates are unavailable for this species.

Queenfish is a summer spawner. Goldberg (1976) found queenfish to enter spawning condition in April and spawn into August, while DeMartini and Fountain (1981) recorded spawning as early as March. Spawning is asynchronous among females, but there are monthly peaks in intensity during the waxing (first quarter) of the moon (DeMartini and Fountain 1981). They also

stated that mature queenfish spawn every 7.4 days, on average, regardless of size. Duration of the spawning season is a function of female body size, ranging from three months (April–June) in recruit spawners to six months (March–August) in repeat spawners (>13.5 cm SL [5.3 in]). Based on the spawning frequency and number of months of spawning, these two groups of spawners can produce about 12 and 24 batches of eggs during their respective spawning seasons (DeMartini and Fountain 1981). Demartini (1991) noted the relationship between declines in fecundity, gonadal and somatic condition of queenfish in southern California, and the crash in planktonic production during the 1982–84 El Niño event.

Goldberg (1976) found no sexually mature females less than 14.8 cm SL (5.8 in) in Santa Monica Bay. This differs from the findings of DeMartini and Fountain (1981) who found sexually mature females at 10.0–10.5 cm SL (3.9-4.1 in) off San Onofre at slightly greater than age-1. Batch fecundities in queenfish off San Onofre ranged from 5,000 eggs in a 10.5 cm (4.1 in) female to about 90,000 eggs in a 25 cm (9.8 in) fish. The average-sized female (14 cm [5.5 in], 42 g [1.5 ounces]) had a potential batch fecundity of 12,000–13,000 eggs. Parker and DeMartini (1989) estimated the average batch fecundity to be 12,700 for queenfish collected over a five-year period. Based on a female spawning frequency of 7.4 days, a 10.5-cm (4.1 in) female that spawns for three months (April–June) can produce about 60,000 eggs per year, while a 25cm (9.8 in) female that spawns for six months (March through August) can produce nearly 2.3 million eggs per year (DeMartini and Fountain 1981).

Queenfish feed mainly on crustaceans, including amphipods, copepods, and mysids, along with polychaetes and fishes (Quast 1968, Hobson and Chess 1976, Hobson et al. 1981, Feder et al. 1974). They are a forage species that is probably consumed by a wide variety of larger piscivorous fishes such as halibut, kelp bass, Pacific bonito, Pacific mackerel, and sharks as well as sea lions and cormorants.

### 3.3.7.2 Population Trends and Fishery

Queenfish was the most abundant sciaenid impinged at five southern California generating stations from 1977 to 1998, and accounted for over 60% of the total fishes impinged (Herbinson et al. 2001). Annual abundance fluctuated from year to year, with notable declines during the strong El Niño events of 1982–83, 1986–87, and 1997–98. However, abundance remained relatively high throughout the over 20-year study period. Queenfish was also one of the three most abundant species of soft-bottom associated fishes in southern California along with white croaker and northern anchovy during a 1982–1984 trawl study (Love et al. 1986).

There are both recreational and commercial fisheries for queenfish. Recreational fishers landed an average of 311,000 queenfish per year from 2000 through 2004, with the greatest estimated landings of 942,000 (40 metric tons) occurring in 1992 (RecFIN database). No specific landings for queenfish are reported in the commercial landings statistics for San Diego County during the 1995–2005 time period (PacFIN database), although they may be included in other landings groups such as unspecified croakers.



### 3.3.7.3 Sampling Results

Queenfish larvae were the sixteenth most abundant taxon collected from the entrainment station with an average annual density of 5.5 larvae per 1,000 $m^3$ (264,172 gal) (**Table 3-5**). They comprised 0.14% of the larvae collected at the entrainment station, 0.07% from the lagoon source water, and 2.18% from the nearshore source water. This species was found in the entrainment samples collected in June, August, September and October with a peak abundance of over 50 larvae per 1,000 $m^3$ (264,172 gal) during September 2004 (**Figure 3-25**). Queenfish larvae were found at the source water stations during the same period of the year mainly at the nearshore and outer lagoon stations (**Figure 3-26**). The number and density of larval queenfish collected during each entrainment and source water survey is presented in **Appendix E**.

The 29 queenfish larvae in the entrainment samples from all surveys ranged in length from 1.6 to 7.2 mm (0.06 to 0.28 in) with a mean length of 4.0 mm (0.16 in) (**Figure 3-27**). Hatch length of queenfish is approximately 2.9 mm (0.11 in) (Moser 1996).

### 3.3.7.4 Modeling Results

The following sections present the results for empirical transport modeling of entrainment effects on queenfish larvae. Demographic model estimates of entrainment effects (*FH* and *AEL*) were not calculated because of the absence of information on life history parameters necessary for model calculations. Total annual entrainment at EPS was estimated at 6.7 million using measured cooling water flow and at 7.5 million larvae using maximum cooling water flow for the June 2004 through May 2005 period (**Table 3-6**).

#### *Empirical Transport Model (ETM)*

Only 29 queenfish larvae were collected and measured from the entrainment samples. As a result, length frequency data on queenfish from entrainment samples collected for the Huntington Beach Generating Station between September 2003 and August 2004 (MBC and Tenera Environmental 2004) were used in estimating the period that the larvae are exposed to entrainment. The 25$^{th}$ (3.8 mm [0.15 in]) and 95$^{th}$ (7.7 mm [0.3 in]) percentile values from the measurements were used with a larval growth rate for white croaker of 0.20 mm/day (0.008 in/day) from Murdoch et al. (1989b) to estimate that the larvae were exposed to entrainment for a period of approximately 19.4 days. The duration of the planktonic egg stage, 2.2 d, was added to the period for the larvae to estimate a total period of exposure of 21.6 d.

The monthly estimates of proportional entrainment (*PE*) for queenfish for the June 2004 – May 2005 period ranged from 0 to 0.00370 using the actual flows, and from 0 to 0.00608 using the maximum flows during the period (**Table 3-23**). The largest estimate was calculated for the October survey, and the largest proportion of the source population was present during the September survey ($f_i$ = 0.441 or 44.1%). Queenfish larvae were collected from entrainment samples from four of the entrainment surveys and from seven surveys from the source water samples. The values in the table were used to calculate a $P_M$ estimate of 0.009 with a standard

error of 0.0055 using the actual flows during the sampling period and an estimate of 0.0102 with a standard error of 0.0062 using the maximum flows.

**Table 3-23**. *ETM* data for queenfish larvae based on actual and maximum daily cooling water flows. The *PE* estimates incorporate all three components of the source water shown in Equation 7.

| | Actual Flows | | Maximum Flows | | |
|---|---|---|---|---|---|
| **Survey Date** | ***PE* Estimate** | ***PE* Std. Err.** | ***PE* Estimate** | ***PE* Std. Err.** | $f_i$ |
| 10-Jun-04 | 0.00029 | 0.00099 | 0.00035 | 0.00119 | 0.15001 |
| 24-Jun-04 | 0 | 0 | 0 | 0 | 0.23205 |
| 6-Jul-04 | 0 | 0 | 0 | 0 | 0.12955 |
| 13-Aug-04 | 0.00190 | 0.01025 | 0.00220 | 0.01185 | 0.03996 |
| 23-Sep-04 | 0.00064 | 0.00438 | 0.00070 | 0.00472 | 0.44080 |
| 21-Oct-04 | 0.00370 | 0.02183 | 0.00608 | 0.03561 | 0.00522 |
| 18-Nov-04 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec-04 | 0 | 0 | 0 | 0 | 0 |
| 13-Jan-05 | 0 | 0 | 0 | 0 | 0 |
| 24-Feb-05 | 0 | 0 | 0 | 0 | 0 |
| 23-Mar-05 | 0 | 0 | 0 | 0 | 0 |
| 21-Apr-05 | 0 | 0 | 0 | 0 | 0.00242 |
| 19-May-05 | 0 | 0 | 0 | 0 | 0 |
| $P_M$ | **0.0090** | | **0.0102** | | |
| Std. Error | 0.0055 | | 0.0062 | | |

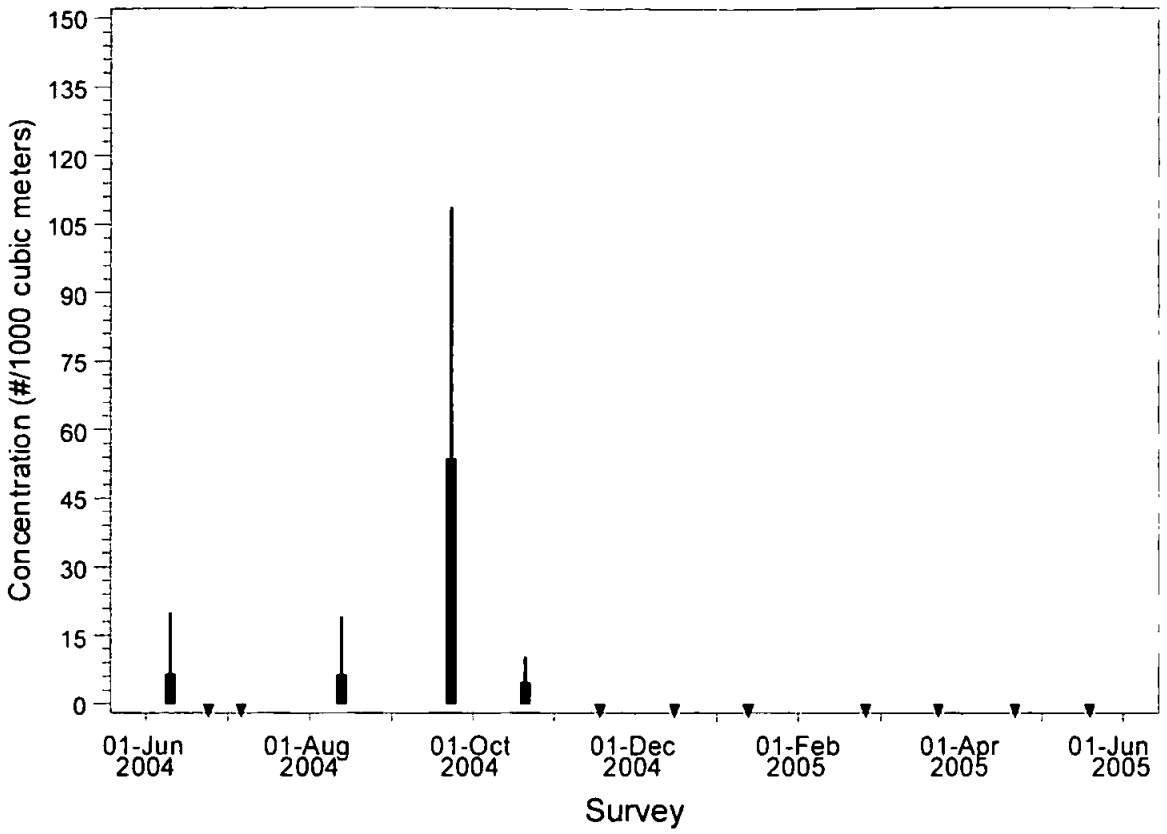



**Figure 3-25**. Comparison among surveys of mean concentration (#/1,000 $m^3$ [264.172 gal]) of queenfish larvae at entrainment Station E1.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

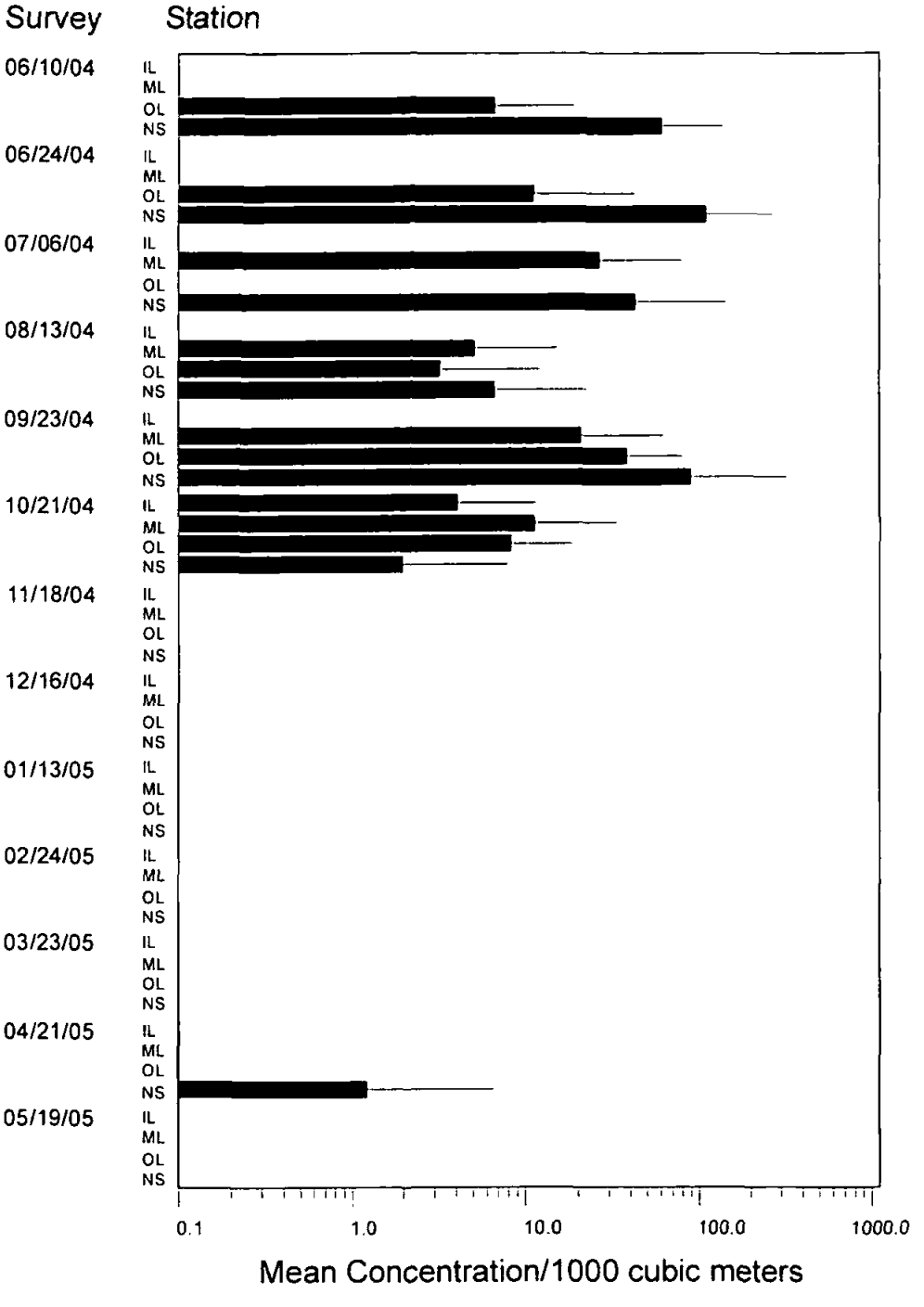



**Figure 3-26.** Mean concentration (#/1,000 $m^3$ [264.172 gal]) and standard error of queenfish larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods.

*Note logarithmic abundance scale.*

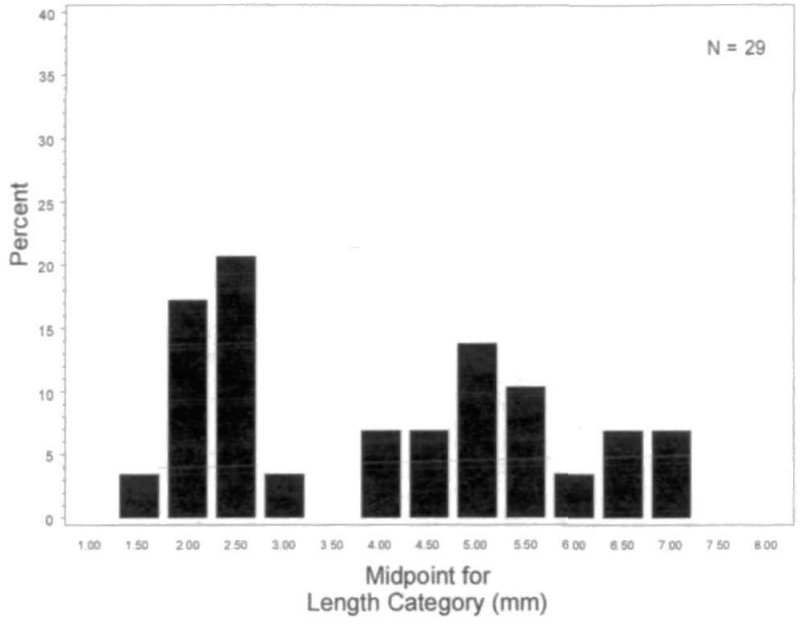
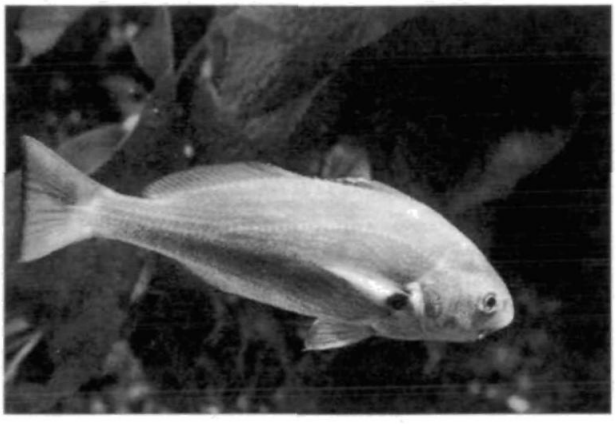



**Figure 3-27.** Length frequency of queenfish larvae at entrainment Station E1. Data from all surveys in 2004–2005.

## 3.3.8 Spotfin croaker (*Roncador stearnsii*)



***Range***: Point Conception, California to Mazatlan, Mexico including the Gulf of California

***Life History***:

- Size up to 68.6 cm (27 in)
- Size at maturity 23 cm (9 in) at 2 yrs of age for males, and 32 cm (12.6 in) at 3 yrs for females
- Life span to at least 10 years
- Broadcast spawner inshore with peak larval abundances June through September; pelagic eggs

***Habitat***: Sand bottoms from surf zone to 22 m (73 ft).

***Fishery***: Sport fishery only in southern California; variable annual catches average approx. 12,000 fish per year.

Spotfin croaker (*Roncador stearnsii*) (Family Sciaenidae) ranges from Mazatlan, Mexico to Point Conception, California, including the Gulf of California and occurs in depths ranging from the surf zone to 17 m (Miller and Lea 1972). Seven species of croaker, in addition to spotfin croaker, are common to the Southern California Bight (SCB). These include white croaker (*Genyonemus lineatus*), queenfish (*Seriphus politus*), yellowfin croaker (*Umbrina roncador*), white seabass (*Atractoscion nobilis*), California corbina (*Menticirrhus undulatus*), black croaker (*Cheilotrema saturnum*), and shortfin corvina (*Cynoscion parvipinnis*) (Miller and Lea 1972). Two other croakers [orangemouth corvina (*Cynoscion xanthulus*) and bairdiella (*Bairdiella icistia*)] are believed to be restricted in California to the Salton Sea.

Pondella and Allen (2000) noted a predominantly coastal distribution throughout the SCB, indicated by an absence in samples from the California Channel Islands. Allen (1985) indicated spotfin croaker to be a common member of the open-coast sandy-beach ichthyofauna, with seasonal occurrences in bays and harbors within the SCB. Love et al. (1984) observed distributions of spotfin croaker in the 6.1 m (20 ft) isobath over soft-substrate, with diminishing abundances with increasing depth. Limbaugh (1955) observed sporadic occurrences of spotfin croaker in the rocky bottom/kelp bed biotope. Valle and Oliphant (2001) noted spotfin croaker prefer depressions in the sandy bottom in water depths greater than 3 m (9.8 ft).

### 3.3.8.1 Life History and Ecology

Spotfin croaker is an oviparous broadcast spawner with pelagic eggs and larvae (Moser 1996). Gonosomatic index (GSI [gonad weight expressed as percent of whole body weight]) peaked for both sexes in June (Miller et al. in prep b), while peak larval abundances were observed from June to September (Moser 1996). Although usually found in small groups (< 5 individuals), observations have been made of large aggregations (> 50 individuals; Feder et al. 1974). Initially thought to migrate offshore to spawn (Valle and Oliphant 2001), recent observations within the SCB indicate an inshore spawning ground based on seasonal fluctuations in catch per unit effort and GSI (Miller et al. in prep b). Within spawning aggregations, gender ratios were significantly

skewed towards males with nearly a 10:1 male to female ratio (Miller et al. in prep b). In groups not exhibiting reproductive activity (high GSI), the gender ratio is nearly 1:1 (Miller et al. in prep b). Valle and Oliphant (2001) estimated males to mature at two years old and 228.5 mm SL (8.9 in), while females mature, on average, in their third year and 317.4 mm SL (12.5 in).

At hatching, spotfin croaker yolk sac larvae are less than 1.9 mm (0.07 in) long, flexion occurs at 5–6 mm (0.19–0.24 in), and transformation at about 13 mm (0.5 in) long (Moser 1996). Miller and Lea (1972) indicate the maximum length for spotfin croaker at 68.6 cm SL (2.7 in). Joseph (1962) estimated the maximum age for spotfin croaker at ten years using scale aging. Spotfin croaker exhibit the greatest growth rate between the first and second years, with a mean increase of 100 mm SL (3.9 in), quickly tapering off to under 30 mm SL (1.2 in) per year after age five (Joseph 1962). No information on variation in growth by gender or mortality estimations is available for spotfin croaker.

Spotfin croaker feeds primarily on benthic invertebrates commonly found in sandy environments, such as clams and polychaetes, but also mysids (Joseph 1962). This species of croaker migrates seasonally as indicated by individuals tagged near Los Angeles, California and subsequently recaptured near Oceanside, California (Valle and Oliphant 2001). California corbina (*Menticirrhus undulatus*), another member of the croaker family, is frequently encountered with spotfin croaker due to the strong similarities in habitat preferences between the two species (Miller et al. in prep b). Within southern California, spotfin croaker populations are historically known to exhibit "runs" (Valle and Oliphant 2001) when they form large aggregations, principally during spawning season (Miller et al. in prep b). Notably absent during the majority of the year near Seal Beach, California, spotfin croaker abundance rises dramatically between April and August, with peaks in abundance typically occurring in June (Miller et al. in prep b).

### 3.3.8.2 Population Trends and Fishery

Spotfin croaker is the least frequently impinged croaker at coastal generating stations within the SCB (Herbinson et al. 2001). Since 1977, four of the five generating stations built by Southern California Edison within the SCB have reported spotfin croaker in impingement samples (Herbinson et al. 2001). Based on these impingement samples, spotfin croaker populations in southern California have been low since 1983, although their abundance was less than all other croakers, except white seabass (Herbinson et al. 2001). Nearshore gillnet sampling within the SCB has indicated a general rise in abundance, corresponding to a general rise in sea surface temperatures (Miller et al. in prep b).

Spotfin croaker has been reserved for recreational angling within California State waters since 1915, with a ban on the use of nets imposed in 1909 and a ban on commercial sale in 1915 (Valle and Oliphant 2001). Incidental catches were possible in the nearshore gillnet fishery for white seabass, which was closed in 1992 by legislative action. Recreational angling, specifically surf-fishing, continues, as anglers enjoy greater success during periods of dense aggregations, such as

spawning periods. There was an average of approximately 12,000 fish caught annually in southern California from 2000 through 2005 based on information from the RecFIN database.

### 3.3.8.3 Sampling Results

Spotfin croaker larvae had the thirteenth highest mean density of all taxa collected in the entrainment samples for the period of June 2004 through May 2005 with a mean density of 8.3 larvae per 1,000 $m^3$ (264,172 gal) (**Table 3-5**). It was more abundant in the combined source water samples with a concentration of 20.2 larvae per 1,000 $m^3$ (**Table 3-7**). Spotfin croaker larvae occurred almost exclusively in summer and early fall surveys and were mostly absent during other times of the year (**Figure 3-28**). They were most abundant in the source water samples at the outer AHL and nearshore stations (**Figure 3-29**). The numbers of larval spotfin croaker collected during each entrainment and source water survey are presented in **Appendix E**.

Most of the spotfin croaker larvae sampled were slightly larger than 2 mm (0.08 in), indicating that they were recently hatched. Moser (1996) reported the hatch length at 2.1 mm (0.08 in). The length frequency distribution of 45 spotfin croaker larvae ranged from a minimum of 1.3 mm (0.05 in) to a maximum of 4.5 mm (0.18 in) with a mean size of 2.2 mm (0.09 in).

### 3.3.8.4 Modeling Results

The following sections present the results for empirical transport modeling of entrainment effects on spotfin croaker larvae. Demographic model estimates of entrainment effects (*FH* and *AEL*) were not calculated because of the absence of information on life history parameters necessary for model calculations. Total annual entrainment at EPS was estimated to be 9.5 million using measured cooling water flow and 10.7 million larvae using maximum cooling water flow for the June 2004 through May 2005 period (**Table 3-6**).

#### *Empirical Transport Model (ETM)*

Only 45 spotfin croaker larvae were collected and measured from the entrainment samples. As a result, length frequency data on queenfish from entrainment samples collected for the Huntington Beach Generating Station between September 2003 and August 2004 (MBC and Tenera Environmental 2004) were used in estimating the period that the larvae are exposed to entrainment. The 25$^{th}$ (1.9 mm [0.075 in]) and 95$^{th}$ (3.8 mm [0.15 in]) percentile values from the measurements were used with a larval growth rate for white croaker of 0.20 mm/day (0.008 in/day) from Murdoch et al. (1989b) to estimate that the larvae were exposed to entrainment for a period of approximately 9.2 days. The duration of the planktonic egg stage, 2.2 d, was added to the period for the larvae to estimate a total period of exposure of 11.4 d.

Spotfin croaker larvae were only present from June through September in the entrainment samples. The monthly estimates of proportional entrainment (*PE*) for the June 2004 – May 2005 period ranged from 0 to 0.00269 using the actual flows and from 0 to 0.00300 using the maximum flows (**Table 3-24**). Spotfin croaker larvae were collected from samples from five of the entrainment surveys and from six surveys from the source water samples. The largest estimates occurred during both the July and September surveys, and the largest proportion of the



source population was present during the September survey ($f_i$ = 0.332 or 33.2%). The values in the table were used to calculate a $P_M$ estimate of o.0157 with a standard error of 0.0163 using the actual flows and an estimate of 0.0177 with a standard error of 0.0183 using the maximum flow volumes.

**Table 3-24**. *ETM* data for spotfin croaker larvae based on actual and maximum daily cooling water flows. The *PE* estimates incorporate all three components of the source water shown in Equation 7.

| | Actual Flows | | Maximum Flows | | |
|---|---|---|---|---|---|
| Survey Date | *PE* Estimate | *PE* Std. Err. | *PE* Estimate | *PE* Std. Err. | $f_i$ |
| 10-Jun-04 | 0.00011 | 0.00028 | 0.00013 | 0.00033 | 0.27272 |
| 24-Jun-04 | 0.00012 | 0.00047 | 0.00014 | 0.00058 | 0.15573 |
| 6-Jul-04 | 0.00247 | 0.00761 | 0.00300 | 0.00915 | 0.17050 |
| 13-Aug-04 | 0.00064 | 0.00298 | 0.00074 | 0.00344 | 0.06863 |
| 23-Sep-04 | 0.00269 | 0.0077 | 0.00290 | 0.00831 | 0.33239 |
| 21-Oct-04 | 0 | 0 | 0 | 0 | 0 |
| 18-Nov-04 | 0 | 0 | 0 | 0 | 0 |
| 16-Dec-04 | 0 | 0 | 0 | 0 | 0 |
| 13-Jan-05 | 0 | 0 | 0 | 0 | 0 |
| 24-Feb-05 | 0 | 0 | 0 | 0 | 0 |
| 23-Mar-05 | 0 | 0 | 0 | 0 | 0 |
| 21-Apr-05 | 0 | 0 | 0 | 0 | 0.00003 |
| 19-May-05 | 0 | 0 | 0 | 0 | 0 |
| $P_M$ | **0.0157** | | **0.0177** | | |
| Std. Error | 0.0163 | | 0.0183 | | |

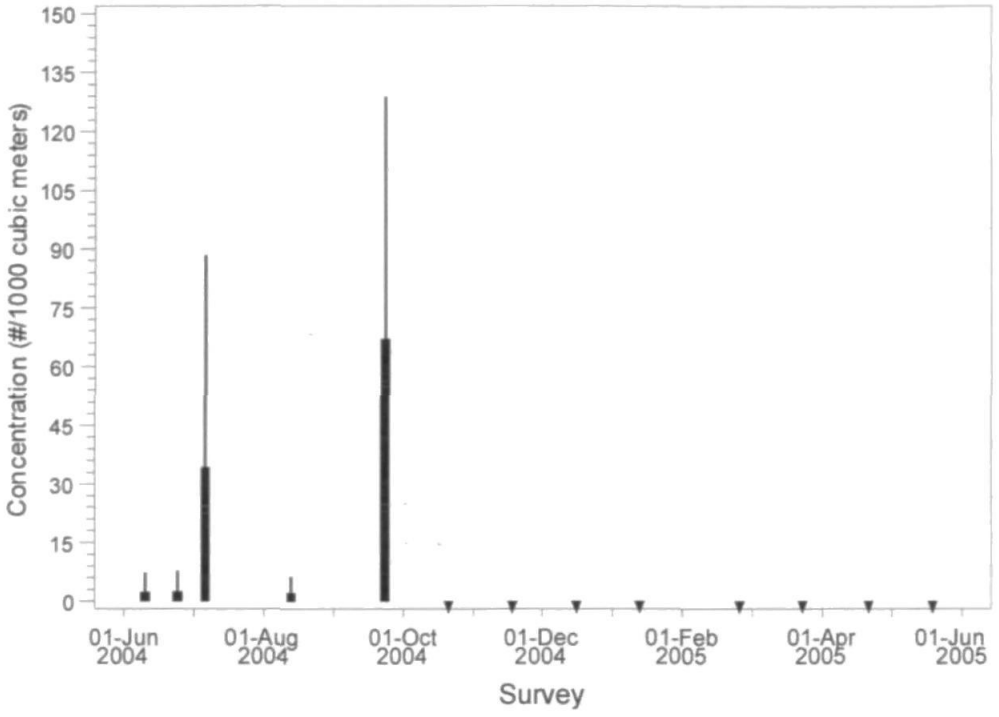



**Figure 3-28**. Comparison among surveys of mean concentration (#/1,000 $m^3$ [264,172 gal]) of spotfin croaker larvae at entrainment Station E1.

*Note: downward pointing triangle indicates survey with no larvae collected.*

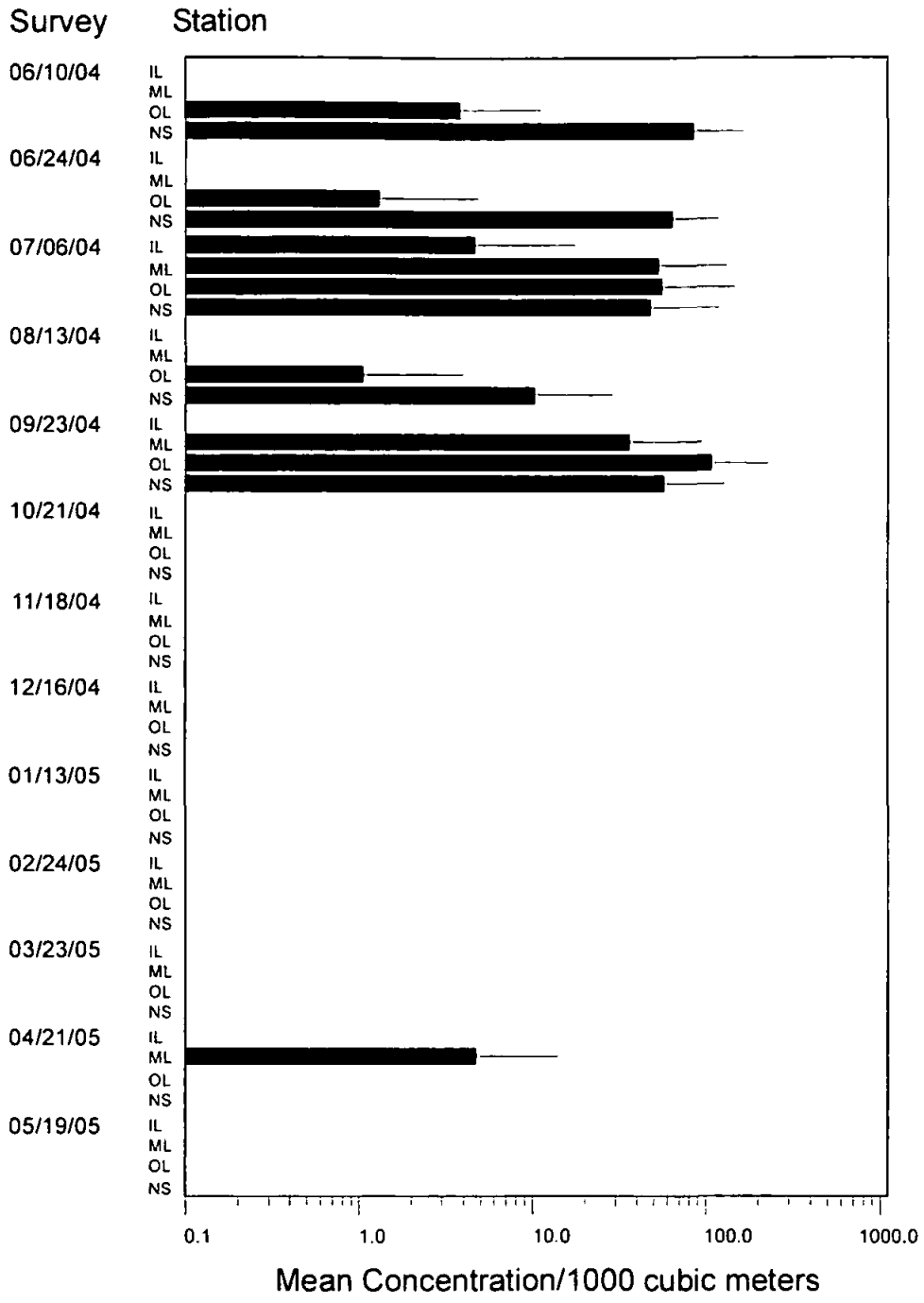



**Figure 3-29.** Mean concentration (#/1,000 $m^3$ [264,172 gal]) and standard error of spotfin croaker larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods.

*Note logarithmic abundance scale.*

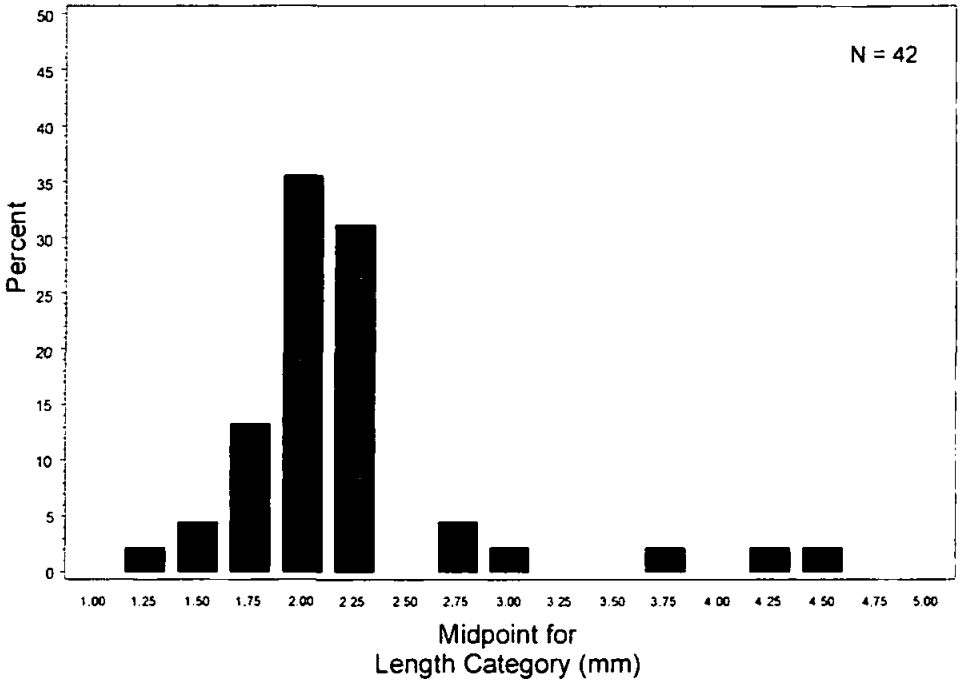
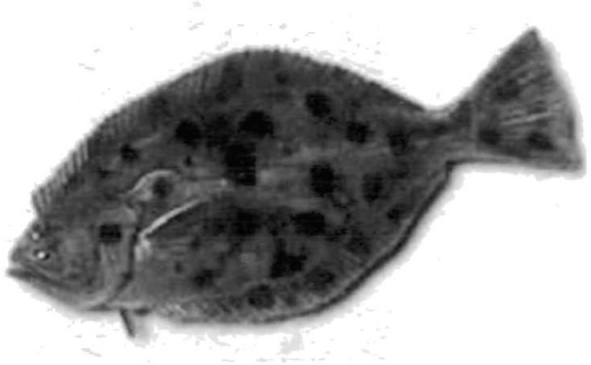



**Figure 3-30.** Length frequency of spotfin croaker larvae at entrainment Station E1. Data from all surveys in 2004–2005.

## 3.3.9 California halibut (*Paralichthys californicus*)



***Range***: northern Washington to southern Baja California

***Life History***:

- Size up to 152 cm (5 ft)
- Age at first maturity ~2 yr (20 cm TL [7.9 in]) in males and ~3 yr (43 cm TL [16.9 in]) in females
- Life span up to 30 yrs
- Spawns generally February–August in bays and estuaries; pelagic eggs; female spawns multiple times per season and may release from 5–50 million eggs/season

***Habitat***: Sand bottoms from the surf zone to 281 m (922 ft).

***Fishery***: Sport and commercial fishery in southern and central California; minimum legal size is 56 cm TL (22 in).

California halibut (*Paralichthys californicus*) is an important part of California's commercial and recreational fisheries (Leet et al. 2001; Starr et al. 1998). It ranges from northern Washington to southern Baja California and is found from very shallow nearshore waters in bay nursery grounds to depths of at least 281 m (922 ft) (Love et al. 2005; Haaker 1975).

### 3.3.9.1 Life History and Ecology

Juveniles and adults typically occur on sandy sediments at depths less than 30 m (98 ft) but sometimes concentrate near rocks, algae, or Pacific sand dollar (*Dendraster excentricus*) beds (Feder et al. 1974). As with other flatfishes, they frequently lie buried or partially buried in the sediment. Newly settled and juvenile halibut often occur in unvegetated shallow embayments and occasionally on the outer coast, suggesting that bays are an important nursery habitat for this species (Leet et al. 2001).

California halibut is a broadcast spawner with eggs being fertilized externally. The spawning season is generally thought to extend from February to August with most spawning occurring in May (Frey 1971) although some fall spawning may also occur. The average number of eggs per spawn is 313,000–589,000 with an average reproductive output of approximately 5.5 million eggs per spawning season (Caddell et al. 1990). During spawning season females may release eggs every 7 days and the largest individuals may produce in excess of 50 million eggs per year (Caddell et al. 1990). Captive specimens were observed to spawn at least 13 times per season. Halibut eggs are 0.7–0.8 mm (0.027–0.03 in) in diameter (Ahlstrom et al. 1984) and are most abundant in the water column in less than 75 m (246 ft) depths and within 6.5 km (47 miles) from shore (Leet et al. 2001).

Upon hatching, the larvae (1.6–2.1 mm NL [0.06-0.08 in] [Moser 1996]) are pelagic (Frey 1971), and most abundant between Santa Barbara, California, and Punta Eugenia, Baja California Sur (Ahlstrom and Moser 1975) from January through April and June through August (Moser 1996). California halibut have a pelagic larval stage of 20–29 days (Gadomski et al.

1990). Larval transformation occurs at a length of ca. 7.5–9.4 mm SL (0.29-0.37 in) (Moser 1996) at which time the young fish settle to the bottom, generally in bays but also occasionally in shallow substrates along the open coast (Haugen 1990). Kramer (1991) found that 6–10 mm (0.24-0.39 in) California halibut larvae grew <0.3 mm/day (0.11 in/day), while larger 70–120 mm (2.75-4.7 in) halibut grew about 1.0 mm/day (0.04 in/day). In a laboratory study, California halibut held at 16°C (60.8°F) grew to a length of 11.1 mm ± 2.61 (SD) (0.44 in ± 0.1) in 2 mo from an initial hatch length of 1.9 mm (0.075 in) (Gadomski et al. 1990). After settling in the bays, the juveniles may remain there for about 2 years until they emigrate to the outer coast. Males mature at 2–3 years and 20–23 cm SL (7.87-9.05 in); females mature at 4–5 years and 38–43 cm SL (14.96-16.93 in) (Fitch and Lavenberg 1971; Haaker 1975). Males emigrate out of the bays when they mature (i.e. at 20 cm [7.87 in]) but females migrate out as subadults at a length of about 25 cm (9.8 in) (Haugen 1990). Subadults remain nearshore at depths of 6–20 m (19.7-65.6 ft) (Clark 1930; Haaker 1975). California halibut may reach 152 cm (58.9 in) and 33 kg (73 lb) (Eschmeyer et al. 1983). Individuals may live as long as 30 years (Frey 1971).

California halibut feed during both day and night, but show a preference for daytime feeding (Haaker 1975). The species is an ambush feeder, typically lying partially buried in the sand until prey approaches. They prey on Pacific sardine, anchovies, squid, and other nektonic nearshore fish species (Leet et al. 2001). Small halibut in bays eat small crustaceans and become increasingly piscivorous with size. Other similar species of flatfishes such as sand sole and bigmouth sole may compete with California halibut within their range (Haugen 1990). Because of an extensive overlap in diet, habitat, geographic and bathymetric distributions, and probable foraging behavior, the California lizardfish may be the most important potential competitor of medium-sized California halibut (Allen 1982).

### 3.3.9.2 Population Trends and Fishery

It appears that the size of the California halibut population may be limited by the availability of shallow-water nursery habitat, and a long-term decline in landings corresponds to a decline in these habitats in southern California associated with dredging and filling of bays and wetlands (Leet et al. 2001). A fishery-independent trawl survey for halibut conducted in the early 1990s estimated that the southern California biomass was 3,130 metric tons (3,450 tons) (3.9 million adult fish) and the central California biomass was 1,043 metric tons (1,150 tons) (0.7 million fish).

California halibut have a high commercial and recreational fishery value. The fishery for California halibut was reviewed by Leet et al. (2001) and recent catch statistics are available through the PSMFC PacFIN (commercial) and RecFIN (recreational) databases. Historically, halibut have been commercially harvested by three principal gear types: otter trawl, set gill and trammel net, and hook and line. Presently there are numerous gear, area, and seasonal restrictions that have been imposed on the commercial halibut fishery for management purposes. Since 1980 the commercial catch has averaged approximately one million pounds per year statewide. In southern California (San Diego, Orange and Los Angeles counties) the average annual

commercial catch and ex-vessel revenue from California halibut for the years 2000–2004 was approximately 56,000 lb and $202,000 respectively. During this time the greatest catches were in 2000 (82,225 lb) and the least were in 2003 (38,113 lb). PacFIN records indicate that 14.3 MT of halibut worth $106,554 was landed in San Diego County in 2005.

### 3.3.9.3 Sampling Results

California halibut was the eighteenth most abundant taxon collected from the entrainment station (average concentration of 3.7 larvae per 1,000 $m^3$ [264,172 gal]; **Table 3-5**) and sixth most abundant at the nearshore source water stations (average concentration of 42.9 larvae per 1,000 $m^3$; **Table 3-7**). The larvae occurred in low numbers at the entrainment station in all but the late June and early July 2004 surveys (**Figure 3-31**). They were more abundant at the nearshore stations than at the lagoon stations and were mostly absent at the Inner and Middle Lagoon stations (**Figure 3-32**). The numbers of larval California halibut collected during each entrainment and source water survey are presented in **Appendix E**.

The length frequency distribution of nineteen California halibut larvae from the entrainment samples showed a range of small sizes (**Figure 3-33**) dominated by recently hatched larvae, based on the reported hatch length of 1.6–2.1 mm (0.06-0.08 in) (Moser 1996). The mean, maximum, and minimum sizes for the measurements were 2.6, 4.8, and 1.7 mm (0.1, 0.19, and 0.07 in), respectively.

### 3.3.9.4 Modeling Results

The following sections present the results for demographic and empirical transport modeling of entrainment effects on California halibut larvae. The available information on late larval and post-larval survival rates was insufficient to forecast adult equivalent losses, but enough information was available from the literature to estimate equivalent adult reproductive output using the fecundity hindcasting approach. Total annual entrainment at EPS was estimated at 3.8 million using measured cooling water flows and at 4.9 million larvae using maximum cooling water flows for the June 2004 through May 2005 period (**Table 3-6**).

#### *Fecundity Hindcasting (FH)*

The annual entrainment estimate for California halibut larvae was used to estimate the number of breeding females needed to produce this number of larvae. Egg survival for California halibut was 0.50 based on laboratory studies on fertilization success (Gadomski et al. 1990). The mean length for larval California halibut in entrainment samples was 2.1 mm (0.08 in). A larval growth rate of 0.186 mm/d (0.007 in/day) was derived from laboratory growth rates from first feeding larvae to the flexion stage over a period of 21 days (Gadomski and Peterson 1988). Since only 19 larvae were collected in the entrainment samples, length frequency data on California halibut from entrainment samples collected for the Huntington Beach Generating Station between September 2003 and August 2004 (MBC and Tenera Environmental 2004) were used in estimating the age at entrainment. The mean length (2.1 mm [0.08 in]) and the length at the 25$^{th}$ percentile (1.4 mm [0.06 in]) from these data were used with the growth rate (0.186 mm/d [0.007



in/day]) to estimate the mean age at entrainment of 3.5 d. A daily survival rate of 0.96 from Kramer (1991) was used to calculate survival to the average age at entrainment (0.86). A survivorship table was constructed using data from Caddell et al. (1990), MacNair et al. (2001), Hobbs et al. (1990) and Love and Brookes (1990) to estimate a total lifetime fecundity of 2.00 million eggs. Love and Brooks (1990) expressed the proportion of mature females at age $x$ years as

$$P_x = \frac{1}{1+e^{-1.52x+6.56}}. \qquad (11)$$

Hobbs et al. (1990) used the following relationship for female length in millimeters and weight in grams at age $x$,

$$Length_x = 1440\left[1-e^{(-0.0118x-0.0852)}\right];\ W_L = 7.811\times10^{-5}\,L^{3.048}. \qquad (12)$$

Female weight at age was estimated using Equation 12. An annual number of eggs spawned per age $x$ female was estimated by multiplying the average of two natural condition spawns in Caddell et al. (1990), i.e. 5,460,000 and 7,657,000, normalized by the weight at age to that of age 6 females. The estimated total lifetime fecundity was the sum of the product of the relative number of females at age, beginning at age 2, estimated using exponential mortality rate of Z=0.68 per year (MacNair et al. 2001), times proportion mature times eggs (**Table 3-25**).

Love and Brookes (1990) report that the age of female maturity is 4.3 years. However, the survivorship table analysis corresponded to age 2.5, the mid-interval of the 2 year olds. The number of California halibut at the age of maturity of 2.5 years whose lifetime reproductive output was entrained through the EPS CWS for the June 2004 through May 2005 period was estimated to be that of four to six females (**Table 3-26**).



**Table 3-25.** Fecundity and survivorship table for adult female California halibut from data in Caddell et al. (1990), MacNair et al. (2001), Hobbs et al. (1990) and Love and Brookes (1990) showing spawners ($L_x$) surviving to the beginning of the age interval and numbers of eggs spawned annually ($M_x$). The total lifetime fecundity was calculated as the sum of $L_xM_x$ divided by 5,000.

| Age (yr) | $P_x$ | Length$_x$ (mm) | $W_L$ (g) | $L_x$ | $M_x$ | $L_xM_x$ |
|---|---|---|---|---|---|---|
| 2 | 0.029 | 396 | 644 | 5,000 | 23,031 | 115,156,083 |
| 3 | 0.119 | 512 | 1,413 | 2,533 | 209,415 | 530,466,656 |
| 4 | 0.382 | 615 | 2,475 | 1,283 | 1,176,078 | 1,509,265,847 |
| 5 | 0.739 | 707 | 3,782 | 650 | 3,473,609 | 2,258,344,248 |
| 6 | 0.928 | 789 | 5,275 | 329 | 6,087,878 | 2,005,187,394 |
| 7 | 0.983 | 861 | 6,897 | 167 | 8,432,714 | 1,407,136,170 |
| 8 | 0.996 | 925 | 8,594 | 85 | 10,645,763 | 899,964,365 |
| 9 | 0.999 | 983 | 10,320 | 43 | 12,820,398 | 549,072,613 |
| 10 | 1.000 | 1,034 | 12,037 | 22 | 14,962,658 | 324,651,024 |
| 11 | 1.000 | 1,079 | 13,716 | 11 | 17,051,287 | 187,432,517 |
| 12 | 1.000 | 1,119 | 15,333 | 6 | 19,062,907 | 106,158,961 |
| 13 | 1.000 | 1,155 | 16,874 | 3 | 20,978,956 | 59,187,658 |
| 14 | 1.000 | 1,187 | 18,328 | 1 | 22,786,689 | 32,569,288 |
| 15 | 1.000 | 1,215 | 19,689 | 1 | 24,478,549 | 17,725,254 |
| | | | | | **TLF =** | **2,000,464** |

**Table 3-26.** Results of *FH* modeling for California halibut larvae based on a) actual flows and b) maximum flows. The upper and lower estimates are based on a 90% confidence interval of the mean. *FH* estimates were also calculated using the upper and lower confidence estimates from the entrainment estimates.

| Parameter | Mean | Std. Error | *FH* Lower Estimate | *FH* Upper Estimate | *FH* Range |
|---|---|---|---|---|---|
| **a) Actual Flows** | | | | | |
| *FH* Estimate | 4 | 4 | 1 | 18 | 17 |
| Total Entrainment | 3,752,551 | 223,985 | 4 | 5 | 1 |
| **b) Maximum Flows** | | | | | |
| *FH* Estimate | 6 | 5 | 1 | 24 | 23 |
| Total Entrainment | 4,879,725 | 263,926 | 5 | 6 | 1 |

### *Empirical Transport Model (ETM)*

Only 19 California halibut larvae were collected and measured from the entrainment samples. As a result, length frequency data on halibut from entrainment samples collected for the Huntington Beach Generating Station between September 2003 and August 2004 (MBC and Tenera Environmental 2004) were used in estimating the period that the larvae are exposed to entrainment. The 25$^{th}$ (1.4 mm [0.06 in]) and 95$^{th}$ (6.8 mm [0.27 in]) percentile values from the measurements were used with a larval growth rate of 0.186 mm/day (0.007 in) from Gadomski and Peterson (1988) to estimate that the larvae were exposed to entrainment for a period of approximately 28.9 days. The planktonic egg stage of 2.2 d was added to this value for a total period of exposure to entrainment of 31.1 d.

Although California halibut larvae were present in the source water during all of the surveys they were not collected at the entrainment station during two of the surveys. The monthly estimates of proportional entrainment (*PE*) for the June 2004 – May 2005 period ranged from 0 to 0.0107 using the actual flows and from 0 to 0.00188 using the maximum flows (**Table 3-27**). The largest estimate occurred during the January survey, and the largest proportion of the source population was present during the September survey ($f_i$ = 0.362 or 36.2%). The values in the table were used to calculate a $P_M$ estimate of 0.0032 with a standard error of 0.0023 using the actual flows during the sampling period and an estimate of 0.0042 with a standard error of 0.003 based on the maximum flows.

**Table 3-27**. *ETM* data for California halibut larvae based on actual and maximum daily cooling water volumes. The *PE* estimates incorporate all three components of the source water shown in Equation 7.

| | Actual Flows | | Maximum Flows | | |
|---|---|---|---|---|---|
| **Survey Date** | ***PE* Estimate** | ***PE* Std. Err.** | ***PE* Estimate** | ***PE* Std. Err.** | $f_i$ |
| 10-Jun-04 | 0.00013 | 0.00065 | 0.00016 | 0.00079 | 0.03876 |
| 24-Jun-04 | 0 | 0 | 0 | 0 | 0.03912 |
| 6-Jul-04 | 0 | 0 | 0 | 0 | 0.25640 |
| 13-Aug-04 | 0.00009 | 0.00069 | 0.00010 | 0.00080 | 0.08947 |
| 23-Sep-04 | 0.00008 | 0.00069 | 0.00009 | 0.00075 | 0.36188 |
| 21-Oct-04 | 0.00020 | 0.00146 | 0.00033 | 0.00236 | 0.04843 |
| 18-Nov-04 | 0.00015 | 0.00170 | 0.00024 | 0.00265 | 0.01426 |
| 16-Dec-04 | 0.00062 | 0.01013 | 0.00077 | 0.01241 | 0.00498 |
| 13-Jan-05 | 0.00107 | 0.00608 | 0.00188 | 0.01038 | 0.00915 |
| 24-Feb-05 | 0.00020 | 0.00156 | 0.00033 | 0.00256 | 0.04461 |
| 23-Mar-05 | 0.00005 | 0.00046 | 0.00008 | 0.00067 | 0.06386 |
| 21-Apr-05 | 0.00100 | 0.00550 | 0.00117 | 0.00645 | 0.01923 |
| 19-May-05 | 0.00054 | 0.00421 | 0.00072 | 0.00567 | 0.00985 |
| $P_M$ | **0.0032** | | **0.0042** | | |
| Std. Error | 0.0023 | | 0.0030 | | |

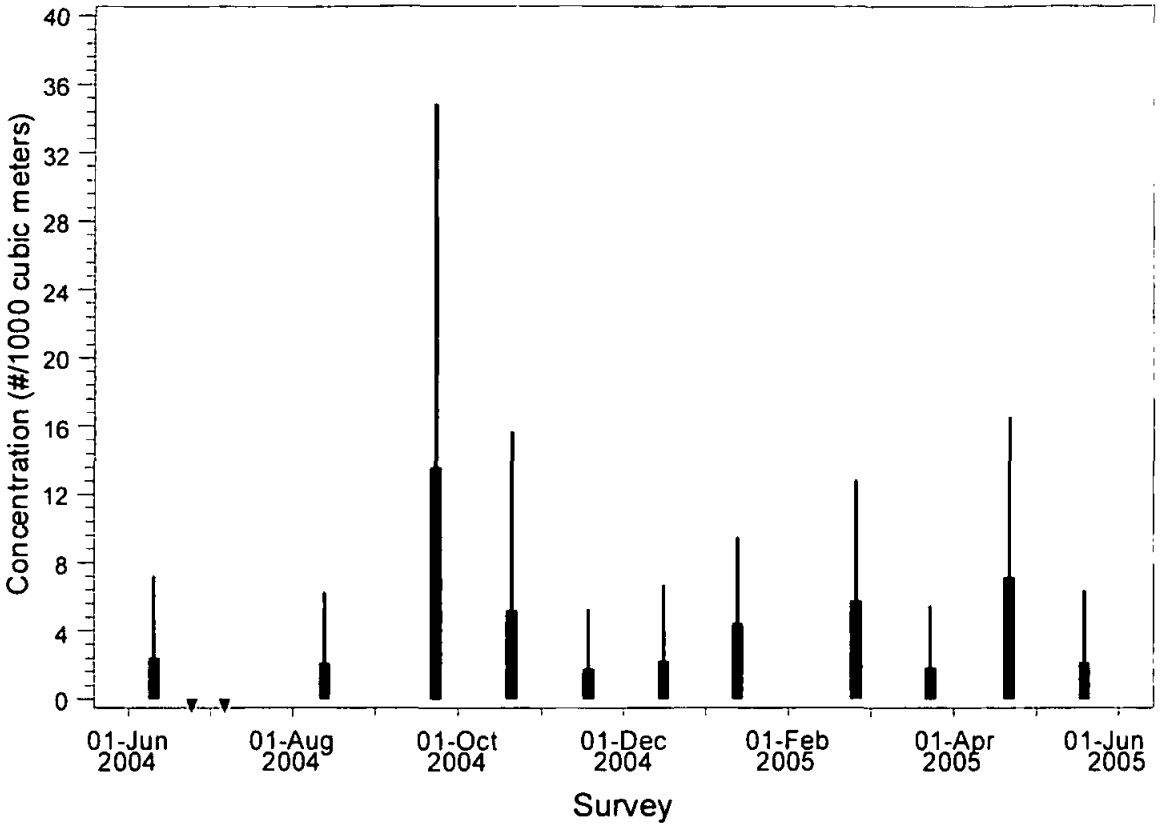



**Figure 3-31**. Comparison among surveys of mean concentration (#/1,000 $m^3$ [264,172 gal]) of California halibut larvae at entrainment Station E1.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

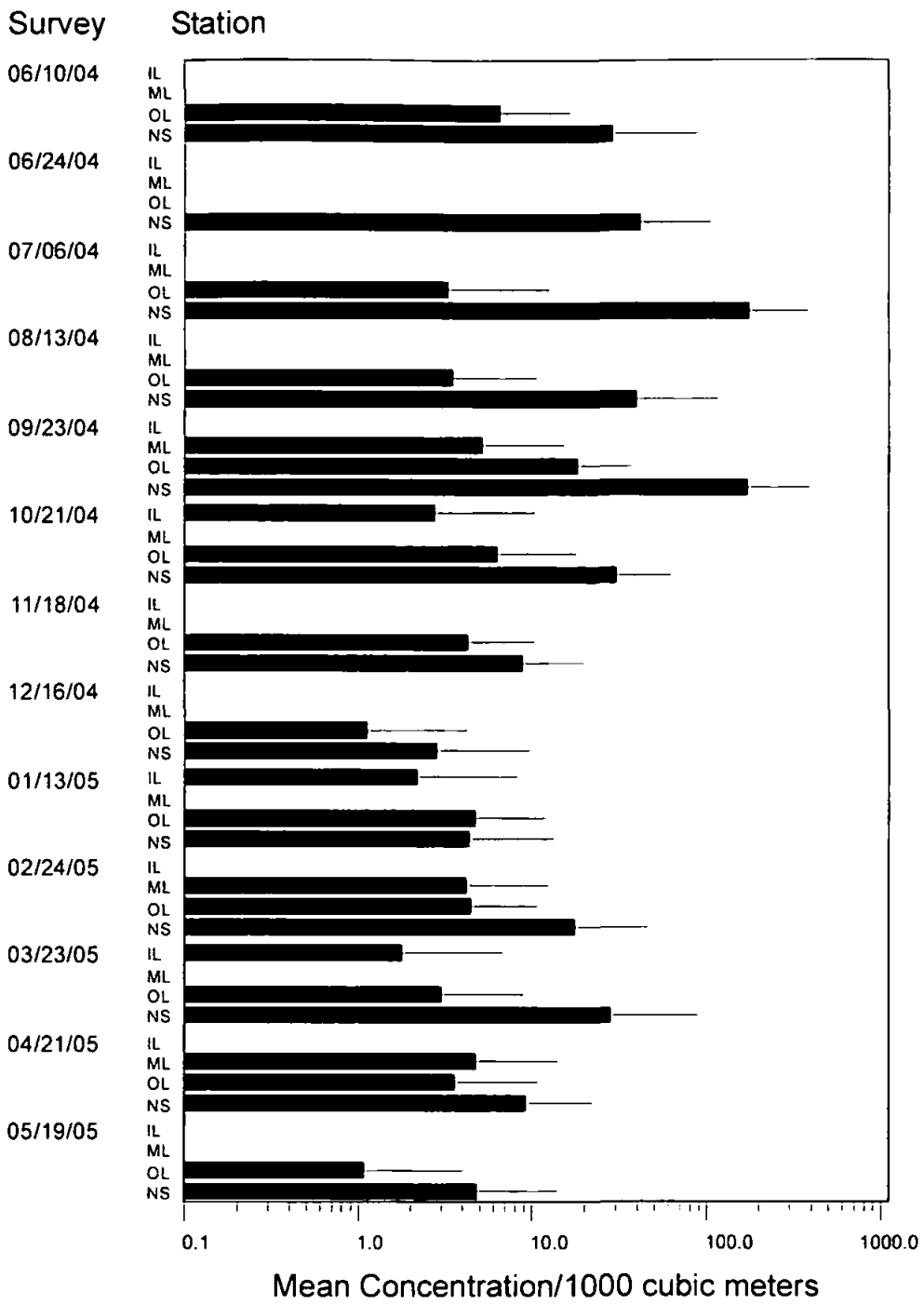



**Figure 3-32.** Mean concentration (#/1,000 $m^3$ [264,172 gal]) and standard error of California halibut larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods.

*Note logarithmic abundance scale.*

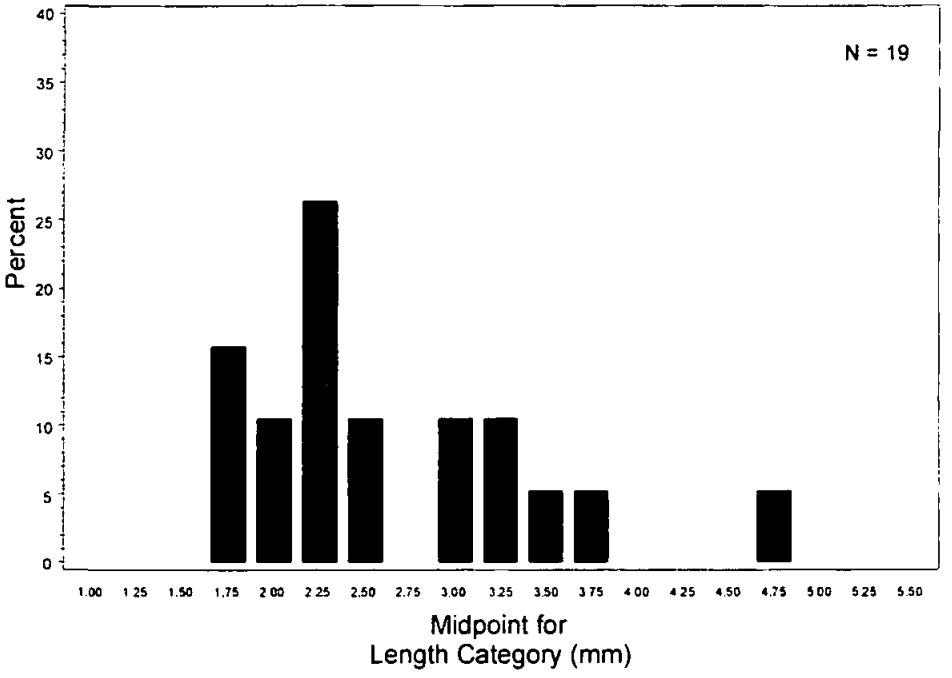



**Figure 3-33.** Length frequency of California halibut larvae at entrainment Station E1. Data from sub-samples of all surveys in 2004–2005.

# 4.0 Impingement Study Results

## 4.1 Introduction

The purpose of the EPS impingement study was to evaluate the potential impacts of the operation of the cooling water intake structure as required under Section 316(b) of the CWA (USEPA 1977). The SDRWQCB reviewed the need for and design of the studies with representatives of Cabrillo Power, Tenera Environmental, U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Game (CDFG), and other agencies. The group reviewed and approved the final 316(b) Cooling Water Intake Effects Entrainment and Impingement Sampling Plan (**Appendix A**).

The impingement study was designed to specifically address the following questions:

- What are the species composition and abundance of the juvenile and adult fishes and shellfishes impinged by EPS?
- What are the potential impacts of impingement losses on populations of fishes and shellfishes due to operation of the CWIS?

An earlier study of impingement of fishes and invertebrates was conducted from February 4, 1979 to January 4, 1980 (SDG&E 1980). Each 24-hour period was divided into two 12-hour periods, roughly separated into a daylight and nighttime sample. All material impinged during the two 12-hour periods was rinsed from the traveling screens and collected in ¼ inch mesh liners that had been placed in the metal collection baskets. The fishes and invertebrates were removed from the impinged debris and then identified, counted, and measured. All the data from each 12-hour period was recorded separately. Organisms impinged on the bar racks were processed in the same manner at the end of the entire 24-hour period. During this study a total of 76 taxa of fishes and 45 taxa of macro-invertebrates totaling 85,943 individuals and weighing 1,548 kg (3,414 lb) was impinged during the surveys conducted during normal operations. Of this material, about 90% of the weight was from fishes and 10% from invertebrates. The numerically most abundant fishes impinged during normal operations surveys were queenfish, deepbody anchovies, topsmelt, California grunion, northern anchovy, and shiner surfperch (**Table 4-1**). These six species comprised about 82% of all the individuals collected, but only about 47% of the overall weight of the collected fishes. The most abundant shellfishes were rock crabs, swimming crabs, striped shore crabs, and squid.

Sampling was also conducted during the seven heat treatment events that occurred during this same approximate 12-month period. During the heat treatments the heated discharge water is diverted back through the CWS to kill all organisms that are growing on the conduits. All fishes and invertebrates that are living in the water within this area are killed and end up as impinged organisms. A record was also made of the identity, number, and measurement of all fishes and shellfishes impinged during these heat treatments using the sample procedures used during the

normal operation surveys. A total of 108,102 fishes weighing 2,422 kg (5,341 lb) was collected during these seven heat treatments. The most abundant fishes collected during heat treatment surveys were deepbody anchovy, topsmelt, northern anchovy, shiner surfperch, California grunion, and walleye surfperch. These six species comprised about 88% of all the fishes collected during the heat treatments. The most abundant shellfishes found were unidentified crabs, striped shore crabs, and rock crabs.

**Table 4-1**. Number and weight (grams) of the 'critical fish species' collected during normal operations and seven heat treatment surveys at EPS, February 1979 – January 1980 (from SDG&E 1980).

| | | Normal Operations | | Heat Treatments | |
|---|---|---|---|---|---|
| **Species** | **Common Name** | **# Impinged** | **Weight impinged (g)** | **# Impinged** | **Weight impinged (g)** |
| *Seriphus politus* | queenfish | 18,681 | 91,314 | 3,485 | 96,320 |
| *Anchoa compressa* | deepbody anchovy | 13,299 | 64,323 | 23,142 | 182,179 |
| *Atherinops affinis* | topsmelt | 10,915 | 112,340 | 21,788 | 166,058 |
| *Leuresthes tenuis* | California grunion | 8,583 | 33,770 | 9,671 | 81,708 |
| *Engraulis mordax* | northern anchovy | 7,434 | 14,573 | 19,567 | 93,981 |
| *Cymatogaster aggregata* | shiner surfperch | 6,545 | 53,258 | 12,326 | 275,549 |
| *Hyperprosopon argenteum* | walleye surfperch | 1,877 | 50,405 | 8,305 | 522,797 |
| *Anchoa delicatissima* | slough anchovy | 1,758 | 4,106 | 464 | 1,405 |
| *Phanerodon furcatus* | white surfperch | 1,751 | 16,991 | 604 | 8,609 |
| *Urolophus halleri* | round stingray | 1,626 | 185,896 | 1,685 | 404,237 |
| *Paralichthys californicus* | California halibut | 1,215 | 57,128 | 329 | 52,995 |
| *Heterostichus rostratus* | giant kelpfish | 1,046 | 14,912 | 1,421 | 36,212 |
| *Xenistius californiensis* | salema | 538 | 2,244 | 161 | 1,389 |
| *Paralabrax nebulifer* | barred sand bass | 189 | 15,309 | 518 | 26,724 |
| *Menticirrhus undulatus* | California corbina | 117 | 9,263 | 29 | 4,634 |
| *Amphistichus argenteus* | barred surfperch | 83 | 1,853 | 166 | 15,946 |
| *Mugil cephalus* | striped mullet | 73 | 44,730 | 10 | 5,593 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 73 | 10,857 | 616 | 87,360 |
| *Paralabrax clathratus* | kelp bass | 34 | 502 | 568 | 38,505 |
| *Cynoscion nobilis* | white seabass | 25 | 226 | 13 | 833 |
| *Citharichthys sordidus* | Pacific sanddab | - | - | - | - |
| *Semicossyphus pulchra* | California sheephead | - | - | - | - |
| *Pleuronichthys verticalis* | hornyhead turbot | - | - | - | - |
| | **Total Above Fishes** | **75,862** | **784,000** | **104,868** | **2,103,034** |
| | Total Other Fishes | 3,800 | 611,200 | 3,610 | 322,517 |
| | Total Invertebrates | 6,281 | 153,200 | 1,682 | 49,884* |

* - only includes weights of counted invertebrates from Table 7-12.1

The total abundance and weight of the 22 'critical fish species' impinged during the seven heat treatment surveys was higher than the total during the normal operation surveys (**Table 4-1**). These 22 species comprised the majority of the numbers of fishes collected during both normal operations and heat treatments. The weight of the 'critical fish species' collected during normal operations was only slightly higher than the overall weight of the other fish species during those



surveys. The majority of the weight of impinged fishes during heat treatments was due to the 'critical fish species' group. The total number and weight of the shellfishes was generally much less than that of the fishes during both normal operations and heat treatments.

## 4.2 Methods

The following sections provide information on impingement sample collection and field processing done from June 2004 through June 2005, and also on methods used to assess impingement impacts. The impingement sampling program was designed to provide current estimates of the abundance, taxonomic composition, diel periodicity, and seasonality of organisms impinged at EPS. This was accomplished by calculating the rates (i.e., number or biomass of organisms per cubic meter of water flowing per time into the plant) at which various species of fishes and selected shellfishes (crab, shrimp, lobster, squid, octopus, etc.) were impinged. Impingement rates are subject to tidal and seasonal influences that vary on several temporal scales (e.g., hourly, daily, and monthly) while the rate of circulating water flow varies with power plant operations.

### 4.2.1 Sampling

The EPS has one intake structure that withdraws water from the Agua Hedionda Lagoon. Seawater entering the CWS passes through metal trash racks (bar racks) on the intake structure. Behind the trash racks, the intake tapers into two and then four tunnels (**Figure 2-3**), which provide cooling water for five steam-generating units (Units 1–5). The seawater then goes through vertical traveling screens. Units 1–4 each have two traveling screens with a mesh size of 0.95 cm (⅜ in), and Unit 5 has three screens with a mesh size of 1.6 cm (⅝ in).

All material that passed through the bar racks but was larger than the traveling screen mesh was impinged and was subsequently rinsed from the screens when the screens were rotated for cleaning. A high-pressure wash system (70-100 psi) located at the head of the screens was used to wash the material into a sluiceway that emptied into metal collection baskets, where the material accumulated until disposal. The traveling screens were operated either manually or automatically when a specified pressure differential was detected across the screens due to the accumulation of debris.

Impingement sampling at EPS was conducted during a 24-hr period one day each week from June 24, 2004 through June 15, 2005. Each sampling period was divided into six approximately 4-hr cycles. Before each weekly sampling effort, all of the screens were rotated and rinsed clean of any impinged material. Nets (0.5 cm (¼ in) mesh size) were placed into each metal basket during impingement sampling for ease of collection of impinged material.

During each cycle the traveling screens remained stationary for a period of approximately 3.5 hr. Screens for Units 1–4 were rotated and rinsed for 35 minutes and screens for Unit 5 were rotated

and rinsed for 30 min (approximate time for one complete revolution of the screens). This rinse period allowed the entire traveling screen to be rinsed of all material that had been impinged since the last screen wash cycle. In a few instances during impingement collections, the screen wash system started automatically due to a high differential pressure prior to the end of the cycle. The material that was rinsed from the screens during the automatic screen washes was combined with the material collected at the end of that cycle. All debris and organisms rinsed from each set of traveling screens were kept separate.

All fishes and selected shellfishes collected at the end of each 4-hr cycle were removed from the debris and then identified and counted. Individual weights and lengths of bony fishes, sharks and rays were recorded (standard length [SL] for the bony fishes, total length [TL] for the sharks, and disc width [DW] for the rays). Any mutilated fishes were identified if possible, and the total weight recorded by taxa. No length measurements were recorded for mutilated fishes. Carapace width was measured for crabs, total length was measured for shrimps and mantle length was measured for cephalopod mollusks. Weight was also recorded for these shellfishes. Other macroinvertebrates, including hydroids, anemones, sea jellies, barnacles, worms, brittlestars, bryozoans, tunicates, gastropods, and bivalves, were not enumerated or weighed but were only recorded as present when found in the impinged material.

During periods when many fishes or shellfishes were impinged during a single cycle, a maximum of 50 individuals of any one taxa from each traveling screen set were measured and weighed. All lengths were recorded to the nearest 0.1 mm and all weights to the nearest 0.1 g. The condition (alive, dead, or mutilated) of the organisms and the amount and type of impinged debris was also recorded. In addition, the operating status of the circulating water pumps and traveling screens was also recorded. All data were recorded on sequentially numbered data sheets, verified, and subsequently entered into a computer database (MS Access™).

Impingement sampling was also conducted during heat treatment operations. Procedures for heat treatment involved clearing and rinsing the traveling screens prior to the start of the heat treatment procedure. At the end of the heat treatment procedure, normal pump operation was resumed and the traveling screens were rinsed until no more fish were collected on the screens or live fish were found amongst the debris collected. Processing of the samples followed the same procedures used for normal impingement sampling. Six heat treatments were performed and sampled during the one-year study.

A quality control (QC) program was implemented to ensure the correct identification; enumeration, length, and weight measurements of the organisms were recorded on the data sheet. QC surveys were conducted on regular impingement sampling quarterly and one heat treatment was selected for a QC survey. Two cycles were randomly chosen for QC re-sorts to verify that all the collected organisms were removed from the impinged material and processed correctly.

A log containing hourly observations of the operating status (on or off) of the ten circulating water pumps for the entire study period was obtained from the power plant's operation staff. This



provided a record of the volume of circulating water pumped through the plant, which was used to calculate impingement rates.

### 4.2.2 Data Analysis

To estimate taxa-specific impingement rates, the cooling water flow during each of the six cycles of the 24-hr survey was first calculated. The total time for each cycle (generally 4 hr) was multiplied by the manufacturer's rated flow of each of the pumps that had operated during the cycle. Each unit has two circulating water pumps with the following flow rates: Units 1, 2, and 3 pumps–90.9 $m^3$/min/pump (24,000 gpm), Unit 4 pumps–378.5 $m^3$/min/pump (100,000 gpm) and Unit 5 pumps–393.7 $m^3$/min/pump (104,000 gpm). In addition each unit has one service water pump except for Unit 3, which has two service pumps. The service pumps have the following flow rates: Units 1, 2, and 3 pumps–11.4 $m^3$/min/pump (3,000 gpm), Unit 4 pump–49.2 $m^3$/min/pump (13,000 gpm) and Unit 5 pump–68.9 $m^3$/min/pump (18,200 gpm). During periods when the units were undergoing maintenance and not operational during sampling, water flows for those pumps were not added into the total for that cycle as impinged organisms were not collected from those units. The cooling water flow rate for each cycle (obtained from the plant's operator pump logs showing which pumps were operating and manufacturer's rated flow for each operating pump) was then used to calculate an average daily impingement rate and associated standard error per volume of cooling water for each taxa for the three sets of traveling screens (Units 1–5). **Figure 2-7** presents the pump flow volume during the study period. Although many of the impinged fishes were juveniles, for analysis purposes it was assumed that they were all adults and that none of the impinged organisms survived.

An adjustment was made to the total weight of each taxa to compensate for any mutilated fishes that were collected and not weighed. The average weight of non-mutilated individuals of a given taxa collected in each cycle was assigned to any mutilated individuals in that cycle. This adjusted weight was then used in all biomass calculations.

The estimated daily impingement rate was used to calculate estimated weekly, monthly, and annual impingement. The days between the impingement collections were assigned to a weekly survey period by setting the collection day as the median day within the period and assigning the days on either side of the collection date to the closest adjacent sampling day to create a weekly survey period. In most cases, the weekly survey periods were 7 d, but in a few instances the survey period varied from 5-9 d in length. The total calculated flow for each weekly survey period was multiplied by the taxon-specific impingement rate calculated from the daily sampling to obtain estimates of the weekly impingement rates of both counts and biomass for each taxon. Finally, the estimated abundance and biomass impingement rate for each survey period was summed to determine monthly and annual estimates of impingement for each taxon for the yearlong study period. In addition, the maximum flow rate, assuming all pumps were operating continuously, was used to calculate the maximum possible, or "worst-case scenario" impingement rates.



Organisms collected on the bar racks were added to the total number and biomass of organisms impinged for each survey, but were not included in the impingement rate calculations. Data collected during heat treatment operations was summed for each heat treatment survey. This data was kept independent of the normal impingement data and is presented separately.

Data for all impinged taxa are presented in this report, but a subset of the taxa was selected for more detailed analysis. This included fishes that comprised the top 90% of the total abundance and biomass impinged during normal impingement sampling plus any taxon that was commercially or recreationally important and in the top 95% of the total abundance or biomass. The impinged commercially or recreationally important shellfishes that were in the top 90% of the total abundance or biomass are also discussed in more detail in the following sections.

## 4.3 Fish Impingement Results

### 4.3.1 Fish Community Overview

A total of 19,408 fishes representing 96 taxa was collected during normal operation impingement sampling at the EPS traveling screens during the 52 weekly surveys from June 24, 2004 through June 15, 2005 (**Table 4-2** and **Appendix G**). These fishes had a combined weight of 351.7 kg (775.3 lb). The greatest fish impingement rate (both in numbers and biomass) was seen during the January and February 2005 surveys (**Figure 4-1**). Impingement of all fishes was generally higher during nighttime cycles (Cycles 4-5, 8pm – 4am) than the daytime cycles (Cycles 1–2, 0800– 1600 hrs) (**Figures 4-2** and **4-3**). There was also a total of 34 fishes weighing 22.2 kg (48.4 lb) collected from the bar racks during the 52 surveys. During the six heat treatments completed from June 2004 through June 2005, a total of 94,991 fishes (71 taxa) weighing 2,035 kg (4,486 lb) was collected. The July 2004 and June 2005 heat treatments had the greatest number of fishes but the largest weight of fishes was seen during the February and June 2005 heat treatments (**Figures 4-4**).

The numerically most abundant fishes collected during the normal operations impingement sampling included topsmelt, shiner surfperch, deepbody anchovy, queenfish, salema, and slough anchovy (**Table 4-2**). These six species comprised about 70% of all the fishes impinged during normal operations. The fish taxa with the greatest weight impinged during normal operations were California butterfly ray, topsmelt, shiner surfperch, speckled midshipmen, walleye surfperch, and round stingray. The numerically most abundant fishes collected during the heat treatment sampling included deepbody anchovy, shiner surfperch, topsmelt, California grunion, Pacific sardine, and jacksmelt. These six species comprised about 80% of the total number of fishes collected during the heat treatment surveys. The fishes with the greatest weight impinged during the heat treatments were white seabass, round stingray, deepbody anchovy, shiner surfperch, walleye surfperch, and spotted sand bass (**Table 4-2**).

The survey information was combined with the circulating water pump (CWP) data to generate annual impingement estimates. **Table 4-3** presents the estimated abundance and weight of the fishes and shellfishes annually impinged during normal operations at the traveling screens and bar racks based on maximum flow and reported flow recorded at EPS during the impingement survey days. As the plant did not operate all the CWPs every hour during the year, the estimated number of organisms impinged during maximum flows was greater than during reported flows.

The annual estimated number and weight of impinged fishes and shellfishes collected during normal operations (traveling screens and bar racks) and heat treatments were combined and are presented in **Table 4-4**. The top eight most abundant fish taxa based on the overall estimated numbers impinged at maximum CWS flow were topsmelt, shiner surfperch, deepbody anchovy, queenfish, unidentified silversides, slough anchovy, salema, and California grunion. These taxa comprised about 75% of the estimated number that would be impinged if all the pumps were run every hour of every day for a year. The fishes with the highest weight estimated to be impinged with full CWS flow for an entire year were California butterfly ray, topsmelt, shiner surfperch, round stingray, white seabass, walleye surfperch, deepbody anchovy, and speckled midshipman. They comprised about 64% of the total weight estimated to have been impinged if the plant had sustained maximum flow of all pumps for an entire year.

The fishes that were ranked in the top 90$^{th}$ percentile by abundance and biomass were identified. The fishes that were ranked in high abundance in both abundance and biomass, and the taxa that were commercially or recreationally important were selected for detailed evaluation of impingement effects. This resulted in the selection of the nine following taxa:

- anchovies (primarily two *Anchoa* species)
- silversides (Atherinopsidae)
- shiner surfperch (*Cymatogaster aggregata*)
- queenfish (*Seriphus politus*)
- walleye surfperch (*Hyperprosopon argenteum*)
- sand basses (*Paralabrax maculatofasciatus* and *P. nebulifer*)
- Pacific sardine (*Sardinops sagax*)
- spotfin croaker (*Roncador stearnsii*)
- white seabass (*Atractoscion nobilis*)

**Table 4-2.** Number and weight of fishes, sharks, and rays impinged during normal operation and heat treatment surveys at EPS from June 2004 to June 2005.

| | | | Normal Operations Sample Totals | | | | Heat Treatment | |
|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Sample Count | Sample Weight (g) | Bar Rack Count | Bar Rack Weight (g) | Sample Count | Sample Weight (g) |
| 1 | *Atherinops affinis* | topsmelt | 5,242 | 42,299 | 10 | 262 | 15,696 | 67,497 |
| 2 | *Cymatogaster aggregata* | shiner surfperch | 2,827 | 28,374 | - | - | 18,361 | 196,568 |
| 3 | *Anchoa compressa* | deepbody anchovy | 2,079 | 11,606 | 2 | 21 | 23,356 | 254,266 |
| 4 | *Seriphus politus* | queenfish | 1,304 | 7,499 | 2 | 17 | 929 | 21,390 |
| 5 | *Xenistius californiensis* | salema | 1,061 | 2,390 | - | - | 1,577 | 6,154 |
| 6 | *Anchoa delicatissima* | slough anchovy | 1,056 | 3,144 | - | - | 7 | 10 |
| 7 | Atherinopsidae | silverside | 999 | 4,454 | - | - | 2,105 | 8,661 |
| 8 | *Hyperprosopon argenteum* | walleye surfperch | 605 | 23,962 | 1 | 21 | 2,547 | 125,434 |
| 9 | *Engraulis mordax* | northern anchovy | 537 | 786 | - | - | 92 | 374 |
| 10 | *Leuresthes tenuis* | California grunion | 489 | 2,280 | - | - | 7,067 | 40,849 |
| 11 | *Heterostichus rostratus* | giant kelpfish | 344 | 2,612 | - | - | 908 | 9,088 |
| 12 | *Paralabrax maculatofasciatus* | spotted sand bass | 303 | 4,604 | - | - | 1,536 | 107,563 |
| 13 | *Sardinops sagax* | Pacific sardine | 268 | 1,480 | - | - | 6,578 | 26,266 |
| 14 | *Roncador stearnsii* | spotfin croaker | 182 | 8,354 | 2 | 3,000 | 106 | 17,160 |
| 15 | *Paralabrax nebulifer* | barred sand bass | 151 | 1,541 | - | - | 1,993 | 32,759 |
| 16 | *Gymnura marmorata* | Calif. butterfly ray | 146 | 60,629 | 1 | 390 | 70 | 36,821 |
| 17 | *Phanerodon furcatus* | white surfperch | 144 | 4,686 | - | - | 53 | 823 |
| 18 | *Strongylura exilis* | California needlefish | 135 | 6,025 | - | - | 158 | 11,899 |
| 19 | *Paralabrax clathratus* | kelp bass | 111 | 680 | - | - | 976 | 13,279 |
| 20 | *Porichthys myriaster* | specklefin midshipman | 103 | 28,189 | - | - | 218 | 66,860 |
| 21 | unidentified chub | unidentified chub | 96 | 877 | - | - | 7 | 44 |
| 22 | *Paralichthys californicus* | California halibut | 95 | 1,729 | - | - | 21 | 4,769 |
| 23 | *Anisotremus davidsoni* | sargo | 94 | 1,662 | - | - | 963 | 68,528 |
| 24 | *Urolophus halleri* | round stingray | 79 | 20,589 | - | - | 1,090 | 300,793 |
| 25 | *Atractoscion nobilis* | white seabass | 70 | 11,295 | 6 | 872 | 1,618 | 332,056 |
| 26 | *Hypsopsetta guttulata* | diamond turbot | 66 | 10,679 | 1 | 85 | 112 | 24,384 |
| 27 | *Micrometrus minimus* | dwarf surfperch | 57 | 562 | - | - | - | - |
| 28 | *Syngnathus spp.* | pipefishes | 55 | 161 | - | - | 56 | 90 |
| 29 | *Atherinopsis californiensis* | jacksmelt | 54 | 1,152 | - | - | 4,468 | 45,152 |
| 30 | *Myliobatis californica* | bat ray | 50 | 19,899 | 4 | 5,965 | 132 | 68,572 |
| 31 | *Menticirrhus undulatus* | California corbina | 43 | 1,906 | - | - | 16 | 4,925 |
| 32 | *Amphistichus argenteus* | barred surfperch | 43 | 1,306 | - | - | 34 | 2,528 |
| 33 | *Fundulus parvipinnis* | California killifish | 43 | 299 | - | - | 16 | 41 |
| 34 | unidentified fish, damaged | unid. damaged fish | 36 | 1,060 | 1 | 70 | 8 | 262 |
| 35 | Ictaluridae | catfish unid. | 35 | 4,279 | - | - | - | - |
| 36 | *Leptocottus armatus* | Pacific staghorn sculpin | 32 | 280 | - | - | 5 | 26 |
| 37 | *Sphyraena argentea* | California barracuda | 29 | 397 | - | - | 46 | 1,667 |
| 38 | *Lepomis cyanellus* | green sunfish | 29 | 1,170 | - | - | - | - |
| 39 | *Umbrina roncador* | yellowfin croaker | 28 | 573 | - | - | 127 | 22,399 |
| 40 | *Lepomis macrochirus* | bluegill | 20 | 670 | - | - | - | - |
| 41 | *Ophichthus zophochir* | yellow snake eel | 18 | 5,349 | - | - | 51 | 17,303 |
| 42 | *Citharichthys stigmaeus* | speckled sanddab | 17 | 62 | - | - | 1 | 30 |
| 43 | *Brachyistius frenatus* | kelp surfperch | 16 | 182 | - | - | 17 | 598 |
| 44 | *Cheilotrema saturnum* | black croaker | 15 | 103 | - | - | 288 | 9,029 |
| 45 | *Embiotoca jacksoni* | black surfperch | 14 | 1,240 | - | - | 69 | 5,367 |
| 46 | *Genyonemus lineatus* | white croaker | 12 | 171 | - | - | 9 | 79 |

*(table continued)*



**Table 4-2** (continued). Number and weight of fishes, sharks, and rays impinged during normal operation and heat treatment surveys at EPS from June 2004 to June 2005.

| | | | Normal Operations Sample Totals | | | | Heat Treatment | |
|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Sample Count | Sample Weight (g) | Bar Rack Count | Bar Rack Weight (g) | Sample Count | Sample Weight (g) |
| 47 | *Platyrhinoidis triseriata* | thornback | 11 | 4,731 | 1 | 1,500 | - | - |
| 48 | *Chromis punctipinnis* | blacksmith | 10 | 396 | - | - | 151 | 4,431 |
| 49 | unidentified fish | unidentified fish | 10 | 811 | - | - | - | - |
| 50 | *Porichthys notatus* | plainfin midshipman | 9 | 1,792 | - | - | - | - |
| 51 | *Hermosilla azurea* | zebra perch | 9 | 1,097 | - | - | 62 | 3,518 |
| 52 | *Micropterus salmoides* | large mouth bass | 9 | 27 | - | - | - | - |
| 53 | *Trachurus symmetricus* | jack mackerel | 7 | 7 | - | - | 15 | 702 |
| 54 | *Hypsoblennius gentilis* | bay blenny | 7 | 37 | - | - | 440 | 2,814 |
| 55 | *Heterostichus* spp. | kelpfish | 7 | 48 | - | - | - | - |
| 56 | Engraulidae | anchovies | 6 | 3 | - | - | - | - |
| 57 | *Anchoa* spp. | anchovy | 6 | 27 | - | - | - | - |
| 58 | *Peprilus simillimus* | Pacific butterfish | 5 | 91 | - | - | 1 | 33 |
| 59 | *Rhacochilus vacca* | pile surfperch | 4 | 915 | - | - | - | - |
| 60 | *Sebastes atrovirens* | kelp rockfish | 4 | 40 | - | - | - | - |
| 61 | *Pleuronichthys verticalis* | hornyhead turbot | 4 | 190 | - | - | 2 | 251 |
| 62 | *Pylodictis olivaris* | flathead catfish | 4 | 480 | - | - | - | - |
| 63 | Pleuronectiformes unid. | flatfishes | 4 | 62 | - | - | - | - |
| 64 | *Syngnathus leptorhynchus* | bay pipefish | 3 | 9 | - | - | - | - |
| 65 | *Hypsoblennius gilberti* | rockpool blenny | 3 | 16 | - | - | 8 | 77 |
| 66 | *Mustelus californicus* | gray smoothhound | 3 | 1,850 | - | - | 22 | 19,876 |
| 67 | *Cheilopogon pinnatibarbatus* | smallhead flyingfish | 3 | 604 | - | - | - | - |
| 68 | *Ameiurus natalis* | yellow bullhead | 3 | 220 | - | - | - | - |
| 69 | *Lepomis* spp. | sunfishes | 3 | 196 | - | - | - | - |
| 70 | *Girella nigricans* | opaleye | 2 | 346 | - | - | 355 | 30,824 |
| 71 | *Rhinobatos productus* | shovelnose guitarfish | 2 | 461 | 2 | 6,200 | - | - |
| 72 | *Acanthogobius flavimanus* | yellowfin goby | 2 | 55 | - | - | - | - |
| 73 | *Scomber japonicus* | Pacific mackerel | 2 | 10 | - | - | 15 | 880 |
| 74 | *Hypsoblennius* spp. | blennies | 2 | 11 | - | - | 113 | 489 |
| 75 | *Hypsoblennius jenkinsi* | mussel blenny | 2 | 17 | - | - | 175 | 946 |
| 76 | *Paralabrax* spp. | sand bass | 2 | 2 | - | - | 6 | 19 |
| 77 | *Scorpaena guttata* | Calif. scorpionfish | 2 | 76 | - | - | - | - |
| 78 | *Hyporhamphus rosae* | California halfbeak | 2 | 23 | - | - | 1 | - |
| 79 | *Symphurus atricaudus* | California tonguefish | 2 | 15 | - | - | - | - |
| 80 | *Tilapia* spp. | tilapias | 2 | 7 | - | - | - | - |
| 81 | *Sarda chiliensis* | Pacific bonito | 2 | 1,010 | - | - | 2 | 540 |
| 82 | *Albula vulpes* | bonefish | 2 | 1,192 | - | - | 1 | 900 |
| 83 | Sciaenidae unid. | croaker | 2 | 3 | - | - | 17 | 1,212 |
| 84 | *Oxylebius pictus* | painted greenling | 1 | 5 | - | - | - | - |
| 85 | *Lyopsetta exilis* | slender sole | 1 | 26 | - | - | - | - |
| 86 | *Citharichthys sordidus* | Pacific sanddab | 1 | 1 | - | - | - | - |
| 87 | *Gibbonsia montereyensis* | crevice kelpfish | 1 | 8 | - | - | - | - |
| 88 | *Pleuronichthys ritteri* | spotted turbot | 1 | 7 | - | - | 13 | 2,745 |
| 89 | *Gillichthys mirabilis* | longjaw mudsucker | 1 | 34 | - | - | - | - |
| 90 | *Dorosoma petenense* | threadfin shad | 1 | 3 | - | - | - | - |
| 91 | *Porichthys* spp. | midshipman | 1 | 200 | - | - | - | - |
| 92 | *Cynoscion parvipinnis* | shortfin corvina | 1 | 900 | - | - | - | - |

*(table continued)*

**Table 4-2** (continued). Number and weight of fishes, sharks, and rays impinged during normal operation and heat treatment surveys at EPS from June 2004 to June 2005.

| | | | Normal Operations Sample Totals | | | | Heat Treatment | |
|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Sample Count | Sample Weight (g) | Bar Rack Count | Bar Rack Weight (g) | Sample Count | Sample Weight (g) |
| 93 | *Mugil cephalus* | striped mullet | 1 | 3 | - | - | 5 | 3,854 |
| 94 | *Paraclinus integripinnis* | reef finspot | 1 | 4 | - | - | 4 | 12 |
| 95 | *Hyperprosopon* spp. | surfperch | 1 | 115 | - | - | 7 | 552 |
| 96 | *Ameiurus nebulosus* | brown bullhead | 1 | 100 | - | - | - | - |
| 97 | *Micropterus dolomieu* | smallmouth bass | 1 | 150 | - | - | - | - |
| 98 | *Citharichthys* spp. | sanddabs | - | - | - | - | 1 | 3 |
| 99 | *Triakis semifasciata* | leopard shark | - | - | - | - | 2 | 688 |
| 100 | *Medialuna californiensis* | halfmoon | - | - | - | - | 53 | 1,864 |
| 101 | *Torpedo californica* | Pacific electric ray | - | - | 1 | 3,750 | - | - |
| 102 | Scorpaenidae | scorpionfishes | - | - | - | - | 2 | 64 |
| 103 | *Halichoeres semicinctus* | rock wrasse | - | - | - | - | 1 | 33 |
| 104 | *Hypsypops rubicundus* | garibaldi | - | - | - | - | 5 | 1,897 |
| 105 | *Seriola lalandi* | yellowtail jack | - | - | - | - | 21 | 978 |
| 106 | *Dasyatis dipterura* | diamond stingray | - | - | - | - | 2 | 1,468 |
| 107 | *Heterodontus francisci* | horn shark | - | - | - | - | 1 | 850 |
| 108 | Zoarcidae | eelpouts | - | - | - | - | 1 | 17 |
| | | | **19,408** | **351,672** | **34** | **22,152** | **94,991** | **2,034,900** |

**Table 4-3.** Calculated annual impingement of fishes, sharks, and rays based on EPS maximum flows and actual flows during normal operation surveys from June 2004 to June 2005.

| | | | Maximum flow rate basis | | | | Actual flow rate basis | | | | Bar rack impingement | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Weight (g) |
| 1 | *Atherinops affinis* | topsmelt | 55,176 | 7,012 | 477,267 | 68,702 | 28,840 | 3,767 | 233,437 | 34,341 | 70 | 1830 |
| 2 | *Cymatogaster aggregata* | shiner surfperch | 26,506 | 2,689 | 300,068 | 34,418 | 19,303 | 2,024 | 197,272 | 21,678 | - | - |
| 3 | *Anchoa compressa* | deepbody anchovy | 20,833 | 3,157 | 135,216 | 20,501 | 13,915 | 2,259 | 79,668 | 11,514 | 14 | 147 |
| 4 | *Seriphus politus* | queenfish | 11,568 | 1,386 | 68,156 | 10,153 | 8,536 | 1,116 | 48,923 | 7,931 | 14 | 115 |
| 5 | *Anchoa delicatissima* | slough anchovy | 11,211 | 4,077 | 33,692 | 15,528 | 5,000 | 2,010 | 14,729 | 7,645 | - | - |
| 6 | Atherinopsidae | silverside | 10,198 | 2,624 | 46,649 | 10,901 | 6,857 | 1,979 | 30,372 | 8,035 | - | - |
| 7 | *Xenistius californiensis* | salema | 9,533 | 3,393 | 20,754 | 7,082 | 6,933 | 2,732 | 15,588 | 5,744 | - | - |
| 8 | *Hyperprosopon argenteum* | walleye surfperch | 6,623 | 1,751 | 276,928 | 79,508 | 3,032 | 866 | 122,967 | 39,161 | 7 | 147 |
| 9 | *Engraulis mordax* | northern anchovy | 4,778 | 1,282 | 7,368 | 1,625 | 3,835 | 1,128 | 5,530 | 1,226 | - | - |
| 10 | *Leuresthes tenuis* | California grunion | 3,963 | 594 | 19,037 | 2,990 | 3,077 | 454 | 3,077 | 2,135 | - | - |
| 11 | *Paralabrax maculatofas.* | spotted sand bass | 3,910 | 778 | 59,213 | 14,560 | 1,779 | 385 | 30,692 | 8,194 | - | - |
| 12 | *Heterostichus rostratus* | giant kelpfish | 2,793 | 461 | 21,335 | 3,568 | 2,345 | 408 | 17,649 | 3,127 | - | - |
| 13 | *Sardinops sagax* | Pacific sardine | 2,344 | 403 | 13,949 | 1,690 | 1,735 | 359 | 9,096 | 1,135 | - | - |
| 14 | *Paralabrax nebulifer* | barred sand bass | 2,156 | 455 | 19,188 | 4,540 | 1,130 | 226 | 11,230 | 2,968 | - | - |
| 15 | unidentified chub | unid. chub | 1,746 | 916 | 15,832 | 8,437 | 838 | 446 | 7,606 | 4,108 | - | - |
| 16 | *Roncador stearnsii* | spotfin croaker | 1,700 | 455 | 83,903 | 35,219 | 1,231 | 353 | 42,602 | 18,092 | 14 | 21,000 |
| 17 | *Phanerodon furcatus* | white surfperch | 1,411 | 225 | 51,760 | 14,552 | 860 | 146 | 24,193 | 7,275 | - | - |
| 18 | *Gymnura marmorata* | Cal. butterfly ray | 1,321 | 132 | 581,992 | 71,334 | 914 | 91 | 351,686 | 42,603 | 7 | 2,730 |
| 19 | *Paralabrax clathratus* | kelp bass | 1,203 | 219 | 7,382 | 1,456 | 554 | 111 | 3,289 | 727 | - | - |
| 20 | *Strongylura exilis* | Cal. needlefish | 1,173 | 153 | 59,304 | 9,622 | 895 | 120 | 36,949 | 5,904 | - | - |
| 21 | *Anisotremus davidsonii* | sargo | 992 | 155 | 16,510 | 5,431 | 603 | 94 | 9,355 | 3,305 | - | - |
| 22 | *Paralichthys californicus* | California halibut | 954 | 192 | 18,504 | 4,476 | 591 | 105 | 10,668 | 2,380 | - | - |
| 23 | *Porichthys myriaster* | midshipman | 888 | 98 | 245,274 | 31,495 | 713 | 80 | 194,289 | 24,590 | - | - |
| 24 | *Fundulus parvipinnis* | California killifish | 779 | 386 | 5,615 | 3,090 | 369 | 188 | 2,672 | 1,505 | - | - |
| 25 | *Hypsopsetta guttulata* | diamond turbot | 735 | 91 | 118,470 | 19,617 | 420 | 54 | 67,812 | 11,142 | 7 | 595 |
| 26 | *Atractoscion nobilis* | white seabass | 724 | 140 | 119,954 | 30,746 | 442 | 85 | 69,962 | 17,493 | 42 | 6,105 |
| 27 | Ictaluridae | catfish unid. | 708 | 352 | 87,489 | 54,747 | 339 | 171 | 41,926 | 26,656 | - | - |
| 28 | *Urolophus halleri* | round stingray | 696 | 124 | 185,157 | 44,163 | 510 | 83 | 129,583 | 27,211 | - | - |
| 29 | *Micrometrus minimus* | dwarf surfperch | 615 | 178 | 6,035 | 1,707 | 268 | 89 | 2,573 | 848 | - | - |
| 30 | *Lepomis cyanellus* | green sunfish | 534 | 221 | 20,796 | 8,079 | 190 | 43 | 2,231 | 1,244 | - | - |
| 31 | *Atherinopsis californiensis* | jacksmelt | 516 | 161 | 10,341 | 3,138 | 339 | 98 | 7,517 | 2,341 | - | - |
| 32 | *Syngnathus spp.* | pipefishes | 469 | 75 | 1,331 | 398 | 375 | 61 | 1,105 | 365 | - | - |

**Table 4-3.(continued)** Calculated annual impingement of fishes, sharks, and rays based on EPS maximum flows and actual flows during normal operation surveys from June 2004 to June 2005.

| | | | Maximum flow rate basis | | | | Actual flow rate basis | | | | Bar rack impingement | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Weight (g) |
| 33 | *Menticirrhus undulatus* | California corbina | 452 | 151 | 19,581 | 12,307 | 191 | 75 | 8,682 | 6,191 | - | - |
| 34 | *Amphistichus argenteus* | barred surfperch | 444 | 157 | 13,864 | 7,231 | 211 | 79 | 5,658 | 3,559 | - | - |
| 35 | *Myliobatis californica* | bat ray | 429 | 58 | 177,308 | 33,107 | 330 | 46 | 125,302 | 20,852 | 28 | 41,755 |
| 36 | unidentified fish, damaged | unid. damaged fish | 381 | 91 | 12,530 | 4,868 | 240 | 57 | 9,228 | 3,513 | 7 | 490 |
| 37 | *Lepomis macrochirus* | bluegill | 331 | 169 | 10,399 | 6,734 | 162 | 82 | 5,090 | 3,288 | - | - |
| 38 | *Leptocottus armatus* | Pac. staghorn sculpin | 286 | 74 | 2,551 | 695 | 216 | 55 | 1,897 | 504 | - | - |
| 39 | *Umbrina roncador* | yellowfin croaker | 251 | 69 | 5,785 | 3,488 | 170 | 49 | 2,859 | 1,748 | - | - |
| 40 | *Sphyraena argentea* | California barracuda | 245 | 58 | 3,558 | 2,027 | 269 | 109 | 10,542 | 4,035 | - | - |
| 41 | *Brachyistius frenatus* | kelp surfperch | 217 | 87 | 2,306 | 847 | 114 | 45 | 1,271 | 460 | - | - |
| 42 | *Ophichthus zophochir* | yellow snake eel | 214 | 42 | 65,618 | 14,945 | 111 | 24 | 34,071 | 8,366 | - | - |
| 43 | *Citharichthys stigmaeus* | speckled sanddab | 180 | 52 | 643 | 187 | 109 | 32 | 406 | 124 | - | - |
| 44 | *Embiotoca jacksoni* | black surfperch | 127 | 31 | 14,381 | 7,593 | 99 | 23 | 9,970 | 4,996 | - | - |
| 45 | *Chromis punctipinnis* | blacksmith | 124 | 34 | 3,655 | 1,292 | 79 | 21 | 2,790 | 1,063 | - | - |
| 46 | *Micropterus salmoides* | large mouth bass | 115 | 53 | 345 | 165 | 65 | 30 | 195 | 93 | - | - |
| 47 | *Cheilotrema saturnum* | black croaker | 109 | 31 | 822 | 439 | 96 | 28 | 629 | 289 | - | - |
| 48 | *Genyonemus lineatus* | white croaker | 104 | 33 | 1,468 | 801 | 77 | 25 | 1,202 | 679 | - | - |
| 49 | *Platyrhinoidis triseriata* | thornback | 104 | 27 | 43,446 | 14,790 | 67 | 18 | 28,953 | 11,149 | 7 | 10,500 |
| 50 | unidentified fish | unid. fish | 89 | 30 | 7,284 | 5,883 | 67 | 23 | 5,961 | 4,904 | - | - |
| 51 | *Hermosilla azurea* | zebra perch | 86 | 31 | 9,263 | 5,738 | 56 | 21 | 7,608 | 4,823 | - | - |
| 52 | *Porichthys notatus* | plainfin midshipman | 76 | 38 | 16,617 | 8,882 | 60 | 31 | 12,177 | 6,586 | - | - |
| 53 | *Pylodictis olivaris* | flathead catfish | 70 | 31 | 8,359 | 3,973 | 34 | 15 | 4,020 | 1,934 | - | - |
| 54 | *Trachurus symmetricus* | jack mackerel | 68 | 33 | 75 | 38 | 50 | 25 | 51 | 24 | - | - |
| 55 | *Heterostichus* spp. | kelpfish | 66 | 52 | 453 | 370 | 51 | 40 | 348 | 285 | - | - |
| 56 | *Hypsoblennius gentilis* | bay blenny | 61 | 21 | 308 | 134 | 45 | 16 | 232 | 107 | - | - |
| 57 | Engraulidae | anchovies | 57 | 39 | 27 | 18 | 43 | 30 | 20 | 13 | - | - |
| 58 | *Anchoa* spp. | anchovy | 53 | 23 | 246 | 116 | 39 | 17 | 179 | 83 | - | - |
| 59 | *Peprilus simillimus* | Pacific butterfish | 47 | 20 | 773 | 388 | 34 | 14 | 602 | 336 | - | - |
| 60 | *Rhacochilus vacca* | pile surfperch | 44 | 21 | 11,110 | 6,656 | 26 | 13 | 6,366 | 3,903 | - | - |
| 61 | Pleuronectiformes unid. | flatfishes | 44 | 25 | 453 | 359 | 28 | 16 | 387 | 318 | - | - |
| 62 | *Ameiurus natalis* | yellow bullhead | 40 | 17 | 2,966 | 1,256 | 20 | 9 | 1,505 | 640 | - | - |
| 63 | *Lepomis* spp. | sunfishes | 39 | 22 | 3,121 | 2,314 | 20 | 12 | 1,540 | 1,136 | - | - |
| 64 | *Pleuronichthys verticalis* | hornyhead turbot | 37 | 17 | 1,517 | 862 | 29 | 13 | 1,299 | 762 | - | - |

**Table 4-3.(continued)** Calculated annual impingement of fishes, sharks, and rays based on EPS maximum flows and actual flows during normal operation surveys from June 2004 to June 2005.

| | | | Maximum flow rate basis | | | | Actual flow rate basis | | | | Bar rack impingement | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Weight (g) |
| 65 | *Sebastes atrovirens* | kelp rockfish | 34 | 20 | 338 | 210 | 28 | 17 | 280 | 174 | - | - |
| 66 | *Mustelus californicus* | gray smoothhound | 32 | 20 | 19,800 | 15,052 | 13 | 10 | 7,766 | 7,404 | - | - |
| 67 | *Hypsoblennius* spp. | blennies | 32 | 22 | 146 | 96 | 21 | 15 | 97 | 64 | - | - |
| 68 | *Syngnathus leptorhynchus* | bay pipefish | 28 | 15 | 81 | 45 | 21 | 11 | 60 | 33 | - | - |
| 69 | *Hypsoblennius gilberti* | rockpool blenny | 28 | 15 | 144 | 78 | 17 | 10 | 90 | 52 | - | - |
| 70 | *Acanthogobius flavimanus* | yellowfin goby | 27 | 16 | 729 | 452 | 14 | 8 | 370 | 230 | - | - |
| 71 | *Tilapia* spp. | tilapia | 26 | 15 | 86 | 54 | 15 | 9 | 49 | 30 | - | - |
| 72 | *Cheilopogon pinnatibar* | spotted flyingfish | 23 | 12 | 4,563 | 2,666 | 21 | 11 | 4,305 | 2,519 | - | - |
| 73 | *Scorpaena guttata* | Cal. scorpionfish | 22 | 14 | 821 | 537 | 10 | 7 | 386 | 283 | - | - |
| 74 | *Albula vulpes* | bonefish | 21 | 13 | 12,760 | 7,472 | 8 | 6 | 5,005 | 3,676 | - | - |
| 75 | *Sarda chiliensis* | Pacific bonito | 21 | 14 | 10,712 | 7,290 | 13 | 9 | 6,813 | 4,673 | - | - |
| 76 | *Hypsoblennius jenkinsi* | mussel blenny | 19 | 13 | 147 | 100 | 13 | 9 | 109 | 80 | - | - |
| 77 | *Hyporhamphus rosae* | California halfbeak | 19 | 18 | 214 | 198 | 15 | 14 | 165 | 153 | - | - |
| 78 | *Ameiurus nebulosus* | brown bullhead | 19 | 17 | 1,890 | 1,749 | 9 | 9 | 909 | 852 | - | - |
| 79 | *Rhinobatos productus* | shovelnose guitarfish | 18 | 12 | 4,244 | 2,918 | 14 | 9 | 3,164 | 2,187 | 14 | 43,400 |
| 80 | *Girella nigricans* | opaleye | 18 | 17 | 3,086 | 2,858 | 15 | 14 | 2,626 | 2,441 | - | - |
| 81 | *Symphurus atricaudus* | California tonguefish | 18 | 12 | 137 | 92 | 11 | 8 | 82 | 58 | - | - |
| 82 | *Micropterus dolomieu* | smallmouth bass | 16 | 15 | 2,395 | 2,217 | 8 | 7 | 1,152 | 1,080 | - | - |
| 83 | Sciaenidae unid. | croaker | 16 | 10 | 19 | 17 | 14 | 9 | 19 | 17 | - | - |
| 84 | *Scomber japonicus* | Pacific mackerel | 15 | 10 | 73 | 53 | 14 | 9 | 68 | 50 | - | - |
| 85 | *Paralabrax* spp. | sand bass | 15 | 10 | 15 | 10 | 14 | 9 | 14 | 9 | - | - |
| 86 | *Lyopsetta exilis* | slender sole | 12 | 11 | 313 | 290 | 7 | 6 | 175 | 163 | - | - |
| 87 | *Dorosoma petenense* | threadfin shad | 12 | 11 | 41 | 38 | 7 | 6 | 24 | 22 | - | - |
| 88 | *Gillichthys mirabilis* | longjaw mudsucker | 12 | 11 | 409 | 379 | 6 | 6 | 202 | 190 | - | - |
| 89 | *Cynoscion parvipinnis* | shortfin corvina | 11 | 10 | 9,647 | 8,932 | 4 | 5 | 3,784 | 4,394 | - | - |
| 90 | *Citharichthys sordidus* | Pacific sanddab | 11 | 10 | 5 | 5 | 4 | 5 | 2 | 2 | - | - |
| 91 | *Hyperprosopon* spp. | surfperch | 11 | 10 | 1,219 | 1,128 | 4 | 5 | 495 | 550 | - | - |
| 92 | *Pleuronichthys ritteri* | spotted turbot | 10 | 9 | 65 | 60 | 6 | 6 | 42 | 39 | - | - |
| 93 | *Gibbonsia montereyensis* | crevice kelpfish | 10 | 9 | 79 | 73 | 7 | 6 | 56 | 52 | - | - |
| 94 | *Mugil cephalus* | striped mullet | 8 | 7 | 27 | 25 | 7 | 6 | 24 | 22 | - | - |
| 95 | *Porichthys* spp. | midshipman | 8 | 7 | 1,608 | 1,489 | 7 | 6 | 1,400 | 1,297 | - | - |
| 96 | *Paralabrax nebulifer* | barred sandbass | 8 | 7 | 28 | 26 | 7 | 6 | 25 | 23 | - | - |

**Table 4-3.(continued)** Calculated annual impingement of fishes, sharks, and rays based on EPS maximum flows and actual flows during normal operation surveys from June 2004 to June 2005.

| | | | Maximum flow rate basis | | | | Actual flow rate basis | | | | Bar rack impingement | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Weight (g) |
| 97 | *Oxylebius pictus* | painted greenling | 7 | 7 | 35 | 32 | 7 | 6 | 33 | 31 | - | - |
| 98 | *Citharichthys* spp | sanddabs | - | - | - | - | - | - | - | - | - | - |
| 99 | *Triakis semifasciata* | leopard shark | - | - | - | - | - | - | - | - | - | - |
| 100 | *Medialuna californiensis* | halfmoon | - | - | - | - | - | - | - | - | - | - |
| 101 | *Torpedo californica* | Pacific electric ray | - | - | - | - | - | - | - | - | 7 | 26,250 |
| | | | **194,333** | | **3,651,179** | | **120,354** | | **2,168,422** | | **238** | **155,065** |

**Table 4-4.** Calculated overall annual impingement of fishes, sharks, and rays from all sources combined (normal operations [traveling screens and bar racks] and heat treatments) based on EPS maximum flows and actual flows, June 2004–June 2005.

| | | | Maximum Flow | | Actual Flow | |
|---|---|---|---|---|---|---|
| | Taxon | Common Name | Abundance | Weight (g) | Abundance | Weight (g) |
| 1 | *Atherinops affinis* | topsmelt | 70,942 | 546,594 | 44,606 | 302,764 |
| 2 | *Cymatogaster aggregata* | shiner surfperch | 44,867 | 496,636 | 37,664 | 393,840 |
| 3 | *Anchoa compressa* | deepbody anchovy | 44,203 | 389,629 | 37,285 | 334,081 |
| 4 | *Seriphus politus* | queenfish | 12,511 | 89,662 | 9,479 | 70,429 |
| 5 | Atherinopsidae | silverside | 12,303 | 55,310 | 8,962 | 39,033 |
| 6 | *Anchoa delicatissima* | slough anchovy | 11,218 | 33,702 | 5,007 | 14,739 |
| 7 | *Xenistius californiensis* | salema | 11,110 | 26,909 | 8,510 | 21,742 |
| 8 | *Leuresthes tenuis* | California grunion | 11,030 | 59,886 | 10,144 | 55,273 |
| 9 | *Hyperprosopon argenteum* | walleye surfperch | 9,177 | 402,509 | 5,586 | 248,549 |
| 10 | *Sardinops sagax* | Pacific sardine | 8,922 | 40,215 | 8,313 | 35,362 |
| 11 | *Paralabrax maculatofasciatus* | spotted sand bass | 5,446 | 166,777 | 3,315 | 138,255 |
| 12 | *Atherinopsis californiensis* | jacksmelt | 4,984 | 55,493 | 4,807 | 52,669 |
| 13 | *Engraulis mordax* | northern anchovy | 4,870 | 7,742 | 3,927 | 5,904 |
| 14 | *Paralabrax nebulifer* | barred sand bass | 4,149 | 51,947 | 3,123 | 43,989 |
| 15 | *Heterostichus rostratus* | giant kelpfish | 3,701 | 30,423 | 3,253 | 26,737 |
| 16 | *Atractoscion nobilis* | white seabass | 2,384 | 458,115 | 2,102 | 408,122 |
| 17 | *Paralabrax clathratus* | kelp bass | 2,179 | 20,661 | 1,530 | 16,568 |
| 18 | *Anisotremus davidsonii* | sargo | 1,955 | 85,039 | 1,566 | 77,884 |
| 19 | *Roncador stearnsii* | spotfin croaker | 1,820 | 122,063 | 1,351 | 80,762 |
| 20 | *Urolophus halleri* | round stingray | 1,786 | 485,950 | 1,600 | 430,376 |
| 21 | unidentified chub | unid. chub | 1,753 | 15,875 | 845 | 7,650 |
| 22 | *Phanerodon furcatus* | white surfperch | 1,464 | 52,583 | 913 | 25,016 |
| 23 | *Gymnura marmorata* | California butterfly ray | 1,398 | 621,543 | 991 | 391,238 |
| 24 | *Strongylura exilis* | California needlefish | 1,331 | 71,203 | 1,053 | 48,848 |
| 25 | *Porichthys myriaster* | specklefin midshipman | 1,106 | 312,133 | 931 | 261,148 |
| 26 | *Paralichthys californicus* | California halibut | 975 | 23,273 | 612 | 15,437 |
| 27 | *Hypsopsetta guttulata* | diamond turbot | 854 | 143,448 | 539 | 92,790 |
| 28 | *Fundulus parvipinnis* | California killifish | 795 | 5,656 | 385 | 2,713 |
| 29 | Ictaluridae | catfish unid. | 708 | 87,489 | 339 | 41,926 |
| 30 | *Micrometrus minimus* | dwarf surfperch | 615 | 6,035 | 268 | 2,573 |
| 31 | *Myliobatis californica* | bat ray | 589 | 287,635 | 490 | 235,629 |
| 32 | *Lepomis cyanellus* | green sunfish | 534 | 20,796 | 190 | 2,231 |
| 33 | *Syngnathus spp.* | pipefishes | 525 | 1,421 | 431 | 1,195 |
| 34 | *Hypsoblennius gentilis* | bay blenny | 501 | 3,121 | 485 | 3,045 |
| 35 | *Amphistichus argenteus* | barred surfperch | 478 | 16,392 | 245 | 8,186 |
| 36 | *Menticirrhus undulatus* | California corbina | 468 | 24,505 | 207 | 13,607 |
| 37 | *Cheilotrema saturnum* | black croaker | 397 | 9,851 | 384 | 9,658 |
| 38 | unidentified fish, damaged | unid. damaged fish | 396 | 13,282 | 255 | 9,980 |
| 39 | *Umbrina roncador* | yellowfin croaker | 378 | 28,185 | 297 | 25,258 |
| 40 | *Girella nigricans* | opaleye | 373 | 33,910 | 370 | 33,449 |
| 41 | *Lepomis macrochirus* | bluegill | 331 | 10,399 | 162 | 5,090 |
| 42 | *Sphyraena argentea* | California barracuda | 291 | 5,225 | 315 | 12,209 |
| 43 | *Leptocottus armatus* | Pacific staghorn sculpin | 291 | 2,577 | 221 | 1,924 |
| 44 | *Chromis punctipinnis* | blacksmith | 275 | 8,086 | 230 | 7,221 |
| 45 | *Ophichthus zophochir* | yellow snake eel | 265 | 82,921 | 162 | 51,374 |
| 46 | *Brachyistius frenatus* | kelp surfperch | 234 | 2,904 | 131 | 1,869 |
| 47 | *Embiotoca jacksoni* | black surfperch | 196 | 19,748 | 168 | 15,337 |

*(table continued)*

**Table 4-4** (continued). Calculated overall annual impingement of fishes, sharks, and rays from all sources combined (normal operations [traveling screens and bar racks] and heat treatments) based on EPS maximum flows and actual flows, June 2004–June 2005.

| | | | Maximum Flow | | Actual Flow | |
|---|---|---|---|---|---|---|
| | **Taxon** | **Common Name** | **Abundance** | **Weight (g)** | **Abundance** | **Weight (g)** |
| 48 | *Hypsoblennius jenkinsi* | mussel blenny | 194 | 1,093 | 188 | 1,055 |
| 49 | *Citharichthys stigmaeus* | speckled sanddab | 181 | 672 | 110 | 435 |
| 50 | *Hermosilla azurea* | zebra perch | 148 | 12,781 | 118 | 11,126 |
| 51 | *Hypsoblennius* spp. | blennies | 145 | 636 | 134 | 587 |
| 52 | *Micropterus salmoides* | large mouth bass | 115 | 345 | 65 | 195 |
| 53 | *Genyonemus lineatus* | white croaker | 113 | 1,546 | 86 | 1,281 |
| 54 | *Platyrhinoidis triseriata* | thornback | 111 | 53,946 | 74 | 39,453 |
| 55 | unidentified fish | unidentified fish | 89 | 7,284 | 67 | 5,961 |
| 56 | *Trachurus symmetricus* | jack mackerel | 83 | 777 | 65 | 753 |
| 57 | *Porichthys notatus* | plainfin midshipman | 76 | 16,617 | 60 | 12,177 |
| 58 | *Pylodictis olivaris* | flathead catfish | 70 | 8,359 | 34 | 4,020 |
| 59 | *Heterostichus* spp. | kelpfish | 66 | 453 | 51 | 348 |
| 60 | Engraulidae | anchovies | 57 | 27 | 43 | 20 |
| 61 | *Mustelus californicus* | gray smoothhound | 54 | 39,676 | 35 | 27,642 |
| 62 | *Anchoa* spp. | anchovy | 53 | 246 | 39 | 179 |
| 63 | *Medialuna californiensis* | halfmoon | 53 | 1,864 | 53 | 1,864 |
| 64 | *Peprilus simillimus* | Pacific butterfish | 48 | 806 | 35 | 636 |
| 65 | *Rhacochilus vacca* | pile surfperch | 44 | 11,110 | 26 | 6,366 |
| 66 | Pleuronectiformes unid. | flatfishes | 44 | 453 | 28 | 387 |
| 67 | *Ameiurus natalis* | yellow bullhead | 40 | 2,966 | 20 | 1,505 |
| 68 | *Lepomis* spp. | sunfishes | 39 | 3,121 | 20 | 1,540 |
| 69 | *Pleuronichthys verticalis* | hornyhead turbot | 39 | 1,769 | 31 | 1,550 |
| 70 | *Hypsoblennius gilberti* | rockpool blenny | 36 | 221 | 25 | 167 |
| 71 | *Sebastes atrovirens* | kelp rockfish | 34 | 338 | 28 | 280 |
| 72 | Sciaenidae unid. | croaker | 33 | 1,231 | 31 | 1,231 |
| 73 | *Rhinobatos productus* | shovelnose guitarfish | 32 | 47,644 | 28 | 46,564 |
| 74 | *Scomber japonicus* | Pacific mackerel | 30 | 953 | 29 | 948 |
| 75 | *Syngnathus leptorhynchus* | bay pipefish | 28 | 81 | 21 | 60 |
| 76 | *Acanthogobius flavimanus* | yellowfin goby | 27 | 729 | 14 | 370 |
| 77 | *Tilapia* spp. | tilapia | 26 | 86 | 15 | 49 |
| 78 | *Sarda chiliensis* | Pacific bonito | 23 | 11,252 | 15 | 7,353 |
| 79 | *Cheilopogon pinnatibarbatus* | spotted flyingfish | 23 | 4,563 | 21 | 4,305 |
| 80 | *Pleuronichthys ritteri* | spotted turbot | 23 | 2,810 | 19 | 2,787 |
| 81 | *Albula vulpes* | bonefish | 22 | 13,660 | 9 | 5,905 |
| 82 | *Scorpaena guttata* | California scorpionfish | 22 | 821 | 10 | 386 |
| 83 | *Seriola lalandi* | yellowtail jack | 21 | 978 | 21 | 978 |
| 84 | *Paralabrax* spp. | sand bass | 21 | 33 | 20 | 32 |
| 85 | *Hyporhamphus rosae* | California halfbeak | 20 | 214 | 16 | 165 |
| 86 | *Ameiurus nebulosus* | brown bullhead | 19 | 1,890 | 9 | 909 |
| 87 | *Hyperprosopon* spp. | surfperch | 18 | 1,771 | 11 | 1,047 |
| 88 | *Symphurus atricaudus* | California tonguefish | 18 | 137 | 11 | 82 |
| 89 | *Micropterus dolomieu* | smallmouth bass | 16 | 2,395 | 8 | 1,152 |
| 90 | *Mugil cephalus* | striped mullet | 13 | 3,881 | 12 | 3,878 |
| 91 | *Lyopsetta exilis* | slender sole | 12 | 313 | 7 | 175 |
| 92 | *Dorosoma petenense* | threadfin shad | 12 | 41 | 7 | 24 |
| 93 | *Gillichthys mirabilis* | longjaw mudsucker | 12 | 409 | 6 | 202 |

*(table continued)*

**Table 4-4** (continued). Calculated overall annual impingement of fishes, sharks, and rays from all sources combined (normal operations [traveling screens and bar racks] and heat treatments) based on EPS maximum flows and actual flows, June 2004–June 2005.

| | | | Maximum Flow | | Actual Flow | |
|---|---|---|---|---|---|---|
| | **Taxon** | **Common Name** | **Abundance** | **Weight (g)** | **Abundance** | **Weight (g)** |
| 94 | *Paraclinus integripinnis* | reef finspot | 12 | 40 | 11 | 37 |
| 95 | *Cynoscion parvipinnis* | shortfin corvina | 11 | 9,647 | 4 | 3,784 |
| 96 | *Citharichthys sordidus* | Pacific sanddab | 11 | 5 | 4 | 2 |
| 97 | *Gibbonsia montereyensis* | crevice kelpfish | 10 | 79 | 7 | 56 |
| 98 | *Porichthys* spp. | midshipman | 8 | 1,608 | 7 | 1,400 |
| 99 | *Oxylebius pictus* | painted greenling | 7 | 35 | 7 | 33 |
| 100 | *Torpedo californica* | Pacific electric ray | 7 | 26,250 | 7 | 26,250 |
| 101 | *Hypsypops rubicundus* | garibaldi | 5 | 1,897 | 5 | 1,897 |
| 102 | *Triakis semifasciata* | leopard shark | 2 | 688 | 2 | 688 |
| 103 | Scorpaenidae | scorpionfishes | 2 | 64 | 2 | 64 |
| 104 | *Dasyatis dipterura* | diamond stingray | 2 | 1,468 | 2 | 1,468 |
| 105 | *Citharichthys* spp. | sanddabs | 1 | 3 | 1 | 3 |
| 106 | *Halichoeres semicinctus* | rock wrasse | 1 | 33 | 1 | 33 |
| 107 | *Heterodontus francisci* | horn shark | 1 | 850 | 1 | 850 |
| 108 | Zoarcidae | eelpouts | 1 | 17 | 1 | 17 |
| | | | **289,562** | **5,841,143** | **215,583** | **4,358,386** |

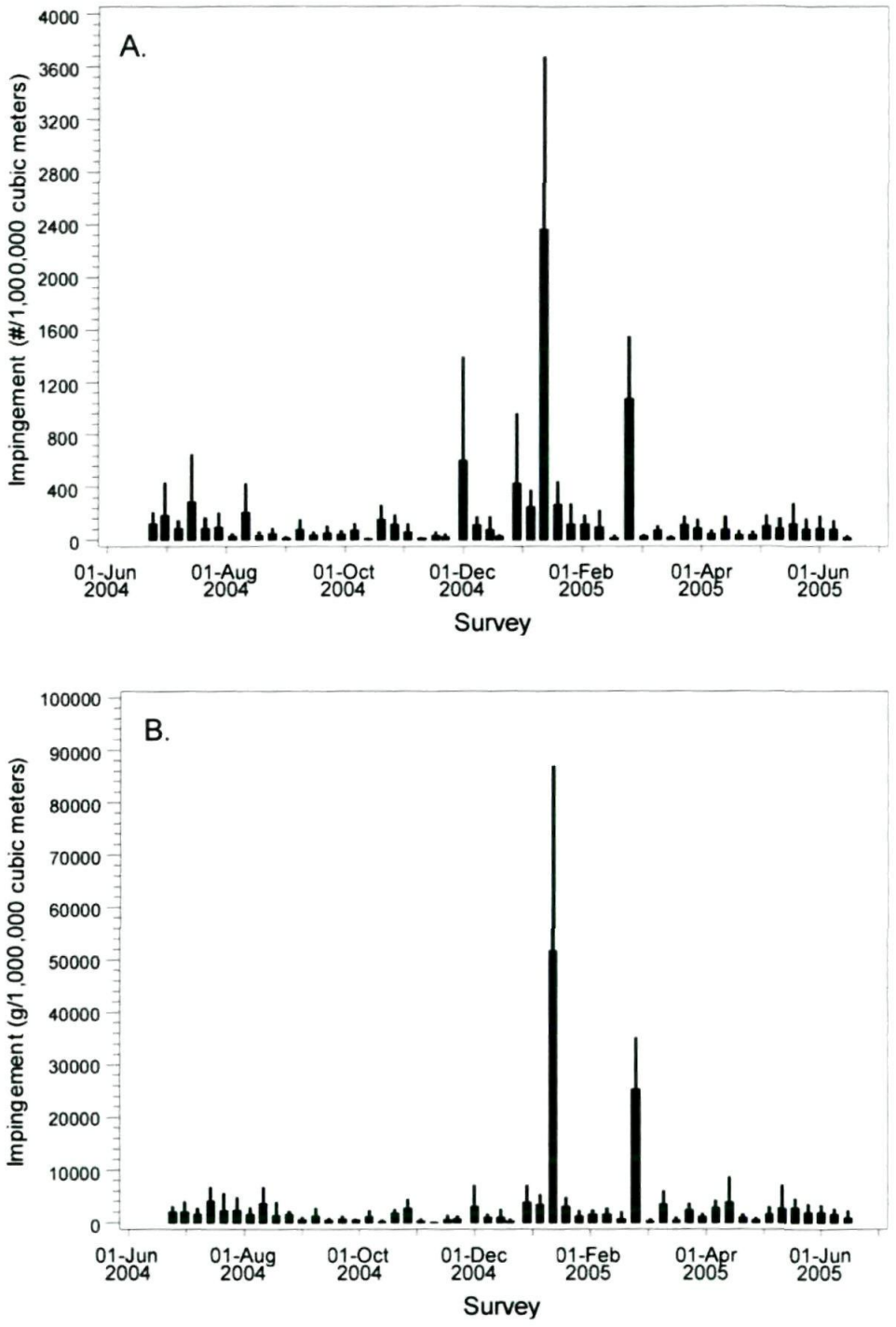



**Figure 4-1**. Mean concentration and standard error of all fish impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

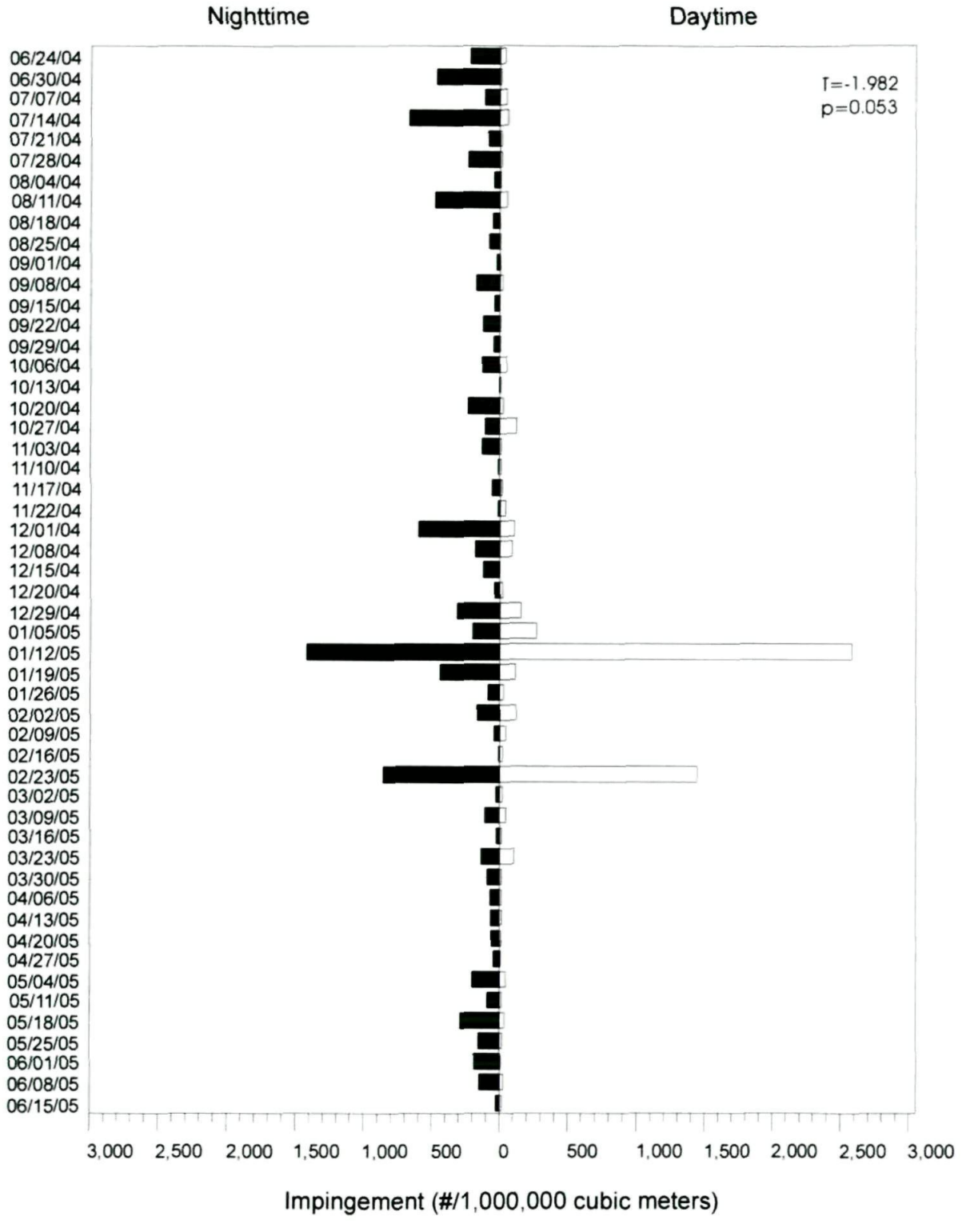



**Figure 4-2.** Abundance (#/$10^6$ $m^3$) of all fish impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples .

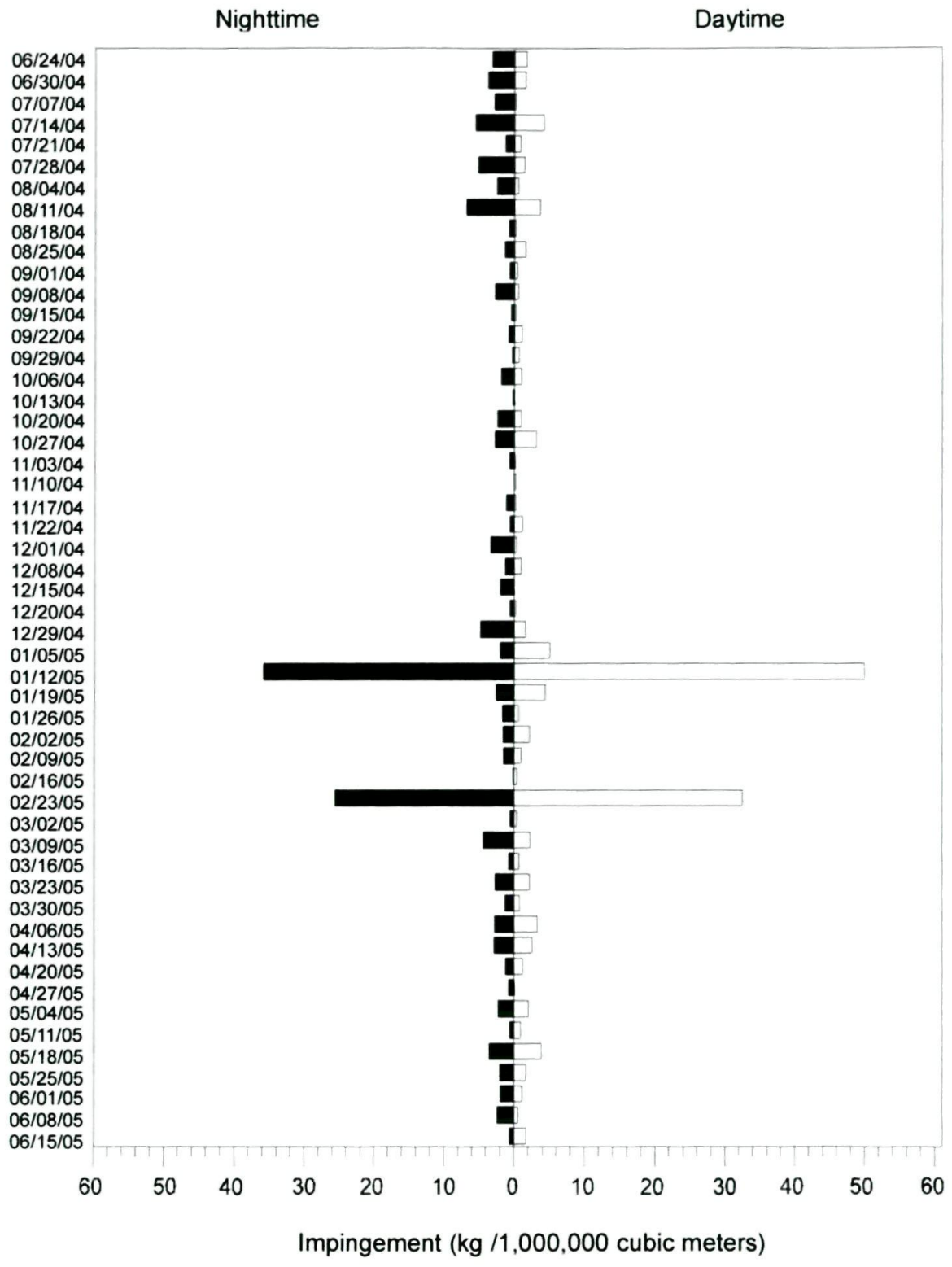



**Figure 4-3.** Biomass (kg/$10^6$ $m^3$) of all fish impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

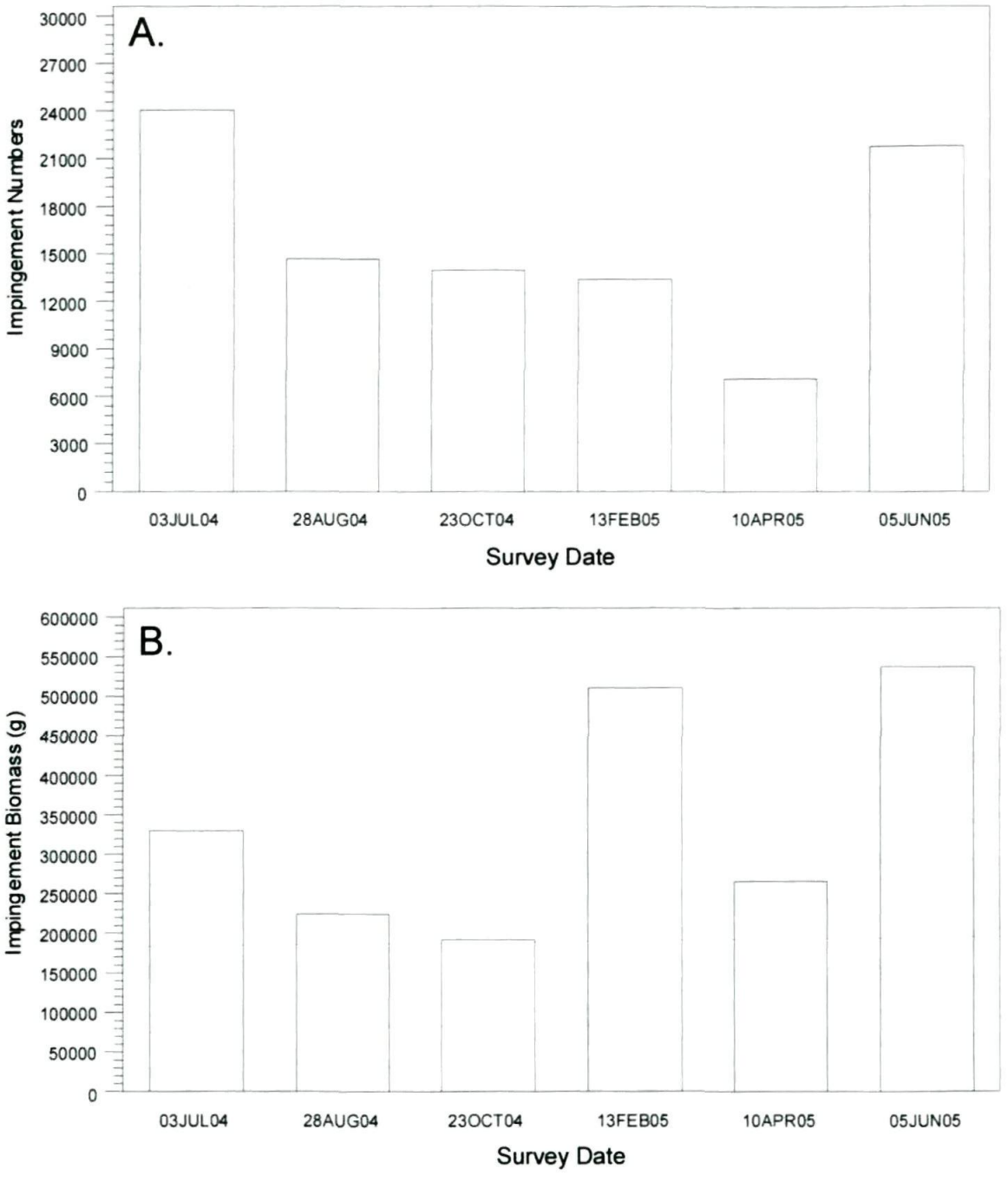



**Figure 4-4**. A) abundance, and B) biomass of all fish impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

## 4.3.2 Anchovies (Engraulidae)

Four species of anchovies (family Engraulidae) occur off of California (Miller and Lea 1972). Slough anchovy (*Anchoa delicatissima)*, deepbody anchovy (*Anchoa compressa)*, and northern anchovy (*Engraulis mordax)* are found in the vicinity of the EPS, while the anchoveta (*Cetengraulis mysticetus*) is considered rare north of Magdelena Bay, Baja California. Northern anchovy larvae were abundant in plankton samples collected as part of the entrainment portion of the present study and it was the only larval engraulid that could be positively identified to the species level. Numerous engraulid larvae were collected that were recently hatched and these specimens did not have enough distinct characteristics to allow them to be positively identified to species level. The life history characteristics of northern anchovy are presented in Section 3.3.4 of this report.

### 4.3.2.1 Sampling Results

Three anchovy species: deepbody, slough, and northern, were impinged during the study. A total of 3,684 anchovies was impinged during the normal impingement surveys, of which 2,079 were deepbody, 1,056 were slough, 537 were northern, and 12 were recorded as *Anchoa* spp. or Engraulidae since they could not be identified to the species level. The impinged anchovies had a combined total weight of 15.6 kg (34.4 lb) in the 52 weekly surveys (**Table 4-2**). Anchovies combined were the second most abundant fish taxa impinged and had the eighth highest biomass. Large spikes in abundance occurred in some weeks during December through February but the remainder of the weekly surveys had low but consistent levels of impingement (**Figure 4-5**). Abundance and biomass were typically greater in most surveys during nighttime cycles, although the two surveys with the highest numbers and biomass (January and February 2005) had the majority of fishes impinged during the daytime cycles (**Figures 4-6** and **4-7**). A total of 23,455 anchovies weighing 254.7 kg (561.5lb) was impinged in the heat treatments (**Figure 4-8**), with a peak in their abundance being during the summer surveys. Nearly all of the impinged specimens were deepbody anchovy during both normal operation and heat treatment surveys. Lengths ranged from 19 to 169 mm (0.75 to 6.7 in), with a mean length of 76.1 mm (3.0 in) (**Figure 4-9; Appendix G**).

### 4.3.2.2 Annual Impingement Estimates

Based on the impinged abundance and biomass of anchovies from weekly surveys and actual CWS flow during the year-long study, the impingement abundance of all species of anchovies combined (not including bar rack or heat treatment mortality) was calculated as 22,832 individuals, approximately 61% of which were deepbody anchovy, 22% slough anchovy, and the remainder northern anchovy (**Table 4-3**). The estimated biomass of anchovies impinged during the year, based on actual flows, was calculated as 100.1 kg (220.7 lb). Under maximum CWS flow, the impinged numbers and biomass of anchovies would have increased 62% and 76% respectively, assuming that impingement was directly proportional to flow rate. The total annual impingement including normal operations, heat treatments and the few individuals impinged on

the bar racks was 46,301 and 354.9 kg (782 lb) using actual flows and 60,401 and 431.3 kg (951 lb) using maximum flows (**Table 4-4**).

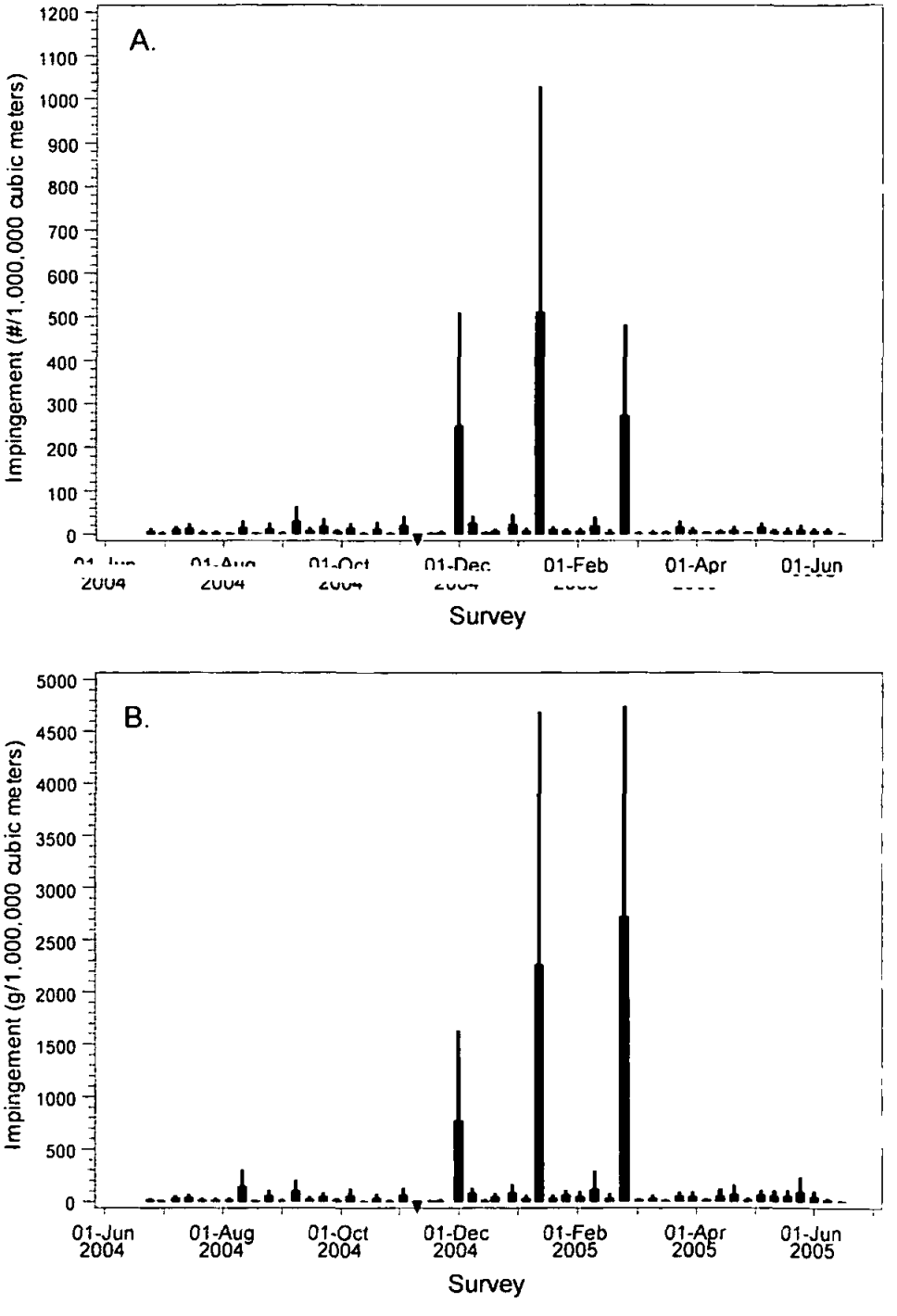



**Figure 4-5**. Mean concentration and standard error of anchovies impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys); A) abundance, and B) biomass.
*Note: Downward pointing triangle indicates survey with no larvae collected.*

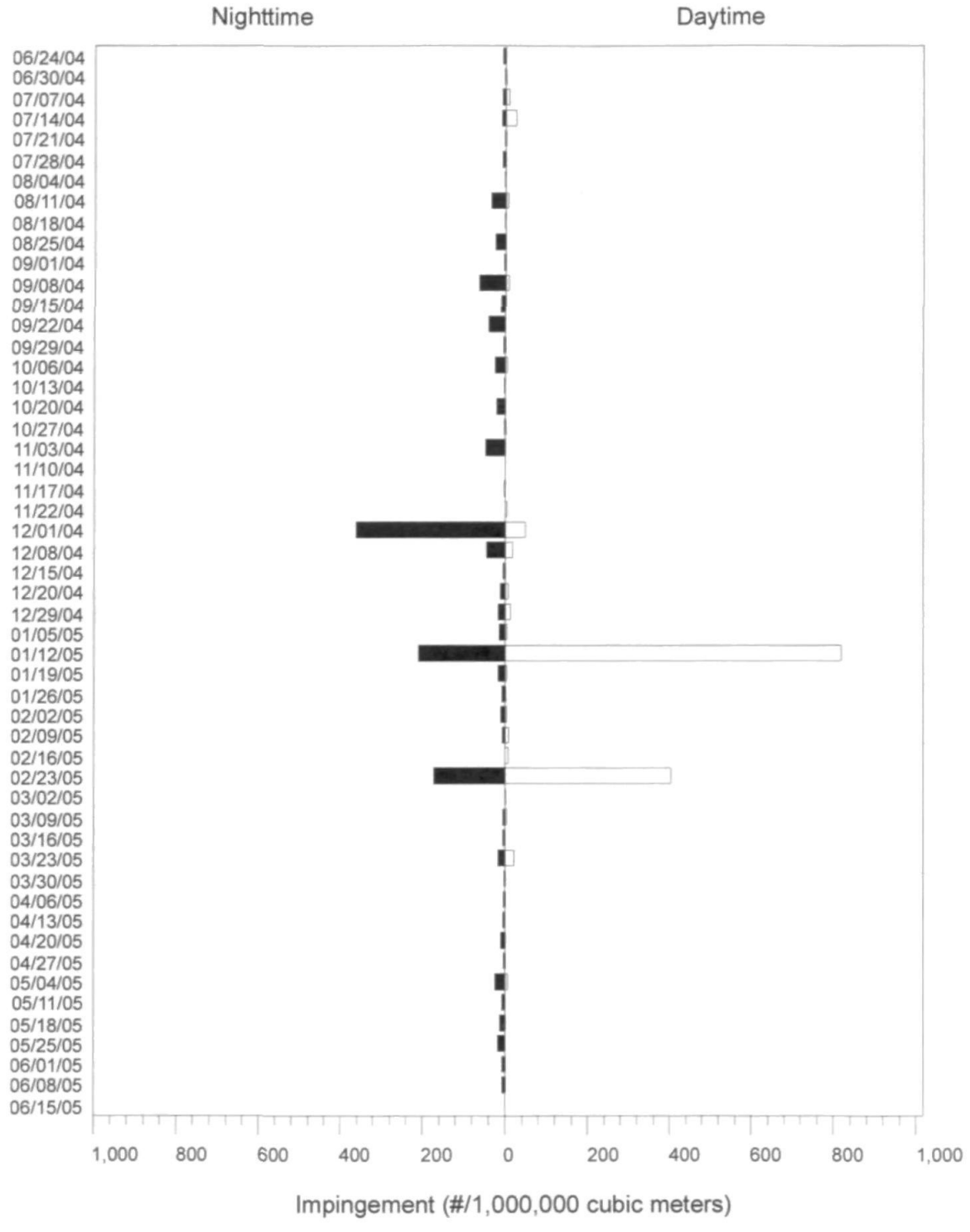



**Figure 4-6.** Abundance (#/$10^6$ $m^3$) of anchovies impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

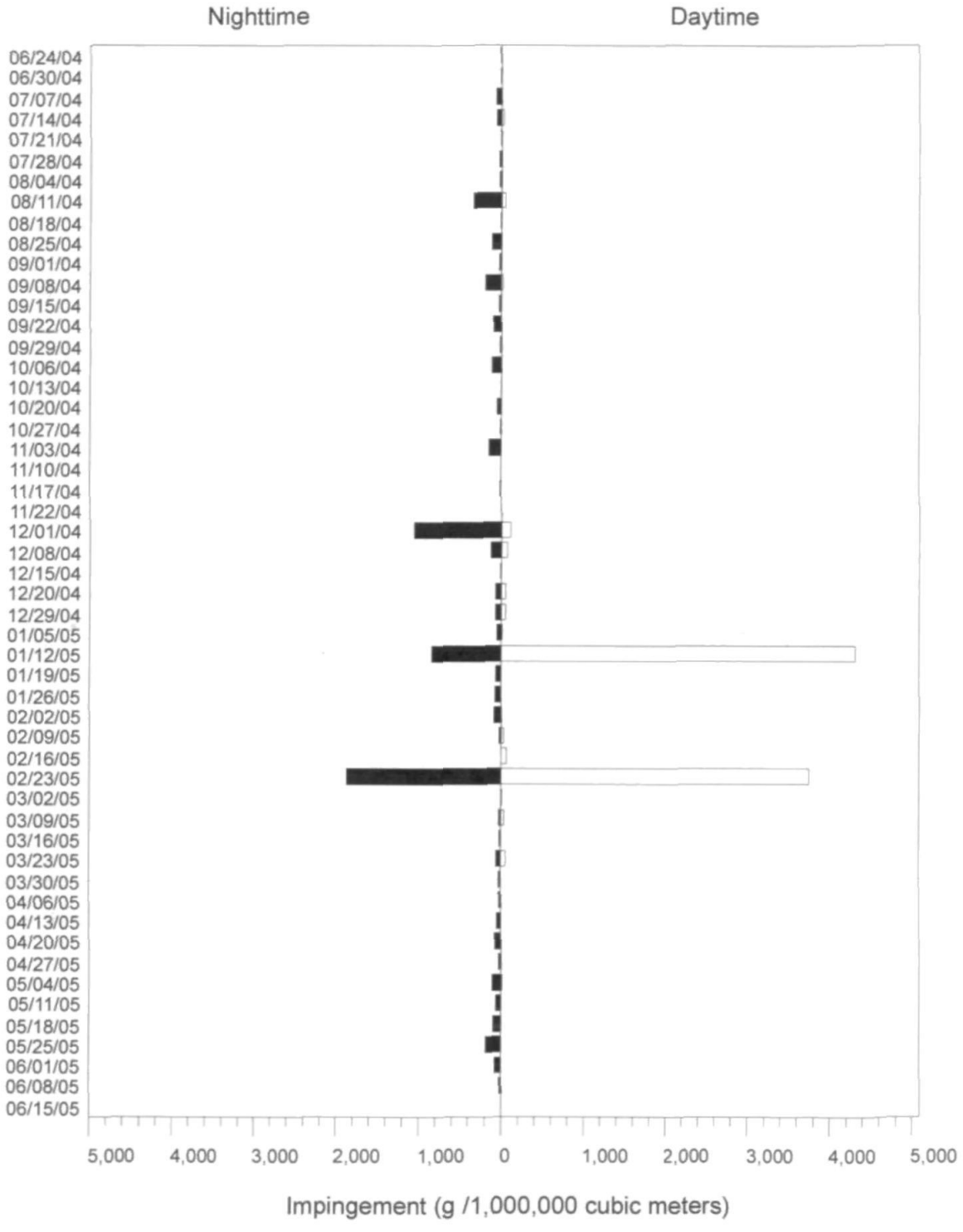



**Figure 4-7.** Biomass ($g/10^6$ $m^3$) of anchovies impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

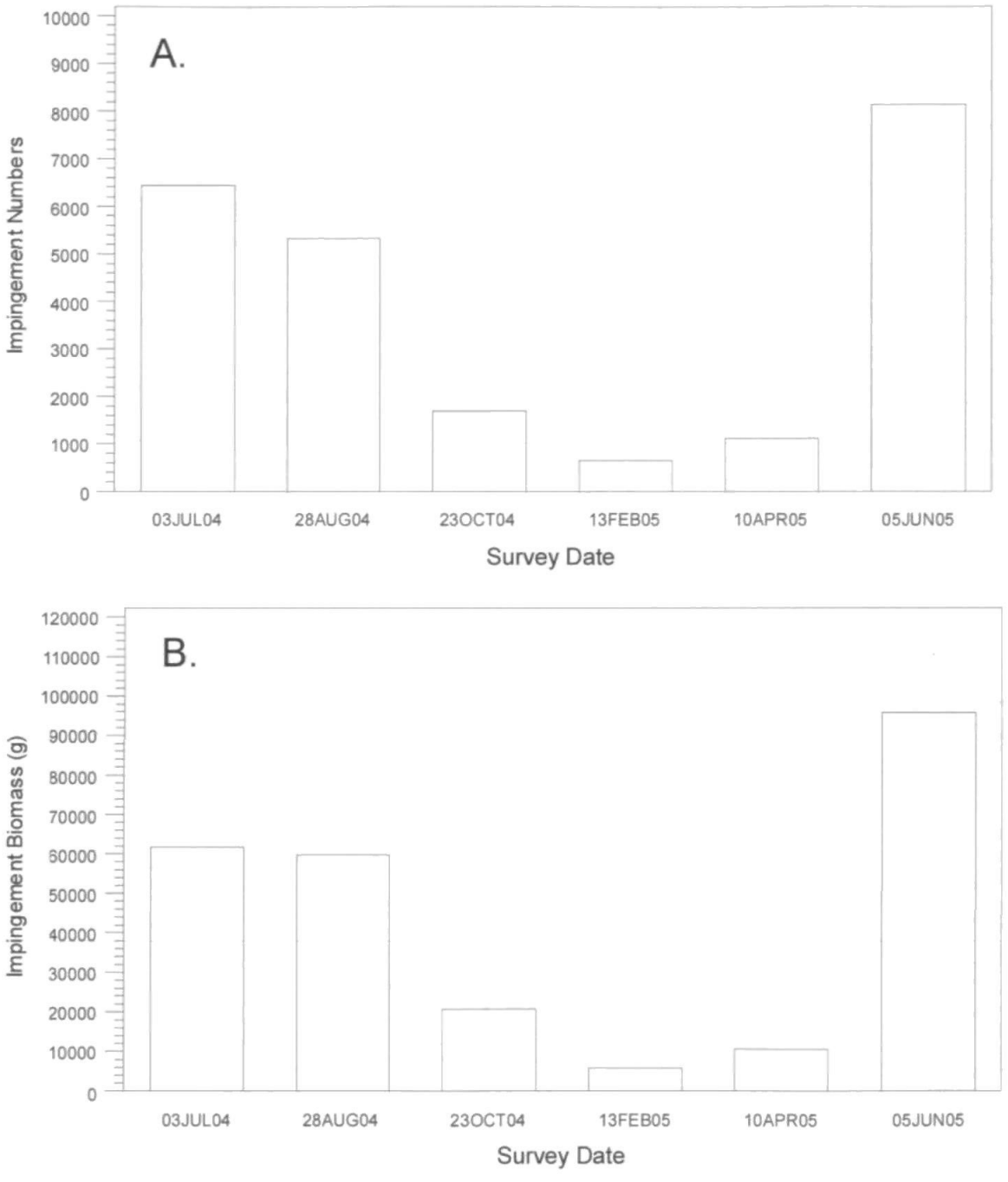



**Figure 4-8**. A) abundance, and B) biomass of anchovies impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

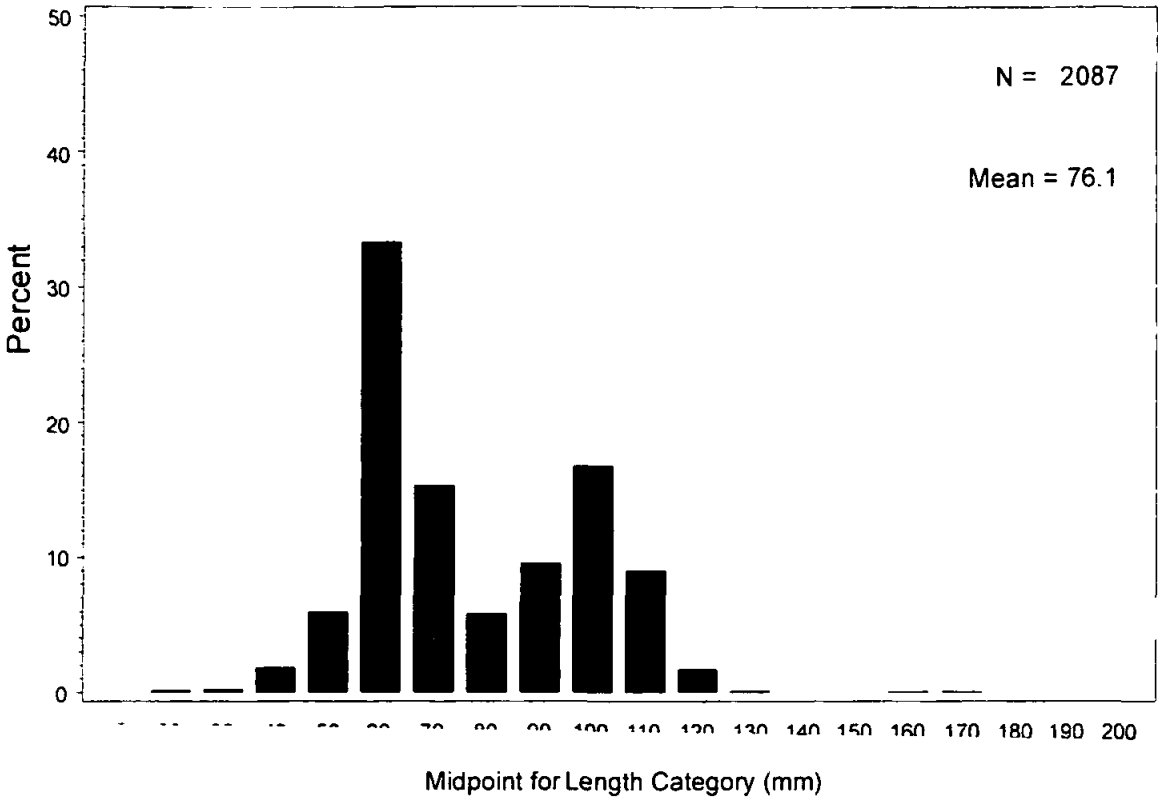



**Figure 4-9**. Size frequency distribution of anchovies from EPS Units 1–5 impingement samples.

## 4.3.3 Silversides (Atherinopsidae)



*Jamie Siler*

***Range***:

- Topsmelt-Vancouver Island, British Columbia, to southern Baja California and the upper Gulf of California
- Jacksmelt-Yaquina Bay, Oregon through Gulf of California
- Grunion-San Francisco to southern Baja California

***Life History***:

- Size up to 19 cm (7.5 in) (grunion); 37 cm (14.5 in) (topsmelt); 44cm (17 in) (jacksmelt)
- Age at maturity from 2–3 yr all species
- Life span to 4 yr (grunion); 8 yr (topsmelt); 10 yr (jacksmelt)
- Spawn from February to June (topsmelt); October to March (jacksmelt); February to September (grunion) with fecundity ranging from 1,000 (topsmelt)–3,000 (grunion) eggs

***Habitat***: Bays, estuaries, nearshore surface waters to depths of 9-29 m (30-95 ft).

***Fishery***: Incidental commercial and limited recreational take on hook and line or with nets.

Three species of silversides (family Atherinopsidae) occur in California ocean waters and in the vicinity of the EPS: topsmelt (*Atherinops affinis)*, jacksmelt (*Atherinopsis californiensis)*, and the California grunion (*Leuresthes tenuis)*. Topsmelt are found from Vancouver Island British Columbia, to the Gulf of California, (Miller and Lea 1972), with a disjunct distribution in the northern gulf (Robertson and Allen 2002). Jacksmelt are found in estuaries and coastal marine environments from Yaquina Bay, Oregon to the Gulf of California (Eschmeyer et al. 1983, Robertson and Allen 2002). California grunion are found from San Francisco to Magdalena Bay, Baja California (Miller and Lea 1972) but are most abundant from Point Conception southward (Love 1996).

### 4.3.3.1 Life History and Ecology

These schooling fishes are very common in estuaries, kelp beds, and along sandy beaches. Although mostly observed on the surface, topsmelt have been seen to depths of 9 m (30 ft) (Love 1996). Jacksmelt have been observed at depths of 29 m (95 ft). Grunion are usually seen from just behind the surf line to depths of about 18 m (60 ft).

In a five-year study of fishes in San Diego Bay, topsmelt ranked second in abundance and fifth in biomass, comprising about 23% of the individuals and 9% of the total weight (Allen 1999). Topsmelt were captured in all samples with peak abundances generally occurring in April due to heavy recruitment of young-of-the-year (YOY). Topsmelt occurred in a wide size range over the study and were represented by four age classes. Typically, YOY and juvenile topsmelt primarily occupied the intertidal zone while adult fish also occupied nearshore and midwater channel sub-habitats. Topsmelt and grunion were collected in the 1979–80 impingement study conducted at

EPS, comprising 13.7 and 10.8% respectively of total number of fishes collected (SDG&E 1980).

Adult topsmelt mature within 2–3 years to an approximate length of 10–15 cm (4–6 in) and can reach a length of 37 cm (14.5 in). They have a life expectancy of up to eight years (Love 1996). Jacksmelt is the largest member of the three species of the silverside that occur in California with adults reaching a maximum length of 44 cm (17 in) (Miller and Lea 1972). The fish reach maturity after two years at a size range of 18–20 cm (7.0–7.8 in) SL, and can live to a maximum age of nine or ten years (Clark 1929). Grunion reach 19 cm (7.5 in) in length, with a life span of up to four years. They mature at one year old at a length of approximately 12–13 cm (5 in).

The spawning activity of topsmelt corresponds to changes in water temperature (Middaugh et al. 1990). In Newport Bay, topsmelt spawn from February to June peaking in May and June (Love 1996). Females deposit the eggs on marine plants and other floating objects where fertilization occurs (Love 1996). Fecundity is a function of female body size with individuals in the 110–120 mm range spawning approximately 200 eggs per season, and fish 160 mm or greater spawning 1,000 eggs per season (Fronk 1969). The spawning season for jacksmelt is from October through March (Clark 1929), with peak activity from January through March (Allen et al. 1983). Individuals may spawn multiple times during the reproductive season and reproductive females have eggs of various sizes and maturities present in the ovary (Clark 1929). Fecundity has not been well documented but is possibly over 2,000 eggs per female (Emmett et al. 1991). Females lay eggs on marine plants and other floating objects where fertilization by males occurs (Love 1996). The spawning activity of grunion is quite different from the other silversides. Spawning occurs only three or four nights following each full or new moon, and then only for 1–3 hours immediately after the high tide, from late February to early September (peaking late March to early June) (Love 1996). The female swims onto the beach and digs into the wet sand, burying herself up to her pectoral fins or above. The male or males curve around her with vents touching her body, and when the female lays her eggs beneath the sand, males emit sperm, which flows down her body and fertilizes the eggs (Love 1996). Females spawn four to eight times per season at about 15-day intervals, producing 1,000–3,000 eggs.

### 4.3.3.2 Fishery and Population Trends

A limited fishery exists for silversides, which are marketed fresh for human consumption or for bait (Leet et al. 2001). The commercial fishery for silversides has been conducted with a variety of gear. Historically, set-lines have been used in San Francisco Bay for jacksmelt, and during the 1920s beach nets, pulled ashore by horses, were used at Newport Beach (Leet et al. 2001). Commercial catches of jacksmelt have varied sharply over the past 80 years fluctuating from more than two million pounds in 1945 to 2,530 pounds in 1998 and 1999 (Leet et al. 2001). Silversides are an incidental fishery and the large fluctuations in the catch records reflect demand, not actual abundances (Leet et al. 2001). The commercial use of grunion is limited as this species forms a minor portion of the commercial "smelt" catch (Leet et al. 2001). Grunion are taken incidentally in bait nets and other round haul nets, and limited quantities are used as

live bait, though no commercial landings have been reported (Leet et al. 2001). In the 1920s, the recreational fishery was showing signs of depletion, and a regulation was passed in 1927 establishing a closed season of three months, April through June. The fishery improved, and in 1947, the closure was shortened to April through May. Both topsmelt and jacksmelt are caught by sport fishers from piers and along shores. Sport fishermen may take grunion by hand only, and no holes may be dug in the beach to entrap them (Leet et al. 2001). Recent catch estimates of silversides by recreational anglers in southern California were 49,000 fish in winter 2005. Catch estimates averaged 267,000 fish from 2000–2004 (RecFIN 2005).

#### 4.3.3.3 Sampling Results

Silversides were the most abundant fish impinged and had the second highest biomass (**Table 4-2**). Three silverside species, topsmelt, grunion, and jacksmelt, were impinged during the study. Of the 6,784 silversides, there were 5,242 topsmelt, 489 grunion, 54 jacksmelt, and 999 others that could not be identified to the species level and were recorded as Atherinopsidae. The impinged silversides had a combined total weight of 50.2 kg (110.7 lb) in the 52 weekly surveys. An additional 10 topsmelt were collected from the bar racks, weighing 262 g (0.6 lb). Impingement of silversides occurred year-round, peaking late December through late February (**Figure 4-10**). Time of day was not a significant factor in the impingement of silversides with approximately equal numbers and biomass occurring in both day and night cycles (**Figure 4-11** and **4-12**). The majority of impinged biomass was recorded during one survey in January 2005. Topsmelt were the most abundant silverside collected in the heat treatments (53.5%), followed by grunion (24.1%) and jacksmelt (15.2%). A total of 29,336 individuals weighing 162.2 kg (357.6 lb) was impinged in the heat treatment surveys with the highest abundance and biomass occurring during the October 2004 heat treatment (**Figure 4-13**). Lengths of impinged silversides ranged from 18 to 325 mm SL (0.71 to 12.8 in) with a mean length of 84.4 mm (3.3in) (**Figure 4-14; Appendix G**).

#### 4.3.3.4 Annual Impingement Estimates

The estimated annual impingement abundance for silversides using actual CWS flows (not including bar rack or heat treatment mortality) was 39,113 individuals, weighing 274.4 kg (604.9 lb) (**Table 4-3**). Estimated bar rack impingement abundance was 70 individuals, weighing 1.8 kg (4.0 lb). The estimated annual impingement abundance would increase to 69,853 individuals (±10,392 std. error), weighing 553.3 kg (1,219.8 lb) (±85.7 kg std. error) using maximum CWS flows. All sources of impingement combined resulted in an estimated mortality of 68,519 individuals weighing 449.7 kg (991.4 lb) using actual CWS flows and 99,259 individuals weighing 717.3 kg (1,581 lb) using maximum flows (**Table 4-4**).



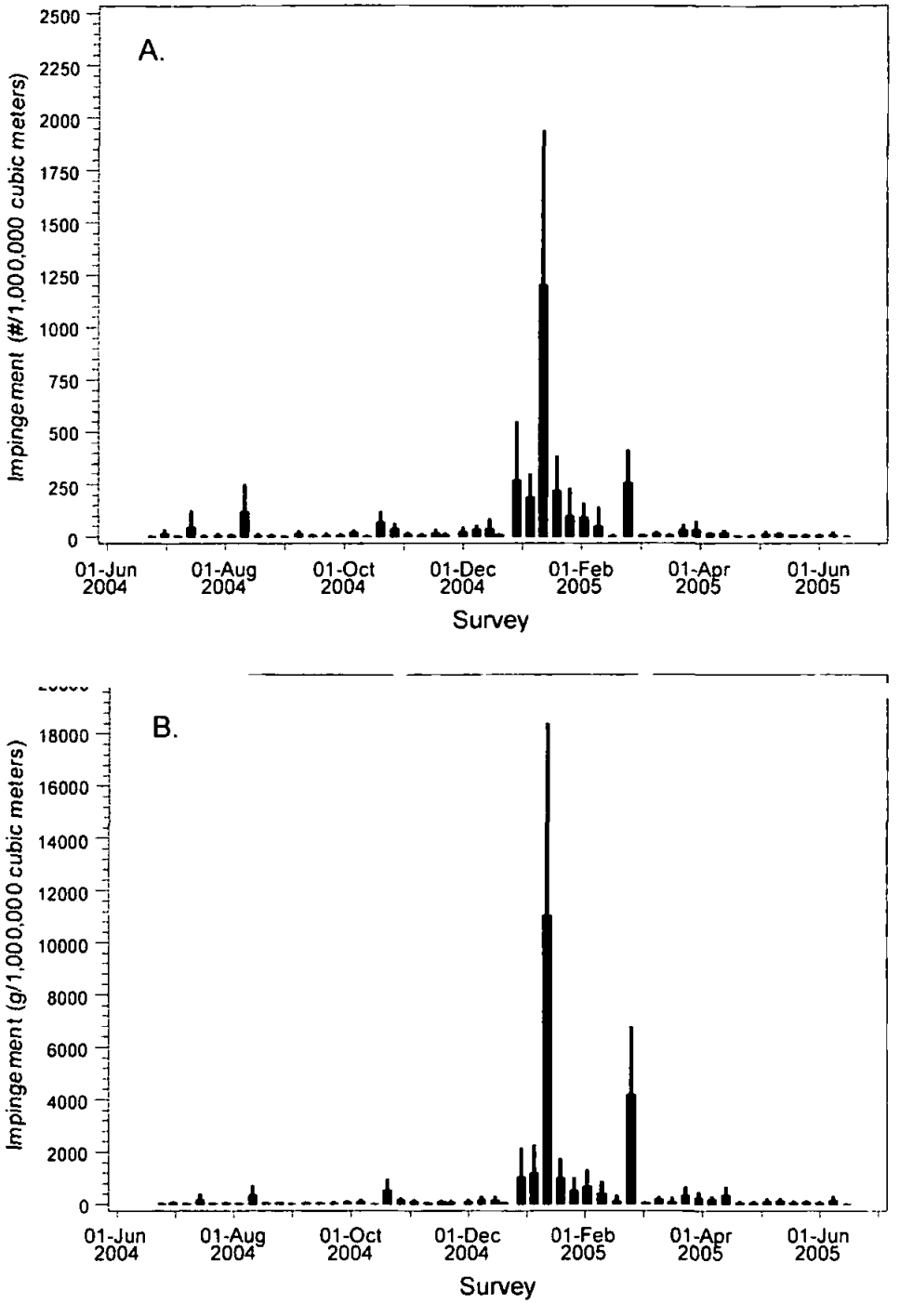



**Figure 4-10.** Mean concentration and standard error of silversides impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

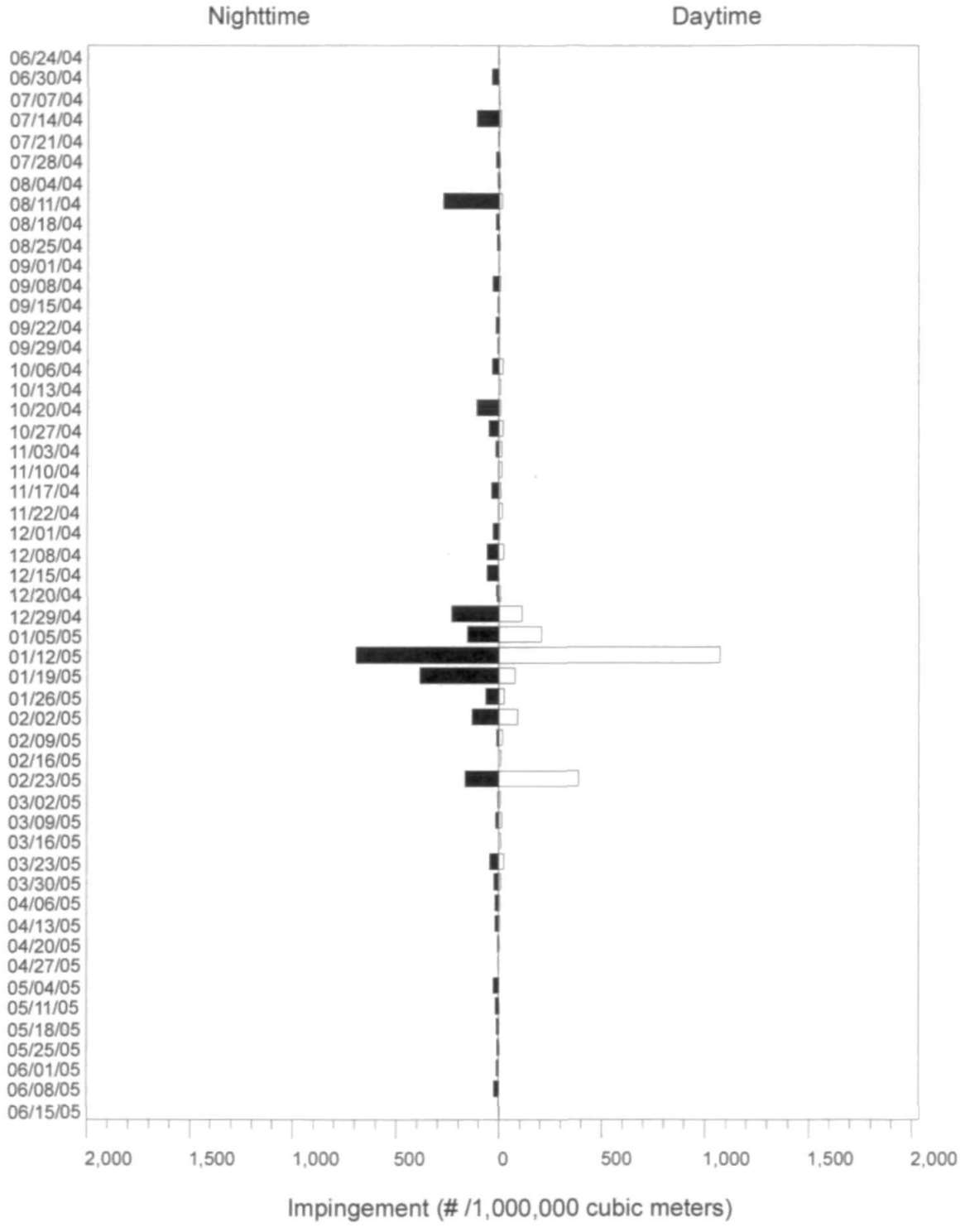



**Figure 4-11.** Abundance (#/$10^6$ $m^3$) of silversides impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

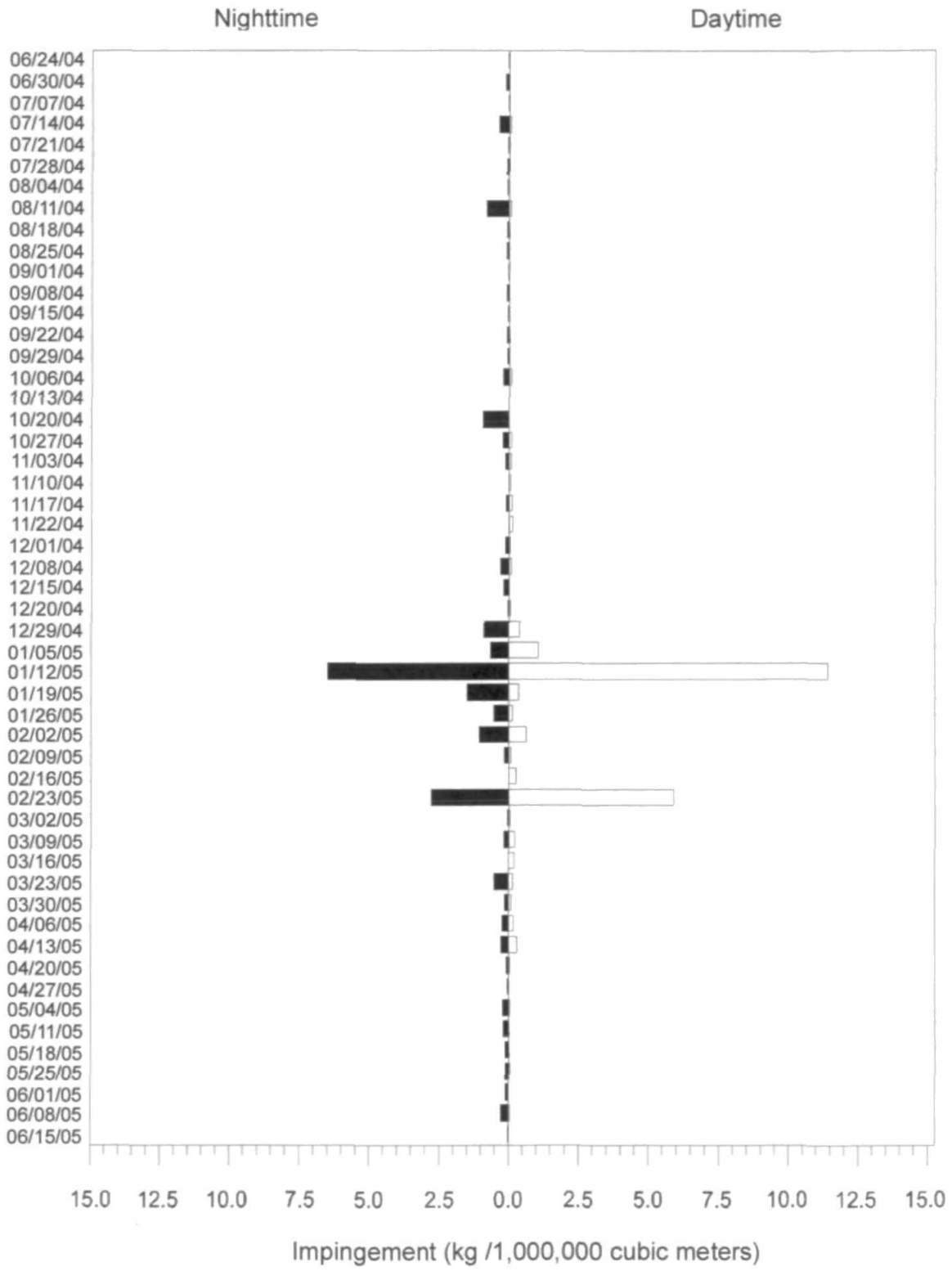



**Figure 4-12.** Biomass (kg/$10^6$ $m^3$) of silversides impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

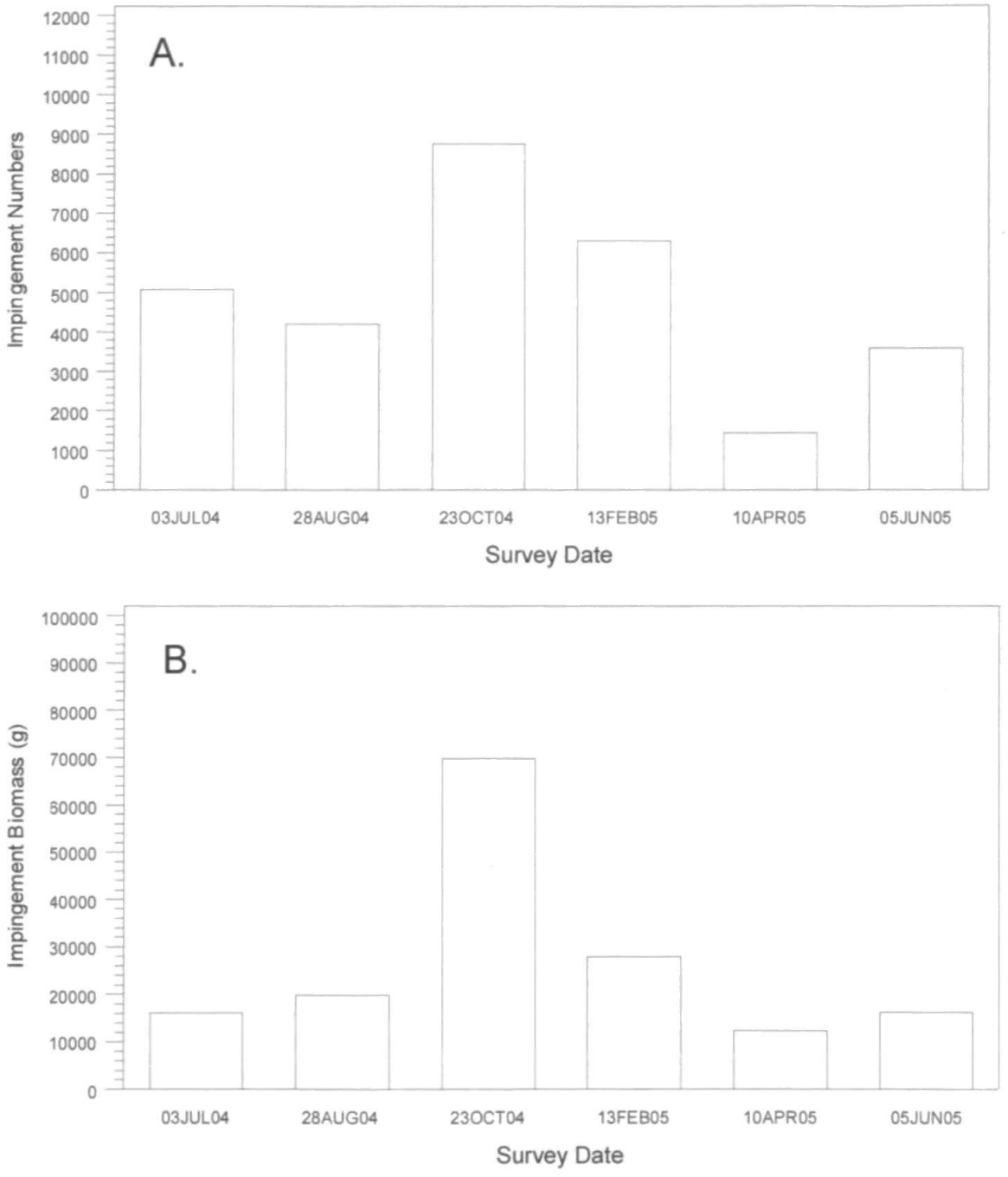



**Figure 4-13**. A) abundance, and B) biomass of silversides impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

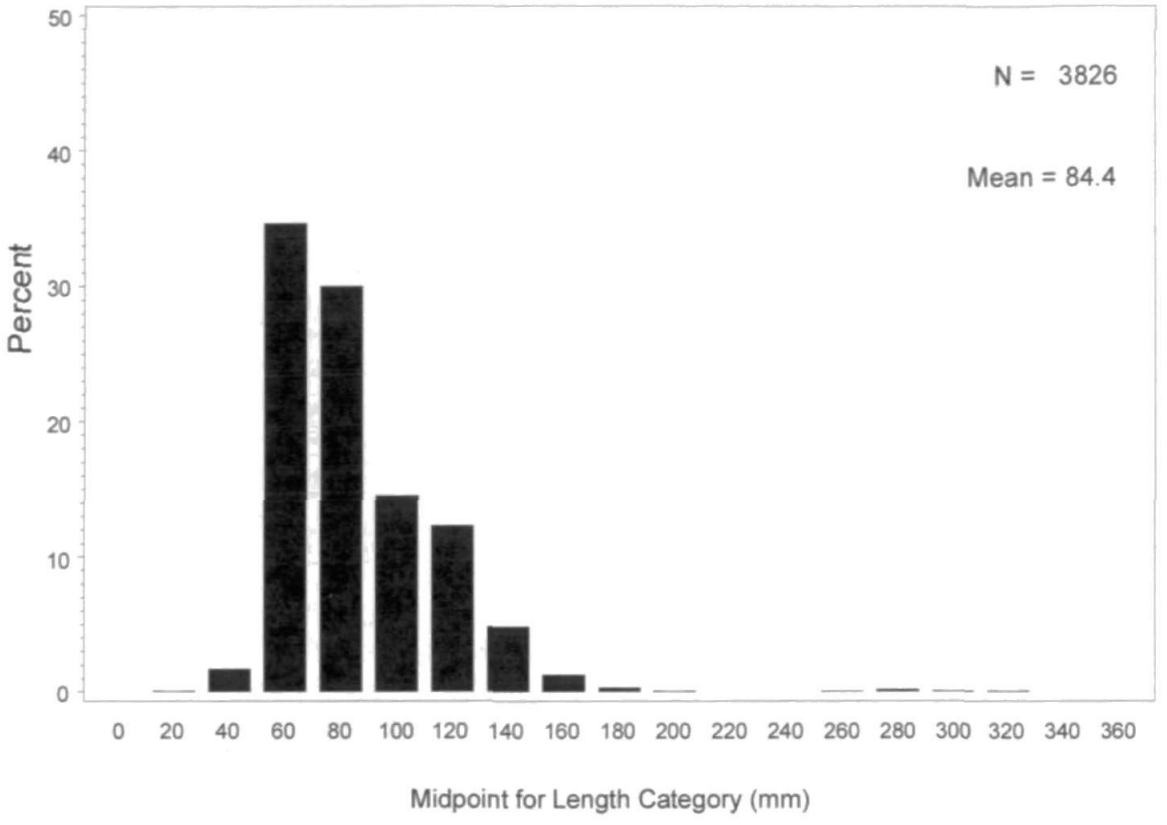
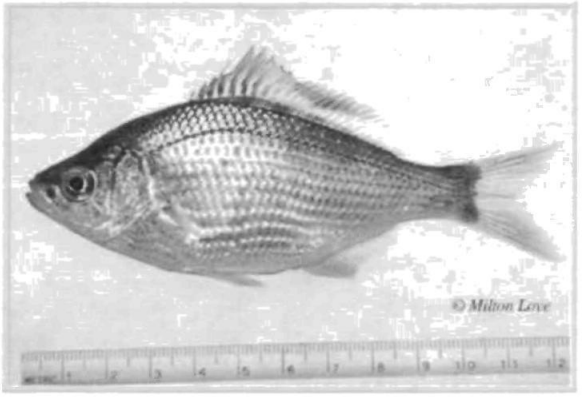



**Figure 4-14**. Size frequency distribution of silversides from EPS Units 1–5 impingement samples.

## 4.3.4 Shiner Surfperch (*Cymatogaster aggregata*)




***Range***: San Quentin Bay, Baja California, to Port Wrangell Alaska

***Life History***:

- Size up to 18 cm (7 in)
- Size at maturity 9.3 cm (3.6 in)
- Livebearers with up to 25 embryos
- Life span: to 6 yr

***Habitat***: bays, near eelgrass and kelp beds, oil platforms, piers, and jetties.

***Fishery***: Taken both recreationally and commercially; minor commercial value as bait.

Nineteen of the twenty species of surfperch (family Embiotocidae) found in California occur in inshore coastal waters (Miller and Lea 1972), and southern California is the center of distribution for many of the species (Bane and Robinson 1970).

Distributed from Port Wrangell, Alaska to San Quintin Bay, Baja California, *Cymatogaster aggregata* exhibits the widest range of the embiotocids (Miller and Lea 1972). Love (1996) reports that they are more common south of British Columbia. Bane and Robinson (1970) attributes this wide range to its euryhaline and eurythermal characteristics. Although they have been taken in water as deep as 146 m (480 ft) they are common at 61 m (200 ft) and abundant at depths less than 15 m (50 ft) (Love 1996). Love (1996) states that they are found in a wide variety of environments including quiet bays and backwaters, eelgrass and kelp beds, oil platforms, piers, jetties and occasionally the tidal zones of coastal streams. They form loose schools by day and disperse at night.

### 4.3.4.1 Life History and Ecology

Love (1996) summarized the life history of the shiner surfperch. Adults can reach 18 cm (7 in) in length and live to at least 6 years old. Surfperch are viviparous, giving birth to free swimming young. Females mature within the first year when they are approximately 9.3 cm (3.6 in) long and may contain up to 25 embryos (Wilson and Millemann 1969). Bane and Robinson (1970) reported on their reproductive cycle. Males are sexually mature at birth. Fertilization does not occur at the time of mating. After spawning females will carry spermatozoa in their oviduct until the eggs are mature. Fertilization occurs in winter for populations near San Diego (Love 1996). Odenweller (1975) found that birth in the Anaheim bay population of shiner surfperch occurs primarily in May. Wilson and Millemann (1969) found that embryo size was directly related to the size of the female.

Sport fishery catch estimates of shiner surfperch in the southern California region from 1999 to 2003 ranged from 2,000 to 20,000 annually with a mean of 11,000 fish (RecFIN 2005). For

2003, CDFG estimates an average recreational take of 121.6 metric tons of shiners from 1999 to 2001. The PacFIN database does not distinguish among individual species of surfperch (PacFIN 2005). Commercial landings for surfperches in general from 1999 to 2003 ranged from 22.4 to 34.2 metric tons for the entire state (PacFIN 2005). CDFG (2003) noted that the commercial fishery of shiner surfperch averaged 22.5 metric tons per year in all of California from 1999 to 2001.

### 4.3.4.2 Sampling Results

Shiner surfperch were the second most abundant fish impinged at EPS with the third highest biomass during normal operation surveys. A total of 2,827 shiner surfperch with a total weight of 28.4 kg (62.6 lb) was impinged at EPS during the study (**Table 4-3**). Except for periodic high abundances in winter months, most shiner surfperch were impinged from April through August (**Figure 4-15**). Shiners were significantly more abundant in impingement collections at night than during the day, although more were impinged during the day in a few of the weekly surveys (**Figures 4-16** and **4-17**). A total of 18,361 individuals weighing 196.6 kg (433.4 lb) was collected in the heat treatments with the greatest biomass collected in the April 2005 treatment and highest numbers occurring in the July 2004 treatment (**Figure 4-18**). Impinged shiners ranged in length from 11 to 228 mm SL (0.4 to 9.0 in), with an average length of 70.3 mm (2.8 in) (**Figure 4-19; Appendix G**).

### 4.3.4.3 Annual Impingement Estimates

Based on the impinged abundance and biomass of shiner surfperch the estimated annual impingement abundance of shiner surfperch using actual CWS flow (not including heat treatment mortality) was 19,303 individuals, weighing 197.3 kg (435.0 lb) (**Table 4-3**). At maximum CWS flow the estimated annual impingement abundance of this species was 26,506 individuals, weighing 300.1 kg (661.7 lb). When all sources of impingement mortality were combined, it was estimated that during actual flows a total of 37,664 shiner surfperch weighing 393.8 kg (868.2 lb) were impinged (**Table 4-4**). If the plant operated at maximum flow for the entire year, the annual estimates of impingement increase to 44,867 individuals with a combined weight of 496.6 kg (1,095 lb).

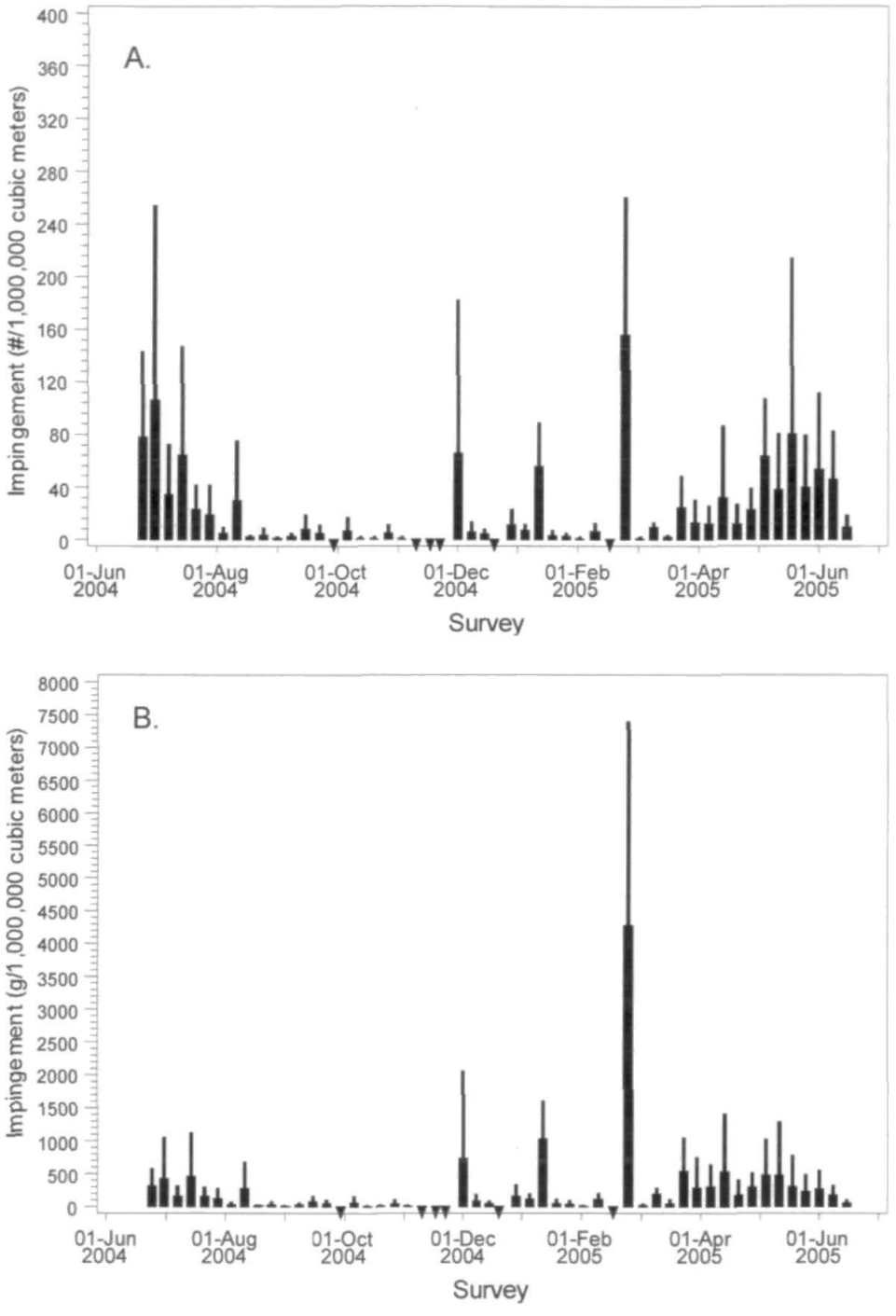



**Figure 4-15**. Mean concentration and standard error of shiner surfperch impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

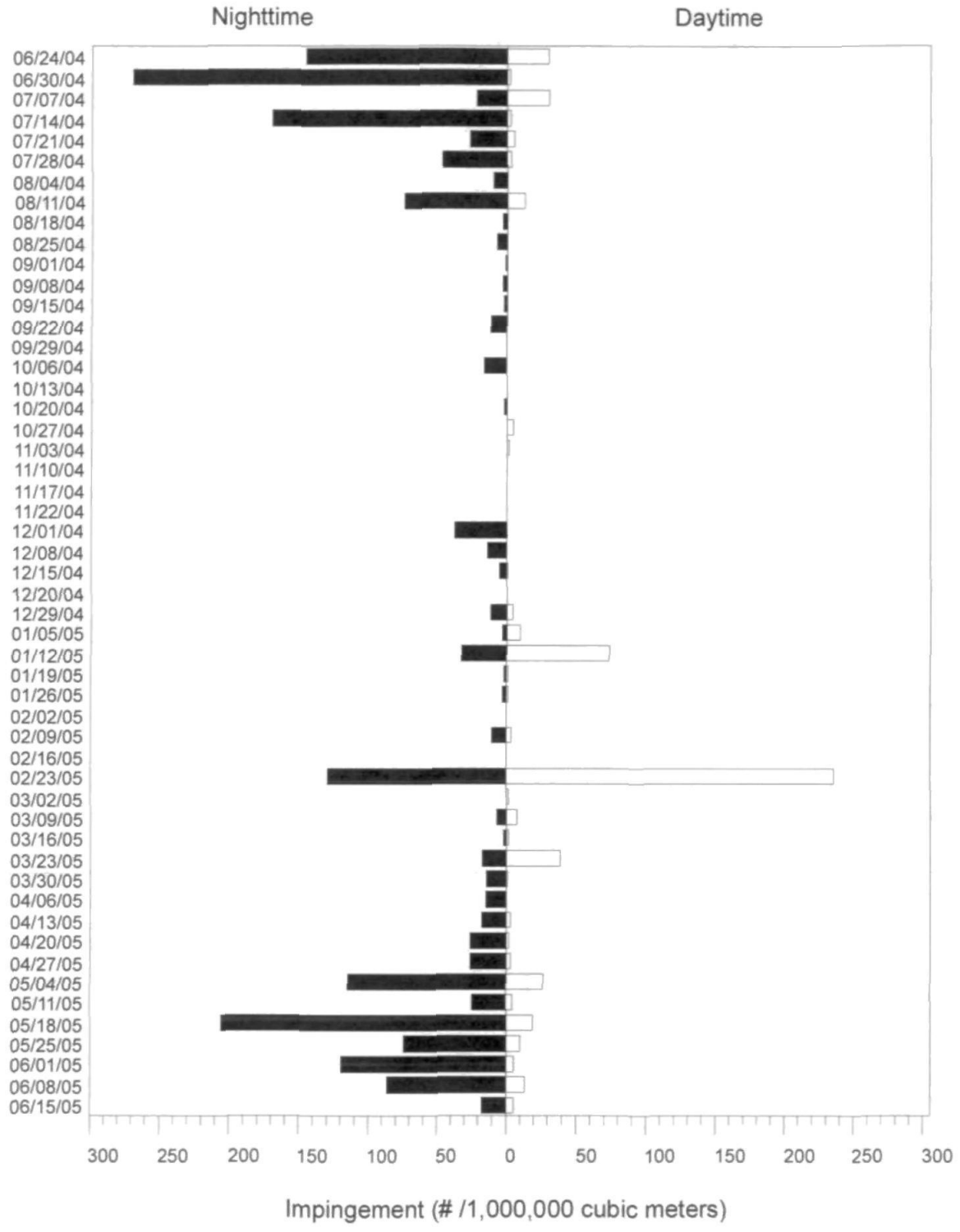



**Figure 4-16.** Abundance (#/$10^6$ $m^3$) of shiner surfperch impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

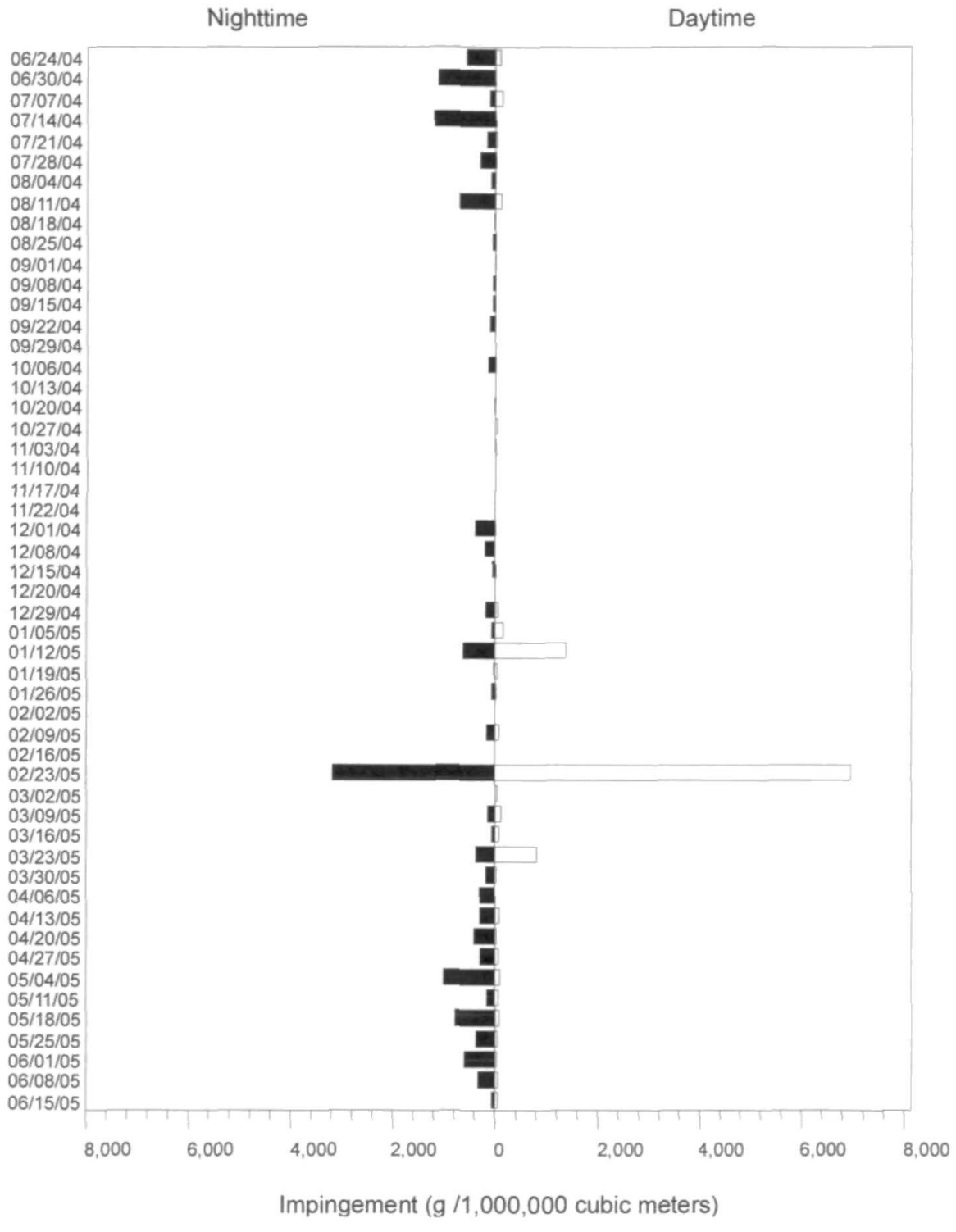



**Figure 4-17.** Biomass ($g/10^6$ $m^3$) of shiner surfperch impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

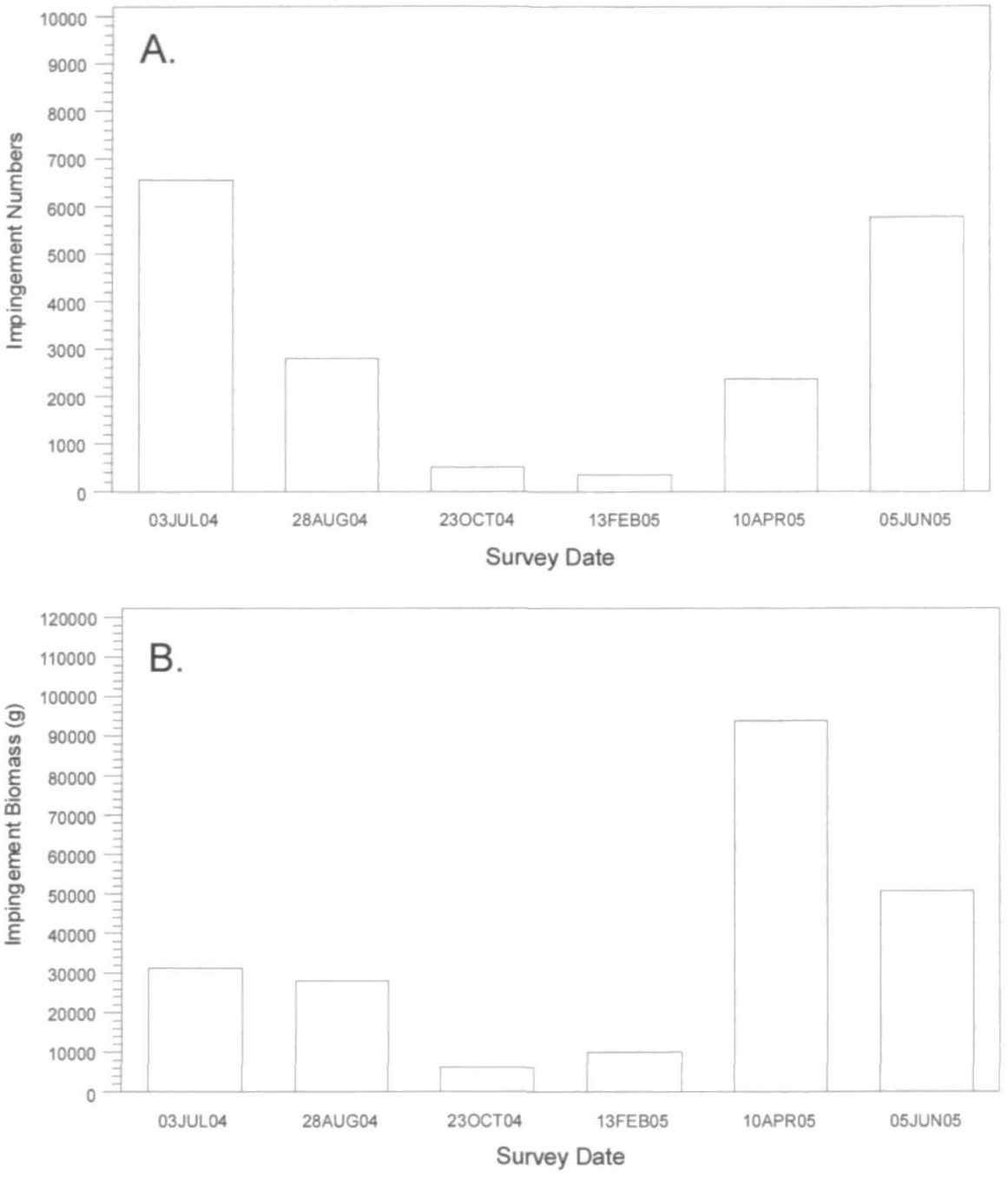



**Figure 4-18**. A) abundance, and B) biomass of shiner surfperch impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

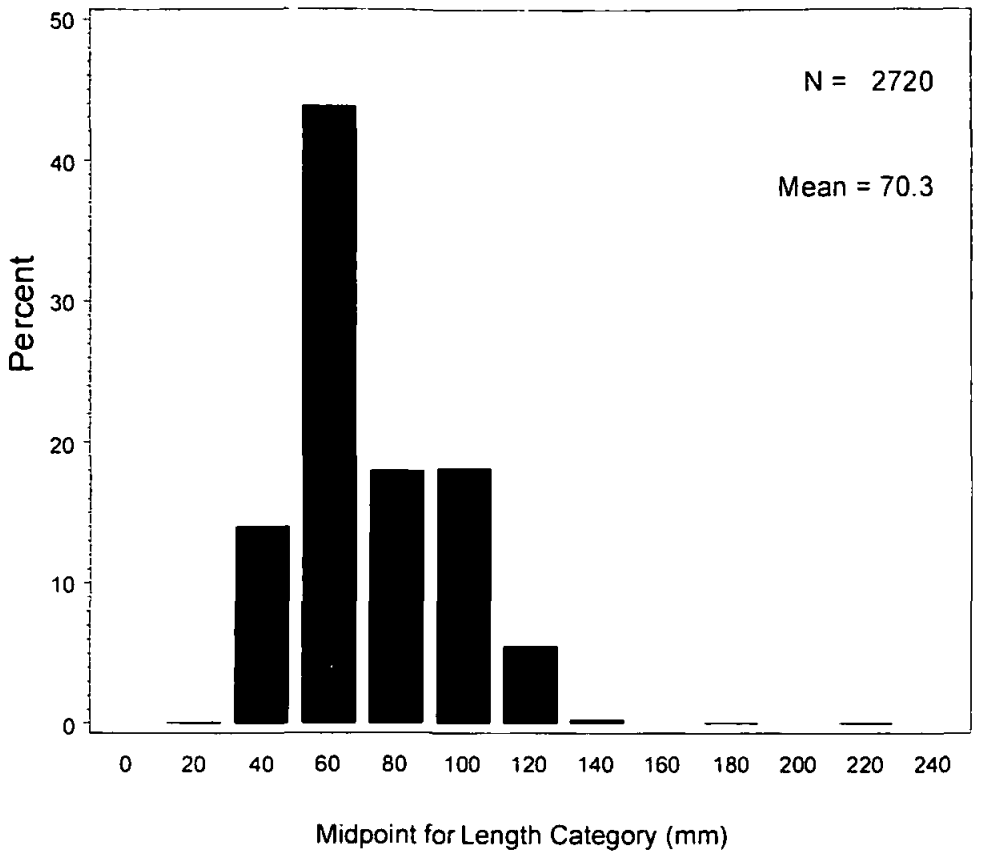



**Figure 4-19**. Size frequency distribution of shiner surfperch from EPS Units 1–5 impingement samples.

## 4.3.5 Queenfish (*Seriphus politus*)

Queenfish (*Seriphus politus*) is one of eight species of croakers (family Sciaenidae) found off of the California coast. Queenfish was the most abundant sciaenid impinged at five generating stations in southern California from 1977 to 1998, and accounted for over 60% of the total fishes impinged (Herbinson et al. 2001). A study of the fish composition of Aqua Hedionda Lagoon in 1995 observed queenfish as one of the more abundant fish in the lagoon (MEC 1995). Queenfish were the most abundant species of fish collected in the 1979-80 impingement study conducted at the EPS, comprising 23.4% of the total number of fishes collected. Queenfish larvae were abundant in plankton samples collected as part of the entrainment impact portion of the present study, and their life history is presented in Section 3.3.7 of this report.

### 4.3.5.1 Sampling Results

A total of 1,304 queenfish was collected in the normal impingement sampling at EPS weighing 7.5 kg (16.5 lb) with 2 additional fish weighing 17 g (0.04 lb) collected from the bar racks (**Table 4-2**). Queenfish numbers were significantly more abundant at night than during the day (**Figure 4-21**) although greater numbers were impinged during daytime cycles in some weeks, and biomass was found not to be significantly different between night and day cycles (**Figure 4-22**). A total of 929 individuals was collected during heat treatments, weighing 21.4 kg (47.2 lb) (**Table 4-2**). The peak in abundance during heat treatment surveys was during April 2005, while the peak in biomass was impinged during the heat treatment in August 2004 (**Figure 4-2.3**). Lengths of the measured individuals ranged from 22 to 499 mm SL (0.9 to 19.6 in SL), with a mean length of 73.7 mm (**Figure 4.24; Appendix G**). Queenfish were the fourth most abundant species of fish impinged during the year-long survey with the seventh highest biomass of all fish species collected (**Table 4-2**).

### 4.3.5.2 Annual Impingement Estimates

Based on the impinged abundance and biomass of queenfish, the estimated annual impingement using actual CWS flow was 8,536 individuals weighing 48.9 kg (107.8 lb) (**Table 4-3**). Estimated bar rack impingement was 14 individuals, weighing 0.1 kg (0.22 lb). Under maximum CWS flow the estimated annual impingement abundance would increase to 11,568 individuals, weighing 68.2 kg (150.4 lb). The estimated annual impingement of queenfish from all sources based on actual CWS flows was 9,479 individuals weighing 70.4 kg (155.2 lb) (**Table 4-4**). Under maximum CWS flows the estimated impingement mortality from all sources would be 12, 511 individuals having a combined weight of 89.7 kg (197.8 lb).

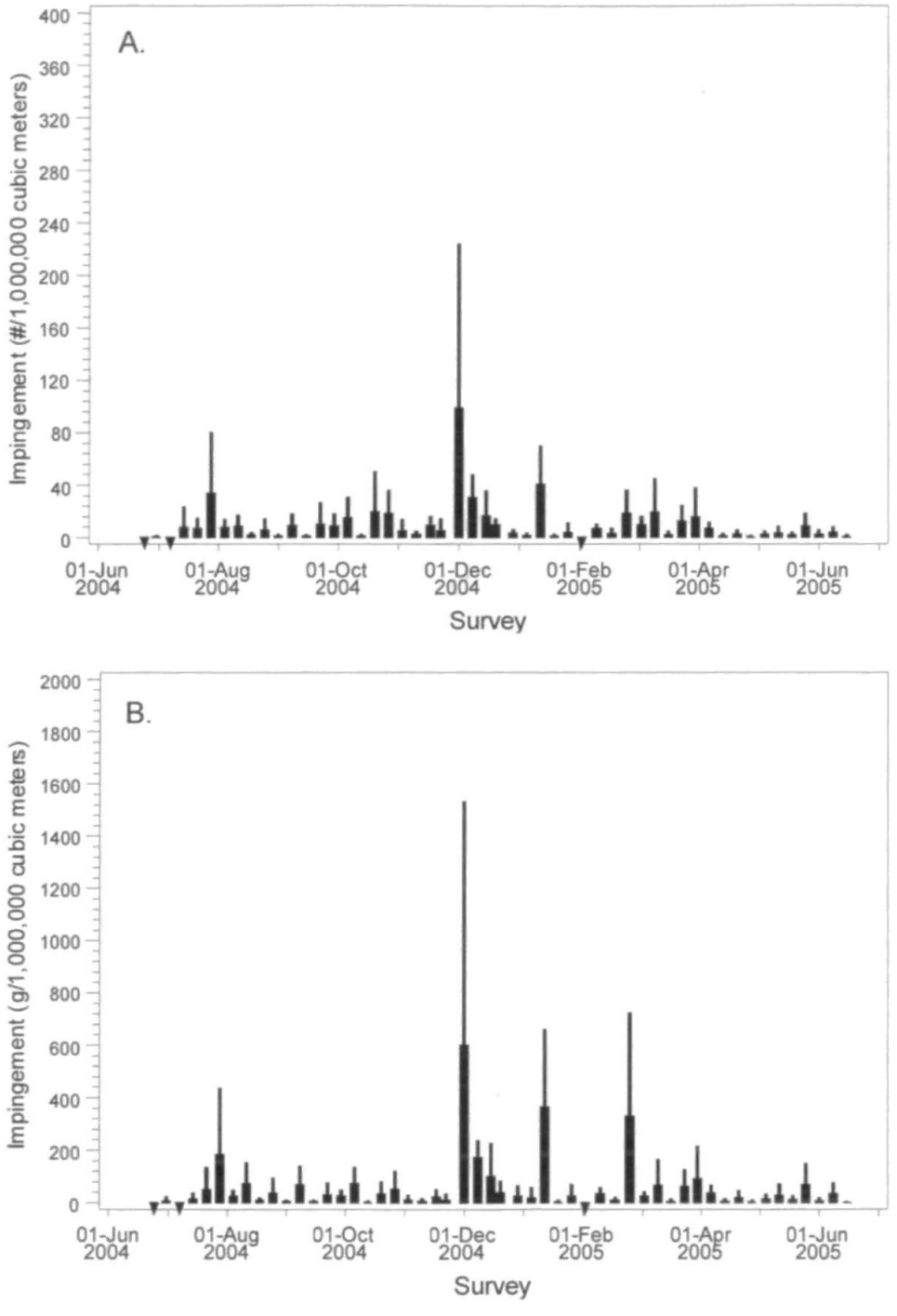



**Figure 4-20**. Mean concentration and standard error of queenfish impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

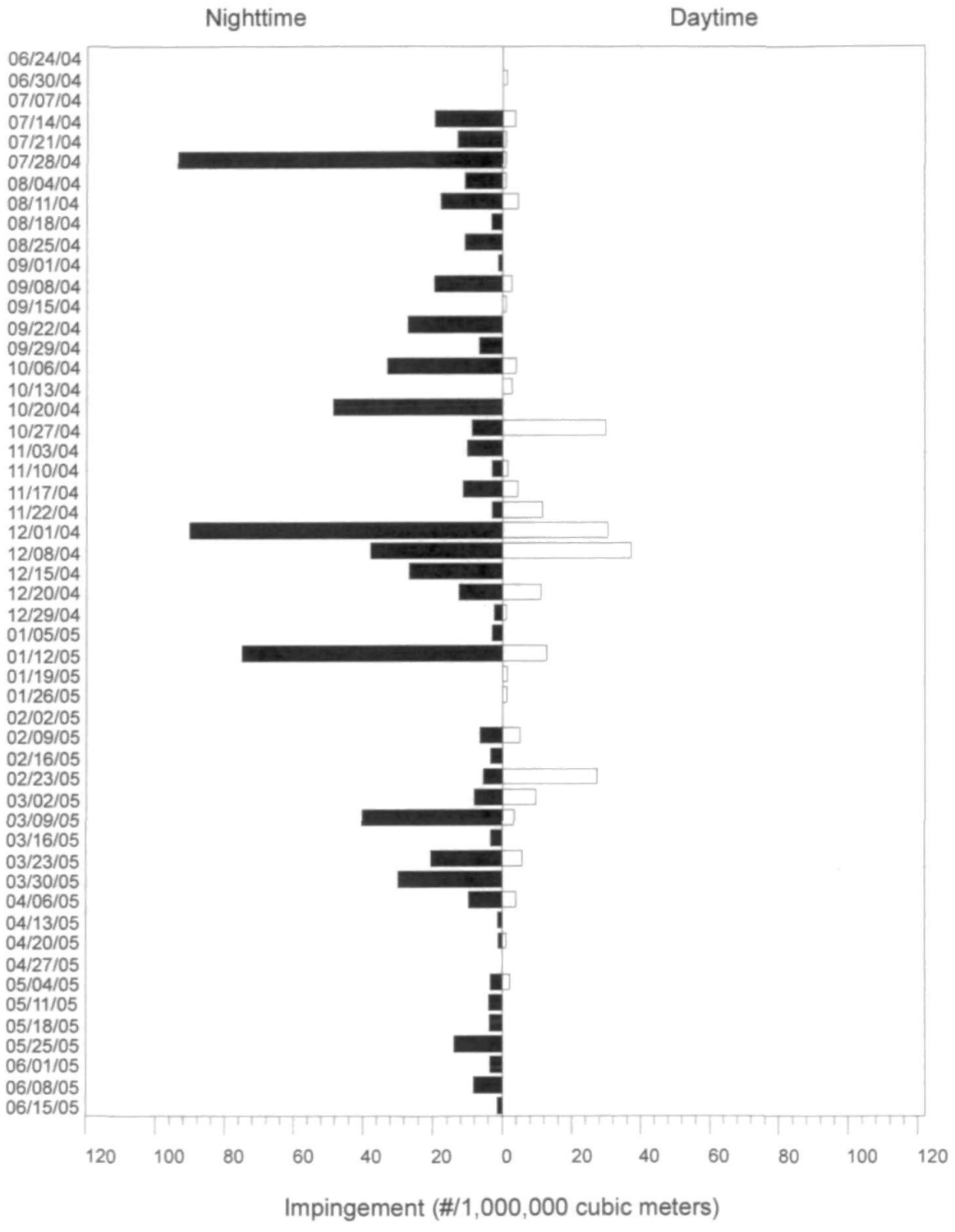



**Figure 4-21.** Abundance (#/$10^6$ $m^3$) of queenfish impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

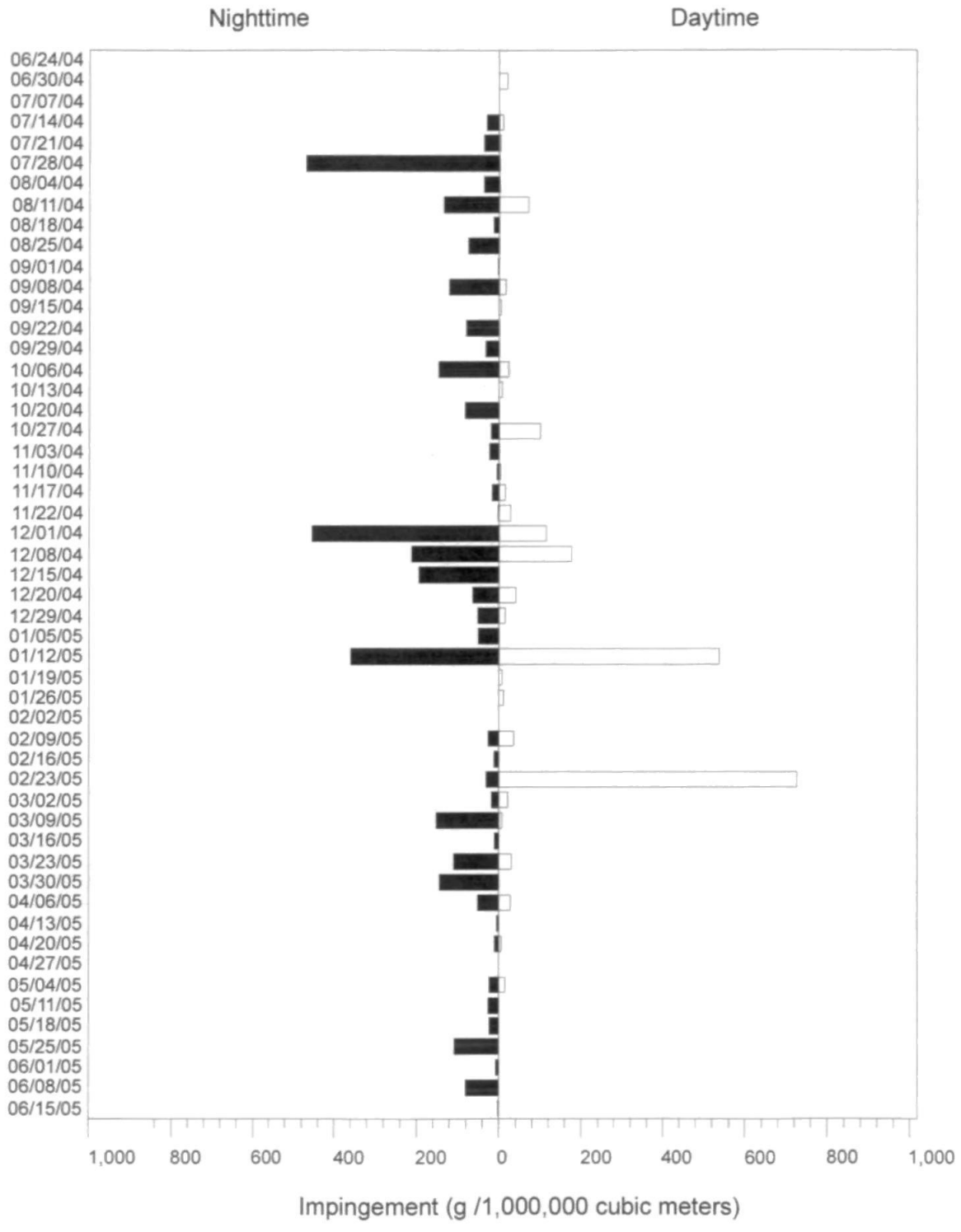



**Figure 4-22.** Biomass ($g/10^6$ $m^3$) of queenfish impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

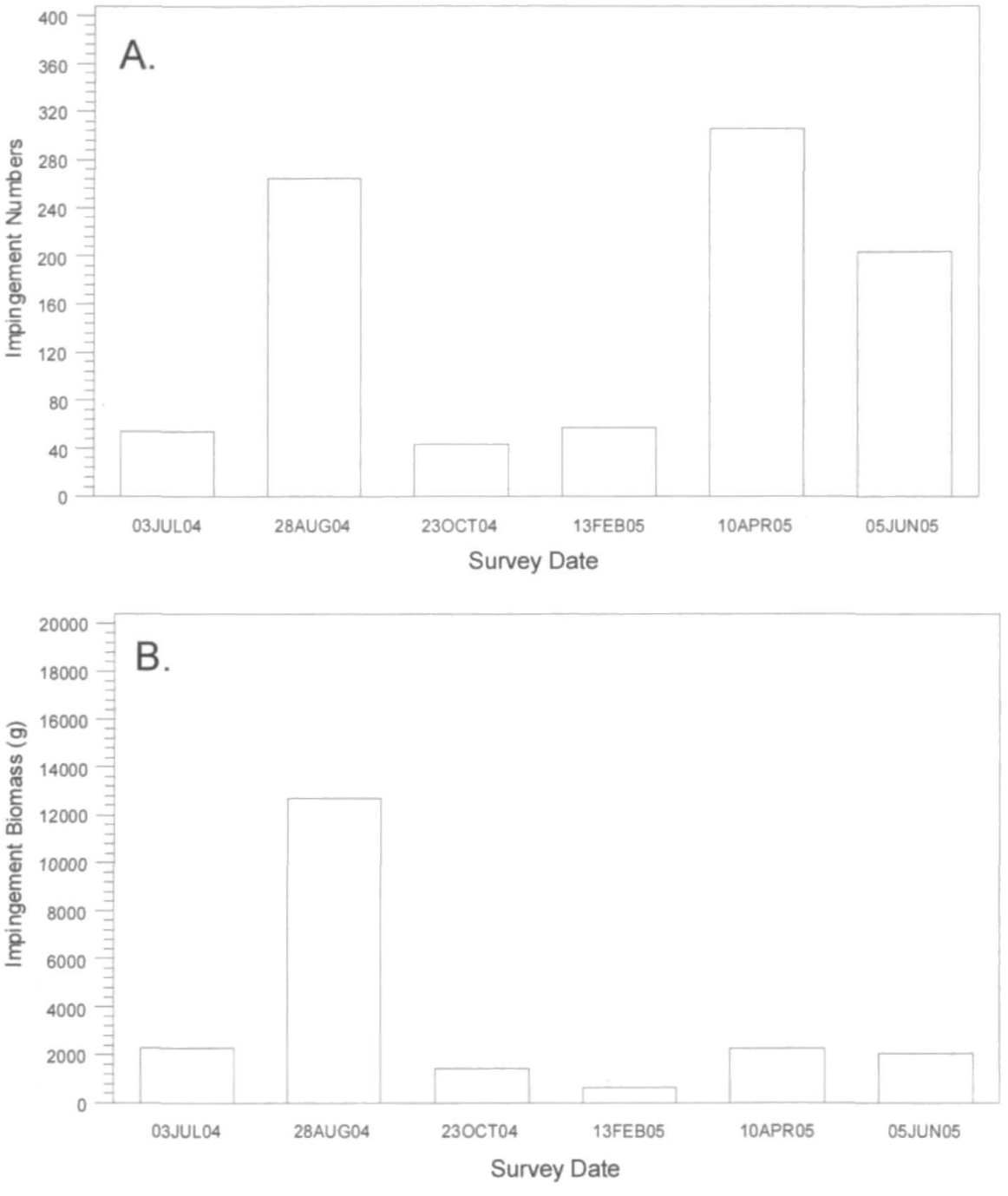



**Figure 4-23**. A) abundance, and B) biomass of queenfish impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

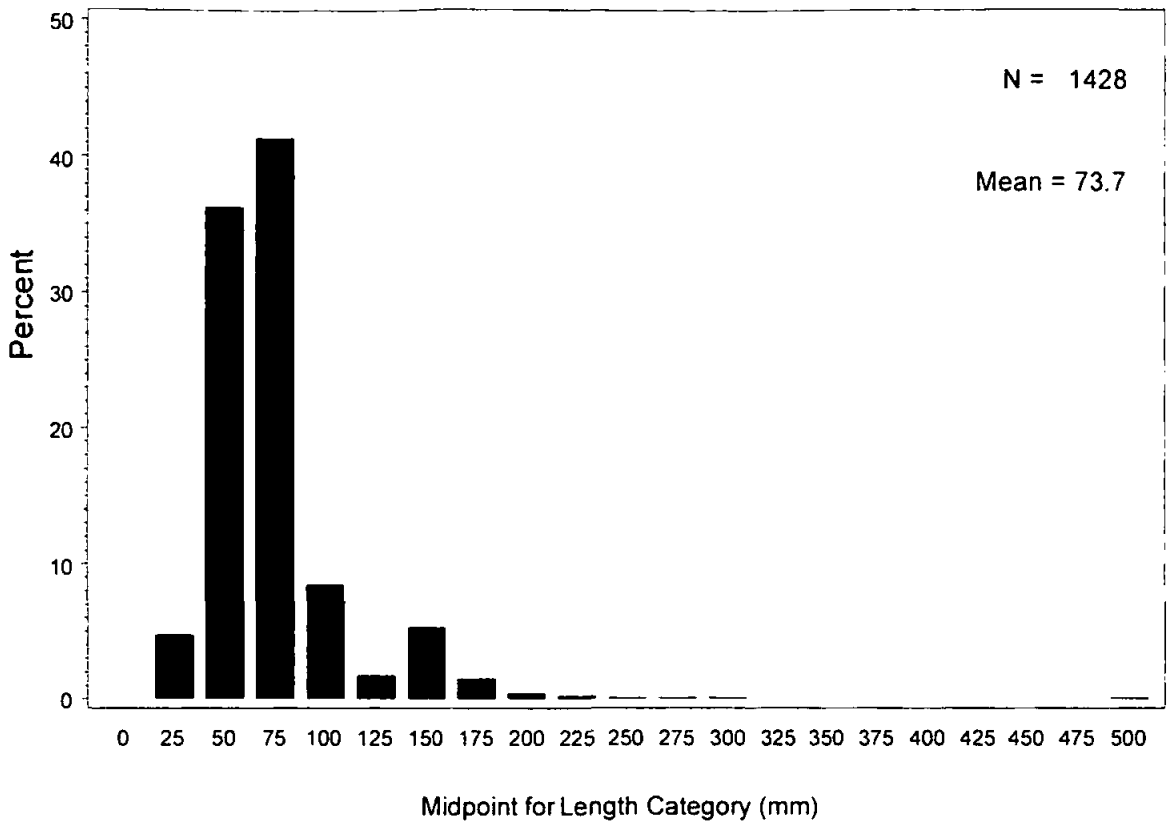
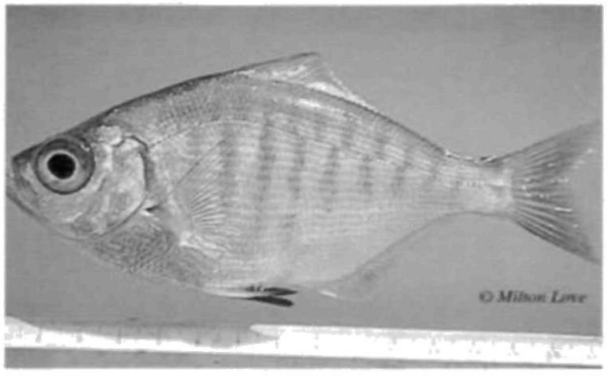



**Figure 4-24**. Size frequency distribution of queenfish from EPS Units 1–5 impingement samples.

## 4.3.6 Walleye Surfperch (*Hyperprosopon argenteum*)




***Range***: Vancouver Island, British Columbia to Central Baja California, Mexico

***Life History***:

- Size up to 30.2 cm (12.0 in)
- Size at maturity ca. 11.3 cm (4.5 in)
- Life span to 6 yr
- Fecundity up to 19 per litter

***Habitat***: Along sandy beaches, jetties, kelp beds and other sand-rock margins; moving onto reefs at night.

***Fishery***: Commercial and sport fishing allowed but primarily caught by sport fishers.

Twenty of the 23 surfperch (family Embiotocidae) species are found off the California coast, and 17 of these occur in the San Diego region (Love et al. 2005). Eight species were identified during the impingement study at EPS including shiner surfperch (*Cymatogaster aggregata)*, walleye surfperch (*Hyperprosopon argenteum)*, white surfperch (*Phanerodon furcatus)*, dwarf surfperch (*Micrometrus minimus)*, barred surfperch (*Amphistichus argenteus)*, kelp surfperch (*Brachyistius frenatus)*, black surfperch (*Embiotoca jacksoni)*, and pile perch (*Rhacochilus vacca)*.

Walleye surfperch range from Vancouver Island, British Columbia to Punta San Rosarito in central Baja California, Mexico, including Guadalupe Island (Miller and Lea 1972). Love (1996) states that they are common from Washington southward and are even more abundant off of California. They are most common at depths down to 9.0 m (30 ft) but have been recorded to a maximum depth of 181.4 m (600 ft) (Love 1996).

### 4.3.6.1 Life History and Ecology

Adults can reach 30.2 cm (12.0 in) in length and live about 6 years (Love 1996). Walleye mature during their first year at a length of 11.0 cm (4.5 in). While males mature faster than females, females grow faster and live longer than males. Walleye spawn in November and release their offspring between April and June. Females are viviparous and may produce up to 19 young per litter (Love 1996), although Eschmeyer and Herald (1983) state that litters typically range from 5 to 12 individuals.

No commercial fishery for walleye surfperch exists in the San Diego area (PacFIN), but they are recreationally fished. Sport fishery catch estimates of walleye surfperch in the southern California region from 1999 to 2003 ranged from 15,000–107,000 annually with a mean of 59,600 fish (RecFIN 2005). CDFG (2001) noted that the sport fishery has recently averaged 112,000 fish per year in all of California, which agrees with estimates from RecFIN (2005) of about 110,750 fish per year in 1995–2002 for all of California.

### 4.3.6.2 Sampling Results

Walleye surfperch were the eighth most abundant fish taxa collected during the year-long study at EPS during normal operations, with the fourth highest biomass of all the fishes impinged during normal operations (**Table 4-2**). A total of 605 walleye surfperch individuals with a total weight of 24.0 kg (52.9 lb) was impinged (**Table 4-2**). One additional walleye surfperch was collected from the bar racks, weighing 0.02 kg (0.04 lb). These individuals were primarily collected from late December to June, with being impinged in a single survey (January 5, 2005) (**Figure 4-25**). Although they were found with greater frequency during night impingement cycles, the greatest abundance and biomass during some surveys occurred during the daytime (**Figures 4-26** and **4-27**). A total of 2,547 individuals weighing 125.4 kg (276.5 lb) was impinged during the heat treatment surveys (**Table 4-2**). Walleye surfperch were more common in the heat treatment surveys from October 23 2004 to June 5, 2005, but most were collected in one survey in February 2005 (**Figure 4-28**). Impinged individuals ranged in length from 20 to 225 mm SL (0.8 – 8.9 in) with a mean length of 113 mm SL (4.5 in) (**Figure 4-29; Appendix G**).

### 4.3.6.3 Annual Impingement Estimates

The estimated annual impingement abundance and biomass of walleye surfperch under actual CWS flows was 3,032 individuals, weighing 123.0 kg (271.2 lb) (**Table 4-3**). Under maximum CWS flows the estimate increases to 6,623 individuals, weighing 276.9 kg (610.6 lb) (**Table 4-3**). Combining data from normal operations, heat treatment and bar rack the total estimated annual impingement mortality under actual CWS flows was 5,586 walleye surfperch weighing 248.5 kg (547.8 lb) (**Table 4-4**). Under maximum flows the annual estimates of impingement increase to 9,177 individuals with a combined weight of 402.5 kg (887.4 lb).

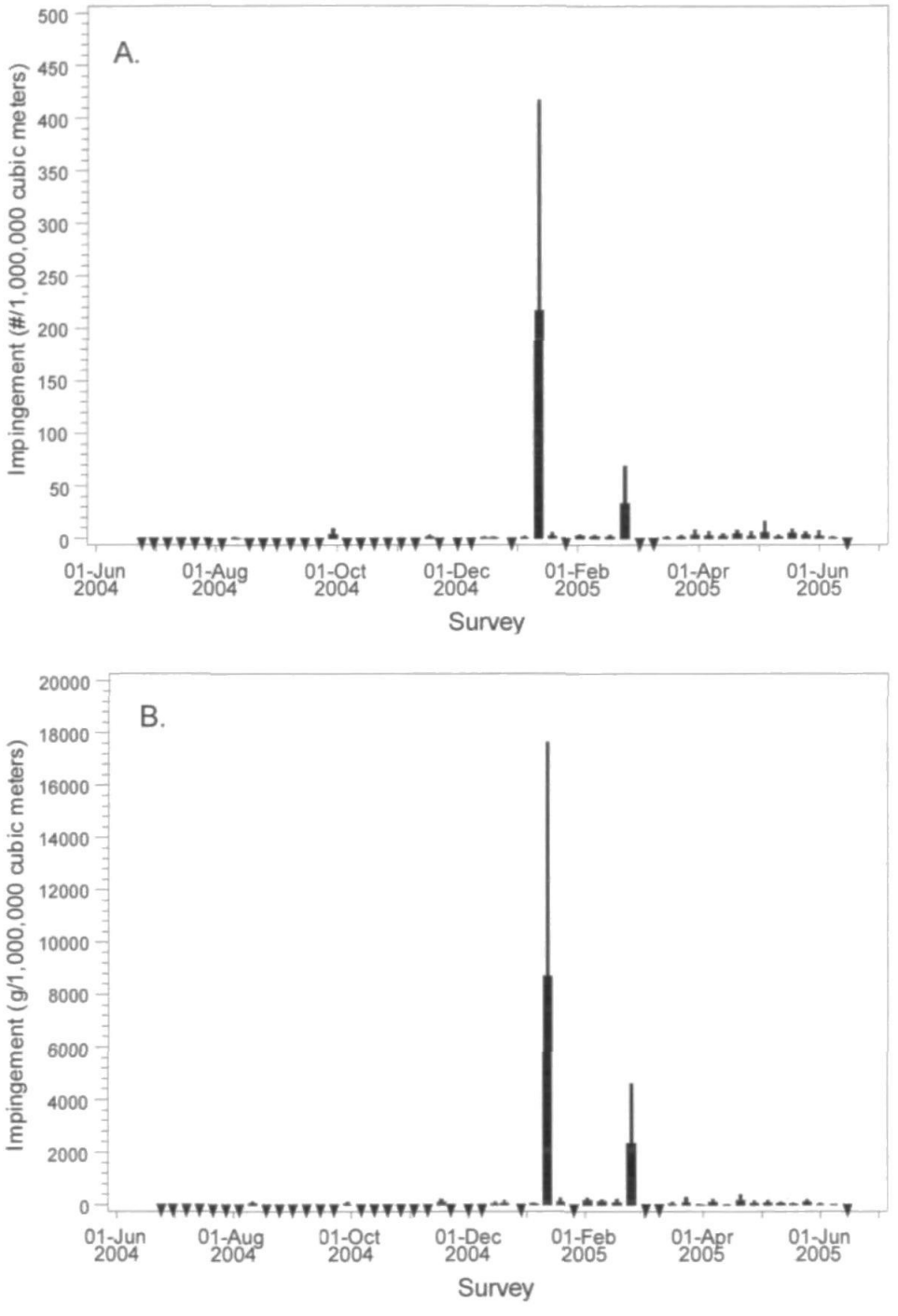



**Figure 4-25**. Mean concentration and standard error of walleye surfperch impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

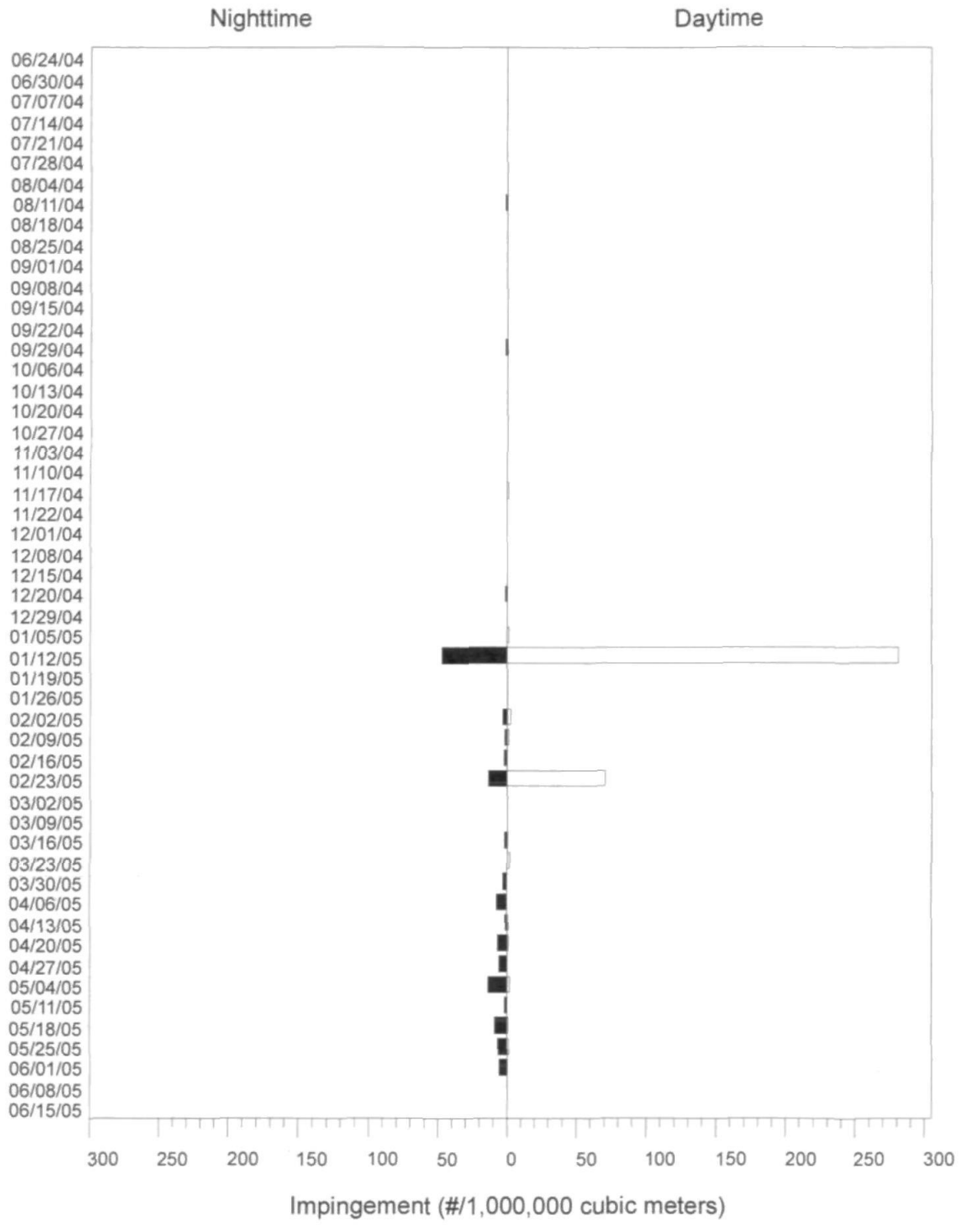



**Figure 4-26.** Abundance (#/$10^6$ $m^3$) of walleye surfperch impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

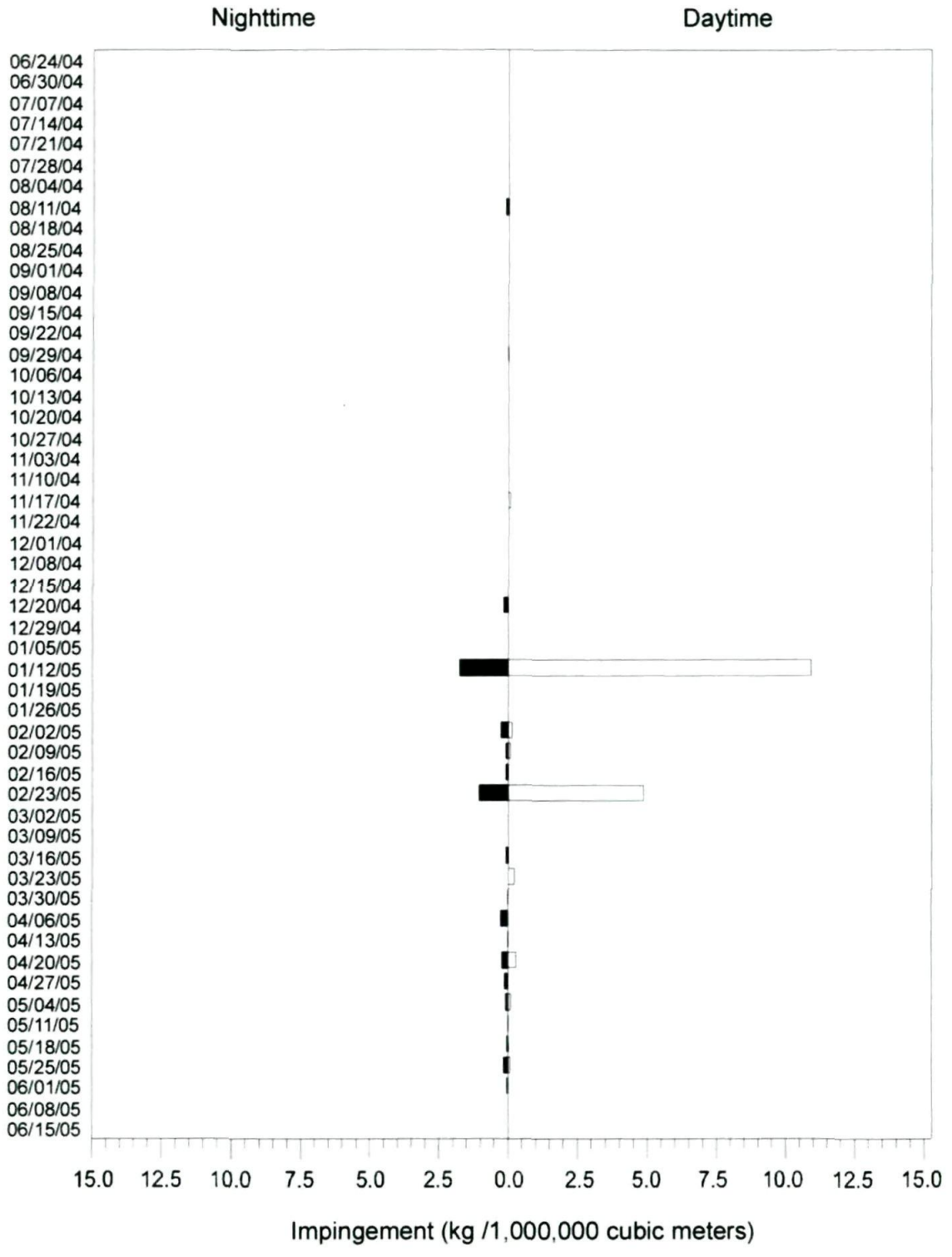



**Figure 4-27.** Biomass (kg/$10^6$ $m^3$) of walleye surfperch impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

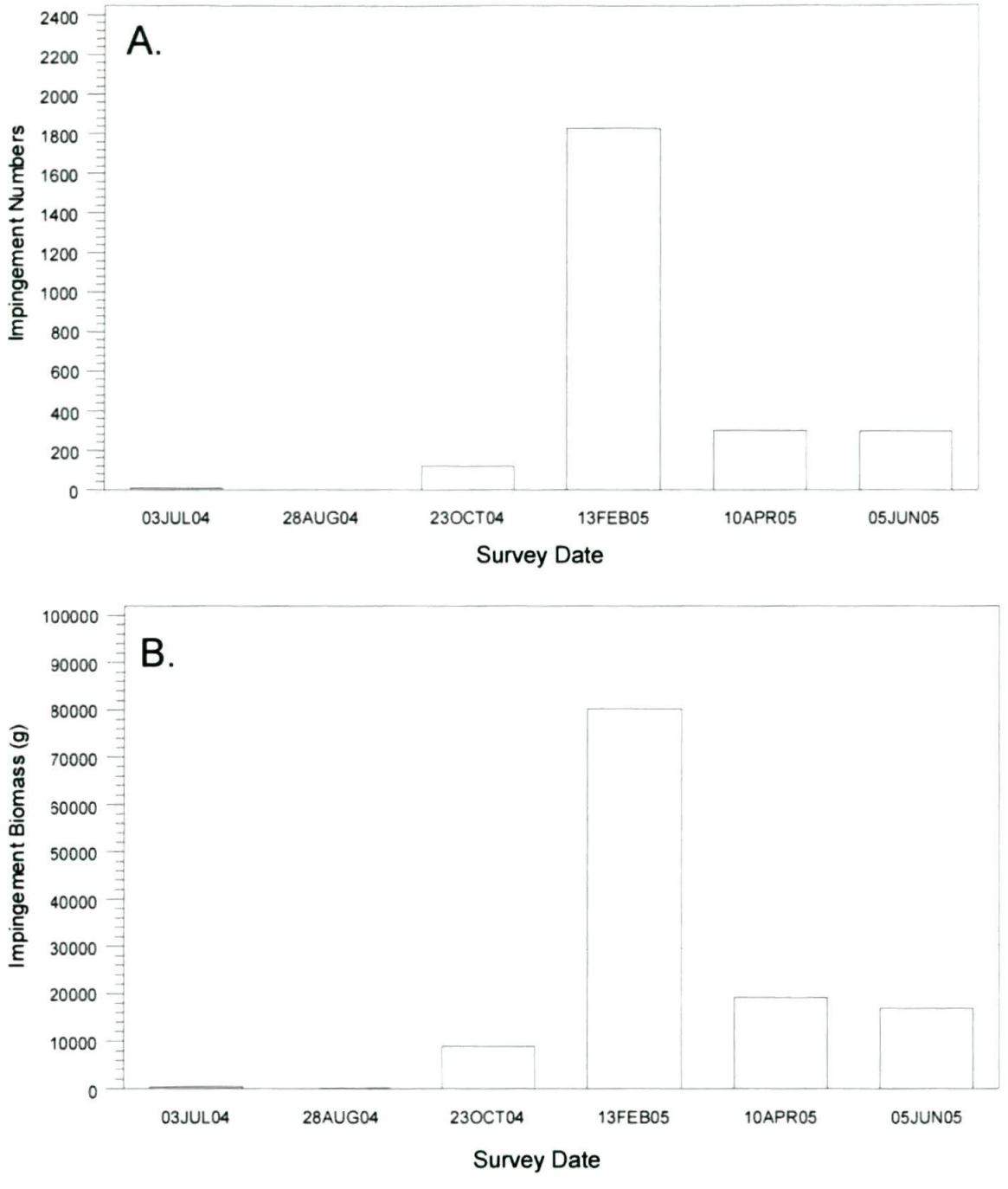



**Figure 4-28**. A) abundance, and B) biomass of walleye surfperch impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

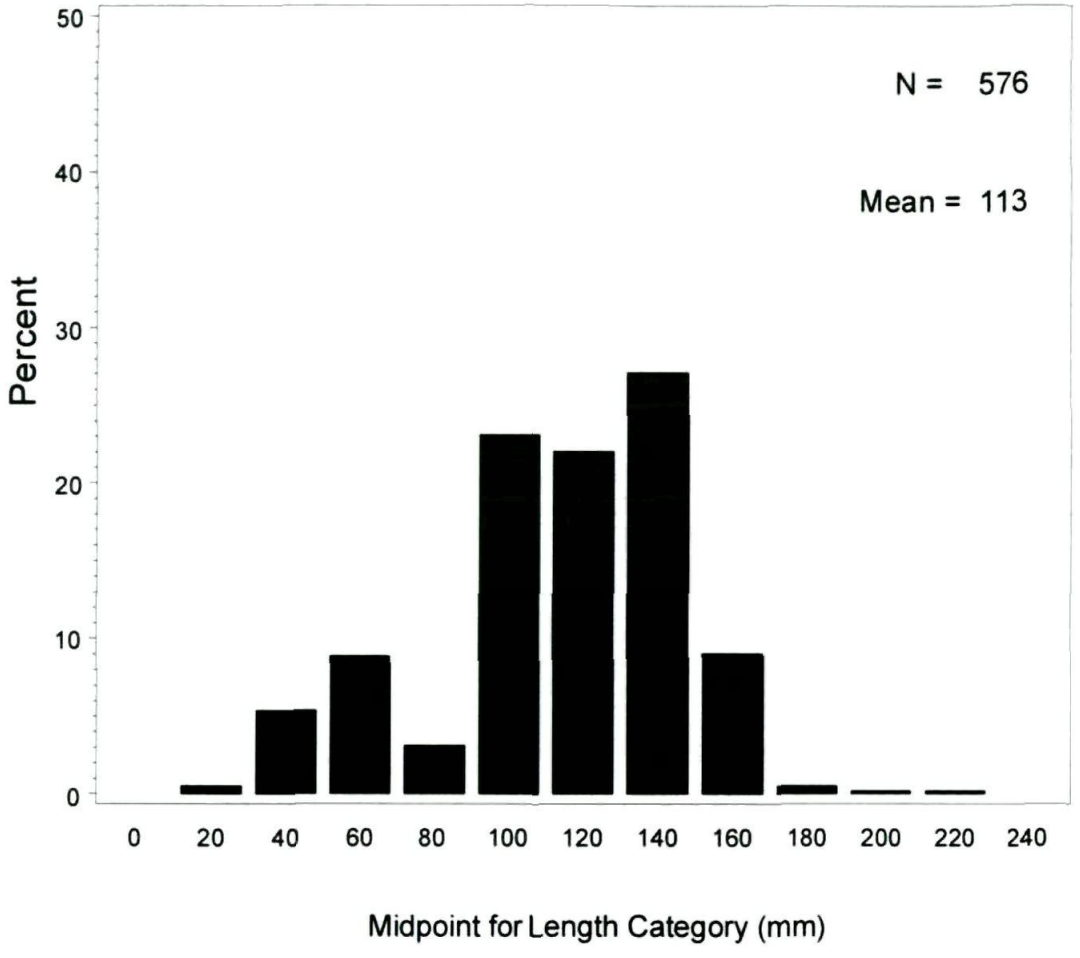
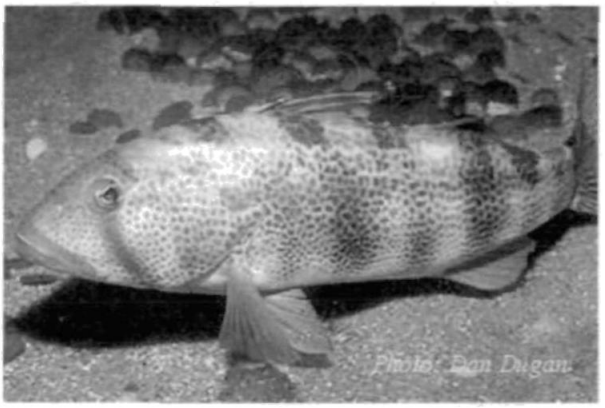



**Figure 4-29.** Size frequency distribution of walleye surfperch from EPS Units 1–5 impingement samples.

## 4.3.7 Sand Basses (*Paralabrax* spp.)




***Range***:

- Spotted: Monterey, California to Mazatlan, Mexico, including the Gulf of California
- Barred: Santa Cruz south to Bahia Magdelena, Baja California
- Kelp: Washington south to Bahia Magdalena, Baja California

***Life History***:

- Size to 56 cm (22 in) (spotted); 69 cm (27 in) (barred); 72 cm (28.5 in) (kelp)
- Age at maturity >1 to 5 yr, all species
- Life span to 14 yr (spotted); 24 yr (barred); 34 yr (kelp)
- Spawning occurs April to November for barred and kelp bass, June to August for spotted; fecundity up to 185,00 eggs/ year

***Habitat***: shallow water rock-sand ecotone; nearshore sand flats, near kelp beds, rocky areas, and bays.

***Fishery***: Sport fishery only; no commercial fishery allowed.

Three species of basses, family Serranidae, genus *Paralabrax*, occur in the San Diego region and were collected in the EPS impingement abundance study: spotted sand bass (*P. maculato-fasciatus),* barred sand bass (*P. nebulifer),* and kelp bass (*P. clathratus).* Spotted sand bass are found from Monterey, California to Mazatlan, Mexico, including the Gulf of California; barred sand bass are found from Santa Cruz to Bahia Magdalena; and kelp bass are found from the mouth of the Columbia River in Washington to Bahia Magdalena, Baja California (Miller and Lea 1972). However, Love (1996) reports that spotted sand bass are not common north of Newport Bay in southern California and Leet et al. (2001) states that barred and kelp bass are rare north of Point Conception.

### 4.3.7.1 Life History and Ecology

The life history of the spotted sand bass was summarized by Love (1996). Adults can reach 56 cm (22 in) in length and live to at least 14 years of age. Females mature within the first year and approximately one-half are mature when they are approximately 15 cm (6 in) long. Males reach maturity at approximately 3 yr with about half of the males being mature at 18 cm (7 in). Some individuals in the populations are protogynous, changing sex from female to male as they grow. Spawning in California populations occurs from June through August. Leet et al. (2001) summarized the life history of barred and kelp sand bass. Adult barred sand bass can reach 69 cm (27 in) and can live to 24 years of age. Adult kelp bass can reach 72 cm (28.5 in) and live to at least 34 years of age. Barred and kelp sand bass reach sexual maturity between 18 and 27 cm (7 to 10.5 in), at about 3–5 years of age. Barred and kelp sand bass form large breeding aggregations in deeper waters and spawn from April through November, peaking in summer months. All three species are multiple spawners (Oda et al. 1993).

In a study of *Paralabrax* fecundity by DeMartini (1987), the number of eggs ranged over a factor of 15 from about 12,000 eggs in a 447 g fish to >185,000 eggs in a 2,625 g fish. The smallest fish, a 148 g sand bass, contained 16,500 eggs. Sample females contained a mean ± 1 S. E. of 760 ± 80 eggs per gram of ovary and 70 ± 12 eggs per gram of ovary-free body weight. All three species are capable of daily spawning (Oda et al. 1993). However, not all fish captured in the Oda et al. (1993) study demonstrated evidence of daily spawning: 32% of the *P. clathratus* females (n = 84), 20% of the *P. maculatofasciatus* females (n = 79), and 31% of the *P. nebulifer* females (n = 81) showed evidence of spawning on two consecutive days. There was no statistically significant difference in the average size of specimens that exhibited evidence of daily spawning, compared to those that had spawned the day before collection. A standard weight female (ca. 700 g [ovary-free weight] and 300 mm SL) was calculated to average 81,000 eggs per batch. This estimate of batch fecundity for *Paralabrax* is higher than that reported by DeMartini (1987) and may indicate the variation possible in these species of *Paralabrax*.

Kelp bass are found associated with structure, such as kelp or rocks, from the subtidal zone to depths of 61 m (200ft) (Love 1996). They are typically found in water less than 21 m (70 ft) (Leet et al. 2001). Spotted sand bass are found in back bays and lagoons, were there is extensive cover (Love 1996). They have been taken in water as deep as 61 m (200 ft), however they are usually found shallower than 6.1 m (20 ft) (Love 1996). Barred sand bass are found at the rock interface, and are commonly observed at artificial reefs. Barred sand bass have been taken in water as deep as 183 m (600 ft), but are usually found in water shallower than 27 m (90 ft);

### 4.3.7.2 Fishery and Population Trends

Barred and kelp bass are two of the most important recreational fishes in southern California (Leet et al. 2001). Sport fishery catch estimates of spotted sand bass in the southern California region from 2000 to 2004 ranged from 10,000 to 74,000 fish, with an average of 49,400 fish caught annually (RecFIN 2006). Catch estimates of kelp bass in southern California ranged from 291,000 to 587,000 fish from 2000 to 2004, with an average of 424,400 fish caught annually. Barred sand bass catch estimates ranged from 695,000 to 1,130,000 fish caught annually, with an average of 917,000 fish caught annually (RecFIN 2006).

### 4.3.7.3 Sampling Results

A total of 567 sand bass was impinged during the normal impingement surveys (**Table 4-2**). Of these, 303 were spotted, 151 were barred, 111 were kelp and 2 could not be identified to the species level and were recorded as *Paralabrax* spp. These impinged sand bass had a combined total weight of 6.8 kg (15.0 lb) (**Table 4.2**). *Paralabrax* spp. combined were the ninth most abundant fish impinged and had the thirteenth highest biomass of the impinged fish. Sand bass were impinged throughout the year, but the peak in sand bass impingement abundance was in January and February, with the peaks in biomass being in January, February, April, and June (**Figures 4-30 and 4-31**). Most sand bass were impinged during two surveys (January 12 and February 23, 2005). Sand basses were more frequent during the nighttime impingement cycles but there was no substantial difference in overall numbers or biomass between day and night

samples throughout the year (**Figures 4-31** and **4-32**). Sand bass were also collected during all heat treatments, peaking in numbers during the June 5, 2005 survey (**Figure 4-33**). A total of 4,511 sand bass was impinged in the heat treatments, weighing 153.6 kg (338.6 lb) (**Table 4-2**). Of these fish, 1,536 were spotted, 1,993 were barred, 976 were kelp and 6 could only be identified to *Paralabrax* spp. Lengths ranged from 28 to 358 mm SL (1.1 to 14.1 in SL), with a mean length of 81.3 mm SL (3.2 in) (**Figure 4-34; Appendix G**). Although the majority of *Paralabrax* spp. were small, they were assumed to be reproductively mature adults for the purposes of this assessment.

#### 4.3.7.4 Annual Impingement Estimates

The estimated annual impingement of sand bass under normal operations using actual CWS flows was 3,477 individuals, weighing 45.2 kg (99.6 lb) (**Table 4-3**). Under maximum CWS flows the estimates increase to 7,274 individuals, weighing 85.8 kg (189.2 lb) (**Table 4-3**). When all sources of impingement mortality are combined, the annual impingement of sand basses under actual CWS flows was 7,988 individuals weighing 198.8 kg (438.3 lb) (**Table 4-4**). Under maximum flows the estimated number was 11,795 individuals weighing 239.4 kg (527.8 lb).

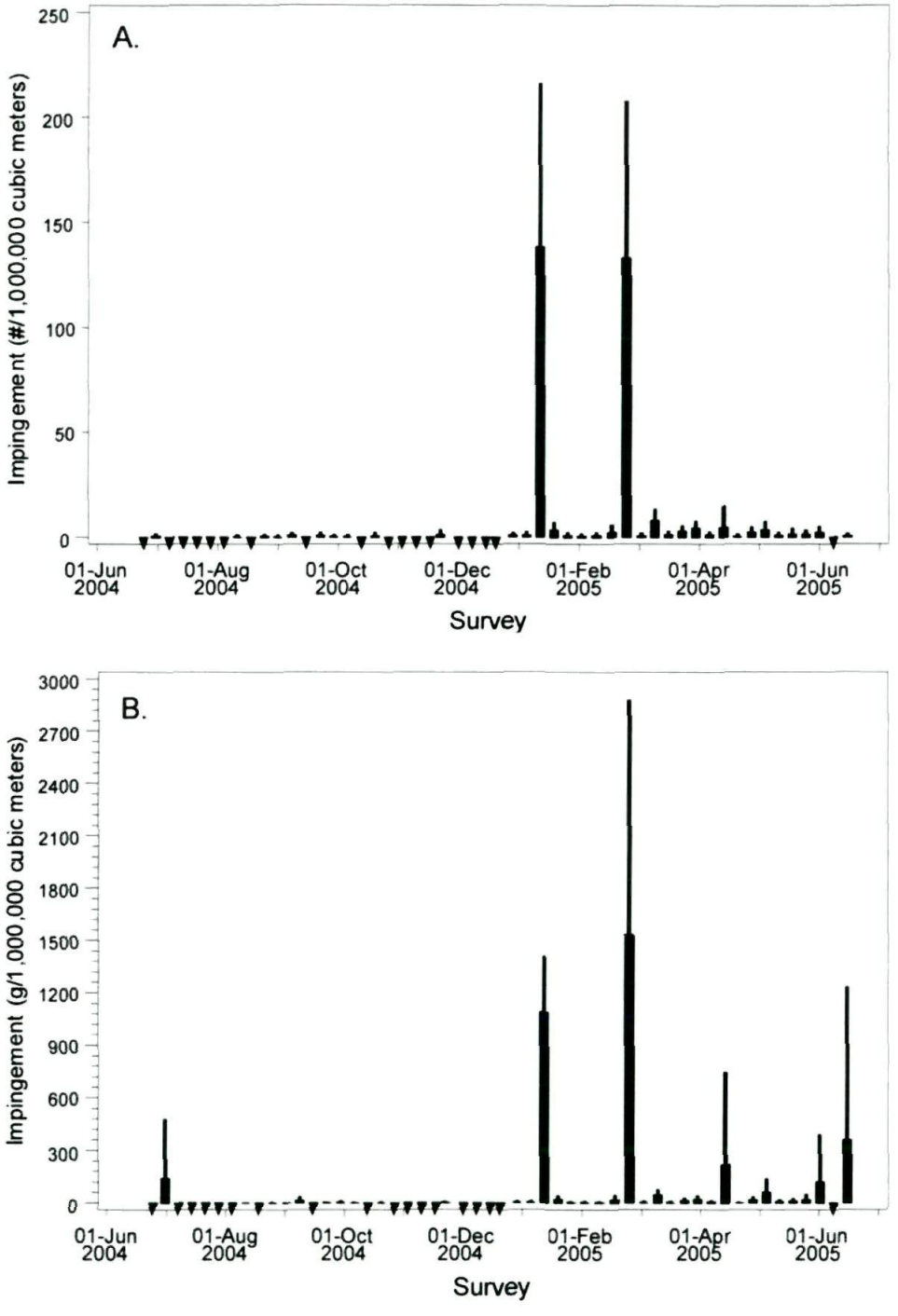



**Figure 4-30**. Mean concentration and standard error of sand basses impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

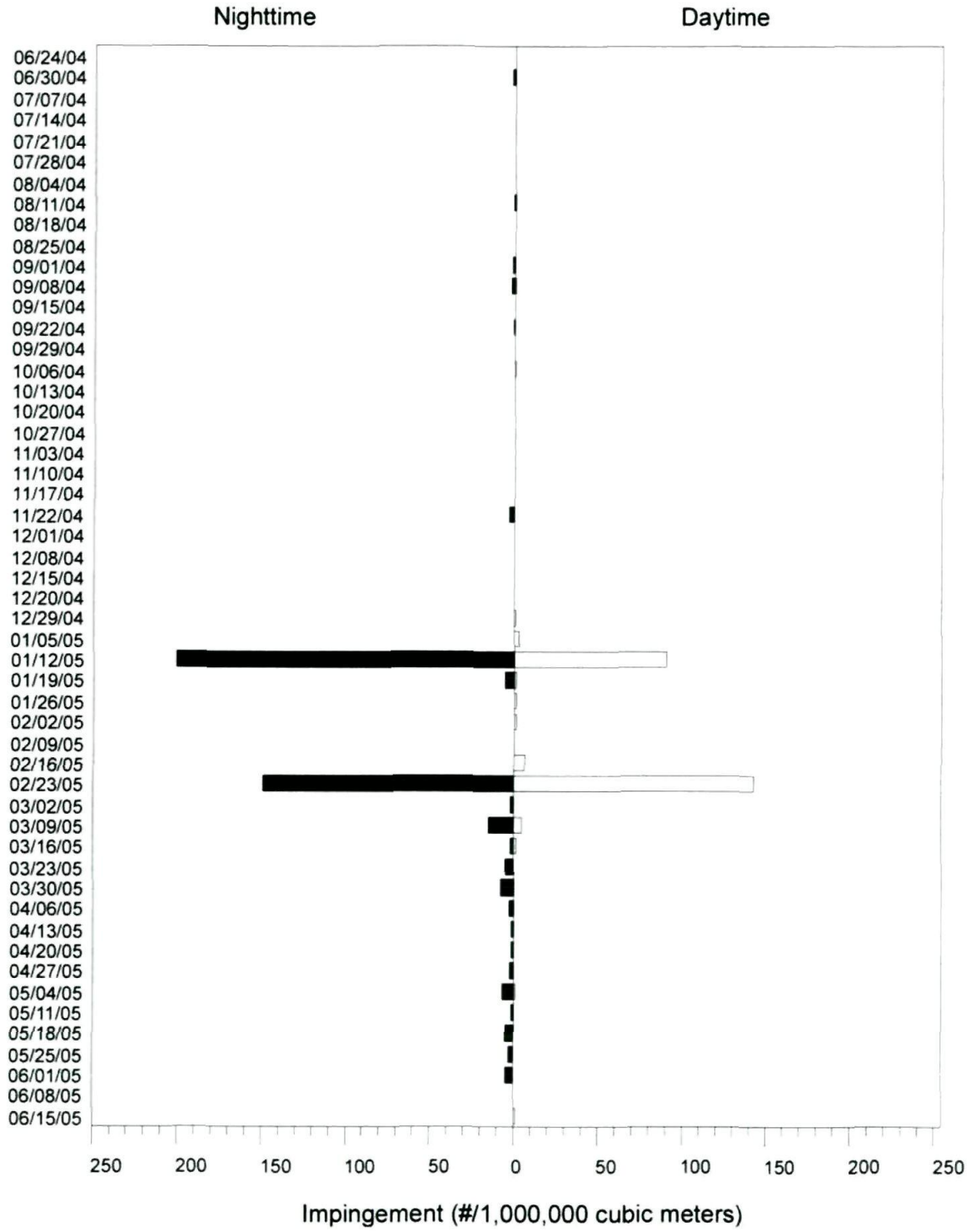



**Figure 4-31.** Abundance (#/$10^6$ $m^3$) of sand basses impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

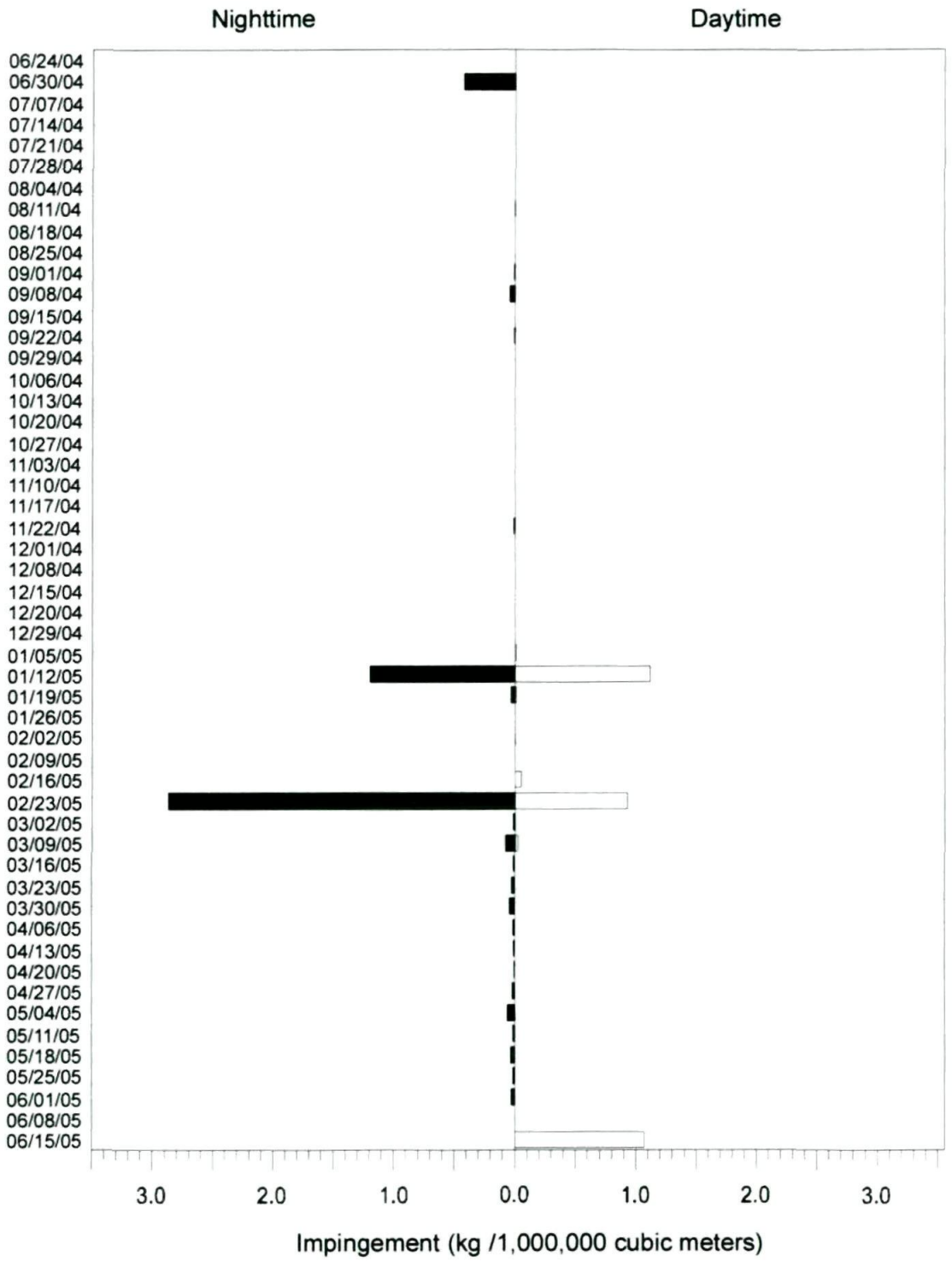



**Figure 4-32.** Biomass (kg/$10^6$ $m^3$) of sandbasses impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

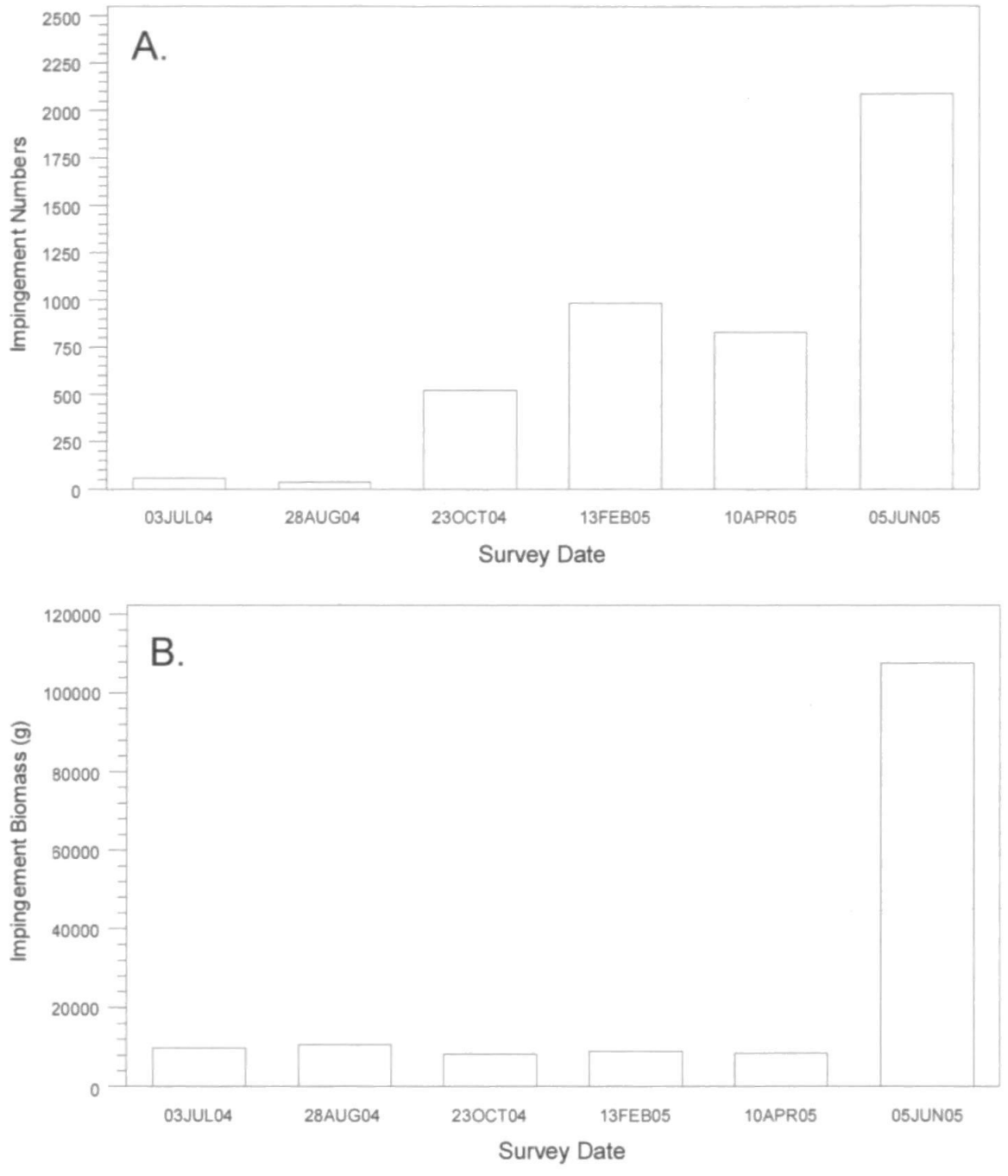



**Figure 4-33**. A) abundance, and B) biomass of sandbasses impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

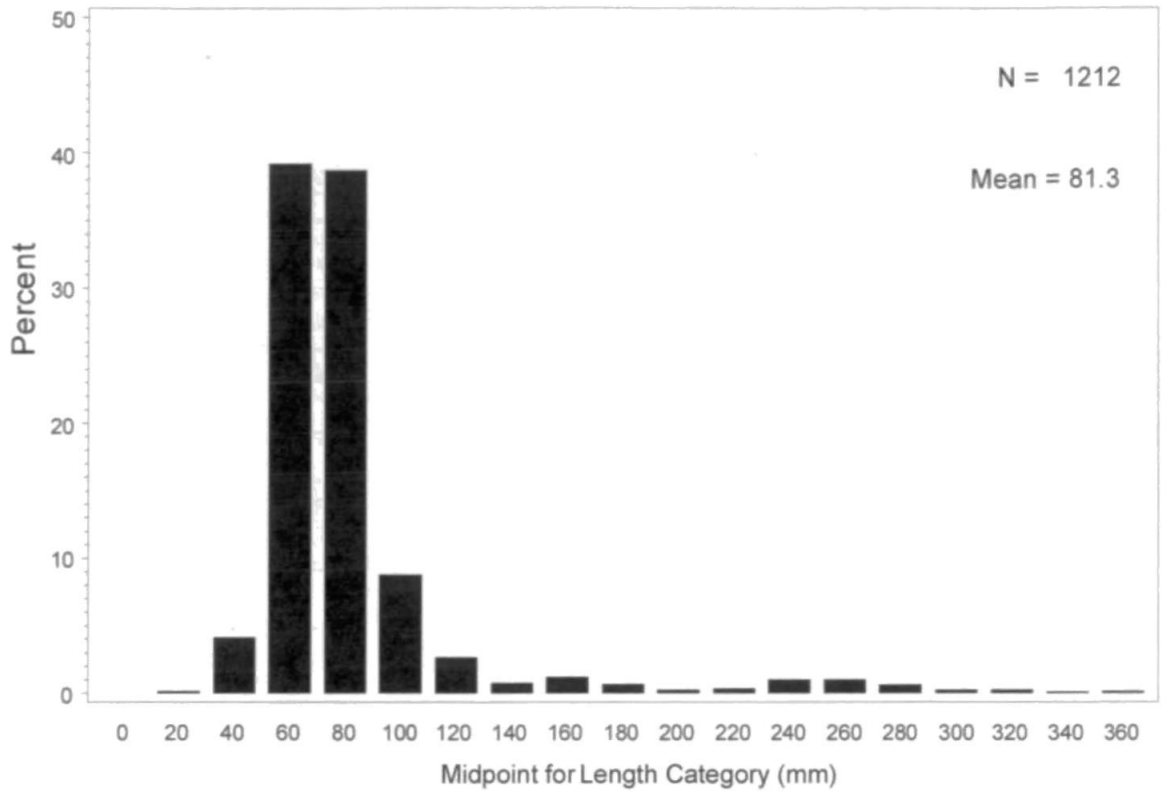



**Figure 4-34**. Size frequency distribution of sand basses from EPS Units 1–5 impingement samples.

## 4.3.8 Pacific Sardine (*Sardinops sagax*)



*Monterey Bay Aquarium*

***Range***: Kamchatka, Russia, southeast Alaska to Guaymas, Mexico, and Peru to Chile

***Life History***:

- Size up to 41 cm (16 in)
- Age at maturity less than one year
- Life span to 13 yr
- Spawning occurs year-round with a fecundity of 200,000 eggs/yr

***Habitat***: schools over continental shelf, often near shore.

***Fishery***: Commercial and sport fishery.

Pacific sardines are small pelagic schooling fish that are members of the herring family (Clupeidae). Pacific sardines occur in coastal areas from Kamchatka, Russia and southeast Alaska to Guaymas, Mexico, and from Peru and Chile in the southern hemisphere. Pacific sardines are often found in schools with other pelagic forage species such as anchovy, mackerel, and hake (Leet et al. 2001).

### 4.3.8.1 Life History and Ecology

Pacific sardines can grow to 410 mm (16 cm), but typically are less then 300 mm (12 cm). Fitch and Lavenberg (1971) indicated that Pacific sardine can live to 25 yr, but longevity is more likely about 13 yr according to Butler et al. (1993). Reproduction is temperature dependent, and the spawning biomass may move north during El Niño years. Size at maturity also may be temperature dependent, with 50% of females maturing at about 16 cm standard length (SL) in southern California (Macewicz et al. 1996) and 50% of the females maturing at about 13 cm off Ensenada, Baja California Norte, Mexico in 1958 during an El Niño year (Ahlstrom 1960). Butler et al. (1996) reported that fish less than 1 year old were sexually mature.

Spawning occurs year-round with a summer and fall peak (Love 1996). Estimates from previous studies of sardine fecundity range widely. Hart (1973) estimated 30,000–65,000 eggs/batch with large individuals producing 200,000 eggs/yr. Fitch and Lavenberg (1971) reported an estimate of sardine fecundity of 90,000–200,000 eggs/yr. Lo et al. (1996) estimated an average batch fecundity of 24,282 (CV=11%). The highest estimates of annual fecundity from Butler et al. (1993) indicate that Pacific sardine fecundity ranged from 146,754 eggs/two-yr-old female to as many as 2,156,600 eggs for ten-yr and older females.

Age and growth characteristics of Pacific sardine at all life stages have been well described. Larval growth estimated from otoliths has been measured in several temperature regimes (Miller 1952), from which we are able to derive an approximate larval growth rate of 0.24 mm/day. Growth of the adults has been described with a von Bertalanffy growth function (Von

Bertalanffy growth function: $L_\infty$=205.4 mm ± 1.6 mm SE, k=1.19 ± 0.04 SE, $t_0$ = 0) by Butler et al. (1996).

Pacific sardine are among the few fishes with age- and stage-specific mortality estimates from the egg stage through later life stages reported in the scientific literature. Instantaneous egg mortality has been estimated as 0.13/d off of Oregon with a CV=243% (Barnes et al. 1992). Lo et al. (1996) produced a similar estimate of embryonic (yolk-sac) mortality of 0.12/d, but with a CV=97%. Butler et al. (1993) modeled the demography of Pacific sardine from the egg stage through the late adult stages with estimates of instantaneous daily natural mortality, the estimated duration of each stage, and daily fecundity (**Table 4-5**). Deriso et al. (1996) modeled the annual fishing mortality of Pacific sardine for the years 1983–1995. The natural adult mortality rate in fished populations has been assumed to be 0.4/yr (Murphy 1966; MacCall 1979).

Sardines school over the continental shelf and often near shore. Each year sardines migrate northward early in summer and return south in fall, migrating farther with each year of life. The timing and extent of these migrations are complex and may be affected by oceanographic conditions. Age stratification of the adult population does appear to occur over a latitudinal gradient, with the larger, older fish occurring farther north (Hart 1973).

### 4.3.8.2 Fishery and Population Trends

The sharp decline of the Pacific sardine population in the mid-1940's led to the demise of the world's largest commercial fishery and to the establishment of the California Cooperative Oceanic Fisheries Investigations (CalCOFI) program (originally named the Cooperative Sardine Research Program) in 1947 (Moser 1996). In 1999, CDFG issued a press release (January 15, 1999) indicating that the Pacific sardine resource had fully recovered. The sport fisheries catch estimates for Pacific sardine for southern California was 452,000 fish in 2003 and 808,000 fish in 2004 (RecFin 2005). Average commercial catches of Pacific sardine for 2001–2004 was 184,029,382 pounds for all gear types in the Pacific region (PacFIN 2005). Records from the CDFG commercial fishery database (CDFG 2005) indicate that in 2004 there were 44.5 MT of sardine was landed in the San Diego Region (primarily at the port of Oceanside) with an ex-vessel value of $26,428.

### 4.3.8.3 Sampling Results

A total of 268 Pacific sardines was impinged during normal operations impingement surveys (**Table 4-2**). They had a combined weight of 1.5 kg (3.3 lb). They were most abundant from July to August and late December to early February (**Figure 4-35**). Sardines were most frequently collected during nighttime impingement cycles although both numbers and biomass were greater in the daytime during some weeks of the year (**Figures 4-36** and **4-37**). A total of 6,578 individuals weighing 26.3 kg (58.0 lb) was collected in the heat treatment surveys (**Table 4-2**). The overall size of impinged Pacific sardine ranged from 35 to 242 mm SL (1.4 to 9.5 in) with a mean length of 84.8 mm SL (3.3 in) (**Figure 4-39; Appendix G**).

### 4.3.8.4 Annual Impingement Estimates

The estimated annual impingement of Pacific sardines under actual CWS flows during normal operations was 1,735 individuals weighing 9.1 kg (20.1 lb). Under maximum CWS flows, the estimated annual impingement rates was 2,344 individuals weighing 13.9 kg (30.6 lb). When all sources of impingement mortality (normal operations, bar racks and heat treatments) are combined, the annul estimate of impingement based on actual CWS water flow was 8,313 individuals weighing 35.4 kg (78.0 lb). Under maximum CWS flow the estimated impingement mortality from all sources was 8,922 individuals weighing 40.2 kg (88.6lb).



**Table 4-5**. Life table for Pacific sardine (*Sardinops sagax*): a) Age-specific fecundity schedule ($M_x$=natality rate; $L_x$=survivorship) and b) stage-specific survivorship schedule (Z=instantaneous daily mortality; S=finite survival rate) modified from Butler et al. (1993).

a) Age-specific fecundity

| Age (yr) | $M_x$ | $L_x$ | $M_xL_x$ |
|---|---|---|---|
| 1 | 0 | 1,000 | 0 |
| 2 | 146,754 | 670 | 98,325,180 |
| 3 | 388,188 | 449 | 174,296,412 |
| 4 | 599,640 | 301 | 180,491,640 |
| 5 | 849,490 | 202 | 171,596,980 |
| 6 | 1,167,457 | 135 | 157,606,695 |
| 7 | 1,487,528 | 91 | 135,365,048 |
| 8 | 1,617,450 | 61 | 98,664,450 |
| 9 | 1,887,025 | 41 | 77,368,025 |
| 10 | 2,156,600 | 27 | 58,228,200 |
| 11 | 2,156,600 | 18 | 38,818,800 |
| 12 | 2,156,600 | 12 | 25,879,200 |
| 13 | 2,156,600 | 8 | 17,252,800 |

b) Stage-specific survivorship

| Stage | $Z_{min}$ | $Z_{best}$ | $Z_{max}$ | Duration (d) | Cumulative | Duration (d) | $S_{max}$ | $S_{best}$ | $S_{min}$ | $CV_{best}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Egg | 0.3100 | 0.7200 | 2.1200 | 3 | | 3 | 0.4607 | 0.1653 | 0.0050 | 0.4595 |
| Yolk-sac larva | 0.3940 | 0.6698 | 0.9710 | 3 | 6 | 3 | 0.2948 | 0.1254 | 0.0493 | 0.3264 |
| Early larva | 0.1423 | 0.2417 | 0.3502 | 11 | 17 | 7.26 | 0.356 | 0.173 | 0.0788 | 0.267 |
| | | | | **Survivorship from egg to entrainment:** | | | | **0.0036** | | |
| Early larva | 0.1423 | 0.2417 | 0.3502 | 11 | 17 | 3.74 | 0.587 | 0.4047 | 0.270 | 0.131 |
| Late larva | 0.0570 | 0.0964 | 0.1390 | 35 | 52 | 35 | 0.1360 | 0.0343 | 0.0077 | 0.6243 |
| Early juvenile | 0.0290 | 0.0560 | 0.0810 | 25 | 77 | 25 | 0.4843 | 0.2466 | 0.1320 | 0.2381 |
| Juvenile I | 0.0116 | 0.0197 | 0.0285 | 50 | 127 | 50 | 0.5599 | 0.3734 | 0.2405 | 0.1425 |
| Juvenile II | 0.0023 | 0.0040 | 0.0058 | 110 | 237 | 110 | 0.7765 | 0.6440 | 0.5283 | 0.0642 |
| Juvenile III | 0.0016 | 0.0028 | 0.0040 | 146 | 383 | 146 | 0.7917 | 0.6644 | 0.5577 | 0.0587 |
| Juvenile IV | 0.0012 | 0.0022 | 0.0032 | 170 | 553 | 170 | 0.8155 | 0.6880 | 0.5804 | 0.0569 |
| Pre-recruit | 0.0006 | 0.0011 | 0.0015 | 175 | 728 | 175 | 0.9003 | 0.8249 | 0.7691 | 0.0265 |
| | | | | **Survivorship from entrainment to recruitment:** | | | | **0.0003** | | |

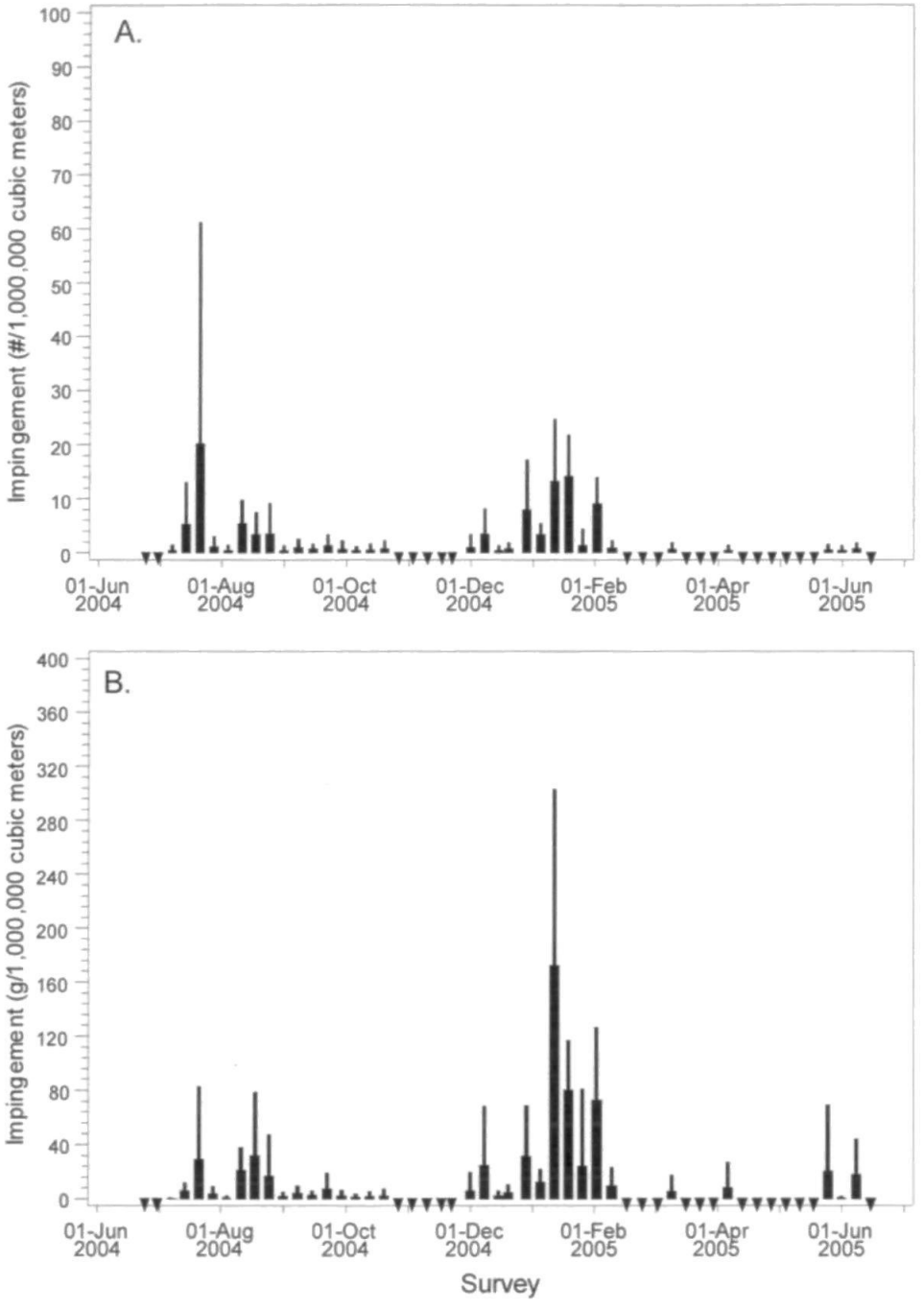



**Figure 4-35.** Mean concentration and standard error of Pacific sardine impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

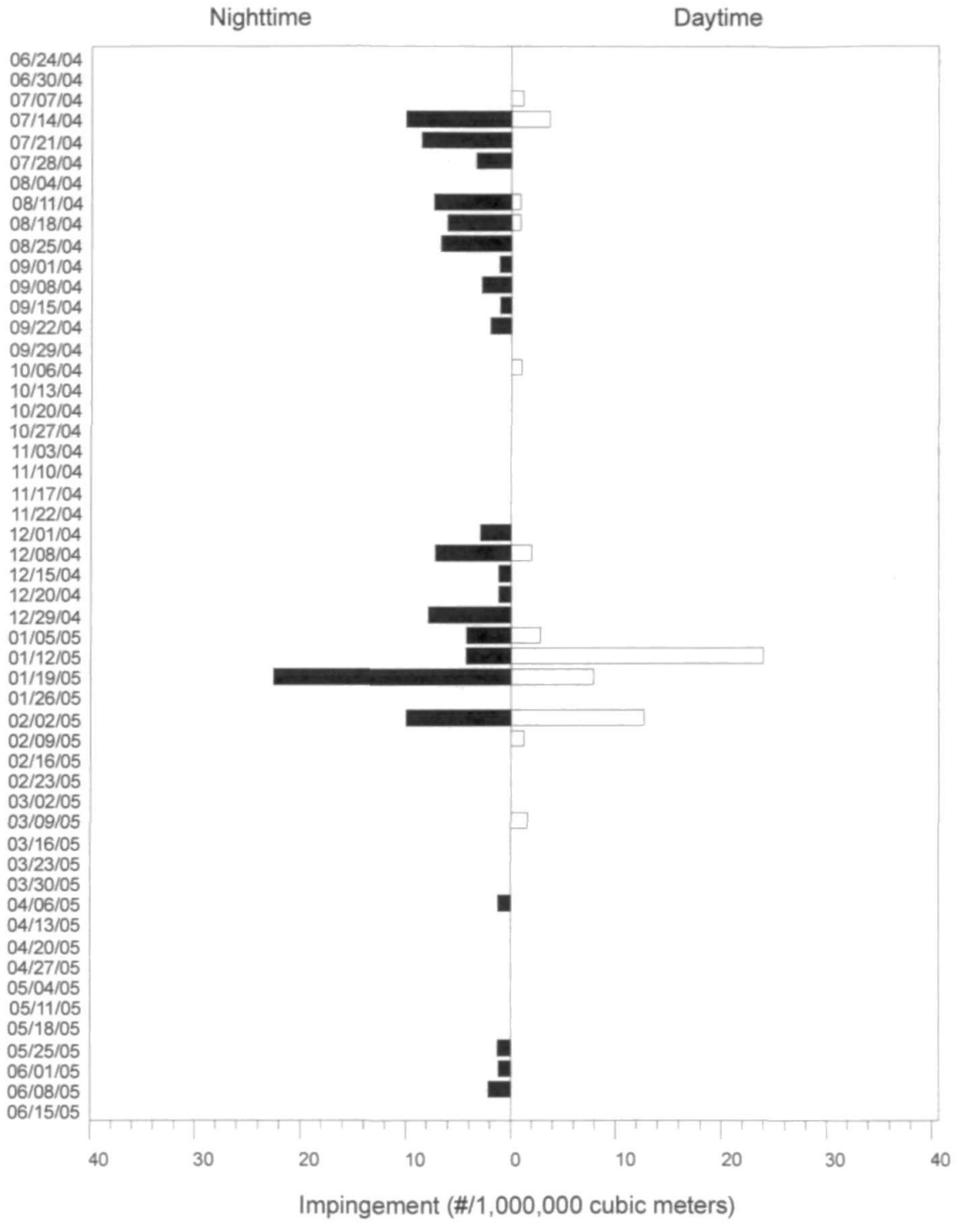



**Figure 4-36.** Abundance (#/$10^6$ $m^3$) of Pacific sardine impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

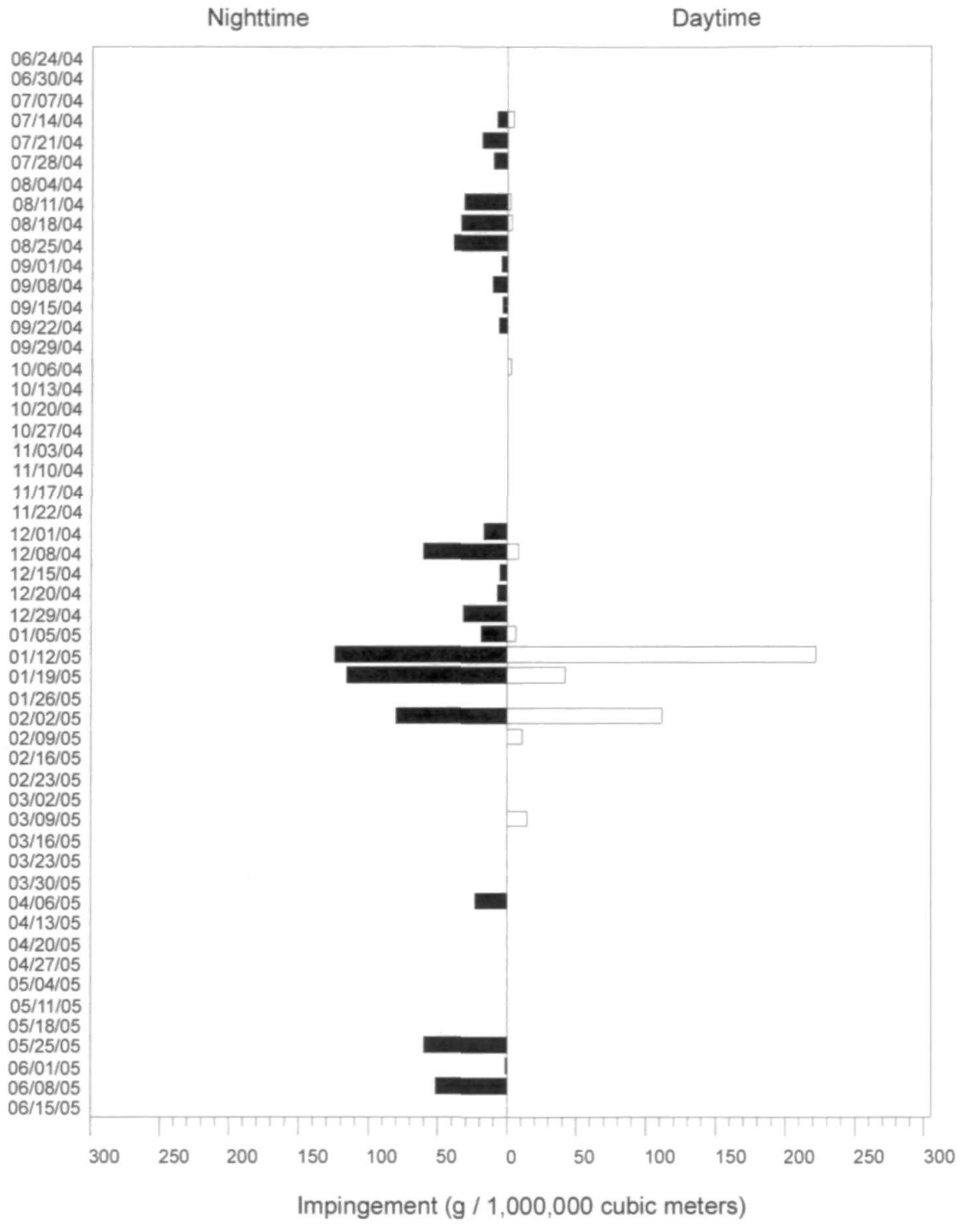



**Figure 4-37.** Biomass ($g/10^6$ $m^3$) of Pacific sardine impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

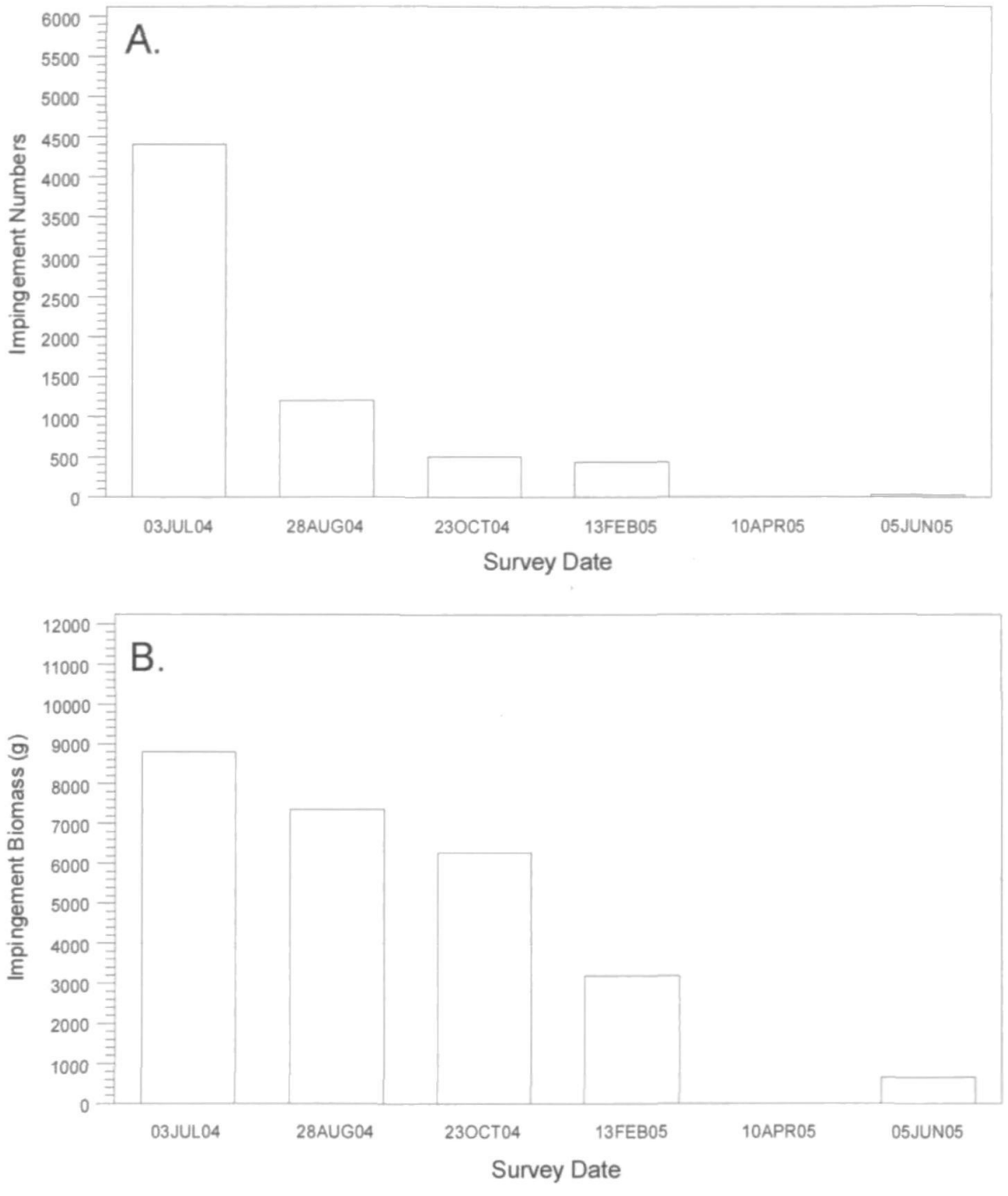



**Figure 4-38**. A) abundance, and B) biomass of Pacific sardine impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

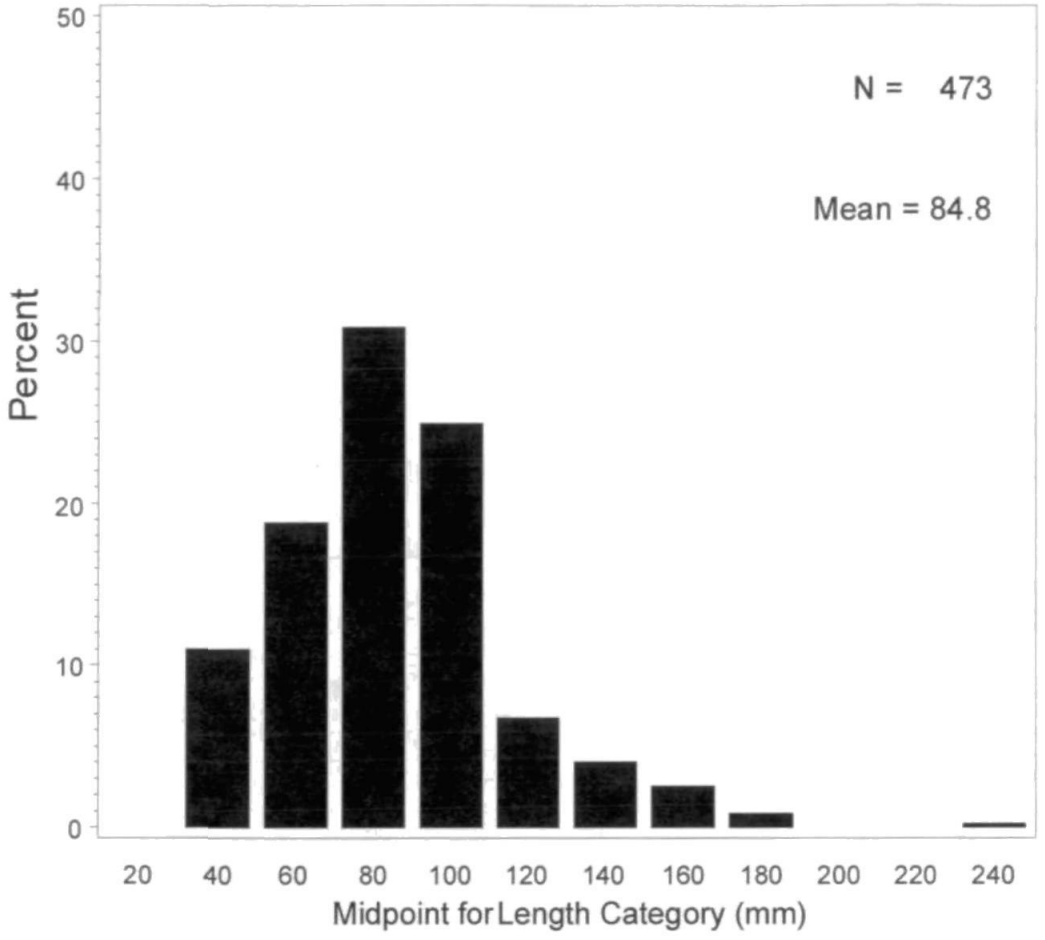



**Figure 4-39.** Size frequency distribution of Pacific sardine from EPS Units 1–5 impingement samples.

## 4.3.9 Spotfin Croaker (*Roncador stearnsii*)

Spotfin croaker (*Roncador stearnsii*) is one of the eight members of the croakers (Family Sciaenidae) found off of the California coast.. Spotfin croaker larvae were abundant in plankton samples collected as part of the entrainment impact portion of the present study, and their life history is presented in Section 3.3.8 of this report.

### 4.3.9.1 Sampling Results

A total of 182 spotfin croaker was collected in the normal impingement sampling at EPS weighing 8.4 kg (18.5 lb) with an additional 2 collected from the bar racks weighing 3.0 g (0.01 lb) (**Table 4-2**). Spotfin croaker was the fourteenth most abundant taxa impinged during the yearlong survey and ranked eleventh in total biomass of all species collected. The numbers of spotfin croaker were significantly greater in nighttime samples, particularly in June and July 2004 (**Figure 4-41**), but the presence of a few larger individuals impinged during some daytime samples contributed to more biomass being impinged during daytime cycles (**Figure 4-42**). A total of 106 individuals was collected during heat treatments, weighing 17.2 kg (37.9 lb) (**Table 4-2**). The greatest number of spotfin croakers collected during heat treatment surveys were seen in June 2005, with the highest biomass in February 2005 (**Figure 4-43**). Standard lengths of the measured individuals ranged from 33 – 555 mm (1.3 – 21.9 in SL) with a mean length of 103 mm (4.1 in) (**Figure 4-44; Appendix G**).

### 4.3.9.2 Annual Impingement Estimates

The estimated annual impingement of spotfin croaker under normal operations using actual CWS flows was 1,231 individuals weighing 42.6 kg (94.0 lb). Estimated bar rack impingement was 14 individuals, weighing 21.0 kg (46.3 lb) (**Table 4-3**). Under maximum CWS flow estimated annual impingement increases to 1,700 individuals weighing 83.9 kg (185.0 lb) (**Table 4-3**). Combining all sources of impingement mortality, estimated annual impingement of spotfin croaker under actual CWS flows was 1,351 individuals weighing 80.8 kg (178.1 lb) (**Table 4-4**). Under maximum CWS flows the estimate was 1,820 spotfin croaker weighing 122.1 kg (269.2 lb).

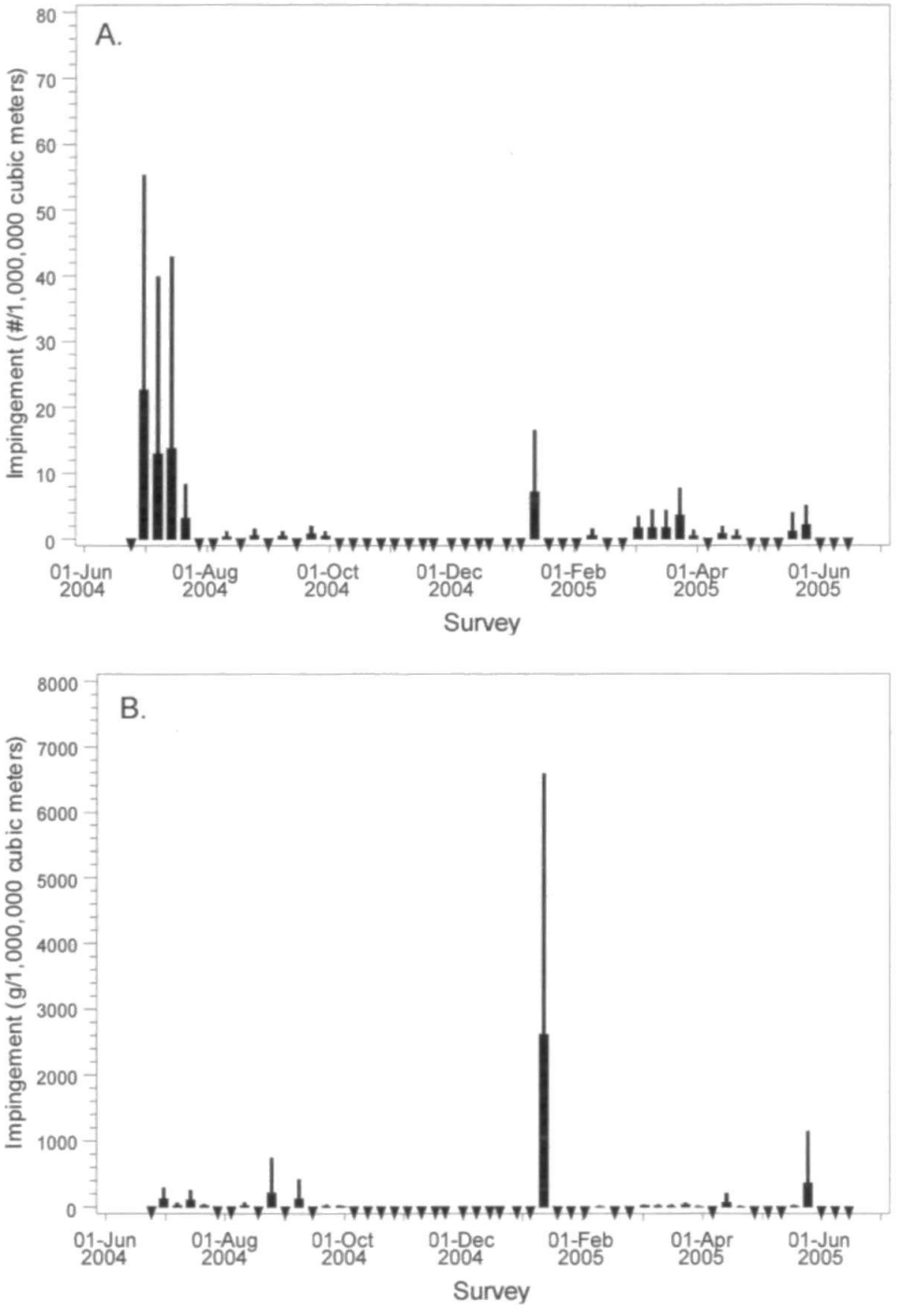



**Figure 4-40.** Mean concentration and standard error of spotfin croaker impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

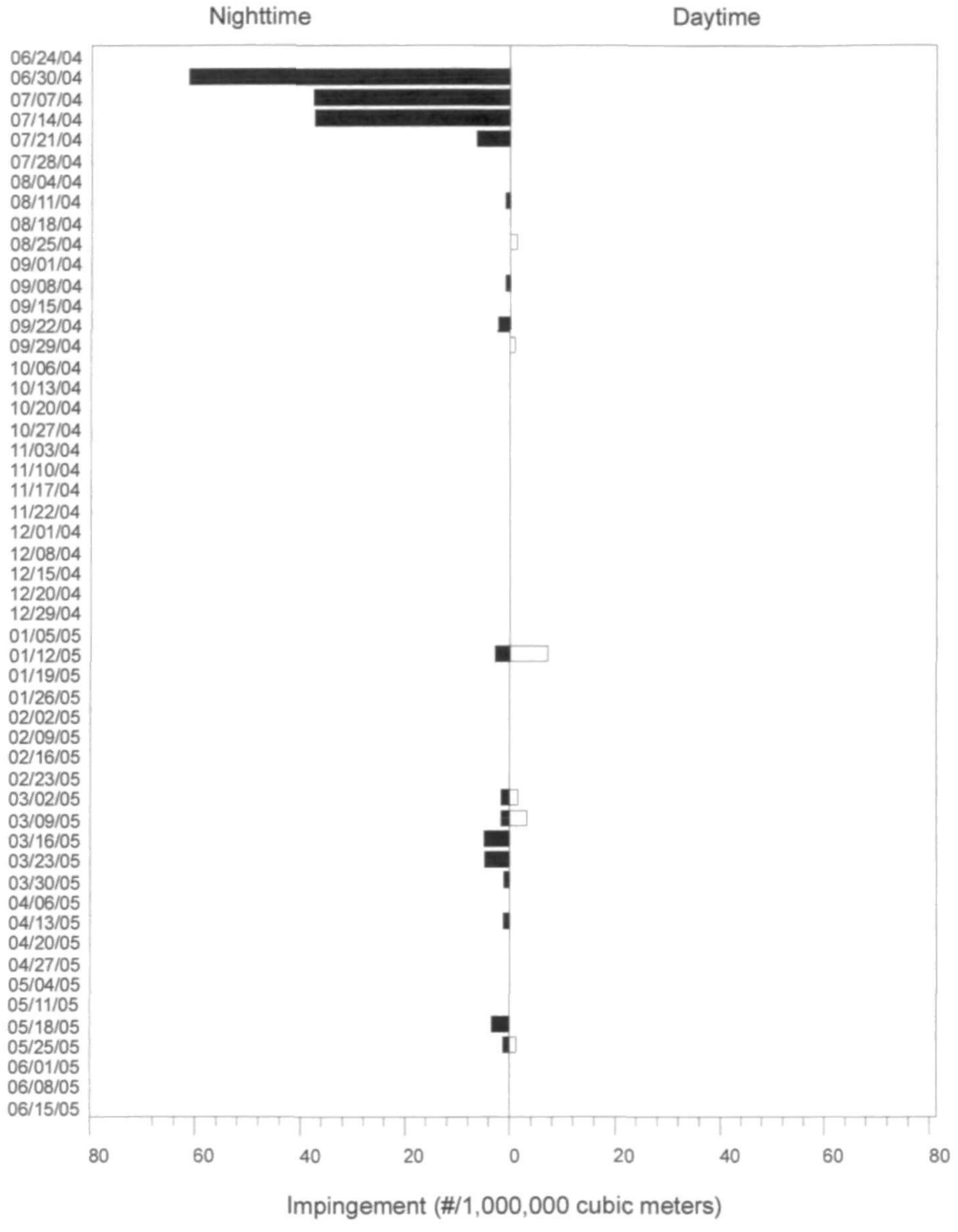



**Figure 4-41.** Abundance (#/$10^6$ $m^3$) of spotfin croaker impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

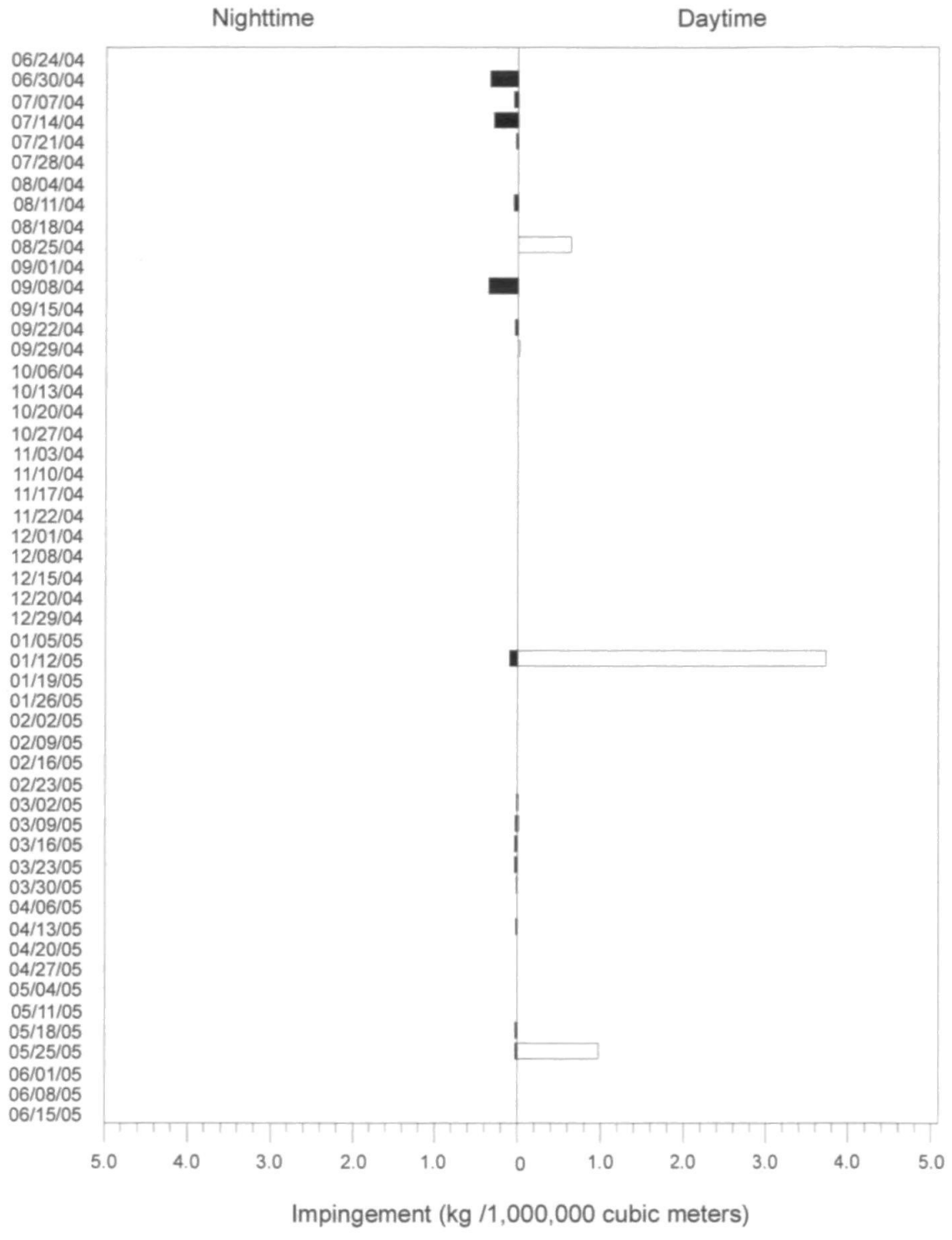



**Figure 4-42.** Biomass (kg/$10^6$ $m^3$) of spotfin croaker impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

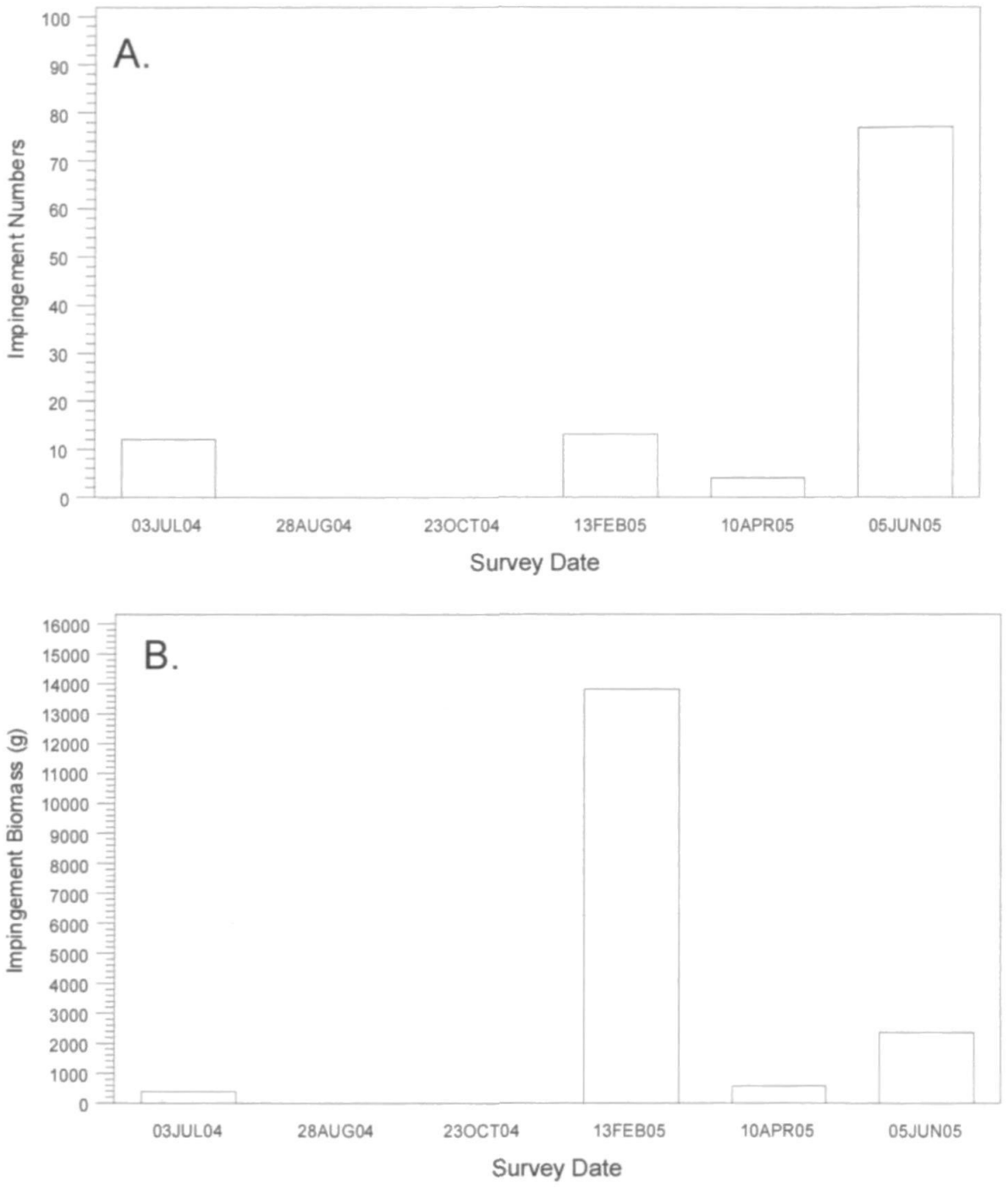



**Figure 4-43**. A) abundance, and B) biomass of spotfin croaker impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

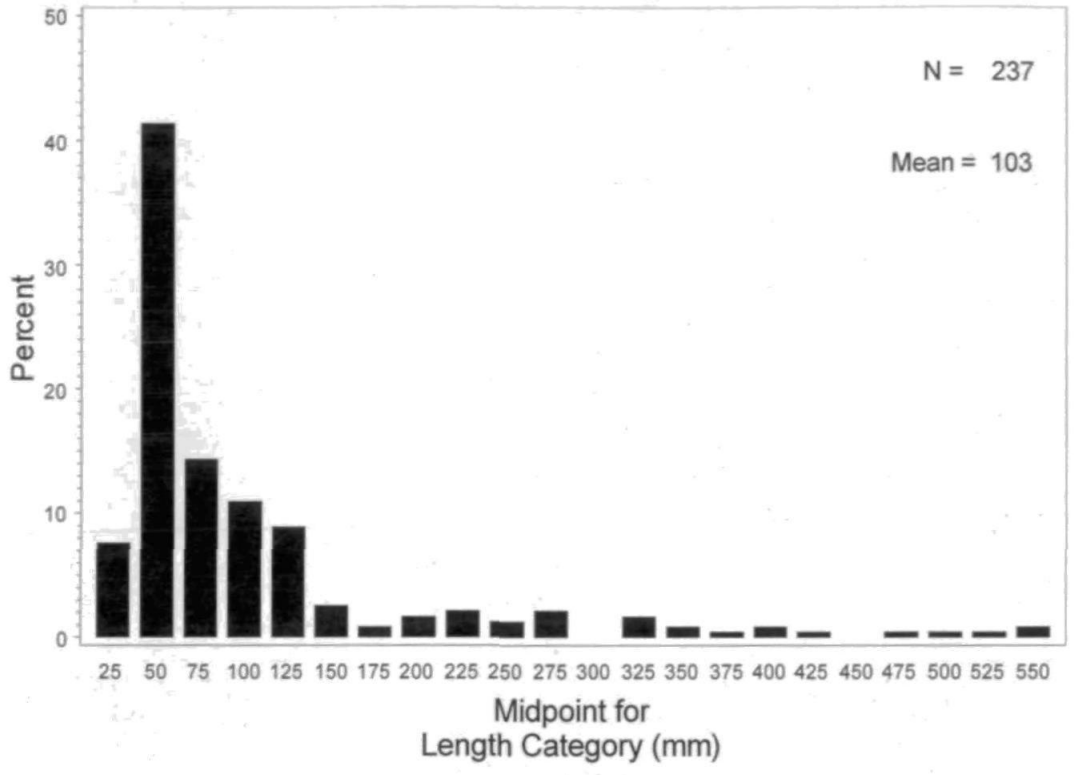



**Figure 4-44**. Size frequency distribution of spotfin croaker from EPS Units 1–5 impingement samples.

## 4.3.10 White Seabass (*Atractoscion nobilis*)



*Hubbs-SeaWorld*

***Range:*** Juneau, Alaska to Magdalena Bay, Baja California, including the Gulf of California

***Life History***:

- Size to 166 cm (65.4 in)
- Size at maturity to 71.1 cm (28 in)
- Fecundity up to 1,500,000 eggs per yr
- Life span to 27 yr

***Habitat***: Very young fish live in drift algae behind the surf line, juveniles are in bays and shallow coastal waters near kelp or rock; adults tend to be near reefs or kelp beds.

***Fishery***: Sport and commercial fishery; stock replenishment in southern California through culturing facilities and grow-out pens.

White seabass is one of the eight members of the croakers (Family Sciaenidae) found off of the California coast. The white seabass is the largest croaker in California and the only member of the genus *Atractoscion.*

White seabass have been found from Juneau, Alaska to Magdalena Bay, Baja California, and the Gulf of California (Miller and Lea 1972). However, Love (1996) reported that they are not common north of Point Conception. Franklin (1997) examined white seabass DNA and concluded that the white seabass stock in the Eastern Pacific is composed of three components: northern, southern and Sea of Cortez.

### 4.3.10.1 Life History and Ecology

White seabass can be found as deep as 122 m (400 ft) (Miller and Lea 1972). Adults can reach 166 cm (65.4 in) in length and live to at least 27 years (Love 1996). A 71 cm (28 in.) white seabass (the minimum legal size) was determined to be five years old and weighed about 3 kg (7 lb) (Thomas 1968), however, recent growth data from CDFG (2003) suggest that minimum legal size may be obtained by the third year. Fifty percent of females are sexually mature at 71 cm (28 in) while half of males reach maturity at approximately 61 cm (24 in).

Spawning occurs from April through August, with a peak in May and June. White seabass are multiple spawners with individuals releasing eggs every 3 weeks for 4–5 months (Orhun 1989). Eggs are free-floating for 3 days before hatching, and the total larval duration is approximately 35-37 days (Bartley et al. 1995). Fecundity has been determined from artificial propagation attempts (CDFG 1994). Batch fecundity, the number of eggs released by one female at a single time, has ranged from 0.76 million to 1.5 million eggs, and has varied as a function of mean female body weight. Mortality estimates were developed by Kent and Ford (1990) as 0.258 (1 to 2 yr old) and 0.117 (3 to 4 yr old).

In a study of young-of-the-year (YOY) populations in Long Beach Harbor, Allen and Franklin (1992) found that no YOY white seabass were collected in the 93 tows made in protected bays, however, they tended to be concentrated in semi-protected and exposed coasts among various species of drift algae, clumps of sessile invertebrates, and debris of terrestrial origin. The highest abundances were found in July. Older juveniles occupy bays and shallow coastal waters, often near kelp or rocks. Adults are usually found near reefs or kelp beds, and in winter many move into deep water (36.6-106.7 m) (Love 1996). Seasonally, white seabass were most abundant in coastal power plant entrainment samples in winter with lowest abundances in spring, and a secondary peak in June (Herbinson et al. 2001).

Juvenile white seabass feed on mysid shrimps and adults are known to feed on northern anchovy (*Engraulis mordax*); market squid (*Loligo opalescens*); Pacific sardine (*Sardinops sagax*); blacksmith (*Chromis punctipinnis*); silversides (Atherinopsidae species); and pelagic red crab (*Pleuroncodes planipes*) (Thomas 1968).

Commercial fishermen have recorded numerous instances of sea lion and shark predation on adult white seabass caught in nets (Fitch and Lavenberg 1971). Studies to identify the predators of white seabass eggs, larvae, and juveniles have not been done. Hypothetically, predators would include all piscivorous fishes such as kelp and sand bass (*Paralabrax clathratus* and *P. nebulifer*). In laboratory tanks, white seabass larvae are cannibalistic and must be graded by size. This behavior probably takes place in the wild.

#### 4.3.10.2 Population Trends and Fishery

Declining stocks of white seabass due to overfishing have resulted in the development of a hatchery release program to replenish stocks of this valuable sport species. In a survey of private boaters at launch ramp facilities from 1978 to 1982, it was found that only six to 16% of white seabass were of legal size (Vojkovich and Crooke 2001). Populations of white seabass have been low since 1977 but declined dramatically from 1980 to 1982 and have never recovered to previous levels (Herbinson et al. 2001). In 1983, the California legislature created the Ocean Resources Enhancement and Hatchery Program (OREHP). The purpose of this program was to research artificial propagation, rearing, stocking, and distribution of economically important species of fish south of Point Arguello. By 1999, more than 375,000 juvenile white seabass had been released off southern California, and it is estimated that 17,500 of those may have survived to legal size or larger (Vojkovich and Crooke 2001). Since 1999, commercial and recreational catches of white seabass have increased north of Point Conception; possibly indicating a recent northward shift in the stock due to warmer waters brought up during the El-Niño/Southern Oscillation (ENSO) of 1997–1998. Fishery-independent data from gill net surveys indicate a significant increase in 0 to 4 year old white seabass from 1995–2001 (Allen et al. 2001). The largest recruitment during this period occurred in 1999 when a large number of one and two year old fish were caught. This was probably a result of a strong year class associated with the ENSO of 1997–1998.

Sport fishery catch estimates of white seabass in the southern California region from 1995 to 2004 ranged from 3,000 to 29,000 fish annually with a mean of 16,182 fish (RecFIN 2005). Commercial catch estimates in San Diego County for 2005 were 26.8 MT valued at $140,612 (PacFIN 2005).

#### 4.3.10.3 Sampling Results

A total of 70 white seabass was collected in the normal impingement sampling at EPS weighing 11.3 kg (24.9 lb) with an additional 6 collected from the bar racks weighing 0.87 kg (1.9 lb) (**Table 4-2**). The peak in abundance and biomass during normal operation impingement was seen in January and February (**Table 4-45**). White seabass was impinged during both day and night sampling periods with the greatest numbers occurring in daytime samples (**Figure 4-46**). Biomass followed the same trends in diel abundances as numerical abundance (**Figure 4-47**). A total of 1,618 individuals weighing 332.1 kg (732.2 lb) was collected during heat treatments (**Figure 4-48**) with the highest abundance and biomass being during the February heat treatment survey. Lengths of the measured individuals ranged from 36–441 mm (1.4–17.4 in), with a mean length of 224 mm (8.8 in) (**Table 4-49**).

#### 4.3.10.4 Annual Impingement Estimates

The estimated annual impingement of white seabass during normal operations and using actual CWS flows was 442 individuals weighing 70.0 kg (154.2 lb) (**Table 4-3**). Estimated bar rack impingement was 42 individuals, weighing 6.1 kg (13.5 lb) (**Table 4-3**). Under maximum CWS flows the estimated annual impingement abundance would increase to 724 individuals weighing 120.0 kg (264.6 lb) (**Table 4-3**). When all sources of impingement at EPS are combined, the estimated mortality using actual CWS flows was 2,102 individuals weighing 408.1 kg (899.7 lb) and using maximum flows was 2,384 individuals weighing 458.1 kg (1,010 lb) (**Table 4-4**).

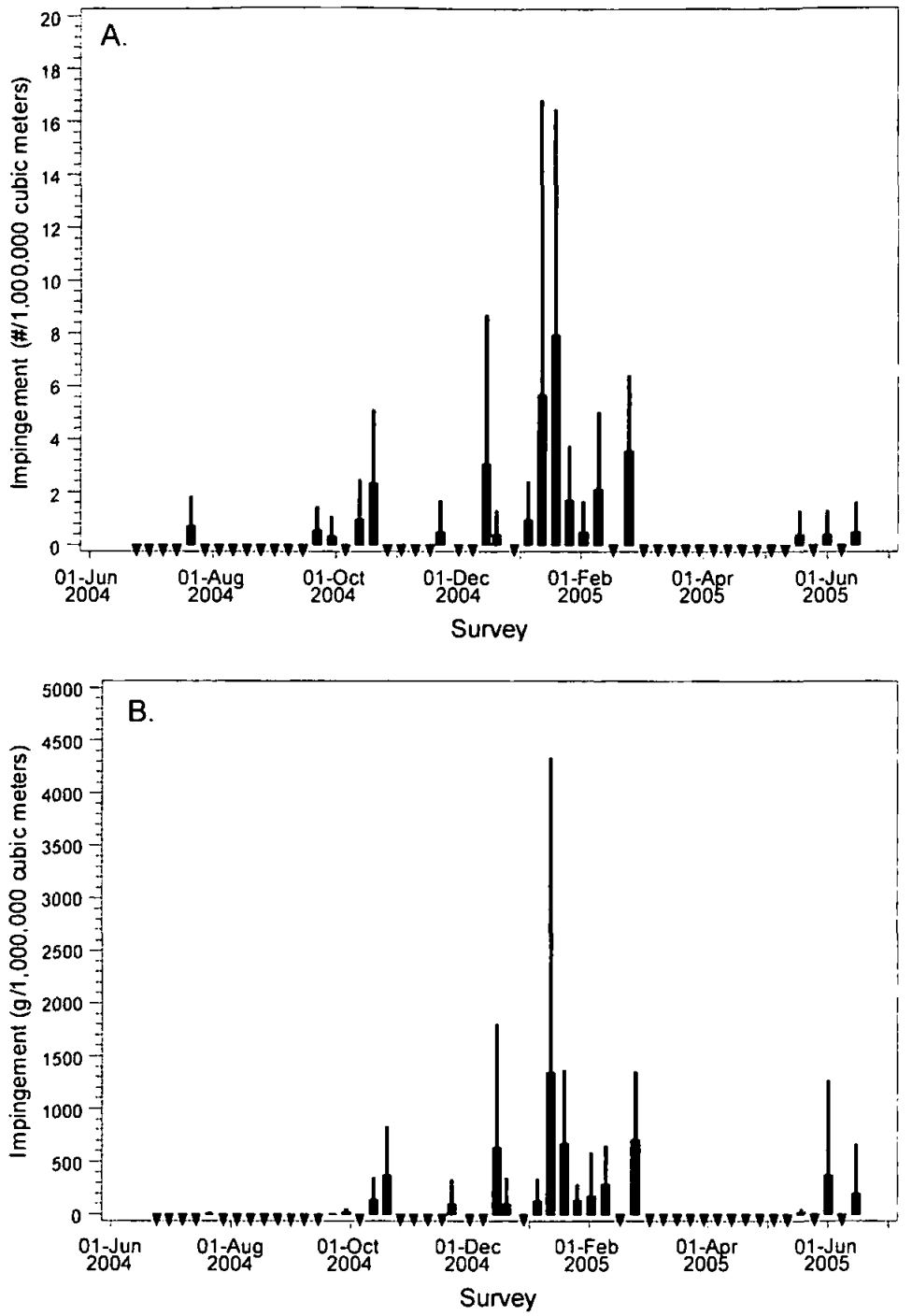



**Figure 4-45.** Mean concentration and standard error of white seabass impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

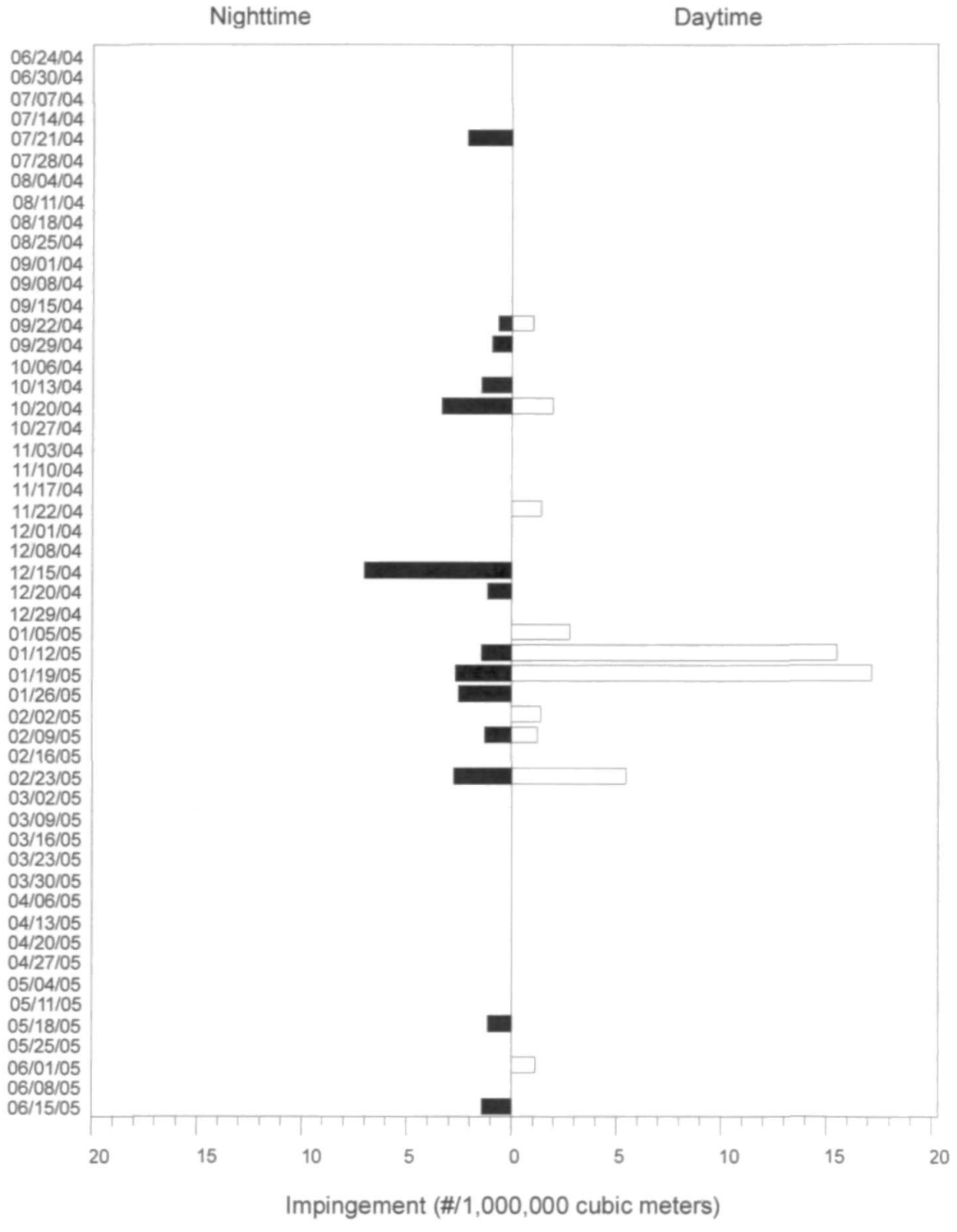



**Figure 4-46.** Abundance (#/$10^6$ $m^3$) of white seabass impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

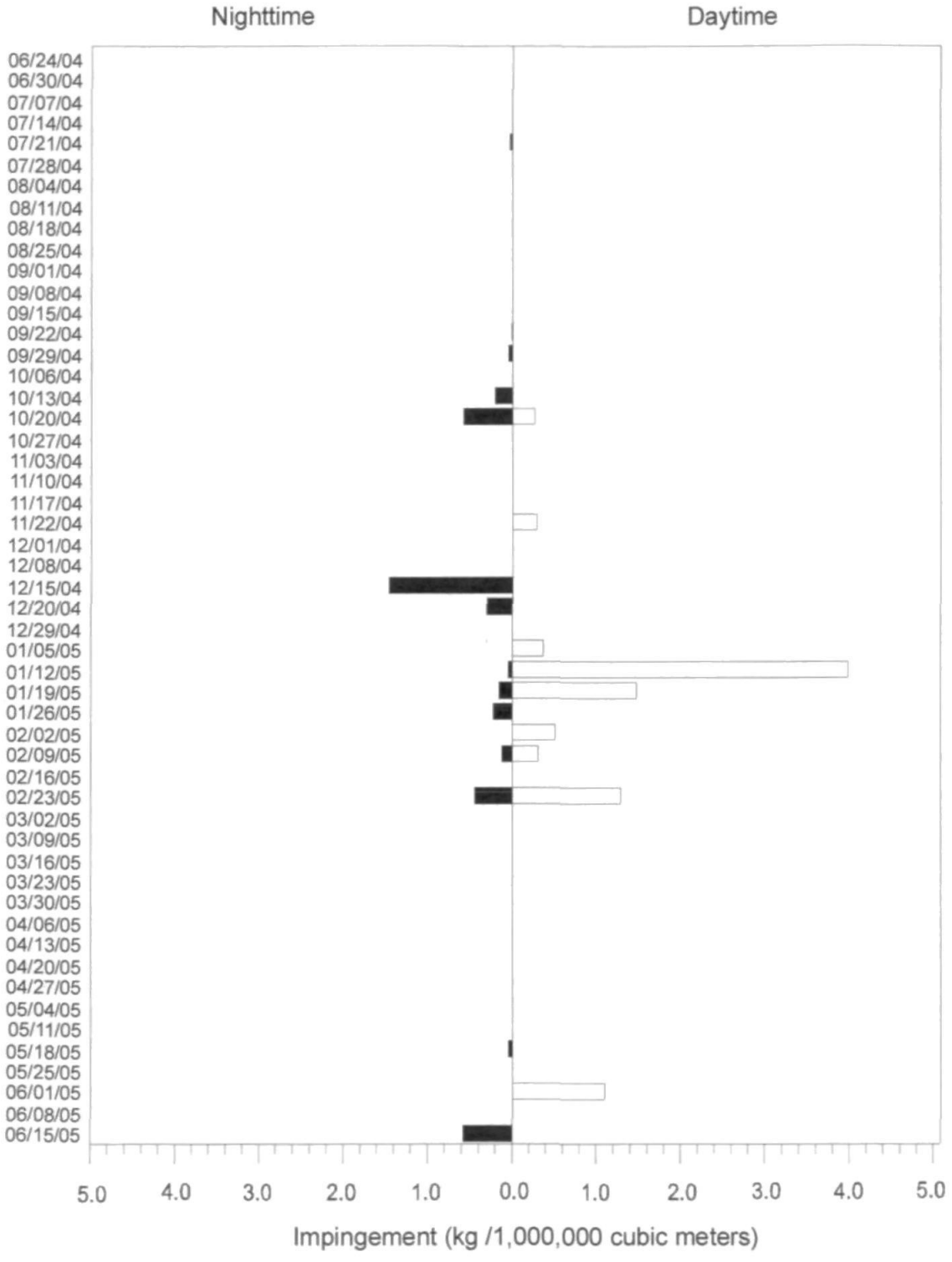



**Figure 4-47.** Biomass (kg/$10^6$ $m^3$) of white seabass impinged at EPS Units 1–5 from June 2004 through June 2005 during two 4-hr nighttime samples and two 4-hr daytime samples.

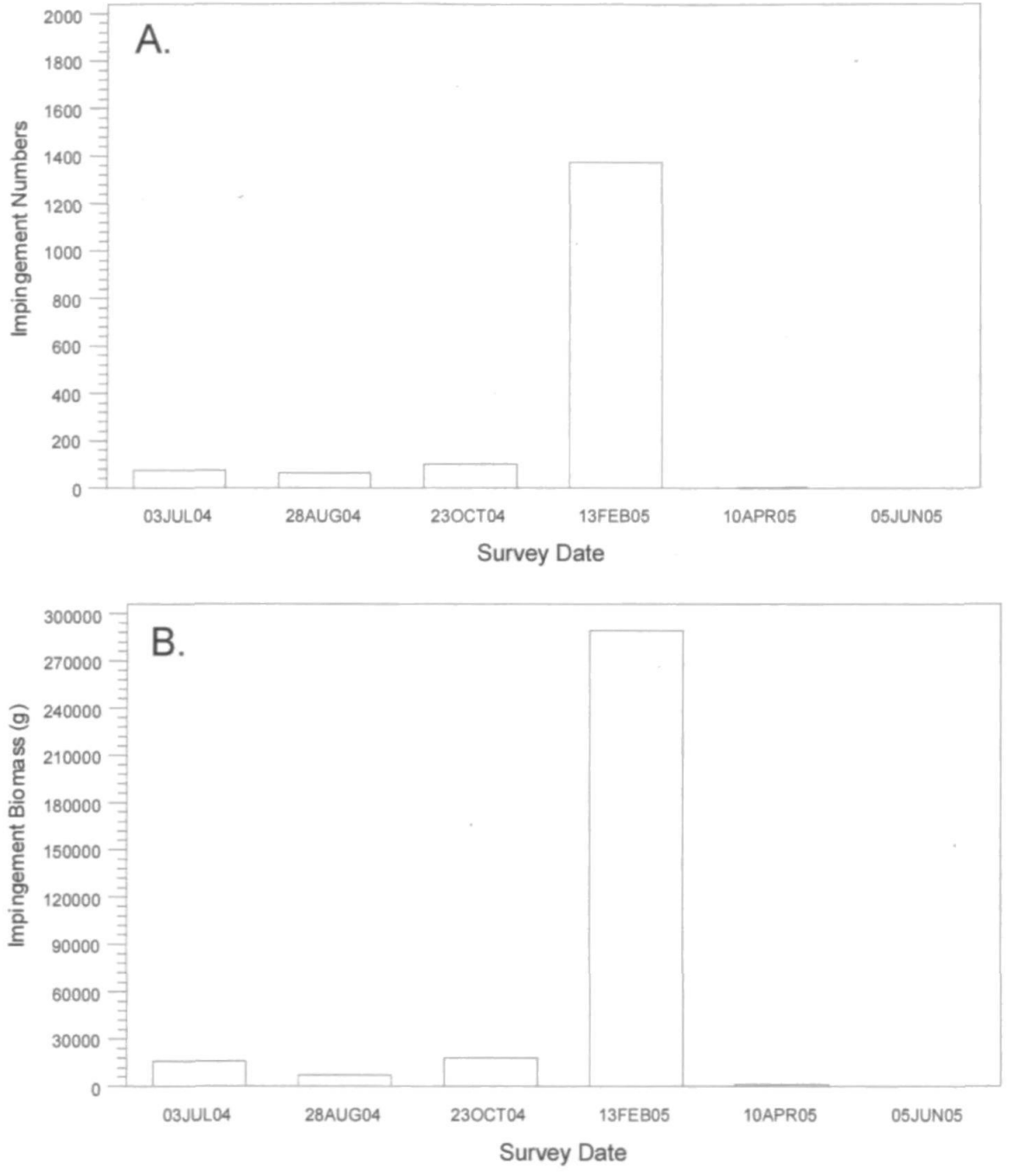



**Figure 4-48**. A) abundance, and B) biomass of white seabass impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

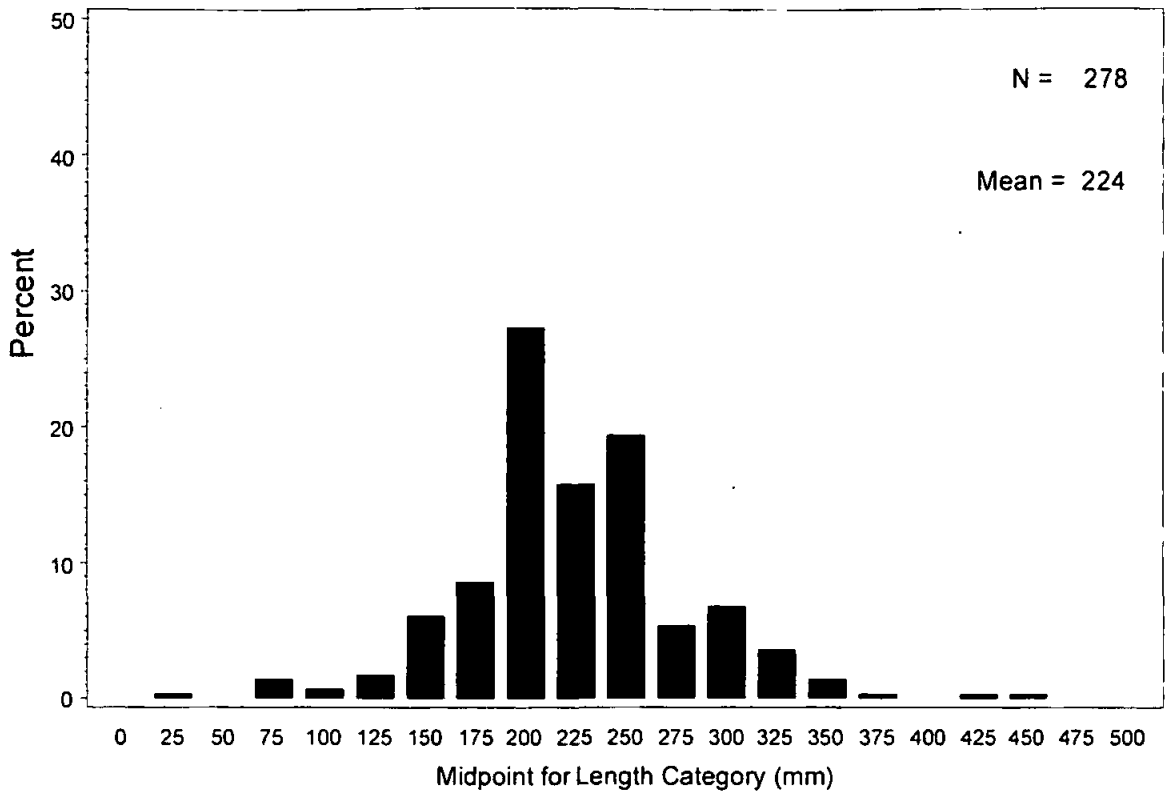



**Figure 4-49.** Size frequency distribution of white seabass from EPS Units 1–5 impingement samples.

# 4.4 Shellfish Impingement Results

## 4.4.1 Community Overview

A total of 1,985 shellfishes (36 taxa) was collected during normal operation impingement sampling at the EPS during the 52 weekly surveys from June 24, 2004 through June 15, 2005 (**Table 4-6** and **Appendix G**). The combined weight of these shellfishes was 17.2 kg (38.0 lb). There were only two shellfishes with a combined weight of 0.5 kg (1.1 lb) removed from the bar racks during the 52 surveys. During the six heat treatments completed from June 2004 through June 2005, a total of 1,384 shellfishes weighing 19.9 kg (43.9 lb) was collected.

The most abundant shellfishes collected during the normal operations impingement sampling were three crab species: Xantus' swimming crab, striped shore crab, and unidentified shore crab (**Table 4-6**). These three species comprised about 89% of all the shellfishes impinged during normal operations. The invertebrate taxa with the greatest weigh impinged during normal operations were octopus, Xantus' swimming crab, and striped shore crab (**Table 4-6**). The most abundant shellfishes collected during the heat treatment sampling included red rock crab and striped shore crab (**Table 4-6**). These two species comprised about 72% of the total number of shellfishes collected during the heat treatment surveys. The shellfishes with the greatest weight impinged during the heat treatments were octopus, striped shore crab, and red rock crab (**Table 4-6**).

The estimated number and biomass of the shellfishes annually impinged during normal operations at EPS are presented in **Table 4-7**. The combined annual impingement estimates for all sources of mortality (traveling screens, bar racks, and heat treatments) based on maximum and reported flow of the CWS pumps are found in **Table 4-8**. The three most abundant shellfishes impinged based on all sources combined and maximum flow were Xantus' swimming crab (7,268), striped shore crab (7,229), and unidentified shore crab (5,044). This comprised about 86% of the total number estimated to be impinged during maximum flow at EPS. The most abundant shellfishes based on weight were octopus (two taxa: 130.4 kg [287.5 lb]), Xantus' swimming crab (45.7 kg [100.8 lb]) and striped shore crab (30.6 kg [67.5 lb]).

The following four taxa of shellfish were selected for detailed evaluation of impingement effects based on their abundance in the normal and heat treatment samples and/or importance as fishery species:

- cancer crabs (*Cancer spp.*)
- California spiny lobster (*Panulirus interruptus*)
- market squid (*Loligo opalescens*)
- octopus (*Octopus* spp.)

**Table 4-5.** Number and weight of shellfishes impinged during normal operation and heat treatment surveys at EPS from June 2004 to June 2005.

| | | | Normal Operations Sample Totals | | | | Heat Treatment | |
|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Sample Count | Sample Weight (g) | Bar Rack Count | Bar Rack Weight (g) | Sample Count | Sample Weight (g) |
| 1 | *Portunus xantusii* | Xantus' swimming crab | 699 | 4,423 | - | - | 59 | 443 |
| 2 | *Pachygrapsus crassipes* | striped shore crab | 655 | 2,786 | - | - | 494 | 3,101 |
| 3 | *Pachygrapsus* spp. | shore crab | 418 | 822 | - | - | 1 | 2 |
| 4 | *Octopus* spp. | octopus | 36 | 6,909 | - | - | 76 | 6,309 |
| 5 | *Cancer productus* | red rock crab | 26 | 222 | - | - | 502 | 2,876 |
| 6 | *Pugettia* spp. | kelp crabs | 24 | 53 | - | - | 1 | 26 |
| 7 | *Loligo opalescens* | market squid | 24 | 264 | - | - | - | - |
| 8 | *Cancer* spp. | cancer crabs | 23 | 57 | - | - | 36 | 87 |
| 9 | *Pugettia producta* | northern kelp crab | 11 | 20 | - | - | 11 | 46 |
| 10 | *Pyromaia tuberculata* | tuberculate pea crab | 11 | 18 | - | - | 19 | - |
| 11 | *Octopus bimaculatus* | Calif. two-spot octopus | 8 | 1,108 | - | - | 91 | 5,464 |
| 12 | *Taliepus nuttallii* | globose kelp crab | 6 | 3 | - | - | - | - |
| 13 | *Cancer antennarius* | brown rock crab | 4 | 11 | - | - | 27 | 170 |
| 14 | *Loxorhynchus crispatus* | moss crab | 4 | 2 | - | - | - | - |
| 15 | Brachyuran unid. | unidentified crab | 4 | 271 | - | - | - | - |
| 16 | *Hemigrapsus oregonensis* | yellow shore crab | 3 | 6 | - | - | - | - |
| 17 | *Cancer jordani* | hairy rock crab | 3 | 16 | - | - | 18 | 86 |
| 18 | *Pugettia richii* | cryptic kelp crab | 2 | 12 | - | - | - | - |
| 19 | *Lophopanopeus* spp. | black-clawed crabs | 2 | 9 | - | - | 26 | 27 |
| 20 | *Blepharipoda occidentalis* | spiny mole crab | 2 | 12 | - | - | - | - |
| 21 | *Panulirus interruptus* | Calif. spiny lobster | 2 | 96 | - | - | 9 | 1,223 |
| 22 | *Callianassa californiensis* | ghost shrimp | 2 | 3 | - | - | - | - |
| 23 | Caridean unid. | unidentified shrimp | 2 | 35 | - | - | 1 | - |
| 24 | *Lophopanopeus frontalis* | crestleg crab | 2 | 1 | - | - | - | - |
| 25 | *Loxorhynchus* spp. | spider crabs | 1 | - | 1 | 0.5 | - | - |
| 26 | Majidae | spider crabs | 1 | 2 | - | - | 6 | 20 |
| 27 | *Crangon* spp. | bay shrimp | 1 | 21 | - | - | - | - |
| 28 | Hippolytidae unid. | *hippolytid shrimps* | 1 | - | - | - | - | - |
| 29 | *Podochela hemphilli* | Hemphill's kelp crab | 1 | 3 | - | - | - | - |
| 30 | *Cancer magister* | Dungeness crab | 1 | - | - | - | 1 | 18 |
| 31 | *Pandalus platyceros* | spot shrimp | 1 | 2 | - | - | - | - |
| 32 | *Pelia tumida* | dwarf teardrop crab | 1 | 2 | - | - | - | - |
| 33 | *Callinectes* spp. | Swimming crab | 1 | 14 | - | - | - | - |
| 34 | *Rhithropanopeus harrisii* | Harris mud crab | 1 | 18 | - | - | - | - |
| 35 | *Cycloxanthops novemdentatus* | ninetooth pebble crab | 1 | 3 | - | - | - | - |
| 36 | *Sicyonia ingentis* | Ridgeback rock shrimp | 1 | 16 | - | - | - | - |
| 37 | *Pandalus* spp. | unidentified shrimp | - | - | - | - | 1 | 1 |
| 38 | *Crangon nigromaculata* | spotted bay shrimp | - | - | - | - | 1 | 4 |
| 39 | *Pilumnus spinohirsutus* | retiring hairy crab | - | - | - | - | 4 | 5 |
| 40 | *Dosidicus gigas* | jumbo squid | - | - | 1 | 500 | - | - |
| | | | **1,985** | **17,241** | **2** | **501** | **1,384** | **19,909** |

**Table 4-6.** Calculated annual impingement of shellfishes based on EPS maximum flows and actual flows during normal operations surveys from June 2004–June 2005.

| | | Maximum flow rate basis | | | | Actual flow rate basis | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Taxon | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error | Abundance | Abundance Std. Error | Weight (g) | Weight Std. Error |
| 1 | *Portunus xantusii* | 7,209 | 756 | 45,263 | 4,436 | 4,492 | 464 | 28,299 | 2,830 |
| 2 | *Pachygrapsus crassipes* | 6,735 | 1,683 | 27,517 | 4,159 | 4,395 | 1,060 | 18,635 | 2,920 |
| 3 | *Pachygrapsus* spp. | 5,043 | 4,662 | 9,921 | 9,179 | 2,745 | 2,636 | 5,396 | 5,189 |
| 4 | *Octopus* spp. | 559 | 125 | 101,779 | 23,094 | 272 | 62 | 49,346 | 11,486 |
| 5 | *Cancer productus* | 282 | 89 | 2,481 | 974 | 168 | 52 | 1,448 | 571 |
| 6 | *Pugettia* spp. | 244 | 45 | 550 | 151 | 165 | 31 | 365 | 103 |
| 7 | *Cancer* spp. | 217 | 90 | 508 | 247 | 156 | 69 | 388 | 197 |
| 8 | *Loligo opalescens* | 190 | 45 | 2,193 | 539 | 162 | 39 | 1,770 | 440 |
| 9 | *Pugettia producta* | 127 | 42 | 214 | 83 | 75 | 31 | 121 | 55 |
| 10 | *Octopus bimaculatus* | 108 | 51 | 16,842 | 13,943 | 58 | 26 | 8,341 | 6,804 |
| 11 | *Pyromaia tuberculata* | 100 | 43 | 151 | 71 | 70 | 23 | 133 | 54 |
| 12 | *Taliepus nuttallii* | 52 | 21 | 25 | 11 | 38 | 17 | 19 | 9 |
| 13 | Brachyuran unid. | 47 | 22 | 3,102 | 2,305 | 27 | 13 | 1,795 | 1,334 |
| 14 | *Loxorhynchus crispatus* | 37 | 18 | 21 | 11 | 28 | 13 | 17 | 9 |
| 15 | *Cancer antennarius* | 36 | 19 | 115 | 76 | 22 | 15 | 53 | 39 |
| 16 | *Blepharipoda occidentalis* | 35 | 25 | 166 | 109 | 19 | 13 | 95 | 64 |
| 17 | *Cancer jordani* | 32 | 16 | 165 | 101 | 16 | 9 | 93 | 64 |
| 18 | Caridea unid. | 24 | 12 | 473 | 19 | 14 | 9 | 251 | 196 |
| 19 | *Cancer magister* | 22 | 20 | - | - | 15 | 14 | - | - |
| 20 | *Callianassa californiensis* | 21 | 16 | 30 | 381 | 9 | 6 | 12 | 9 |
| 21 | *Hemigrapsus oregonensis* | 21 | 14 | 43 | 29 | 20 | 14 | 40 | 27 |
| 22 | *Lophopanopeus* spp. | 20 | 13 | 98 | 80 | 11 | 8 | 43 | 40 |
| 23 | *Pugettia richii* | 18 | 12 | 127 | 109 | 9 | 7 | 53 | 54 |
| 24 | *Panulirus interruptus* | 16 | 11 | 747 | 503 | 13 | 9 | 640 | 451 |
| 25 | *Lophopanopeus frontalis* | 14 | 13 | 6 | 5 | 14 | 13 | 6 | 5 |
| 26 | *Loxorhynchus* spp. | 13 | 12 | 1 | 1 | 6 | 6 | 1 | 1 |
| 27 | *Crangon* spp. | 13 | 12 | 263 | 243 | 7 | 6 | 146 | 135 |
| 28 | *Rhithropanopeus harrisii* | 13 | 12 | 226 | 210 | 7 | 6 | 126 | 117 |
| 29 | *Cycloxanth. novemdenta.* | 11 | 10 | 29 | 27 | 6 | 6 | 16 | 15 |
| 30 | *Podochela hemphilli* | 11 | 10 | 32 | 30 | 7 | 7 | 22 | 21 |
| 31 | *Pandalus platyceros* | 11 | 10 | 19 | 18 | 4 | 5 | 8 | 9 |
| 32 | *Sicyonia ingentis* | 11 | 10 | 171 | 159 | 4 | 5 | 67 | 78 |
| 33 | Hippolytidae unid. | 9 | 8 | - | - | 7 | 6 | - | - |
| 34 | Majidae | 8 | 8 | 15 | 14 | 6 | 6 | 11 | 10 |
| 35 | *Callinectes* spp. | 8 | 7 | 106 | 98 | 7 | 7 | 100 | 92 |
| 36 | *Pelia tumida* | 7 | 6 | 13 | 12 | 7 | 6 | 13 | 12 |
| | | **21,323** | | **213,414** | | **13,083** | | **117,870** | |

**Table 4-7.** Calculated overall annual impingement of shellfishes from all sources combined (normal operations [traveling screens and bar racks] and heat treatments) based on EPS maximum flows and reported flows, June 2004–June 2005.

| | | | Maximum Flow | | Actual Flow | |
|---|---|---|---|---|---|---|
| | Taxon | Common Name | Abundance | Weight (g) | Abundance | Weight (g) |
| 1 | *Portunus xantusii* | Xantus' swimming crab | 7,268 | 45,706 | 4,551 | 28,742 |
| 2 | *Pachygrapsus crassipes* | striped shore crab | 7,229 | 30,618 | 4,889 | 21,736 |
| 3 | *Pachygrapsus* spp. | shore crab | 5,044 | 9,924 | 2,746 | 5,399 |
| 4 | *Cancer productus* | red rock crab | 784 | 5,357 | 670 | 4,324 |
| 5 | *Octopus* spp. | octopus | 635 | 108,088 | 348 | 55,656 |
| 6 | *Cancer* spp. | cancer crabs | 253 | 596 | 192 | 475 |
| 7 | *Pugettia* spp. | kelp crabs | 245 | 576 | 166 | 391 |
| 8 | *Octopus bimaculatus* | Calif. two-spot octopus | 199 | 22,305 | 149 | 13,805 |
| 9 | *Loligo opalescens* | market squid | 190 | 2,193 | 162 | 1,770 |
| 10 | *Pugettia producta* | northern kelp crab | 138 | 261 | 86 | 168 |
| 11 | *Pyromaia tuberculata* | tuberculate pea crab | 119 | 151 | 89 | 133 |
| 12 | *Cancer antennarius* | brown rock crab | 63 | 286 | 49 | 224 |
| 13 | *Taliepus nuttallii* | globose kelp crab | 52 | 25 | 38 | 19 |
| 14 | *Cancer jordani* | hairy rock crab | 50 | 251 | 34 | 178 |
| 15 | Brachyura unid. | unidentified crab | 47 | 3,102 | 27 | 1,795 |
| 16 | *Lophopanopeus* spp. | black-clawed crabs | 46 | 125 | 37 | 70 |
| 17 | *Loxorhynchus crispatus* | moss crab | 37 | 21 | 28 | 17 |
| 18 | *Blepharipoda occidentalis* | spiny mole crab | 35 | 166 | 19 | 95 |
| 19 | *Panulirus interruptus* | California spiny lobster | 25 | 1,970 | 22 | 1,863 |
| 20 | Caridea unid. | unidentified shrimp | 25 | 473 | 15 | 251 |
| 21 | *Cancer magister* | Dungeness crab | 23 | 18 | 16 | 18 |
| 22 | *Callianassa californiensis* | ghost shrimp | 21 | 30 | 9 | 12 |
| 23 | *Hemigrapsus oregonensis* | yellow shore crab | 21 | 43 | 20 | 40 |
| 24 | *Loxorhynchus* spp. | spider crabs | 20 | 5 | 13 | 4 |
| 25 | *Pugettia richii* | cryptic kelp crab | 18 | 127 | 9 | 53 |
| 26 | Majidae | spider crabs | 14 | 35 | 12 | 31 |
| 27 | *Lophopanopeus frontalis* | crestleg crab | 14 | 6 | 14 | 6 |
| 28 | *Crangon* spp. | bay shrimp | 13 | 263 | 7 | 146 |
| 29 | *Rhithropanopeus harrisii* | Harris mud crab | 13 | 226 | 7 | 126 |
| 30 | *Cycloxanthops novemdentatus* | ninetooth pebble crab | 11 | 29 | 6 | 16 |
| 31 | *Podochela hemphilli* | Hemphill's kelp crab | 11 | 32 | 7 | 22 |
| 32 | *Pandalus platyceros* | spot shrimp | 11 | 19 | 4 | 8 |
| 33 | *Sicyonia ingentis* | Ridgeback rock shrimp | 11 | 171 | 4 | 67 |
| 34 | Hippolytidae unid. | hippolytid shrimps | 9 | - | 7 | - |
| 35 | *Callinectes* spp. | crab | 8 | 106 | 7 | 100 |
| 36 | *Pelia tumida* | dwarf teardrop crab | 7 | 13 | 7 | 13 |
| 37 | *Pilumnus spinohirsutus* | retiring hairy crab | 4 | 5 | 4 | 5 |
| 38 | *Pandalus* spp. | unidentified shrimp | 1 | 1 | 1 | 1 |
| 39 | *Crangon nigromaculata* | spotted bay shrimp | 1 | 4 | 1 | 4 |
| 40 | *Dosidicus gigas* | jumbo squid | 1 | 500 | 1 | 500 |
| **Totals** | | | **22,714** | **233,326** | **14,474** | **137,782** |

## 4.4.2 Cancer crabs (*Cancer spp.*)



***Range***:

- Red rock crab: Kodiak Island to central Baja California
- Brown rock crab: northern Washington to central Baja California
- Dungeness crab: Alaska to Santa Barbara, rare south of Point Conception
- Hairy rock crab: Washington to Baja California

***Life History***:

- Size to 20 cm (8 in) (Red); 16 cm (6.5 in) (brown); 4 cm (1.5 in) (hairy); 23 cm (9 in) (Dungeness)
- Age at maturity: 2 yr (Dungeness)
- Life span to 6 yr (Pacific); 8 yr (Dungeness)
- Spawning occurs in winter; Fecundity: size dependant, from 500,000 to 4.0 million eggs

***Habitat***: Intertidal to 91 m (300 ft), sand and rocky bottoms.

***Fishery***: Commercial fishery for Dungeness crab (*C. magister*) and Rock crabs (*C. antennarius, C. productus*, and *C. anthonyi* combined). No fishery for *C. jordani*.

Crabs of the genus Cancer are widely distributed in the coastal waters of the west coast of North America. Four species of Cancer crabs were collected in the impingement survey: red rock crab (*Cancer productus)*, brown rock crab (*C. antennarius)*, hairy rock crab (*C. jordani)*, and Dungeness crab (*C. magister)*. Red rock crabs range from Kodiak Island to Central Baja California; and brown rock crabs range from northern Washington to central Baja California. The Dungeness crab ranges from Alaska to Santa Barbara, but is rare south of Point Conception (Leet et al. 2001). The hairy rock crab ranges from Neah Bay, Washington to Bahia de Tortuga, Baja California (Jensen 1995).

### 4.4.2.1 Life History and Ecology

All species of Cancer crabs share certain fundamental life history traits. Maturity is generally attained within 1–2 years. Mature females mate while in the soft shell molt condition and extrude fertilized eggs onto the abdominal pleopods. Females generally produce one or two batches per year, typically in winter. Red rock crabs can grow to 20 cm (8 in) in carapace width. Brown rock crabs are sexually mature at 8 cm (3 in) and can grow to over 16 cm (6.5 in) across the carapace. They may live up to 6 years of age. Sexual maturity of Dungeness crabs is reached at the end of the second year, when they are about 10 cm (4 in) across. Females reach a maximum size of 18 cm (7 in) and males, 23 cm (9 in). Males may live as long as 6 to 8 years. One of the smallest Cancer species, hairy rock crab males reach a maximum size of 3.9 cm (1.5 in) and females grow to 1.95 cm (0.7 in) (Jensen 1995). The main determinant of brood size and reproductive output in brachyuran crabs is body size, and the range of egg production in Cancer crabs generally reflects this relationship (Hines 1991). Dungeness crab females may carry from 500,000 to up to 2.0 million eggs per brood. The next largest species, red rock crab, produces up to 877,000 eggs per

brood. Other *Cancer* spp. females may carry 4.0 million eggs, dependant upon size of the female and her molt stage (Leet et al. 2001).

Cancer crabs are common in intertidal and shallow subtidal habitats on both rock and sand substrate down to about 91 m (300 ft). Brown and red rock crabs prefer rocky or reef-like habitat. Juvenile Dungeness crabs settle in shallow coastal waters, tidal flats, and estuaries, living on beds of eelgrass and other aquatic vegetation. Adult Dungeness crabs have be found down to depths of 750 ft (Leet et al. 2001).

### 4.4.2.2 Fishery and Population Trends

Of the nine species known to occur in the northeast Pacific, four species contribute to economically significant fisheries. Dungeness crab has the highest economic value among these, and three species of rock crabs (yellow rock crab *C. anthonyi, C. antennarius, and C. productus*) comprise the remainder of the catches. Rock crabs are fished along the entire California coast with crab pots, though some landings are reported from set gill nets and trawls as well (CDFG 2004). The rock crab fishery is most important in southern California (from Morro Bay south), where most of the landings occur, and of lesser importance in northern areas of California where a fishery for the more desirable Dungeness crab takes place. Most rock crabs are landed alive for retail sale by fresh fish markets. The commercial harvest has been difficult to assess on a species-by-species basis because the fishery statistics are combined into the general "rock crab" category. From 1991 through 1999 state-wide rock crab landings (including claws) averaged 1.2 million lb/year (Parker 2001).

Recent catch statistics from the PSMFC PacFIN (commercial) database were examined for the years 2000–2005 for San Diego County (http://www.psmfc.org/pacfin/woc.html). The average annual commercial catch and ex-vessel revenue for rock crab for this period was approximately 164,063 lb and $179,528, respectively. The 2005 catch of 47.4 MT was valued at $107,722.

### 4.4.2.3 Sampling Results

Four Cancer crab species were impinged during the study. Of the 57 Cancer crabs impinged during the normal impingement surveys, there were 26 red, 4 brown, 3 hairy, 1 Dungeness, and 23 others that could not be identified to the species level and were recorded as *Cancer* spp. The impinged Cancer crabs had a combined total weight of 0.3 kg (0.67 lb) (**Table 4-6**) in the 52 weekly surveys. Cancer crabs combined were the fourth most abundant taxon of shellfish impinged and had the fifth highest biomass. Cancer crabs were the most abundant shellfish impinged in the heat treatment surveys, with a total of 584 crabs impinged weighing 3.2 kg (7.1 lb) (**Table 4-6**). Of these crabs, 502 were red, 27 were brown, 18 were hairy, 1 was Dungeness, and 36 were could not identified to the species level.

Cancer crabs were impinged in surveys from late September through June, with most being collected in the winter surveys (**Figure 4-50**). Cancer crabs were also collected in five of the six heat treatment surveys, with most being collected in one survey in June 2005 (**Figure 4-51**).



### 4.4.2.4 Annual Impingement Estimates

The estimated annual impingement of Cancer crabs under normal operations using actual CWS flows was 377 individuals weighing 2.0 kg (4.4 lb) (**Table 4-7**). Under maximum CWS flow the estimate was 589 individuals weighing 3.3 kg (7.3 lb). Combining all three sources of impingement at EPS the estimate was 961 individuals weighing 5.2 kg (11.5 lb) using actual and 1,173 weighing 6.5 kg (14.3 lb) under maximum flow (**Table 4-8**).

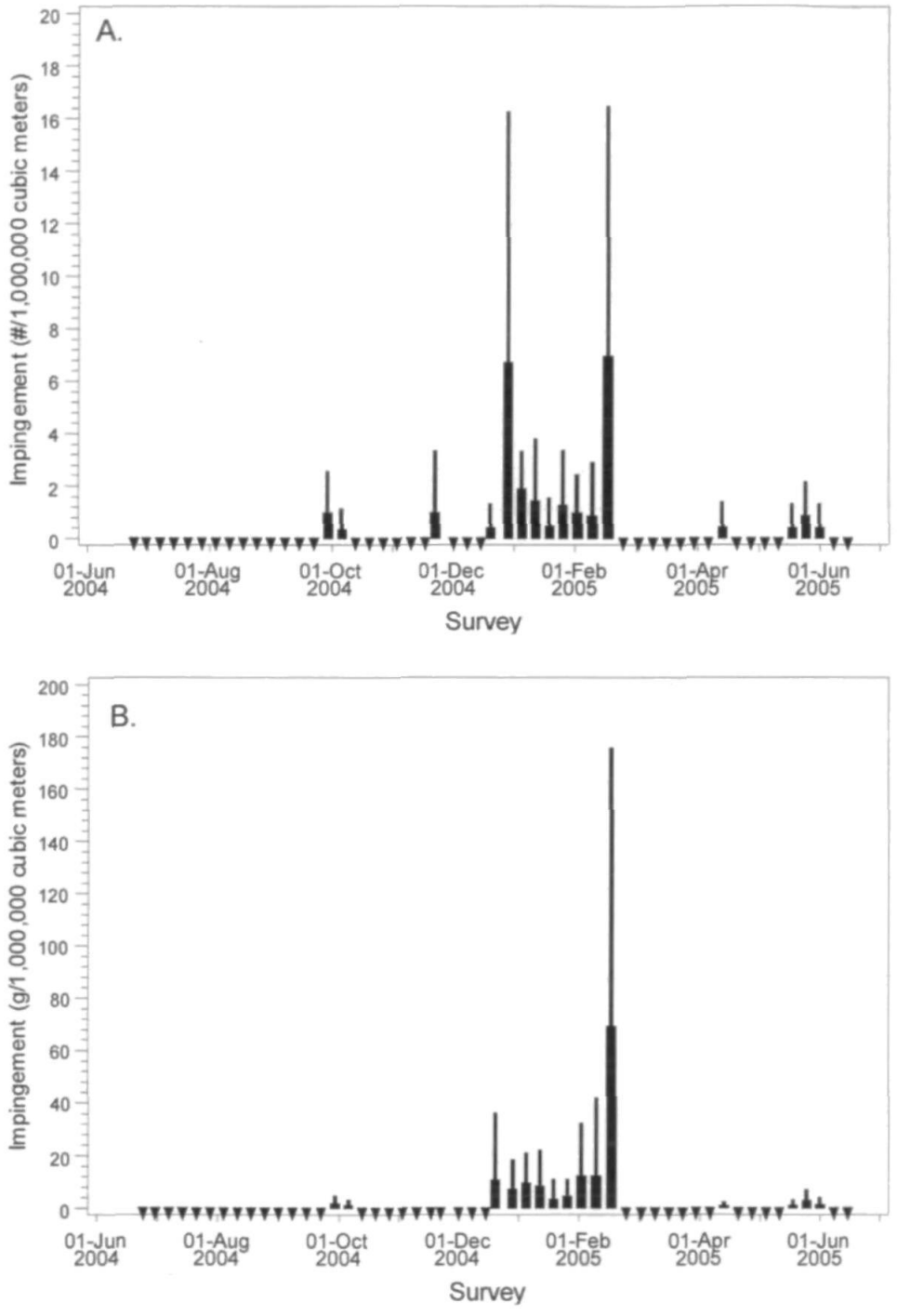



**Figure 4-50**. Mean concentration and standard error of Cancer crabs impinged at EPS Units 1–5 June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

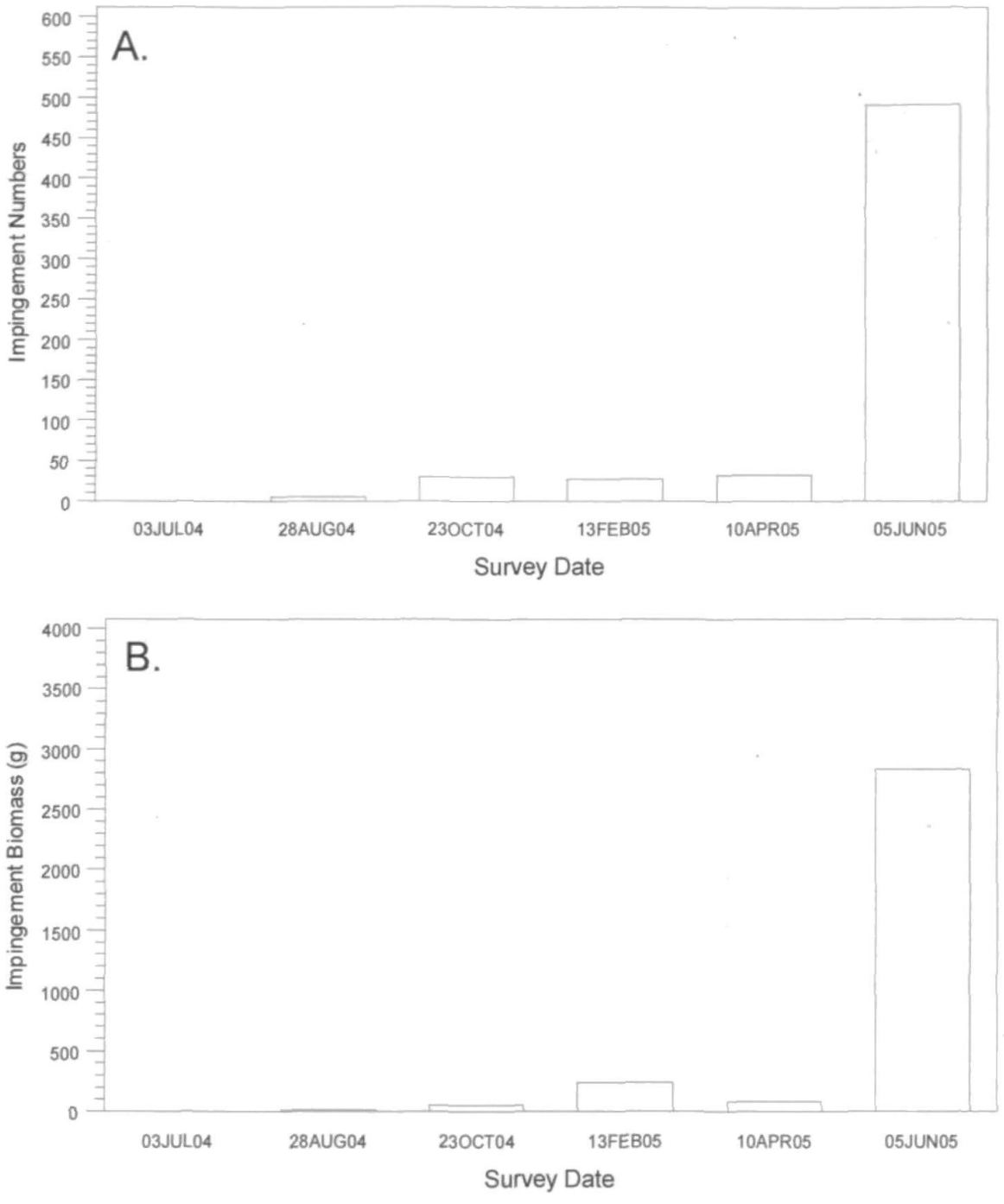
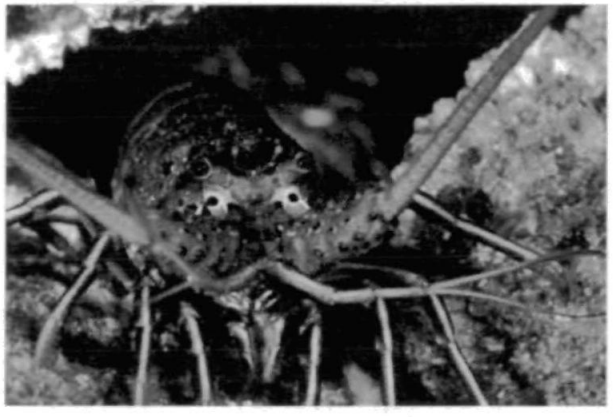



**Figure 4-51**. A) abundance, and B) biomass of Cancer crabs impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

## 4.4.3 California Spiny Lobster (*Panulirus interruptus*)



***Range***: From Monterey Bay, California to southern Baja California and northern Gulf of California, Mexico

***Life History:***

- Size to 75 cm (2.5 ft) total length
- Age at maturity 3 to 9 yr
- Life span from 20 to 30 yr
- Spawns March through August with a fecundity of 50,000–800,000 eggs

***Habitat***: Nearshore surfgrass beds and rocky habitat in depths from intertidal to 75 m (0–245 ft).

***Fishery***: Commercial and recreational fishery throughout range.

The California spiny lobster *Panulirus interruptus* inhabits coastal waters of the Pacific Southwest from Monterey Bay, California, to Manzanillo, Mexico (Leet et al. 2001), with the majority of the population being found between Point Conception and central Baja California (Lindberg 1955, Johnson 1960). There is an isolated population in the northern waters of the Gulf of California (Duffy 1973).

### 4.4.3.1 Life History and Ecology

Adult lobsters usually inhabit rocky areas from the intertidal zone to depths of 73 m (240 ft) (Leet et al. 2001). Lobsters make an annual offshore-onshore migration stimulated by water temperature and an increase in wave action. In winter months, male and female lobsters are found in depths of 15 m (50 ft) or greater. Mating occurs in November through May (Leet et al. 2001) while the lobsters are offshore. Starting in late March through May they move onshore into depths of less than 9 m (30 ft). They generally migrate in small groups after dark.

Spawning occurs from March through August with primary activity during May, June, and July (Allen 1916). Females move inshore and release 50,000–800,000 eggs (Shaw 1986). The female extrudes the eggs which are fertilized by sperm released from a tar-like spermatophore deposited by the male on the under side of the female's sternum (Leet et al. 2001). The female attaches the fertilized eggs to the pleopods at the tail, where they develop for 9–10 wk before hatching (Leet et al. 2001).

The larval development of spiny lobster, described by Johnson (1956), is protracted and complex compared to other crustaceans. There are 11 pelagic stages with the first stages or phyllosomes being transparent, with dorsoventrally flattened bodies and long spider-like legs. The average body length is 1.4 mm (0.06 in) for stage I phyllosomes and 29 mm (1.1 in) for stage IV phyllosomes. Only 3% of larvae survive to reach stage IV. During the larval period, the phyllosomes drift with the prevailing currents feeding on other planktonic organisms. After 5–9 months, the phyllosome larvae metamorphose into stage XI, the puerulus stage. Here the animal resembles the adult form, although the body is still transparent and the second antennae are three

times the length of the body. The puerulus actively swims inshore where it settles to the bottom if the habitat is suitable. The larvae are commonly found in surf grass, *Phyllospadix torreyi.* The puerulus stage lasts approximately 60–90 d. Ten days after settling, the puerulus become fully pigmented and begins life as a benthic juvenile. Most juvenile lobsters spend their first two years in nearshore surf grass beds, mussel beds, or shallow rocky crevices.

Approximately 90% of females are sexually mature when they have a 69 mm (2.7 in) carapace length (CL) (Shaw 1986). Males mature at 3–6 yr and females mature at 5–9 yr. Growth rates are highly variable depending on food resources, water temperature, size, and sex of the animal. Males tend to grow faster and live longer than females. Males reach the minimum legal harvest CL of 83 mm (3.3 in) in 7–10 yr and females after 12 yr. Lobsters shelter in crevices or holes during daylight hours to avoid a variety of predators including sheephead, cabezon, kelp bass, octopus, California moray eel, giant sea bass, rockfishes, leopard shark, and horn shark. At night lobsters leave the safety of the den to search for food. Being omnivores, they consume algae and a wide variety of fish and invertebrates such as snails, mussels, sea urchins, and clams, as well as injured or newly molted lobsters.

### 4.4.3.2 Fishery and Population Trends

Spiny lobsters have been commercially fished in southern California since the 1800s. Fishermen use weighted wire mesh boxes or "traps" baited with fish or crushed mussels to attract the lobsters. The traps are usually clustered around rocky outcrops or along depth contours of less than 30 m (100 ft). Seasonal landings in California between 1916 and 2001 varied from a peak in 1950 of 423,412 kg (933,449 lb) to a low in 1942 of 76,486 kg (168,641 lb) (Shaw 1986, CDFG 2004). San Diego County is located in the central portion of the spiny lobster range where up to 60% of California landings occur. The average landings for San Diego County in 2000–2005 were 112,243 kg (247,450 lb) (PacFIN). Annual revenue generated by lobster landings in San Diego County during this period averaged $1,667,371 (PacFIN) and the 2005 catches were 111.4 MT valued at $1.81 million. Estimated annual landings of spiny lobster for all of California from 2000–2005 averaged 338,779 kg (746,867 lb) (PacFIN). There is also a substantial sport fishery. Lobsters are taken by skin divers and scuba divers, as well as with hoop nets. Although there are little data, it is estimated that annual sport take is equal to half of the commercial catch (Frey 1971). Fluctuations in landings can be due to factors other than population such as weather events like El Nino or La Nina. Based on the proportion of short and legal lobsters taken, CDFG believes that the lobster population in California is well managed and in a healthy status.

### 4.4.3.3 Sampling Results

A total of 2 spiny lobsters, with a combined weight of 0.1 kg (0.22 lb), was impinged during normal impingement surveys during the entire one-year study (**Table 4-6**). No lobster were impinged on the bar racks. These two lobsters were found during late September and late January surveys (**Figure 4-52**). Nine spiny lobsters were impinged in the heat treatment surveys, weighing 1.2 kg (2.6 lb) (**Figure 4-6**). They were collected in the heat treatments surveys from July 2004 to February 2005, with the most being collected during the August survey (**Figure 4-**

53). Their lengths ranged from 21 to 211 mm TL (0.83 to 8.31 in TL) with a mean length of 162.3 mm TL (6.4 in) (**Appendix G**).

#### 4.4.3.4 Annual Impingement Estimates

The estimated impingement of California spiny lobster under normal operations using actual CWS flows was 13 individuals weighing 0.6 kg (1.3 lb) (**Table 4-7**). Under maximum CWS flows the estimate increased to 16 individuals weighing 0.7 kg (1.5 lb) (**Table 4-7**). When all sources of loss due to the operation of the EPS CWS were combined (normal operations, bar racks and heat treatment), the annual loss based on actual CWS flow was 22 individuals weighing 1.9 kg (4.1 lb.) and 25 individuals weighing of 2.0 kg (4.3 lb) under maximum CWS flows (**Table 4-8**).

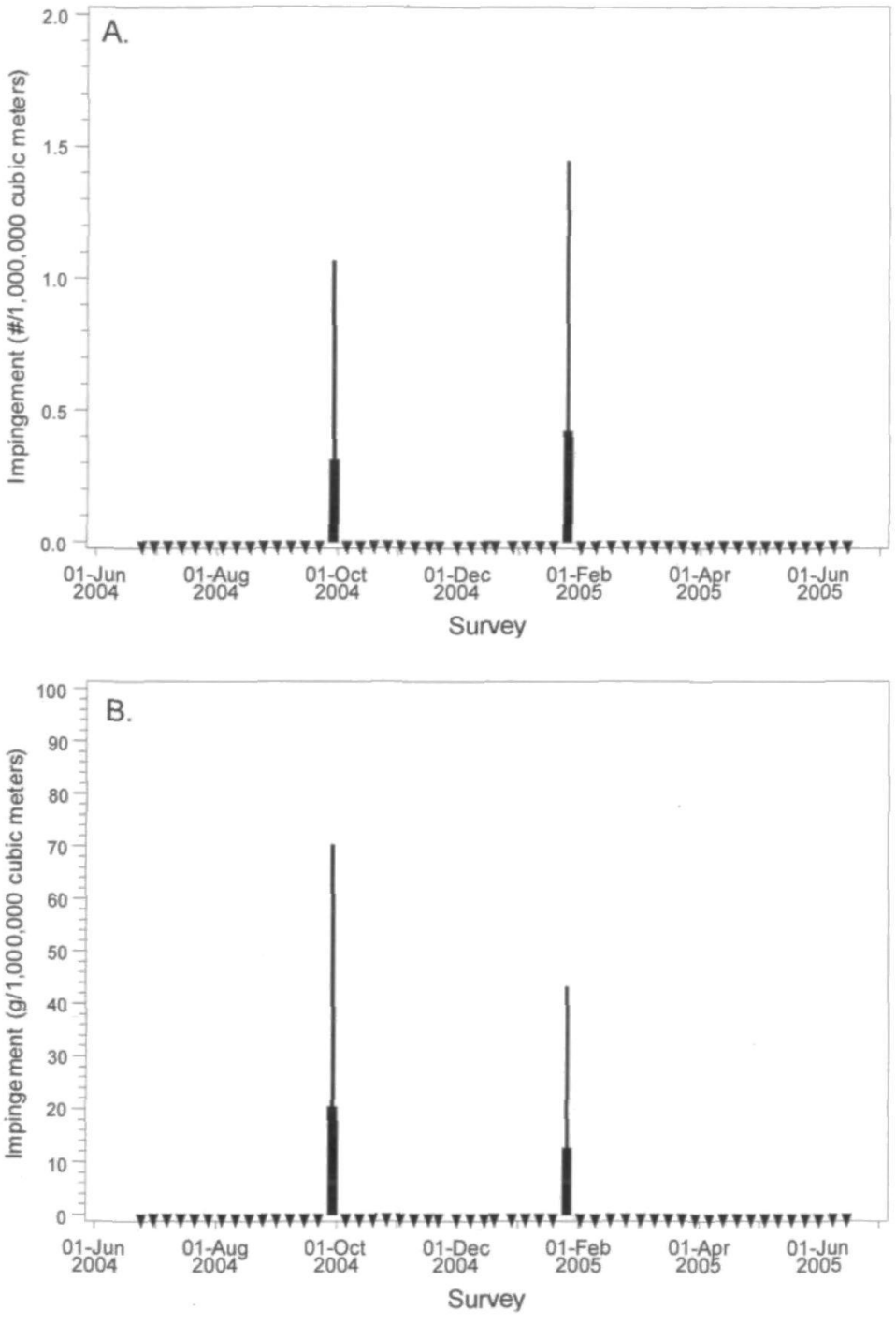



**Figure 4-52.** Mean concentration and standard error of California spiny lobster impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

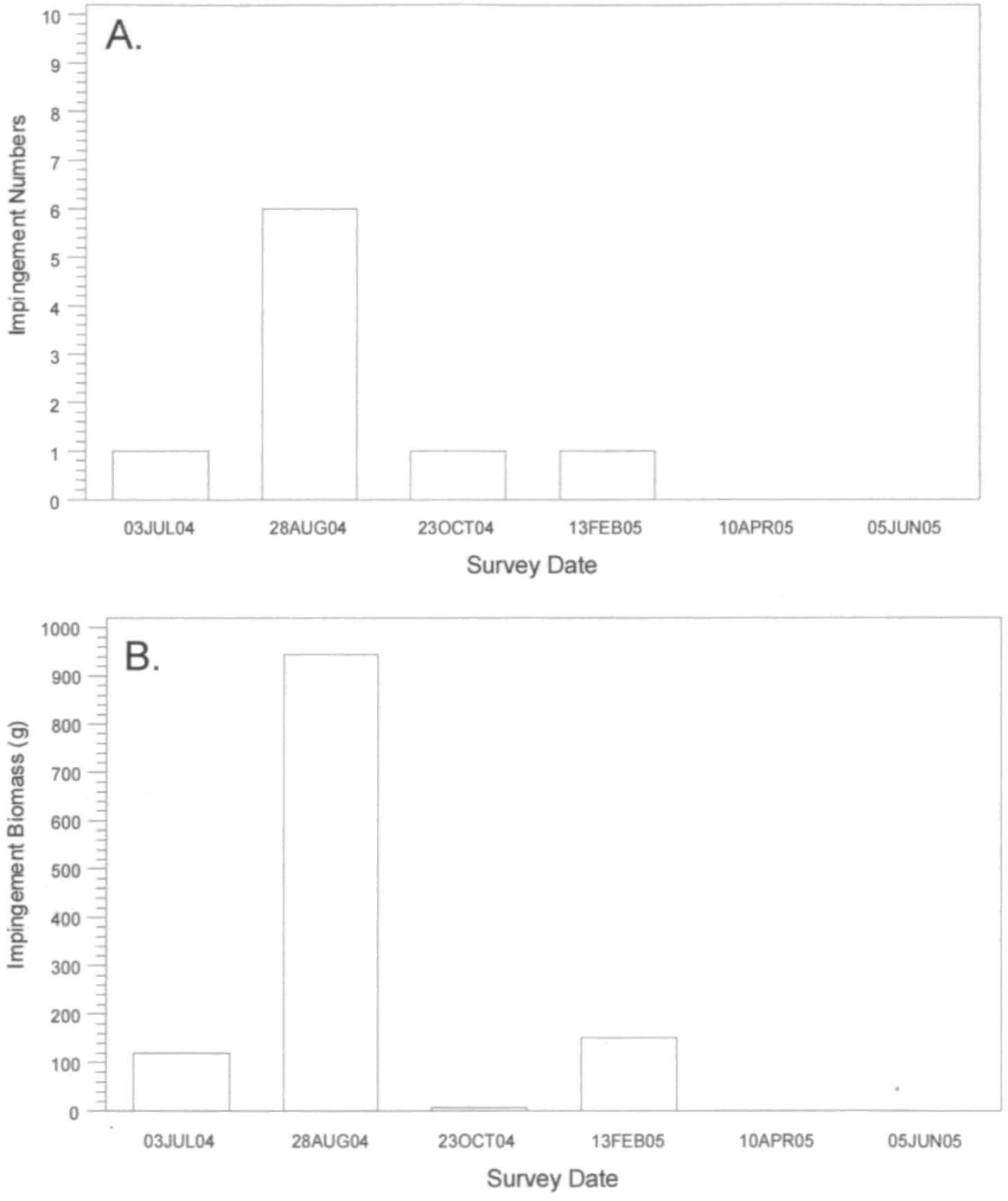



**Figure 4-53**. A) abundance, and B) biomass of California spiny lobster impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

## 4.4.4 Market Squid (*Loligo opalescens*)

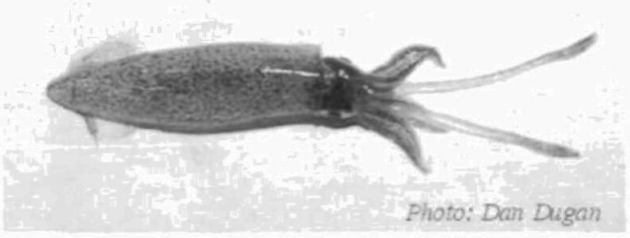


Photo: Dan Dugan

***Range***: From southern Alaska to Isla Guadalupe, Mexico

***Life History***:

- Size to 275 mm (11 in) (males) (not including tentacles) and to approximately 200 mm (8 in) (females)
- Life span <1 yr
- Spawn year-round with fecundity of about 180–300 eggs encased in a capsule, may extrude 20–30 capsules

***Habitat***: Pelagic, living in coastal waters but returning to shallow inshore waters to spawn.

***Fishery:*** Commercial, marketed for human consumption or sold as bait.

The market squid is a member of the family Loliginidae in the order Decapoda that also contains octopus. Market squid range from southern Alaska to Isla Guadalupe, Mexico, and Bahía Asuncíon, Baja California, but are most common from British Columbia southward (Morris et al. 1980). Several other species of *Loligo* occur in the Pacific Ocean, but are generally found in deeper water (Leet et al. 2001).

### 4.4.4.1 Life History and Ecology

Market squid are pelagic, living in coastal waters and moving to semi-sheltered bays and other locations with suitable substrata (sand or mud bottoms) to spawn in depths ranging from just below the intertidal down to 180 m (540 ft) (Fields 1965, Kato and Hardwick 1975).

Male market squid can reach 275 mm (11 in) in dorsal mantle length (DML), and females can attain 200 mm (8 in) DML (UCLA 1999). Growth of squid in the southern California bight was found to be related to water temperature and productivity (Jackson and Domeier 2003). Male and female market squid reach maturity at around 70–80 mm (ca. 3 in) DML in as little as six months (Butler et al. 1999) At 15 mm (0.6 in) DML, squid are reported to be approximately 50 days old. Recent age estimates indicate that the market squid may complete their life cycle in less than one year (Butler et al. 1999).

Market squid spawn year-round from San Francisco to Baja California, but exhibit two spawning peaks annually (Starr et al. 1998). Spawning activity begins in the southern California population in December and continues through March. In Monterey Bay, they begin spawning in April and continue through November (McInnis and Broenkow 1978, Morris et al. 1980). Both male and female squid are terminal spawners and die after spawning.

The female produces from 180–300 eggs encased in a cylindrical capsule and may extrude 20–30 capsules during a spawning event (Starr et al. 1998, FWIE 1999). Macewicz et al. (2000) estimated around 5,500 eggs per spawning female per year. Egg cases are attached with thin stalks to the bottom substratum (Fields 1965). Subsequent layers can then be deposited until large clusters are formed (Starr et al. 1998). Egg cases have been observed in depths ranging from 3–180 m (10–590 ft) (FWIE 1999) and the eggs hatch in 15–90 d, depending on water temperature (Fields 1965, Yang et al. 1986).

The majority of fishing for market squid has shifted from Monterey Bay to southern California since the 1980's (Zeidberg et al. 2006). Approximately 90% of the seasonal harvest of market squid in California occurs south of Point Conception (Leet et al. 2001). Large fluctuations in annual landings are thought to be correlated with changes in ocean climate that affect market squid reproduction and survival. Annual commercial landings of market squid landed in California during 2000–2005 averaged 69.8 million kg (153.8 million lb) with an average annual valued of $23,188 (PacFIN). Very few market squid were landed in San Diego during this period, with the majority being landed during 2001 (10,965 kg [24,174 lb] valued at $4,623) with none being reported to have been landed in 2000, 2003, and 2004 (PacFIN).

#### 4.4.4.2 Sampling Results

A total of 24 market squid weighing 0.3 kg (0.67 lb) was collected during the normal operations impingement sampling (**Table 4-6**). They were ranked as the fifth most abundant invertebrate impinged based on both abundance and biomass. No squid were collected on the bar racks or in the heat treatment surveys. Squid were only impinged from September through January, with the most individuals being seen during October (**Figure 4-54**). Lengths ranged from 47–129 mm ML (1.9 –5.1 in) (**Appendix G**).

#### 4.4.4.3 Annual Impingement Estimates

The estimated annual impingement of market squid under normal operations and actual CWS flows was 162 individuals weighing 1.8 kg (4.0 lb) (**Table 4.4-1**). Under maximum CWS flows the estimate was 190 individuals weighing 2.2 kg (4.9 lb).

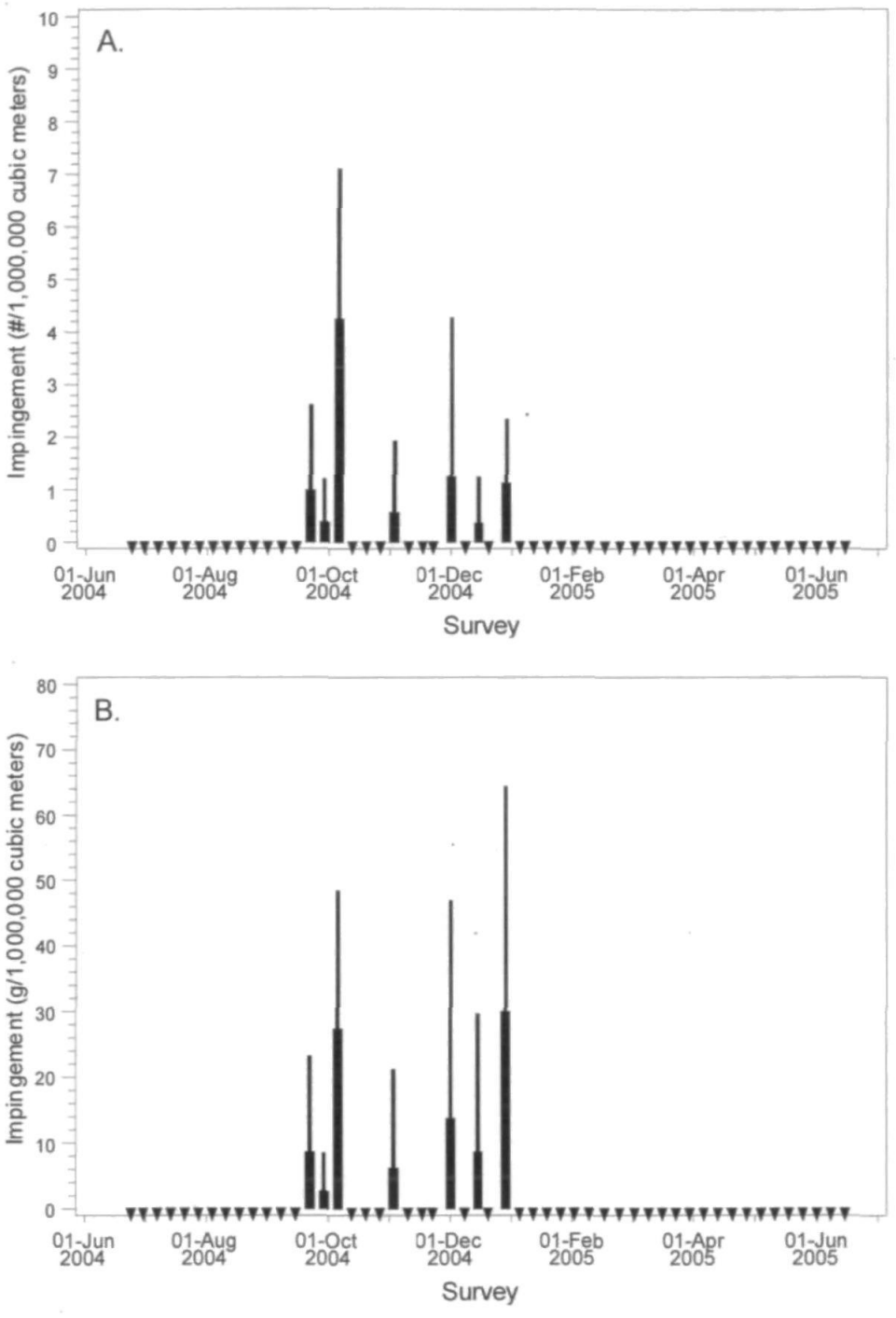



**Figure 4-54**. Mean concentration and standard error of market squid impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

## 4.4.5 Two-spotted Octopus (*Octopus* spp.)




***Range***: *O. bimaculoides*: San Simeon (San Luis Obispo Co.) to Ensenada, Baja California; *O. bimaculatus*: Santa Barbara to Gulf of California

***Life History:***

- Size: Dorsal mantle length from 5–20 cm (2.0– 7.9 in) at maturity
- Life span varies with species, approximately 0.5–3 years
- Spawn late-winter to early-summer; fecundity varies with species and size

***Habitat***: *O. bimaculoides* found from the Middle and low intertidal zones and mud flats to the subtidal, on rocks or in kelp beds, to depths of 20 m; *O. bimaculatus* from the lower intertidal zone to 50 m.

***Fishery:*** Commercial and recreational.

The two-spotted octopus group consists of two similar species: *Octopus bimaculoides* and *O. bimaculatus. Octopus bimaculoides* occurs from San Simeon (San Luis Obispo Co.) to Ensenada, Baja California, and *O. bimaculatus* has a more southerly distribution extending into the Gulf of California (Morris et al. 1980).

### 4.4.5.1 Life History and Ecology

Octopus occur from the middle intertidal zone to depths of 20–50 m (66–164 ft). *O. bimaculatus* occupies holes and crevices in a wide range of hard substrate habitats (Ambrose 1988). They can also shelter in large gastropod shells or discarded bottles and cans.

Morris et al. (1980) summarized the life history of *O. bimaculoides*. Two-spotted octopuses begin laying eggs primarily from January through May. Females lay their eggs under rocks from late winter to early summer, and brood them continuously from 2–4 mo until hatching. MacGinitie and MacGinitie (1968) report that female *O. bimaculoides* weighing approximately 0.5 lb will lay approximately 600 eggs. At Santa Catalina Island, with an average octopus size of 260 g (0.6 lb) (71 mm [2.8 in] mantle length [ML]), the average clutch size was approximately 20,000 eggs (Ambrose 1981). The eggs are attached by slender stalks, are about 0.5 in. long and 1/6 inch in diameter. The young remain on the bottom after hatching, often moving into the intertidal.

Octopus are commercially and recreationally fished. Commercial landings in California for all octopus averaged 4,332 kg (9,550 lb) annually from 2000–2005, peaking at 11,110 kg (24,500 lb) in 2002 (PacFIN). The average annual landing of octopus in San Diego during this period was 74.4 kg (161 lb), and the 2005 catch of 0.1 MT was valued at $339 (PacFIN).

### 4.4.5.2 Sampling Results

A total of 44 octopuses weighing 8.0 kg (17.6 lb) was collected from impingement samples (**Table 4-6**). They were the third most abundant invertebrate impinged and the most abundant in biomass (**Table 4-6**). Most of the octopi were impinged during normal operations surveys were found in one survey in late February (**Figure 4-55**). A total of 167 individuals weighing 11.8 kg (26.0 lb) was impinged in the heat treatment surveys (**Figure 4-6**). Most octopuses collected during the heat treatment surveys were seen in October 2004 (**Figure 4-56**).

### 4.4.5.3 Annual Impingement Estimates

The estimated annual impingement of octopus during the normal operation surveys using actual CWS flows was 330 individuals weighing 57.7 kg (127.2 lb) (**Table 4-7**). Under maximum CWS flows, the estimated annual impingement was 667 individuals weighing 118.6 kg (261.5 lb) (**Table 4-7**). When all sources of impingement mortality were combined, the annual estimate of impingement during actual and maximum flow was 348 and 834 individuals weighing 69.5 kg (153.2 lb) and 130.4 kg (287.5 lb), respectively (**Table 4-8**).

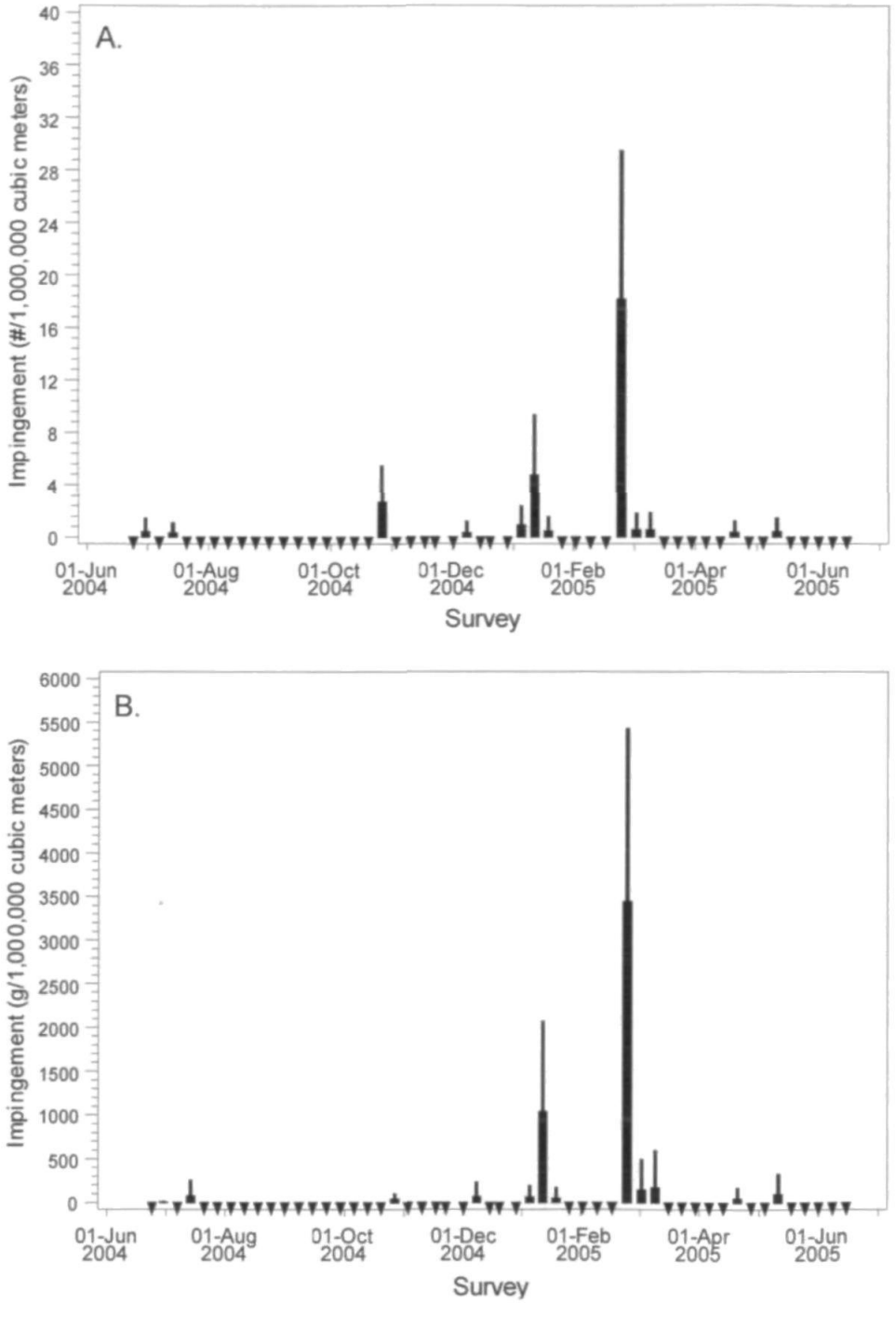



**Figure 4-55.** Mean concentration and standard error of octopus impinged at EPS Units 1–5 from June 2004 through June 2005 ($n$=52 surveys): A) abundance, and B) biomass.

*Note: Downward pointing triangle indicates survey with no larvae collected.*

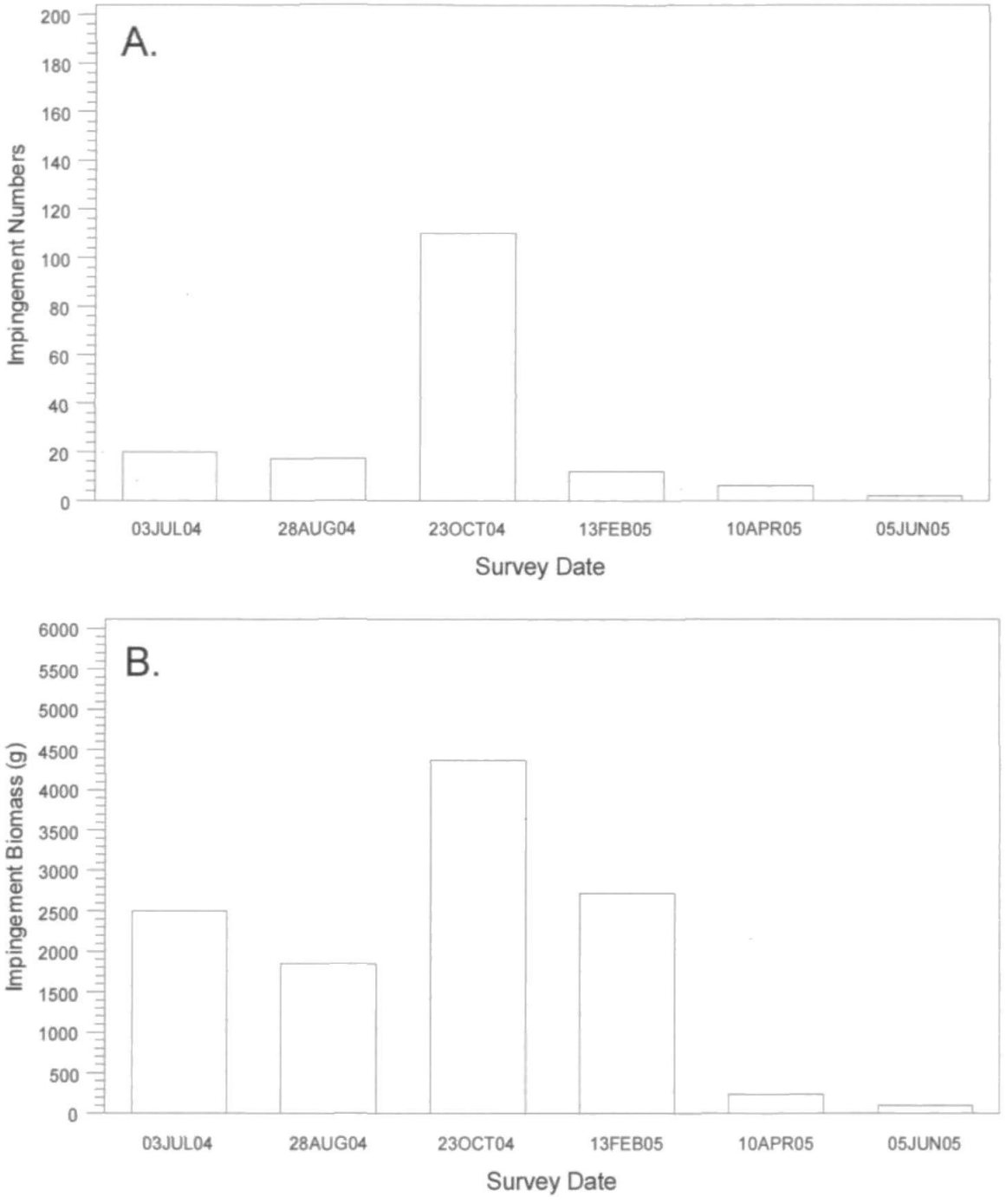



**Figure 4-56**. A) abundance, and B) biomass of octopus impinged during heat treatments at EPS Units 1–5 from July 2004 through June 2005 ($n$=6 surveys).

# 5.0 Impact Assessment of the EPS Cooling Water System

## 5.1 Impact Assessment Overview: Data and Approach

Section 316(b) of the Clean Water Act regulates cooling water intake systems at electrical generating facilities, and requires the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impacts (AEI). In 2004, EPA published Phase II 316(b) regulations for existing power plants, which established performance standards for reducing entrainment by 60–90% and impingement mortality by 80–95%. However, the Phase II regulations were suspended by EPA in 2007. On May 20, 2007, EPA sent a memorandum to regional administrators informing them that the Phase II rule should be considered suspended, and that "*...all permits for Phase II facilities should include conditions under Section 316(b) of the Clean Water Act developed on a Best Professional Judgment basis. See 40 CFR 401.14.*" As written, the Clean Water Act does not specify required cooling water intake system (CWIS) technologies or methods by which EPA must make its determinations under Section 316(b).

Prior to the publication of the Phase II regulations in 2004, regulators relied on EPA's (1977) draft guidelines for evaluating adverse impacts of cooling water intake structures to determine compliance with Section 316(b). Since the new Phase II regulations were based on performance standards for reducing entrainment and impingement and did not explicitly rely on determining whether existing levels represented an adverse environmental impact (AEI), EPA determined that the "*...performance standards reflect the best technology available for minimizing adverse environmental impacts determined on a national categorical basis.*" Although AEI was not intended to be used in assessing compliance under the new regulations, the potential for AEI was still considered in determining the types of plants and water bodies where the new performance standards would apply. Plants with low capacity factors and low cooling water volumes were considered to be BTA since their cooling systems had a low potential for AEI.

In its 1977 draft guidance document, EPA stated that "*Adverse aquatic environmental impacts occur whenever there will be entrainment or impingement damage as a result of the operation of a specific cooling water intake structure. The critical question is the magnitude of any adverse impact.*" EPA further stated in the document that "*Regulatory agencies should clearly recognize that some level of intake damage can be acceptable if that damage represents a minimization of environmental impact.*"

The 2004–2005 EPS IM&E study was performed to determine if the existing intake and its operations results in AEI. Entrainment and impingement losses were measured by collecting samples within the EPS (IM) and in front of the cooling water system intake (E). The impact assessment puts the measured losses into context of the marine ecological setting at the facility.



### 5.1.1 CWIS impacts

There are three general types of effects associated with intake structures utilizing once-through cooling designs: (1) thermal effects, (2) impingement effects, and (3) entrainment effects. Thermal effects are caused by waste heat rejected from condenser cooling flows and are regulated under Section 316(a) of the Clean Water Act and the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California (California Thermal Plan)*. Entrainment occurs when small planktonic organisms are drawn into the CWIS and subsequently pass through it. Organisms large enough to become trapped on the intake screening system are said to be impinged.

In discussing the potential effects of the EPS CWIS on fish and shellfish populations the life history of the species in the community needs to be considered. For example, several fish species in the nearshore coastal areas around EPS have early life stages that are not susceptible to entrainment. Live-bearers, such as surfperches, and some sharks and rays, produce young that are fully developed and too large to be affected by entrainment. In addition, for fishes with entrainable life stages, the period of time that they are vulnerable to entrainment may be relatively short. As the results for EPS show, many species are only vulnerable to entrainment for a few days when they are newly hatched since their swimming ability increases rapidly with age and development. Although some species spawn in the water column and have free-floating eggs, others such as gobies, which were the most abundant taxon entrained, others have demersal eggs that are not subject to entrainment. Also, with increased age young post larval fishes begin searching for adult habitat, usually on the bottom, where they are not susceptible to entrainment. From the standpoint of impingement effects, gobies are generally not susceptible to impingement after transformation to the juvenile life stage because they are bottom-dwelling species that typically do not move up into the water column. This is also true of many flatfishes which are bottom-dwellers and also tend to be strong swimmers. Even fish species that swim in the water column are generally not susceptible to impingement as they mature because they are able to swim against the slow approach velocity of the cooling water inflow.

### 5.1.2 Review of IM&E Sampling Approach

The Phase II 316(b) regulations required that IM&E studies include "*Documentation of current impingement mortality and entrainment of all life stages of fish, shellfish, and any protected species identified previously and an estimate of impingement mortality and entrainment to be used as the calculation baseline.*" For the purposes of this study the term 'shellfish' was defined as commercially and recreationally important species of crustaceans (crabs, lobsters, shrimp, etc.) and mollusks (squid and octopus) that are harvested on a regular basis from the coastal areas surrounding the EPS. This definition does not include organisms such as clams, mussels, and other crustaceans and mollusks that may only be harvested occasionally for recreational purposes. This definition was used because 'shellfish' could also be considered as including all

species of shelled invertebrates, including zooplankton, and clarification of the term was not provided in the regulations.

The Rule's entrainment performance standard focuses on addressing impacts to fish and shellfish rather than lower tropic levels such as phyto- and zooplankton. EPA recognized the low vulnerability of phyto- and zooplankton in its 1977 draft 316(b) guidance (EPA 1977). There are several reasons why there is a low potential for impacts to phyto- and zooplankton and why the EPA decided to focus on potential effects on fish and shellfish. The reasons include:

- The extremely short generation times of most holoplanktonic organisms; on the order of a few hours to a few days for phytoplankton and a few days to a few weeks for zooplankton;
- Both phyto- and zooplankton have the capability to reproduce continually depending on environmental conditions; and
- The most abundant phyto- and zooplankton species along the California coast have populations that span the entire Pacific or in some cases all of the world's oceans. For example, *Acartia tonsa*, one of the common copepod species found in the nearshore areas of California is distributed along the Atlantic and Pacific coasts of North and South America and the Indian Ocean.

Relative to the large abundances of phyto- and zooplankton, larval fishes make up a small fraction of the total numbers of organisms present in seawater. The EPA has correctly focused on potential impacts on fishes and shellfishes because they are more susceptible to entrainment effects for the following reasons:

- They have much shorter spawning seasons relative to phyto- and zooplankton. In many species, spawning occurs only once during the year;
- Unlike phyto- and zooplankton that may be distributed over large oceanic areas, most fishes are restricted to the narrow shelf along the coast and in some cases have specific habitat requirements that further restrict their distribution; and
- Unlike many phyto- and zooplankton, there is a greater likelihood of mortality due to entrainment in larval fishes, since many lower tropic level organisms are not soft bodied as is the case for finfish and are better able to tolerate passage through the cooling system.

The impingement and entrainment sampling was therefore focused on fishes and shellfishes as required in the new 316(b) Phase II regulations. All of the fishes and shellfishes collected during the impingement sampling were counted and identified, while fish larvae, megalops stages of Cancer crabs, phyllosome larvae of spiny lobster, and squid larvae were identified and counted from the entrainment samples. The new 316(b) Phase II regulations provided latitude for focusing on the set of species that could be accurately quantified and that would provide the necessary detail to support development of other aspects of the CDS. The target group of organisms that were included in the entrainment sample processing was agreed to by the Technical Advisory Group that included staff from the SDRWQCB and other resource agencies.

The specific taxa (species or group of species) that were included in the assessment were limited to the taxa that were sufficiently abundant to provide reasonable assessments of impacts. For the purposes of this study plan, the taxa analyzed in the assessment were limited to the most abundant taxa that together comprised 90–95% of all larvae entrained and/or juveniles and adults impinged by the generating station. The most abundant taxa were used in the assessment because they provide the most robust and reliable estimates for the purpose of assessing impacts. Since the most abundant organisms may not necessarily be the organisms that experience the greatest effects on the population level, the data were also carefully examined to determine if additional taxa should be included in the assessment. For example, this might include commercially or recreationally important taxa, taxa with limited habitats, and any threatened or endangered fish or shellfish species. No listed species were entrained or impinged at the EPS during the study and among the species with few entrained larvae only California halibut was included in the assessment because of its commercial and recreational fishery importance.

Results for individual taxa from the impingement and entrainment sampling need to be combined, where possible, to evaluate the combined effects of the CWIS. This is done by extrapolating the numbers of adult and juvenile fishes impinged to the same age used in the adult equivalent loss (*AEL*) and fecundity hindcasting (*FH*) models for the entrainment data. The age used in the *AEL* and *FH* modeling was the average age of reproductive females in the population. Unfortunately, the life history information necessary for the modeling is unavailable for most species so combined assessments were only possible for northern anchovy.

### 5.1.3 Approaches for Assessment of CWIS impacts

Due to the suspension of the 316(b) Phase II rule, state and federal permit writers have been directed to implement Section 316(b) on a case-by-case basis using "best professional judgment". In the case of the EPS, the permit applicant is obligated to provide the San Diego RWQCB with the "best information reasonably available" to assist it in fulfilling its decision-making responsibility. To make Section 316(b) decisions, permit writers have relied on precedent from other cases and on USEPA's (1977) draft "Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) P.L. 92-500."

As is clear from the statute, the permit writer must consider two basic issues in making a finding that an intake technology employs the BTA for minimizing AEI:

- Whether or not an AEI is caused by the intake and, if so,
- What intake structure represents BTA to minimize that impact.

The usual approach for a 316(b) demonstration would be to consider the question of BTA only if a determination has been made that a facility is causing an AEI.



#### 5.1.3.1 Adverse Environmental Impact (AEI) Standard

Since there are no regulations defining AEI, permit decisions must be based on the USEPA's AEI interpretations provided in guidance documents issued since the 1970's. In those documents, the USEPA has indicated that assessment of AEI should be based on an evaluation of population level effects, not just losses of individual organisms. In its 1975 Draft BTA Guidelines, the USEPA stated that "[a]dverse environmental impacts occur when the ecological function of the organism(s) of concern is impaired or reduced to a level which precludes maintenance of existing populations...". Additionally, in the 1976 Development Document, released in conjunction with the EPA's previous Section 316(b) rules, the USEPA said that "the major impacts related to cooling water use are those affecting the aquatic ecosystems. Serious concerns are with population effects that...may interfere with the maintenance or establishment of optimum yields to sport or commercial fish and shellfish, decrease populations of endangered organisms, and seriously disrupt sensitive ecosystems."

The USEPA (1977) draft guidelines acknowledge that the determination of the extent of AEI when it is occurring is difficult to assess. They stated that "Adverse aquatic environmental impacts occur whenever there will be entrainment or impingement damage as a result of the operation of a specific cooling water intake structure. The critical question is the magnitude of any adverse impact. The exact point at which adverse aquatic impact occurs at any given plant site or water body segment is highly speculative and can only be estimated on a case-by-case basis."

Due to the obvious difficulties with determining the extent of AEI, the document (USEPA 1977) provides some general guidelines. These involve determining the "relative biological value of the source water body zone of influence for selected species and determining the potential for damage by the intake structure" based on the following considerations of the value of a given area to a particular species:

- principal spawning (breeding) ground;
- migratory pathways;
- nursery or feeding areas;
- numbers of individuals present; and
- other functions critical during the life history.

Following this general approach provided by the USEPA (1977), additional criteria can be evaluated that are specific to the marine environment around the EPS that are directly applicable to the present 316(b) study:

- distribution (pelagic, subtidal, nearshore subtidal & intertidal);
- range, density, and dispersion of population;
- population center (source or sink);



- magnitude of effects;
- long-term abundance trends (e.g., fishery catch data);
- long-term environmental trends (climatological or oceanographic); and
- life history strategies (e.g., longevity and fecundity).

By assessing the relative value of each of these criteria for a particular taxon, we will be able to better assess the extent of the impact that the loss of these animals has on the local environment and the population at large.

### 5.1.4 Relating Measured Impacts to Source Populations

The criteria used to evaluate the potential for AEI need to be placed into a larger context using the characteristics of the source water and the biological community. This assessment focuses on a set of species that were collected during the study in adequate abundances to provide reasonable confidence in the estimates of entrainment and impingement effects. These species were also selected to be broad enough to include representatives from the different habitats and species groups present in the source water. As previously discussed (Section 5.1.1), not all of the fishes and shellfishes in the source water are subject to entrainment or impingement, and only a few species occur in high abundance in both entrainment and impingement samples. These differences in the vulnerability to entrainment and impingement occur due to different life histories of the species, and the differences in habitat preferences and behavior that may occur at different life stages. The potential magnitude of the losses due to entrainment and impingement depend on many factors but specifically this assessment focuses on the distribution of the species and their habitats to determine which species are at greatest risk. The extreme case of highest risk would occur for a rare or endangered species with a distribution that was limited to Agua Hedionda Lagoon (AHL). Conversely, larvae for species such as northern lampfish that occurs to depths of 2,900 m (9,500 ft) were entrained at the EPS, but the primary distribution for this species is the outer coastal waters from Baja California to the Bering Sea and Japan (Miller and Lea 1972). The distribution of larval northern lampfish collected by CalCOFI from 1951-19898 is presented in **Figure 5-1** (Moser et al. 2001). The larvae for these and other species that are transported from far offshore into AHL where they are subject to entrainment are not likely to contribute to an adult population that occurs further offshore.

Data on water current flow and direction collected during the study were used to estimate the spatial extent of the effective source populations of larvae for modeling entrainment effects. The larval durations for the species analyzed for this report indicated that the source for some of the larvae was most likely from inside AHL. The larval durations estimated for blennies and garibaldi were both less than three days reflecting the high likelihood that the sources of the larvae are the fouling communities and breakwater habitats in the Outer Lagoon. The estimated duration for CIQ gobies was longer at 11.5 days probably due to the predominant habitat for gobies being the Middle and Inner Lagoons. The longer duration is probably due to the time it

takes for the larvae to be transported out of the inner lagoon segments as a result of tidal currents combined with their behavioral tendency to resist transport by seeking quieter water microhabitats. Although the larval duration for northern anchovy was only 4.8 days, the source population for the larvae extend throughout the Southern California Bight (SCB) with peak larval abundances in the outer shelf areas (**Figure 5-2**) (Moser et al. 2001). The estimated larval durations for the other species analyzed from the entrainment sampling were consistent with their distribution in the nearshore areas inside and outside AHL. The estimates of larval duration and the composition of the fishes collected during the entrainment and impingement sampling indicate that AHL and the surrounding nearshore habitats are the logical focus for examining the potential effects of entrainment and impingement.

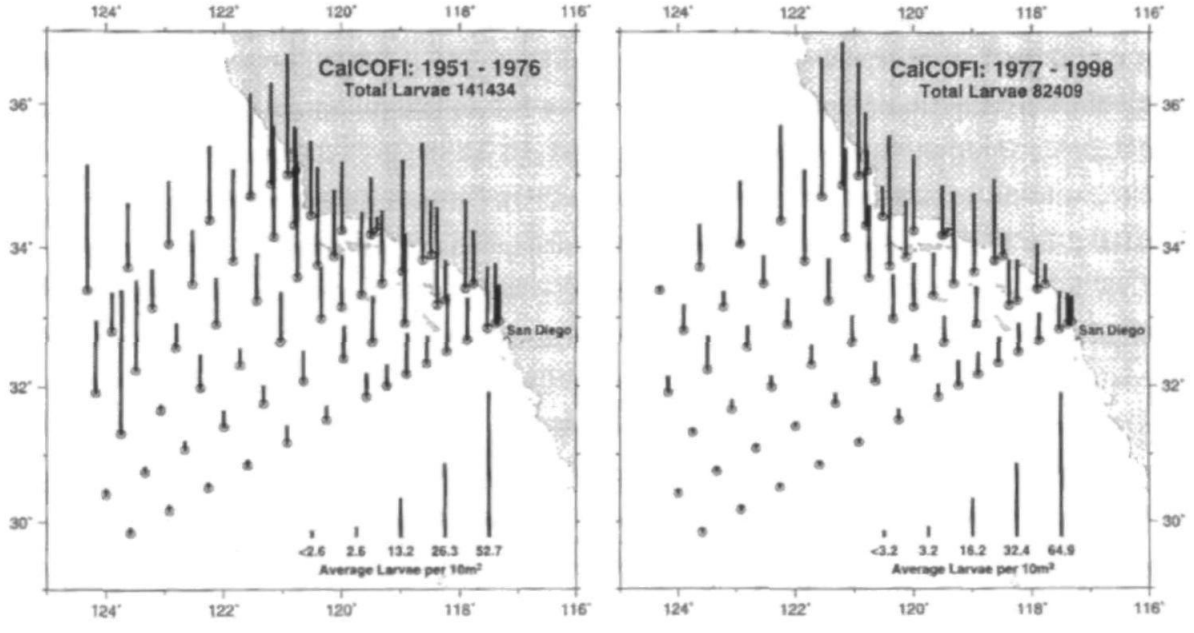



**Figure 5-1**. Distribution and abundance of northern lampfish larvae (*Stenobrachius leucopsarus*) at permanent stations sampled in the CalCOFI study in the SCB from 1951 through 1998 (from Moser et al. 2001).

The location of the EPS intake structure inside AHL makes the fishes and other organisms that utilize that area more susceptible to the potential effects of entrainment and impingement. CWIS effects from EPS will have less effect on fishes that are primarily associated with other habitats or have distributions that extend far offshore. The following criteria from the list in the previous section can be used to focus the assessment on species with adult and larval distributions that would place them at greatest risk to entrainment and impingement effects:

- distribution (pelagic, subtidal, nearshore subtidal & intertidal),
- range, density, and dispersion of population; and
- population center (source or sink).

These criteria relate directly to the habitats associated with the fish and shellfish potentially affected by entrainment and impingement. This approach to classification has been taken in recent studies of marine fishes of California (Horn and Allen 1978, Allen 1985, Allen and Pondella 2006) and will be used to organize the taxa included in this assessment. We have simplified the more detailed categorization of habitats used by Allen and Pondella (2006) which included several habitats used to define deeper offshore areas. These deeper offshore habitat types can be combined for the purposes of our assessment since the taxa associated with those habitats are generally not at risk due to entrainment and impingement and were collected in very low numbers. The habitats defined by Allen and Pondella (2006) have been simplified for this assessment to the following habitat types:

- bays, harbors, and estuaries;
- subtidal and intertidal rocky reefs and kelp beds;
- coastal pelagic;
- continental shelf and slope; and
- deep pelagic including deep bank and rocky reefs.

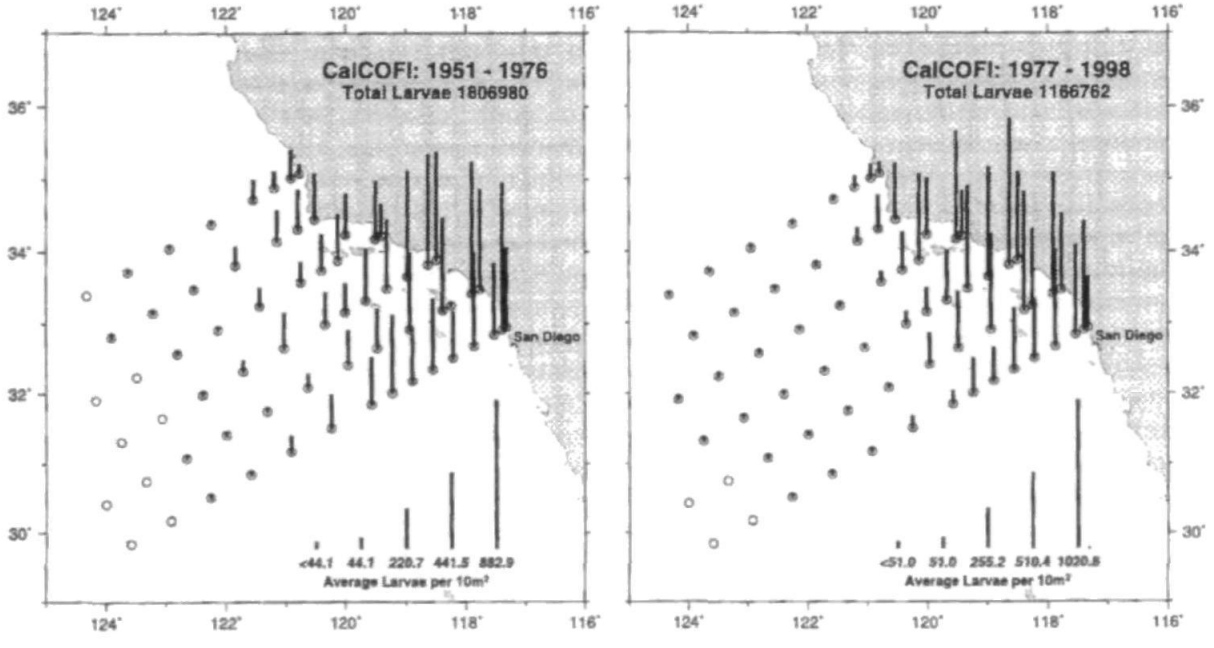



**Figure 5-2**. Distribution and abundance of northern anchovy larvae (*Engraulis mordax*) at permanent stations sampled in the CalCOFI study in the SCB from 1951 through 1998 (from Moser et al. 2001).

The taxa included in this assessment were categorized into these habitat types (**Table 5-1**). Taxa that occur in more than one habitat were included in the habitat group that best reflected the primary distribution for the taxa or if a primary habitat cannot be identified. This raises an important point in regards to impact assessment. Taxa that occupy several different habitats will be at less risk from power plant impacts especially if at least one of the habitats is not directly affected by entrainment and impingement. For example, garibaldi occur along the rock jetties that border the Outer Lagoon which places them directly at risk to entrainment and impingement, but they also occur in rocky reef areas outside of the lagoon where they are not at risk. As previously discussed, the risk of impacts to northern anchovy is very low since their primary habitat is not directly affected by the power plant and they are widely distributed.

This approach to assessing AEI is consistent with a recent trend in fisheries management towards ecosystem-based management (Larkin 1996, Link 2002, Mangel and Levin 2005). This approach recognizes that commercial fishing stocks can only be protected if the habitats and other components of the ecosystem are protected. An ecosystem-based approach also addresses other human activities in addition to fishing and the environmental factors that affect an ecosystem, the response of the ecosystem, and the outcomes in terms of benefits and impacts on humans. In this context it will help identify the habitats most at risk to CWIS effects and help identify a broader context for the effects relative to the entire ecosystem. If restoration were to be allowed as a compliance alternative, this approach to assessment would focus the restoration scaling with the appropriate species from the identified habitats.

**Table 5-1.** Habitat associations for taxa included in assessment of CWIS effects at the EPS. Primary habitat in bold, upper case and secondary habitat in lower case. Taxa also designated as to whether they are targeted by a sport (S) or commercial (C) fishery.

| | | Fishery | Habitats | | | |
|---|---|---|---|---|---|---|
| **Scientific name** | **Common name** | **S-Sport, C-Comm.** | **bays, harbors** | **reefs, kelp beds** | **coastal pelagic** | **shelf** |
| Gobiidae unid. | CIQ goby complex | | **X** | | | |
| *Hypsoblennius* spp. | combtooth blennies | | **X** | **x** | | |
| Engraulidae unid. | anchovies | C | x | | **X** | |
| *Hypsypops rubicundus* | garibaldi | | x | **X** | | |
| *Roncador stearnsii* | spotfin croaker | S | | | | **X** |
| Atherinopsidae unid. | silversides | | x | **X** | x | |
| *Genyonemus lineatus* | white croaker | S, C | x | | **X** | x |
| *Seriphus politus* | queenfish | S | | | **X** | x |
| *Paralichthys californicus* | California halibut | S, C | x | | | X |
| *Paralabrax* spp. | sand and kelp basses | S | x | **X** | | |
| *Sardinops sagax* | Pacific sardine | C | | | **X** | |
| *Cymatogaster aggregata* | shiner surfperch | | **X** | x | | |
| *Hyperprosopon argenteum* | walleye surfperch | S | x | **X** | | x |
| *Atractoscion nobilis* | white seabass | S, C | | | **X** | x |
| *Cancer* spp. | cancer crabs | S, C | x | x | | **X** |
| *Panulirus interruptus* | California spiny lobster | S, C | | **X** | | |
| *Loligo opalescens* | market squid | S, C | | | **X** | |
| *Octopus spp.* | two-spotted octopus | S, C | | **X** | | |

## 5.2 Summary of Entrainment and Impingement Results

Summaries of the entrainment and impingement study results are followed by tables combining the sampling and modeling results for all the taxa included in the assessment and tables with estimated economic losses for those taxa.

### 5.2.1 Entrainment

A total of 20,601 larval fishes representing 41 taxa was collected from the EPS entrainment station (E1) during 13 surveys in the 2004–2005 sampling period. This yielded a total annual entrainment estimate of 4.49 x $10^9$ fish larvae from June 2004 through May 2005 using the EPS CWIS maximum flows as the basis for calculations, and 3.63 x $10^9$ larvae using actual EPS flows during the same time period, a 23.9% difference. Calculations based on actual flows yielded an estimate of nearly 10 million fish larvae per day entrained through the EPS CWS.

An earlier study of entrainment at EPS in 1979 (SDGE 1980) measured the concentrations of larval fishes, fish eggs, and various groups of invertebrate zooplankton in the cooling water supply. Total zooplankton entrainment estimates were 7.4 x $10^9$ organisms annually (based on 505 $\mu$ mesh sampling nets) and 30.9 x $10^9$ organisms annually (335 $\mu$ mesh) with the copepod *Acartia tonsa* the most abundant invertebrate. (Estimates were presumably based on maximum EPS pump flows, although this was not clearly stated in the report). The total annual ichthyoplankton entrainment estimates were 4.2 x $10^9$ and 6.7 x $10^9$ individuals annually for the 505 $\mu$ mesh and 335 $\mu$ mesh, respectively, with 86% of the total consisting of fish eggs. The entrained abundance of fish larvae from February 1979 through January 1980 was estimated at 0.92 x $10^9$ individuals, which was approximately one-quarter of the total numbers estimated during the 2004–2005 survey.

The greatest concentrations of larval fishes during the 2004–2005 study occurred in August 2004 and the fewest occurred in December 2004. Gobies (CIQ goby complex) and blennies, both largely found in lagoons, bays and estuaries, comprised over 90% of all larval specimens collected, with anchovy larvae the third most abundant taxon at approximately 4%. The CIQ goby complex is comprised of up to three species that are common in southern California bays and estuaries (arrow, shadow, and/or cheekspot gobies) but cannot be reliably identified to the species level as young larvae. Although some larger specimens could be positively identified, all gobies of these three species were grouped for analysis. There were very few fish fragments or damaged fishes in the collections.

The fish taxa that were the focus of the analysis have varied distributions and life histories. They include fishes that occur in estuarine and enclosed bay habitats (e.g., gobies), in coastal nearshore habitats (e.g., kelp bass), and in coastal open ocean habitats (e.g. queenfish). As expected, the most abundantly sampled species were those with adult populations that spawned

in lagoon environments and the least abundant were outer coast species, such as flatfishes or croakers, that do not typically spawn directly in lagoons, even though juveniles of the species may eventually migrate into lagoon habitats as they develop. One unexpected result was the lack of deepbody and slough anchovy larvae (*Anchoa* spp.) in the entrainment samples even though deepbody, in particular, were abundant in the impingement samples and the larvae have been found in other southern California bays (Tenera Environmental 2004). The cause of this apparent lack of spawning is not known. The engraulid larvae from AHL that could be identified to species were almost entirely northern anchovy, a species that was also common in impingement samples. In general, most of the entrained larvae could be classified as belonging to forage species for predatory fishes and seabirds, and relatively few of the entrained larvae were from species that have significant sport or commercial fisheries, such as basses (Serranidae), white seabass (Sciaenidae), or California halibut.

One species that had a relatively high entrainment rate in spring and summer months was garibaldi, a large member of the damselfish family. Garibaldi are common throughout southern California and are associated with artificial substrates in bays and harbors, and natural rock reefs along the outer coast and islands. In AHL, adult females attach their eggs in discrete patches to rock surfaces around the margin of the lagoon. As the eggs hatch the larvae are immediately susceptible to entrainment before they develop a strong ability to swim.

Of the target shellfishes sampled, only one *Cancer* crab megalopa and no spiny lobster larvae were collected at the entrainment station. The target invertebrate taxa were selected based on their direct economic value as fishery species, and it was clear from the sampling results that such larvae are not routinely subject to mortality from EPS power plant entrainment. Although many of the other planktonic organisms that pass through the CWS were not quantified in this study, they typically represent taxa that are very widespread and numerous along the entire coast either as larvae of benthic organisms, such as barnacle nauplii, or living an entirely planktonic existence throughout their life cycle, such as copepods. As noted earlier, a single species of copepod was found to be numerically dominant in the entrainment collections from the 1979–1980 study.

## 5.2.2 Impingement

A total of 19,408 fishes weighing 351.7 kg (775.3 lb) and 1,985 shellfishes weighing 17.2 kg (38.0 lb) was collected during normal operation impingement sampling at the EPS traveling screens during 52 weekly surveys from June 24, 2004 through June 15, 2005 (**Tables 4-2** and **4-6**). There were also 34 fishes weighing 22.2 kg (48.4 lb) and two shellfishes weighing 0.5 kg (1.1 lb) collected from the bar racks during the same period. Six heat treatments of the conduits were completed from June 2004 through June 2005, and 94,991 fishes weighing 2,035 kg (4,486 lb) and 1,384 shellfishes weighing 19.9 kg (43.9 lb) were collected. The combined counts from all plant mortality sources were used to estimate a maximum annual impingement of 289,562 fishes weighing 5,841 kg (12,877 lb) and 22,714 shellfishes weighing 233 kg (514 lb) using the



maximum CWS flows, and a best estimate of actual impingement of 215,583 fishes weighing 4,358 kg (11,069 lb) and 14,474 shellfishes weighing 138 kg (304 lb) using the actual CWS flows measured during the sampling period. Nine taxa were examined in detail that included fishes comprising the top 90$^{th}$ percentile in both abundance and biomass, or fishes with commercial or recreational fishery importance that were in the top 90$^{th}$ percentile of abundance or biomass.

The earlier 316(b) impingement study (SDGE 1980) was conducted for 336 consecutive days from February 1979 through January 1980. Totals of 79,662 fishes and 6,281 shellfishes weighing 1,395 kg (3,075 lb) and 153 kg (337 lb), respectively, were collected during normal impingement sampling. During the sampling period there were seven heat treatments with 108,478 fishes weighing 2,426 kg (5,348 lb) being collected. Although the average losses measured during heat treatments were similar between the two studies (**Table 5-2**), the results from normal operation impingement suggest that the total abundances of fishes in AHL that are subject to impingement have increased over the 25 years since the first study was done. Data on shellfishes were not compared because of the differences in sampling protocols for shellfishes between the two studies.

**Table 5-2**. Average daily abundances of fishes collected during normal operations (unadjusted for plant flow) and heat treatment impingement surveys during the 1979-1980 and 2004–2005 surveys.

| | Average Daily Fish Abundance Normal Operations | | Average Fish Abundance Heat Treatments | |
|---|---|---|---|---|
| Study Period | Numbers | Biomass in kg (lb) | Numbers | Biomass in kg (lb) |
| 1979–1980 | 237 | 4.1 (9.0) | 15,497 | 346.5 (763.9) |
| 2004–2005 | 373 | 6.8 (15.0) | 15,832 | 339.2 (747.8) |

Results from the two studies also show similar species composition including topsmelt, shiner surfperch, deepbody anchovy, queenfish, and slough anchovy (**Tables 4-1** and **4-2**). One noticeable difference, however, was a much higher number of salema in 2004–2005. Salema are distributed from Monterey Bay south to Peru and are considered a warmer water species. Impingement rates for salema at other generating stations in southern California have also increased since 1979, possibly due to generally warmer water temperatures and frequent El Niño conditions in the 1980s and 1990s (MBC and K. Herbinson, unpublished data).

The results also showed that heat treatments caused a significant fraction of the total annual impingement mortality. Under maximum CWS flows they accounted for 33% and 35% of the total impingement abundance and biomass of fishes, respectively, and under actual CWS flows they accounted for 44% and 47% of the total impingement abundance and biomass, respectively (**Tables 4-2** and **4-4**). The percentage of the total is higher for biomass since larger fishes are probably able to maintain their position in the tunnels under normal operating conditions but are

killed during heat treatments when they become trapped in the tunnels prior to the warm water circulation procedure. This also results in differences in composition between heat treatment and normal operations impingement. Fishes that are generally strong swimmers such as Pacific sardine, barred sand bass, white seabass, and jacksmelt were collected in much higher abundances during heat treatment surveys. Also, fishes that use the fouling community inside the intake as habitat, such as bay and mussel blennies, were collected almost exclusively during heat treatments.

The shellfishes impinged during heat treatments contributed a much smaller percentage of the total estimated impingement—6% and 10% of the total estimated impingement under maximum and actual flows, respectively (**Tables 4-6** and **4-8**). Most shellfishes are unable to avoid impingement once they enter the CWIS. Therefore, there were fewer differences between impingement types for shellfishes and finfishes. There were some exceptions however, with octopuses and rock crabs both more abundant during heat treatments than normal impingement.

The combined annual estimates for entrainment and impingement based on actual flow rates and maximum flow rates are shown in **Tables 5-3** and **5-4**. The estimated valuation of these losses based on commercial fishery prices for equivalent weight are presented in **Table 5-5**.

**Table 5-3**. Summary of entrainment and impingement impacts on selected fishes and shellfishes. Values are estimates based on actual flow rates during the sampling period.

| Taxon | Entrainment (Annual Larval #) | *AEL* (Estimated Annual Mean) | *2FH* (Estimated Annual Mean) | $P_M$ | Impingement (Annual #, All sources) | Impingement (Annual Biomass (kg), All sources) |
|---|---|---|---|---|---|---|
| Fishes | | | | | | |
| CIQ goby complex | 2,215,477,217 | 1,632,666 | 3,762,916 | 0.398 | 0 | 0 |
| combtooth blennies | 1,098,083,615 | 2,450,084 | 1,150,708 | 0.194 | 832 | 4.85 |
| anchovies | 120,661,087 | 15,456 | 6,178 | 0.004 | 46,301 | 354.92 |
| garibaldi | 29,287,646 | – | – | 0.144 | 5 | 1.90 |
| spotfin croaker | 9,554,139 | – | – | 0.016 | 1,351 | 80.76 |
| silversides | 7,936,121 | – | – | – | 68,519 | 449.74 |
| white croaker | 6,924,470 | – | – | 0.003 | 86 | 1.28 |
| queenfish | 6,746,448 | – | – | 0.009 | 9,479 | 70.43 |
| [illegible] | [illegible] | | [illegible] | 0.003 | 612 | 15.44 |
| sand basses | 2,520,619 | – | – | – | 7,987 | 198.84 |
| Pacific sardine | 2,484,208 | – | – | – | 8,313 | 35.36 |
| shiner surfperch | 0 | – | – | – | 37,664 | 393.84 |
| walleye surfperch | 0 | – | – | – | 5,586 | 248.55 |
| white seabass | 0 | – | – | – | 2,102 | 408.12 |
| Shellfishes | | | | | | |
| Cancer crabs | 162,150 | – | – | – | 962 | 5.22 |
| California spiny lobster | 0 | – | – | – | 22 | 1.86 |
| market squid | 0 | – | – | – | 162 | 1.77 |
| octopus | 0 | – | – | – | 497 | 69.46 |

**Table 5-4**. Summary of entrainment and impingement impacts on selected fishes and shellfishes. Values are estimates based on maximum design flow rates during the sampling period.

| Taxon | Entrainment (Annual Larval #) | *AEL* (Estimated Annual Mean) | *2FH* (Estimated Annual Mean) | $P_M$ | Impingement (Annual #, All sources) | Impingement (Annual Biomass (kg), All sources) |
|---|---|---|---|---|---|---|
| Fishes | | | | | | |
| CIQ goby complex | 2,767,198,570 | 2,039,250 | 4,699,996 | 0.470 | 0 | 0 |
| combtooth blennies | 1,312,458,555 | 2,928,405 | 1,370,576 | 0.228 | 876 | 5.07 |
| anchovies | 157,019,892 | 20,113 | 8,038 | 0.005 | 60,402 | 431.34 |
| Garibaldi | 36,328,962 | – | – | 0.176 | 5 | 1.90 |
| spotfin croaker | 10,677,429 | – | – | 0.018 | 1,820 | 122.06 |
| silversides | 12,654,500 | – | – | – | 99,259 | 717.28 |
| white croaker | 9,466,865 | – | – | 0.004 | 113 | 1.55 |
| queenfish | 7,534,586 | – | – | 0.010 | 12,511 | 89.66 |
| California halibut | 4,879,725 | – | 12 | 0.004 | 975 | 23.27 |
| sand basses | 2,775,286 | – | – | – | 11,795 | 239.42 |
| Pacific sardine | 3,394,522 | – | – | – | 8,922 | 40.22 |
| shiner surfperch | 0 | – | – | – | 44,867 | 496.64 |
| walleye surfperch | 0 | – | – | – | 9,177 | 402.51 |
| white seabass | 0 | – | – | – | 2,384 | 458.12 |
| Shellfishes | | | | | | |
| Cancer crabs | 200,698 | – | – | – | 1,172 | 6.51 |
| California spiny lobster | 0 | – | – | – | 25 | 1.97 |
| market squid | 0 | – | – | – | 190 | 2.19 |
| octopus | 0 | – | – | – | 834 | 130.39 |

**Table 5-5.** Approximate dollar value of estimated entrainment and impingement losses for selected taxonomic groups of fishes at EPS for the study period using actual and maximum CWS flow volumes.

| Taxon | Source for Fishery Data | Landings (MT) | Ex-vessel Value ($) | Cost ($) per kg | Actual Flow | Maximum Flow |
|---|---|---|---|---|---|---|
| | | | | | Value ($) of Estimated Losses | Value ($) of Estimated Losses |
| **Finfish** | | | | | | |
| CIQ goby complex | n.a. | n.a. | | | | |
| combtooth blennies | n.a. | n.a. | | | | |
| anchovies | – | – | | $0.48 | $207.46 | $255.31 |
| garibaldi | protected species | | | | | |
| spotfin croaker | not sold commercially | | | | | |
| silversides | n.a. | n.a. | | $0.55 | $247.36 | $394.50 |
| white croaker | PacFIN '05 SD | 0.33 | $1,022 | $3.13 | $4.01 | $4.85 |
| queenfish | PacFIN '05 SMt ocrk | 5.59 | $9,992 | $1.79 | $125.89 | $160.27 |
| California halibut | PacFIN '05 SD | 14.3 | $106,554 | $7.45 | $429.42 | $644.95 |
| sand basses | not sold commercially | | | | | |
| Pacific sardine | CDFG '04 SD | 44.5 | $26,428 | $0.59 | $20.86 | $23.73 |
| shiner surfperch | PacFIN '05 LA srfp | 0.2 | $403 | $2.02 | $793.59 | $1,000.73 |
| walleye surfperch | PacFIN '05 LA srfp | 0.2 | $403 | $2.02 | $500.83 | $811.06 |
| white seabass | PacFIN '05 SD | 26.8 | $140,612 | $5.25 | $2,141.29 | $2,403.63 |
| | | | | **Total Finfish** | **$4,471** | **$5,699** |
| **Shellfishes** | | | | | | |
| Cancer crabs | PacFIN '05 SD | 47.4 | $107,722 | $2.27 | $11.86 | $14.79 |
| Calif. spiny lobster | PacFIN '05 SD | 111.4 | $1,813,926 | $16.28 | $30.29 | $32.08 |
| market squid | PacFIN '05 LA | 31,561 | $18,781,573 | $0.60 | $1.05 | $1.30 |
| octopus | PacFIN '05 SD | 0.1 | $339 | $3.39 | $235.47 | $442.02 |
| | | | | **Total Shellfish** | **$279** | **$490** |
| | | | | **GRANDTOTAL** | **$4,749** | **$6,189** |

Values for each species are based on landings data from the Pacific States Marine Fisheries Commission (PSMFC) Pacific Fisheries Information Network (PacFIN) internet database of 2005 landings and California Department of Fish and Game (2005), Final Commercial Landings for 2004. SD is San Diego, SMt is Santa Monica Bay, LA is Los Angeles, ocrk is other croaker, srfp is surfperch.

Northern anchovy was based on live bait value from Leet et al. (2001) as $440 per ton.

## 5.3 Assessment of Taxa by Habitat Type

The following sections present assessments for taxa from the five habitat types simplified from Allen and Pondella (2006). A general discussion of the habitat and the potential risk to the habitat due to EPS operation will be followed by discussion of the specific impacts to the fishes and shellfishes included in the assessment for each habitat type (**Table 5-1**).

### 5.3.1 Background Information on Oceanographic Setting and Population Trends

Water temperatures and current patterns have a significant effect on marine faunal composition: Understanding the nature of the variability in these physical factors is essential for explaining long-term population trends for many marine species. The Southern California Bight is the transition zone between the cool temperate Oregonian fauna, from the north and the warm temperate San Diegan fauna from the south. This transition is caused by the geology and oceanic current structure of the region. The source of cold water is the California Current, the eastern branch of the North Pacific Gyre. The strength of the California Current varies on many time frames. On a multi-decadal scale it oscillates between a warm and cold phase referred to as the Pacific Decadal Oscillation (PDO). During the warm phase the PDO is relatively weaker than average, while during the cold phase it is stronger than average. This multi-decadal oscillation has had a significant effect of the Southern California Bight (SCB) and the most pertinent debate concerns when it will switch back to a cold phase (Bogard et al. 2000, Durazo et al. 2001, Lluch-Belda et al. 2001). During the cold phase, the bight is colder than average and dominated by the Oregonian fauna. The opposite is the case for the warm phase; the bight is warmer than average and dominated by the San Diegan fauna. There have been three transitions in the PDO over the last century. The most recent oscillation of the PDO caused a regime shift starting in the late 1970's that was completed by the end of the 1982–1984 El Niño, the largest El Niño recorded at that time (Stephens et al. 1984, Holbrook et al. 1997). The transition culminated with the 1982–1984 El Niño that effectively extirpated the Oregonian fauna from the Southern California Bight.

The strength of the PDO varies annually and the most important phenomenon with respect to this variation is the El Niño Southern Oscillation (ENSO). This oscillation consists of two components, El Niño and La Niña periods. El Niño causes the California Current to weaken and move offshore as warm subtropical water moves into the bight. The rebound from this event is the shift to La Niña, which in effect is manifested as a strengthening of the California Current and generally cooler water in the bight. Either phase of an ENSO generally lasts 1–2 years, depending upon their strength, and are particularly important for understanding fish dynamics in the SCB for a variety of reasons. First, in the El Niño phase, the bight is warmed and vagile warm-water fishes and invertebrates immigrate or recruit into the region (Lea and Rosenblatt 2000, Pondella and Allen 2001). Cold water forms migrate out of the region, move into deeper



(cooler) water or are extirpated. During the La Niña phase, the SCB usually, but not always, is cooler than normal, and we observe an increase in cold temperate (Oregonian fauna) organisms through the same processes. Highly mobile organisms will immigrate or emigrate from the bight during these periods; and on smaller spatial scales less vagile organisms may exhibit offshore versus onshore movements. However, the resident fauna tends not to be altered on such short time frames when compared to the magnitude of the PDO.

In the decade prior to this study there were three major events that affected the California Current System that need to be explained in order to understand the oceanographic setting of this study period. The first was the 1997–98 El Niño, the strongest recorded event of its kind. This was followed by a series of four cold water years (1999–2002) including the strongest La Niña on record (Schwing et al. 2000, Goericke et al. 2005). The possible return to the cold water phase of the PDO did not occur since 2003–2004 was described as a 'normal' year (Goericke et al. 2005). This normal year turned out to be the beginning of an extended warm phase that has persisted through 2006 (Peterson et al. 2006, **Figure 5-3**). Thus, the oceanographic context for this study can best be described as a warm phase of the PDO that has persisted for three years. Prior to this warm phase were four unusually cool years.

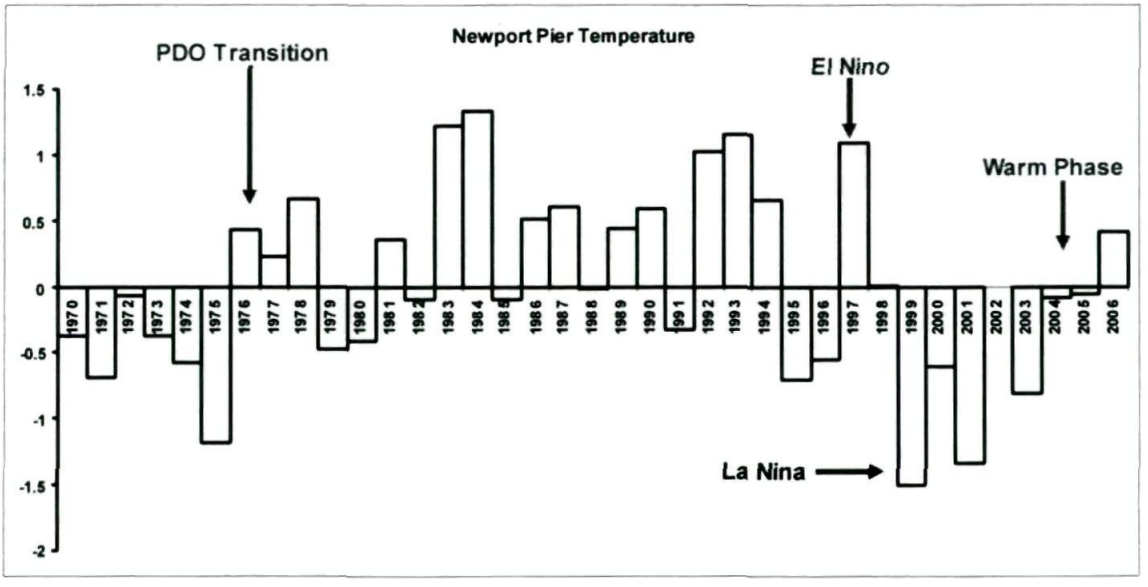



**Figure 5-3.** Sea surface temperature anomalies for Newport Pier, California. Values are ± the long-term average (1925-2006).

To determine the current population status of fishes and invertebrates in the SCB requires placing this data into an appropriate long-term context. From an oceanographic standpoint, the influences that were associated with change over time are the PDO, the ENSO, and the associated ocean temperature changes. These oceanographic metrics are interconnected with each other and have effects in the SCB on varying time scales. In order to understand the responses of organisms in the SCB to these various environmental metrics, it is important to

realize the general trends for the region (Brooks et al. 2002) and that each taxon may have a unique response to these metrics based upon its life history characteristics and evolution.

In addition, to the real time responses these organisms have to oceanographic parameters, anthropogenic influences also have significant effects. Currently, the most extensively studied anthropogenic effects are related to over fishing and the various management actions associated with fishing. In the SCB, all of the top-level predators (with the exception of marine mammals) were over fished during the last seven decades (Ripley 1946, Love et al. 1998, Allen et al. *in press*, Pondella and Allen *in review*). The effects on fisheries were also species specific, as the effort, type of fishery and associated management actions vary case by case. Some fishes were reserved for recreational anglers (e.g. kelp bass, barred sand bass etc.) as they were historically over fished by commercial fishers (Young 1963); others were primarily commercial species (e.g. anchovies); while others are extracted by both fisheries (e.g. California halibut). Fishery data may or may not reflect actual population trends due to socioeconomic considerations such as market value, effort, management actions, etc. Fishery independent monitoring programs produce the best population time series metrics and also allow non-commercial species to be evaluated.

## 5.3.2 Habitat Associations

Most entrained larvae were from species found associated with the bay and harbor habitat where the intake is located (**Table 5-6**). The larvae for species, such as gobies and blennies, are found in the same habitats occupied by the adults. The larvae from other entrained taxa were from fishes associated with kelp bed and reef habitats and coastal pelagic habitats that are found in nearshore areas outside of AHL where the EPS intake is located. The fewest number of taxa were from fishes associated with deep pelagic habitats. Although almost 45 percent of the taxa were from fishes associated with shelf and slope habitats further offshore, these taxa were collected in very low numbers relative to the fishes from nearshore habitats. This would be expected since onshore currents may transport the larvae of these taxa onshore, but they occur in much greater abundances offshore where the adult habitat is located. Most significant to the assessment of impacts is that only about 5% of the larvae entrained were targeted by sport or commercial fishing.

Since impingement affects juvenile and adult stages of fishes and shellfishes, there are greater percentages of species associated with the types of habitats in close proximity to the intakes than found from the entrainment data (**Table 5-6**). For example, no species from deep pelagic habitats were collected and by far the greatest abundance of fishes were associated with the bay-harbor habitat most at risk to impingement. The percentage is much greater than found among the fishes in the entrainment samples since the larvae from the taxa are directly produced in AHL where they are subject to entrainment.

**Table 5-6**. Percent of fish larvae entrained (abundance and number of taxa) or adults/juvenile fishes impinged (biomass and number of taxa) associated with general habitat types and fisheries.

| Attributes | Entrained % of taxa | Entrained % of abundance | Impinged % of taxa | Impinged % of biomass |
|---|---|---|---|---|
| Habitat Association | | | | |
| Bays, Harbors | 34.21 | 97.03 | 50.00 | 69.03 |
| Rocky reef, Kelp | 44.74 | 33.44 | 33.96 | 41.26 |
| Coastal pelagic | 23.68 | 4.08 | 28.30 | 32.10 |
| Continental shelf / slope | 44.74 | 0.91 | 16.98 | 17.10 |
| Deep pelagic | 10.53 | 0.02 | 0.00 | 0.00 |
| Fishery | | | | |
| Sport | 36.84 | 1.22 | 52.83 | 62.38 |
| Commercial | 26.32 | 4.22 | 31.13 | 24.57 |
| None | 57.89 | 95.37 | 40.57 | 35.61 |

Note: Species may have more than one associated habitat or fishery.

### 5.3.2.1 Bay and Harbor Habitats

This habitat type includes, bay, harbors and estuaries that are either entirely marine and largely influenced by tidal movement of seawater, or estuarine areas where freshwater input results in lower salinity seawater in some areas of the habitat. Bays and harbors in the areas around EPS include AHL where the plant is located, Oceanside Harbor and Buena Vista Lagoon to the north, and Batiquitos, San Elijo and San Dieguito Lagoons to the south. Characteristic fishes from these habitats include deepbody anchovy, bay pipefish, bay blenny, round stingray and diamond turbot (Allen and Pondella 2006). There are wetland habitats associated with all of the coastal lagoons and characteristic fishes from this habitat include slough anchovy, barred pipefish, shadow and arrow goby, and longjaw mudsucker (Allen and Pondella 2006). The largest percentage of the fishes collected during the entrainment and impingement sampling had some dependency on bay and harbor habitats during at least some stage of their life, and this habitat is the primary habitat for the most abundant fishes collected during entrainment sampling: CIQ gobies and combtooth blennies (**Tables 5-3** and **5-4**). While CIQ gobies are almost totally confined to these habitats, one species of combtooth blenny, the rockpool blenny (*Hypsoblennius gilberti*), also inhabits shallow intertidal and subtidal rocky reef habitats. The only fish from the impingement sampling included in the assessment that is primarily associated with bay and harbor habitats is shiner surfperch. Assessments of these three species are presented in the following sections.

#### *CIQ Goby Complex*

The CIQ goby complex had the highest estimated entrainment at 2.2 billion larvae annually (actual flows), the highest projected adult losses (1.6–3.8 million annually), and the highest estimated fractional losses of larvae at nearly 40% of the source population (**Table 5-3**). Using the maximum design flows, the estimated entrainment increases to 2.8 billion larvae with projected adult losses of 2.0–4.7 billion fish (**Table 5-4**). Impingement of gobies was negligible.



This section discusses entrainment mortality in relation to the abundance and distribution of source water populations.

Highest concentrations of larval gobies occurred in the Inner Lagoon and lowest concentrations in the nearshore zone, forming a gradient of abundance (**Figure 3-7**). Mean densities fluctuated throughout the year according to the peak spawning season with the highest concentrations in summer and lowest in winter. Monthly densities were typically several thousand per 1,000 $m^3$ in the Inner and Middle Lagoons, over 1,000 per 1,000 $m^3$ in the Outer Lagoon, and less than 100 per 1,000 $m^3$ in the nearshore zone. Similar but slightly lower concentrations were measured in the earlier 316(b) study done in 1979 (SDGE 1980), with goby concentrations averaging almost 500 per 1,000 $m^3$ in the lagoon samples and 30 per 1,000 $m^3$ in the nearshore samples. The higher densities in the recent study indicate that the goby population in AHL has probably increased over time and has not been adversely affected by the operation of EPS. The higher densities are noteworthy since infilling of the Middle and Inner Lagoons and development of sandbars at the western edge of the Inner Lagoon (MEC 1995) have contributed to a reduction in total habitat area in recent years.

Adult and juvenile (post-settlement) populations of gobies are concentrated in coastal embayments such as AHL, and in nearby Batiquitos Lagoon, Mission Bay and San Diego Bay. Their larvae are dispersed by tidal flushing and transported in coastal waters by prevailing currents (Horn and Allen 1978, Brothers 1975). In an ecological resource assessment of AHL in 1994–1995 (MEC 1995) gobies were found to be most abundant in the Inner Lagoon with densities in the samples that approached 5/$m^2$ in April 1995. Even though gobies were relatively abundant in the samples, the sampling methods likely underestimated their true densities because of the selectivity of the sampling gear that was biased toward larger specimens. Most of the gobies in the higher density samples were comprised of unidentified juveniles (nearly 90%) although most of these were probably juvenile arrow gobies, which were also the dominant goby species of the larger size classes. Similar sampling in July 1994 yielded substantially lower densities, reflecting the seasonal nature of goby recruitment in the lagoon. Spatially, densities of gobies declined rapidly into the Middle and Outer Lagoon stations as compared to the Inner Lagoon, being approximately 100-fold less abundant near the lagoon mouth.

Adult and juvenile sampling in 2005 (present study) used enclosures to specifically capture cryptic fishes, and the resulting density estimates were greater than those from the earlier sampling using trawls. For example, arrow gobies of all sizes averaged nearly 20/$m^2$ in the Inner and Middle Lagoon shoreline sampling, yielding an estimate of 200,000/ha of this species alone, whereas previous trawling yielded densities of less than 5/$m^2$ for all gobies. With an estimated combined habitat area between the +1 ft and –4 ft MLLW elevations in the Middle and Inner Lagoons of 18.56 ha (based on 1995 bathymetry), the enclosure sampling yielded an extrapolated estimate of 3.8 million gobies in the lagoon. Reproductive individuals would only comprise a fraction of this estimate but would still be capable of producing large numbers of larvae as evidenced by the large entrainment of those larvae.

Other studies have also measured high concentrations of gobies in southern California bays and lagoons. MacDonald (1975) found densities of 4–5/$m^2$ in Anaheim Bay in winter, although concentrations of up to 20/$m^2$ were found in some individual burrows. Restoration efforts and subsequent monitoring in Batiquitos Lagoon 7 km south of AHL from 1997–2001 measured goby densities from 0.3 to 1.6/$m^2$ annually using enclosure sampling devices (Merkel and Associates 2002). Adult densities in the same areas ranged from 0.01 to 0.05/$m^2$ based on data from a large bottom seine, demonstrating the differences in density estimates between sampling methods.

Even with a substantial fraction of the source larval production in AHL cropped by power plant entrainment, the lagoon habitat continues to sustain a thriving population of gobies, as evidenced not only by the large larval concentrations that are over 70 times that of the nearshore source water, but also by a census of the local juvenile and adult population. In a lagoon or bay such as AHL that is significantly affected by tidal exchange, many of the larvae are inevitably lost to the system due to export by outgoing tidal currents. The hydrodynamic study of AHL showed that all of water in the lagoon was turned over within 6.3 tidal cycles or 3.2 days (**Appendix B**), which, in the absence of behavioral mechanisms to allow larval retention, would result in the loss of all of the goby larvae from the lagoon before they developed to the stage when they recruit into their adult habitat after 60 days (Brothers 1975). Fishes and other organisms that inhabit lagoons with strong tidal currents have behavioral adaptations that cause larvae to migrate toward the bottom or move to areas with less current and minimize export (Barlow 1963, Pearcy and Myers 1974, Brothers 1975) or, in larger systems, have mechanisms that allow some larvae to return to the estuary after a period of development in offshore waters. In addition, detailed hydrodynamic modeling of tidal processes indicates that exchange rates can vary considerably within the lagoon (Fischer et al. 1979), especially in the Middle and Inner Lagoon where the majority of the goby habitat is located. Larvae that are transported into coastal waters can provide genetic exchange between estuarine areas along the coast by moving back into bays with incoming tidal currents (Dawson et al. 2002). However, most of these exported larvae experience much higher mortality rates in the open ocean than those that are retained in their natal estuaries. Although the intake and discharge of EPS increases the export rate of larvae from AHL over natural transport, it mainly affects the outer lagoon where larvae are less abundant, and many of these larvae would be lost to the system even under natural conditions.

Demographic-based estimates of projected losses assume that there is available habitat to support the additional production in the source water area, which is not usually the case in the example of substrate-oriented or territorial species like gobies. In contrast, species that live in open water environments, such as anchovies, are generally not limited by habitat availability but by other factors such as food availability, oceanographic conditions, or predation. In AHL where there is a limited amount of benthic habitat, density-dependent mortality may be a substantial factor affecting post-settlement recruits (Brothers 1975). The large decreases in numbers of gobies in 2005 between the spring and late-summer surveys and the increasing mean length in the collected fishes reflects this high mortality rate. Therefore, projections of adult equivalents based on larval entrainment likely overestimate actual adult losses. The limited habitat area in AHL



coupled with the short generation times of gobies (1–3 years) explains why the population densities in AHL are similar to other bays and lagoons in southern California that have no additional mortality from once-through industrial cooling systems. The results indicate that even with the projected loss of nearly 50 percent of the larval source water population due to entrainment there is little measurable effect on the adult population of gobies.

In terms of potential economic losses resulting from CIQ goby entrainment, there are no direct impacts because gobies have no fishery value, except the occasional use of larger specimens as bait by recreational anglers. Larval reductions could have some effect on the trophic structure of the source water through the loss of available forage for predators. However, any potential effects would not be measurable due to the high natural variation in the system and the unknown compensatory response of other species present in the lagoon and nearshore environment.

### *Combtooth Blennies*

Combtooth blennies (*Hypsoblennius* spp.) had an estimated entrainment of approximately one billion larvae annually, with projected adult losses of 1.2 to 2.5 million based on the actual flows during the study period and 1.4 to 2.9 million lost based on the maximum flows. Estimated fractional losses of larvae were approximately 19% of the source population of larvae (**Table 5-3**) and increased to 23% using the design flows (**Table 5-4**). Impingement of combtooth blennies from all sources was negligible. This section discusses entrainment mortality in relation to the abundance and distribution of source water populations.

Adult and juvenile (post-settlement) populations of combtooth blennies are concentrated in coastal areas and harbors that have rock structure (either natural or artificial), pier pilings, or other fouled surfaces that provide protective habitats. The aquaculture floats in outer AHL that are used to culture mussels and oysters provide an extensive potential habitat area for mussel blennies (*H. jenkinsi*) and the rock revetments around the lagoon provide habitat for *H. gilberti* and *H. gentilis*. The kelp forest environment offshore of EPS also provides potential habitat for combtooth blennies. An assessment of ecological resources in AHL in 1994–1995 (MEC 1995) recorded combtooth blennies only as infrequent in trawl samples, but this would be expected because of their cryptic habits and general lack of susceptibility to trawl or seine sampling. The only species captured was bay blenny, which tends to occupy benthic and eelgrass habitats, and the highest densities were in the west Inner and Middle Lagoons ($0.02/m^2$). Special studies completed in spring and summer of 2005 (**Appendix C**) were intended to improve estimates of the local post-settlement population by specifically sampling cryptic habitats, but only a few blenny specimens were recorded during sampling. One factor that may have contributed to the low numbers was a persistent plankton bloom or "red tide" throughout the summer months of 2005 that may have induced widespread mortality by decreasing the oxygen content of the seawater. Qualitative observations have revealed that blennies can be common on both the mussel floats and collector lines in the aquaculture facility, and several adults were collected from the rock rip-rap areas earlier in the season as brood stock for larval survival experiments. These observations, and the fact that blenny larvae were more abundant in the Outer Lagoon

samples than in any other source water areas (**Figure 3-11**), suggests that artificial habitats in the Outer Lagoon can support high densities of adult blennies.

Mean larval densities fluctuated throughout the year according to the peak spawning season with high densities in spring and summer and very few, if any, in winter. Highest densities exceeded 1,000 per 1,000 $m^3$ in the Outer Lagoon. Lower concentrations were measured in the earlier 316(b) study done in 1979 (SDG&E 1980), with averages of 67 per 1,000 $m^3$ in the lagoon samples and 48 per 1,000 $m^3$ in the nearshore samples. The increase in larval production in AHL over this time period may reflect the establishment and expansion of the aquaculture operations that provide additional habitat for these fishes. The comparison with previous study results for blennies contrasts with the results for gobies that showed only slightly increased densities in the recent study. Whereas the habitat for gobies has declined slightly since the previous study, the habitat for blennies has increased significantly due to the placement of artificial habitat in the Outer Lagoon.

Even with a substantial fraction of the source larval production cropped by power plant entrainment, the AHL lagoon habitat continues to sustain a thriving population of combtooth blennies adults as evidenced by the prolific larval concentrations that are over 70 times that of the nearshore source water. As with the gobies, blenny larvae would also be significantly affected by tidal exchange with many of the early larvae lost to the system due to export by outgoing tidal currents. The fact that much of the available blenny habitat in AHL is in the Outer Lagoon in direct proximity to the EPS intake structure means that larvae hatching from the demersal egg masses have a high probability of entrainment. This has resulted in the relatively high $P_M$ estimate of 0.19 for this group of species. The estimated age of the entrained blenny larvae used in the *ETM* calculations, 2.7 d, was much less than the larval duration of 3 months reported by Stephens et al. (1970). This duration is also shorter than the estimated duration of goby larvae, 11.5 d, which were probably transported out of the Middle and Inner Lagoons, and is further evidence that the source of the blenny larvae is the Outer Lagoon.

Similar to the gobies, the demographically-based estimates of projected losses (*FH* and *AEL*) assume that there is available habitat to support additional adult densities in the source water area, which is probably limiting in AHL, even though artificial habitat is present. Therefore, projections of adult equivalents based on the larval entrainment likely overestimate actual adult losses. Blennies also have relatively short generation times of 1–2 years and attain peak reproductive potential in the third year (Stephens 1969) suggesting that adult populations are adapted to recover quickly from environmental perturbations. Since their abundance in AHL is closely associated with the presence of artificial substrates, populations in the natural reef environments of the outer kelp forest likely benefit from established adult populations in AHL with some export occurring naturally out of the lagoon mouth from tidal currents.

In terms of potential economic losses resulting from combtooth blenny entrainment, there are no direct losses because blennies have no fishery value. As with gobies, larval reductions could have some effect on the trophic structure of the source water through the increased loss of

available forage for predators, but any potential effects could not be measured directly due to the high natural variation in the system.

### *Shiner surfperch*

The annual estimated impingement of shiner surfperch (*Cymatogaster aggregata*) under normal operations was 19,303 individuals weighing 197.3 kg (435 lb) based on actual CWS flows (not including bar rack or heat treatment mortality) (**Table 4-3**). The estimated annual impingement abundance using maximum CWS flows was 26,506 individuals weighing 300.1 kg (662 lb). The total annual impingement including normal operations, heat treatments and individuals impinged on the bar racks was 44,867 individuals weighing 496.6 kg (1,095 lb) using maximum flows and 37,664 individuals weighing 393.8 kg (868 lb) using actual flows (**Tables 5-3** and **5-4**). As noted earlier, surfperches are not subject to entrainment because females bear fully developed young.

Shiner surfperch were less abundant in the 1979–1980 impingement study. The estimated annual impingement of shiner perch during normal operations was 7,100 and an average of 1,761 individuals was collected during each of the seven heat treatments (Tables 7.4-3 and 7.12-1 SDG&E 1980). An average of 3,060 shiner surfperch was collected per heat treatment during the 2004–2005 study. Shiner surfperch mainly occur in protected coastal bays and estuaries such as AHL and would be expected to have decreased in abundance over time if EPS impingement was having a significant effect on the populations. The results show increased impingement of shiner surfperch between the 1979–1980 and 2004–2005 studies providing evidence that the AHL population has not been significantly affected by EPS impingement.

Sport fishery catch estimates of shiner surfperch in the southern California region from 1999 to 2003 ranged from 2,000 to 20,000 annually with a mean of 11,000 fish (RecFIN 2005). For 2003, CDFG estimated an average recreational take of 121.6 metric tons of shiners from 1999 to 2001 which is considerably higher than the RecFIN estimates. Shiner surfperch are caught and sold as bait in northern California, but low abundances resulted in more restrictions on the fishery in recent years with no reported catches in 2003 and 2004. Commercial catches of only 96 kg (211 lb) and 279 kg (616 lb) were reported statewide in 2001 and 2002, respectively (source: commercial landings reported at www.dfg.ca.gov/mrd/fishing). An average price per kg of $2.02 for unspecified surfperch from the 2005 PacFIN database was used to estimate that the total cost of the impingement losses was $1,000 using maximum flows and $794 using actual flows (**Table 5-5**).

### *Summary*

The greatest impacts resulting from the EPS CWIS occur to organisms that are primarily associated with bay, harbor, and estuarine habitats. Most of these organisms are affected through entrainment since the juveniles and adults of species such as gobies and blennies occupy habitats within the lagoon where they are less susceptible to the effects of impingement. Although the CWIS affects the larval supply for these species, the results indicate that the limiting factor for these populations is probably the available habitat in AHL since larval abundances appear to have increased since the previous 316(b) study was completed. The habitat is not unique as it

was partially constructed to accommodate the EPS intake. As a result the entrance to AHL is regularly dredged by the plant to maintain open flow with the ocean. This circulation helps maintain the water quality in AHL and may partially explain why the larval concentrations for many of the taxa are similar or have increased since the previous 316(b) study. The habitat within AHL is not unique as there are several similar habitat areas located in close proximity to AHL. These also provide additional sources of larvae for recruitment into the lagoon. These factors all contribute to a low potential for any adverse environmental impacts (AEI) to bay and harbor species.

### 5.3.2.2 Rocky Reef and Kelp Bed Habitats

Physical structure and food resources are essential factors in promoting fish abundance and diversity. Shallow rocky reefs and the giant kelp (*Macrocystis* spp.) forests often associated with them provide both factors. Both occur in the shallow nearshore areas directly offshore from EPS. Artificial structures such as harbor breakwaters in the Outer Lagoon and at Oceanside Harbor, and emplaced artificial fishing reefs north of Oceanside are also significant resources for fishes associated with these habitats. Common species in these assemblages include kelp bass, barred sand bass, black perch, opaleye, halfmoon, California sheephead, señorita, garibaldi, salema and zebraperch (Stephens et al. 2006). Although the presence and extent of giant kelp affects the abundance of some reef fishes, many other factors can also affect their distributions, and it is not unusual to find many of the species characteristic of kelp bed habitats in other shallow water locations. Common species of fishes and target invertebrates that are typically associated with rocky reef habitats and were entrained or impinged at EPS included garibaldi (*Hypsypops rubundicus*), sea basses (*Paralabrax* spp. [includes kelp bass, *P. clathratus*, spotted sand bass, *P. maculatofasciatus*, and barred sand bass, *P. nebulifer*]), silversides (Family Atherinopsidae), California spiny lobster (*Panulirus interruptus*) and octopus (*Octopus* spp.) (**Table 5-1**).

#### *Garibaldi*

Total annual entrainment of garibaldi larvae at EPS was estimated at 29 million larvae using measured cooling water flows and 36 million larvae using maximum cooling water flows for the June 2004 through May 2005 period (**Tables 5-3** and **5-4**). Garibaldi larvae were present in 6 of the 12 entrainment surveys, being absent in samples taken from September through March. No estimates of adult equivalents based on larval entrainment were developed due to the lack of mortality rate information and other life history data necessary for the demographic modeling. However, *ETM* modeling was done based on a comparison of source water and entrainment densities and yielded a $P_M$ estimate of 0.144 (14.4%) using the actual CWS flows and an estimate of 0.176 (17.6%) using the maximum flows. No adult or juvenile garibaldi were impinged during normal pump operations, but five specimens were collected during the intake tunnel heat treatments. The species ranked very low in the 1979–1980 entrainment survey with a mean entrainment density of 0.0015 larvae per 1,000 $m^3$.

Garibaldi are common throughout southern California and are associated with artificial substrates in bays and harbors, and natural rock reefs along the outer coast and islands. As noted

earlier, garibaldi larvae had a relatively high entrainment rate in spring and summer because the adult females deposit their eggs in discrete nests to rock surfaces around the margin of the lagoon. When the eggs hatch the larvae are immediately susceptible to entrainment before they develop a strong ability to swim.

As a protected species under CDFG fishery regulations, there is no take of garibaldi in California. Therefore, it has no direct commercial or recreational fishery value. At small sizes it can function as a minor forage species for some types of larger predatory fishes, and may be consumed by seals at larger sizes. Perhaps its most notable value to humans, and the main reason for its protected status, is its striking bright orange color and obvious visibility that makes it a subject for underwater photography and observation by skin and scuba divers, coupled with its territorial behavior and susceptibility to spearfishing. Garibaldi can normally be seen in spring and summer in shallow rocky areas around harbors and marinas as they guard nesting territories.

The reductions in larval density caused by EPS entrainment losses are difficult to translate into adult equivalents because the population is probably limited to some degree by the availability of suitable nest sites and the territorial nature of the species during breeding season. Quantitative observations of garibaldi in the Outer Lagoon (**Appendix C**) during August 2005 recorded densities of 7 fish per 30 m x 2 m transect along the North Jetty, 2 fish per transect in front of the EPS intake, and 1 per transect along the east channel leading into the Middle Lagoon. Based on the distribution of hard substrate in the lagoon, it would not be an overestimate to conclude that several hundred garibaldi could be present in AHL, especially during the peak of breeding season in June and July. Any reductions in overall abundance of the population as a result of increased larval mortality related to EPS operation would be spread throughout the greater source water body and not localized in AHL. Based on the earlier entrainment study in 1979 when garibaldi larvae were relatively rare in samples, it is evident that the local population has increased considerably and now utilizes the artificial substrate in the lagoon for spawning to a much greater degree than previously. Some of the increase may reflect the long-term protected status of the species from sport or commercial collections in California.

### *Silversides*

Three species of silversides (Atherinopsidae) were impinged during the study: topsmelt, jacksmelt, and California grunion. The annual estimated impingement based on actual CWS flows of all species of silversides (not including bar rack or heat treatment mortality) was 39,113 individuals weighing 274 kg (605 lb) (**Table 4-3**). The estimated annual impingement abundance using maximum CWS flows was 69,853 individuals, weighing 553 kg (1,220 lb). Topsmelt was the most abundant silverside collected in the heat treatments (53.5%), followed by grunion (24.1%) and jacksmelt (15.2%). A total of 29,336 individuals weighing 162 kg (358 lb) was impinged in the heat treatment surveys with the highest abundance and biomass occurring during the October 2004 heat treatment. The total annual impingement including normal operations, heat treatments and bar racks was 68,519 and 449.7 kg (991 lb) using actual flows and 99,259 and 717.3 kg (1,581 lb) using maximum flows (**Tables 5-3** and **5-4**).

Earlier impingement surveys done in 1979 (SDGE 1980) yielded the same relative abundance of topsmelt as in the present study, but grunion were considerably more abundant than jacksmelt compared to the 2004–2005 results (**Table 5-7**). The total impingement of 166 kg was less than the 274 kg estimated during the most recent survey, but silversides are schooling fishes and high variation in their spatial distribution and temporal occurrence would be expected.

Silverside larvae comprised 0.26% of the larvae entrained through EPS annually, which yielded an annual estimate of 7,936,121 larvae based on actual flows and 12,654,500 based on maximum flows (**Tables 5-3** and **5-4**). A detailed analysis of the adult equivalents represented by these larvae, or the proportion of the source water population potentially affected by entrainment was not done because the species was neither abundant enough nor had significant fisheries for consideration. However, topsmelt are multiple spawners and can produce several thousand eggs annually, so the annual larval entrainment would roughly represent the reproductive output of several thousand females.

**Table 5-7.** Summary of impingement results for silversides from normal operations impingement surveys from February 1979 – January 1980 (from SDG&E 1980). Totals for 336 days of sampling were used to compute daily averages that were then used to compute annual impingement totals.

| Species | Abundance | Weight (kg) | Average Daily Abundance | Average Daily Weight (kg) | Annual Estimated Abundance | Annual Estimated Weight (kg) | Percent Composition |
|---|---|---|---|---|---|---|---|
| topsmelt | 10,915 | 112.3 | 32 | 0.33 | 11,857 | 122.0 | 55.9% |
| California grunion | 8,583 | 33.8 | 26 | 0.10 | 9,324 | 36.7 | 43.9% |
| jacksmelt | 40 | 7.0 | 0 | 0.02 | 43 | 7.6 | 0.2% |
| ***Totals*** | | | | | **21,224** | **166.3** | |

A limited fishery exists for silversides, which are marketed fresh for human consumption or used as bait (Leet et al. 2001). Commercial catches of jacksmelt have varied sharply over the past 80 years fluctuating from more than two million pounds in 1945 to 2,530 pounds in 1998 and 1999 (Leet et al. 2001). Silversides are an incidental fishery and the large fluctuations in the catch records reflect demand, not actual abundances (Leet et al. 2001). The commercial catch of grunion is limited as this species forms a minor portion of the commercial "smelt" catch (Leet et al. 2001). In the 1920s, the recreational fishery was showing signs of depletion, and a regulation was passed in 1927 establishing a closed season of three months, April through June. The fishery improved, and in 1947, the closure was shortened to April through May where it presently remains. Both topsmelt and jacksmelt are caught by sportfishers from piers and along shores. Sport fishermen may take grunion by hand only, and no holes may be dug in the beach to entrap them (Leet et al. 2001). Recent catch estimates of silversides by recreational anglers in southern California were 49,000 fish in winter 2005. Catch estimates averaged 267,000 fish from 2000–2004 (RecFin 2005).

From 2001 through 2004 there were no reported landings of silversides from the San Diego area ports (source: commercial landings reported at www.dfg.ca.gov/mrd/fishing). Over the same

period a total of 24,430 kg (53,858 lb) worth $41,944 or $1.72 per kg were landed in Los Angeles area ports. Using the dollar value of $0.55 from the 2004 commercial landings data, the estimated total dollar loss due to impingement of silversides from all sources was $395 using maximum flows and $247 using actual flows(**Table 5-5**). These estimates are very conservative because the calculations assume that the impinged silversides were all fishery-sized individuals. The results showed that only a small number of the impinged silversides were greater than 160 mm (6.3 in).

### *Sand Basses*

Barred sand bass and kelp bass are two of the most important recreationally fished species in southern California (Leet et al. 2001). Barred sand bass catch estimates ranged from 695,000 to 1,130,000 fish annually, with an average of 917,000, while kelp bass catches ranged from 291,000 to 587,000 fish in 2000–2004, with an average of 424,400 fish caught annually (RecFin 2006). Catch estimates of spotted sand bass in the southern California region during the same period ranged from 10,000 to 74,000 fish, with an average of 49,400 fish caught annually. Commercial fishing for sand basses is not allowed in California.

All three species were present in fish samples from AHL (MEC 1995), and fish observations conducted in the Outer Lagoon in 2005 (**Appendix C**) recorded barred sand bass along the North Jetty at densities up to 15 per 60 $m^2$ transect and kelp bass at 9.5 per transect. Most of the individuals recorded in these studies were juveniles or subadults, although sport fishers catch legal-sized adult fishes in the lagoon off the north and west jetties.

Sand bass larvae were scarce in entrainment samples with only 11 larvae (1.86 per 1,000 $m^3$) collected during the year-long study (**Table 3-5**). This, however, yielded an extrapolated entrainment of approximately 2.5 million larvae annually for actual cooling water flow rates. Using maximum design flows, the estimate increased to 2.7 million larvae entrained annually. Nearshore densities were considerable higher at 24.99 per 1,000 $m^3$, indicating that the source water kelp forests and adjacent sand bottom habitats are the preferred spawning habitat for this group. Sand basses are capable of daily spawning during their reproductive season and an average-sized female can release well over 100,000 eggs (Oda et al. 1993). Because of their relatively low larval entrainment rate compared to other taxa, a detailed analysis of entrainment effects was not done for this taxon.

All three species, primarily juveniles, were impinged during normal flow conditions and heat treatment operations. A total of 567 sand bass with a combined weight of 6.8 kg (15.0 lb) was collected during the weekly impingement surveys (**Table 4-2**). Of these, 303 were spotted, 151 were barred, 111 were kelp, and 2 could not be identified to the species level and were recorded as *Paralabrax* spp. Sand basses were impinged throughout the year, but the peak abundance was in January and February. Most were collected during heat treatments, with a total of 4,511 individuals weighing 153.6 kg (338.6 lb) (**Table 4-2**). Of these fish, 1,536 were spotted, 1,993 were barred, 976 were kelp, and 6 could only be identified to *Paralabrax* spp. Lengths ranged from 28 to 358 mm SL (1.1 to 14.1 in SL), with a mean length of 81.3 mm SL (3.2 in).



The estimated annual impingement of sand bass under normal operations using actual CWS flows was 3,477 individuals, weighing 45.2 kg (99.6 lb) (**Table 4-3**). Under maximum CWS flow rates the estimate increased to 7,274 individuals weighing 85.8 kg (189.2 lb) (**Table 4-3**). When all sources of impingement mortality are combined, the annual impingement of sand basses under actual CWS flows and heat treatments was estimated at 7,987 individuals weighing 198.8 kg (438.3 lb) (**Table 5-3**) for an average weight per fish of approximately 25 g (.05 lb). The mean length of sand basses impinged during normal operations was 81 mm (3.2 in). Using the maximum flows, the estimated impingement increased to 11,795 individuals weighing 239.4 kg (528 lb) (**Table 5-4**).

Sand basses were less abundant in the 1979–1980 impingement study (SDG&E 1980) during heat treatment surveys with an average of 243 fishes per survey compared with 751 fishes per survey in the 2004–2005 study (**Table 5-8**). Although large variations in abundance among years would be expected in AHL for fishes that mainly utilize the area as juveniles, there has also been a generally increasing trend in the recreational fishery coastwide since the 1970s, especially for barred and spotted sand bass (Leet et al. 2001).

Although substantial numbers of sand basses are impinged annually during EPS operations most of these are juveniles less than 1 year old. In terms of potential impacts to local fisheries, few of these juveniles would survive to retainable fishery size (12 in TL under present CDFG regulations) which are at least 5–6 yr old (Young 1963). Therefore, the combination of entrainment and impingement is unlikely to produce any measurable impacts on populations of sand basses in the vicinity. Because commercial fishing for this group of fishes has been illegal in California since 1953, the dollar value of the estimated impingement losses was not calculated.

**Table 5-8**. Summary of impingement results for sand basses from normal operations impingement surveys from February 1979 – January 1980. Totals for 336 days of sampling were used to compute daily averages that were then used to compute annual impingement totals. From Tables 7.4-3 and 7.4-6 (SDG&E 1980).

| Species | Abundance | Weight (kg) | Average Daily Abundance | Average Daily Weight (kg) | Annual Estimated Abundance | Annual Estimated Weight (kg) | Percent Composition |
|---|---|---|---|---|---|---|---|
| barred sand bass | 189 | 15.3 | 0.56 | 0.05 | 205 | 16.6 | 63.9% |
| spotted sand bass | 73 | 10.9 | 0.22 | 0.03 | 79 | 11.8 | 24.7% |
| kelp bass | 34 | 0.5 | 0.10 | 0.00 | 37 | 0.5 | 11.5% |
| **Totals** | | | | | **322** | **29.0** | |

### *Walleye surfperch*

The estimated annual impingement abundance of walleye surfperch (*Hyperprosopon argenteum*) under normal operations was 3,032 individuals weighing 123.0 kg (271.2 lb) based on actual

CWS flows (**Table 4-3**). Using maximum CWS flows the estimate increased to 6,623 individuals weighing 276.9 kg (610.6 lb). The estimated annual impingement from all sources based on actual CWS flows was 5,586 individuals weighing 248.5 kg (547.8 lb) (**Table 5-3**). Under maximum flows the annual estimate of total impingement increased to 9,177 individuals with a combined weight of 402.5 kg (887.4 lb) (**Table 5-4**). Surfperches are not subject to entrainment because females bear fully-developed young.

Walleye surfperch was the eighth most abundant fish collected during normal operations impingement surveys during the 1979–1980 study with a total estimated annual impingement of 2,039 individuals (Table 7.4-3 in SDG&E 1980). It was the sixth most abundant species during heat treatment surveys with an average of 1,186 individuals per survey (Table 7.12-1 in SDG&E 1980). Although their total abundance during normal impingement surveys was greater during the 2004–2005 study, they were less abundant during heat treatment surveys with an average abundance of only 425 individuals (**Table 4-2**).

No commercial fishery for walleye surfperch exists in the San Diego area (PacFIN), but they are fished recreationally. Sport fishery catch estimates in the southern California region from 1999 to 2003 ranged from 15,000–107,000 annually with a mean of 59,600 fish (RecFIN 2005). CDFG (2001) noted that the sport fishery has recently averaged 112,000 fish per year in all of California, which agrees with estimates from RecFIN (2005) of about 110,750 fish per year from 1995–2002 for all of California. Reported commercial landings of walleye surfperch from 2001 through 2004 were very low and almost exclusively from northern California ports (source: commercial landings reported at www.dfg.ca.gov/mrd/fishing). An average price per kg of $2.02 for unspecified surfperch from the 2005 PacFIN database was used to estimate that the total cost of the impingement losses under actual flows was $501 and under maximum flows was $813 (**Tables 5-5** and **5-6**).

### *California spiny lobster*

Impingement of California spiny lobster (*Panulirus interruptus*) at EPS was very low during the study, and no larvae were collected in the entrainment samples. Two spiny lobsters, with a combined weight of 0.1 kg (0.22 lb), were impinged during normal operations surveys and nine lobsters weighing a total of 1.2 kg (2.6 lb) were impinged in the heat treatment surveys (**Table 4-5**). Their body lengths ranged from 21 to 211 mm TL (0.83 to 8.31 in TL) with a mean length of 162.3 mm TL (6.4 in). When all sources of loss due to the operation of the EPS CWS were combined (normal operations, bar racks and heat treatment), the annual loss based on actual CWS flow was 22 individuals weighing 1.9 kg (4.1 lb.) and 25 individuals weighing of 2.0 kg (4.3 lb) based on maximum CWS flows (**Table 5-3** and **5-4**).

Spiny lobsters have been commercially fished in southern California since the 1800s and San Diego County is located in the central portion of the spiny lobster range where up to 60% of California landings occur. The average annual landings from San Diego County in 2000–2005 were 112,243 kg (247,450 lb) with an average annual value of $1,667,371 (PacFIN) and the 2005 catches were 111.4 MT valued at $1.81 million. Estimated annual landings of spiny lobster



for all of California from 2000–2005 averaged 338,779 kg (746,867 lb) (PacFIN database). There is also a substantial sport fishery. Lobsters are taken by skin divers and scuba divers, as well as with baited hoop nets. It is estimated that annual sport take is equal to half of the commercial catch (Frey 1971). Based on the proportion of short and legal lobsters taken, CDFG believes that the lobster population in California is well-managed and in a healthy status.

Despite EPS being adjacent to a nearshore kelp forest area where spiny lobsters are abundant, the impact of the EPS CWS on this species is minimal. The total impingement biomass of spiny lobsters from all sources was equivalent to only a few legal-sized individuals. Total estimated losses during actual flow were valued at $30 based on 2005 prices or $32 using the maximum flows (**Table 5-5**). Although juvenile lobsters occur in the Outer Lagoon along the rip-rap structure around the lagoon margin, the population is mainly concentrated in deeper nearshore areas where they are not affected by impingement or entrainment.

### *Two-spotted Octopus*

The estimated annual impingement abundance of two-spotted octopus (*Octopus bimaculatus / O. bimaculoides*) under normal operations was 330 individuals weighing 26.1 kg (58 lb) based on actual CWS flows (**Table 4-6**). The estimated annual impingement from all sources based on actual CWS flows was 497 individuals weighing 69.5 kg (153 lb) (**Table 5-3**). Under maximum flows the annual estimate of total impingement increased to 834 weighing 130.4 kg (287 lb) (**Table 5-4**). No octopus larvae were collected during entrainment surveys.

The total dollar value of the impingement losses was very low. The reported commercial catch from Los Angeles and San Diego area ports of octopus from 2002 through 2004 totaled 1,791 kg (3,948 lb) worth $4,870 (source: commercial landings reported at www.dfg.ca.gov/mrd/fishing). A 2005 catch of 0.1 MT in the San Diego region was valued at $339 (PacFIN). This value per kg resulted in total estimated CWS losses from the 2004–2005 study of $235 to $442 (**Table 5-5**).

### *Summary*

Species that inhabit rocky reef and kelp habitats are directly affected by the EPS CWIS due to the rocky habitat surrounding the Outer Lagoon. Other similar habitats occur in the shallow nearshore areas near the plant and at other sites with rock jetties such as Oceanside Harbor. Recruitment from these other areas probably helps maintain the populations of these species since their abundances have increased or remained similar to abundances measured during the previous 316(b) study for the species included in the assessment. Garibaldi appear to have increased in abundance over time and are more likely to be limited by available habitat than larval supply since the adults are highly territorial (Clarke 1970). The annual losses due to entrainment and impingement of species associated with rock reefs and kelp habitats were low in comparison to the fishery take for these species. The results and comparisons with the previous study indicate a low potential for any adverse environmental impacts (AEI) to rocky reef and kelp bed species.

### 5.3.2.3 Coastal Pelagic Habitats

The most extensive type of nearshore habitat outside AHL is coastal pelagic habitat, which in the expanded definition used for this assessment also includes the surfzone and nearshore soft bottom habitats. Most of the shallow water areas around AHL are sand bottom with relatively few hard bottom relief features. This is the main habitat type in close proximity to the entrance to AHL and as a result many of the species entrained or impinged are characteristic of the coastal pelagic zone. These mainly included northern anchovy, Pacific sardine, white croaker, queenfish, white seabass, and market squid. Some of these species, such as northern anchovy and white croaker, can be considered habitat generalists because they are also be found in bays and a variety of other shallow water locations (Allen and Pondella 2006). Juveniles of most of these species also tend to be abundant in the shallower depths of the habitat range as demonstrated by the small size distributions collected from impingement data.

#### *Anchovies*

Three species of anchovy (Family Engraulidae) are known to inhabit AHL and the nearshore areas around the EPS: northern anchovy (*Engraulis mordax*), deepbody anchovy (*Anchoa compressa*) and slough anchovy (*Anchoa delicatissima*). Entrainment effects were largely restricted to northern anchovy because all of the Engraulid larvae collected that were large enough to be positively identified were northern anchovies. Almost half of the larval anchovy specimens could only be identified to the family level (Engraulidae) because many were still in their recently-hatched yolk-sac stage and some were damaged to an extent that did not allow positive identification to the species level. No *Anchoa* larvae of any size were positively identified in the entrainment samples although adult deepbody anchovy were very common in the EPS impingement samples. All three species of anchovies were collected in the impingement samples during normal operations and heat treatments.

Engraulid larvae (predominantly northern anchovy) were the third most abundant taxon at the entrainment station with a mean concentration of 134 per 1,000 $m^3$ over all the surveys (**Table 3-5**). Their abundance was highly seasonal with over 90% of the larvae in the entrainment samples occurring from March through May. There was a broader temporal distribution of the larvae in the monthly source water samples although peak abundances still tended to occur in March–May with the lowest abundances occurring in December. The nearshore station group generally had higher concentrations of anchovy larvae than the lagoon stations. The earlier study at EPS in 1979 (SDG&E 1980) recorded Engraulid larval densities of approximately 86 per 1,000 $m^3$ in the entrainment samples, which was about 2/3 of the density found during the 2004–2005 sampling.

Total annual entrainment at EPS for the June 2004 through May 2005 period was estimated at 120.7 million using actual cooling water flows and 157.0 million larvae using maximum cooling water flows. The projected adult losses were 6,000 to 15,000 annually as a result of entrainment mortality under actual operating flows, and estimated fractional losses of larvae of approximately 0.4% of the source population (**Table 5-3**). Projected adult losses increased to 8,000 to 20,000

annually with estimated fractional losses of larvae at 0.5% of the population using the design flows (**Table 5-4**).

Impingement mortality from all sources was about eight times greater than the estimated entrainment mortality for anchovies of all species, including deepbody and slough anchovies, amounting to over 46,000 individuals and 355 kg (783 lb) annually using actual flows, and 60,401 individuals weighing 431 kg (951 lb) using maximum flows (**Tables 5-3** and **5-4**). The annual estimated impingement under normal operations based on actual CWS flows of all species of anchovies (not including bar rack or heat treatment mortality) was calculated as 22,832 individuals weighing 100.1 kg (220.7 lb) (**Table 4-3**). The estimate increased to 36,932 individuals weighing 176.5 kg (389 lb) when they were calculated using maximum CWS flows (**Table 4-4**).

Anchovies were less abundant in the 1979–1980 impingement study than in the 2004–2005 sampling (**Table 5-9**). Deepbody anchovy was the most abundant species in both studies but slough anchovies made up a larger portion of the total catch of anchovies in the 2004–2005 study (21%). The total annual impingement estimates (actual CWS flows) of deepbody anchovy during normal operations from both studies were remarkably similar (14,447 and 13,915 from **Table 4-3**). Both deepbody and slough anchovies are resident in AHL and would be expected to decrease if EPS impingement was having a significant cumulative effect on the populations over time. Northern anchovy move into coastal estuaries and embayments as juveniles but primarily inhabit open coastal waters from the surface to depths of 310 m (1,017 ft) (Davies and Bradley 1972). As the result, their abundances can show considerable variation from year-to-year as is shown in the estimates from the two studies.

**Table 5-9**. Summary of impingement results for anchovies from normal operations impingement surveys from February 1979 – January 1980. Totals for 336 days of sampling were used to compute daily averages that were then used to compute annual impingement totals. From Tables 7.4-3 and 7.4-6 in SDG&E (1980).

| Species | Abundance | Weight (kg) | Average Daily Abundance | Average Daily Weight (kg) | Annual Estimated Abundance | Annual Estimated Weight (kg) | Percent Composition |
|---|---|---|---|---|---|---|---|
| deepbody anchovy | 13,299 | 64.3 | 40 | 0.19 | 14,447 | 69.8 | 59.1% |
| slough anchovy | 1,758 | 4.1 | 5 | 0.01 | 1,910 | 4.5 | 7.8% |
| northern anchovy | 7,434 | 14.6 | 22 | 0.04 | 8,076 | 15.9 | 33.1% |
| **Totals** | | | | | **24,432** | **90.2** | |

From the standpoint of a direct economic impact, anchovy losses from impingement and entrainment at EPS comprises an insignificant loss in comparison to the overall population size of these species. Northern anchovy are fished commercially for reduction (e.g., fish meal, oil, and paste) but the live or frozen bait market is the primary target of the nearshore fishery. Along with Pacific sardine it is the most important bait fish in southern California, and is usually collected in open-water purse seines. Slough and deepbody anchovy are not typically harvested

because their occurrence in shallow bay environments makes them difficult to capture commercially. Total anchovy harvest and exploitation rates have been below theoretical levels for maximum sustainable yield, and the stock is thought to be relatively stable (Bergen and Jacobsen 2001). The size and fluctuations of the anchovy resource is largely dependent on natural influences such as ocean temperature and current patterns. Live bait catches are monitored by the California Department of Fish and Game (CDFG), but the nature of the mixed species composition between anchovy and sardine, and the conversion of recorded "scoops" of bait to pounds landed present some problems in tracking the fishery (PMFC 2005). There have not been any landings of northern anchovy in San Diego County recorded in the PacFIN database since 1996 when 144,242 kg (318,000 lb) were landed, although CDFG retains records of bait catches during this period. In 2004, there were 147,417 kg (325,000 lb) landed in the Los Angeles area, 2,753,000 kg (6.07 million pounds) in the Santa Barbara area, and 3,892,000 kg (8.58 million pounds) in the Monterey area for a total value of $750,000 (approximately $0.05 per pound). Based on these values the direct value of EPS impingement losses of northern anchovy total $39 to $47 using actual and maximum flows, respectively. Anchovies are sold as live bait at a considerably higher price than frozen or reduced product, but even at these higher rates ($0.48 per kg) the total losses from projected entrainment or impingement would not exceed several hundred dollars (**Table 5-5**).

Anchovy are an important forage species for predatory fishes (white seabass, sand basses) and seabirds (brown pelicans and various species of terns including the endangered least tern). Any indirect impacts of losses of potential forage species would be difficult to measure although the $P_M$ values from the ETM calculations suggest that impacts to the source water larvae amount to about 0.4% of the local nearshore northern anchovy population and would be significantly less based on the actual distribution of this species which can extend offshore and along the entire coast of California.

### *White croaker*

White croaker was the fifteenth most abundant taxon in the entrainment samples with a mean concentration of 7.0 larvae per 1,000 $m^3$, and comprised only about 0.2% of all of the larvae collected at the entrainment station (**Table 3-5**). Total annual entrainment was estimated at 6.92 million using measured cooling water flows and 9.47 million larvae using maximum cooling water flows (**Tables 5-3** and **5-4**). No age-specific estimates of survival for later stages of development were available from the literature for white croaker, therefore no estimates of *FH* or *AEL* were calculated. White croaker larvae were present in the source water during all of the surveys but were only present during eight of the entrainment surveys. They are known to occur more frequently in nearshore and shelf areas of the SCB than in shallow bays or lagoons and their larval distributions near EPS reflected this difference. When the *ETM* model was applied to the sampling results for this species, the monthly estimates of proportional entrainment (*PE*) for the June 2004 – May 2005 period ranged from 0 to 0.00072, with a $P_M$ estimate of 0.0029 (0.29%). Using the maximum flows, *PE* estimates ranged from 0 to 0.00084 and the $P_M$ estimate increased to 0.0039 (0.39%). Very few white croaker were impinged during either the heat treatments or normal operations and the resulting estimate for annual impingement was 86

individuals using the actual flows and increased to 113 individuals using the maximum flows (**Table 4-2**).

Impacts to white croaker and queenfish at San Onofre Nuclear Generating Station (SONGS), 32 km (20 mi) northwest of EPS, were reviewed by EPA (2004b) and were substantially greater than impacts measured at EPS in the present study, This was due to the offshore intake location and greater cooling water volume at SONGS. In a normal (non-El Niño) year, an estimated 57 tons of fish of all species were killed per year through impingement when all units were in operation (Murdoch et al. 1989b). Unit 1, which accounted for about 20% of total losses, was taken out of operation in November 2002. The estimates included approximately 350,000 juvenile white croaker, which represents approximately 33,000 adults weighing 3.5 tons. Within 3 km of SONGS, the density of queenfish and white croaker in shallow-water samples decreased by 34% and 36%, respectively comparing before and during power plant operation. Queenfish declined by 50–70% in deepwater samples. In contrast, relative abundances of bottom-dwelling adult queenfish and white croaker increased in the vicinity of SONGS. Increased numbers of these and other bottom-dwelling species were believed to be related to the SONGS discharges which result in increased circulation including nutrients, which in turn may support elevated numbers of prey items for bottom fish.

White croaker is an important constituent of sport fisheries in California and is also caught commercially. Most white croaker are caught by gillnet and hook-and-line (Moore and Wild 2001). Since 1991, commercial landings averaged 461,000 lb statewide but steadily declined to a low of 142,500 lb in 1998. In 2005 there was a reported 0.33 MT landed in San Diego County for a value of $1,022 (PacFIN database). State-wide landings by recreational fishermen aboard commercial passenger fishing vessels (CPFVs) averaged about 12,000 fish per year from 1990 to 1998, with most of the catch from southern California. The recreational fishery in southern California from 2000 to 2005 had landings in the range of 20-40 MT per year (RecFIN data). Using the dollar value of $3.13 from the 2005 commercial landings data, the estimated total dollar loss due to impingement of white croaker from all sources was less than $5 using the maximum flows or the actual flows (**Table 5-5**).

Based on the estimates of entrainment and impingement losses it is unlikely that EPS had any effect on the source water population of white croaker.

### *Queenfish*

Total annual entrainment of queenfish at EPS was estimated at 6.7 million larvae using measured cooling water flows and at 7.5 million larvae using maximum cooling water flows (**Tables 5-3** and **5-4**). It was the sixteenth most abundant taxon collected from the entrainment station with an average annual density of 5.5 larvae per 1,000 $m^3$. They comprised 0.14% of the larvae collected at the entrainment station and 2.18% of the nearshore source water larvae. There was insufficient life history information available to develop equivalent adult loss estimates from the larval entrainment data. Queenfish larvae were collected from entrainment samples from four of the entrainment surveys and from seven of the source water surveys. A $P_M$ estimate of 0.009

indicated that, overall, approximately 1% of the source water larval population of queenfish was lost due to entrainment through EPS. Using the maximum flows, *PE* estimates ranged from 0.00608 and the $P_M$ estimate increased to 0.010.

Queenfish was the fourth most abundant species of fish impinged during the study with the seventh highest biomass of all fish species collected. The estimated annual impingement of queenfish from all sources based on actual CWS flows was 9,479 individuals weighing 70.4 kg (155.2 lb) (**Table 5-3**). Under maximum CWS flows, the estimated impingement mortality from all sources was 12,511 individuals having a combined weight of 89.7 kg (197.8 lb) (**Table 5-4**). A total of 1,304 queenfish weighing 7.5 kg (16.5 lb) was collected in the normal impingement sampling at EPS, with 2 additional fish collected from the bar racks (**Table 4-2**). A total of 929 individuals weighing 21.4 kg (47.2 lb) was collected during heat treatments. Queenfish was the most abundant fish collected during normal operations surveys during the 1979–1980 impingement study (SDGE 1980). The estimated annual impingement during that study was 18,784 and an average of 498 individuals were collected during each of the seven heat treatments. The levels of impingement measured during the 2004-2005 study were less than the levels measured during the 1979–1980.

Queenfish was the most abundant croaker impinged at five southern California generating stations from 1977 to 1998, and accounted for over 60% of the total fishes impinged (Herbinson et al. 2001). Annual abundance fluctuated from year to year, with notable declines during the strong El Niño events of 1982–83, 1986–87, and 1997–98. However, abundances remained relatively high over the 22-year study period. Queenfish was also one of the three most abundant species of soft-bottom associated fishes in southern California, along with white croaker and northern anchovy, during a 1982–1984 trawl study (Love et al. 1986). They typically occur at depths of 10–70 m (33–230 ft), with highest abundance occurring at the 10 m stratum (Allen 1982). Adult queenfish may move close to shore during the day, and disperse to feed in midwater after sunset (Hobson and Chess 1976), but immature fish generally remained within 2.5 km (1.5 miles) of shore at night (DeMartini et al. 1985). Their abundance in AHL depends on many factors and would be expected to show considerable variation from year-to-year and also over shorter time periods. The results from the study in 1994–1995 showed low densities of adult queenfish present during the July 1994 survey and no fishes in the April 1995 surveys (MEC 1995). This difference in the results for the two impingement studies may reflect the high variation in abundance for this species but also declines in abundance throughout the bight associated with increased ocean temperatures.

There are both recreational and commercial fisheries for queenfish. Recreational fishers landed an average of 311,000 queenfish per year from 2000 through 2004, with the greatest estimated landings of 942,000 (40 metric tons) occurring in 1992 (RecFIN database). From 2001 through 2004 most of the statewide reported landings for queenfish were from Los Angeles and San Diego area ports (source: commercial landings reported at www.dfg.ca.gov/mrd/fishing). Over this period a total of 5,594 kg (12,333 lb) worth $9,992 or $1.79 per kg were landed statewide. This dollar value was used to estimate the total dollar loss due to impingement of queenfish from



all sources at $126 using actual flows and $160 using maximum flows (**Table 5-5**). These estimates are very conservative because the calculations assume that the impinged queenfish were all fishery-sized individuals. The results showed that only a small number of the impinged queenfish were greater than 150 mm (5.9 in) (**Figure 4-24**). Combining the projected loss estimates from the entrainment and impingement analyses, it is apparent that mortality from EPS has an insignificant effect on the queenfish population in comparison to the bight-wide distribution and annual fishery for this species.

### *Pacific sardine*

The estimated annual entrainment of Pacific sardine (*Sardinops sagax*) was 2,484,208 larvae based on actual CWS flows and 3,394,522 larvae using maximum CWS flows (**Tables 5-3** and **5-4**). No analysis was done to convert these larval numbers into equivalent adults because of the relatively low numbers entrained. The estimated annual impingement abundance under normal operations at EPS was 1,735 individuals weighing 9.1 kg (20.1 lb) based on actual CWS flows and 2,344 individuals weighing 13.9 kg (30.6 lb) using maximum CWS flows (**Table 4-3**). The estimated annual impingement from all sources based on actual CWS flows was 8,313 individuals weighing 35.4 kg (78.0 lb) (**Table 5-3**). Under maximum flows the annual estimate of total impingement increased to 8,922 individuals weighing 40.2 kg (88.6lb) (**Table 5-4**). Approximately 90% of the Pacific sardines impinged during normal operations surveys were less that 100 mm (4 in) and generally less than one year old.

Pacific sardine was not collected during the previous impingement or entrainment surveys at EPS in 1979. A sharp decline of the Pacific sardine population in the mid-1940's due to a combination of overfishing and changing oceanographic conditions led to the demise of one of the world's largest commercial fisheries and resulted in the establishment of the California Cooperative Oceanic Fisheries Investigations (CalCOFI) program in 1947 (Moser 1996). In 1999, CDFG declared that the Pacific sardine resource had fully recovered. Sport fishery catch estimates for Pacific sardine for southern California was 452,000 fish in 2003 and 808,000 fish in 2004 (RecFin 2005). In addition, smaller individuals are caught by purse seine in mixed schools with northern anchovies and sold as live bait. From 2001 through 2004 a total of 128,191 metric tons (141,306 tons) were landed in the ports of Los Angeles and San Diego with a total value of $12,600,000 (source: commercial landings reported at www.dfg.ca.gov/mrd/fishing). Records from the CDFG commercial fishery database (CDFG 2005) indicate that in 2004 there were 44.5 MT of sardine landed in the San Diego Region (primarily at the port of Oceanside) with an ex-vessel value of $26,428. Based on these values a conservative estimate of the cost of the impingement losses of Pacific sardine was only $21 using the actual flows or $24 using the maximum flows, assuming all of the fishes were of commercial size (**Table 5-5**). If losses are based on the price paid for live bait then the costs would be proportionately higher, but still insignificant.

### *White seabass*

The estimated annual impingement abundance of white seabass (*Atractoscion nobilis*) under normal operations was 442 individuals weighing 70.0 kg (154.2 lb) based on the actual CWS

flows (**Table 4-3**). Using maximum CWS flows the estimate increased to 724 individuals weighing 120.0 kg (264.6 lb). The estimated annual impingement from all sources based on actual CWS flows was 2,102 individuals weighing 408.1 kg (899.7 lb) (**Table 5-3**). Under maximum flows the annual estimate of total impingement increased to 2,384 individuals weighing 458.1 kg (1,010 lb) (**Table 5-4**). There were no white seabass larvae collected in the entrainment samples.

White seabass was much less abundant in the 1979–1980 impingement study with an annual estimate of only 27 fishes during normal operations and 13 fishes during all seven heat treatments (SDG&E 1980). Data from impingement studies at other southern California power plants show that populations of white seabass have been low since 1977 but declined dramatically from 1980 to 1982 and have never recovered to previous levels (Herbinson et al. 2001). Declining stocks of white seabass due to overfishing has led to the development of a hatchery release program to replenish stocks of this valuable sport species. A hatchery operated by the Hubbs-SeaWorld Research Institute (HSWRI) is located on the northern shoreline of the Outer Lagoon and has contributed to increases in commercial and recreational catches of white seabass in the SCB since 1999.

The HSWRI releases a portion of their hatchery-raised white seabass juveniles into AHL several times throughout the year. A comparison of release dates and EPS heat treatment dates showed a positive correlation between numbers of hatchery releases and heat treatment impingement of white seabass (**Table 5-10**). A total of 1,375 white seabass (85% of fish collected in all heat treatment surveys combined) were collected during heat treatment survey 4 on February 13, 2005. In the 30 days prior to this survey over 31,000 white seabass were released into the lagoon. For the period January 14 through February 4, 2005, the estimated average weight of the released fish was 134.9 grams, while the average weight in heat treatment survey 4 was 210.3 grams. The release date closest to this survey was February 4, when 6,312 white seabass were released with an estimated average weight of 103.5 grams. Sonic tag tracking of these fish has shown that many will stay in the lagoon for several months before moving into the open ocean (D. Jirsa, HSWRI, personal communication). As a result of these observations, EPS plant and HSWRI staff will coordinate future heat treatments and hatchery releases to ensure that impingement is minimized.

Sport fishery catch estimates of white seabass in the southern California region from 1995 to 2004 ranged from 3,000 to 29,000 fish annually with a mean of 16,182 fish (RecFIN 2005). Reported commercial catch from Los Angeles and San Diego area ports from 2001 through 2004 totaled 302,429 kg (666,741 lb) worth $1,170,808 (source: commercial landings reported at www.dfg.ca.gov/mrd/fishing). The PacFIN database from San Diego County listed a 2005 catch of 26.8 MT valued at $140,612. Based on these values a conservative estimate of the cost of the impingement losses of white seabass range from $2,141 to $2,404 depending on plant flows (**Table 5-5**).

**Table 5-10.** Comparison of the number of white seabass impinged during EPS heat treatment surveys and white seabass released 30 days prior to the surveys in the Agua Hedionda Outer Lagoon by Hubbs-SeaWorld Research Institute.

| Heat Treatment Survey | Date | White seabass impinged | | # Releases 30 days prior | White seabass released | |
|---|---|---|---|---|---|---|
| | | # Fish | Weight (g) | | # Fish | Weight (g) |
| 1 | Jul 3, 2004 | 75 | 213.9 | 2 | 1,052 | 177.6 |
| 2 | Aug 28,2004 | 64 | 116.0 | 1 | 1,537 | 99.0 |
| 3 | Oct 23, 2004 | 100 | 180.7 | 2 | 6,019 | 398.1 |
| 4 | Feb 13, 2005 | 1,375 | 210.3 | 9 | 31,056 | 1214.3 |
| 5 | Apr 10, 2005 | 3 | 336.8 | 0 | 0 | 0 |
| 6 | Jun 5, 2005 | 1 | 344.8 | 1 | 504 | 73.9 |

### *Market Squid*

The estimated annual impingement of market squid (*Loligo opalescens*) under normal operations and actual CWS flows was 162 individuals weighing 1.8 kg (4.0 lb) (**Table 4-6**). Under maximum CWS flows the estimate was 190 individuals weighing 2.2 kg (4.9 lb). In comparison, an estimated annual total of 13,909 market squid weighing 13.9 kg (31 lb) were collected during the 1979–1980 impingement study (SDG&E 1980). Impingement of market squid was lower during heat treatment surveys in both studies with no squid being collected in the 2004–2005 study and only 99 market squid collected during all seven heat treatment surveys in the 1979–1980 study.

No market squid paralarvae were collected during entrainment sampling. Market squid hatch from egg masses as small squid with strong swimming abilities that would typically enable them to avoid entrainment.

The total dollar value of the impingement losses was very low. The reported commercial catch from Los Angeles and San Diego area ports of market squid from 2002 through 2004 totaled 46,372,810 kg (102,234,560 lb) worth $15,705,111 (source: commercial landings reported at www.dfg.ca.gov/mrd/fishing), resulting in total estimated CWS losses from the 2004–2005 study of just over one dollar (**Table 5-5**).

### *Summary*

In summary, the coastal pelagic habitat is extensive within the southern California bight, and most of the common fish species that are part of this assemblage have wide-ranging distributions. Commercial or sport fisheries target many of these species and their populations are generally sensitive to large-scale oceanographic influences. The largest effect of the EPS CWIS on species in this particular marine habitat type occurs as a result of the white seabass hatchery in AHL. Coordinating the releases of the juvenile fish with heat treatments operations at the plant should eliminate this source of mortality. Impacts to other species would be expected to

be low since they are not resident in AHL and have distributions that extend far beyond the limits of the source water used in estimating entrainment losses.

### 5.3.2.4 Shelf Habitats

Shelf habitats include several different habitats from Allen and Pondella (2006) including inner, middle, and outer shelf, and shallow slope habitats. The abundance, biomass, and other population attributes of the fish assemblages in these habitats increase from the inner to outer shelf (Allen 2006). Allen attributed this gradient to the increased variability in ocean conditions on the inner shelf due to runoff, pollution, and a variety of other factors. A variety of flatfishes and other species dominate the fish assemblages on the soft mud and sandy bottoms in these habitats. Fishes characteristic of the inner and middle shelf include white croaker, California halibut, bay goby, California tonguefish, bigmouth sole, hornyhead turbot, and California skate (Allen and Pondella 2006). Fishes characteristic of the outer shelf and slope include plainfin midshipman, Pacific sanddab, pink seaperch, curlfin turbot, Dover sole, longspine thornyhead, and California rattail (Allen and Pondella 2006).

The fishes from these habitats support a variety of commercially and recreationally important fishery species including rock and Dungeness crab fisheries. The species caught by commercial fisheries in these habitats are broadly categorized as groundfish and are jointly managed by the California Department of Fish and Game (CDFG), and the Pacific Fishery Management Council (PFMC) and NOAA Fisheries. Two periods of rapid growth in groundfish landings have been identified (Mason 2004). The first period was during the early 1940s when demand due to World War II led to increased landings with Dover sole as the most abundant component of the catch. The second period of increase occurred in the 1970s leading to the largest groundfish landing on record in the late 1970s and early 1980s with rockfishes, Dover sole, and sablefish being the largest components of the catch. Through the 1990s there was a general decline in landings. Mason (2004) identified market demand, variability in ocean conditions, and effects of exploitation as the three primary factors contributing to the changes in groundfish landings.

#### *Spotfin Croaker*

Spotfin croaker was selected for specific analysis because it is a recreationally fished species that was entrained and impinged at EPS, although in relatively low abundances. Spotfin croaker larvae had the thirteenth highest mean density of all taxa collected in the entrainment samples for the period of June 2004 through May 2005 with a mean density of 8.3 larvae per 1,000 $m^3$ (264,172 gal) (**Table 3-5**). It was more abundant in the source water samples with a concentration of 20.2 larvae per 1,000 $m^3$ and occurred almost exclusively in summer and early fall surveys being mostly absent during other times of the year (**Table 3-7**). Total annual entrainment at EPS was estimated at 9.5 million using measured cooling water flows and 10.7 million using maximum cooling water flows (**Tables 5-3** and **5-4**). There was insufficient life history information available to develop *AEL* estimates from the larval entrainment data, but the *ETM* modeling was used to estimate that 0.016, or slightly less than 2% of the source population

was lost due to entrainment, which increased to 0.018 using maximum design flows (**Tables 5-3** and **5-4**).

A total of 182 spotfin croaker weighing 8.4 kg (18.5 lb) were collected in the normal impingement sampling at EPS, with an additional 2 specimens collected from the bar racks (**Table 4-2**). It was the fourteenth most abundant taxa impinged during the yearlong survey and ranked eleventh in total biomass of all species collected. A total of 106 individuals weighing 17.2 kg (37.9 lb) were collected during the six heat treatments. The total impingement was estimated at 1,351 fishes weighing 80.8 kg (178 lb) using actual flows and 1,820 fishes weighing 122.1 kg (269 lb) using design flows (**Tables 5-3** and **5-4**). Spotfin croaker was much less abundant in the 1979–1980 study with an annual impingement estimate of only 36 fishes during normal operations and 10 fishes during all seven heat treatments (SDG&E 1980).

Spotfin croaker is the least frequently impinged croaker at coastal generating stations within the SCB (Herbinson et al. 2001). Since 1977, four of the five generating stations built by Southern California Edison have reported spotfin croaker in impingement samples (Herbinson et al. 2001). Based on these impingement samples, spotfin croaker populations in southern California have been low since 1983 (Herbinson et al. 2001). More recently, nearshore gillnet sampling within the SCB has indicated a general rise in abundance, corresponding to an increase in sea surface temperatures (Miller et al. in prep b).

Spotfin croaker has been reserved for recreational angling within California State waters since 1915, with a ban on the use of nets imposed in 1909 and a ban on commercial sale in 1915 (Valle and Oliphant 2001). Incidental catches, however, did occur in the nearshore gillnet fishery for white seabass, which was closed in 1992 by legislative action. Recreational angling, specifically surf-fishing, continues as anglers enjoy greater success during periods of dense aggregations, such as spawning periods. There was an average of approximately 12,000 fish caught annually in southern California from 2000 through 2005 based on information from the RecFIN database. Because there is no commercial market for spotfin croaker, there is no specific wholesale value per pound associated with this species.

Although the estimated numbers of spotfin croakers impinged annually amounts to approximately 10% of annual reported recreational landings, the impinged fishes at EPS are typically juveniles with a mean size of approximately 100 mm (4 in) whereas the typical sport-caught fish would be at least 9 in for males and 12 in for females which are the approximate sizes at maturity in the population (Love 1996). The difference in ages between impinged fishes (ca. +1 yr) and sport-caught fishes (ca. >3 yr) would yield a substantial reduction in adult equivalents. The increase in impingement abundance from the previous study also indicate that it is unlikely that the combined entrainment or impingement from EPS measurably affects local populations of spotfin croaker in the source water area.

### *California halibut*

California halibut was selected for detailed analysis because they have a high commercial and recreational fishery value. The fishery for California halibut was reviewed by Leet et al. (2001) and recent catch statistics are available through the PSMFC PacFIN (commercial) and RecFIN (recreational) databases. Historically, halibut have been commercially harvested by three principal gear types: otter trawl, set gill and trammel net, and hook and line. Presently there are numerous gear, area, and seasonal restrictions that have been imposed on the commercial halibut fishery for management purposes. Since 1980 the commercial catch has averaged approximately one million pounds per year statewide. In southern California (San Diego, Orange and Los Angeles counties) the average annual commercial catch and ex-vessel revenue from California halibut for the years 2000–2004 was approximately 56,000 lb and $202,000 respectively. During this time the greatest catches were in 2000 (82,225 lb) and the least were in 2003 (38,113 lb). It appears that the size of the California halibut population may be limited by the availability of shallow-water nursery habitat, and a long-term decline in landings corresponds to a decline in these habitats in southern California associated with dredging and filling of bays and wetlands (Leet et al. 2001).

During the 2004–2005 study, only 19 California halibut larvae were collected and measured from the entrainment samples (**Table 3-5**). The larvae occurred in low numbers at the entrainment station in all but the late June and early July 2004 surveys. They were more abundant at the nearshore stations than at the lagoon stations and were mostly absent at the Inner and Middle Lagoon stations (**Figure 3-32**). Total annual entrainment of California halibut at EPS was estimated at 3.7 million and 4.9 million larvae using actual and maximum design cooling water flows, respectively, for the June 2004 through May 2005 period (**Tables 5-3** and **5-4**). Applying the *FH* demographic model to these data, it was estimated that the lifetime reproductive output of 8-12 females was entrained through the EPS CWS for the June 2004 through May 2005 period (**Tables 5-3** and **5-4**). The *ETM* model results were used to calculate a $P_M$ estimate of 0.003, indicating an entrainment mortality of less than 0.5% of the source water larval population (**Tables 5-3**). Using the maximum flows, the $P_M$ estimate increased slightly to 0.004 (**Tables 5-4**).

California halibut ranked twenty-second on the list of fishes impinged during normal operations with a total of 95 individuals weighing 1.7 kg (3.7 lb) (**Table 4-2**). These were all juvenile fishes that averaged approximately 120 mm TL (4.7 in). Fewer individuals were collected during heat treatment operations (21) but these were slightly larger fishes with a combined weight of 4.8 kg (10.5 lb). These numbers were extrapolated to estimate that approximately 600–975 California halibut weighing a total of 15.4–23.3 kg (34–51 lb) were impinged during normal and heat treatment operations using actual and design flows, respectively (**Tables 5-3** and **5-4**). The total revenue value of impingement losses, if calculated on estimated annual biomass and an ex-vessel value of $7.45 per pound would be approximately $430 using the actual flows or $645 using the maximum flows (**Table 5-5**).

Newly settled and juvenile halibut often occur in shallow embayments and occasionally on the outer coast, suggesting that bays are an important nursery habitat for this species (Leet et al. 2001). Juveniles were collected in all segments of AHL during a resources survey in 1994–1995 (MEC 1995), and they were also present during fish studies done in 2005 (**Appendix C**). With an AHL bottom area of approximately 107 ha (264 ac), which was defined as the lagoon surface area at mean lower low water, the density estimates from the comprehensive MEC (1995) surveys were used to calculate a total abundance of over 25,000 juvenile halibut potentially utilizing AHL annually (**Table 5-11**). The calculated annual impingement abundance in 2004–2005 represents approximately 2% of this total.

**Table 5-11.** Estimated abundance of juvenile California halibut present in AHL from beam trawl and beach seine sampling done in 1994–1995 by MEC (1995). Benthic area is the surface area of each lagoon segment at the +0.0 MLLW tide level (Elwany et al. 2005).

| | Outer Lagoon | Middle Lagoon | Inner Lagoon | Total AHL |
|---|---|---|---|---|
| **Benthic area (ha)** | 21.30 | 9.49 | 76.46 | 107.26 |
| **Average density per $m^2$** | 0.0023 | 0.0136 | 0.0313 | |
| **Estimated Abundance** | 479 | 1,293 | 23,933 | **25,705** |

All estimates of entrainment and impingement effects on California halibut point to a minimal impact of the EPS on this species. Although AHL is a suitable nursery habitat for juvenile halibut, the primary spawning area in the source water region appears to be in the nearshore areas where larval abundances exceeded lagoon abundances by over a factor of ten. Coupled with the primarily benthic habitat preference of California halibut which minimizes impingement risk, there is no overall risk of AEI to halibut from EPS operation.

### *Cancer crabs*

Cancer crabs (primarily yellow, brown, and red rock crab) are fished both commercially and recreationally in southern California. Dungeness or market crab is also a commercially fished species but is more common in central and northern California and is generally not found in SCB commercial catches. The slender crab and hairy crab, also members of the family Cancridae, are not part of the fishery due to their small size. Recent catch statistics for rock crab from the PSMFC PacFIN (commercial) database for the years 2000–2005 for San Diego County showed an average annual commercial catch and ex-vessel revenue of 164,063 lb and $179,528, respectively. The 2005 catch of 47.4 MT was valued at $107,722 for a cost per kg of $2.27.

Both the entrainment of advanced larval stages and the impingement of juveniles and adults was very low during 2004–2005. Only a single cancer crab megalops was collected in the entrainment samples, which yielded an annual estimate of 162,150 megalops under actual flow conditions. Cancer crabs can produce several hundred thousand to several million eggs annually (Hines 1991), so the estimated entrainment represents the reproductive output of a very small

number of crabs. Of the 57 Cancer crabs impinged during the normal impingement surveys, there were 26 red, 4 brown, 3 hairy, 1 Dungeness, and 23 others that could not be identified to the species level and were recorded as *Cancer* spp. (**Table 4-5**). Cancer crabs were the most abundant type of shellfish impinged in the heat treatment surveys, with a total of 584 crabs weighing 3.2 kg (7.1 lb). Of these crabs, 502 were red, 27 were brown, 18 were hairy, 1 was Dungeness, and 36 could not be identified to the species level.

The estimated annual impingement of Cancer crabs from all sources under normal operations using actual CWS flows was 962 individuals weighing 5.2 kg (11.5 lb) (**Table 5-3**). Using design flows the estimate was 1,172 weighing 6.5 kg (14.3 lb) (**Table 5-4**). The direct loss for the actual impingement biomass based on 2005 commercial values was $12- $15 using the actual and design CWS flows (**Table 5-5**).

***Summary***

In summary, the shelf habitat is extensive within the southern California bight, and most of the common fish species that are part of this assemblage have wide-ranging distributions. Many of the fishes in this habitat are targeted by commercial or sport fisheries and their populations are generally sensitive to large-scale oceanographic influences. Impacts to species from this habitat would be expected to be low since they are not resident in AHL and have distributions that extend far beyond the limits of the source water used in estimating entrainment losses.

### 5.3.2.5 Deep Pelagic Habitats

Deep pelagic habitats include several different habitats from Allen and Pondella (2006) including deep slope, deep bank, and deep rocky reef habitats. This category also includes open ocean pelagic habitats. Some of these habitats are extremely productive and the fishes inhabiting these areas are the basis of large commercial fisheries. The fisheries in the areas outside the three-mile limit of California state waters are federally managed by the PFMC. Fishes characteristic of the deep shelf, bank and slope habitats include Pacific hake, splitnose rockfish, rex sole, sablefish, blackgill rockfish, and shortspine thornyhead. Several different species of rockfishes dominate the fish assemblages on the deep reef, shelf and canyon habitats including bocaccio, chilipepper, and greenspotted, greenstripe, rosethorn, and pinkrose rockfishes. Fishes characteristic of open ocean pelagic habitats include swordfish, striped marlin, several species of shark, albacore, and bluefin, bigeye, and yellowfin tuna. Although the fishes characteristic of these habitats occasionally occur closer to shore their primary habitats are offshore in open water or at deep ocean depths.

Fishes from these habitats are not at risk due to entrainment or impingement by the EPS CWIS. No fishes or shellfishes characteristic of this habitat type were collected during impingement sampling. The larvae from these habitats are subject to entrainment, but once the larvae are transported into nearshore areas the likelihood of them maturing to adults is probably very low due to the unique adaptations many of these species have to life in deep water habitats which do not occur close to shore. One species from these habitats that was collected during entrainment samples was northern lampfish. This species is characteristic of an offshore species that occurs to

depths of 2,900 m (9,500 ft) but also occurs in midwater (Neighbors and Wilson 2006) where its larvae are subject to onshore currents that result in transport into nearshore waters where the larvae are subject to entrainment. The primary distribution for this species is the outer coastal waters where it larvae are in higher abundances (**Figure 5-1**) and therefore it was not included in this assessment.

## 5.4 Summary of Cooling Water System Effects

Impacts to SCB fish and invertebrate populations caused by the entrainment of planktonic larvae through the EPS CWIS can only be assessed indirectly through modeling. These impacts are additive with the direct impingement losses. Two taxa, CIQ goby complex and combtooth blennies, comprised 90% of all entrained fish larvae. Of the ten most abundant fish species entrained at EPS, only one (anchovies) has any direct commercial or recreational fishery value. All of the abundantly entrained species with the possible exception of garibaldi, *Hypsypops rubicundus*, can be considered forage species for larger predatory fishes, sea birds, or marine mammals. Approximately 40% of the 38 different fish taxa entrained belonged to species with some direct fishery value (e.g., anchovies, croakers, sand basses, California halibut) even though most of those were in very low abundance in the samples and as a result were not assessed for potential impacts. An exception was California halibut, which was included in the assessment because of its commercial and recreational fishery importance. Even with a total estimated annual entrainment of nearly 4 million larvae the power plant impacts to this species were negligible, amounting to the loss of four to six females at the age of maturity.

The *ETM* procedure estimates the annual probability of mortality due to entrainment ($P_M$). It puts the entrainment estimate into context by comparing it with a known source population at risk of entrainment. The greatest $P_M$ estimate for a target taxon was for the CIQ goby complex with a predicted fractional larval loss of 39.8% (**Table 5-1**). The next greatest probabilities of mortality were for combtooth blennies (19.4%) and garibaldi (14.4%). The distance of shoreline potentially affected by entrainment is directly proportional to the estimate of time that the larvae are exposed to entrainment. All three of these species had local populations primarily located in the habitats of Agua Hedionda Lagoon, and most larvae were entrained at sizes that indicated they were recently hatched. Other modeled species with primarily nearshore (non-lagoon) distributions, such as white croaker and queenfish, had $P_M$ estimates below 1%. Even in a heavily exploited commercial species these levels of additional mortality would be considered very low, especially when the populations of these species extend over a much larger geographic range than the extrapolated source water bodies. No invertebrate taxa were modeled for entrainment impacts due to the low abundance of the target taxa (e.g., spiny lobsters, *Cancer* crabs).

Compared to the IM&E study conducted by SDG&E in 1979–1980, goby larvae were approximately five times more abundant in the recent entrainment samples while combtooth blenny larvae were nearly twenty times more abundant. These increases are probably the result

of increases in habitat for these two taxa. In the case of gobies, the shallow mudflat habitat in AHL has increased due to watershed erosion and sedimentation. The addition of floats and barges from aquaculture operations provides large surface area for fouling communities utilized by blennies for habitat. Anchovy and croaker larvae were significantly more abundant in the earlier study, perhaps due to the cooler water climatic regime in the SCB during that period that favored these taxa. Surfperches, topsmelt and anchovies were the most vulnerable taxa for impingement during both studies. Annual impingement of fish biomass (normal operations and heat treatments) was similar in both studies—approximately 4,202 kg (9,263 lb) in 2004–2005 compared to approximately 3,820 kg (8,421 lb) in 1979–1980.

Key findings of the entrainment study are as follows:

- No State- or Federally-listed threatened or endangered species were entrained in the year-long study.
- Annual entrainment losses of equivalent adults were projected for CIQ gobies (3.76 million using *FH* and 1.63 million using *AEL*), combtooth blennies (1.15 million using *FH* and 2.45 million using *AEL*), anchovies (6,000 for *FH* and 15,456 using *AEL*), and California halibut (less than 10 using the *FH* modeling approach).
- Fish larval entrainment losses were from 14–40% of the source water populations for species that lived mainly within the Agua Hedionda Lagoon system, but less than 2% for most other species that occurred in nearshore areas outside of the lagoon. Approximately 40% of the taxa entrained through EPS had some direct value to sport or commercial fishers, although most were entrained in very low abundance.
- The five most abundantly entrained fish species (CIQ gobies, combtooth blennies, anchovies, garibaldi, and clinid kelpfishes) represented fishes mainly from the bay and harbor habitat (gobies and blennies), but also rocky reef (garibaldi and kelpfishes) and coastal pelagic habitats (anchovies). All of these species could be considered abundant in the SCB. The only entrained target shellfish larvae were Cancer crabs, which are also widely distributed in nearshore zones in the SCB.

The following is a summary of impingement impacts:

- No State- or Federally-listed threatened or endangered species were impinged in the year-long study.
- A total of 101 species of fishes, sharks and rays was impinged, with the top five species by numbers being topsmelt, shiner surfperch, deepbody anchovy, queenfish, and silversides. The top five species by weight were California butterfly ray, topsmelt, shiner surfperch, round stingray, and white seabass.
- Direct impingement losses (fish and macroinvertebrates) from both normal operations and tunnel heat treatments were equivalent to $4,749–$6,189 using 2005 commercial value data.
- The most abundantly impinged fish species are also considered fairly abundant throughout the SCB.

### 5.4.1 IM&E Losses Relative to 1977 EPA AEI Criteria

The USEPA (1977) provided some general guidelines to determine the "relative biological value of the source water body zone of influence for selected species and the potential for damage by the intake structure" based on the following considerations of the value of a given area to a particular species:

- principal spawning (breeding) ground;
- nursery or feeding areas;
- migratory pathways;
- numbers of individuals present; and
- other functions critical during the life history.

The area in which the EPS intake structure is located does not include any essential fish or invertebrate habitat such as kelp forest, rocky reef or eelgrass. It is located in the outer segment of Agua Hedionda Lagoon that was largely constructed as a source of cooling water for the plant. Similar coastal lagoons are located north and south of the plant. Fishes in the vicinity of the AHL intake structure are part of the bay and harbor and rocky reef zone fish assemblages characteristic of the Southern California Bight as defined by Allen and Pondella (2006). These include gobies, blennies, silversides, garibaldi, anchovy, white croaker, California halibut, and walleye and shiner surfperch. In regards to the AEI criteria, the habitat is not unique as a spawning area for these particular fishes because they are widespread in southern California. Although many species utilize AHL as a spawning and nursery area, including silversides (e.g. submerged aquatic vegetation), garibaldi (e.g. embayments with vertical rock faces of shallow reefs or constructed breakwalls), and California halibut (e.g. shallow mudflat with submerged vegetation), the Outer Lagoon where the intake is located is not the principal spawning area for any species.

The issue in the EPA guidelines of fish migratory pathways relative to intake location primarily concerns anadromous fishes and situations where power plant intake locations are on or near rivers that may function as narrow migratory corridors for certain species. Because the EPS intakes are located in AHL, this issue is not of concern for any of the species that were impinged. In addition, most of the impinged species are year-round residents and not highly migratory although some, such as northern anchovy and California halibut may exhibit some seasonal onshore-offshore movements but these would not be affected by the EPS CWIS.

The other points of concern relative to intake location and fish distribution are numbers of individuals present and other functions critical during the life history (i.e., high concentrations of individuals present in the area for reasons other than spawning, recruitment or migration). This may include a circumstance where, for example, prevailing currents or the proximity to certain bathymetric features attracts prey items for a predatory species and thus results in high concentrations of a species that may subsequently be at risk of impingement. None of the data

collected during this study suggests that there are any species that are especially vulnerable to impingement or entrainment due to their behavior at any stage in their life history. This includes all common species as well as any special status species designated for protection under state or federal statutes.

No federal/state threatened or endangered fish/shellfish species were identified in entrainment and impingement samples collected from EPS. This is consistent with the previous entrainment and impingement study (SDG&E 1980).

### 5.4.2 IM&E Losses Relative to Other AEI Criteria

Additional criteria that were evaluated because they were specific to the marine environment around EPS included:

- distribution (pelagic, subtidal, nearshore subtidal & intertidal);
- range, density, and dispersion of population;
- population center (source or sink);
- magnitude of effects;
- long-term abundance trends (e.g., fishery catch data);
- long-term environmental trends (climatological or oceanographic); and
- life history strategies (e.g., longevity and fecundity).

These criteria were used in assessing the effects of individual taxa and to place the estimated effects into a larger context using the characteristics of the source water and the biological community. The separation of the taxa on the basis of habitat allowed us to focus on the groups most at risk due to entrainment and impingement. Taxa with larvae that are transported from nearshore or offshore areas into AHL where they are subject to entrainment are less at risk than taxa that occur in the vicinity of the intake where all life stages are vulnerable to both entrainment and impingement. Gobies and blennies both primarily occur in the protected bay and harbor habitats that occur in AHL and as a result are at greatest risk to any CWIS effects. Also, taxa that occur in several different habitats will be less at risk than taxa that only occur in habitats directly affected by the AHL intake. Most of the taxa included in the assessment, with the exception of gobies, did not have limited habitat associations that would place them at risk to entrainment. Finally, the entire distribution of the population is also important, especially for species that may be more limited to bay and harbor areas where they are not only subject to CWIS effects from EPS, but other impacts associated with nearshore coastal environments such as pollution. As a result, fishes such as Pacific sardine and northern anchovy that are distributed across large coastal areas, and California halibut, white seabass, and the croakers (white croaker, spotfin croaker, and queenfish) that are distributed across the shelf will be less at risk than species with more limited distributions.



The criteria of distribution, range, habitat, and population center all need to be considered relative to the magnitude of the effects. The greatest attention should be placed on fishes or shellfishes with limited distribution in the habitat directly affected by the intake, such as gobies. Other fishes potentially affected by entrainment are typically distributed across hundreds of miles of coastline that are connected by coastal currents that help distribute larvae into areas that may have reduced abundances. At EPS, the largest entrainment and impingement effects occurred to fishes that were resident in AHL, but the two resident fishes whose larvae were most affected by entrainment, gobies and blennies, were not greatly affected by impingement since they occupy bottom or cryptic habitats as adults. It is also important that the fishes with the greatest potential impacts are not targeted by commercial or recreational fishing that would compound any effects of the CWIS on the population. Since the magnitude of the impacts to some of these taxa, especially due to entrainment, were relatively high, special studies were initiated in AHL to examine the adult populations of some of these fishes. These studies and comparisons with the previous 316(b) study and other studies in AHL all indicate that healthy populations of these species are present in AHL and that the CWIS is not resulting in any AEI to these species.

The conclusion that the levels of entrainment and impingement at EPS are not resulting in any AEI to fish or shellfish populations is consistent with a recent review on population-level effects on harvested fish stocks (Newbold and Iovanna 2007). They modeled the potential effects of entrainment and impingement on populations of fifteen fish stocks that are targeted by either commercial or recreational fisheries using empirical data on entrainment and impingement, life history, and stock size. For twelve of the fifteen species, the effects of theoretically removing all of the sources of power plant entrainment and impingement were very low (less than 2.5%). For the other three species, the effects ranged from 22.3% for striped bass on the Atlantic coast to 79.4% for Atlantic croaker. Their overall conclusions were that population-level effects were negligible for most fish stocks but could be severe for a few.

Newbold and Iovanna (2007) attributed the absence of large effects for most species to compensatory mechanisms that are probably acting on the populations at some level. If there is strong density dependence acting on these populations during the life stages from the period when they are vulnerable to entrainment as larvae through the age of maturity, then they concluded that there should be very little potential for population-level effects due to entrainment and impingement. The results for gobies from the studies conducted in AHL provide evidence of strong density dependence at recruitment which helps explain the apparent absence of any effects on local populations of this group despite the high levels of entrainment mortality.

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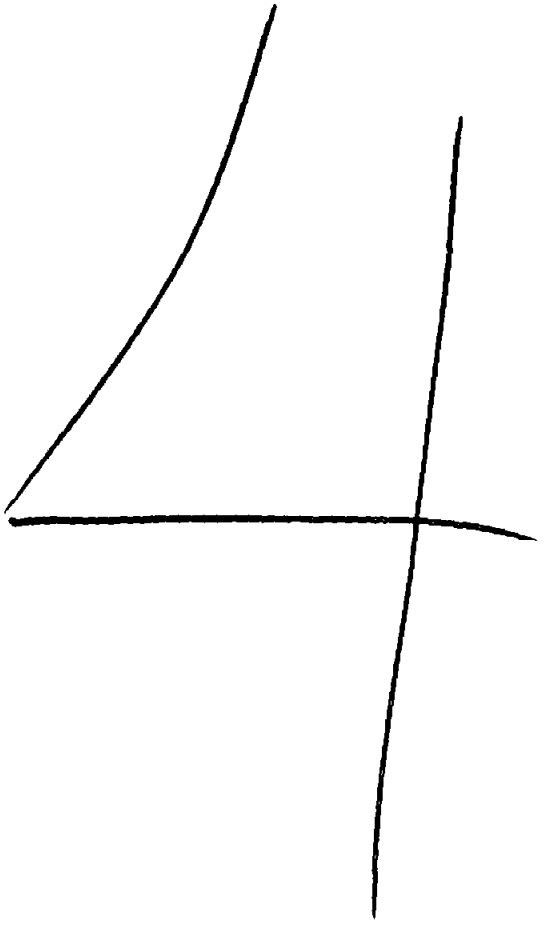

# California Regional Water Quality Control Board

## San Diego Region

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Item 7, Supporting Document 3
April 9, 2008

February 19, 2008

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In reply refer to:
**NCR: 02-1429.02:ebecker**

Dear Mr. MacLaggan:

**Revised Flow, Entrainment and Impingement Minimization Plan & Coastal Habitat Restoration and Enhancement Plan, Order No. R9-2006-0065, NPDES Permit No. CA0109223, The Poseidon Resource Corporation, Carlsbad Desalination Project**

On February 13, 2007, Poseidon submitted a Flow, Entrainment, and Impingement Minimization Plan dated February 12, 2007 (Plan) in compliance with Section VI.C.2.(e) of Order R9-2006-0065. Subsequently, in response to Regional Board and interested parties' comments, Poseidon submitted a revised plan (dated June 29, 2007) on July 2, 2007. To supplement this Plan, Poseidon has also submitted both a Coastal Habitat Restoration and Enhancement Plan (CHREP) dated October 2007 and a revised CHREP dated November 2007.

The Regional Board has the following comments from the review of the Plan and CHREP (referenced above):

**General Comments:**

1. The Plan does not yet integrate all the elements of the statutory requirements of California Water Code (CWC) Section 13142. The proposed project only includes "mitigation", while the statute CWC Section 13142.5(b) also requires that dischargers implement best available technology and mitigation measures. The Plan does not appear to include technology measures for the intake structure to reduce impingement and entrainment (I&E).

2. The Plan provides an evaluation of impacts based upon one year of data, 2004-05 with record rainfall, but does not explicitly evaluate the on-going impacts from Poseidon's operations.

3. The Carlsbad desalination project's (CDP) listing of impacts appears to omit specific impacts to target invertebrates.

4. The proposed mitigation project does not appear to account for all pertinent impacts resulting from impingement of invertebrates, entrainment of invertebrates, discharges of brine, etc.

5. The CHREP did not identify and evaluate the possible mitigation projects located within the same watershed, prior to proposing the out of watershed mitigation in San Dieguito Lagoon. The best mitigation for impacting the lagoon would be to replace lost functions by restoring current upland acreage to the historic wetland condition, or by creating new wetlands where there were none historically.

6. The proposed mitigation ratio of 1.1:1.0 isn't fully supported. The Plan should be revised to include an evaluation of other mitigation options that may be available within the watershed. The proposed mitigation ratio appears inadequate in light of several factors generally considered by the Regional Board:

    a. The proposed mitigation project is located within a different watershed (the San Dieguito Lagoon) instead of the Agua Hedionda Lagoon. A higher ratio may be appropriate for this project because the referenced mitigation project is out-of-kind (i.e., discharger is not actually replacing the lost resources and functions).
    b. It is not clear that the proposed one-time mitigation is adequate to compensate for the long-term ongoing impacts to beneficial uses, resources, and functions present in Agua Hedionda Lagoon.
    c. The mitigation project is for restoration of coastal wetland habitat, rather than the lagoon habitat impacted by the operation of the CDP.

7. Poseidon might benefit from convening a joint meeting with the resources agencies (including California Dept Fish and Game, US Fish and Wildlife Service, Army Corps of Engineers, National Marine Fisheries) to discuss the impacts to beneficial uses, resources, and functions by the proposed project, and on the preferred mitigation project so they can discuss agency concerns/comments.

**Specific Comments on the Plan**

8. The assessment should address the seasonal and/or daily variations in impingement impacts.

9. The assessment needs to include results of an impingement study for target invertebrates. Table 3.2 includes only results for fish during 2004-05.

10. The assessment states that: "The total amount of impinged organisms for the individual sampling events is presented in Table 3-2" (p.19). The Plan, however, does not clearly identify individual sampling events. The interpretation of the results is hampered by the absence of a presentation of results for impinged organisms (including invertebrates) with dates, times, and flow rates of sampling events.

11. The assessment states that, "The daily biomass of impinged fish during normal operations is 0.96 kgs/day (1.92 lbs/day) for an intake flow of 304 MGD" (p.19). The text discussion should clarify how this figure is determined and how the total impingement results were adjusted to an intake flow of 304 MGD. Also, there is a conversion discrepancy since 0.96kgs converts to 2.12lbs, not 1.92 lbs as indicated in the Plan.

12. The assessment of impacts from entrainment assessment appears to include larval fish but does not clearly include impacts to fish eggs and invertebrates. It is the understanding of the Regional Board that the 2004-05 study was to include monitoring of (at least) entrained Cancer crab megalops and lobster larvae, but the assessment does not appear to include these data. Also, it is unclear that sampling followed a protocol approved by the Regional Board as stated (p.22).

13. The Plan does not clearly identify the supporting data or an explanation of underlying assumptions and calculations that were used to estimate proportional mortality values for larval fish as presented (p.23) in the Plan. Therefore, the Regional Board could not objectively evaluate the validity of the estimated proportional entrainment mortality (12.2%) presented in the Plan.

14. Impacts are based upon the few most commonly entrained (most abundant) species. It is unclear how much more severe impacts may be when populations are small.

15. The Regional Board has the following comments regarding the estimated number of lagoon acres impacted, as presented in the plan since:

    a. The estimate of the number of lagoon acres used by the three most commonly entrained species is based on a 2000 Coastal Conservancy Inventory (Table 4-2, p.23). It is unclear if this document is accurate or appropriate for the purpose of determining such an important component of the area of habitat production forgone (APF). The reference document (Attachment 4, Table 2), includes the footnote caveat "...This information is not suitable for any regulatory purpose and should not be the basis for any determination relating to impact assessment or mitigation." An accurate delineation of lagoon habitats should be used for this critical component of the APF.

b. The estimate of the number of lagoon acres used by the three most commonly entrained species appears to exclude salt marsh and brackish/freshwater acreage (p.23). Excluding these intertidal habitats may result in the analysis underestimating this component of the APF.

c. The calculation of the APF (p.23) appears to use values for mortality and lagoon acreage that are not fully supported.

d. The text should be revised to include a clear explanation of how the estimated lagoon acreage for commonly entrained species was adjusted to include only impacts associated with operations of CDP, rather than impacts from operation of the Encina Power Station.

16. The evaluation concludes that the small fraction of marine organisms lost to entrainment would have "no effect on the species' ability to sustain their population" and goes on to describe the natural rates of high mortality (p. 24). But the argument that that there are "excess" larvae appears to omit an important consideration. Besides contributing to marine food webs, the naturally high production of larvae serves as a buffer against catastrophic and cumulative impacts to populations. These are important 'ecological services' that must not be taken lightly or given away without adequate mitigation.

17. The Regional Board prefers that the evaluation of the impact be presented as a rate (loss of x-amount of organisms per year, or impact/year). The proposed mitigation is a fixed amount ($3 to $4 million). It seems unlikely that a fixed amount would adequately compensate for a loss that is a rate over multiple, future years. It appears more likely that a proposed fixed amount really only accounts for mitigation for just one year of operation. The Regional Board may find a fixed amount to be acceptable, provided that:

a. The average annual impact could be reasonably determined and reasonably translated into a dollar amount, and that amount (or correct share) is paid every year of operation – but that is not what is proposed in the Plan or the CHREP.

b. A fixed amount might also be reasonable if the CDP mitigates its share by increasing lagoon acreage via restoration or creation. Such in-kind mitigation would (if functional) replace the productivity lost to the operation of the CDP, and the impact would be fully mitigated.

The heading portion of this letter includes a Regional Board code number noted after "In reply refer to:" In order to assist us in the processing of your correspondence please

include this code number in the heading or subject line portion of all correspondence and reports to the Regional Board pertaining to this matter.

If you have any questions regarding the above, please contact Mr. Eric Becker at (858) 492-1785, or at Ebecker@waterboards.ca.gov

Respectfully,

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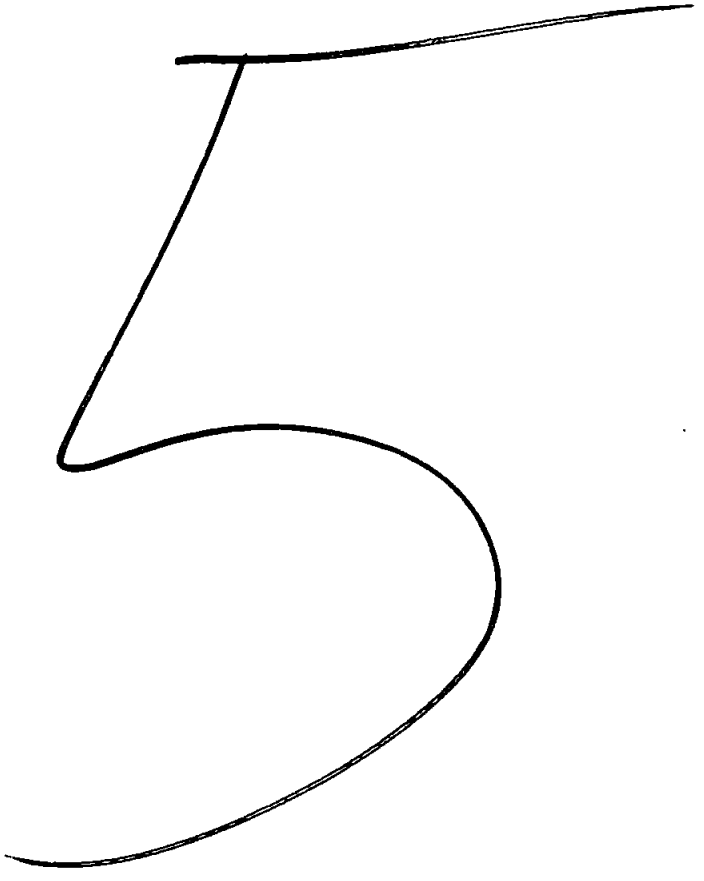

# CARLSBAD SEAWATER DESALINATION PROJECT

## SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD

## REGION 9, SAN DIEGO REGION

## ORDER NO. R-9-2006-0065

## NPDES NO. CA0109223

# FLOW, ENTRAINMENT AND IMPINGEMENT MINIMIZATION PLAN

**March 6, 2008**

**CARLSBAD SEAWATER DESALINATION PROJECT**

**FLOW, ENTRAINMENT AND IMPINGEMENT MINIMIZATION PLAN**

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**ATTACHMENT 3** - PROPOSAL FOR INFORMATION COLLECTION CLEAN WATER ACT SECTION 316(B), ENCINA POWER STATION, CABRILLO POWER I LLC, NPDES PERMIT NO. CA0001350, APRIL 1, 2006.

**ATTACHMENT 4** - UPDATED IMPINGEMENT AND ENTRAINMENT ASSESSMENT, TENERA ENVIRONMENTAL, MAY 2007.

**ATTACHMENT 5** - CARLSBAD DESALINATION FACILITY – ENCINA POWER STATION, SUMMARY OF FISH AND TARGET SHELLFISH LARVAE COLLECTED FOR ENTRAINMENT AND SOURCE WATER STUDIES IN THE VICINITY OF AGUA HEDIONDA LAGOON FROM JUNE 2005 THROUGH MAY 2006.

# EXECUTIVE SUMMARY

## PLAN PURPOSE

The San Diego Regional Water Quality Control Board (Regional Board) adopted Order No. R9-2006-0065 (Permit) for Poseidon Resources Corporation's (Poseidon) Carlsbad Desalination Project (CDP) discharge to the Pacific Ocean via the existing Encina Power Station (EPS) discharge channel. The CDP is planned to operate in conjunction with the EPS by using the EPS cooling water discharge as its source water whenever the power plant is operating.

In the event that the EPS were to cease operations, and Poseidon were to independently operate the seawater intake and outfall for the benefit of the CDP, such independent operation will require additional review pursuant to Water Code Section 13142.5(b). Water Code Section 13142.5(b) requires industrial facilities using seawater for processing to use the best available site, design, technology, *and* mitigation feasible to minimize impacts to marine life.

This Flow, Entrainment and Impingement Minimization Plan (Plan) is developed in fulfillment of the above-stated requirements and contains site-specific activities, procedures, practices and mitigation plans which Poseidon proposes to implement to minimize impacts to marine organisms when the Carlsbad Desalination Project intake requirements exceed the volume of water being discharged by the EPS.

## PLAN COMPLIANCE

As shown in Table ES-1, the Plan addresses each of the provisions of Water Code Section 13142.5(b):

- Identifies the best available site feasible to minimize Project related impacts to marine life;
- Identifies the best available design feasible to minimize Project related impacts to marine life;
- Identifies the best available technology feasible to minimize Project related impacts to marine life;
- Quantifies the unavoidable impacts to marine life; and
- Establishes a state-agency coordinated process for identification of the best available mitigation feasible to minimize Project related impacts to marine life.

| Table ES-1<br>Design, Technology and Mitigation Measures to Minimize Impacts to Marine Life | | |
|---|---|---|
| **Category** | **Feature** | **Result** |
| 1. Site | Proposed location at Encina Power Station (EPS) | Best available site for the project, no feasible and less environmentally damaging alternative locations. |
| 1. Design | Use of EPS discharge as source water | Sixty-one percent reduction of entrainment and impingement impacts attributable to the CDP |
| 2. Design | Reduction in inlet screen velocity | Reduction of impingement of marine organisms |
| 3. Design | Reduction in fine screen velocity | Reduction of impingement of marine organisms |
| 4. Design | Ambient temperature processing | Eliminate entrainment mortality associated with the elevated seawater temperature |
| 5. Design | Elimination of heat treatment | Eliminate mortality associated with heat treatment. |
| 1. Technology | Installation of VFDs on CDP intake pumps | Reduce the total intake flow for the desalination facility to no more than that needed at any given time, thereby minimizing the entrainment of marine organisms. |
| 2. Technology | Installation of micro-screens | Micro-screens (120 μ) minimize entrainment and impingement impacts to marine organisms by screening the fish larvae and plankton from the seawater. |
| 3. Technology | Installation of low impact prefiltration technology | UF filtrations system minimizes entrainment and impingement impacts to marine organisms by screening the small plankton from the seawater. |
| 4. Technology | Return to the ocean of marine organisms captured by the screens and filters | Minimize entrainment and impingement impacts to marine organisms captured by the screens and filters by returning the organisms to the ocean. |
| 5. Technology | After ten years of operation, State Lands Commission (SLC) to analyze environmental effects of facility and the availability of alternative technologies that may reduce any impacts. | SLC may require Poseidon install additional technology as are reasonable and as are consistent with applicable state and federal laws and regulations. This ensures that the CDP operations at that time are using technologies that the SLC determines may reduce any impacts and are appropriate in light of environmental review. |
| 1. Mitigation | Implementation of project mitigation plan developed pursuant to a state-agency coordinated process described in Chapter 6. | Compensate for unavoidable entrainment and impingement impacts and enhance the coastal environment. |
| 2. Mitigation | Preservation of Agua Hedionda Lagoon though continued maintenance dredging and Lagoon stewardship. | Preserve and protect highly productive marine habitat; maintain and enhance opportunities for public access and recreation; provide sand for beach replenishment and grunion spawning habitat; maintain adequate water quality to support aquaculture, fish hatchery and natural fish habitat; and provide a new high-quality water supply. |
| 3. Mitigation | Fund watershed education programs at the AHL Foundation Discovery Center. | Helps ensure the long-term health and vitality of Agua Hedionda Lagoon and the surrounding watershed. |

## PROPOSED MITIGATION APPROACH

Poseidon is using all feasible methods to minimize or reduce its entrainment impacts. These methods are likely to reduce the Project related impacts to marine life well below the levels identified in Chapter 5. To minimize unavoidable Project related impacts to marine life, Poseidon has voluntarily committed to a state-agency coordinated process to identify the best available mitigation feasible. The objective of the mitigation portion of this plan is to identify mitigation needs, set forth mitigation goals, and present a plan and approach for achieving the goals.

Recognizing that mitigation opportunities in Agua Hedionda Lagoon may be limited, Poseidon proposes a comprehensive but flexible approach for mitigating potential impacts. This approach is based on:

- Conservatively estimating maximum potential impacts
- Identifying goals and objectives of the mitigation program
- Identifying any available mitigation opportunities in Agua Hedionda Lagoon that meet the goals and objectives
- Identifying additional offsite mitigation that meets the mitigation goals
- Developing an action plan and schedule for coordinating with regulatory and resource agencies to finalize locations and acreages selected for the proposed mitigation.

Investigations to date have not identified any mitigation opportunities within Agua Hedionda Lagoon that meet the goals of the program. As a result, the proposed mitigation plan includes a core offsite mitigation program that meets the plan goals and objectives that is being developed in parallel with Poseidon's continued effort to identify feasible mitigation opportunities in Agua Hedionda Lagoon.

Poseidon recognizes the need and priority of implementing mitigation in Agua Hedionda Lagoon if feasible. Poseidon also recognizes that mitigation requirements and regulations of the various review agencies differ, and additional agency coordination is required to insure that needs of all applicable agencies are addressed.

Accordingly, while this plan identifies a core offsite mitigation project, the mitigation plan also presents an implementation action schedule that includes additional coordination activities to either (1) confirm the lack of opportunities, or (2) identify if new mitigation options exist within Agua Hedionda Lagoon.

Poseidon will be contacting the Department of Fish & Game to more fully assess the potential for restoration opportunities in Agua Hedionda Lagoon. If subsequent Agua Hedionda Lagoon mitigation is determined to be feasible, Poseidon will coordinate with regulatory agencies to implement such mitigation.

If Agua Hedionda Lagoon mitigation is confirmed as infeasible, Poseidon will implement the proposed offsite mitigation project.

Table ES-2 summarizes the implementation action schedule for the proposed mitigation plan.

**Table ES-2**
**Mitigation Implementation Approach and Schedule**

| Element | Actions/Objectives | Schedule |
|---|---|---|
| Submittal of draft Minimization Plan to Regional Board | • Public and agency review of revised draft Plan | March 2008 |
| Regional Board consideration of Minimization Plan | • Approval of Plan<br>• Regional Board provides directions on Plan implementation | April 2008 |
| Contacts with California Department of Fish & Game to assess mitigation opportunities in Agua Hedionda Lagoon | • Assess mitigation opportunities for saltwater marsh creation in Agua Hedionda Lagoon via dredging | March 2008 |
| Supplemental contacts with other resource agencies | • Identify (or conform lack of) additional mitigation opportunities in Agua Hedionda Lagoon | April 2008 |
| Convene meeting of resource agencies; Regional Board and Coastal Commission. | • Identify (or confirm lack of) additional mitigation opportunities in Agua Hedionda Lagoon<br>• If applicable, address agency requirements for Agua Hedionda Lagoon mitigation and determine overall implementation feasibility<br>• Address mitigation rations/requirements for core offsite mitigation project in San Dieguito Lagoon | April 2008 |
| Finalize and distribute mitigation program implementation details | • Agency review of implementation details | May 2008 |
| Modify/finalize implementation program details (if applicable) | • Agency review and approval<br>• May involve additional inter-agency coordination meeting | June 2008 |
| Coastal Commission consideration of mitigation project(s) | • Coastal Commission approval of mitigation project | July 2008 |

## REGULATORY ASSURANCE OF PLAN ADEQUACY

There are a number of regulatory assurances in place to confirm the adequacy of the proposed restoration plan. The Regional Board, Coastal Commission and State Lands

Commission have ongoing jurisdiction over the proposed Project to insure the adequacy of the proposed restoration plan.

Additionally, ten years after the lease is issued, that the CDP will be subject to further environmental review by the State Lands Commission (SLC) to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. SLC may require additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations.

This approach will ensure that the stand-alone CDP operations continue to use the best available site, design, technology and mitigation feasible to minimize Project related impacts to marine life.

# CHAPTER 1

# INTRODUCTION

## 1.1 PURPOSE OF THE PLAN

The San Diego Regional Water Quality Control Board (Regional Board) adopted Order No. R9-2006-0065 (Permit) for Poseidon Resources Corporation's (Poseidon) Carlsbad Desalination Project (CDP) discharge to the Pacific Ocean via the existing Encina Power Station (EPS) discharge channel. The CDP is planned to operate in conjunction with the EPS by using the EPS cooling water discharge as its source water whenever the power plant is operating.

When operating in conjunction with the power plant, the desalination plant feedwater intake would not increase the volume or the velocity of the power station cooling water intake. As a result, the incremental impacts to marine associated with the CDP operating in conjunction with the EPS would not trigger the need for additional technology or mitigation to minimize impacts to marine life.

However, in the event that the EPS were to cease operations, and Poseidon were to independently operate the seawater intake and outfall for the benefit of the CDP, such independent operation will require additional review pursuant to Water Code Section 13142.5(b).[1] Water Code Section 13142.5(b) requires industrial facilities using seawater for processing to use the best available site, design, technology, *and* mitigation feasible to minimize impacts to marine life.

The Regional Water Board recognized that future EPS flows may not follow historical trends and required Poseidon prepare this Flow, Entrainment and Impingement Minimization Plan (Minimization Plan) to assess the feasibility of site-specific plans, procedures, and practices to be implemented and/or mitigation measures to minimize the impacts to marine organisms when the CDP intake requirements exceed the volume of water being discharged by the EPS.[2] The Regional Board review and approval of the Minimization Plan will address any additional review required pursuant to Water Code Section 13142.5(b).[3]

This Flow, Entrainment and Impingement Minimization Plan (Plan) is developed in fulfillment of the above-stated requirements and contains site-specific activities, procedures, practices and mitigation measures which are planned to be implemented to

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[1] Permit at F-49.

[2] Permit at Section VI.2.e provides: "The Discharger shall submit a Flow, Entrainment and Impingement Minimization Plan within 180 days of adoption of the Order. The plan shall assess the feasibility of site-specific plans, procedures, and practices to be implemented and/or mitigation measures to minimize the impacts to marine organisms when the CDP intake requirements exceed the volume of water being discharged by the EPS. The plan is subject to the approval of the Regional Water Board and is modified as directed by the Regional Water Board."

[3] Permit at F-50.

minimize impacts to marine organisms when the Carlsbad Desalination Project (hereafter referred to as CDP or Project) intake requirements exceed the volume of water being discharged by the EPS.

## 1.2 PLAN ORGANIZATION

The Plan is organized so to sequentially analyze the steps that have been take by Poseidon to address each of the provisions of Water Code Section 13142.5(b):

- Chapter 2 identifies best available site feasible to minimize Project related impacts to marine life;
- Chapter 3 identifies best available design feasible to minimize Project related impacts to marine life;
- Chapter 4 evaluates identifies best available technology feasible to minimize Project related impacts to marine life;
- Chapter 5 quantifies the unavoidable impacts to marine life; and
- Chapter 6 establishes a coordinated state-agency directed process for identification of best available mitigation feasible to minimize Project related impacts to marine life

## 1.3 PLAN DEVELOPMENT

In anticipation that the EPS might not always satisfy the CDP's source water demands, the Regional Board required Poseidon to submit the Plan within 180 days of the adoption of the Permit. The Permit states:[4]

> The Regional Board recognizes that future EPS flows may not follow historical trends. For this reason, it is warranted to require the Discharger prepare a Flow, Entrainment, and Impingement Minimization Plan. The Flow, Entrainment, and Impingement Minimization Plan shall be submitted within 180 days of adoption of the Order. The plan shall assess the feasibility of site-specific plans, procedures, and practices to be implemented and/or mitigation measures to minimize the impacts to marine organisms when the CDP intake requirements exceed the volume of water being discharge by the EPS. The plan shall be subject to the approval of the Regional Water Board and shall be modified as directed by the Regional Water Board.

[4] Permit at F-48.

The Plan has been under development for past 12 months. The original Plan was submitted to the Regional Board on February 12, 2007. Shortly thereafter, the Regional Board posted the Plan and related correspondence on its website for public review and comment. Poseidon revised the Plan in response to comments received from the Regional Board and the public and resubmitted it to the Regional Board on July 2, 2007.

The Regional Board posted the revised Plan and related correspondence on its website for public review and comment. To supplement the Plan, Poseidon also submitted to the Regional Board a Coastal Habitat Restoration and Enhancement Plan (CHREP) that includes a summary projects to accomplish the mitigation element of the Plan. On February 19, 2008, the Regional Board provided Poseidon with written comments from its review of the revised Plan and CHREP. In response to Regional Board comments, Poseidon submitted this revised Plan dated March 4, 2008 to the Regional Board. The revised Plan is subject to the approval of the Regional Board.

# CHAPTER 2

# SITE

## INTRODUCTION

Pursuant to Water Code Section 13142.5(b), this Chapter identifies the best available site feasible to minimize Project related impacts to marine life. This Chapter is broken down into four sections:

- *The first section describes the proposed site and existing power plant facilities.*
- *The second section describes alternative sites that were considered and rejected.*
- *The third section describes why the proposed Project location is the best available site feasible to minimize Project related impacts to marine life.*
- *The fourth section concludes that proposed location for the Project is the best available and there are no feasible and less environmentally damaging alternative locations.*

## 2.1 PROPOSED SITE

The Carlsbad Desalination Project (CDP) is proposed to be located adjacent to the Encina Power Station (EPS) owned by Cabrillo Power I LLC (Cabrillo). An important consideration for this location is the availability of an existing seawater intake and discharge facilities as well as close proximity to the local regional water distribution systems. The desalination plant would be located on a site currently occupied by a surplus fuel oil storage tank. The tank would be removed, and the desalination plant would be constructed in its place. Integration of the operation of the desalination facility with the existing power plant operation would require two main points of interconnection – seawater intake and concentrate discharge.

The Encina Power Plant withdraws cooling water from the Pacific Ocean via Agua Hedionda Lagoon. After passing through the intake structure (Figure 2-1), trash racks, and traveling screens, the cooling water is pumped through the condensers for the five steam generator units located on site. Depending on the number of generating units in operation, the amount of cooling water circulated through the plant ranges from zero to over 800 MGD.

**Figure 2-1 Intake Structure**

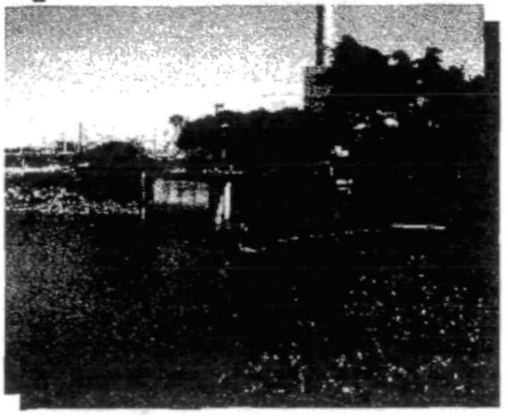

Figure 2-2 Discharge Pond



Figure 2-3 Discharge Channel



The primary diversion point for the source of water to the desalination plant would be downstream of the condenser outlet.

The seawater intake would divert seawater from the power plant's cooling water discharge channel to the inlet of the desalination facility. The intake facilities would consist of a diversion structure, pipeline, and a pump station to transport water from the cooling water discharge channel to the inlet of the desalination facility. The pump station would consist of high-volume, low-head vertical turbine pumps.

The EPS discharges seawater to the Pacific Ocean via a discharge pond (Figure 2-2) and channel that extends 500 feet west of Carlsbad Boulevard (Figure 2-3). The concentrated seawater from the desalination process would be mixed with power plant discharge. The discharge facilities would consist of a pipeline (up to 48-inch diameter) from the outlet of the desalination facility back to the existing discharge channel. The discharge point would be located downstream of the diversion point for the intake to prevent re-circulation of the concentrate back to the inlet of the desalination facility.

### 2.1.1 Existing Power Plant Facilities

The EPS is a once-through cooling power plant which uses seawater to remove waste heat from the power generation process. Cooling water is withdrawn from the Pacific Ocean via the Aqua Hedionda Lagoon. The cooling water intake structure complex is located approximately 2,200 feet from the ocean inlet of the lagoon. Variations in the water surface level due to tide are from low -5.07 feet to a high +4.83 feet from the mean sea level (MSL). The intake structure is located in the lagoon approximately 525 feet north of the generating units.

The mouth of the intake structure is 49 feet wide. Water passes first trough metal coarse screens (trash racks with vertical bars spaced 3-1/2 inches apart) to screen large debris

and marine life. The intake forebay tapers into two 12-foot wide intake tunnels. From these tunnels the seawater flow is split among four six-foot wide conveyance tunnels. Tunnels 1 and 2 deliver seawater to intakes for power plant generation Units 1, 2 and 3. Tunnels 3 and 4 carry cooling water to intakes for power plant generation Units 4 and 5, respectively. Vertical traveling screens are located ahead of each of the intakes of pumps.

Each pump intake consists of two circulating water pump cells and one or two service pump cells. During normal operation, one circulating pump serves each half of the condenser, i.e., when one unit is online, both pumps are in operation.

A total of seven vertical screens are installed to remove marine life and debris that has passed through the trash racks. The screens are conventional through-flow, vertically rotating, single entry-single exit, band-type metal screens which are mounted in the screen wells of the intake channel. Each screen consists of series of baskets or screen panels attached to a chain drive. The screening surface is made of 3/8-inch stainless steel mesh panels, with the exception of the Unit 5 screens, which have 5/8-inch square openings.

The screens rotate automatically when the buildup of debris on the screening surface causes the water level behind the screen to drop below that of the water in front of the screen and a predetermined water level differential is reached. The screens can also be pre-set to rotate automatically at a present interval of time. The screen's rotational speed is 3 feet per minute, making one complete revolution in approximately 20 minutes. A screen wash system using seawater from the intake tunnel washes debris from the traveling screen into a debris trough. Accumulated debris are discharged periodically back to the ocean via the power plant discharge lagoon. Table 2-1 summarizes the capacity of the individual power plant intake pumps.

The EPS intake pumping station consists of cooling water intake pumps that convey water through the condensers of the electricity generation units of the power plant and has a total capacity of 794.9 MGD (552,000 gpm). The service water pumps have a combined capacity is 62.1 MGD (43,200 gpm). During temporary shutdown of the power plant generation units, only the cooling water pumps are taken out of service. The service water pumps remain in operation at all times in order to maintain the functionality of the power plant. If the power plant is shut down permanently, than the service water pumps will not be operational.

The volume of cooling water passing through the power plant intake power station at any given time is dependent upon the number of cooling water pumps and service water pumps that are in operation. With all of the pumps in operation, the maximum permitted power plant discharge volume is 857 MGD or about 595,000 gallons gpm.

TABLE 2-1

SUMMARY OF EPS POWER GENERATING CAPACITY AND FLOWS

| Unit # | Date on Line* | Capacity (MW) | Number of Cooling Water Pumps | Cooling Water Flow (gpm)** | Service Water Pump Flow (gpm)** | Total (MGD ) |
|---|---|---|---|---|---|---|
| 1 | 1954 | 107 | 2 | 48,000 | 3,000 | 73 |
| 2 | 1956 | 104 | 2 | 48,000 | 3,000 | 73 |
| 3 | 1958 | 110 | 2 | 48,000 | 6,000 | 78 |
| 4 | 1973 | 287 | 2 | 200,000 | 13,000 | 307 |
| 5 | 1978 | 315 | 2 | 208,000 | 18,200 | 326 |
| Gas turbine | 1968 | 16 | 0 | 0 | 0 | 0 |
| | | | **Total:** | **552,000** | **43,200** | **857** |

* Encina Power Station NPDES Permit No. CA0001350, Order No. 2000-03, SDRWCB.
** Encina Power Station Supplemental 316(b) Report (EA Engineering, Science, and Technology 1997).

## 2.2 ALTERNATIVE SITES

There are only three possible sites in the City of Carlsbad that could accommodate a project of this nature. These are: (1) the Encina Power Station (EPS); (2) Encina Water Pollution Control Facility (EWPCF); and (3) Maerkle Reservoir. Among these, EPS is the only site in reasonable proximity to the seawater intake, the outfall, and key delivery points of the distribution system of the largest user of the desalinated seawater – the City of Carlsbad. This location allows the Project to optimize the cost of delivery of the produced water and minimize the environmental impacts associated with construction and operation of the Project. This particular site also offers the advantage of avoiding the construction of major new intake and discharge facilities, which provides significant environmental and cost benefits.

The Project EIR analyzed the viability of alternative sites for the seawater desalination plant within the boundaries of the EPS and alternative sites within the boundaries of the EWPCF.[1] The Coastal Commission Staff requested an evaluation of other potential locations for the desalination facility and its associated infrastructure. As a result, Poseidon added the Maerkle Reservoir site to the list of alternative sites to be considered. The sites evaluated by the Poseidon and the City of Carlsbad are the only parcels in the entire City of Carlsbad with compatible land use designation and sufficient space

[1] See Final EIR – 03-05 for the Precise Development Plan and Desalination Plant Project SCH #2004041081, City of Carlsbad, p. 4.8-17, June 13, 2006, Section 6.0, Alternatives to the Proposed Action, Subsection 6.2 - Alternative Site Location, pages 6-1 and 6-2.

available to accommodate the desalination facility. The merits of each site are summarized below.

### 2.2.1 Encina Power Station.

Alternative sites at the EPS were found infeasible because the power plant owner has reserved the remaining portion of the site to—accommodate future power plant modifications, upgrades or construction of new power plant facilities.

### 2.2.2 Encina Water Pollution Control Facility.

The site located within the boundaries of the EWPCF can only accommodate a desalination plant with a 10 MGD production capacity, due to outfall constraints. A desalination plant of 10 MGD production capacity will be inadequate to satisfy the demand of even one of the users of desalinated water from the Project – the City of Carlsbad, with a demand of up to 25 MGD. This deficiency renders the use of the EWPCF site infeasible. In addition, the use of this site would require construction of a 2-mile long, 72-inch diameter intake pipeline to convey the source seawater from the power plant cooling canal to the EWPCF site, which would have significant cost impacts on the Project and additional environmental and traffic impacts resulting from the construction of such a large pipeline. Installation of a new intake at the EWPCF site is cost-prohibitive.

### 2.2.3 Maerkle Reservoir.

Maerkle Reservoir is the only other area within the City of Carlsbad that offers compatible land use and is of suitable size to accommodate the Project. The Maerkle Reservoir site is owned by the City of Carlsbad and is located 10.6 miles east of the proposed Project site.

For a number of reasons, this location does not provide a feasible alternative site. First, the public rights-of-way between Maerkle Reservoir and the Pacific Ocean do not have sufficient space to accommodate a 72-inch intake pipeline and a 48-inch concentrate line (Poseidon, 2007). Second, it would be extremely disruptive to the public and the environment to acquire sufficient public and private property outside existing public rights-of-way to construct the pipelines. Third, over 100 MGD of seawater would have to be pumped to an elevation of 531 feet for processing, compared to pumping the seawater to an elevation of 70 feet at the proposed site. Fourth, because the Maerkle site is zoned as "Open Space," a "Public Utility" zoning designation would be incompatible with the Carlsbad General Plan and the proposed Project would be in direct conflict with the adjacent residential retirement community of Ocean Hills. Fifth, such a proposal would be in direct conflict with the City of Carlsbad's objective *"[t]o locate and design a*

*desalination plant in a manner that maximizes efficiency for construction and operation and minimizes environmental effects."*

Finally, the additional construction and operating costs associated with piping and pumping the seawater and concentrate over this additional distance would represent a 20 percent increase in the cost of water. Such an increase in cost would render the Project infeasible while providing no measurable benefit to the public or the environment. An additional 10.6 miles of 72-inch seawater supply line would cost approximately $57.1 million. The enlarged pump station to accommodate the additional 461 feet of pump lift required to move the seawater to the alternative site would cost an additional $8.0 million. The additional cost of the 10.6 mile, 48-inch concentrate return line would be $29.6 million. In summary, the alternative Project site at Maerkle Reservoir would result in a $94.7 million (35 percent) increase in the capital budget for the Project (Poseidon, 2006).

Similarly, the alternative Project site at Maerkle Reservoir would result in three significant changes to the Project operating budget arising out of the increase in the amount of energy necessary to pump seawater to an inland location at a higher elevation, which would result in a net increase in operating cost for the Project. First, the cost to pump the seawater from the intake to the alternative plant site would increase $6.7 million per year. Second, the cost to pump the product water from the plant to the intended use area would decrease $3.0 million per year due to the fact that the product water is being pumped from a starting elevation of 511 feet rather than sea level. Finally, the energy recovery opportunity associated with the discharge of the concentrate from 511 feet down to sea level will result in an additional $1.1 million reduction in operating cost. The net increase in operating cost for the alternative Project located at Maerkle Reservoir would be $2.6 million per year (10 percent) (Poseidon, 2006).

The environmental issues associated with the construction of a 10.6-mile, 72-inch intake pipe and a 10.6-mile, 48–inch discharge line, compared to the proposed single 10.6-mile 48-inch product water conveyance pipeline, would be significant. There would be an approximately 225% increase in the volume of material that would need to be excavated. All of this material would need to be trucked offsite for disposal, resulting in over 200% increase in construction-related air quality impacts and traffic impacts over that already accounted for in the Project EIR due to the hauling of pipeline-related excavation material (Poseidon, 2007).

The 72-inch pipeline would likely be constructed in designated open-space or on private property for almost the entire length of the alignment due to the lack of space for additional utilities within existing rights-of-way. Construction-related activities could cause temporary disruption and impacts to an additional 40 feet of private property or public open space along the entire length of the pipeline. Much of this alignment is sensitive habitat such as coastal sage scrub which may prohibit the construction methods that are the basis of the cost estimates provided above. Alternatively, the construction impacts would require mitigation in the form of replacement habitat per the ratios set forth in section 4.3 of the EIR. Tunneling and mitigation costs associated with this

alternative could be in the tens of millions of dollars. For these reasons, the alternative Project location at Maerkle Reservoir is financially and environmentally infeasible. In addition, the alternative location is not properly zoned for a desalination facility.

## 2.3 BEST AVAILABLE SITE

The proposed location for the CDP at the EPS is the best available site for the Project for a number of reasons:

- The site is properly zoned and the proposed use is consistent with other uses in the area.

- The location of the proposed desalination facility adjacent to the existing EPS has a number of environmental and cost advantages that cannot be matched at any other location within the service area to which water will be delivered. These advantages are as follows:

    - Least environmental impacts;
    - Lowest energy consumption;
    - Least disruption to public and private property;
    - Lowest construction cost; and
    - Lowest operating cost.

The proposed site is the only feasible location for the proposed Project in the service area and presents a unique opportunity for minimizing environmental impacts in a cost-effective manner. Locating the desalination facility further inland increases costs, which would indirectly increase the cost of the water to consumers, and increases construction-related disruptions to the public and the environment due to the need to construct a 72-inch and 48-inch pipeline instead of a single 48-inch pipeline, with no clear environmental benefit. Any of the proposed alternatives to co-location would require fundamental changes to the Project, which in turn would require complete redesign and re-engineering, as well as new entitlements from the City of Carlsbad and a new NPDES permit from the Regional Board. Poseidon has already invested eight years developing and obtaining permits for the Project. The potential delays posed by the alternative locations also would preclude the successful completion of the Project within a reasonable time. Therefore, such alternatives are not feasible.

The City of Carlsbad determined that, from a land use planning perspective, the best site for the desalination facility in the entire City of Carlsbad was the parcel in the northwest corner of the power plant property where Fuel Oil Tank No. 3 is currently located.[2] This location was selected specifically to further the City of Carlsbad Redevelopment Plan goals related to facilitating the conversion and relocation of the power plant east of the railroad tracks and enhancement of commercial and recreational opportunities in the area

[2] Final EIR – 03-05 for the Precise Development Plan and Desalination Plant Project SCH #2004041081, City of Carlsbad, p. 4.8-17, June 13, 2006.

west of the railroad tracks currently occupied by the existing power plant. This location leaves the majority of the site open for potential redevelopment at some future date and will create no significant impacts to relocation of the power plant to a site to the east of the railroad tracks or infrastructure needed to serve a power plant at this location.[3]

The Coastal Act provides for special consideration of coastal-dependent industrial facilities. Even if a coastal-dependent project is found to be inconsistent with certain Coastal Act goals, it can be approved upon application of a three part test – (1) that alternative locations are infeasible or more environmentally damaging; (2) that adverse environmental effects are mitigated to the maximum extent feasible; and (3) that to do otherwise (i.e., deny the project) would adversely affect the public welfare.[4]

The Coastal Commission determined that Poseidon's proposed seawater desalination facility would be a coastal-dependent industrial facility, as it would need to be sited on or adjacent to the sea in order to function at all.[5] In applying the three tests above, the Commission found (1) that there are no feasible and less environmentally damaging alternative locations available the Project;[6] (2) that the proposed Project as conditioned mitigates its impacts to the maximum extent feasible;[7] and (3) that facility is a necessary part of the region's water portfolio and denial of the Project would adversely affect the public welfare.[8]

## 2.4 CONCLUSION

The proposed location for the CDP at the EPS is the best available site for the Project. There are no feasible and less environmentally damaging alternative locations for the Project.

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[3] Id.
[4] See Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 91 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf
[5] Id.
[6] See Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 92 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf
[7] Id. at 93.
[8] Id. at 99 and 100.

# CHAPTER 3

# DESIGN

## INTRODUCTION

Pursuant to Water Code Section 13142.5(b), this Chapter identifies the best available design feasible to minimize Project related impacts to marine life. This Chapter is broken down into eight sections:

- *The first section provides a general description of the design features that have been incorporated into the Project to minimize Project related impacts to marine life.*
- *The second section describes the desalination plant intake and discharge facilities and modes of operation.*
- *The third section describes the design feature to use the power plant discharge to the maximum extent feasible to minimize Project related impacts to marine life.*
- *The fourth section describes the design feature to reduce the velocity of seawater through the intake to the maximum extent feasible to minimize the impacts to marine life.*
- *The fifth section describes the design feature to reduce the velocity of seawater through the fine screens to the maximum extent feasible to minimize the impacts to marine life.*
- *The sixth section describes design feature to process ambient temperature seawater to the maximum extent feasible to minimize temperature related impacts to marine life.*
- *The seventh section describes design feature to eliminate heat treatment to the maximum extent feasible to minimize the impacts to marine life.*
- *The eighth section summarizes the design features and the resulting impact they have on minimizing Project related impacts to marine life.*

## 3.1 DESIGN FEATURES

The Carlsbad seawater desalination project (CDP) incorporates a number of design features that would minimize impingement and entrainment impacts associated with this project. The CDP is designed to use the existing intake and discharge facilities of the Encina Power Generation Station (EPS). When EPS is producing electricity and using 304 MGD or more of seawater for once-through cooling, the proposed desalination plant operation would cause a *de minimis* increase in impingement and entrainment of marine organisms.

Under conditions when the EPS operation is temporarily or permanently discontinued, the desalination plant will continue to use the existing power plant intake and discharge facilities. Under this condition, the impingement and entrainment impacts of the desalination plant

operations would be significantly lower than those caused by the EPS operations at the same intake flow, due to a number of differences in the desalination plant and power plant intake design and operations. The key differences are summarized below and described in the following sections:

1. **Use of EPS discharge as source water for CDP.** In 2007 seawater pumping by the EPS would have met 61 percent of the CPD flow requirements, resulting in a 61 percent reduction of entrainment and impingement impacts attributable to the CDP.

2. **Reduction in inlet screen velocity.** The CPD is designed for intake flow of 304 MGD. At this rate of flow, the velocity of the seawater entering the inlet channel is at or below 0.5 feet per second (fps), resulting in impingement losses being reduced to an insignificant level.

3. **Reduction in fine screen velocity.** Under stand-alone operations, the CDP seawater supply would be pumped through an optimum combination of the existing fine screens and condensers serving the power plant so to minimize the velocity and turbulence of the water moving through the system. Lowering velocity and turbulence of the seawater would lessen the physical damage to marine life; resulting in a reduction of impingement and entrainment mortality.

4. **Ambient temperature processing.** One of the factors contributing to entrainment mortality of marine organisms during power plant operations is the increase of the seawater temperature during the once-through cooling process. Under stand-alone operations, the CDP would be designed to use ambient temperature seawater instead of heated seawater, which would eliminate entrainment mortality associated with the elevated seawater temperature.

5. **Elimination of heat treatment.** Periodic heat treatment of the power plant intake and discharge has significant contribution to entrainment and impingement mortality. Under stand-alone operations of the desalination plant, the heat treatment of the intake and discharge would be discontinued and associated entrainment and impingement mortality would be eliminated.

## 3.2 DESALINATION PLANT INTAKE AND DISCHARGE CONFIGURATION

The seawater desalination plant intake and discharge facilities would be located adjacent to the Encina Power Plant. A key feature of the proposed design is the direct connection of the desalination plant intake and discharge facilities to the discharge canal of the power generation plant. This approach allows using the power plant cooling water as both source water for the seawater desalination plant and as a blending water to reduce the salinity of the desalination plant concentrate prior to the discharge to the ocean.

Figure 3-1 illustrates the configuration of the desalination plant and EPS intake and discharge facilities. As shown on this figure, under conditions when both the desalination facility and the

power plant are operating, seawater collected from Agua Hedionda Lagoon enters the power plant intake facilities, passes through the 3.5-inch inlet screens at the mouth of the intake structure, and subsequently through the vertical travelling screens, and then it is pumped through the plant's condensers. The warm seawater released from the condensers is conveyed to the ocean via discharge canal. The CDP intake structure would be connected to this discharge canal and would divert an average of 104 MGD of the cooling water for production of fresh water.

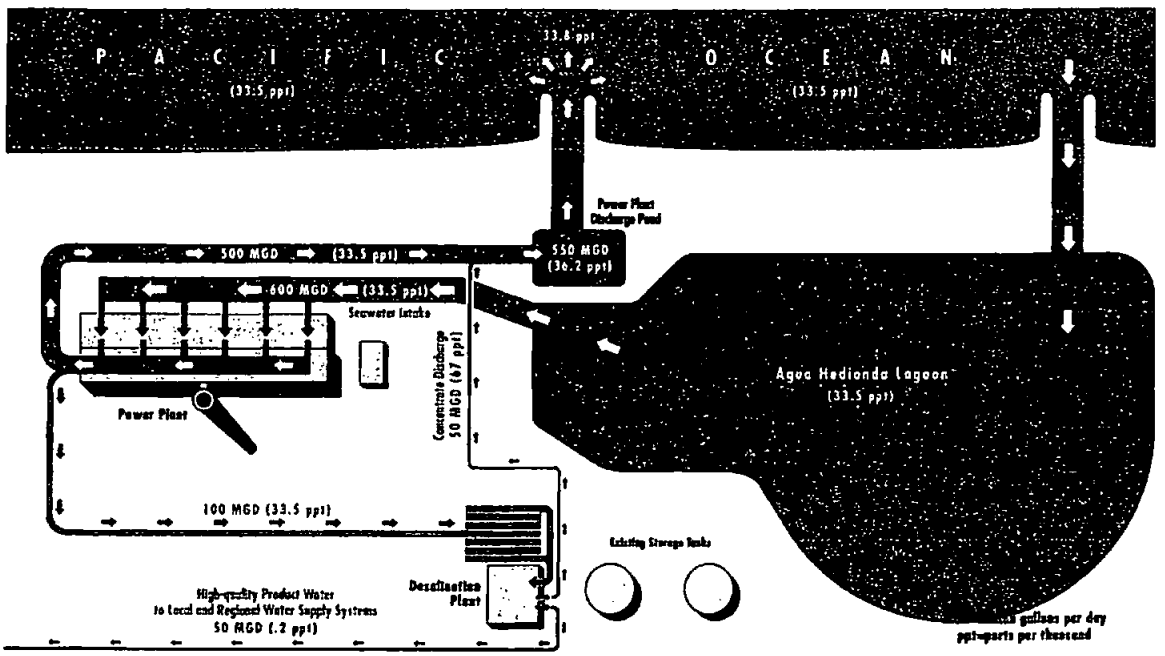



**Figure 3-1 –Carlsbad Desalination Plant and Encina Power Station**

Approximately 50 MGD of the seawater would be desalinated via reverse osmosis treatment and conveyed for potable use. The remaining 54 MGD would have salinity approximately two times higher than that of the ocean water (67 ppt vs. 33.5 ppt). This seawater concentrate would be returned to the power plant discharge canal downstream of the point of intake for blending with the cooling water prior to conveyance to the Pacific Ocean. A minimum of 200 MGD of cooling water would be needed to blend with the 54 MGD of concentrate in order to reduce the desalination plant discharge salinity below the limit of 40/44 ppt (daily/hourly average) established by the Regional Board Order R9-2006-0065 for this project. Therefore, the total volume of cooling water required for normal operation of the desalination plant is 304 MGD.

If the power plant discharge flow is equal to or higher than 304 MGD, then the cooling water discharge volume is adequate to sustain desalination plant operations. Under this condition, since no additional seawater is collected for production of drinking water, the incremental impingement and entrainment impacts of the desalination plant operations is minimal, especially taking under consideration that the power plant operations are assumed to cause 100 percent mortality of the entrained marine organisms.

Under the conditions of temporary or permanent power plant shutdown, or curtailed power generation that results in cooling water discharge below 304 MGD, the existing power plant intake system would need to be operated to collect up to 304 MGD of seawater for the desalination plant. This seawater will pass sequentially through the power plant inlet screens (bar racks), the fine vertical screens, the power plant intake pumps and the power plant condensers before it reaches the desalination plant intake pump station. The features incorporated in the desalination plant design to reduce impingement, entrainment and flow collection under such "stand-alone" operating conditions are discussed below.

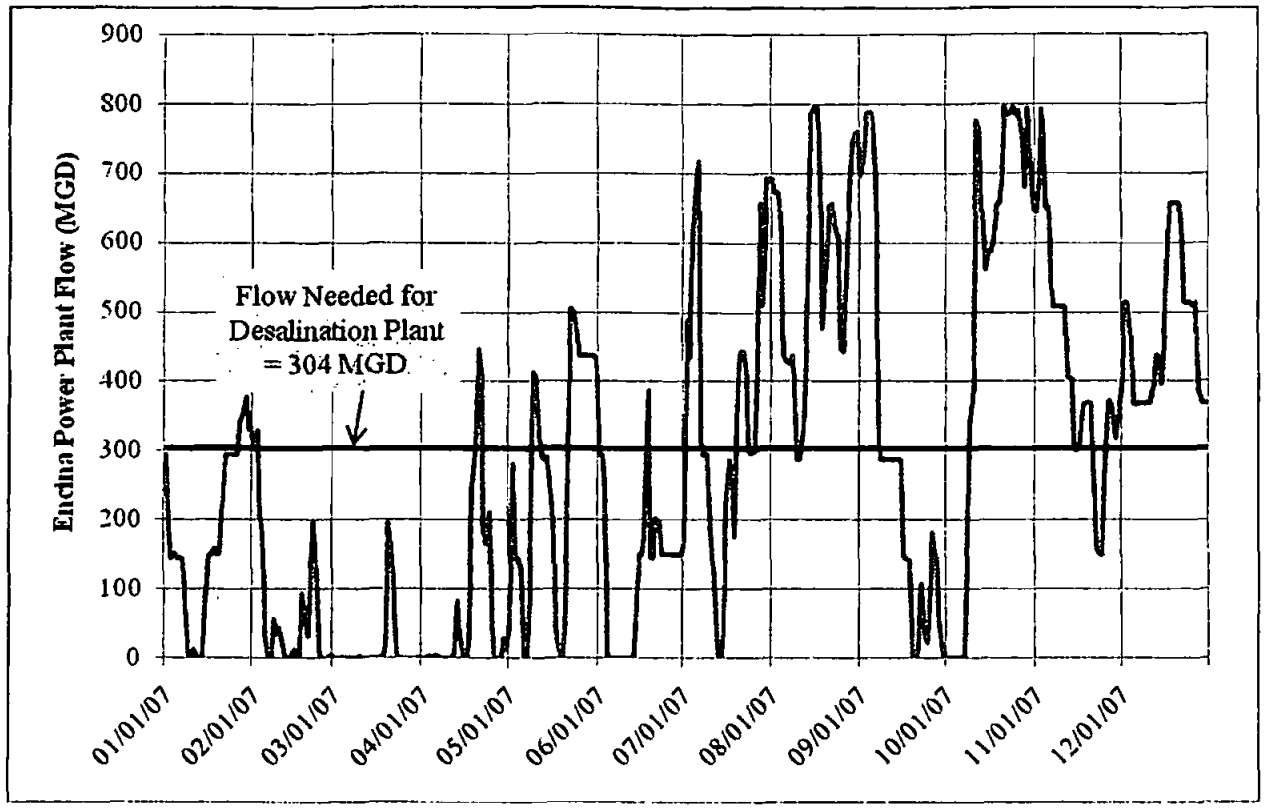
## 3.3 USE OF EPS DISCHARGE AS SOURCE WATER FOR CDP

The CDP is designed to use the existing intake and discharge facilities of the Encina Power Generation Station (EPS). When EPS is producing electricity and using 304 MGD or more of seawater for once-through cooling, the proposed desalination plant operation would cause a *de minimis* increase in impingement and entrainment of marine organisms.

Under conditions when the EPS operation is temporarily or permanently discontinued, the desalination plant will continue to use the existing power plant intake and discharge facilities. Under this condition, the impingement and entrainment impacts of the desalination plant operations would be significantly lower than those caused by the EPS operations at the same intake flow, due to a number of differences in the desalination plant and power plant intake design and operations.

Figure 3-2 provides a comparison of the 2007 EPS cooling water discharge to the flow needed to support CDP operations. Under 2007 operating conditions, the EPS discharge would provide 61 percent of the CDP annual seawater intake requirements and the CDP would have withdrawn an additional 39 percent of its source water from the EPS intake to make up the deficit in supply available from the EPS discharge. Under these operating conditions, the entrainment and impingement impact that would be attributed to the desalination operations would be limited to only 39 % of that identified in Chapter 5 for the stand-alone desalination facility operations. The CDP's direct use of the EPS discharge, coupled with other design and technology features described in Chapters 3 and 4, would result in a substantial reduction in the CDP entrainment and impingement impacts.

**Figure 3-2**
**2007 EPS Cooling Water Discharge versus CDP Flow Requirements**




## 3.4 REDUCTION IN INLET SCREEN VELOCITY

The CDP was designed for intake flow of 304 MGD (50 percent recovery) to minimize the impingement and entrainment of marine organisms under stand-alone operations. Higher intake flow, although preferable from a point of view of ease of desalination plant operations, would result in elevated potential for impingement and entrainment.

Impingement losses associated with the collection of seawater at the power plant intake would be reduced when the through-screen velocity at the inlet intake screens (bar racks) is equal to or less than 0.5 fps because this velocity would be low enough to allow some of the marine organisms to swim away from the inlet mount and to avoid potential harm from impingement.

At the design flow of 304 MGD needed for CDP operations, the inlet screen velocity would be less than or equal to 0.5 fps, thereby creating flow conditions that would reduce impingement losses to a less than significant level.

## 3.5 REDUCE FINE SCREEN VELOCITY

During stand-alone operations, the power plant intake pumps and screens will be operated in modified configuration that minimizes the through-screen velocity and thereby reduces potential impingement of marine organisms that reach these screens.

### 3.5.1 Description of Power Plant Intake Screen and Pump System

A detailed description of the power plant intake system is provided in Section 2. After the seawater passes through the inlet screens (bar racks) the intake forebay tapers into two 12-foot wide intake tunnels. From these tunnels the seawater enters one of four 6-foot wide conveyance tunnels. Cooling water for conveyance tunnels 1 and 2 passes though two vertical traveling screens to prevent fish, grass, kelp, and debris from entering intakes for power plant generation Units 1, 2 and 3. Conveyance tunnels 3 and 4 carry cooling water to intakes for power plant generation Units 4 and 5, respectively. Intakes for Unit 4 and 5 are equipped with two and three vertical travelling screens, respectively.

As electrical demand varies, the number of generating units in operation and the number of cooling water pumps needed to supply those units will also vary. Over the period of 2002 to 2005, the EPS has reported combined discharge flows ranging from 99.8 MGD to 794.9 MGD with a daily average of 600.4 MGD. Over the 20.5 year period of January 1980 to mid 2000 the average discharge flow was 550 MGD. In 2007, the average annual intake flow was 276 MGD. For comparison, the total intake flow needed for stand-alone operations of the desalination plant is 304 MGD.

### 3.5.2 Typical Mode of EPS Vertical Screen and Intake Pump Operations

As discussed in the previous section, each of the five power generation units is equipped with two cooling water pumps both of which operate when a given generating unit is producing electricity. All six pumps of power generation units 1, 2 and 3 share two common vertical screens of identical size (3/8-inch) and capacity. The two pumps of unit 4 are serviced by two 3/8-inch screens, and the two pumps of unit 5 are serviced by three 5/8-inch screens located in a common channel upstream of the pumps. With all pumps in operation, the through screen velocity of the vertical screens typically is higher than 0.5 fps, thereby contributing to the impingement of marine organisms that may have reached these screens.

### 3.5.3 Modified Utilization of the EPS Intake Screens and Pumps During Stand-Alone Operations of the Desalination Plant

Desalination plant operation is independent from the power production process and therefore, the existing EPS intake pumps do not need to be operated coupled with the intake screens of a given unit. This design flexibility of the desalination plant allows a greater number of screens to collect the volume of water needed for the CDP operation. For example, if the power plant needs to generate 287 MW of electricity, typically unit 4 (see Table 2-1) would be used for

power generation and both intake pumps and screens associated with this unit would be in service. Under this operational condition, the cooling water flow used would be 307 MGD.

If the desalination plant is operated in stand-alone condition (i.e. no power is generated) then there is greater pump selection flexibility. For example, rather than using two intake pumps of unit 4, the desalination plant would collect similar amount of seawater by running only one pump of unit 4, and one pump of unit 5. However, in this case approximately the same amount of flow would be screened through five screens (the two screens of unit 4 and the three screens of unit 5), thereby reducing the through-screen velocity to at least a half. This significant reduction of the through screen velocity would allow to reduce the impingement of marine life on the vertical screens as well. Such impingement reduction cannot be achieved if the power plant intake pumps are used to deliver cooling water for power generation because when a given power generation unit is used to generate electricity, than both cooling pumps must be in operation simultaneously to provide adequate amount of cooling water for the normal operation of this unit. If the power plant discontinues power generation, than cooling pump operation can be decoupled from the operation of the condensers and this in turns allows to pump the same flow through two over times larger screening area and therefore to reduce the through screen velocity more than two times.

## 3.6 ELIMINATION OF HEAT-RELATED ENTRAINMENT MORTALITY

The seawater desalination plant will be designed with the flexibility to operate using warm water from the power plant condensers when they are in operation; and cold seawater when the power plant is not generating energy. This design feature will also avoid the need to preheat the intake seawater in the future if and when the power plant once-through cooling operation is discontinued. Elevated seawater temperature may increase the mortality of the entrained marine life. Since under stand-alone conditions the source seawater will not be heated this entrainment mortality factor will be eliminated.

## 3.7 ELIMINATION OF HEAT TREATMENT RELATED MORTALITY

Under the current mode of operations, the power plant completes heat treatment of the intake facilities every 6 to 8 weeks for 6 to 8 hours per event. Since seawater is re-circulated during the heat treatment event (i.e. no new seawater is collected or discharged), there is 100% mortality of the marine organisms residing in the intake canals unless they are physically removed prior to exposure to elevated temperature. Desalination plant operations would not require heat treatment of the existing intake and discharge facilities and marine organism mortality associated with the heat treatment events will be eliminated. Instead, the power plant intake and discharge system will be cleaned periodically by circulation of plastic scrubbing balls that will be circulated through the system via the existing pumps in a close cycle process. The scrubbing calls will be introduced at the beginning of the cleaning process and captured at the end of the process. The size of the scrubbing balls is usually 0.5 inches and they will move freely within the channels and piping at relatively low velocity (3 to 5 fps).

## 3.8 SUMMARY OF DESALINATION PLANT DESIGN FEATURES TO MINIMIZE IMPACTS TO MARINE LIFE

The design features are included in the CDP to minimize impacts to marine organisms are summarized in Table 3-1.

**TABLE 3-1**

**DESIGN FEATURES TO MINIMIZE IMPACTS TO MARINE LIFE**

| Category | Feature | Result |
|---|---|---|
| 1. Design | Use of EPS discharge as source water for CDP | Sixty-one percent reduction of entrainment and impingement impacts attributable to the CDP |
| 2. Design | Reduction in inlet screen velocity | Reduction of impingement of marine organisms |
| 3. Design | Reduction in fine screen velocity | Reduction of impingement of marine organisms |
| 4. Design | Ambient temperature processing | Eliminate entrainment mortality associated with the elevated seawater temperature |
| 5. Design | Elimination of heat treatment | Entrainment and impingement mortality associated with heat treatment would be eliminated |

# CHAPTER 4

# TECHNOLOGY

## INTRODUCTION

Pursuant to Water Code Section 13142.5(b), this Chapter identifies the best available technology feasible to minimize Project related impacts to marine life. This Chapter is broken down into five sections:

- *The first section describes constraints and opportunities associated with inclusion of technology features in the Project to minimize Project related impacts to marine life.*
- *The second section assesses the feasibility of alternative intake technologies to minimize Project related impacts to marine life.*
- *The third section assesses the feasibility of alternative intake screening technologies to minimize Project related impacts to marine life.*
- *The fourth section assesses the feasibility of alternative desalination technologies to minimize Project related impacts to marine life.*
- *The fifth section summarizes the feasibility assessment of technology features and the resulting impact they have on minimizing Project related impacts to marine life.*

## 4.1 FEASIBILITY CONSIDERATIONS

Poseidon conducted a feasibility assessment of the best available technology for reduction of entrainment and impingement impacts. This assessment resulted in the identification of those technologies that are feasible for implementation under the site-specific conditions of the proposed project. For the purposes of this assessment, we relied upon the definition of feasible set forth in the California Environmental Quality Act (CEQA) Guidelines: "*'Feasible' means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors*" (CEQA Guidelines, § 15364).

Site-specific conditions dictate that a fundamental feasibility constraint associated with potential entrainment and impingement reduction technologies is that the technology must be compatible with both CDP and EPS operations. In its recommended amendment of the EPS intake and outfall lease to authorize use of these facilities by the CDP, the State Lands Commission (SLC) staff recognized entrainment and impingement minimization measures cannot interfere with, or interrupt ongoing power plant operations:[1]

[1] State Lands Commission October 24, 2007 recommended Amendment of Lease PRC 8727.1

> *12. Without interference with, or interruption of, power plant scheduled operations and at its sole cost and expense, Poseidon Resources, as a separate obligation, shall use the best available design, technology, and mitigation measures at all times during with this Lease is in effect to minimize the intake (impingement and entrainment) and mortality of all forms of marine life associated with the operation of the desalination facility as determined by the San Diego Regional Water Quality Control Board or any other federal, state, or local entity.*

When the EPS permanently ceases use of the once-through cooling water system, additional entrainment and impingement technologies may become feasible. While no timeline has been established as to when this might occur, SLC's proposed Lease Amendment requires that in ten years SLC would evaluate the feasibility of the implementation of those additional technologies it determines are appropriate in light of an environmental review it would undertake at that time:[2]

> *14. Ten years from October 30, 2007, Lessor will undertake an environmental review of the ongoing impacts of the operation of the desalination facility to determine if additional requirements pursuant to Paragraph 12 are required. Lessor will hire a qualified independent environmental consultant at the sole expense of Poseidon Resources with the intent to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. Lessor may require, and Poseidon Resources shall comply with, such additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations and as Lessor determines are appropriate in light of the environmental review.*

The CDP design includes the best available technology that has been determined to be feasible for the site specific conditions and size of this project and to minimize impingement and entrainment of marine organisms in the intake seawater. The selection of the desalination plant intake, screening and seawater treatment technologies planned to be used for this project is based on thorough analysis and investigation of a number of alternative seawater intake, screening and treatment technologies.

The following intake alternatives were analyzed:

- Subsurface intake (vertical and horizontal beach wells, slant wells, and infiltration galleries);
- New open ocean intake;
- Modifications to the existing power plant intake system; and
- Installation of variable frequency drives (VFDs) on seawater intake pumps.

Screening technologies compared to identify BTA included:

- Fish net, acoustic and air bubble barriers upstream of the existing intake inlet mouth;

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[2] Id.

- New screening technologies to replace the existing inlet screens (bar racks) and fine vertical traveling screens;

Desalination plant treatment technologies for reduced entrainment and improved survival included:

- Installation of micro screens ahead of the pretreatment system;
- Use of membrane pretreatment technology that allows to avoid the use of seawater conditioning chemicals;
- Return to the ocean of marine organisms captured at the desalination plant micro-screens and the pretreatment filters.

The following combination of intake, screening and treatment technologies were found to be feasible impingement, entrainment and flow reduction technology measures for the site-specific conditions of the Carlsbad project:

1. **Installation of VFDs on Desalination Plant Intake Pumps.** The desalination plant intake pump station design will incorporate variable frequency drives to reduce the total intake flow for the desalination facility to no more than that needed at any given time, thereby minimizing the entrainment of marine organisms.

2. **Installation of micro-screens.** Micro-screens (120 μ) minimize entrainment and impingement impacts to marine organisms by screening the fish larvae and plankton from the seawater.

3. **Installation of low impact pretreatment technology.** The desalination facility will rely on low pressure, chemical free membrane pretreatment filtration technology to minimize entrainment and impingement impacts to marine organisms that have passed through the micro screens by filtering the organisms from the seawater via 0.02 μ filters.

4. **Return to the ocean of marine organisms captured by the screens and filters.** Minimize entrainment and impingement impacts to marine organisms captured by the screens and filters by returning them to the ocean.

The assessment of the various technologies considered for impingement, entrainment and flow reduction is presented below.

## 4.2 ALTERNATIVE DESALINATION PLANT INTAKE TECHNOLOGIES

### 4.2.1 Desalination Plant Subsurface Intakes

The feasibility of using subsurface intakes (beach wells, slant wells, horizontal wells, and filtration galleries) was evaluated in detail during the EIR and Coastal Commission review phases of this project. A thorough review of the site-specific applicability of subsurface intakes

and a comprehensive hydro-geological study of the use of subsurface intakes in the vicinity of the proposed desalination plant site indicate that subsurface intakes are not viable due to limited production capacity of the subsurface geological formation, the potential to trigger subsidence in the vicinity of the site and the poor water quality of the collected source water. The geotechnical evaluation relied on drilling and testing information and near shore sediment surveys to assess the feasibility of using vertical, slant, and horizontal wells as seawater intake structures for the proposed project.

**Vertical Intake Wells:** Vertical intake wells consist of water collection systems that are drilled vertically into a coastal aquifer. A well yield of about 2,100 gpm would be expected from a properly constructed, large diameter production well at the test well location in Agua Hedionda Lagoon. Modeling results indicate that up to nine vertical wells could be placed in the 700 foot wide alluvial channel, each pumping about 2,100 gpm. Therefore, the maximum production from vertical wells placed under optimum conditions would be about 20,000 gpm (28.8 MGD). Given that the test well was placed in the optimum location, this would represent the upper limit of expected well yields from the alluvial deposits in the coastal basins of San Diego County, which is consistent with historic observations.

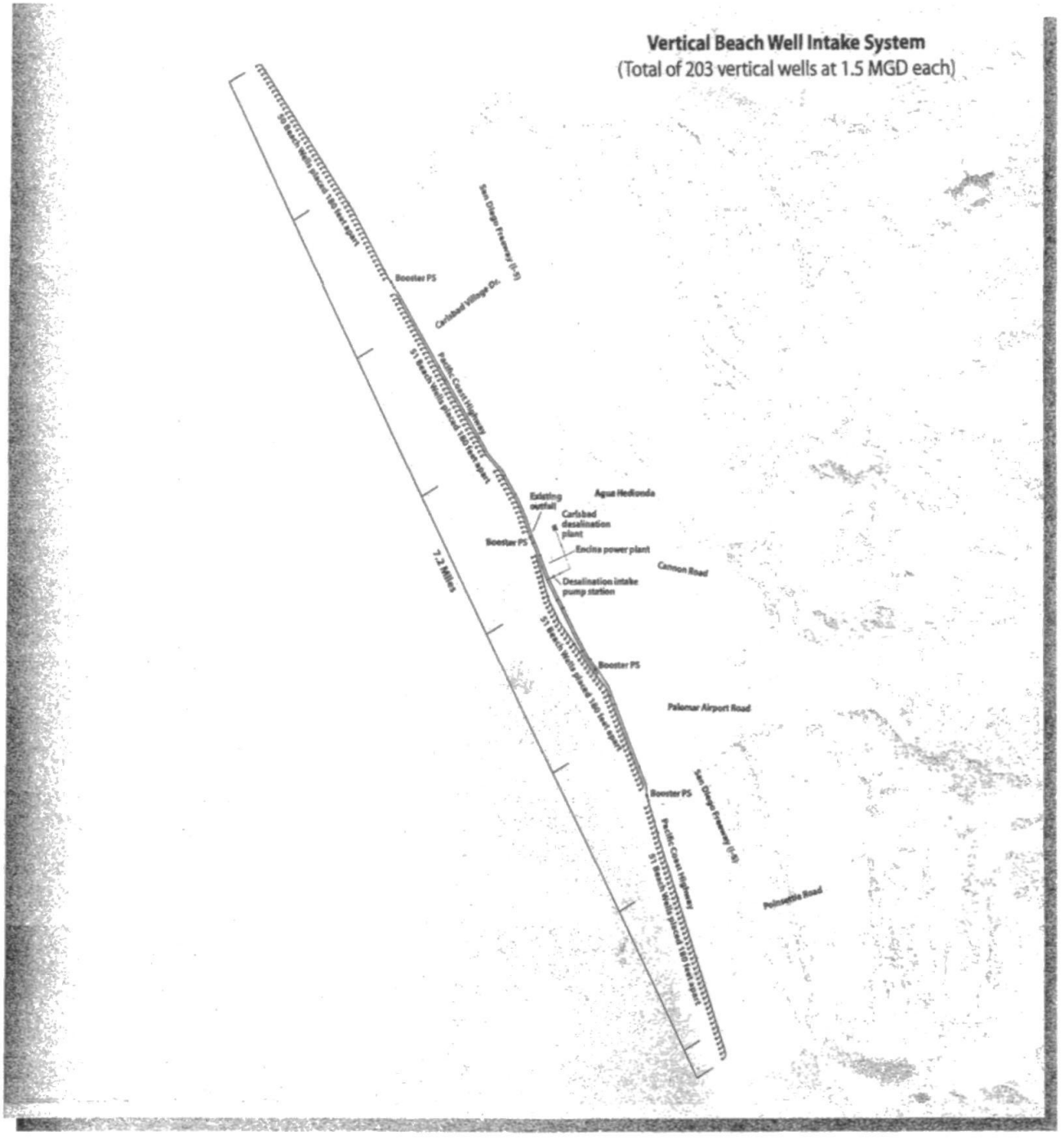
To meet the 304 MGD seawater demand of the project, 253 wells of a 1.5 MGD intake capacity each would have to be constructed. As shown in Figure 4-1, the vertical well intake system would impact 7.2 miles of coastline to collect and transport the water to the proposed desalination facility. As a result, the vertical well intake system is not the environmentally preferred alternative.

Use of vertical intake wells is not viable for the site-specific conditions of this project due to the limited transmissivity and yield capacity of the wells. The implementation of this scenario would require installation of very large number of wells (253) for which beach property is not available. The length of beach that would be occupied by desalination plant intake using vertical wells would be over seven miles and the total cost of the implementation of such intake would be approximately $650 million. See Attachment 1 for a detailed cost estimate. In summary, the vertical well intake alternative is not the environmentally preferred alternative, technically infeasible, and cost prohibitive.

**Slant Wells.** Slant wells are subsurface intake wells drilled at an angle and extending under the ocean floor to maximize the collection of seawater and the beneficial effect of the filtration of the collected water through the ocean floor sediments. Collection of 304 MGD of seawater needed for this project would require the use of 76 slant intake wells of capacity of 5 MGD each. The total length of beach occupied by slant wells would be over 4 miles and the construction costs for implementation of this alternative would exceed $410 million. See Attachment 1 for a detailed cost estimate.

The use of slant wells does not offer any advantage in this setting. The well field for which maximum production rates were calculated for vertical wells is located on sand spit located approximately 100 ft from Agua Hedionda and 300 ft from the Pacific Ocean. Those constant

# Figure 4-1 - Vertical Beach Well Intake System



head conditions were taken into account when assessing the yield of this type of subsurface intake.

The use of slant wells increases the screened thickness of saturated sediment slightly (a 45 degree well would result in a 20 percent increase in screened thickness over a vertical well) and places the screened section more directly below the constant head lagoon or ocean boundary condition. The close proximity of the well field to the constant head condition already achieves this, with a little increase in yield resulting from the slant well. Due to the site-specific hydrogeological conditions (low transmissivity of the ocean floor sediments and near shore aquifer) the use of slant wells is also not viable for the Carlsbad seawater desalination project. In summary, the slant well intake alternative is not the environmentally preferred alternative, technically infeasible, and cost prohibitive.

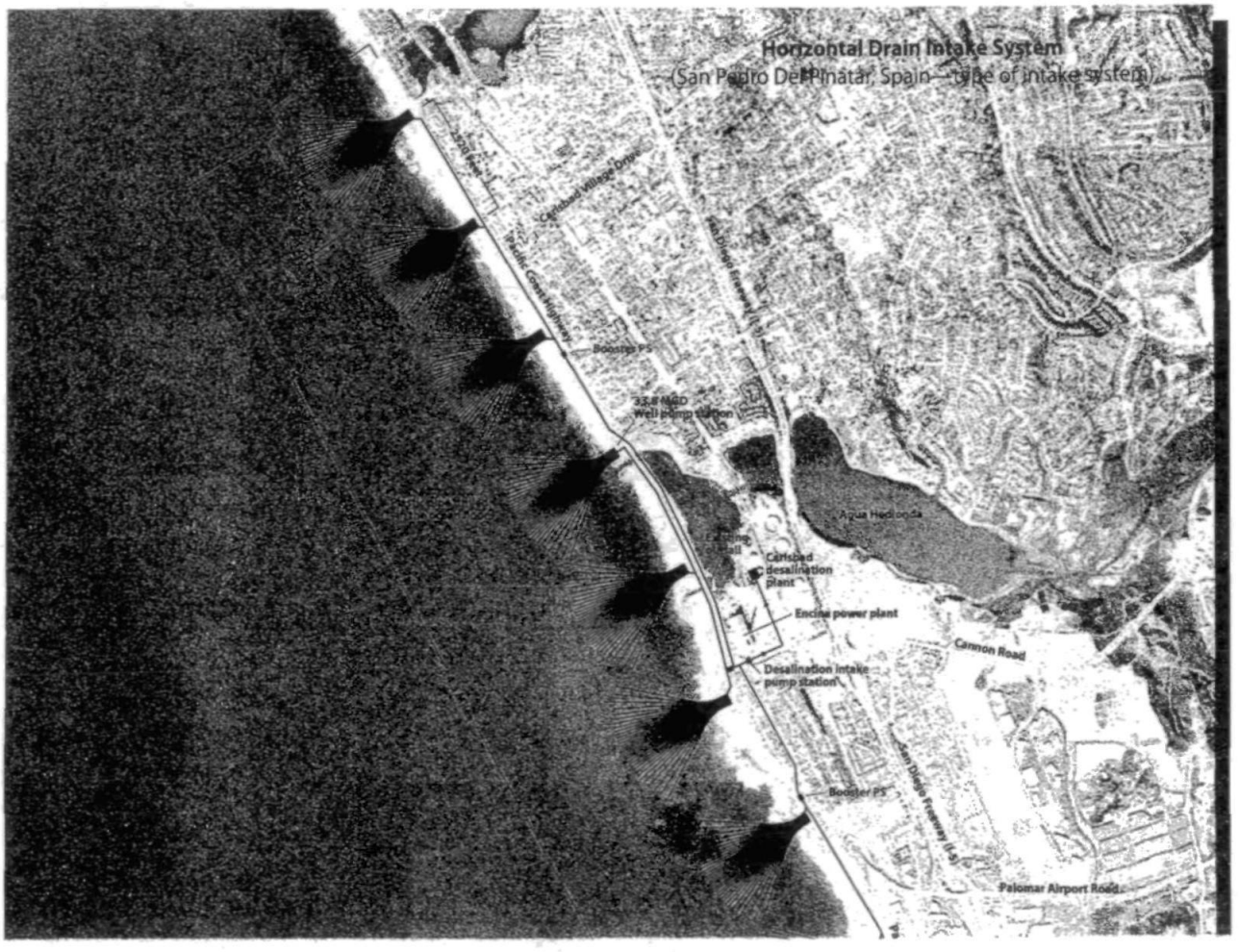
**Horizontal Wells.** Horizontal wells are subsurface intakes which have a number of horizontal collection arms that extend into the coastal aquifer from a central collection cason in which the source water is collected. The water is pumped from the cason to the desalination plant intake pump station, which in turn pumps it through the plant pretreatment system.

The use of horizontal wells, if the alluvial channel can be tapped offshore and the well can be kept inside this alluvial channel, can theoretically produce greatly increased yields by markedly increasing the screened length of the well in contact with permeable sediments.

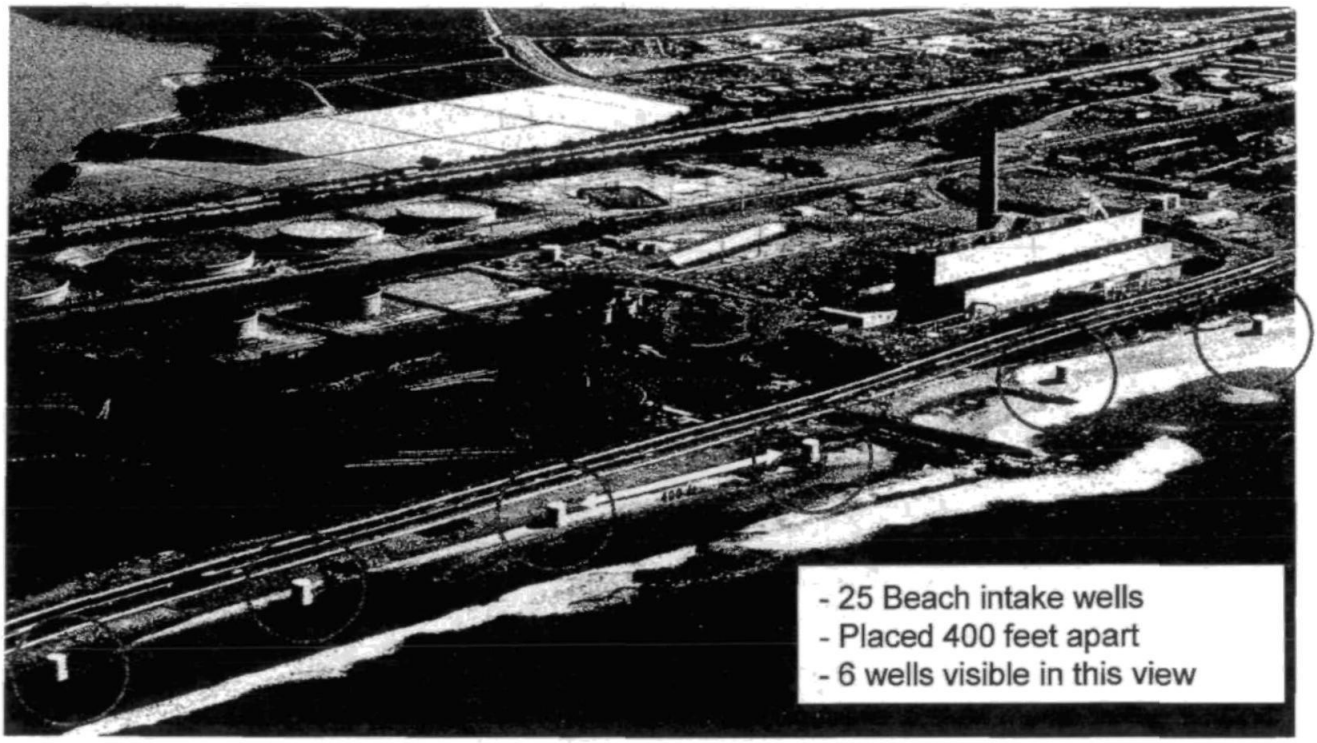
However, the diameter of the collection arms of the horizontal wells is limited to 12 inches (and most are 8-inch or smaller), in turn limiting the production rate to 1,760 gpm (2.5 MGD) per well. This conclusion was also confirmed by the Dana Point Ocean Desalination Project test well that documented a yield of 1,660 gpm (2.4 MGD) from a 12 inch diameter well in that location. Analysis of the sediment properties indicates that this would be achieved with a horizontal well extending approximately 200 ft below the Pacific Ocean or Agua Hedionda. Because of the constant head boundary at the ocean bottom or bottom of Agua Hedionda, there would be minimal interference between multiple horizontal wells, but the practicalities of drilling horizontal wells limit the space no less than about 50 ft. Given the limited width of the alluvial channel, only about 14 horizontal wells could be placed in the channel, for a total production rate of 28,000 gpm (40 MGD), still far below the project demand of 304 MGD. This approach assumes that additional exploration work will prove that elevated TDS concentrations in groundwater in the most permeable strata can be overcome.

Even if ideal conditions for this type of wells are assumed to exist (i.e., each well could collect 5 MGD rather than the 2.5 MGD determined based on actual hydrogeological data), horizontal well intake construction would include the installation of a total of 76 wells. The total length of coastal seashore impacted by this type of well intake would be 4.3 miles. As shown in Figures 4-2 and 4-3, the horizontal intake system would include nine large pump stations located on Tamarac State Beach and would impact 500 acres of shoreline and sensitive nearshore habitat. As a result, the horizontal intake system is not the environmentally preferred alternative. The cost for construction of horizontal well intake system for collection of 304 MGD of seawater needed for the desalination plant operation is estimated at $438 million. See Attachment 1 for a

# Figure 4-2 - Horizontal Drain Intake System



# Figure 4-3 – Pump Stations with Horizontal Intakes



detailed cost estimate. In summary, the horizontal intake alternative is not the environmentally preferred alternative, and is technically infeasible, and cost prohibitive.

**Subsurface Infiltration Gallery (Fukuoka Type Intake).** The subsurface infiltration gallery intake system consists of a submerged slow sand media filtration system located at the bottom of the ocean in the near-shore surf zone, which is connected to a series of intake wells located on the shore. As such, seabed filter beds are sized and configured using the same design criteria as slow sand filters. The design surface loading rate of the filter media is typically between 0.05 to 0.10 gpm/sq ft. Approximately one inch of sand is removed from the surface of the filter bed every 6 to 12 months for a period of three years, after which the removed sand is replaced with new sand to its original depth. As it can be seen on Figures 4-4 and 4-5, the ocean floor has to be excavated to install the intake piping of the wells and pipes are buried at the bottom of the ocean floor.

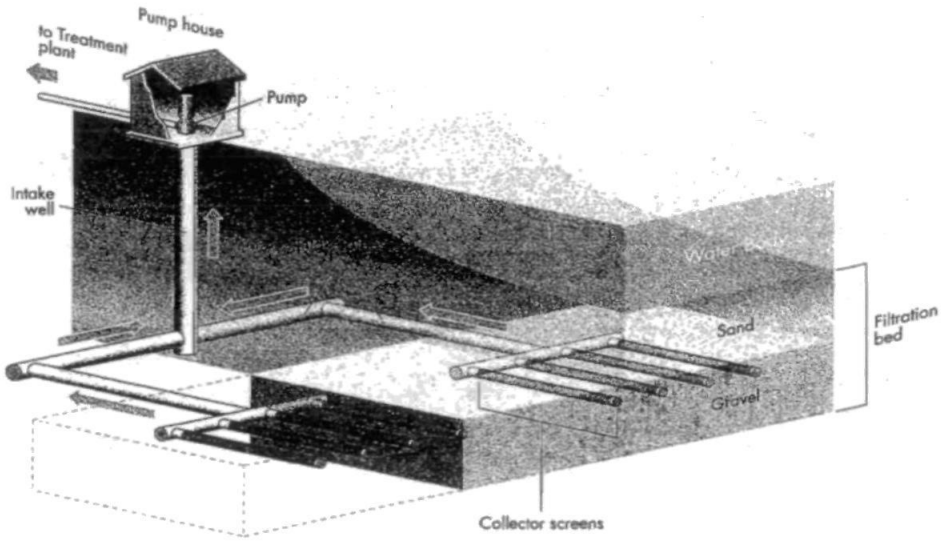



**Figure 4-4 – Subsurface Infiltration Gallery (Fukuoka Type Intake)**

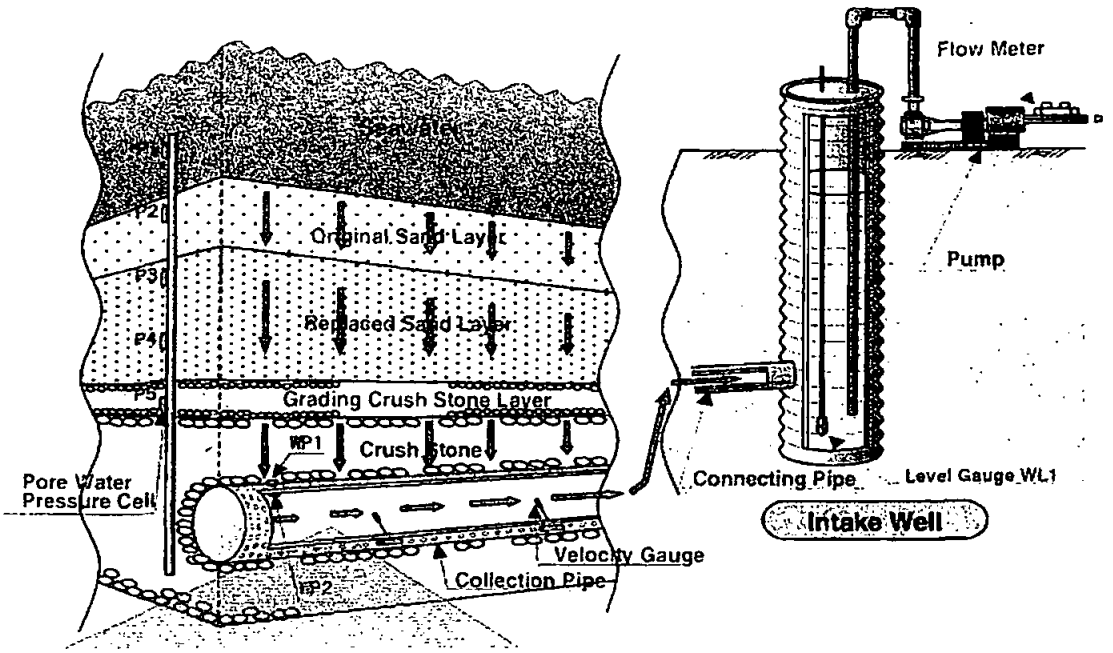


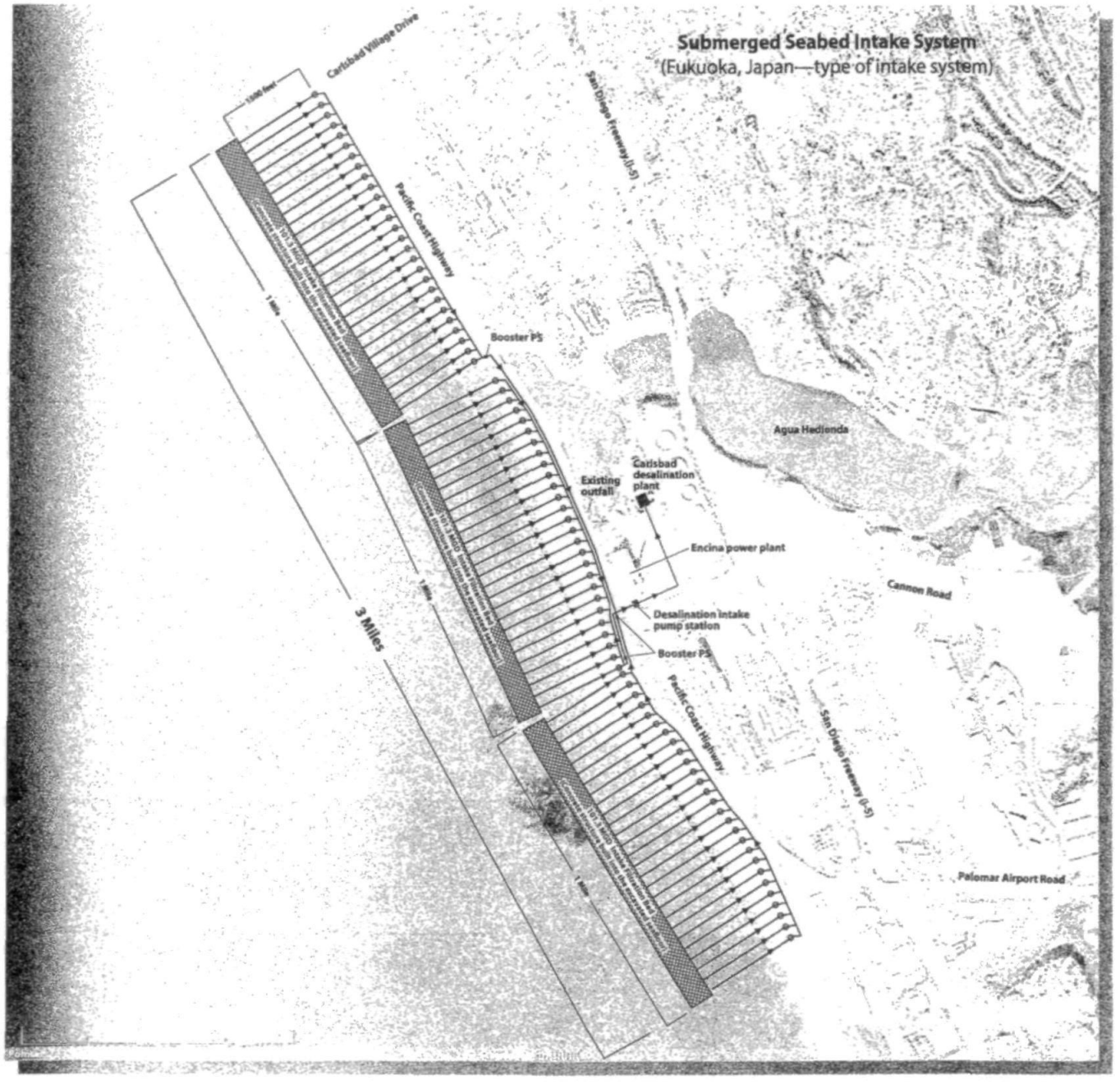

**Figure 4-5 – A Cross-Section of Subsurface Infiltration Gallery**

For the source water intake feed rate of 304 MGD needed for the Carlsbad seawater desalination project the total area of the ocean floor needed to be excavated to build a seabed intake system of adequate size is 146 acres. As shown in Figure 4-6, a submerged seabed intake system sized to meet the needs of the Carlsbad Desalination Project would impact three linear miles of sensitive nearshore hard bottom kelp forest habitat. The excavation of 146 acre/3-mile long strip of the ocean floor at depth of 15 feet in the surf zone to install a seabed filter system of adequate size to supply the Carlsbad desalination project, will result in a very significant impact on the benthic marine organisms in this location. In addition, the subsurface seabed intake system would have a similar effect on Tamarac State Beach. To collect the seawater from the filter bed and transfer it to the desalination facility, the intake system would require 78 collector pipelines on the ocean floor connected to 78 pump stations that would be installed on the State beach.

The cost for construction of subsurface seabed intake system for collection of 304 MGD of seawater needed for the desalination plant operation is estimated at $647 million. See Attachment 1 for a detailed cost estimate. In summary, the subsurface seabed intake alternative is not the environmentally preferred alternative, technically infeasible, and cost prohibitive.

**Water Quality Issues for Subsurface Intakes.** Based on the results of actual intake well test completed in the vicinity of the EPS, a key fatal flaw of the beach well water quality was the high salinity of this water. The total dissolved solids (TDS) concentration in the water was on the order of 60,000 mg/L, nearly twice that of typical seawater (33,500 mg/L). The test well water also had elevated iron and suspended solids content. The pumping test was extended for nearly a month at 330 gpm (0.5 MGD) to determine if additional pumping would cause the TDS,

# Figure 4-6 - Submerged Seabed Intake System



iron and suspended solids concentrations to approach that of the nearby seawater. After 30 days of pumping, the quality of the water withdrawn from the well did not improve significantly.

**Summary Evaluation of Subsurface Intake Feasibility.** The site-specific hydrogeologic studies used to evaluate the feasibility of use of alternative subsurface intakes for this project demonstrate that the alternative intakes that were evaluated are incapable of providing sufficient seawater to support the proposed project. None of the subsurface intake systems considered (vertical wells, slant wells, or horizontal wells) can only deliver a fraction of the 304 MGD of seawater needed for environmentally safe operation of the CDP. The maximum capacity that could be delivered using subsurface intakes is 28,000 gpm (40 MGD), which is substantially below the needed intake flow. Additionally, the quality of the water available from the subsurface intake (salinity twice that of seawater, excessive iron and high suspended solids) would be untreatable. Additionally, the alternative subsurface intake systems were determined not to be the environmentally preferred alternative. Taking into account economic, environmental and technological factors, the alternatives subsurface intakes are not capable of being accomplished in a successful manner within a reasonable period of time; and therefore, have been determined to be infeasible. The Coastal Commission draft findings agree with this conclusion: "find that subsurface intakes appear to be an infeasible alternative."[3]

### 4.2.2 Construction of New Open Intake for the Desalination Plant

Poseidon also evaluated whether the construction and operation of a new offshore intake to serve the seawater supply needs of the desalination project would be a viable alternative to the use of the existing intake at the Encina Power Generation Station and whether this approach would result in reduced impacts to marine resources.

Specifically, Poseidon studied whether an offshore intake would reduce the frequency of dredging of Agua Hedionda Lagoon under the stand-alone desalination facility operation; and whether a construction of a new intake would reduce environmental impacts as compared to the use of the existing Encina Power Station intake under the stand-alone desalination facility operation. The analysis included the review of the environmental impact report (EIR) for the Agua Hedionda Inlet Jetty Extension Project (Jetty EIR). This EIR identified an offshore intake as an environmentally preferred alternative to the proposed extension of the inlet jetty. Poseidon prepared two studies that demonstrate the construction of a new offshore intake would not reduce the frequency of dredging of Agua Hedionda Lagoon and it is not the environmentally preferred alternative.

The first study addresses whether an offshore intake would reduce the frequency of dredging of Agua Hedionda Lagoon under the stand-alone desalination facility operation.[4] This study concluded that the dredging frequency needed for normal operation of the stand alone desalination facility would be approximately once every three years when adhering to present

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[3] See Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 50 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

[4] *Comparative Analysis of Intake Flow Rate on Sand Influx Rates at Agua Hedionda Lagoon: Low-Flow vs. No-Flow Alternatives*, Jenkins and Waysl, September 28, 2007

dredging practices. Under the "no power plant and no desalination project" scenario, the minimum dredging volume required to keep Agua Hedionda open to the Pacific Ocean would be about 15 percent less than for the stand-alone desalination facility. This 15 percent reduction however, would not be sufficient to allow the dredge frequency to be extended beyond once every three years due to schedule limitations that prohibit dredging during least tern nesting season. Given the variability in the actual sand transport from year to year and the accuracy of the modeling, there isn't any discernable difference between the estimated dredging frequency and related environmental impacts associated with the operation of stand-alone desalination facility versus the "no power plant, nor desalination project" scenario.

The second study addresses whether an offshore intake would result in fewer environmental impacts than the use of the existing Encina Power Station intake under the stand-alone desalination facility operation.[5] Here the authors evaluate the Jetty EIR and conclude that the draft EIR did not adequately evaluate the environmental impacts associated with constructing an offshore intake. The Jetty EIR did not assess the biological impacts of installing a large diameter pipe 1000 feet offshore, which depending on placement, would potentially destroy existing rocky reef outcroppings occurring offshore. The Jetty EIR did not evaluate the down coast effects of an intake structure on habitat, sand flow, or sedimentation.

Further, the Jetty EIR did not adequately evaluate entrainment and impingement effects. Based on the environmental analysis of the area for potential location of a new offshore intake, Poseidon is of the opinion that an offshore intake has the potential to affect a greater diversity of adult and juvenile organisms as well as both phyto- and zooplankton species than is currently impacted by the existing intake at the Encina Power Station. The estimated cost of the new offshore intake shown in Figure 4-7 is approximately $150 million (see Attachment 1).

In conclusion, construction of a new open water intake would not result in significant reduction in dredging frequency, would cause permanent construction related impacts to the marine environment and would shift entrainment impacts to a more sensitive area of the marine environment that would affect a greater diversity species. As compared to the environmental impacts caused by the existing EPS intake, the new offshore intake is not the environmentally preferred alternative. Taking into account economic, environmental and technological factors, the alternatives intake is not capable of being accomplished in a successful manner within a reasonable period of time; and therefore, have been determined to be infeasible. The Coastal Commission draft findings agree with conclusion: "determined that alternative intakes that might avoid or minimize environmental impacts are infeasible or would cause greater environmental damage."[6]

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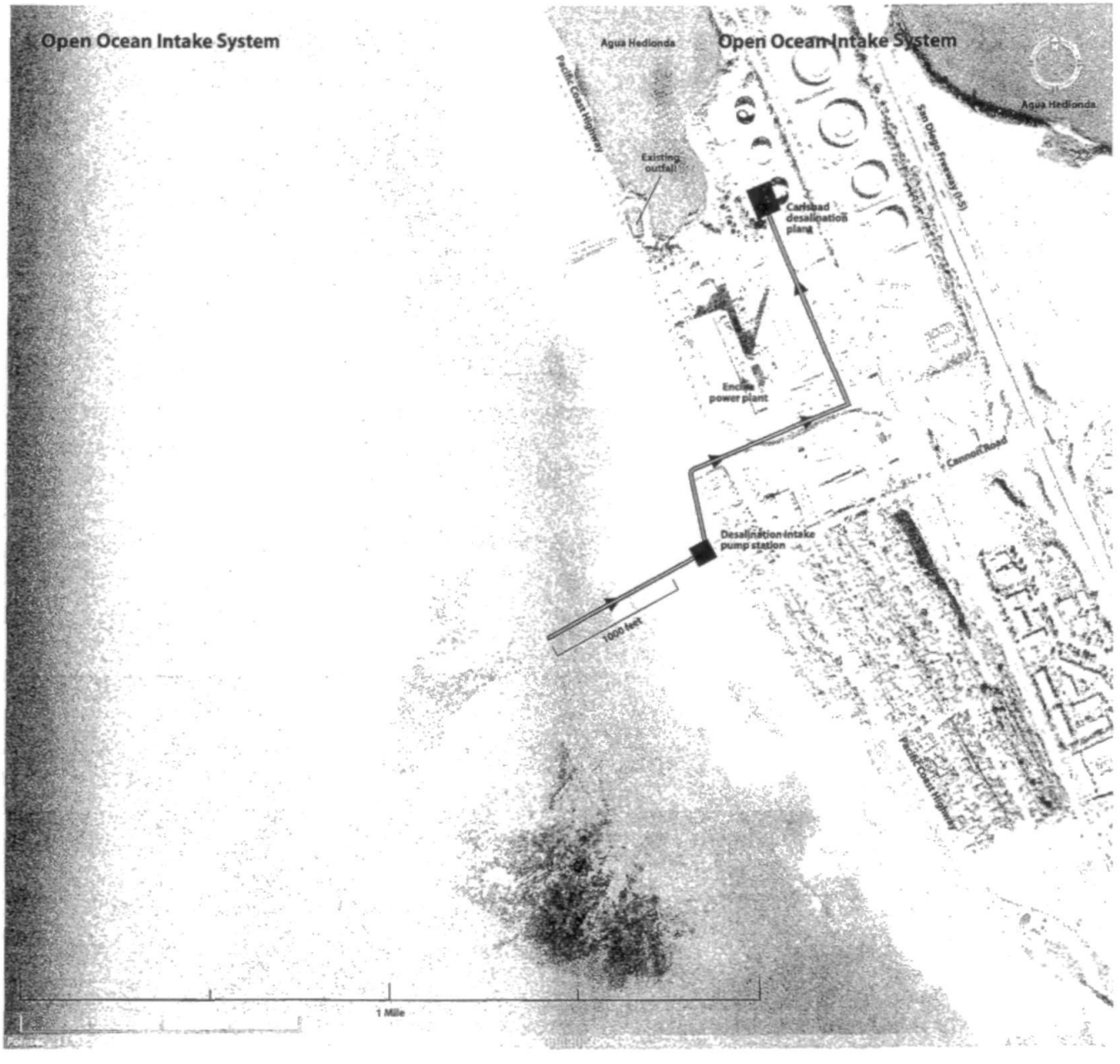
[5] *Issues Related to the Use of the Agua Hedionda Inlet Jetty Extension EIR to Recommend An Alternative Seawater Intake for the Carlsbad Desalination Project,* Graham, Le Page and Mayer, October 8, 2007

[6] See Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 63 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

# Figure 4-7 – Open Ocean Intake System



## 4.3 ALTERNATIVE POWER PLANT INTAKE & SCREENING TECHNOLOGIES

A number of alternative intake and screening technologies were evaluated to determine whether they offer a viable and cost-effective reduction of impingement and entrainment associated with the desalination plant operations under the conditions of a complete shutdown of EPS operations. As indicated previously, under these conditions, the EPS intake facilities (combination of screens and pumps) will be operated to collect a total flow of 304 MGD which is 38 percent of the installed EPS intake pump capacity.

Under the stand-alone desalination plant operations, the existing power plant intake facilities will be operated at reduced flow and fewer pumps will be collecting water through the same existing intake screening facilities. The velocity of the water flowing into the intake would be reduced to 0.5 fps or less. This alone will substantially reduce the impingement impacts associated with the desalination plant operations to a level that the Coastal Commission acknowledged is "a *de minimis* impact."[7]

Technologies listed in Table 4-1 have been evaluated based upon feasibility for implementation at the facility, including the following:

- Ability to achieve a significant reduction in impingement and entrainment (IM&E) for all species, taking into account variations in abundance of all life stages;
- Feasibility of implementation at the facility;
- Cost of implementation (including installed costs and annual O&M costs);
- Impact upon facility operations.

### 4.3.1 Fish Screens and Fish Handling and Return System

This alternative would include the replacement of the existing traveling screens within the tunnel system with new traveling screens that have features that could enhance fish survival are designed with the latest fish removal features, including the Fletcher type buckets on the screen baskets (Ristroph-type screens), dual pressure spray systems (low pressure to remove fish, and high pressure to remove remaining debris), and separate sluicing systems for discarding trash and returning the impinged fish back to the Aqua Hedionda Lagoon (AHL) or the ocean.

[7] See Id. at 46.

TABLE 4-1

POTENTIAL IMPINGEMENT/ENTRAINMENT REDUCTION TECHNOLOGIES

| Technology | Impact Reduction Potential | |
|---|---|---|
| | Impingement | Entrainment |
| Modified traveling screens with fish return | Yes | No |
| Replacement of existing traveling screens with fine mesh screens | Yes | Yes |
| New fine mesh screening structure | Yes | Yes |
| Cylindrical wedge-wire screens – fine slot width | Yes | Yes |
| Fish barrier net | Yes | No |
| Aquatic filter barrier (e.g. Gunderboom) | Yes | Yes |
| Fine mesh dual flow screens | Yes | Yes |
| Modular inclined screens | Yes | No |
| Angled screen system – fine mesh | Yes | Yes |
| Behavior barriers (e.g. light, sound, bubble curtain) | Maybe | No |

The modified screening system could potentially improve impingement survival. This system however will have a negative effect in terms of entrainment reduction, because the intake pumps will need to collect more source water (3 MGD) to service the dual pressure spray system of the new screens. In addition, a fish return system is required as part of this scenario to transport fish washed from the screens alive back to the water body to a location where they would not be subject to re-entrainment into the intake.

The capital cost associated with this impingement reduction alternative is estimated at: US$5.7 million. The annual O&M costs for such system are estimated at $200,000 over the costs of operation of the existing intake screening system.

Poseidon considers this alternative to be infeasible for the following reasons:

- The impingement impacts of the proposed Project (0.96 kgs per day of fish species that are highly abundant in the area) have been found by the Coastal Commission, CEQA lead and others to be insignificant.
- Substantial construction costs for a limited benefit;
- The implementation of this alternative will result in increased entrainment because of the significant volume of additional seawater needed to be collected to operate the screen.

### 4.3.2 New Power Plant Intake and Fine Mesh Screening Structure

Fine mesh traveling screens have been tested and found to retain and collect fish larvae with some success. Application of fine mesh traveling screen technology for EPS would require the

construction of a complete new screen structure located at the south shore of the lagoon, including both coarse and fine mesh traveling screen systems and fish collection and return systems. This alternative would replace the existing trash rack structure with a much larger screening structure. Major modifications to the existing tunnel system would be required. Additionally, an appropriate and suitable location to return collected fish, shellfish, and their eggs and larvae would have to be constructed.

The demolition of the existing intake structure; removal of the existing screens; construction of a new intake structure; and installation of new coarse and fine mesh screens equipped with fish collection and return systems; would require a total construction expenditure of $53.3 million. Similar to the previous technology, the implementation of this alternative will also require additional intake flow (4 MGD to 5 MGD) for the operation of the coarse and fine mesh screen organism retrieval and return systems. The additional O&M costs associated with the operation of this system are $300,000 per year.

Poseidon considers this alternative infeasible for the following reasons:

- The impingement and entrainment impacts of the proposed Project have been found by the CEQA lead and others to be insignificant.
- Poseidon has committed to restore and enhance at least 37 of marine wetlands habitat that significantly overcompensates for the limited impact of the Project to marine resources.
- Uncertain survival of the captured marine organisms.
- Substantial increase in Project construction costs for a very limited benefit.

### 4.3.3 Cylindrical Wedge-Wire Screens – Fine Slot Width

Wedge-wire screens are passive intake systems, which operate on the principle of achieving very low approach velocities at the screening media. Wedge-wire screens installed with small slot openings reduce impingement and entrainment and is an EPA approved technology for compliance with the US EPA 316(b) Phase II rule provided the following conditions exist:

- The cooling water intake structure is located in a freshwater river or stream;
- The cooling water intake structure is situated such that sufficient ambient counter currents exist to promote cleaning of the screen face;
- The through screen design intake velocity is 0.5 ft/s or less;
- The slot size is appropriate for the size of eggs, larvae, and juveniles of any fish and shellfish to be protected at the site; and
- The entire water flow is directed through the technology.

Wedge-wire screens are designed to be placed in a water body where significant prevailing ambient cross flow current velocities (≥ 1 ft/s) exist. This cross flow allows organisms that would otherwise be impinged on the wedge-wire intake to be carried away with the flow. An integral part of a typical wedge-wire screen system is an air burst back-flush system, which directs a charge of compressed air to each screen unit to blow off debris and impinged organisms back into the water body where they would be carried away from the screen unit by the ambient cross flow currents.

The EPS, located on the tidal Agua Hedionda Lagoon, would not meet the first two EPA criteria discussed above. First, the intake is not located on a freshwater river. Second, there is not sufficient crosscurrent in the lagoon to sweep organisms and debris away from the screen units; so debris and organisms back-flushed from the screens would immediately re-impinge on the screens following the back-flush cycle. For these reasons, Poseidon considers this alternative infeasible.

### 4.3.4 Fish Net Barrier

A fish net barrier, as it would be applied to the EPS intake system, is a mesh curtain installed in the source water body in front of the exiting intake structure such that all flow to the intake screens passes through the net, blocking entrance to the intake of all aquatic life forms large enough to be blocked by the net mesh. The net barrier is sized large enough to have very low approach and through net velocities to preclude impingement of juvenile fish with limited swimming ability. The mesh size must be large enough to preclude excessive fouling during operation, while at the same time small enough to keep the marine organisms out of the intake system. These conditions typically limit the mesh size such that adult and a percentage of juvenile fish can be blocked. The mesh is not fine enough to block most larvae and eggs. The fish net barrier could potentially reduce impingement; however, it would not meet reduce the entrainment of eggs and larvae.

The fish net barrier technology is still experimental, with very few successful installations. Using a 20 gpm/ft$^2$ design loading rate, a net area of approximately 30,000 ft$^2$ would be required for EPS. Maintaining such a large net moored in the lagoon is not practical. In addition, the fish barrier is a passive screening device, which is subject to fouling and has no means for self-cleaning. This technology would be rapidly clogged with kelp and other debris. The services of a diving contractor would be required to remove the net for cleaning onshore and to replace the fouled net with a clean net on each cleaning cycle. For these reasons, this technology is not practically feasible for implementation at EPS and further evaluation is not warranted.

### 4.3.5 Aquatic Filter Barrier

An aquatic filter barrier system, such as the Gunderboom Marine Life Exclusion System (MLES)$^{TM}$, is a moored water permeable barrier with fine mesh openings that is designed to prevent both impingement and entrainment of ichthyoplankton and juvenile aquatic life. An integral part of the MLES is an air-burst back flush system similar in concept to the air burst

system used with wedge-wire screen systems to back flush impinged organisms and debris into the water body to be carried away by ambient cross currents.

The MLES has much smaller mesh openings and would block fish eggs and larvae from being entrained into the intake. These smaller organisms would be impinged permanently on the barrier due to the lack of cross currents to carry them away. Consequently, this technology is not feasible for implementation at the existing EPS intake and further evaluation is not warranted.

### 4.3.6 Fine Mesh Dual Flow Screens

A modified dual flow traveling water screen is similar to the through flow design, but this type of screen would be turned 90 degrees to the direction of the flow so that its two faces would be parallel to the incoming water flow. When equipped with fine mesh screening media, the average 0.5 fps approach velocity to the screen face would have to be met by the dual flow screen design. Water flow enters the dual flow screen through both the ascending and the descending screen faces, and then flows out between the two faces. All of the fish handling features of the Ristroph screen design would be incorporated in the dual flow screen design.

The dual flow screen configuration has been shown to produce low survival rates for fish larvae. This is because of the longer impingement time endured by organisms impinged on the descending face of the screen. This longer impingement time is suspected to result in higher mortality rates than similar fine mesh screens with a flow through screen design.

The primary advantage of this screen configuration is the elimination of debris carryover into the circulating water system. Also, because both ascending and descending screen faces are utilized, there is greater screening area available for a given screen width than with the conventional through-flow configuration.

However, the dual flow screen can create adverse flow conditions in the approach flow to the circulating water pumps. The flow exiting the dual flow screens is turbulent with an exit velocity of greater than 3 fps. Modifications to the pump bays downstream of the screens, usually in the form of baffles to break up and laterally distribute the concentrated flow prior to reaching the circulating water pumps would be required.

The implementation of this technology to the EPS CWIS would require an entirely new intake screen structure similar to the fine mesh through flow intake screen structure discussed previously. The dual flow fine mesh screen configuration offers no advantages in terms reduction of impingement and entrainment mortality as compared to through flow fine mesh traveling screens discussed above and in fact would probably not perform as well as the through flow design. The design concept for the dual flow screen structure would be similar to the through flow fine mesh screen structure with trash racks, coarse mesh traveling screens and fine mesh traveling screens in each screen train. The implementation cost and operation and maintenance costs for this facility would be of the same order of magnitude as for the through flow screen structure. Dual flow screen technology does not offer a significant performance or cost

advantage as compared with through flow screen technology. Therefore, the use of this technology for the EPS is not recommended.

### 4.3.7 Modular Inclined Screens

Modular Inclined Screen (MIS) is a fish protection technology for water intakes developed and tested by the Electric Power Research Institute (EPRI). This technology was developed specifically to bypass fish around turbines at hydro-electric stations. The MIS is a modular design including an inclined section of wedge-wire screen mounted on a pivot shaft and enclosed within a modular structure. The pivot shaft enables the screen to be tilted to back-flush debris from the screen. The screen is enclosed within a self-contained module, designed to provide a uniform velocity distribution along the length of the screen surface. Transition guide walls taper in along the downstream third of the screen, which guide fish to a bypass flume. A full size prototype module would be capable of screening up to 800 cfs (518 MGD) at an approach velocity of 10 ft/sec.

The MIS design underwent hydraulic model studies and biological effectiveness testing at Alden Research Laboratory to refine the hydraulic design and test its capability to divert fish alive. Eleven species of freshwater fish were tested including Atlantic salmon smolt, coho salmon, Chinook salmon, brown trout, rainbow trout, blueback herring, American shad and others. After some refinements in the design were made during this testing, the results showed that most of these species and sizes of fish can be safely diverted.

Following laboratory testing, the MIS design was field tested at the Green Island Hydroelectric Project on the Hudson River in New York in the fall of 1995. In addition to the MIS, the effectiveness of a strobe light system was also studied to determine its ability to divert blueback herring from the river to the MIS. Results for rainbow trout, golden shiner and blueback herring, which were released directly into the MIS module were similar to the laboratory test results in terms of fish survivability. The limited amount of naturally entrained blueback herring did not allow reliable evaluation of test results.

The MIS technology, as tested, does not address entrainment of eggs and larvae. Also, this technology has never been tested for, or installed in, a power station with a seawater intake system. Further research would be required to evaluate the efficacy of this technology for application to a seawater intake system. MIS is not a suitable and proven technology, at this time, for retrofit to the EPS intake system. Therefore, this technology is not found viable the desalination plant intake impact.

### 4.3.8 Angled Screen System – Fine Mesh

Angled screens are a special application of through-flow screens where the screen faces are arranged at an angle of approximately 25 degrees to the incoming flow. The conventional through-flow screen arrangement would place the screen faces normal or 90 degrees to the incoming flow. The objective of the angled-screen arrangement is to divert fish to a fish bypass

system without impinging them on the screens. Most fish would not be lifted out of the water but would be diverted back to the receiving water by screw-type centrifugal or jet pumps.

Using fine screen mesh on the traveling screens minimizes entrainment, but increases potential for impingement of organisms that would have otherwise passed through the power plant condenser tubes. Application of this technology would require construction of new angled screen structure at the south shore of the lagoon similar to the new fine mesh screen intake structure discussed previously. The angled screen facility would not provide a significant performance advantage in terms of reducing impingement and entrainment as compared to the fine mesh screen structure, and would be at least as large and a significantly more complex structure. This facility would be potentially more costly to implement and maintain than the fine mesh screen facility. Therefore, further evaluation of this technology for the EPS is not warranted.

### 4.3.9 Behavior Barriers

A behavioral barrier relies on avoidance or attraction responses of the target aquatic organisms to a specific stimulus to reduce the potential of entrainment or impingement. Most of the stimuli tested to date are intended to repulse the organism from the vicinity of the intake structure.

Nearly all the behavioral barrier technologies are considered to be experimental or limited in effectiveness to a single target species. There are a large number of behavioral barriers that have been evaluated at other sites, and representative examples these are discussed separately below.

### 4.3.10 Offshore Intake Velocity Cap

This is a behavioral technology associated with a submerged offshore intake structure(s). The velocity cap redirects the area of water withdrawal for an offshore intake located at the bottom of the water body. The cap limits the vertical extent of the offshore intake area of withdrawal and avoids water withdrawals from the typically more productive aquatic habitat closer to the surface of the water body.

This technology operates by redirecting the water withdrawal laterally from the intake (rather than vertically from an intake on the bottom), and as a result, the water entering the intake is accelerated laterally and is more likely to provide horizontal velocity cues to fish and allow fish to respond and move away from the intake. Potentially susceptible juvenile and adult fish that are able to identify these changes in water velocity as a result of their lateral line sensory system are able to respond and actively avoid the highest velocity areas near the mouth of the intake structure.

This technology potentially reduces impingement of fish by stimulating a behavioral response. The technology does not necessarily reduce entrainment, except when the redirected withdrawal takes water from closer to the bottom of the water body and where that location has lower plankton abundance.

Application of this technology to the EPS, to be fully effective, would require development of an entirely new intake system with a submerged intake structure and connecting intake conduit system installed out into the Pacific Ocean. For the reasons previously discussed, this is not a practically feasible consideration for the EPS. Therefore, further evaluation of this technology is not warranted.

### 4.3.11 Air Bubble Curtain

Air bubble curtains have been tested alone and in combination with strobe lights to elicit and avoidance response in fish that might otherwise be drawn into the cooling water intake. Generally, results of testing the bubble curtain have been poor based on testing completed by EPRI. Therefore, further evaluation of this technology is not warranted.

### 4.3.12 Strobe Lights

There has been a great deal of research with this stimulus over the last 15 years to guide fish away from intake structures. The Electric Power Research Institute has co-funded a series of research projects and reviewed the results of research in this field as well. In both laboratory studies and field applications, strobe lights were shown to effectively move selected species of fish away from the flashing lights. Most of the studies conducted to date have been with riverine fish species and for projects associated with hydroelectric generating facilities. One early study was conducted at the Roseton Generating Facility on the Hudson River in New York, another study was conducted on Lake Cayuga in New York, and others for migratory stages of Atlantic and Pacific salmon. Few species similar to those occurring in the Agua Hedionda Lagoon have been tested for avoidance response either in the lab or in actual field studies.

Laboratory testing was done for an application of strobe lights for the San Onofre Nuclear Generating Facility. Testing was conducted for white croaker, Pacific sardine and northern anchovy. The testing demonstrated no conclusive results and the California Coastal Commission found this device not useful at this station. Therefore, further evaluation of this technology is not warranted.

### 4.3.13 Other Lighting

Incandescent and mercury vapor lights have also been tested as a behavioral stimulus to direct fish away from an intake structure. Mercury lights have generally been tested as a means of drawing fish to a safe bypass of the intake structure as generally the light has an attractive effect on fish. Tests have not demonstrated a uniform and clearly repeatable pattern of attraction for all fish species. The mercury lights have been somewhat effective in attracting European eel, Atlantic salmon, and Pacific salmon. But results with other species including American shad, blue back herring and alewife had more variable results. One test with different life stages of Coho salmon shows both attraction and repulsion from the mercury light for the different life

stages of the coho. Testing with incandescent, sodium vapor and fluorescent lamps was more limited but also had variable and species specific results.

Other lighting systems, as with most all the behavioral barrier alternatives, have not been tested with the species of fish common in Agua Hedionda Lagoon. As a result there is no basis to recommend these lights systems as an enhancement to reduce impingement or entrainment at the EPS.

### 4.3.14 Sound

Sound has also been extensively tested in the last 15 years as a method to alter fish impingement rates at water intake structures. Three basic groups of sound systems including percussion devices (hammer, or poppers), transducers with a wide range of frequency output, and low frequency or infrasound generators, have all been tested on a variety of fish species.

Of all the recently studied behavioral devices the sound technology has demonstrated some success with at least one group of fish species. Clupeids, such as alewife, demonstrate a clear repulsion to a specific range of high frequency sound. A device has been installed in the Fitzpatrick Nuclear Generating station on Lake Ontario in New York State, which has been effective in reducing impingement of landlocked alewives. The results were repeated with alewife at a coastal site in New Jersey. Similar results with a high frequency generator also reported a strong avoidance response for another clupeid species, the blue back herring, in a reservoir in South Carolina.

Testing of this high frequency device on many other species including weakfish, spot, Atlantic croaker, bay anchovy, American shad, blue back herring, alewife, white perch, and striped bass demonstrated a similar and strong avoidance response by American shad and blue back herring. Alewife and sockeye salmon have also been reported to be repelled by a hammer percussion device at another facility. But testing of this same device at other facilities with alewife did not yield similar results.

Although high frequency sound has potential for eliciting an avoidance response by the Alosid family of fish species, there is no data to demonstrate a clear avoidance response for the species of fish common to the Agua Hedionda Lagoon. Therefore there is no basis to use sound as a viable method to reduce impingement of fish at the EPS.

### 4.3.15 Installation of Variable Frequency Drives on Existing Power Plant Intake Pumps

Under this alternative, variable frequency drives would be installed on the EPS intake cooling water pumps to minimize the volume of water collected for the desalination plant operations. As indicated previously, the total volume of seawater that is required for the normal operation of the desalination plant is 304 MGD. Of this flow, 104 MGD will be collected for production of fresh water, while the remaining 200 MGD of seawater will be used to dilute the concentrated seawater from the desalination plant.

As indicated in Table 2-1, the EPS has ten cooling water pumps of total capacity of 794.9 MGD. Currently, all of these pumps are equipped with constant speed motors. Each of the five existing power generation units is coupled with two cooling pumps per unit and both pumps are operated when a given power generator is in service. Because the individual power generation units are designed to operate efficiently only at a steady-state near constant rate of electricity production and therefore, near constant thermal discharge load, reducing cooling flow by VFD in order to diminish entrainment would result in an increased temperature of the thermal discharge which in turn would have a detrimental effect on the marine organisms in the discharge area. The installation of VFDs is also limited by physical site constraints. The VFD units would need to be located near the pump motors in the existing concrete pump pit, which would need to be enlarged in order to accommodate this equipment. The cost associated with such mayor structural modifications along with the cost of the VFDs would exceed $8.5 million. Taking into consideration the limited useful life of the existing power plant, such large expenditures at this time are not prudent.

Under stand-alone operational conditions of the desalination plant, the power plant intake pumps would be operated as described in the precious section (Section 3 – Design). The cooling water pump operations will be decoupled from the condenser operations, which would substantially reduce the seawater velocity through screens. Under these conditions, the intake flow of the desalination plant (and associated entrainment) would be controlled by the VFD system of the desalination plant intake pump station. Installing an additional VDF system on the power plant intake pumps would have a negligible benefit.

In summary, installation of variable frequency drives on existing power plant intake pumps would provide limited benefits to marine life while significantly interfering with ongoing power plant operations. Taking into account economic, environmental and technological factors, this alternative has been determined to be infeasible.

### 4.3.16 Summary Evaluation of Power Plant Intake and Screening Alternatives

Implementation of the alternatives associated with the modification of the existing power plant intake and screening facilities were found to be infeasible because they would interfere with, or interrupt, power plant scheduled operations. Such significant modifications of the existing intake, and prolonged periods of power plant downtime are difficult to justify given the limited environmental benefit. The extended disruption to power plant operations and significant expenditures associated such modifications would not yield commensurate benefits for the following key reasons:

1. **Impingement.** The impingement impact of the stand-alone operation of the desalination plant has been found to be insignificant by both the City of Carlsbad (Project EIR) and *de minimis* according to the Coastal Commission (Draft CDP Findings) (approximately 2

lbs/day of fish).[8] Therefore, complex and costly intake modifications to reduce this already minimal impingement impact are not prudent. In addition, operational modifications of the existing EPS intake system under stand-alone CDP operation would reduce the fine screen-flow through velocity to further minimize impingement.

2. **Entrainment.** The entrainment impact of the stand-alone CDP operation is mainly driven by the volume of intake flow needed to produce fresh drinking water. In contrast with power plant operations, where water is not essential to produce electricity, in seawater desalination, seawater has to be collected and used to produce fresh water. Therefore, CDP entrainment effects cannot be avoided completely or minimized drastically by modifying the existing power plant intake facilities. Quite the opposite, many of the impingement reduction scenarios (see Sections 4.3.1, 2 &3 and 4.3.6,7&8) could increase the total flow needed for stand-alone desalination plant operations, thereby trading negligible impingement reduction benefits for incremental increase in entrainment.

Taking into account these economic, environmental and technological factors, the power plant intake screening alternatives are not capable of being accomplished in a successful manner within a reasonable period of time; and therefore, have been determined to be infeasible. The Coastal Commission draft findings agree with this conclusion: "The impingement impact of the stand-alone operation of the desalination plant has been found to be *de minimis* and insignificant"[9]; and "the Commission finds that Poseidon's proposal is using all feasible methods to minimize or reduce its entrainment impacts."[10]

When the EPS permanently ceases the use of the once-through cooling water system, additional entrainment and impingement technologies may become feasible. While no timeline has been established as to when this might occur, SLC staff is recommending that in ten years Poseidon would be required to evaluate and implement those additional technologies it determines are appropriate in light of an environmental review it would undertake at that time:[11] The draft State Lands Commission lease would require, ten years after the lease is issued, that the CDP be subject to further environmental review to ensure its operations at that time are using technologies that may reduce any impacts.

## 4.4 DESALINATION TECHNOLOGIES FOR IMPROVED SURVIVAL OF MARINE LIFE

Seawater desalination treatment processes and technologies differ significantly from these used in once-trough cooling power generation. In power plant installations, all of the entrained organisms pass through a complex system of power generation equipment and piping, and are exposed to thermal stress caused by high-temperature heat exchangers before they exit the power

[8] See Final Environmental Impact Report EIR 03-05 and Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 40 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

[9] See Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 40 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

[10] See Id. at 53.

[11] State Lands Commission October 24, 2007 recommended Amendment of Lease PRC 8727.1.

plant with the discharge. Therefore, typically a 100 percent mortality of marine organisms is assumed during the once-through cooling power generation process. State-of-the art reverse osmosis seawater desalination plants, such as the CDP, differ by the following key features:

1. Seawater is not heated in order to produce drinking water, which eliminates the thermal stress of marine organisms entrained in the source water flow;

2. Marine organisms are captured in the first stage of treatment (pretreatment) and therefore, do not pass through most of the desalination plant facilities, which in turn increases their chance of survival. The captured marine organisms are returned to the ocean.

The Carlsbad seawater desalination plant will incorporate a number of technologies that would reduce entrainment and increase the potential to capture marine organisms and to successfully return them to the ocean. These technologies are described below.

### 4.4.1 Installation of Variable Frequency Drives on Desalination Plant Intake Pumps

The desalination plant intake pump station will be equipped with variable frequency drive system to closely control the volume of the collected seawater. As water demand decreases during certain periods of the day and the year, the variable frequency drive system will automatically reduce the intake pump motor speed thereby decreasing intake pump flow to the minimum level needed for water production.

As in any other water treatment plant, the desalination plant production would vary diurnally and seasonally in response to water demand fluctuations. If variable frequency drive system is not available, the CDP intake pumps would collect a constant flow corresponding to the highest flow requirements of the CDP. The installation of VFD system at the intake pump station would reduce the total intake flow of the desalination plant compared to constant speed-design, which in turns would result in proportional decrease in entrainment associated with desalination plant operations. Pump motor operation at reduced speed during off-peak demand periods also would increase the chance for survival of the marine organisms entrained in the source seawater.

### 4.4.2 Installation of Micro-screens Ahead of Seawater Pretreatment Facilities

A very fine screen (120 micron/0.12 mm) or also known as micro-screen filtration technology is planned to be installed to filter out most of the marine organisms entrained by the desalination plant intake pumps. The micro-screens are equipped with polypropylene discs, which are diagonally grooved on both sides to a specific micron size. A series of these discs are stacked and compressed on a specially designed spine. The groove on the top of the disks runs opposite to the groove below, creating a filtration element with series of valleys and traps for marine particulates. The stack is enclosed in corrosion and pressure resistant housing. Filtration occurs while water is percolating from the peripheral end to the core of the element (Figure 4-8).

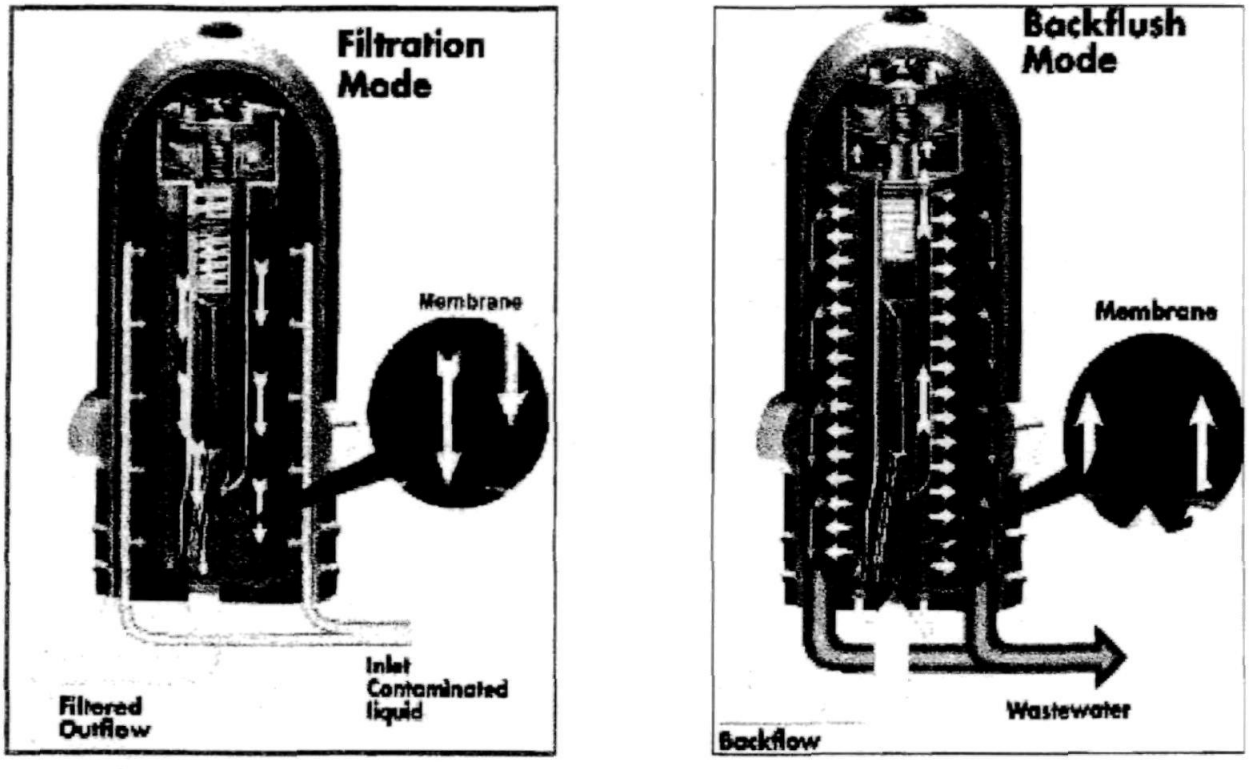



**Figure 4-8. Microscreens in filtration and backwash flow modes**

Since the intake seawater is already pre-screened by the 3/8 to 5/8- inch power plant intake screens, the seawater directed to the disk filters will contain debris and marine organisms smaller than 3/8-inch (9500 microns) (5/8-inch = 15.8 mm = 15,800 microns). During the filtration mode, seawater debris and marine organisms larger than 15,800 microns but smaller than 120 microns will be retained and accumulated in the cavity between the filter disks and the outer shell of the filters, thereby increasing the head loss through the filters. Once the filter head loss reaches a preset level (typically 5 psi or less) the filters enter backwash mode. All debris and marine organisms retained on the outer side of the filters are then flushed by tangential water jets of filtered seawater flow under 2 to 3 psi of pressure and the flush water is directed to a pipe, which returns the debris and marine organisms retained on the filters back to the ocean.

Because of the small size and relatively low differential pressure, these filters are likely to minimize entrainment and impingement mortality of the marine organisms in the source seawater. Since the disk filtration system is equipped with a wash water/organism return pipe, the impinged marine organisms are returned back to the ocean, thereby increasing their chance of survival. Based on US EPA source (US EPA, 2002, Technical Development Document for the Proposed Section 316 (b) Phase II Existing Facilities Rule, EPA 821-R-02003) fine mesh screens show promise for both impingement and entrainment control and "can reduce entrainment by 80 % or more". According to this source, the use of 0.5 mm (500 μ) screen at the Big Bend Power Plant in Tampa Bay area, "the system efficiency in screening fish eggs (primarily drums and bay anchovy) exceeded 95 % with 80 % latent survival for drum and 93 % efficiency for bay

anchovy. For larvae (primarily drums, bay anchovies, blennies, and gobies), screening efficiency was 86 % with 65 % latent survival for drum and 66 % for bay anchovy. (Note that latent survival in control samples was also approximately 60 %). According to the same source, a full-scale test by the Tennessee Valley Authority at the John Sevier Plant showed less than half as many larvae entrained with a 0.5-mm (500 μ) screen than 1.0 mm (1,000 μ) and 2.0 mm (2,000 μ) screens combined. These data are indicative of the fact that most likely using finer screens would result in lower entrainment effect. Since the micro-screens proposed for the Carlsbad project have 120 μ openings which are smaller than the smallest fine screens used elsewhere (i.e., 500 μ), the entrainment reduction capability of these micro-screens is expected to be comparable to the fine screens tested at the full scale installations referenced above.

### 4.4.3 Use of Low Pressure Membrane Pretreatment System

After the source seawater is screened by the 120-μ micro-screens, this water would be conveyed to a membrane pretreatment system in order to remove practically all remaining suspended solids and particulates. The filtered water will then be pumped to the seawater reverse osmosis system for salt separation.

The pretreatment system planned to be used for the Carlsbad seawater desalination project will consist of submerged ultrafiltration (UF) hollow-fiber membranes bundled in cassettes and operated under slight vacuum – typically in a range of 2.5 to 6 psi (see Figure 4-9). The nominal fiber pore size of the UF membranes is 0.02 μ. Practically all marine organisms that were not removed by the 120-μ micro-screens (mostly algae and other phyto- and zooplankton) would be retained by the UF membranes and would periodically be returned back to the ocean during the backwash cycle of these membranes. Membrane backwash would typically be completed with air and water once every 20 to 40 minutes. No chemicals are planned to be applied for seawater conditioning prior to filtration.

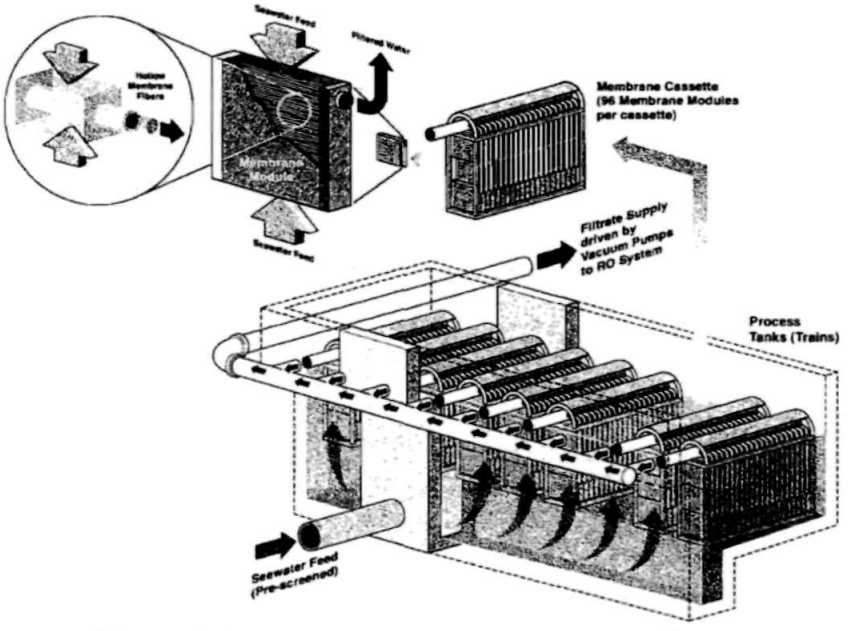



**Figure 4-9 – Ultrafiltration Pretreatment System**

Evaluation of the same UF pretreatment technology at the Carlsbad seawater desalination pilot plant indicates that the UF system retains all plankton and has potential to be effective entrainment reduction measure. Initial microscopic analysis of the phytoplankton in the UF system backwash completed by M-REP Consulting shows that over 70 % of algal cells maintain their integrity after passing through the micro-screens and the ultrafiltration process (see Figure 4-10).[12]

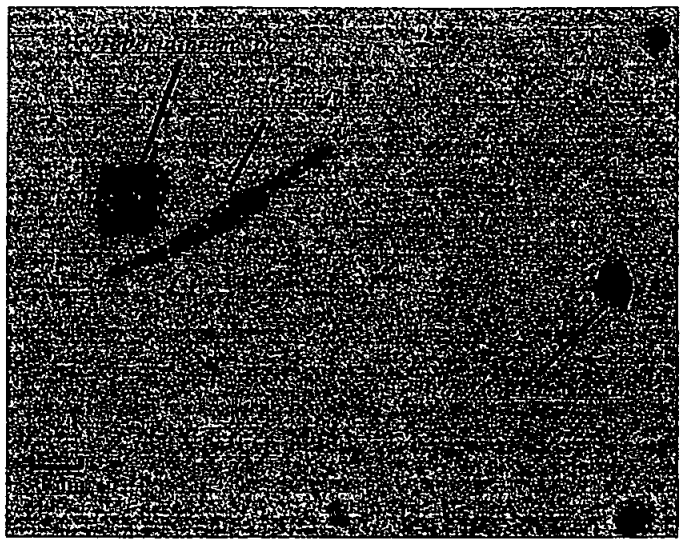


**Figure 4-10 – Algae Removed by the UF Pretreatment System**

## 4.5 SUMMARY OF THE FEASIBILITY ASSESSMENT OF TECHNOLOGY FEATURES TO MINIMIZE IMPACTS TO MARINE LIFE

A combination of intake, screening and treatment technologies were found to be feasible for the site-specific conditions of the proposed Project. The technology features are included in the CDP to minimize impacts to marine life are summarized in Table 4-2.

[12] M-Rep Consulting, Update on the preliminary results of the Carlsbad Pilot Algal Study, February 27, 2008.

## TABLE 4-2

## DESIGN FEATURES TO MINIMIZE IMPACTS TO MARINE LIFE

| Category | Feature | Result |
|---|---|---|
| 1. Technology | Installation of VFDs on CDP intake pumps | Reduce the total intake flow for the desalination facility to no more than that needed at any given time, thereby minimizing the entrainment of marine organisms. |
| 2. Technology | Installation of micro-screens | Micro-screens (120 μ) minimize entrainment and impingement impacts to marine organisms by screening the fish larvae and plankton from the seawater. |
| 3. Technology | Installation of low impact prefitration technology | The desalination facility will rely on low pressure, chemical free membrane pretreatment filtration technology to minimize entrainment and impingement impacts to marine organisms that have passed through the micro-screens by filtering the organisms from the seawater. |
| 4. Technology | Return to the ocean of marine organisms captured by the screens and filters | Substantial reduction in entrainment and impingement impacts to marine organisms captured by the screens and membrane filter by returning the organisms to the ocean. Studies indicate potential for survival of 80 percent or more of the larvae captured by the micro-screens and 70 percent of the algae and other phyto- and zooplankton captured by the membrane filter. |
| 5. Technology | Ten years after the lease is issued, that the CDP will be subject to further environmental review by the State Lands Commission (SLC) to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. | SLC may require additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations. This ensures that the CDP operations at that time are using technologies that the SLC determines may reduce any impacts and are appropriate in light of environmental review. |

In addition, taking into account economic, environmental and technological factors previously discussed, the following technology alternatives intake are not capable of being accomplished in a successful manner within a reasonable period of time; and therefore, have been determined to be infeasible.

- **Installation of subsurface intakes** (beach wells, slant wells, infiltration galleries, etc.) is infeasible for the site-specific conditions of the Carlsbad project because of the limited production capacity, poor water quality of the coastal aquifer, extensive environmental damage associated with the implementation of such intakes and excess cost.

- **Construction of new open ocean intake** in the vicinity of the project site was found more environmentally damaging than the use of the existing intake located in Agua Hedionda Lagoon. This alternative is also cost-prohibitive.

- **Major physical or structural modifications to the existing power plant intake** facilities were found to be infeasible because of the very limited potential of impingement and entrainment benefits they could offer as well as practical constraints with their implementation while the power plant is in operation.

- **Installation of variable frequency drives on existing power plant intake pumps** would provide limited benefits to marine life while significantly interfering with ongoing power plant operations. Taking into account economic, environmental and technological factors, this alternative has been determined to be infeasible.

# CHAPTER 5

# QUANTIFICATION OF UNAVOIDABLE IMPACTS TO MARINE RESOURCES

## INTRODUCTION

This Chapter provides a conservative (upper-end) quantification of the Project related impacts to marine life. This Chapter is broken down into four sections:

- *The first section describes conservative approach to quantification of the Project related impacts to marine life.*
- *The second section provides an assessment of the impingement impact of the desalination facility stand-alone operations.*
- *The third section provides an assessment of the entrainment impact of the desalination facility stand-alone operations.*
- *The fourth section provides a summary of the assessment of impingement and entrainment impacts associated with desalination facility stand-alone operation.*

## 5.1 CONSERVATIVE APPROACH

As previously described, the CDP is designed to use the existing intake and discharge facilities of the Encina Power Generation Station (EPS). When EPS is producing electricity and using 304 MGD or more of seawater for once-through cooling, the proposed desalination plant operation would cause a *de minimis* increase in impingement and entrainment of marine organisms.

Under conditions when the EPS operation is temporarily or permanently discontinued, the desalination plant will continue to use the existing power plant intake and discharge facilities. Under this mode of operation, the impingement and entrainment impacts of the desalination plant operations would be significantly lower than those caused by the EPS operations at the same intake flow, due to a number of differences in the desalination plant and power plant intake design and operations.

Figure 3-2 provides a comparison of the 2007 EPS cooling water discharge to the flow needed to support CDP operations. Under this operating scenario, the EPS discharge would provide 61 percent of the CDP annual seawater intake requirements and the CDP would pump the remaining source water required to support the desalination plant operations from the EPS intake. The CDP's direct use of the EPS discharge, coupled with the design and technology features described in Chapters 3 and 4, would result in a substantial reduction in the CDP entrainment and impingement impacts.

Nevertheless, Poseidon is proposing a very conservative approach to quantifying the entrainment and impingement impacts that would be used to establish the mitigation requirements for the project that:

1. Does not take any credit for design and technology features that would be incorporated into the CDP to lessen the impacts to marine life;

2. Does not take any credit for the reduction or elimination of the impact to marine life that may occur as a result of the State Lands Commission lease requirements.

3. Does not take any credit for improvements to marine resources that may come about through Poseidon's commitment to assume responsibility for preservation of Agua Hedionda Lagoon after the EPS is decommissioned.

4. Mitigates for the maximum possible impact to marine life associated with the diversion of 304 MGD of seawater from Agua Hedionda Lagoon through the restoration of approximately 37 acres of comparable marine wetlands.

## 5.2 IMPINGMENT EFFECT OF DESALINATION PLANT STAND-ALONE OPERATIONS

### 5.2.1 Methodology for Impingement Assessment

The impingement effect of any intake structure is caused by its screens and is associated with two parameters: the intake flow and the velocity of this flow through the screens. For the purposes of this analysis, the impingement effect is assumed proportional to the intake flow at velocities above 0.5 fps. If the intake through-screen velocity is below or equal to 0.5 fps, the impingement effect of the intake screens is considered to be negligible.

The impingement assessment provided herein is based on the analysis of most recent data collected at the EPC intake facilities during the period June 1, 2004 to May 31, 2005 (Attachment 2). This data was collected and analyzed by Tenera Environmental in accordance with a sampling plan and methodology approved by the San Diego Regional Water Quality Control Board (see Attachment 3).

### 5.2.2 Estimate of the Impingement Effect of Desalination Plant Stand-Alone Operations

The abundance and biomass of fishes, sharks, rays and invertebrates impinged on the EPS traveling screens were documented in an extensive study as part of the 316(b) Cooling Water Intake assessment submitted to the San Diego Regional Water Quality Control Board by Cabrillo Power, LLC in early 2008[1].). All impingement sampling data collected during this study are

[1] Encina Power Station cooling water system entrainment and impingement of marine organisms: Effects on the biological resources of Agua Hedionda Lagoon and the nearshore ocean environment, Tenera Environmental", January 2008.

provided in Attachment 2 of the Minimization Plan. This attachment contains data collected for all individual sampling events, including the dates and times of the sampling events. The average power plant intake flow during the 2004/2005 sampling period was 632.6 MGD. The total annual amount of impinged fish, sharks and rays for intake flow of 304 MGD, representative for stand-alone operation of the desalination plant is presented in Table 5-1. Based on these data, the average he daily biomass of impinged fish, sharks and rays during stand-alone operations of the desalination plant was estimated at 0.96 kg/day (2.11 lbs/day) for an intake flow of 304 MGD.

Table 5-1 presents impingement losses of fishes, sharks and rays during both normal operations and heat treatment operations. Since the seawater desalination plant will be shutdown during heat treatment, the operation of this plant will not be associated with the impingement losses that occur during heat treatment. Stand-alone operations of the desalination plant will not require the use of heat treatment.

## TABLE 5-1

**Number and weight of fishes, sharks, and rays impinged during normal operation and heat treatment surveys at EPS from June 2004 to June 2005 prorated for 304 MGD**

| | | | Normal Operations Sample Totals | | | | Heat Treatment | |
|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Sample Count | Sample Weight (g) | Bar Rack Count | Bar Rack Weight (g) | Sample Count | Sample Weight (g) |
| 1 | *Atherinops affinis* | topsmelt | 5,242 | 42,299 | 10 | 262 | 15,696 | 67,497 |
| 2 | *Cymatogaster aggregata* | shiner surfperch | 2,827 | 28,374 | - | - | 18,361 | 196,568 |
| 3 | *Anchoa compressa* | deepbody anchovy | 2,079 | 11,606 | 2 | 21 | 23,356 | 254,266 |
| 4 | *Seriphus politus* | queenfish | 1,304 | 7,499 | 2 | 17 | 929 | 21,390 |
| 5 | *Xenistius californiensis* | salema | 1,061 | 2,390 | - | - | 1,577 | 6,154 |
| 6 | *Anchoa delicatissima* | slough anchovy | 1,056 | 3,144 | - | - | 7 | 10 |
| 7 | Atherinopsidae | silverside | 999 | 4,454 | - | - | 2,105 | 8,661 |
| 8 | *Hyperprosopon argenteum* | walleye surfperch | 605 | 23,962 | 1 | 21 | 2,547 | 125,434 |
| 9 | *Engraulis mordax* | northern anchovy | 537 | 786 | - | - | 92 | 374 |
| 10 | *Leuresthes tenuis* | California grunion | 489 | 2,280 | - | - | 7,067 | 40,849 |
| 11 | *Heterostichus rostratus* | giant kelpfish | 344 | 2,612 | - | - | 908 | 9,088 |
| 12 | *Paralabrax maculatofasciatus* | spotted sand bass | 303 | 4,604 | - | - | 1,536 | 107,563 |
| 13 | *Sardinops sagax* | Pacific sardine | 268 | 1,480 | - | - | 6,578 | 26,266 |
| 14 | *Roncador stearnsi* | spotfin croaker | 182 | 8,354 | 2 | 3,000 | 106 | 17,160 |
| 15 | *Paralabrax nebulifer* | barred sand bass | 151 | 1,541 | - | - | 1,993 | 32,759 |
| 16 | *Gymnura marmorata* | Calif. butterfly ray | 146 | 60,629 | 1 | 390 | 70 | 36,821 |
| 17 | *Phanerodon furcatus* | white surfperch | 144 | 4,686 | - | - | 53 | 823 |
| 18 | *Strongylura exilis* | California needlefish | 135 | 6,025 | - | - | 158 | 11,899 |
| 19 | *Paralabrax clathratus* | kelp bass | 111 | 680 | - | - | 976 | 13,279 |
| 20 | *Porichthys myriaster* | specklefin midshipman | 103 | 28,189 | - | - | 218 | 66,860 |
| 21 | unidentified chub | unidentified chub | 96 | 877 | - | - | 7 | 44 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 22 | *Paralichthys californicus* | California halibut | 95 | 1,729 | - | - | 21 | 4,769 |
| 23 | *Anisotremus davidsoni* | sargo | 94 | 1,662 | - | - | 963 | 68,528 |
| 24 | *Urolophus halleri* | round stingray | 79 | 20,589 | - | - | 1,090 | 300,793 |
| 25 | *Atractoscion nobilis* | white seabass | 70 | 11,295 | 6 | 872 | 1,618 | 332,056 |
| 26 | *Hypsopsetta guttulata* | diamond turbot | 66 | 10,679 | 1 | 85 | 112 | 24,384 |
| 27 | *Micrometrus minimus* | dwarf surfperch | 57 | 562 | - | - | - | |
| 28 | *Syngnathus spp.* | pipefishes | 55 | 161 | - | - | 56 | 90 |
| 29 | *Atherinopsis californiensis* | jacksmelt | 54 | 1,152 | - | - | 4,468 | 45,152 |
| 30 | *Myliobatis californica* | bat ray | 50 | 19,899 | 4 | 5,965 | 132 | 68,572 |
| 31 | *Menticirrhus undulatus* | California corbina | 43 | 1,906 | - | - | 16 | 4,925 |
| 32 | *Amphistichus argenteus* | barred surfperch | 43 | 1,306 | - | - | 34 | 2,528 |
| 33 | *Fundulus parvipinnis* | California killifish | 43 | 299 | - | - | 16 | 41 |
| 34 | unidentified fish, damaged | unid. damaged fish | 36 | 1,060 | 1 | 70 | 8 | 262 |
| 35 | Ictaluridae | catfish unid. | 35 | 4,279 | - | - | - | |
| 36 | *Leptocottus armatus* | Pacific staghorn sculpin | 32 | 280 | - | - | 5 | 26 |
| 37 | *Sphyraena argentea* | California barracuda | 29 | 397 | - | - | 46 | 1,667 |
| 38 | *Lepomis cyanellus* | green sunfish | 29 | 1,170 | - | - | - | |
| 39 | *Umbrina roncador* | yellowfin croaker | 28 | 573 | - | - | 127 | 22,399 |
| 40 | *Lepomis macrochirus* | bluegill | 20 | 670 | - | - | - | |
| 41 | *Ophichthus zophochir* | yellow snake eel | 18 | 5,349 | - | - | 51 | 17,303 |
| 42 | *Citharichthys stigmaeus* | speckled sanddab | 17 | 62 | - | - | 1 | 30 |
| 43 | *Brachyistius frenatus* | kelp surfperch | 16 | 182 | - | - | 17 | 598 |
| 44 | *Cheilotrema saturnum* | black croaker | 15 | 103 | - | - | 288 | 9,029 |
| 45 | *Embiotoca jacksoni* | black surfperch | 14 | 1,240 | - | - | 69 | 5,367 |
| 46 | *Genyonemus lineatus* | white croaker | 12 | 171 | - | - | 9 | 79 |
| 47 | *Platyrhinoidis triseriata* | thornback | 11 | 4,731 | 1 | 1,500 | - | |
| 48 | *Chromis punctipinnis* | blacksmith | 10 | 396 | - | - | 151 | 4,431 |
| 49 | unidentified fish | unidentified fish | 10 | 811 | - | - | - | |
| 50 | *Porichthys notatus* | plainfin midshipman | 9 | 1,792 | - | - | - | |
| 51 | *Hermosilla azurea* | zebra perch | 9 | 1,097 | - | - | 62 | 3,518 |
| 52 | *Micropterus salmoides* | large mouth bass | 9 | 27 | - | - | - | |
| 53 | *Trachurus symmetricus* | jack mackerel | 7 | 7 | - | - | 15 | 702 |
| 54 | *Hypsoblennius gentilis* | bay blenny | 7 | 37 | - | - | 440 | 2,814 |
| 55 | *Heterostichus* spp. | kelpfish | 7 | 48 | - | - | - | |
| 56 | Engraulidae | anchovies | 6 | 3 | - | - | - | |
| 57 | *Anchoa* spp. | anchovy | 6 | 27 | - | - | - | |
| 58 | *Peprilus simillimus* | Pacific butterfish | 5 | 91 | - | - | 1 | 33 |
| 59 | *Rhacochilus vacca* | pile surfperch | 4 | 915 | - | - | - | |
| 60 | *Sebastes atrovirens* | kelp rockfish | 4 | 40 | - | - | - | |
| 61 | *Pleuronichthys verticalis* | hornyhead turbot | 4 | 190 | - | - | 2 | 251 |
| 62 | *Pylodictis olivaris* | flathead catfish | 4 | 480 | - | - | - | |
| 63 | Pleuronectiformes unid. | flatfishes | 4 | 62 | - | - | - | |
| 64 | *Syngnathus leptorhynchus* | bay pipefish | 3 | 9 | - | - | - | |
| 65 | *Hypsoblennius gilberti* | rockpool blenny | 3 | 16 | - | - | 8 | 77 |
| 66 | *Mustelus californicus* | gray smoothhound | 3 | 1,850 | - | - | 22 | 19,876 |
| 67 | *Cheilopogon pinnatibarbatus* | smallhead flyingfish | 3 | 604 | - | - | - | |
| 68 | *Ameiurus natalis* | yellow bullhead | 3 | 220 | - | - | - | |
| 69 | *Lepomis* spp. | sunfishes | 3 | 196 | - | - | - | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | *Girella nigricans* | opaleye | | 2 | 346 | - | - | | 355 | 30,824 |
| 71 | *Rhinobatos productus* | shovelnose guitarfish | | 2 | 461 | 2 | 6,200 | - | - | |
| 72 | *Acanthogobius flavimanus* | yellowfin goby | | 2 | 55 | - | - | - | - | |
| 73 | *Scomber japonicus* | Pacific mackerel | | 2 | 10 | - | - | | 15 | 880 |
| 74 | *Hypsoblennius* spp. | blennies | | 2 | 11 | - | - | | 113 | 489 |
| 75 | *Hypsoblennius jenkinsi* | mussel blenny | | 2 | 17 | - | - | | 175 | 946 |
| 76 | *Paralabrax* spp. | sand bass | | 2 | 2 | - | - | | 6 | 19 |
| 77 | *Scorpaena guttata* | Calif. scorpionfish | | 2 | 76 | - | - | - | - | |
| 78 | *Hyporhamphus rosae* | California halfbeak | | 2 | 23 | - | - | | 1 | - |
| 79 | *Symphurus atricauda* | California tonguefish | | 2 | 15 | - | - | - | - | |
| 80 | *Tilapia* spp. | tilapias | | 2 | 7 | - | - | - | - | |
| 81 | *Sarda chiliensis* | Pacific bonito | | 2 | 1,010 | - | - | | 2 | 540 |
| 82 | *Albula vulpes* | bonefish | | 2 | 1,192 | - | - | | 1 | 900 |
| 83 | Sciaenidae unid. | croaker | | 2 | 3 | - | - | | 17 | 1,212 |
| 84 | *Oxylebius pictus* | painted greenling | | 1 | 5 | - | - | - | - | |
| 85 | *Lyopsetta exilis* | slender sole | | 1 | 26 | - | - | - | - | |
| 86 | *Citharichthys sordidus* | Pacific sanddab | | 1 | 1 | - | - | - | - | |
| 87 | *Gibbonsia montereyensis* | crevice kelpfish | | 1 | 8 | - | - | - | - | |
| 88 | *Pleuronichthys ritteri* | spotted turbot | | 1 | 7 | - | - | | 13 | 2,745 |
| 89 | *Gillichthys mirabilis* | longjaw mudsucker | | 1 | 34 | - | - | - | - | |
| 90 | *Dorosoma petenense* | threadfin shad | | 1 | 3 | - | - | - | - | |
| 91 | *Porichthys* spp. | midshipman | | 1 | 200 | - | - | - | - | |
| 92 | *Cynoscion parvipinnis* | shortfin corvina | | 1 | 900 | - | - | - | - | |
| 93 | *Mugil cephalus* | striped mullet | | 1 | 3 | - | - | | 5 | 3,854 |
| 94 | *Paraclinus integripinnis* | reef finspot | | 1 | 4 | - | - | | 4 | 12 |
| 95 | *Hyperprosopon* spp. | surfperch | | 1 | 115 | - | - | | 7 | 552 |
| 96 | *Ameiurus nebulosus* | brown bullhead | | 1 | 100 | - | - | - | - | |
| 97 | *Micropterus dolomieu* | smallmouth bass | | 1 | 150 | - | - | - | - | |
| 98 | *Citharichthys* spp. | sanddabs | - | - | - | - | - | | 1 | 3 |
| 99 | *Triakis semifasciata* | leopard shark | - | - | - | - | - | | 2 | 688 |
| 100 | *Medialuna californiensis* | halfmoon | - | - | - | - | - | | 53 | 1,864 |
| 101 | *Torpedo californica* | Pacific electric ray | - | - | - | 1 | 3,750 | - | - | |
| 102 | Scorpaenidae | scorpionfishes | - | - | - | - | - | | 2 | 64 |
| 103 | *Halichoeres semicinctus* | rock wrasse | - | - | - | - | - | | 1 | 33 |
| 104 | *Hypsypops rubicundus* | garibaldi | - | - | - | - | - | | 5 | 1,897 |
| 105 | *Seriola lalandi* | yellowtail jack | - | - | - | - | - | | 21 | 978 |
| 106 | *Dasyatis dipterura* | diamond stingray | - | - | - | - | - | | 2 | 1,468 |
| 107 | *Heterodontus francisci* | horn shark | - | - | - | - | - | | 1 | 850 |
| 108 | Zoarcidae | eelpouts | - | - | - | - | - | | 1 | 17 |
| | | | **19,408** | | **351,672** | **34** | **22,152** | | **94,991** | **2,034,900** |

The daily biomass of impinged fish, sharks and rays during normal operations of 0.96 kgs/day was calculated by dividing the total annual sample weight of 351,672 grams (see last row of the second column of the Table 5-1 summarizing all impingement data) by the total number of days per year (i.e., 351,672 grams/365 days = 963.48 grams/day = 0.96 kgs/day.

While Table 5-1 presents impingement information for fish, sharks and rays, Attachment 2 also contains all impingement data for invertebrates (crab, octopus, squid, California spiny lobster, etc.) collected during the 2004/2005 impingement study referenced above. Review of this comprehensive impingement data set in Attachment 2 indicates that the both the number and the total weight of the impinged invertebrates was over 10 times smaller than that of fish, sharks and rays (i.e., less than 0.1 kgs/day).

### 5.2.3 Significance of Impingement Losses

As the CEQA lead agency on the Project EIR, the City of Carlsbad found that the impingement impacts associated with the stand-alone operation of the proposed desalination facility are insignificant and therefore no mitigation is required.[2] In its approval of the Coastal Development permit for the proposed Project, the Coastal Commission found that impingement impacts associated with the stand-alone desalination facility would be "*de minimis* and insignificant."[3] The Coastal Commission conditioned the project to include compensatory mitigation to lessen the effects of unavoidable entrainment and impingement impacts.[4] With the inclusion of this Special Condition 8, the Commission found that the anticipated entrainment and impingement impacts associated with the stand-alone desalination facility would be mitigated to the maximum extent feasible.[5]

## 5.3 METHODOLOGY FOR ASSESSMENT OF ENTRAINMENT IMPACT

### 5.3.1 Background Data Used for Preparation of Entrainment Assessment

The entrainment assessment associated with the desalination plant operations is based on comprehensive data collection study completed at the existing intake of the Encina Power Generation Station following a San Diego Regional Water Quality Control Board (Regional Board) approved data collection protocol during the Period of June 01, 2004 and May 31, 2005 (see Attachment 3). All samples used for the entrainment assessment were collected in front of the EPS intake with a boat-towed plankton net. This is the most up-to-date entrainment assessment available for this facility.

Tenera Environmental estimated the proportional entrainment mortality of the most commonly entrained larval fish living in Agua Hedionda Lagoon by applying the Empirical Transport Model (ETM) to the complete data set from the period of June 01, 2004 and May 31, 2005. The potential entrainment contribution of the desalination facility operations was computed based on a total flow of 304 MGD (104 MGD flow to the desalination facility and 200 MGD for dilution of the concentrated seawater).

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[2] See Final Environmental Impact Report EIR 03-05

[3] See Coastal Commission Recommended Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 40 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

[4] See Coastal Commission Recommended Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, pages 53 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

[5] See Coastal Commission Recommended Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, pages 3 and 4 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

### 5.3.2 Entrainment Effects Model

The Empirical Transport Model (ETM) used to assess the APF the desalination facility is based on principles used in fishery management. The number of days that the larvae are subject to entrainment, or the number of days the desalination facility is operating, is estimated using the size range of the larvae entrained. This number of operating days is then combined with the entrainment mortality (*PE*) to estimate the total mortality due to entrainment for a study period. These estimates for each study period can then be combined to calculate the average proportional mortality due to entrainment for an entire year.

The *ETM* has been proposed by the U.S. Fish and Wildlife Service to estimate mortality rates resulting from cooling water withdrawals by power plants. The *ETM* model provides an estimate of incremental mortality (a conditional estimate in absence of other mortality imposed on local larval populations by using an empirical measure of proportional entrainment (*PE*) rather than relying solely on demographic calculations. Proportional entrainment (*PE*) (an estimate of the daily mortality) to the source water population from entrainment is expanded to predict regional effects on appropriate adult populations using the *ETM*, as described below.

Empirical transport modeling permits the estimation of conditional mortality due to entrainment while accounting for the temporal variability in distribution and vulnerability of each life stage to power plant withdrawals.

The general equation to estimate *PE* for a day on which entrainment was sampled is:

$$PE = \frac{N_{Ei}}{N_{Si}}$$

Where:

$N_{Ei}$ = estimated number of larvae entrained during the day in survey i, calculated as (estimated density of larvae in the water entrained that day) × (design specified daily cooling water intake volume),

$N_{Si}$ = estimated number of larvae in the source water that day in survey i (estimated density of larvae in the souce water that day) × (source water volume).

A source water volume is used because: 1) cooling water flow is measured in volume per time, and 2) biological sampling measures larval concentration in terms of numbers per sample volume. Entrained numbers of larvae are estimated using the volume of water withdrawn. A source population is similarly estimated using the source water volume. If one assumes that larval concentrations at the point of entrainment are the same as larval concentrations in the source population volume then it follows that:

$$PE = \frac{V_{Ei}}{V_{Si}},$$

Where :

$V_{Ei}$ = design specified daily cooling water intake volume,

$V_{Si}$ = estimated source water volume.

The ratio of daily entrainment volume to source volume can thus serve as an estimate of daily mortality. The *PE* value is estimated for each larval duration period over the course of a year by using a source water estimate from an advection model described below.

If larval entrainment mortality is constant throughout the period and a larva is susceptible to entrainment over a larval duration of *d* days, then the proportion of larvae that escape entrainment in period *i* is:

$$(1 - PE_i)^{\hat{d}}.$$

A larval duration of 23 days from hatching to entrainment was calculated from growth rates using the length representing the upper 99$^{th}$ percentile of the length measurements from larval CIQ gobies collected from entrainment samples during 316(b) study completed by Tenera Environmental. The value for *d* was computed by dividing an estimate of growth rate into the change in length based on this 99$^{th}$ percentile estimate. The minimum size used for computing the larval duration was determined after removing the smallest 1 percent of the values.

It is possible that aging was biased, even though standard lengths of larval fishes (i.e., measurements of minimum, mean, and maximum), and larval growth rates were applied to estimate the ages of the entrained larvae. It was assumed that larvae shorter than the minimum length were just hatched and therefore, aged at zero days. Subsequent ages were estimated using this length. Other reported data for various species suggest that hatching length can be either smaller or larger than the size estimated from the samples, and indicate that the smallest observed larvae represent either natural variation in hatch lengths within the population or shrinkage following preservation. The possibility remains that all larvae from the observed minimum length to the greatest reported hatching length (or to some other size) could have just hatched, leading to overestimation of ages for all larvae.

Sixteen larval duration periods over the course of a year were used to estimate larval mortality ($P_M$) due to entrainment using the following equation:

$$P_M = \frac{1}{16}\sum_{i=1}^{16} 1 - (1 - PE_i)^{\hat{d}}$$

Where:

$\hat{P}E_i$ = estimate of proportional entrainment for the $i$th period and

$\hat{d}$ = the estimated number of days of larval life.

The estimate of the population-wide probability of entrainment ($\hat{P}E_i$) is the central feature of the *ETM* approach. If a population is stable and stationary, then $\hat{P}_M$ estimates the effects on the fully-recruited adult age classes when uncompensated natural mortality from larva to adult is assumed.

Assumptions associated with the estimation of $P_M$ include the following:

1) Lengths and applied growth rate of larvae accurately estimate larval duration,
2) A source population of larvae is defined by the region from which entrainment is possible,
3) Source water volume adequately describes the population, and
4) The currents used to calculate the source water volume are representative of other years.

The ratio of daily entrainment volume to source volume is used as an estimate of daily mortality. The *ETM* method estimates the source population using an estimate of the source volume of water from which larvae could possibly be entrained. It has been noted that if some members of the target group lie outside the sampling area, the *ETM* will overestimate the population mortality.

Recent work by Largier showed the value of advection and diffusion modeling in the study of larval dispersal, which is central to the *ETM* method. Ideally, three components could be considered in estimating entrainable populations: advection, diffusion, and biological behavior. An *ad hoc* approach, developed by the Technical Working Group during the Diablo Canyon Power Plant (DCPP) 316(b) study, modeled the three components using a single offshore current meter. For the present analysis, lagoon and coastal source water populations were treated separately.

Larval populations in the Agua Hedionda lagoon were computed using the lagoon segment volumes, described below. Nearshore populations were defined using the *ad hoc* approach developed by the DCPP Technical Working Group.

### 5.3.3 Source Water Volume Used for AHF Calculations

Agua Hedionda Lagoon is comprised of three segments: "outer", "middle", and "inner". The lagoon segments were originally dredged to a mean depth of 2.4 m (8 ft) relative to mean water level (MWL) in 1954. The horizontal areas of the outer, middle, and inner segments at MHW are 267,000 $m^2$ (66 acres), 110,000 $m^2$ (27 acres) and 1,200,000 $m^2$ (295 acres), respectively (Table 5-2). The tidal prism of the outer segment was calculated as 246,696 $m^3$ (200 acre ft) and for the middle and inner segments as 986,785 $m^3$ (800 acre ft). The individual volumes of the middle and inner tidal prisms were estimated to be 82,860 $m^3$ and 903,925 $m^3$ using weighting by areas. The volumes of the three segments below mean water level were computed as the volume below mean high water minus half the tidal prism (Table 5-2).

**TABLE 5-2**

**VOLUMES OF THE OUTER, MIDDLE, AND INNER SEGMENTS OF THE AGUA HEDIONDA LAGOON**

| | Design Depth (m re: MWL) | Area ($m^2$ re: MHW) | Volume ($m^3$ re: MHW) | Volume (MWL) ($m^3$ MHW-.5 Prism) |
|---|---|---|---|---|
| Outer | 2.4 | 267,000 | 791,356 | 668,006 |
| Middle | 2.4 | 110,000 | 326,027 | 284,597 |
| Inner | 2.4 | 1,200,000 | 3,556,656 | 3,104,696 |
| **Total** | | **1,577,000** | **4,674,039** | **4,057,299** |

Figure 5-1 shows the sampling blocks used to calculate near shore source water volume. Sampling done in five (the "N" blocks) of the nine blocks was assumed to be representative of alongshore and offshore variation in abundances and therefore the volume from all nine blocks was used in calculating source water abundances. The volumes for these sampling blocks were calculated from bathymetric data for the coastal areas around Carlsbad using ArcGIS software. The total volume in these nine blocks was estimated at 283,303,115 $m^3$ (Table 5-3).

SDG&E have completed a three-month deployment (June, August, and November 1979) of two Endeco current meter seaward of the outer lagoon entrance. Highest current speeds occurred further offshore, with 10.06 cm/s being the average current speed. The furthest offshore station was over a bottom depth of about 24.4 m (80 ft) at California State plane 355,800 N and 6,625,000 E. The meter was set –3 m below the surface. SCCWRP reported similar current speeds with median offshore currents at Carlsbad of 8.6 cm/s in winter and 7.0–9.5 cm/s in summer from a mid-depth position over a 45 m bottom from 1979–1990.

TABLE 5-3

VOLUMES OF NEAR SHORE SAMPLING BLOCKS USED IN CALCULATING SOURCE WATER ABUNDANCES

| Block | Depth (m re: MWL) | Area ($m^2$ re: MHW) | Volume ($m^3$ re: MHW) |
|---|---|---|---|
| N1 | -5.3 | 1,195,366 | 5,959,236 |
| N2 | -6.4 | 1,653,677 | 9,840,181 |
| N3 | -5.6 | 1,775,546 | 9,247,259 |
| SW1 | -14.8 | 1,055,516 | 15,633,525 |
| N4 | -18.5 | 1,359,040 | 25,081,478 |
| SW2 | -17.9 | 1,711,379 | 30,499,399 |
| SW3 | -27.8 | 1,312,832 | 36,386,864 |
| N5 | -38.5 | 1,661,891 | 63,329,174 |
| SW4 | -42.8 | 2,046,985 | 87,325,998 |
| **Total** | | **13,772,232** | **283,303,115** |

The three months of currents reported in SDG&E in 1980 were rotated to the coastline direction at the Encina Power Station (36 degrees W of N). The average current vector components were 1.702 cm/s downcoast and 0.605 cm/s offshore.

A current meter was placed in the near shore between Stations N4 and N5. The data from the meter was used to characterize currents in the near shore area that would directly affect the dispersal of planktonic organisms that could be entrained by the power plant. The data were used to define the size of the near shore component of the source water by using the current speed and the estimated larval durations of the entrained organisms.

Source water volume and depths of Agua Hedionda Lagoon were very carefully determined based on recent hydrodynamic studies of Agua Hedionda Lagoon.

### 5.3.4 ETM Modeling for Carlsbad Desalination Project

The effect of the proposed CDF operations on source water populations of larval fishes was evaluated in three steps. First, by computing estimates of the incremental mortality that could result from the desalination facility source seawater withdrawal over a one-day period, second by using the incremental mortality to estimate mortality over the period that the larvae are exposed to water withdrawals, and finally by placing these estimates into context based on empirical data of the number of larvae that survive EPS entrainment and are alive at the point of source seawater water withdrawal by the proposed desalination facility.

The estimate of daily incremental mortality, or proportional entrainment (*PE*), was computed as the ratio of the number of larvae in the water withdrawn by the proposed facility to the number

of larvae in the surrounding source water. The estimate of the number of larvae in the water withdrawn is calculated using the average concentration of larvae from samples that were collected inside the EPS cooling water intake system at a point close to the location where the desalination facility would withdraw its water.

The average concentration and variance were calculated for the in-plant surveys conducted on June 10, 2004 and May 19, 2005. The average concentration and variance from these two surveys were then used to calculate estimates of the average in-plant concentration and variance. The average variance from the two surveys was used since it best reflected the level of variation among samples over a 24-hr period. The average concentration was multiplied by desalination facility's maximum feedwater withdrawal volume of 1,150,640 $m^3$/day (304 MGD) to simulate effects under maximum operating conditions. Similar calculations were used to estimate the source water populations of larvae that would be affected by the proposed CDF operations. Average concentrations of larval fishes from stations in the inner, middle, and outer segments of Aqua Hedionda Lagoon, and stations in the ocean directly offshore from EPS were calculated from the thirteen surveys conducted from June 10, 2004 to May 19, 2005. The average concentrations were multiplied by the volume estimates for each of the water body segments and then combined to estimate the average source water population.

**Sources of Variance in ETM**

The major sources of variance in *ETM* results have been shown to include variance in estimates of larval entrainment concentrations, source water concentrations, and larval duration, in this order. Variance in estimates of entrainment and source water concentrations of fish larvae is due to spatial differences among stations, day and night diurnal changes, and temporal changes between surveys.

**ETM Results**

Estimates of desalination intake and source water populations for the fish taxa evaluated are presented in Table 5-4 were based on entrainment and source water data for the sampling period of June 10, 2004 to May 19, 2005. The following documents related to Poseidon's Entrainment Study are enclosed.

- Attachment 2 – Impingement Results, G1 – Traveling Screen and bar Rack Weekly Surveys, G2 – Heat Treatment Surveys
- Attachment 3 – Proposal for Information Collection Clean Water Act Section 316(b), Encina Power Station, Cabrillo Power I LLC, NPDES Permit No. CA0001350, April 1, 2006
- Attachment 4 – Updated Impingement and Entrainment Assessment, Tenera Environmental, May 2007
- Attachment 5 – Carlsbad Desalination Facility – Summary of Fish and Target Shellfish Larvae Collected for Entrainment and Source Water Studies in the Vicinity of Agua Hedionda Lagoon from June 2005 through May 2006.

## TABLE 5-4

## ETM VALUES FOR ENCINA POWER STATION LARVAL FISH ENTRAINMENT FOR THE PERIOD OF 01 JUN 2004 TO 31 MAY 2005 BASED ON STEADY ANNUAL INTAKE FLOW OF 304 MGD

| | ETM Estimate | ETM Std.Err. | ETM + SE | ETM - SE |
|---|---|---|---|---|
| ETM Model Data for 3070 - Gobies | 0.21599 | 0.30835 | 0.52434 | -0.09236 |
| ETM Model Data for 1495 - Blennies | 0.08635 | 0.1347 | 0.22104 | -0.04835 |
| ETM Model Data for 1849 - Hypsopops | 0.06484 | 0.13969 | 0.20452 | -0.07485 |
| **AVERAGE** | **0.122393** | | | |
| | | | | |
| ETM Model Data for 3062 – White Croaker | 0.00138 | 0.00281 | 0.00419 | -0.00143 |
| ETM Model Data for 1496 – Northern Anchovy | 0.00165 | 0.00257 | 0.00422 | -0.00092 |
| ETM Model Data for 1219 – California Halibut | 0.00151 | 0.00238 | 0.00389 | -0.00087 |
| ETM Model Data for 1471 - Queenfish | 0.00365 | 0.00487 | 0.00852 | -0.00123 |
| ETM Model Data for 1494 – Spot Fin Croaker | 0.00634 | 0.01531 | 0.02165 | -0.00896 |
| **AVERAGE** | **0.002906** | | | |

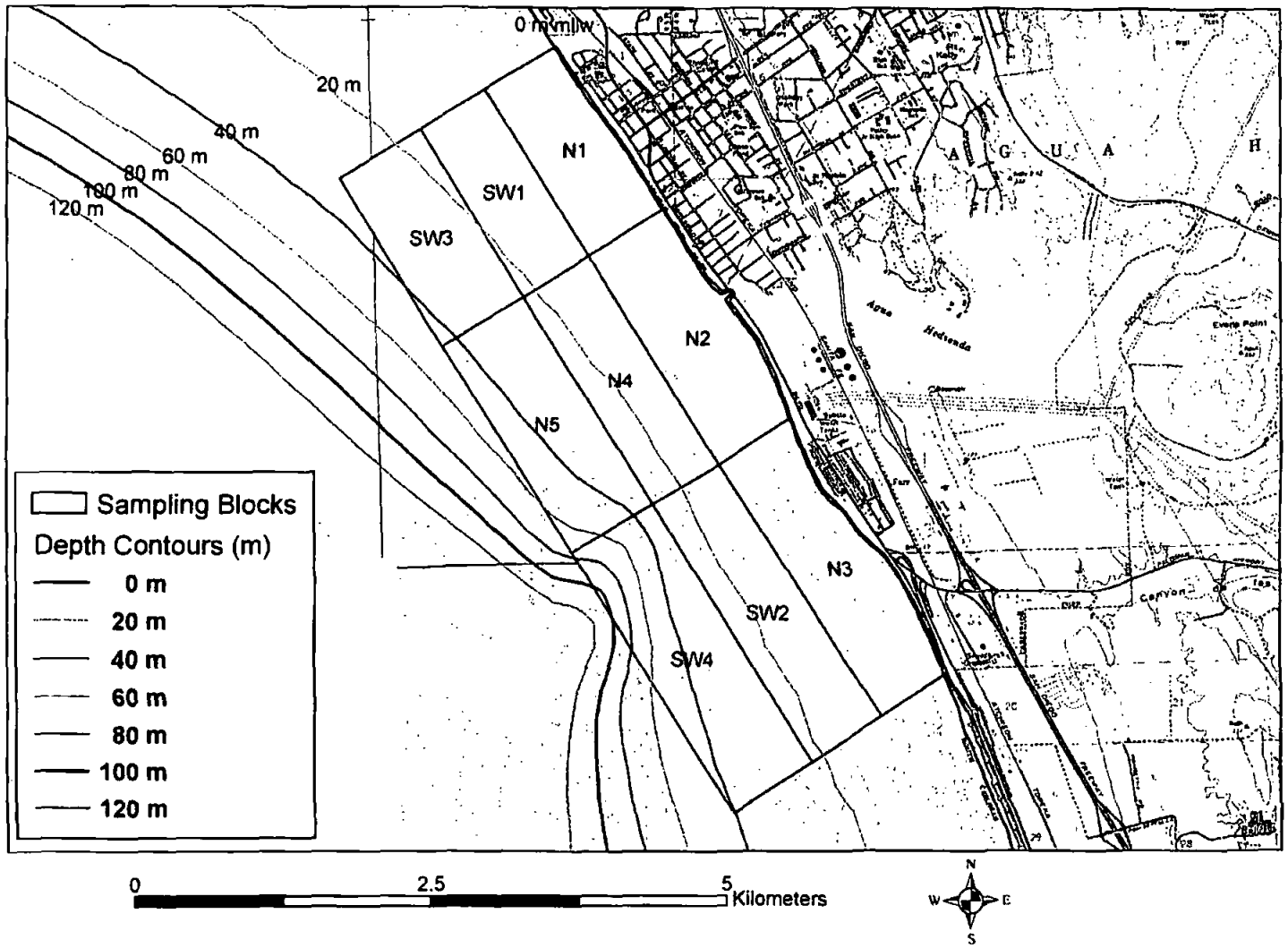


**Figure 5-8 Nearshore sampling blocks used to calculate source water volumes**

The average ETM value of the entrained species of 0.1224 (12.2 percent) average of ETM results for the three most commonly entrained species living in Agua Hedionda Lagoon. This approach makes it possible to establish a definitive habitat value for the source water, and is consistent with the approach taken by the California Energy Commission and their independent consultants for the AES Huntington Beach Power Generation Plant and the Morro Bay Power Plant (MBPP) in assessing and mitigating the entrainment effects of the proposed combined cycle project. The situation in Morro Bay is very analogous to the proposed Carlsbad Project because both projects are drawing water from the enclosed bays.

### 5.3.5 Significance of Worst-Case Scenario Entrainment Impacts

As the CEQA lead agency on the Project EIR, the City of Carlsbad found that the entrainment impacts associated with the stand-alone operation of the proposed desalination facility are insignificant and therefore no mitigation is required.[6]

The Coastal Act applies a different standard of review for projects of this nature. The Coastal Act provides that "[m]arine resources shall be maintained, enhanced, and *where feasible* restored."[7] Additionally, the adverse effects of entrainment shall be minimized where feasible.[8] In its approval of the Coastal Development permit for the proposed Project, the Coastal Commission found that Poseidon is "using all feasible methods to minimize or reduce its entrainment impacts" and conditioned the Project to include compensatory mitigation to lessen the effects of unavoidable entrainment and impingement impacts.[9] With the inclusion of this Special Condition 8, the Commission found that the anticipated entrainment and impingement impacts associated with the stand-alone desalination facility would be mitigated to the maximum extent feasible.[10]

## 5.4 SUMMARY AND CONCLUSIONS

The Coastal Commission found that Poseidon is using all feasible methods to minimize or reduce its impingement and entrainment impacts. These methods are likely to reduce the Project related impacts to marine life well below the levels identified herein. Nevertheless, as described in Chapter 6, Poseidon has voluntarily committed to restore and enhance sufficient coastal habitat to more than compensate for the Project impacts prior to consideration of benefits to be derived form the minimization measures.

Ten years after the lease is issued, that the CDP will be subject to further environmental review by the State Lands Commission (SLC) to analyze all environmental effects of facility operations

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[6] See Final Environmental Impact Report EIR 03-05
[7] Coastal Act Sections 30230.
[8] Coastal Act Sections 30231.
[9] See Coastal Commission draft findings for Poseidon Carlsbad Desalination Project, pages 53 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf
[10] See Coastal Commission draft findings for Poseidon Carlsbad Desalination Project, pages 3 and 4 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

and alternative technologies that may reduce any impacts found. SLC may require additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations. This approach will ensure that the stand-alone CDP operations continue to use the best technologies to minimize impacts to marine life and are mitigated to the maximum extent feasible.

# CHAPTER 6

# MITIGATION

## INTRODUCTION

Pursuant to Water Code Section 13142.5(b), this Chapter establishes a state-agency coordinated process for identification of the best available mitigation feasible to minimize Project related impacts to marine life..

- *Section 6.1 describes the proposed approach to mitigation.*
- *Section 6.2 describes the assessment of the impacted area.*
- *Section 6.3 provides an assessment of the wetlands restoration needed to compensate for entrainment impacts of the desalination facility stand-alone operations.*
- *Section 6.4 describes the restoration plan development and related benefits.*
- *Section 6.5 describes opportunities for restoration and preservation of Agua Hedionda Lagoon.*
- *Section 6.6 describes opportunities for an offsite restoration program in San Dieguito Lagoon.*
- *Section 6.7 describes the regulatory assurances that are in place to insure the adequacy of the restoration plan.*

## 6.1 PROPOSED MITIGATION APPROACH

Poseidon is using all feasible methods to minimize or reduce its entrainment impacts. These methods are likely to reduce the Project related impacts to marine life well below the levels identified in Chapter 5. To minimize unavoidable Project related impacts to marine life, Poseidon has voluntarily committed to a state-agency coordinated process to identify the best available mitigation feasible. The objective of the mitigation portion of this plan is to identify mitigation needs, set forth mitigation goals, and present a plan and approach for achieving the goals.

Recognizing that mitigation opportunities in Agua Hedionda Lagoon may be limited, Poseidon proposes a comprehensive but flexible approach for mitigating potential impacts. This approach is based on:

- Conservatively estimating maximum potential impacts (see Section 6.2),

- Identifying goals and objectives of the mitigation program (see Section 6.4.1),
- Identifying any available mitigation opportunities in Agua Hedionda Lagoon that meet the goals and objectives (see Section 6.5),
- Identifying additional offsite mitigation that meets the mitigation goals (see Section 6.6).
- Developing an action plan and schedule for coordinating with regulatory and resource agencies to finalize locations and acreages selected for the proposed mitigation.

Investigations to date have not identified any mitigation opportunities within Agua Hedionda Lagoon (see Section 6.5) that meet the goals of the program. As a result, the proposed mitigation plan includes a core offsite mitigation program that meets the plan goals and objectives that is being developed in parallel with Poseidon's continued effort to identify feasible mitigation opportunities in Agua Hedionda Lagoon.

Poseidon recognizes the need and priority of implementing mitigation in Agua Hedionda Lagoon if feasible. Poseidon also recognizes that mitigation requirements and regulations of the various review agencies differ, and additional agency coordination is required to insure that needs of all applicable agencies are addressed.

Accordingly, while this plan identifies a core offsite mitigation project, the mitigation plan also presents an implementation action schedule that includes additional coordination activities to either (1) confirm the lack of opportunities, or (2) identify if new mitigation options exist within Agua Hedionda Lagoon.

Under the proposed plan, if subsequent Agua Hedionda Lagoon mitigation is determined to be feasible, Poseidon will coordinate with regulatory agencies to implement such mitigation.

If Agua Hedionda Lagoon mitigation is confirmed as infeasible, Poseidon will implement the proposed offsite mitigation project. Further, it is recognized that the degree of mitigation required will be dependent on mitigation ratio requirements of the various regulatory agencies. As a result, the proposed plan provides for additional coordination with the regulatory agencies to finalize agency-mandated acreage requirements.

Table 6-1 summarizes the implementation action schedule for the proposed plan.

**Table 6-1**
**Mitigation Implementation Approach and Schedule**

| Element | Actions/Objectives | Schedule |
|---|---|---|
| Submittal of draft Minimization Plan to Regional Board | • Public and agency review of revised draft Plan | March 2008 |
| Regional Board consideration of Minimization Plan | • Approval of Plan<br>• Regional Board provides directions on Plan implementation | April 2008 |
| Contacts with California Department of Fish & Game to assess mitigation opportunities in Agua Hedionda Lagoon | • Assess mitigation opportunities for saltwater marsh creation in Agua Hedionda Lagoon via dredging | March 2008 |
| Supplemental contacts with other resource agencies | • Identify (or conform lack of) additional mitigation opportunities in Agua Hedionda Lagoon | April 2008 |
| Convene meeting of resource agencies; Regional Board and Coastal Commission. | • Identify (or confirm lack of) additional mitigation opportunities in Agua Hedionda Lagoon<br>• If applicable, address agency requirements for Agua Hedionda Lagoon mitigation and determine overall implementation feasibility<br>• Address mitigation rations/requirements for core offsite mitigation project in San Dieguito Lagoon | April 2008 |
| Finalize and distribute mitigation program implementation details | • Agency review of implementation details | May 2008 |
| Modify/finalize implementation program details (if applicable) | • Agency review and approval<br>• May involve additional inter-agency coordination meeting | June 2008 |
| Coastal Commission consideration of mitigation project(s) | • Coastal Commission approval of mitigation project | July 2008 |

Ten years after the lease is issued, that the CDP will be subject to further environmental review by the State Lands Commission (SLC) to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. SLC may require additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations.

This approach will insure that the stand-alone CDP operations continue to use the best available site, design, technology and mitigation feasible to minimize Project related impacts to marine life.

## 6.2 CONSERVATIVE ASSESSMENT OF IMPACTED AREA

The assessment of the impacted area due to the desalination facility operation is based on a conservative assumption that the CPD will cause 100 percent mortality to the marine organisms in the seawater diverted from Agua Hedionda Lagoon. This approach to establishing the impact of the desalination plant operation is extremely conservative in that it ignores the design and technology features that have been incorporated in the proposed Project. The following design and technology features are expected to substantially lessen the impacts to marine life.

- **EPS once-through cooling system is expected to continue operating indefinitely.** The magnitude of the entrainment losses identified in Chapter 5 is estimated for continuous operation of the desalination plant on a stand-alone basis notwithstanding the fact that the EPS generating units will be available for service indefinitely. Cal-ISO would ultimately determine when they are no longer needed for grid reliability. In the meantime, seawater pumping by the EPS would likely meet a substantial portion of the CPD flow requirements (e.g., 61 percent in 2007), resulting in a comparable reduction of entrainment and impingement impacts attributable to the CDP.

- **Desalination facility impacts reduced impacts due to modified use of existing facilities.** Potential entrainment mortality that occurs within the existing power plant screens, pumps and condensers upstream of the desalination facility intake would be substantially reduced due to the relatively lower temperature, volume, velocity and turbulence of the desalination operations compared to that of the power plant.

- **Two-thirds of the water is returned to the ocean without further processing.** Only 35 percent of the seawater (104 MGD) actually enters the desalination plant and is subjected to additional processing that would potentially add to the entrainment mortality. The reminder of the seawater (200 MGD) bypasses the desalination facility and is returned to the ocean.

- **Desalination facility incorporates technology to capture marine organisms and return them to the ocean unharmed.** Eighty percent of the marine organisms in the seawater that enters the desalination plant retained by the micro-screens and returned to the ocean. The remaining marine organisms that pass through the micro-screens

are subsequently rejected by the pretreatment filters and returned to the ocean. A substantial number of the organisms that are returned to the ocean are expected to survive.

## 6.3 ESTABLISHING RESTORATION REQUIREMENT

Poseidon is proposing to compensate for the unavoidable impact of stand-alone CDP operation by replacing or restoring comparable marine habitat. The proposed restoration plan is based on the Empirical Transport Model described in Chapter 5 that estimated the portion of the larvae of each target fish species at risk of entrainment with the intake source water. Multiplying the average percent of populations at risk by the physical area from which the fish larvae might be entrained, yields an estimate of the amount of habitat that must be restored to replace the lost fish larvae. This estimate is referred to as the area (acreage) of habitat production foregone (APF).

In order to calculate the APF, the number of lagoon habitat acreage occupied by the three most commonly entrained lagoon fish larvae[1] was multiplied by the average Proportional Entrainment Mortality (PM) for the three lagoon species identified in Chapter 5 (12.2 percent). The estimated acres of lagoon habitat for these species are based on a 2000 Coastal Conservancy Inventory of Agua Hedionda Lagoon habitat shown in Table 6-1.[2]

**TABLE 6-1**

**WETLAND PROFILE: AGUA HEDIONDA LAGOON**

**Approximate Wetland Habitat Acreage**

| Habitat | Acres | Vegetation Source |
|---|---|---|
| Brackish / Freshwater | 3 | Cattail, bulrush and spiny rush were dominant |
| Mudflat / Tidal Channel | 49 | Not specified / Estuarine flats |
| Open Water | 253 | Eelgrass occurred in all basins |
| Riparian | 11 | Not specified |
| Salt Marsh | 14 | |
| Upland | 61 | |
| **TOTAL** | **391** | ***(Riparian not included)*** |

[1] Ninety-eight percent of the fish larvae that would be entrained by the CDP stand-alone operations are gobies, blennies and hypsopops.

[2] The actual acreage will be confirmed through a survey of the lagoon habitats that will be conducted during the final design of Poseidon's Coastal Habitat Restoration and Enhancement Program. To the extent that the lagoon habitat acreage established in the survey is higher or lower than that included in the 2000 Inventory, The wetlands restoration plan would be proportional adjusted to account for the actual acreage identified in the survey.

The areas of Agua Hedionda Lagoon that have potential to be impacted by the CDP operations are those habitats occupied by the three most commonly entrained lagoon fish larvae. These habitats include 49 acres of mudflat/tidal channel and 253 acres of open water. It is not appropriate to include the other lagoon habitats in the APF calculation, such as brackish/freshwater, riparian, salt marsh or upland habitats that are not occupied by the impacted species.

By definition, the APF equals the acres of the lagoon habitat that have the potential to be impacted by the intake operations (302 acres) times the average PM:

$$APF = 302 \text{ acres} \times 0.122 = 36.8 \text{ acres.}$$

Thus, entrainment effect of the stand-alone operation of the desalination plant extends over 12.2 percent, or 36.8 acres of Agua Hedionda Lagoon. The restoration area needed to fully mitigate the stand-alone CDP entrainment losses is 36.8 acres.[3] The restoration requirement is estimated under worst-case conditions when the power plant is no longer operating and the existing pumps are operated solely to deliver 304 MGD of seawater for the operation of the desalination plant.

It is generally accepted that this approach results in an overestimate of the number acres that would be necessary to fully mitigate the CDP entrainment and impingement effects, resulting in a net enhancement of the coastal habitat. This is because the restored habitat provides significant environmental benefits that extend well beyond compensating for the entrainment impacts. For example, the APF calculation does not take into account the enormous ecological value of the restored acreage that will accrue to valuable wetland species completely unaffected by the intake, such as the numerous riparian birds, reptiles, benthic organisms and mammals that will utilize the habitat for foraging, cover and nesting. Nor does the calculation consider the myriad of phytoplankton, zooplankton and invertebrate species that are largely unaffected by the intake operations and benefit directly from the restored wetlands.

Similar to the approach taken throughout this assessment, the APF calculation is also based on a number of very conservative assumptions:

- **Assumes 100 percent mortality of all marine organisms entering the intake.** As indicated previously, this assumption does not take into consideration any of the design and technology features that would be incorporated in the project to avoid impact to marine life. The actual impact to marine life is expected to be substantially lower.

[3] The methodology used to determine the area impacted by the stand-alone desalination facility operation is based on the recommendation from the Coastal Commission that Poseidon follow the approach used by the California Energy Commission for establishing mitigation requirements for the entrainment effects associated with the operation of the AES Huntington Beach power generation plant.

- **Assumes 100 percent survival of all fish larvae in their natural environment.** In fact, over 90 percent of the fish larvae are lost to predators and do not ever reach adulthood.

- **Assumes species are evenly distributed throughout the entire depth and volume of the water body.** This assumption is very conservative for the site-specific conditions of Agua Hedionda Lagoon because it is well known that some impacted species (i.e., garibaldi) mainly inhabit the rocky area near the entrance to the power plant intake.

- **Assumes the entire habitat from which the entrained fish larvae may have originated is destroyed.** This approach to identifying the restoration requirement for the stand-alone desalination facility assumes that the area of production forgone (APF) is an area of lost habitat for all marine species inhabiting this area. This assumption is extremely conservative because only a small portion of the species inhabiting Agua Hedionda Lagoon would actually enter the power plant intake.

## 6.4 RESTORATION PLAN DEVELOPMENT

The main objective of the restoration plan is to implement one or more activities which preserve, restore and enhance exiting wetlands, lagoons or other high-productivity near-shore coastal areas located in the vicinity of Agua Hedionda Lagoon and/or elsewhere in San Diego County. Examples of types of activities that may be included in the restoration plan include:

- Wetland Restoration;
- Coastal Lagoon Restoration;
- Restoration of Historic Sediment Elevations to Promote Reestablishment of Eelgrass Beds;
- Marine Fish Hatchery Enhancement;
- Contribution to a Marine Fish Hatchery Stocking Program;
- Artificial Reef Development;
- Kelp Bed Enhancement.

### 6.4.1 Key Goals and Objectives

The main objective of the restoration plan is to implement one or more activities which preserve, restore and enhance exiting wetlands, lagoons or other high-productivity near-shore coastal areas located in the vicinity of Agua Hedionda Lagoon and/or elsewhere in

San Diego County. The key restoration plan goals are:

- Creation or Restoration of Coastal Habitat. The primary objective of the restoration plan is to create or restore coastal habitat similar to that of Agua Hedionda Lagoon, which will provide measurable long term environmental benefits adequate to mitigate potential impingement and entrainment impacts associated with CDP operations.

- Development of Technically Feasible Project. The restoration plan will rely on well-established methods, techniques and technologies for development and nurturing of coastal habitat of high productivity and long-term sustainability.

- Stakeholder Acceptance for the Selected Project. Implementation of project(s) with a well-defined scope and high priority for the host community and resource agencies and organizations in charge of coastal habitat preservation, restoration development.

- Ability to Measure Performance. The restoration plan will target coastal restoration and enhancement activities with clearly defined methodology to measure performance and success.

### 6.4.2 Identification of Alternatives

In order to identify suitable coastal habitat enhancement alternatives, on August 31, 2007, Poseidon issued a request for expression of interest (REI) for development and implementation of coastal habitat restoration project associated with the Carlsbad. To date, Poseidon has received eight Statements of Interest for coastal restoration and enhancement projects in response to the REI issued in August 2007. Seven of these proposals include specific coastal enhancement opportunities listed below:

1. San Dieguito Coastal Habitat Restoration;

2. City of Oceanside Loma Alta Lagoon Restoration;

3. Aqua Hedionda Lagoon – Land Acquisition for Expansion of Ecological Reserve;

4. Aqua Hedionda Lagoon – Eradication of Invasive Exotic Plants and Restoration of Native Vegetation;

5. Carlsbad Aquafarm at Agua Hedionda Lagoon – Abalone Stock Enhancement;

6. Buena Vista Lagoon Ecological Reserve – Completion of Restoration/Enhancement Plan Environmental Analysis;

7. Frazee State Beach – Coastal Bluff Habitat Restoration.

A summary of the scope and key benefits of each of the seven coastal habitat enhancement projects was submitted to the Regional Board in October 2007.[4]

### 6.4.3 Key Restoration Project Benefits

The habitat restoration will not only compensate for the unavoidable entrainment and impingement impacts, but will also enhance the coastal environment. The proposed Restoration Plan will create pelagic and benthic habitat, salt marsh and uplands habitat, thereby extending the benefits from the proposed mitigation measure far beyond the area of actual impact of the desalination plant operations. The proposed restoration project will yield the following key benefits:

- Restore coastal wetlands habitat comparable to that found in and around Agua Hedionda Lagoon; and
- Provides sustainable, comprehensive environmental benefits for water quality, habitat diversity for species abundance and for sensitive and endangered species.

### 6.4.4 Project Deliverables

Poseidon intends to prepare and submit the following deliverables to the Coastal Commission and the Executive Director of the Regional Board: for review and approval of this restoration plan:

- Restoration Project Implementation Plan which will contain the following:
  - Goals, objectives, performance criteria and maintenance and monitoring to ensure the success of the proposed Restoration Plan.
  - Identification of specific creation, restoration, or enhancement measures that will be used at each site, including grading and planting plans, the timing of the mitigation measures, monitoring that will be implemented to establish baseline conditions and to determine whether the sites are meeting performance criteria.
  - Identification of contingency measures that will be implemented should any of the mitigation sites not meet performance criteria.

[4] Poseidon Resources, *Coastal Habitat Restoration and Enhancement Project*, October 2007.

- As-built plans for each site included in the Restoration Project.
- Annual monitoring reports for no less than five years or until the sites meet performance criteria.
- Legal mechanism(s) proposed to ensure permanent protection of each site – e.g., conservation easements, deed restriction, or other methods.

## 6.5 OPPORTUNITIES FOR RESTORATION AND PRESERVATION OF AGUA HEDIONDA LAGOON

### 6.5.1 Agua Hedionda Lagoon Restoration Opportunities

Poseidon has made a considerable effort to identify a restoration project in Agua Hedionda Lagoon. We sent our August 2007 Request for Expressions of Interest to a number of the organizations and individuals that are involved with the Carlsbad Watershed Network (CWN), as well as Carlsbad Aqua Farm, Hubbs Research Institute and the Agua Hedionda Lagoon Foundation. Three proposals were received from Agua Hedionda Lagoon interests:

**1. Expansion of Agua Hedionda Lagoon Ecological Reserve**

***Project Proponent.***
The proponent for this project is the Agua Hedionda Lagoon Foundation.

***Project Scope***
This project includes the acquisition and preservation of land near the Agua Hedionda Lagoon's Ecological Reserve to serve as a coastal habitat for wildlife and migratory birds. The land is located on the north side of Agua Hedionda Lagoon.

***Project Benefits and Merits***
This project will provide a means for protecting and increasing habitat for migrating birds and endangered species. It also will help insure that nearby archeological sites will remain undisturbed and adjacent Ecological Reserve is maintained as useful wildlife habitat. Foot trails through the Reserve will be proposed to the Department of Fish & Game in exchange for adding land to the Reserve. Enhancing the quality of the Agua Hedionda Lagoon Ecological Reserve will also boost eco-tourism in the area. The project is planned to be completed by the end of year 2010.

**2. Agua Hedionda Lagoon – Eradication of Invasive Exotic Plants and Restoration of Native Vegetation**

***Project Proponent***
The proponent for this project is the Agua Hedionda Lagoon Foundation.

***Project Scope***

The density, biomass and diversity of invasive plant species in the Agua Hedionda Lagoon Watershed are so extensive, that the ability of the natural plant communities to treat nutrients and contaminants from surface runoff into the lagoon has been diminished significantly. The scope of this project is to remove exotic invasive plant species and replace these species with appropriate native plants to restore the protective function of the lagoon watershed vegetation. The project is planned to be completed by December 2009.

***Project Benefits and Merits***

This project aims to restore the native vegetation in the Agua Hedionda Watershed, which is an essential step towards re-establishing the hydrologic and ecological functions of these riparian and coastal wetland habitats. The project is expected to boost the natural ability of the native riparian and wetland plant habitats to sequester contaminants carried to the lagoon by surface runoff, to reduce flooding and bank erosion, and diminish sediment transport thereby increasing the biological productivity of the Agua Hedionda Lagoon.

**3. Agua Hedionda Lagoon – Abalone Stock Enhancement**

***Project Proponent***

The proponent for this project is Carlsbad Aquafarm.

***Project Scope***

This project will create a stock of 100,000 abalone at the Carlsbad Aquafarm located in the Agua Hedionda Lagoon and use this stock to replenish the population of abalone near the intake to the lagoon and the project discharge area. Carlsbad Aquafarm is currently concentrating its efforts on commercial farming of the Green Abalone and also culturing both Red and Pink Abalone. The farm is well equipped with the facilities and personnel to spawn and raise abalone, as well as experienced divers familiar with abalone biology and ecology to manage and monitor the success of the project. The abalone stock enhancement project can be completed by 2011.

***Project Benefits and Merits***

Abalone is a key part of the Southern California coastal ecosystem. However, aggressive harvesting of this aquatic resource has resulted in stock depletion and the recent closure of both commercial and recreational fisheries for all abalone species in this region. This project will help replenish and sustain the abalone stock in the area of the Agua Hedionda Lagoon.

### 6.5.2 Investigation of Additional Restoration Opportunities in Agua Hedionda Lagoon

Investigations to date have not identified any mitigation opportunities within Agua Hedionda Lagoon that meet the goals of the program. As a result, the proposed mitigation plan includes a core offsite mitigation program that meets the plan goals and objectives that is being developed in parallel with Poseidon's continued effort to identify feasible mitigation opportunities in Agua Hedionda Lagoon.

Poseidon recognizes the Regional Board would prefer to see mitigation in Agua Hedionda Lagoon if feasible. Accordingly, while Section 6.6 of this plan identifies a core offsite mitigation project, the mitigation plan also presents an implementation action schedule that includes additional coordination activities to either (1) confirm the lack of opportunities, or (2) identify if new mitigation options exist within Agua Hedionda Lagoon.

Poseidon and will be contacting the Department of Fish & Game to more fully assess the potential for restoration opportunities in Agua Hedionda Lagoon. If Agua Hedionda Lagoon mitigation is determined to be feasible, Poseidon will coordinate with regulatory agencies to implement such mitigation. If Agua Hedionda Lagoon is confirmed to be infeasible, Poseidon will implement the proposed offsite mitigation project (Section 6.6).

### 6.5.3 Agua Hedionda Lagoon Preservation Opportunities

As shown in Figure 6-3, Agua Hedionda Lagoon currently supports a wide range of beneficial uses, including recreational activities, such as fishing, and water contact recreation. Nearly all of these uses are directly or indirectly supported by seawater flow and exchange created by circulation of seawater in the lagoon. The existing tidal exchange renews the Lagoon's water quality and flush nutrients, sediment and other watershed pollution, particularly from the Lagoon's upper reaches. In addition, the inflow of fresh supplies of ocean carry waterborne supplies of planktonic organisms that nourish the many organisms and food chains of the Lagoon, including the White Sea Bass restoration program of the Hubbs Sea World Research Institute and the aquaculture operations in the outer Lagoon.

The Lagoon is connected to the Pacific Ocean by means of a manmade channel that is artificially maintained. Seawater circulation throughout the outer, middle and inner lagoons is sustained both by routine dredging of the manmade entrance to prevent its closure. The name, Agua Hedionda, which means "stinking water" in Spanish, reflects a former stagnant condition that existed prior to the dredging of the mouth of the Lagoon.

To avoid this significant loss of highly productive marine habitat, in the absence of the ongoing operations of the EPS, Poseidon has committed to maintain circulation of the seawater, continue routine dredging of the entrance to the lagoon to prevent its closure, and deposit the sand dredged from the lagoon on adjacent beaches so as to maintain,

restore and enhance habitat for grunion spawning and to maintain, restore and enhance opportunities for public access and recreation along the shoreline and within the coastal zone. To help ensure the long-term health and vitality of Agua Hedionda Lagoon and the surrounding watershed, Poseidon is funding watershed education programs at the Agua Hedionda Lagoon Foundation Discovery Center.

## 6.6 OFFSITE MITIGATION PROGRAM

One proposal was received that meets or exceeds the restoration plan objectives is the proposed San Dieguito Wetland Restoration Plan. The proponent of the project is the San Dieguito River Park Joint Powers Authority (JPA). The JPS's proposal is one part of a larger restoration project that has already been approved by the Coastal Commission, on October 12, 2005.[5] Additionally the San Dieguito Wetland Restoration Plan was the subject of a Final Environmental Impact Report that was prepared and certified by the San Dieguito River Park Joint Powers Authority and U.S. Fish and Wildlife Service.

Pursuant to the requirements of the Coastal Commission,[6] Southern California Edison (SCE) is creating 115 acres of tidal wetlands at San Dieguito and will keep the river mouth open in perpetuity. The San Dieguito Wetlands Restoration Project includes a new deep water lagoon on the west side of I-5, extensive finger channels on the east side of I-5 north of the river, California least tern nesting sites and berms along the river to keep the water in the riverine channel flowing to the sea without dropping sediment or flooding the newly created wetlands under normal conditions.

The proponent for Poseidon's proposed restoration project is San Dieguito River Park Joint Powers Authority (local government agency in partnership with the San Dieguito River Valley Conservancy (501 (c) (3) organization). The JPA is the agency responsible for creating a natural open space park in the San Dieguito River Valley, which will one day extend from the ocean at Del Mar to Volcan Mountain, just north of Julian.

The San Dieguito Lagoon is located approximately 12.5 miles south of Agua Hedionda Lagoon, and has been historically one of the largest lagoons in San Diego County. All property within the proposed restoration project is in public ownership. The JPA is responsible for implementing the San Dieguito River Park Master Plan. Features of the Park Master Plan include trails and interpretive programs, enhancement of the lagoon ecosystem through creation of associated native grassland and coastal sage scrub habitat, expansion of tidal wetlands beyond the SCE project limits, and creation of a series of water quality treatment ponds. The JPA is responsible for maintaining the project area and precluding any uses not consistent with the conservation of wetland habitat.

Poseidon's proposed wetlands restoration project would expand the number of acres of functional wetlands and associated habitat in San Dieguito Lagoon, by supplementing the 115-acre SCE Wetlands Restoration Project. The proposed restoration project will

[5] CDP # 6-04-88
[6] Id.

create at approximately 37 acres of marine wetlands and seasonal marsh habitat from what is now entirely disturbed land. The current state of the land chosen for this project, results from decades of fill, grading and/or agricultural use, rendering it unsuitable for supporting native species that rely on freshwater/intertidal marsh or upland habitat.

Poseidon's proposed Restoration Project would provide approximately 37 acres of coastal wetland habitat in San Dieguito Lagoon above and beyond what is included in the ongoing SCE Wetland Restoration Project. The majority of the coastal habitat will be marine wetlands located at or below the elevation of the mean high tide for this area. As shown in Figures 1 and 2, the key elements of the project are excavation and grading to create new tidal wetlands (Parcel 1), including sub-tidal, intertidal, transitional, and seasonal salt marsh habitats east of I-5.

The central feature of the proposed restoration project is the conversion of disturbed land to more valuable tidal salt marsh or open water wetland which will become a productive in-kind habitat for species similar to these impacted by impingement and entrainment related to the stand-alone desalination plant operations (i.e., gobies, blennies, etc.). All of the acreage that will be converted to tidal wetland habitat is currently disturbed upland that supports weedy, generally non-native (ruderal) vegetation. After restoration to tidal salt marsh, these habitats will be subject to tidal action throughout the year, which will enable salt marsh plants to be healthier and with higher productivity. These goals will be accomplished by grading the site to substantially create an area that is subject to regular tidal inundation.

The restoration site will be graded to match subtidal and the low tidal salt marshes of the San Dieguito Lagoon Restoration Project being constructed by Southern California Edison. Since the new wetlands will be connected to the existing tidal basin through the existing Dieguito River channel, the tidal exchange will maintain the physical and chemical conditions in the these wetlands such that marine and tidal salt marsh species (such as gobies and blennies) will be able to inhabit, disperse and persist in the wetlands created by the Poseidon's restoration project. Since Southern California Edison has already committed to maintain the mouth of the lagoon open in perpetuity, tidal circulation in the proposed new wetlands will be unrestricted.

Based on the biological survey of the existing tidal wetlands of the San Dieguito Lagoon completed as a part of the Southern California Edison Restoration Project,[7] these wetlands are of the same type of habitat that would be impacted by desalination plant operations (i.e., gobies, blennies, anchovy, topsmelt, white croaker, etc.). Therefore, the implementation of the proposed restoration project will create in-kind replacement habitat, which has 1:1 restoration value. The 1:1 restoration ratio of the proposed project is consistent with the methodology used by the California Energy Commission for establishing mitigation requirements for the entrainment effects associated with the operation of the AES Huntington Beach and Morro Bay power generation plants.

[7] SCE, *San Dieguito Wetlands Restoration Project, Final Restoration Plan*, November 2005

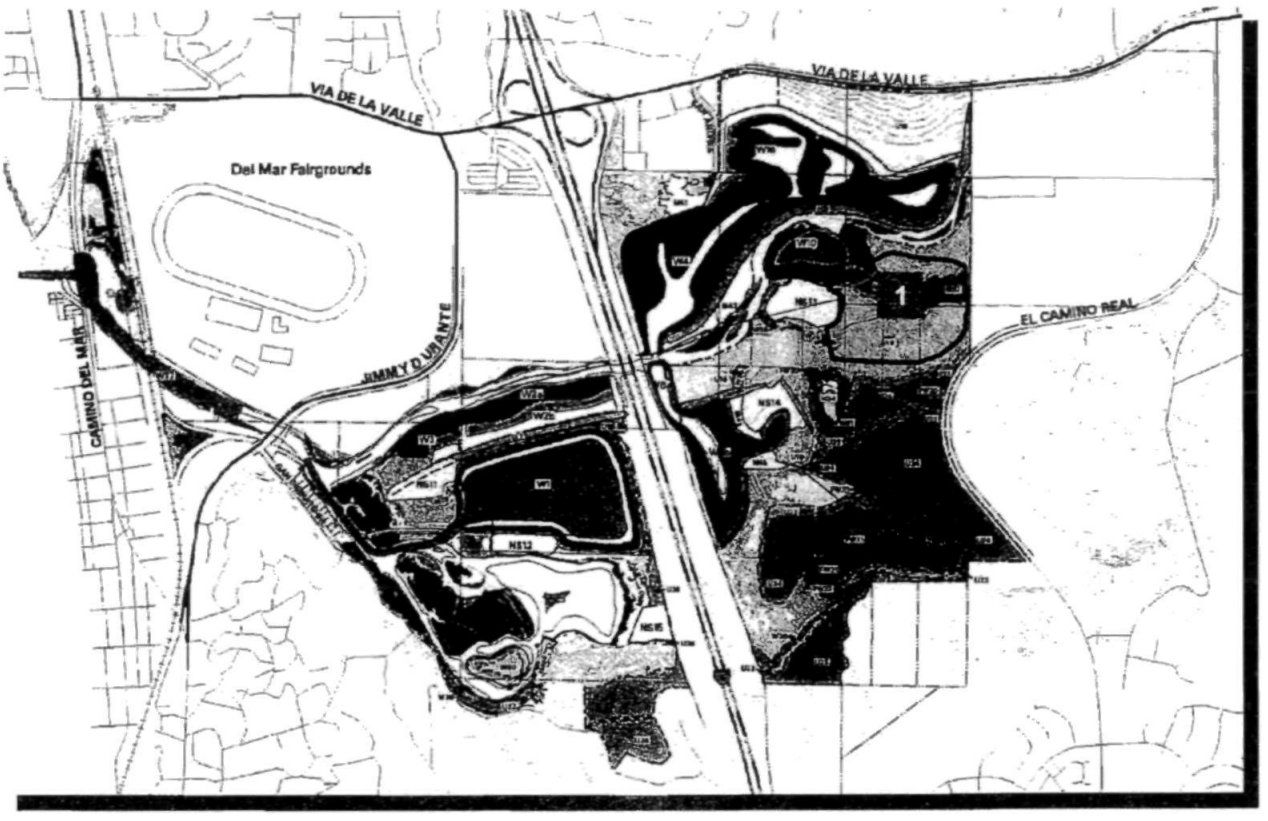


**Figure 6-1 – San Dieguito Wetlands Restoration Project**

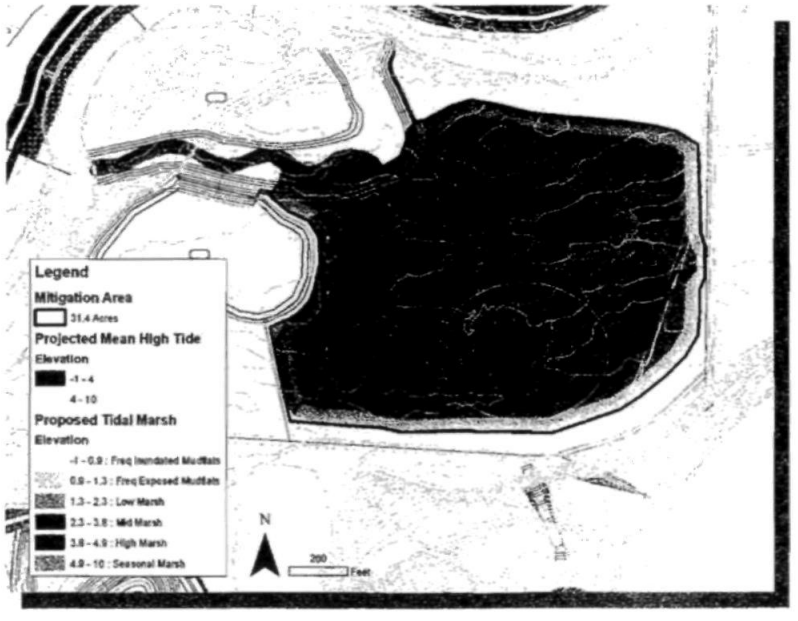


**Figure 6-2 – Proposed Restoration Site**

The Coastal Commission found this location to be acceptable for mitigation of the entrainment and impingement impacts of the San Onofre Nuclear Generating Station which is 45 miles away from San Dieguito Lagoon and is impacting open water fish species that don't necessarily reside in a lagoon environment. The proposed desalination facility is much closer to the proposed mitigation site (12 miles) and Poseidon is proposing to replace tidally exchanged coastal lagoon habitat with in-kind habitat.

## 6.7 REGULATORY ASSURANCE OF RESTORATION PLAN ADEQUACY

There are a number of regulatory assurances in place to confirm the adequacy of the proposed restoration plan. The Regional Board, Coastal Commission and State Lands Commission have ongoing jurisdiction over the proposed Project to insure the adequacy of the proposed restoration plan.

### 6.7.1 Regional Board

The Regional Board is insuring that Poseidon will provide adequate mitigation consistent with Water Code Section 13142.5(b) through the imposition of Special Condition 12 in the draft Lease Amendment for the proposed project:[8]

> b. *California Water Code Section 13142.5(b) Applicability. Water Code Section 13142.5(b) requires industrial facilities using seawater for processing to use the best available site, design, technology, and mitigation feasible to minimize impacts to marine life. The CDP is planned to operate in conjunction with the EPS by using the EPS cooling water discharge as its source water. When operating in conjunction with the power plant, the desalination plant feedwater intake would not increase the volume or the velocity of the power station cooling water intake nor would it increase the number of organisms impinged by the Encina Power Station cooling water intake structure. Recent studies have shown that nearly 98 percent of the larvae entrained by the EPS are dead at the point of the desalination plant intake. As a result, a de minimis number of organisms remain viable which potentially would be lost due to the incremental entrainment effect of the CDP operation. Due to the fact that the most frequently entrained species are very abundant in the area of the EPS intake, Agua Hedionda Lagoon and the Southern California Bight, species of direct recreational and commercial value would constitute less than 1 percent of all the organisms entrained by the EPS. As a result, the incremental entrainment effects of the CDP operation in conjunction with the EPS would not trigger the need for additional technology or mitigation to minimize impacts to marine life. However, in the event that the EPS were to cease operations, and the discharger were to independently operate the seawater intake and outfall for the*

[8] Regional Board Order R9-2006-0065 at F-49.

*benefit of the CDP, such independent operation will require additional review pursuant to Water Code Section 13142.5(b). The Regional Water Board review and approval of the Flow Minimization, Entrainment and Impingement Minimization Plan will address any additional review required pursuant to Water Code Section 13142.5(b).*

With the October 2006 approval Order R9-2006-0065, the Regional Board has ongoing jurisdiction over the Project to insure Poseidon is using the best available design, technology, and mitigation measures at all times consistent with Water Code Section 13142.5(b).

### 6.7.2 State Lands Commission

The State Lands Commission is insuring that Poseidon will provide adequate mitigation consistent with Public Resources Code 6370, et seq. through the imposition of Special Condition 12 in the draft Lease Amendment for the proposed project:[9]

> *12. Poseidon Resources shall use the best available design, technology, and mitigation measures at all times during which this Lease is in effect to minimize the intake (impingement and entrainment) and mortality of all forms of marine life associated with the operation of the desalination facility as determined by the San Diego Regional Water Quality Control Board or any other federal, state, or local entity.*

With the approval of the approval the draft lease for the Project, the State Lands Commission reserves the right to terminate the lease if Poseidon is not using the best available design, technology, and mitigation measures at all times as determined by the San Diego Regional Water Quality Control Board or any other federal, state, or local entity.

### 6.7.3 Coastal Commission

The Coastal Commission is insuring that Poseidon will provide adequate mitigation consistent with applicable Coastal Act provisions through the imposition of Special Condition 8:[10]

> *1) **Marine Life Mitigation Plan:** PRIOR TO ISSUANCE OF THE PERMIT, the Permittee shall submit to and obtain from the Commission approval of*

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[9] State Lands Commission draft Amendment of Lease PRC 8727.1.

[10] See Coastal Commission Recommended Revised Findings Coastal Development Permit for Poseidon Carlsbad Desalination Project, page 91 of 108; http://documents.coastal.ca.gov/reports/2008/3/W25a-3-2008.pdf

*a Marine Life Mitigation Plan in the form of an amendment to this permit that includes the following:*

*a) Documentation of the project's expected impacts to marine life due to entrainment and impingement caused by the facility's intake of water from Agua Hedionda Lagoon. This requirement can be satisfied by submitting a full copy of the Permittee's Entrainment Study conducted in 2004-2005 for this project.*

*b) To the maximum extent feasible, the mitigation shall take the form of creation, enhancement, or restoration of aquatic and wetland habitat*

*c) Goals, objectives and performance criteria for each of the proposed mitigation sites. It shall identify specific creation, restoration, or enhancement measures that will be used at each site, including grading and planting plans, the timing of the mitigation measures, monitoring that will be implemented to establish baseline conditions and to determine whether the sites are meeting performance critieria. The Plan shall also identify contingency measures that will be implemented should any of the mitigation sites not meet performance criteria.*

*d) "As-built" plans for each site and annual monitoring reports for no less than five years or until the sites meet performance criteria.*

*e) Legal mechanism(s) proposed to ensure permanent protection of each site – e.g., conservation easements, deed restriction, or other methods.*

With the approval of the Coastal Development permit for the proposed project conditioned as described above the Coastal Commission is insuring that Poseidon will provide the mitigation needed to address Project related impacts in a manner consistent with applicable Coastal Act provisions.

## 6.8 SUMMARY AND CONCLUSIONS

Poseidon is using all feasible methods to minimize or reduce its entrainment impacts. These methods are likely to reduce the Project related impacts to marine life well below the levels identified in Chapter 5. To minimize unavoidable Project related impacts to marine life, Poseidon has voluntarily committed to a state-agency coordinated process to identify the best available mitigation feasible. The objective of the mitigation portion of this plan is to identify mitigation needs, set forth mitigation goals, and present a plan and approach for achieving the goals.

As shown in Table 6-2, the proposed mitigation strategy includes the implementation of project a coastal wetlands restoration plan that will be developed pursuant to the state-agency coordinated process; long-term preservation of Agua Hedionda Lagoon; and/or

other activities which will benefit the coastal environment in San Diego County. The restoration plan will be enforceable through conditions of approval of the project and the program's success will be monitored through performance standards, monitoring and reporting.

Additionally, ten years after the lease is issued, that the CDP will be subject to further environmental review by the State Lands Commission (SLC) to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. SLC may require additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations.

This approach will insure that the stand-alone CDP operations continue to use the best available site, design, technology and mitigation feasible to minimize Project related impacts to marine life.

**Table 6-2**
**Mitigation**

| Category | Feature | Result |
|---|---|---|
| 1. Mitigation | Implementation of project mitigation plan developed pursuant to a state-agency coordinated process described in Chapter 6. | Compensate for the unavoidable entrainment and impingement impacts and enhance the coastal environment. |
| 2. Mitigation | Preservation of Agua Hedionda Lagoon though continued maintenance dredging and Lagoon stewardship. | Preserve and protect 388 acres of highly productive marine habitat; maintain and enhance opportunities for public access and recreation; provide sand for beach replenishment and grunion spawning habitat; maintain adequate water quality to support aquaculture, fish hatchery and natural fish habitat; and provide San Diego County with a new high-quality drinking water supply. |
| 3. Mitigation | Funding watershed education programs at the Agua Hedionda Lagoon Foundation Discovery Center | Helps ensure the long-term health and vitality of Agua Hedionda Lagoon and the surrounding watershed |

# CHAPTER 7

# CONCLUSION

## 7.1 PLAN PURPOSE

The San Diego Regional Water Quality Control Board (Regional Board) adopted Order No. R9-2006-0065 (Permit) for Poseidon Resources Corporation's (Poseidon) Carlsbad Desalination Project (CDP) discharge to the Pacific Ocean via the existing Encina Power Station (EPS) discharge channel. The CDP is planned to operate in conjunction with the EPS by using the EPS cooling water discharge as its source water whenever the power plant is operating.

In the event that the EPS were to cease operations, and Poseidon were to independently operate the seawater intake and outfall for the benefit of the CDP, such independent operation will require additional review pursuant to Water Code Section 13142.5(b). Water Code Section 13142.5(b) requires industrial facilities using seawater for processing to use the best available site, design, technology, *and* mitigation feasible to minimize impacts to marine life.

This Flow, Entrainment and Impingement Minimization Plan (Plan) is developed in fulfillment of the above-stated requirements and contains site-specific activities, procedures, practices and mitigation plans which Poseidon proposes to implement to minimize impacts to marine organisms when the Carlsbad Desalination Project intake requirements exceed the volume of water being discharged by the EPS.

## 7.2 PLAN COMPLIANCE

As shown in Table 7-1, the Plan addresses each of the provisions of Water Code Section 13142.5(b):

- Identifies the best available site feasible to minimize Project related impacts to marine life;
- Identifies the best available design feasible to minimize Project related impacts to marine life;
- Identifies the best available technology feasible to minimize Project related impacts to marine life;
- Quantifies the unavoidable impacts to marine life; and
- Establishes a state-agency coordinated process for identification of the best available mitigation feasible to minimize Project related impacts to marine life.

**Table 7-1**
**Design, Technology and Mitigation Measures to Minimize Impacts to Marine Life**

| Category | Feature | Result |
|---|---|---|
| 1. Site | Proposed location at Encina Power Station (EPS) | Best available site for the project, no feasible and less environmentally damaging alternative locations. |
| 1. Design | Use of EPS discharge as source water | Sixty-one percent reduction of entrainment and impingement impacts attributable to the CDP |
| 2. Design | Reduction in inlet screen velocity | Reduction of impingement of marine organisms |
| 3. Design | Reduction in fine screen velocity | Reduction of impingement of marine organisms |
| 4. Design | Ambient temperature processing | Eliminate entrainment mortality associated with the elevated seawater temperature |
| 5. Design | Elimination of heat treatment | Eliminate mortality associated with heat treatment. |
| 1. Technology | Installation of VFDs on CDP intake pumps | Reduce the total intake flow for the desalination facility to no more than that needed at any given time, thereby minimizing the entrainment of marine organisms. |
| 2. Technology | Installation of micro-screens | Micro-screens (120 μ) minimize entrainment and impingement impacts to marine organisms by screening the fish larvae and plankton from the seawater. |
| 3. Technology | Installation of low impact prefitration technology | UF filtrations system minimizes entrainment and impingement impacts to marine organisms by screening the small plankton from the seawater. |
| 4. Technology | Return to the ocean of marine organisms captured by the screens and filters | Minimize entrainment and impingement impacts to marine organisms captured by the screens and filters by returning the organisms to the ocean. |
| 5. Technology | After ten years of operation, State Lands Commission (SLC) to analyze environmental effects of facility and the availability of alternative technologies that may reduce any impacts. | SLC may require Poseidon install additional technology as are reasonable and as are consistent with applicable state and federal laws and regulations. This ensures that the CDP operations at that time are using technologies that the SLC determines may reduce any impacts and are appropriate in light of environmental review. |
| 1. Mitigation | Implementation of project mitigation plan developed pursuant to a state-agency coordinated process described in Chapter 6. | Compensate for unavoidable entrainment and impingement impacts and enhance the coastal environment. |
| 2. Mitigation | Preservation of Agua Hedionda Lagoon though continued maintenance dredging and Lagoon stewardship. | Preserve and protect highly productive marine habitat; maintain and enhance opportunities for public access and recreation; provide sand for beach replenishment and grunion spawning habitat; maintain adequate water quality to support aquaculture, fish hatchery and natural fish habitat; and provide a new high-quality water supply. |
| 3. Mitigation | Fund watershed education programs at the AHL Foundation Discovery Center. | Helps ensure the long-term health and vitality of Agua Hedionda Lagoon and the surrounding watershed. |

## 7.3 PROPOSED MITIGATION APPROACH

Poseidon is using all feasible methods to minimize or reduce its entrainment impacts. These methods are likely to reduce the Project related impacts to marine life well below the levels identified in Chapter 5. To minimize unavoidable Project related impacts to marine life, Poseidon has voluntarily committed to a state-agency coordinated process to identify the best available mitigation feasible. The objective of the mitigation portion of this plan is to identify mitigation needs, set forth mitigation goals, and present a plan and approach for achieving the goals.

Recognizing that mitigation opportunities in Agua Hedionda Lagoon may be limited, Poseidon proposes a comprehensive but flexible approach for mitigating potential impacts. This approach is based on:

- Conservatively estimating maximum potential impacts
- Identifying goals and objectives of the mitigation program
- Identifying any available mitigation opportunities in Agua Hedionda Lagoon that meet the goals and objectives
- Identifying additional offsite mitigation that meets the mitigation goals
- Developing an action plan and schedule for coordinating with regulatory and resource agencies to finalize locations and acreages selected for the proposed mitigation.

Investigations to date have not identified any mitigation opportunities within Agua Hedionda Lagoon that meet the goals of the program. As a result, the proposed mitigation plan includes a core offsite mitigation program that meets the plan goals and objectives that is being developed in parallel with Poseidon's continued effort to identify feasible mitigation opportunities in Agua Hedionda Lagoon.

Poseidon recognizes the need and priority of implementing mitigation in Agua Hedionda Lagoon if feasible. Poseidon also recognizes that mitigation requirements and regulations of the various review agencies differ, and additional agency coordination is required to insure that needs of all applicable agencies are addressed.

Accordingly, while this plan identifies a core offsite mitigation project, the mitigation plan also presents an implementation action schedule that includes additional coordination activities to either (1) confirm the lack of opportunities, or (2) identify if new mitigation options exist within Agua Hedionda Lagoon.

Poseidon will be contacting the Department of Fish & Game to more fully assess the potential for restoration opportunities in Agua Hedionda Lagoon. If subsequent Agua Hedionda Lagoon mitigation is determined to be feasible, Poseidon will coordinate with regulatory agencies to implement such mitigation.

If Agua Hedionda Lagoon mitigation is confirmed as infeasible, Poseidon will implement the proposed offsite mitigation project.

Table 7-2 summarizes the implementation action schedule for the proposed mitigation plan.

**Table 7-2**
**Mitigation Implementation Approach and Schedule**

| Element | Actions/Objectives | Schedule |
|---|---|---|
| Submittal of draft Minimization Plan to Regional Board | • Public and agency review of revised draft Plan | March 2008 |
| Regional Board consideration of Minimization Plan | • Approval of Plan<br>• Regional Board provides directions on Plan implementation | April 2008 |
| Contacts with California Department of Fish & Game to assess mitigation opportunities in Agua Hedionda Lagoon | • Assess mitigation opportunities for saltwater marsh creation in Agua Hedionda Lagoon via dredging | March 2008 |
| Supplemental contacts with other resource agencies | • Identify (or conform lack of) additional mitigation opportunities in Agua Hedionda Lagoon | April 2008 |
| Convene meeting of resource agencies; Regional Board and Coastal Commission. | • Identify (or confirm lack of) additional mitigation opportunities in Agua Hedionda Lagoon<br>• If applicable, address agency requirements for Agua Hedionda Lagoon mitigation and determine overall implementation feasibility<br>• Address mitigation rations/requirements for core offsite mitigation project in San Dieguito Lagoon | April 2008 |
| Finalize and distribute mitigation program implementation details | • Agency review of implementation details | May 2008 |
| Modify/finalize implementation program details (if applicable) | • Agency review and approval<br>• May involve additional inter-agency coordination meeting | June 2008 |
| Coastal Commission consideration of mitigation project(s) | • Coastal Commission approval of mitigation project | July 2008 |

## 7.4 REGULATORY ASSURANCE OF PLAN ADEQUACY

There are a number of regulatory assurances in place to confirm the adequacy of the proposed restoration plan. The Regional Board, Coastal Commission and State Lands Commission have ongoing jurisdiction over the proposed Project to insure the adequacy of the proposed restoration plan.

Additionally, ten years after the lease is issued, that the CDP will be subject to further environmental review by the State Lands Commission (SLC) to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. SLC may require additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations.

This approach will ensure that the stand-alone CDP operations continue to use the best available site, design, technology and mitigation feasible to minimize Project related impacts to marine life.

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Poseidon Resources Corporation. Application for Coastal Development Permit, August 28, 2006, including (but not limited to) attachments:

- Final Environmental Impact Report
- Verification of All Other Permits or Approvals Applied for by Public Agencies
- City of Carlsbad Resolution No. 2006-156-EIR 03-05
- City of Carlsbad Resolution No. 420-RP 05-12
- City of Carlsbad Ordinance No. NS-805-SP 144 (H)
- City of Carlsbad Ordinance No. NS-806-PDP 00-02
- Planning Commission Resolution No. 6093 – SUP 05-04
- Planning Commission Resolution No. 6092 – CDP 04-41
- Planning Commission Resolution No. 6090 – DA 05-01 / Development Agreement Finding of Fact
- CEQA Mitigation Monitoring and Reporting Program for the FEIR
- Planning Commission Resolution No. 6094 – HMPP 05-08
- Planning Commission Resolution No. 6088 – PDP 00-02
- Planning Commission Resolution No. 6091 – RP 05-12
- Planning Commission Resolution No. 6089 – SP 144 (H)

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- San Diego Regional Water Quality Control Board, Order No. R9-2006-0065 ("NPDES Permit")
- Poseidon Resources Corporation. Response to California Coastal Commission's December 28, 2006 Request for Additional Information (including attachments), January 19, 2006.
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- Poseidon Resources Corporation. Response to California Coastal Commission's February 20, 2007 Request for Additional Information (including attachments), June 1, 2007.
- Poseidon Resources Corporation. Appeal of California Coastal Commission's July 3, 2007 Notice of Incomplete, July 6, 2007.
- Poseidon Resources Corporation. Response to California Coastal Commission's July 3, 2007 Request for Additional Information (including attachments), July 16, 2007.
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- Poseidon Resources Corporation. Analysis of Offshore Intakes, October 8, 2007, including attachments:
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# 304 MDG Intake Cost Estimates - October 2007

**VERTICAL BEACH WELLS**

| | | | |
|---|---|---|---|
| Total Capacity = | | 304 | MGD |
| Individual Intake Well Capacity = | | 1.5 | MGD |
| Duty Number of Intake Wells Needed = | | 203 | |
| Additional Standby Intakes Needed @ 25 % = | | 51 | |
| Total Intake Wells Needed = | | 253 | |
| Minimum Distance Between Wells (Best Case)= | | 150 | ft |
| Length of Beach Occupied by Wells = | | 7.2 | miles |
| Land Needed to Install Wells & Support Facilities | | 8.6 | acres |
| Cost of Installation of Individual Well = | $ 1,200,000 | | per well |
| Total Costs of Well Installation = | $ 304,000,000 | | |
| Cost of Seawater Conveyance Pipelines @US$500/ft = | $ 18,925,000 | | |
| Cost of Intake Booster Pump Stations - = | $ 30,400,000 | | |
| Cost of Electrical Power Supply for Well Pumps = | $ 50,160,000 | | |
| **Total Construction (Direct) Costs =** | **$ 403,485,000** | | |
| **Indirect Costs** | | | |
| Acquisition of Land to Install Wells & Support Struct. = | $ 4,304,408 | | |
| Engineering, Design and Procurement @ 25 % = | $ 100,871,250 | | |
| Environmental Mitigation Costs @ 15 % = | $ 60,522,750 | | |
| Contingency @ 20 % = | $ 80,697,000 | | |
| **TOTAL INDIRECT COSTS** | **$ 246,395,407.71** | | |
| **TOTAL PROJECT EPC COSTS =** | **$ 649,880,408** | | |

**SLANT WELLS - Similar to Dana Point Desal Plant**

| | | | |
|---|---|---|---|
| Total Capacity = | | | 304 MGD |
| Individual Intake Well Capacity = | | | 5 MGD |
| Duty Number of Intake Wells Needed = | | | 61 |
| Additional Standby Intakes Needed @ 25 % = | | | 15 |
| Total Intake Wells Needed = | | | 76 |
| Minimum Distance Between Wells (Best Case)= | | | 300 ft |
| Length of Beach Occupied by Wells = | | | 4.3 miles |
| Land Needed to Install Wells & Support Facilities | | | 17.4 acres |
| Cost of Installation of Individual Well = | $ | 2,400,000 | per well |
| Total Costs of Well Installation = | $ | 182,400,000 | |
| Cost of Seawater Conveyance Pipelines @US$500/ft = | $ | 11,250,000 | |
| Cost of Intake Booster Pump Stations - = | $ | 30,400,000 | |
| Cost of Electrical Power Supply for Well Pumps = | $ | 31,920,000 | |
| **Total Construction (Direct) Costs =** | **$** | **255,970,000** | |
| **Indirect Costs** | | | |
| Acquisition of Land to Install Wells & Support Struct. = | | $ 8,723,600 | |
| Engineering, Design and Procurement @ 25 % = | $ | 63,992,500 | |
| Environmental Mitigation Costs @ 15 % = | $ | 38,395,500 | |
| Contingency @ 20 % = | $ | 51,194,000 | |
| **TOTAL INDIRECT COSTS** | **$** | **162,305,600** | |
| **TOTAL PROJECT EPC COSTS =** | **$** | **418,275,600** | |

**HORIZONTAL RANNEY WELLS**

| | | | |
|---|---|---|---|
| Total Capacity = | | 304 | MGD |
| Individual Intake Well Capacity = | | 5 | MGD |
| Duty Number of Intake Wells Needed = | | 61 | |
| Additional Standby Intakes Needed @ 25 % = | | 15 | |
| Total Intake Wells Needed = | | 76 | |
| Minimum Distance Between Wells (Best Case)= | | 400 | ft |
| Length of Beach Occupied by Wells = | | 5.7 | miles |
| Land Needed to Install Wells & Support Facilities | | 17.4 | acres |
| Cost of Installation of Individual Well = | $ 2,500,000 | per well | |
| Total Costs of Well Installation = | $ 190,000,000 | | |
| Cost of Seawater Conveyance Pipelines @US$500/ft = | $ 15,000,000 | | |
| Cost of Intake Booster Pump Stations - = | $ 30,400,000 | | |
| Cost of Electrical Power Supply for Well Pumps = | $ 33,060,000 | | |
| **Total Construction (Direct) Costs =** | **$ 268,460,000** | | |
| **Indirect Costs** | | | |
| Acquisition of Land to Install Wells & Support Struct. = | $ 8,723,600 | | |
| Engineering, Design and Procurement @ 25 % = | $ 67,115,000 | | |
| Environmental Mitigation Costs @ 15 % = | $ 40,269,000 | | |
| Contingency @ 20 % = | $ 53,692,000 | | |
| **TOTAL INDIRECT COSTS** | **$ 169,799,600** | | |
| **TOTAL PROJECT EPC COSTS =** | **$ 438,259,600** | | |

**SUBSURFACE INFILTRATION GALLERY (FUKUOKA TYPE INTAKE)**

| | | | |
|---|---|---|---|
| Total Capacity = | | 304 | MGD |
| Capacity of Individual Intake Galleries = | | 101.3 | MGD |
| Duty Intake Galleries Needed = | | 3 | |
| Additional Standby Intakes Needed @ 0 % = | | 0 | |
| Total Intake Galleries Needed = | | 3 | |
| Length x Width x Depth Each Gallery = | | 5280x400x15 | ft |
| Total Length of Intake System = | | 3.0 | miles |
| Land Needed to Install Wells & Support Facilities | | 17.9 | acres |
| Cost of Installation of Individual Gallery = | $ | 120,000,000 | per 100 MGD gallery |
| Total Costs of Gallery Installation = | $ | 360,000,000 | |
| Cost of Seawater Conv. Pipelines @US$500/ft = | $ | 7,922,606 | |
| Cost of Intake Booster Pump Stations - = | $ | 12,160,000 | |
| Cost of Electrical Power Supply for Well Pumps = | $ | 18,608,000 | |
| **Total Construction (Direct) Costs =** | **$** | **398,690,606** | |
| **Indirect Costs** | | | |
| Acquisition of Land to Install Intake & Support Struct. = | $ | 8,956,114 | |
| Engineering, Design and Procurement @ 25 % = | $ | 99,672,652 | |
| Environmental Mitigation Costs @ 15 % = | $ | 59,803,591 | |
| Contingency @ 20 % = | $ | 79,738,121 | |
| **TOTAL INDIRECT COSTS** | **$** | **248,170,478** | |
| **TOTAL PROJECT EPC COSTS =** | **$** | **646,861,084** | |

**NEW OPEN INTAKE - 1,000 FT INTAKE LINE W/ LOW-VELOCITY INTAKE STRUCTURE**

| | | |
|---|---|---|
| Total Capacity = | | 304 MGD |
| Length of Intake Pipe = | | 1000 ft |
| Land Needed to Install Wells & Support Facilities | | 2.3 acres |
| Cost of Installation of Intake Pipe @ US$45,000/ft = | $ | 45,000,000 |
| Cost of Construction of Ocean Intake Structure = | $ | 10,500,000 |
| Cost of New Intake Screens = | $ | 8,000,000 |
| Cost of New Intake Pump Station = | $ | 24,320,000 |
| Cost of Power Supply for New Pump Station = | $ | 5,223,000 |
| **Total Construction (Direct) Costs =** | **$** | **93,043,000** |
| **Indirect Costs** | | |
| Acquisition of Land to Install Intake & Support Struct. = | $ | 1,147,842 |
| Engineering, Design and Procurement @ 25 % = | $ | 23,260,750 |
| Environmental Mitigation @ 15 % = | $ | 13,956,450 |
| Contingency @ 20 % = | $ | 18,608,600 |
| **TOTAL INDIRECT COSTS** | **$** | **56,973,642.06** |
| **TOTAL PROJECT EPC COSTS =** | **$** | **150,016,642** |

# ATTACHMENT 2

## IMPINGEMENT RESULTS

## G1 – TRAVELING SCREEN AND BAR RACK WEEKLY SURVEYS

## G2 – HEAT TREATMENT SURVEYS

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA001** **Survey Date: June 24 - 25, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 186 | 40-84 | 1.3-15.3 | 729.7 |
| *Engraulis mordax* | northern anchovy | 46 | 37-90 | 0.4-10.5 | 69.2 |
| *Heterostichus rostratus* | giant kelpfish | 8 | 81-113 | 4.1-8.2 | 47.9 |
| *Heterostichus* spp. | kelpfish | 7 | 81-118 | 4.0-12.2 | 47.8 |
| *Anchoa compressa* | deepbody anchovy | 6 | 31-107 | 0.1-11.6 | 13.7 |
| Engraulidae | anchovies | 4 | - | 1.6 | 1.6 |
| *Atherinops affinis* | topsmelt | 3 | 54-115 | 0.9-18.8 | 25.5 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 300-378 | 210 | 210.0 |
| unidentified fish | unid. fish | 3 | 34 | 0.5-2.0 | 4.4 |
| *Hyporhamphus rosae* | California halfbeak | 2 | 111-125 | 10.9-11.7 | 22.6 |
| *Paralabrax* spp. | sand bass | 2 | 33-55 | 0.7-2.0 | 2.7 |
| *Anchoa delicatissima* | slough anchovy | 1 | - | 3.0 | 2.8 |
| Atherinopsidae | silverside | 1 | 46 | 1.0 | 1.0 |
| *Hypsoblennius* spp. | blennies | 1 | 252 | 267 | 267.0 |
| *Pleuronichthys verticalis* | hornyhead turbot | 1 | 291 | 227 | 226.5 |
| *Sphyraena argentea* | California barracuda | 1 | 136 | 0.8 | 0.8 |
| *Syngnathus leptorhynchus* | bay pipefish | 1 | 290 | 9.7 | 9.7 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 9 | 253-410 | 143-521 | 1,984.7 |
| *Urolophus halleri* | round stingray | 2 | 285-337 | 244-444 | 688.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 7 | 15-34 | 2.0-18.0 | 66.1 |
| | **Total:** | **294** | | | |

**Survey: EPSIA002** **Survey Date: June 30 - July 1, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 242 | 40-115 | 1.6-31.0 | 957.0 |
| *Roncador stearnsi* | spotfin croaker | 51 | 33-205 | 0.6-106 | 260.4 |
| *Engraulis mordax* | northern anchovy | 36 | 35-103 | 0.2-14.0 | 57.6 |
| *Heterostichus rostratus* | giant kelpfish | 33 | 74-128 | 3.4-16.0 | 209.8 |
| *Atherinops affinis* | topsmelt | 29 | 34-115 | 0.5-15.2 | 117.3 |
| *Strongylura exilis* | California needlefish | 5 | 95-142 | 0.6-2.0 | 6.1 |
| *Hypsopsetta guttulata* | diamond turbot | 3 | 104-140 | 27.7-79.4 | 173.4 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 250-305 | 160-312 | 633.0 |
| *Anchoa delicatissima* | slough anchovy | 2 | 65 | 1.1-3.1 | 4.2 |
| *Paralichthys californicus* | California halibut | 2 | 55-95 | 2.9-11.5 | 14.4 |
| *Sphyraena argentea* | California barracuda | 2 | 78-85 | 2.0-3.6 | 5.6 |
| *Anchoa compressa* | deepbody anchovy | 1 | 43 | 2.2 | 2.2 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 230 | 312 | 312.0 |
| *Seriphus politus* | queenfish | 1 | 102 | 15.7 | 15.7 |
| unidentified fish | unid. fish | 1 | - | 0.1 | 0.1 |
| unidentified fish, damaged | unid. damaged fish | 1 | - | 0.4 | 0.4 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 5 | 224-505 | 112-600 | 1,505.6 |
| *Myliobatis californica* | bat ray | 1 | 295 | 392.0 | 391.5 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 5 | 19-47 | 5.7-47.6 | 96.3 |
| *Octopus* spp. | octopus | 1 | - | 10.1 | 10.1 |
| | **Total:** | **425** | | | |

## Encina Power Station Impingement Abundance: : Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA003** **Survey Date: July 07 - 08, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 83 | 45-66 | 2.5-7.0 | 363.0 |
| *Roncador stearnsi* | spotfin croaker | 31 | 35-52 | 0.7-2.0 | 40.1 |
| *Heterostichus rostratus* | giant kelpfish | 29 | 75-123 | 3.2-14.9 | 181.2 |
| *Anchoa compressa* | deepbody anchovy | 17 | 35-99 | 0.9-10.5 | 64.1 |
| *Strongylura exilis* | California needlefish | 13 | 75-135 | 0.3-9.5 | 64.4 |
| *Engraulis mordax* | northern anchovy | 9 | 42-46 | 0.5-1.3 | 6.5 |
| *Atherinops affinis* | topsmelt | 4 | 60-110 | 2.2-28.8 | 43.4 |
| *Anchoa delicatissima* | slough anchovy | 3 | - | 1.3 | 1.3 |
| *Paralichthys californicus* | California halibut | 3 | 43-63 | 1.5-3.8 | 7.3 |
| Engraulidae | anchovies | 2 | - | 1.2 | 1.2 |
| *Porichthys myriaster* | specklefin midshipman | 2 | 249-270 | 200-250 | 450.0 |
| *Anchoa* spp. | anchovy | 1 | 65 | 2.5 | 2.5 |
| *Cheilotrema saturnum* | black croaker | 1 | 48 | 1.8 | 1.8 |
| *Gibbonsia montereyensis* | crevice kelpfish | 1 | 88 | 8.3 | 8.3 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 285 | 400 | 400.0 |
| *Sardinops sagax* | Pacific sardine | 1 | 35 | 0.4 | 0.4 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 7 | 225-293 | 165-375 | 1,715.1 |
| *Myliobatis californica* | bat ray | 1 | 245 | 240 | 239.5 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 6 | 26-34.5 | 6.2-12.1 | 54.0 |
| | **Total:** | **215** | | | |

**Survey: EPSIA004** **Survey Date: July 14 - 15, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Engraulis mordax* | northern anchovy | 228 | 34-109 | 0.4-11.0 | 186.9 |
| *Cymatogaster aggregata* | shiner surfperch | 191 | 45-228 | 2.3-326 | 1,327.3 |
| *Atherinops affinis* | topsmelt | 126 | 45-139 | 0.8-26.9 | 472.1 |
| *Heterostichus rostratus* | giant kelpfish | 119 | 57-137 | 1.5-19.6 | 834.0 |
| *Roncador stearnsi* | spotfin croaker | 38 | 37-226 | 0.8-149 | 306.5 |
| *Anchoa delicatissima* | slough anchovy | 28 | 33-42 | 0.2-1.5 | 24.4 |
| *Seriphus politus* | queenfish | 25 | 35-60 | 0.7-3.3 | 41.7 |
| *Strongylura exilis* | California needlefish | 17 | 84-375 | 0.6-45.4 | 91.8 |
| *Sardinops sagax* | Pacific sardine | 15 | 35-59 | 0.4-2.3 | 15.4 |
| *Anchoa compressa* | deepbody anchovy | 10 | 60-116 | 2.5-22.5 | 76.1 |
| *Porichthys myriaster* | specklefin midshipman | 7 | 164-354 | 53.3-369.3 | 1,692.9 |
| *Paralichthys californicus* | California halibut | 5 | 41-99 | 1.3-10.6 | 32.5 |
| *Syngnathus* spp. | pipefishes | 4 | 103-179 | 0.8-4.2 | 11.6 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 145 | 79.1 | 79.1 |
| *Scomber japonicus* | Pacific mackerel | 1 | 63 | 2.2 | 2.2 |
| *Symphurus atricauda* | California tonguefish | 1 | 90 | 7.3 | 7.3 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 20 | 268-421 | 179-600 | 5,135.9 |
| *Urolophus halleri* | round stingray | 1 | 85 | 29.7 | 29.7 |
| *Myliobatis californica* | bat ray | 5 | 248-317 | 236.7-531.3 | 2,010.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 3 | 21-33 | 5.8-16.1 | 32.7 |
| *Octopus* spp. | octopus | 1 | - | 239.4 | 239.4 |
| | **Total:** | **846** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA005** **Survey Date: July 21 - 22, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 70 | 51-71 | 3.5-10.0 | 459.0 |
| *Sardinops sagax* | Pacific sardine | 64 | 40-68 | 0.5-4.0 | 90.5 |
| *Engraulis mordax* | northern anchovy | 35 | 41-106 | 0.5-9.6 | 35.1 |
| *Seriphus politus* | queenfish | 20 | 36-499 | 0.9-97.6 | 160.4 |
| *Heterostichus rostratus* | giant kelpfish | 13 | 81-116 | 3.6-12.5 | 93.9 |
| *Atherinops affinis* | topsmelt | 9 | 54-129 | 0.8-20.1 | 56.6 |
| *Roncador stearnsi* | spotfin croaker | 9 | 46-76 | 2.4-7.7 | 35.2 |
| *Porichthys myriaster* | specklefin midshipman | 6 | 233-378 | 132-600 | 1,766.6 |
| *Anchoa delicatissima* | slough anchovy | 5 | 45 | 0.6 | 4.5 |
| *Cheilotrema saturnum* | black croaker | 5 | 43-52 | 1.3-2.3 | 9.3 |
| *Syngnathus* spp. | pipefishes | 4 | 137-207 | 0.8-3.8 | 8.0 |
| *Anchoa compressa* | deepbody anchovy | 3 | 80-116 | 5.9-19.9 | 32.7 |
| *Atractoscion nobilis* | white seabass | 2 | 79-83 | 7.6-11.4 | 19.0 |
| *Hypsopsetta guttulata* | diamond turbot | 2 | 141-163 | 73-124 | 196.7 |
| unidentified fish | unid. fish | 2 | 50-58 | 1.4-1.6 | 3.0 |
| *Paralichthys californicus* | California halibut | 1 | 54 | 2.2 | 2.2 |
| *Scomber japonicus* | Pacific mackerel | 1 | 89 | 7.8 | 7.8 |
| *Strongylura exilis* | California needlefish | 1 | 377 | 39.3 | 39.3 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 11 | 273-618 | 191-1212 | 4,244.2 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 3 | 21-42 | 2.2-14.8 | 21.1 |
| | **Total:** | **266** | | | |

**Survey: EPSIA006** **Survey Date: July 28 - 29, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Seriphus politus* | queenfish | 95 | 41-240 | 1.1-156 | 530.0 |
| *Cymatogaster aggregata* | shiner surfperch | 53 | 52-109 | 2.2-25.5 | 341.2 |
| *Heterostichus rostratus* | giant kelpfish | 23 | 45-116 | 1.9-12.9 | 130.0 |
| *Engraulis mordax* | northern anchovy | 22 | 41-93 | 0.4-7.8 | 28.0 |
| *Atherinops affinis* | topsmelt | 17 | 55-107 | 1.2-11.9 | 86.1 |
| *Strongylura exilis* | California needlefish | 11 | 76-372 | 0.4-55.7 | 90.4 |
| *Porichthys myriaster* | specklefin midshipman | 8 | 285-380 | 226-410 | 2,608.8 |
| *Anchoa delicatissima* | slough anchovy | 4 | 65-84 | 3.4-6.5 | 17.9 |
| *Sardinops sagax* | Pacific sardine | 3 | 55-72 | 1.5-5.1 | 9.4 |
| *Anchoa* spp. | anchovy | 2 | - | 7.4 | 7.4 |
| *Paralichthys californicus* | California halibut | 2 | 87-114 | 8.6-16.3 | 24.9 |
| *Anchoa compressa* | deepbody anchovy | 1 | 66 | 2.9 | 2.9 |
| *Cheilotrema saturnum* | black croaker | 1 | 50 | 2.9 | 2.9 |
| *Sphyraena argentea* | California barracuda | 1 | 45 | 0.3 | 0.3 |
| *Syngnathus* spp. | pipefishes | 1 | 175 | 1.1 | 1.1 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 8 | 265-368 | 160-410 | 1,898.7 |
| *Urolophus halleri* | round stingray | 2 | 160-170 | 217-278 | 495.0 |
| *Myliobatis californica* | bat ray | 1 | 254 | 204.3 | 204.3 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 2 | 25-42 | 8.4-24.1 | 32.5 |
| | **Total:** | **257** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA007** **Survey Date: August 04 - 05, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Seriphus politus* | queenfish | 19 | 43-80 | 1.4-6.3 | 63.0 |
| *Atherinops affinis* | topsmelt | 13 | 57-100 | 0.9-9.8 | 38.0 |
| *Cymatogaster aggregata* | shiner surfperch | 11 | 55-99 | 2.9-21.1 | 77.4 |
| *Heterostichus rostratus* | giant kelpfish | 3 | 83-115 | 5.1-11.4 | 26.6 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 294-309 | 242-331 | 872.5 |
| *Hypsopsetta guttulata* | diamond turbot | 2 | 139-270 | 69.5-282.5 | 352.0 |
| *Strongylura exilis* | California needlefish | 2 | 62-131 | 0.1-1.1 | 1.2 |
| *Anchoa compressa* | deepbody anchovy | 1 | 104 | 15.9 | 15.9 |
| *Anchoa delicatissima* | slough anchovy | 1 | 92 | 9.4 | 9.4 |
| *Engraulis mordax* | northern anchovy | 1 | 70 | 4.0 | 4.0 |
| *Sardinops sagax* | Pacific sardine | 1 | 57 | 1.4 | 1.4 |
| Sciaenidae unid. | croaker | 1 | 25 | 0.1 | 0.1 |
| *Syngnathus* spp. | pipefishes | 1 | 186 | 1.4 | 1.4 |
| unidentified fish | unid. fish | 1 | 315 | 700 | 700.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 7 | 252-296 | 133-213 | 1,250.8 |
| *Myliobatis californica* | bat ray | 3 | 240-250 | 175.4-183.9 | 537.3 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 1 | 25 | 6.3 | 6.3 |
| *Loxorhynchus crispatus* | moss crab | 1 | 7.3 | 1.1 | 1.1 |
| | **Total:** | 72 | | | |

**Survey: EPSIA008** **Survey Date: August 11 - 12, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 375 | 37-156 | 0.5-40.8 | 1,068.2 |
| *Cymatogaster aggregata* | shiner surfperch | 97 | 56-109 | 5.1-29.4 | 895.0 |
| *Anchoa compressa* | deepbody anchovy | 43 | 64-169 | 3.1-19.9 | 426.7 |
| *Seriphus politus* | queenfish | 28 | 35-167 | 1.0-62.1 | 239.2 |
| *Heterostichus rostratus* | giant kelpfish | 24 | 73-137 | 2.9-21.6 | 175.2 |
| *Sardinops sagax* | Pacific sardine | 17 | 59-92 | 2.5-9.3 | 65.8 |
| *Syngnathus* spp. | pipefishes | 16 | 145-210 | 0.5-2.8 | 23.3 |
| *Engraulis mordax* | northern anchovy | 12 | 54-95 | 1.7-7.7 | 37.6 |
| *Strongylura exilis* | California needlefish | 12 | 78-297 | 0.8-20.2 | 59.6 |
| *Porichthys myriaster* | specklefin midshipman | 9 | 53-309 | 1.9-306.2 | 1,556.9 |
| *Leuresthes tenuis* | California grunion | 8 | 52-71 | 1.4-2.9 | 17.9 |
| *Anchoa delicatissima* | slough anchovy | 2 | 75-101 | 4.6-11.1 | 15.7 |
| *Cheilotrema saturnum* | black croaker | 2 | 62-119 | 3.7-20.7 | 24.4 |
| *Hypsopsetta guttulata* | diamond turbot | 2 | 91-202 | 8.4-190 | 198.1 |
| *Anisotremus davidsonii* | sargo | 1 | 243 | 341.2 | 341.2 |
| *Hyperprosopon argenteum* | walleye surfperch | 1 | 153 | 96.9 | 96.9 |
| *Paralabrax* spp. | sand bass | 1 | 32 | 0.9 | 0.9 |
| *Pleuronichthys verticalis* | hornyhead turbot | 1 | 152 | 97.3 | 97.3 |
| *Roncador stearnsi* | spotfin croaker | 1 | 164 | 57.1 | 57.1 |
| Sciaenidae unid. | croaker | 1 | 38 | 2.7 | 2.7 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 8 | 259-341 | 150-297 | 1,595.1 |
| *Urolophus halleri* | round stingray | 8 | 124-242 | 133-600 | 2,290.9 |
| *Myliobatis californica* | bat ray | 9 | 230-315 | 111.6-404.8 | 2,602.8 |
| *Platyrhinoidis triseriata* | thornback | 1 | 53 | 10.2 | 10.2 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 3 | 25.3-36 | 8.0-21.1 | 38.7 |
| *Loxorhynchus crispatus* | moss crab | 1 | 11 | 0.8 | 0.8 |
| *Hemigrapsus oregonensis* | yellow shore crab | 2 | 18-20 | 0.9-2.8 | 3.7 |
| *Pelia tumida* | dwarf teardrop crab | 1 | 13 | 1.9 | 1.9 |
| | **Total:** | 686 | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA009** **Survey Date: August 18 - 19, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 18 | 56-124 | 1.7-15.8 | 81.2 |
| *Heterostichus rostratus* | giant kelpfish | 14 | 66-158 | 3.4-33.2 | 122.2 |
| *Strongylura exilis* | California needlefish | 13 | 87-170 | 0.4-3.7 | 28.3 |
| *Sardinops sagax* | Pacific sardine | 10 | 65-85 | 3.0-9.4 | 90.6 |
| *Cymatogaster aggregata* | shiner surfperch | 5 | 57-75 | 5.0-11.3 | 41.6 |
| *Seriphus politus* | queenfish | 5 | 57-70 | 3.5-5.5 | 22.9 |
| *Anchoa delicatissima* | slough anchovy | 2 | 70-71 | 3.6-4.4 | 8.0 |
| *Hermosilla azurea* | zebra perch | 2 | 53-260 | 4.8-600 | 604.8 |
| *Paralichthys californicus* | California halibut | 2 | 81-103 | 6.9-16.0 | 22.9 |
| *Porichthys myriaster* | specklefin midshipman | 2 | 75-268 | 5.5-200 | 205.5 |
| unidentified fish | unid. fish | 2 | 37-44 | 2.1-2.6 | 4.7 |
| *Hypsoblennius gentilis* | bay blenny | 1 | 95 | 14.7 | 14.7 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 136 | 57.9 | 57.9 |
| *Leuresthes tenuis* | California grunion | 1 | 146 | 19.9 | 19.9 |
| *Syngnathus* spp. | pipefishes | 1 | 184 | 2.5 | 2.5 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 2 | 270-288 | 162-190 | 352.2 |
| *Urolophus halleri* | round stingray | 2 | 133-230 | 95-123 | 218.0 |
| *Myliobatis californica* | bat ray | 1 | 340 | 550 | 550.0 |
| *Ophichthus zophochir* | yellow snake eel | 1 | 420 | 51.8 | 51.8 |
| *Platyrhinoidis triseriata* | thornback | 1 | 630 | 1,500 | 1,500.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 2 | 22-30 | 6.1-15.6 | 21.7 |
| *Pyromaia tuberculata* | tuberculate pea crab | 1 | 15 | 3.2 | 3.2 |
| *Octopus* spp. | octopus | - | - | - | - |
| | **Total:** | **89** | | | |

**Survey: EPSIA010** **Survey Date: August 25 - 26, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 24 | 39-115 | 0.7-16.1 | 110.5 |
| *Seriphus politus* | queenfish | 13 | 46-121 | 1.5-20.2 | 80.6 |
| *Atherinops affinis* | topsmelt | 9 | 64-133 | 2.1-17.0 | 68.0 |
| *Heterostichus rostratus* | giant kelpfish | 9 | 74-125 | 3.1-15.8 | 60.8 |
| *Sardinops sagax* | Pacific sardine | 8 | - | 8.0 | 36.8 |
| *Cymatogaster aggregata* | shiner surfperch | 7 | 64-80 | 6.3-11.3 | 60.7 |
| *Leuresthes tenuis* | California grunion | 6 | 59-81 | 1.6-3.4 | 13.4 |
| *Engraulis mordax* | northern anchovy | 3 | 54-56 | 1-1.8 | 4.4 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 275-314 | 180-350 | 725.8 |
| *Hermosilla azurea* | zebra perch | 2 | 35-70 | 1.1-8.1 | 9.2 |
| *Hypsopsetta guttulata* | diamond turbot | 2 | 188-216 | 39.1-254 | 293.4 |
| *Strongylura exilis* | California needlefish | 2 | 105-508 | 1.2-290 | 291.2 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 57 | 2.6 | 2.6 |
| *Roncador stearnsi* | spotfin croaker | 1 | 280 | 500 | 500.0 |
| unidentified fish | unid. fish | 1 | - | 20.1 | 20.1 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 3 | 260-300 | 145-220 | 546.2 |
| *Urolophus halleri* | round stingray | 3 | 125-147 | 89.4-148 | 353.4 |
| *Myliobatis californica* | bat ray | 2 | 208-240 | 148-185 | 332.4 |
| *Rhinobatos productus* | shovelnose guitarfish | 1 | 410 | 300 | 300.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 4 | 18.5-39 | 0.8-24.3 | 25.1 |
| *Lophopanopeus* spp. | black-clawed crabs | 1 | 14 | 1.3 | 1.3 |
| | **Total:** | **105** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA011** **Survey Date: September 01 - 02, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Heterostichus rostratus* | giant kelpfish | 10 | 80-97 | 3.8-10.1 | 60.6 |
| *Anchoa delicatissima* | slough anchovy | 4 | 60-73 | 2.1-4.0 | 10.4 |
| *Leuresthes tenuis* | California grunion | 4 | 65-112 | 2.2-13.5 | 25.7 |
| *Seriphus politus* | queenfish | 3 | 55-63 | 2.3-5.9 | 11.9 |
| *Cymatogaster aggregata* | shiner surfperch | 2 | 68-70 | 8.2-8.9 | 17.1 |
| *Paralichthys californicus* | California halibut | 2 | 59-118 | 3.1-25.8 | 28.9 |
| *Anchoa compressa* | deepbody anchovy | 1 | 79 | 7.4 | 7.4 |
| *Paralabrax* spp. | sand bass | 1 | 39 | 1.1 | 1.1 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 400 | 550 | 550.0 |
| *Sardinops sagax* | Pacific sardine | 1 | 75 | 3.6 | 3.6 |
| *Strongylura exilis* | California needlefish | 1 | - | 1.8 | 1.8 |
| *Syngnathus* spp. | pipefishes | 1 | 152 | 0.6 | 0.6 |
| unidentified fish, damaged | unid. damaged fish | 1 | - | 137.4 | 137.4 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 1 | 327 | 233.3 | 233.3 |
| *Myliobatis californica* | bat ray | 1 | 340 | 400 | 400.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 1 | 25 | 4.0 | 4.0 |
| *Taliepus nuttallii* | globose kelp crab | 1 | 11 | 0.7 | 0.7 |
| | **Total:** | **36** | | | |

**Survey: EPSIA012** **Survey Date: September 08 - 09, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 93 | 42-94 | 0.2-12.3 | 301.0 |
| *Leuresthes tenuis* | California grunion | 43 | 54-73 | 1.0-5.0 | 94.7 |
| *Seriphus politus* | queenfish | 29 | 32-155 | 0.6-53.0 | 218.0 |
| *Heterostichus rostratus* | giant kelpfish | 24 | 60-122 | 2.1-16.2 | 172.7 |
| *Engraulis mordax* | northern anchovy | 15 | 52-71 | 1.2-4.1 | 29.5 |
| *Cymatogaster aggregata* | shiner surfperch | 7 | 53-95 | 4.9-25.0 | 79.0 |
| *Porichthys notatus* | plainfin midshipman | 5 | 53-400 | 1.6-420 | 723.6 |
| *Sphyraena argentea* | California barracuda | 5 | 48-73 | 0.6-3.3 | 10.2 |
| *Xenistius californiensis* | salema | 4 | 31-55 | 0.7-2.3 | 4.9 |
| *Paralabrax nebulifer* | barred sand bass | 3 | 46-124 | 2.0-28.4 | 43.5 |
| *Sardinops sagax* | Pacific sardine | 3 | 68-75 | 3.5-4.1 | 11.2 |
| *Cheilotrema saturnum* | black croaker | 2 | 35-55 | 1.2-4.3 | 5.5 |
| *Phanerodon furcatus* | white surfperch | 2 | 85-93 | 19.7-20.0 | 39.7 |
| *Porichthys myriaster* | specklefin midshipman | 2 | 54-360 | 1.8-410 | 411.8 |
| *Atherinops affinis* | topsmelt | 1 | 103 | 9.9 | 9.9 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 231 | 380 | 380.0 |
| *Paralichthys californicus* | California halibut | 1 | 105 | 19.0 | 19.0 |
| Pleuronectiformes unid. | flatfishes | 1 | - | 54.7 | 54.7 |
| *Roncador stearnsi* | spotfin croaker | 1 | 250 | 380 | 380.0 |
| *Strongylura exilis* | California needlefish | 1 | 138 | 2.0 | 2.0 |
| *Syngnathus* spp. | pipefishes | 1 | 133 | 0.9 | 0.9 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 4 | 254-599 | 137-265 | 708.2 |
| *Myliobatis californica* | bat ray | 1 | - | 110 | 110.0 |
| *Urolophus halleri* | round stingray | 1 | - | 200 | 200.0 |
| **INVERTEBRATES** | | | | | |
| *Hemigrapsus oregonensis* | yellow shore crab | 1 | 18 | 2.5 | 2.5 |
| | **Total:** | **251** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA013** **Survey Date: September 15 - 16, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 24 | 55-100 | 5.1-29.6 | 216.5 |
| *Leuresthes tenuis* | California grunion | 15 | 48-124 | 0.9-15.8 | 72.3 |
| *Anchoa delicatissima* | slough anchovy | 10 | 40-70 | 0.5-3.5 | 22.4 |
| *Anchoa compressa* | deepbody anchovy | 9 | 58-86 | 2.0-5.7 | 30.9 |
| *Heterostichus rostratus* | giant kelpfish | 8 | 82-124 | 3.4-15.8 | 59.2 |
| *Sphyraena argentea* | California barracuda | 4 | 81-90 | 2.8-3.6 | 13.3 |
| *Trachurus symmetricus* | jack mackerel | 4 | 36-40 | 0.6-0.9 | 3.0 |
| *Atherinops affinis* | topsmelt | 3 | 79-101 | 3.9-9.8 | 19.5 |
| *Strongylura exilis* | California needlefish | 3 | 184-410 | 4.0-64.8 | 89.5 |
| *Porichthys myriaster* | specklefin midshipman | 2 | 57-229 | 1.8-247 | 248.8 |
| *Sardinops sagax* | Pacific sardine | 2 | 67-73 | 3.1-3.2 | 6.3 |
| *Seriphus politus* | queenfish | 2 | 71-73 | 4.0-5.2 | 9.2 |
| *Xenistius californiensis* | salema | 2 | 37-40 | 0.8-1.2 | 2.0 |
| *Brachyistius frenatus* | kelp surfperch | 1 | 95 | 28.9 | 28.9 |
| *Cheilotrema saturnum* | black croaker | 1 | 43 | 0.6 | 0.6 |
| *Engraulis mordax* | northern anchovy | 1 | 72 | 2.6 | 2.6 |
| *Paralichthys californicus* | California halibut | 1 | 60 | 3.1 | 3.1 |
| *Umbrina roncador* | yellowfin croaker | 1 | 37 | 1.0 | 1.0 |
| unidentified fish, damaged | unid. damaged fish | 1 | - | 20.3 | 20.3 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 2 | 299-422 | 201-298 | 499.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 5 | 30-58 | 2.5-17.5 | 33.2 |
| *Pachygrapsus crassipes* | striped shore crab | 2 | 18-35 | 0.5-24.8 | 25.3 |
| *Pugettia* spp. | kelp crabs | 1 | 22 | 4.1 | 4.1 |
| | **Total:** | 104 | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA014** **Survey Date: September 22 - 23, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 52 | 22-94 | 0.8-9.3 | 119.4 |
| *Seriphus politus* | queenfish | 34 | 22-82 | 0.1-8.4 | 102.1 |
| *Leuresthes tenuis* | California grunion | 20 | 49-115 | 1.0-17.1 | 89.4 |
| *Cymatogaster aggregata* | shiner surfperch | 17 | 56-90 | 5.6-18.3 | 162.5 |
| *Anchoa delicatissima* | slough anchovy | 5 | 50-76 | 1.8-4.0 | 12.3 |
| *Sardinops sagax* | Pacific sardine | 4 | 62-80 | 2.8-10.6 | 20.3 |
| *Anisotremus davidsonii* | sargo | 3 | 42-72 | 1.9-10.6 | 16.9 |
| *Heterostichus rostratus* | giant kelpfish | 3 | 90-98 | 5.2-7.3 | 17.7 |
| *Roncador stearnsi* | spotfin croaker | 3 | 90-93 | 9.6-17.7 | 42.3 |
| *Xenistius californiensis* | salema | 3 | 30-41 | 0.6-1.9 | 4.2 |
| *Atractoscion nobilis* | white seabass | 2 | 36-75 | 0.5-3.4 | 3.9 |
| *Cheilopogon pinnatibarbatus* | spotted flyingfish | 2 | 310-313 | 291-310 | 601.1 |
| *Cheilotrema saturnum* | black croaker | 2 | 62-87 | 5.9-14.4 | 20.3 |
| *Engraulis mordax* | northern anchovy | 2 | 57-58 | 1.1-1.5 | 2.6 |
| *Paralabrax nebulifer* | barred sand bass | 2 | 43-50 | 1.5-3.0 | 4.5 |
| *Sphyraena argentea* | California barracuda | 2 | 72-111 | 2.3-8.3 | 10.6 |
| *Strongylura exilis* | California needlefish | 2 | 118-225 | 1.7-12.5 | 14.2 |
| *Umbrina roncador* | yellowfin croaker | 2 | 50-55 | 2.5-3.6 | 6.1 |
| *Atherinopsis californiensis* | jacksmelt | 1 | 125 | 22.1 | 22.1 |
| *Menticirrhus undulatus* | California corbina | 1 | 108 | 18.9 | 18.9 |
| *Oxylebius pictus* | painted greenling | 1 | 66 | 4.8 | 4.8 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 163 | 41.2 | 41.2 |
| *Syngnathus* spp. | pipefishes | 1 | 505 | 50.0 | 50.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 1 | 340 | 330 | 330.0 |
| *Myliobatis californica* | bat ray | 1 | 297 | 375 | 375.0 |
| **INVERTEBRATES** | | | | | |
| *Loligo opalescens* | market squid | 3 | 75-129 | 7.4-10.8 | 26.2 |
| *Callinectes* spp. | crab | 1 | 26 | 13.8 | 13.8 |
| *Pachygrapsus crassipes* | striped shore crab | 1 | 28 | 10.1 | 10.1 |
| *Pyromaia tuberculata* | tuberculate pea crab | 1 | 12 | - | - |
| | **Total:** | **173** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA015** **Survey Date: September 29 - 30, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Seriphus politus* | queenfish | 28 | 35-78 | 0.5-7.0 | 77.4 |
| *Leuresthes tenuis* | California grunion | 16 | 57-150 | 1.5-36.0 | 136.0 |
| *Engraulis mordax* | northern anchovy | 11 | 33-116 | 0.2-14.0 | 24.7 |
| *Anchoa compressa* | deepbody anchovy | 10 | 45-81 | 0.5-5.0 | 22.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 10 | 49-85 | 2.0-15.0 | 80.5 |
| *Xenistius californiensis* | salema | 10 | 35-63 | 0.5-4.0 | 19.5 |
| *Anchoa delicatissima* | slough anchovy | 5 | 56-77 | 1.0-5.0 | 14.0 |
| *Anisotremus davidsonii* | sargo | 4 | 38-58 | 1.0-5.0 | 9.5 |
| *Heterostichus rostratus* | giant kelpfish | 4 | 95-121 | 4.0-22.0 | 45.0 |
| *Sphyraena argentea* | California barracuda | 4 | 88-115 | 4.0-10.0 | 24.0 |
| *Strongylura exilis* | California needlefish | 4 | 139-325 | 0.7-42.0 | 54.7 |
| *Atherinops affinis* | topsmelt | 2 | 64-78 | 3.0-6.0 | 9.0 |
| *Embiotoca jacksoni* | black surfperch | 2 | 164-175 | 170-200 | 370.0 |
| *Paralichthys californicus* | California halibut | 2 | 120-133 | 20.0-35.0 | 55.0 |
| *Sardinops sagax* | Pacific sardine | 2 | 71-75 | 2.0-3.5 | 5.5 |
| *Atherinopsis californiensis* | jacksmelt | 1 | 181 | 47.0 | 47.0 |
| *Atractoscion nobilis* | white seabass | 1 | 145 | 45.0 | 45.0 |
| *Genyonemus lineatus* | white croaker | 1 | 100 | 2.1 | 2.1 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 81 | 10.5 | 10.5 |
| *Peprilus simillimus* | Pacific butterfish | 1 | 130 | 50.0 | 50.0 |
| *Roncador stearnsi* | spotfin croaker | 1 | 115 | 20.0 | 20.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 1 | 292 | 190 | 190.0 |
| *Urolophus halleri* | round stingray | 1 | 272 | 270 | 270.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 7 | 18-33 | 2.5-9.0 | 36.2 |
| *Cancer antennarius* | brown rock crab | 2 | 11-25 | 0.2-1.7 | 1.9 |
| *Lophopanopeus frontalis* | molarless crestleg crab | 2 | 11-13 | 0.4 | 0.8 |
| *Cancer productus* | red rock crab | 1 | 26 | 3.4 | 3.4 |
| *Loligo opalescens* | market squid | 1 | 70 | 7.0 | 7.0 |
| *Panulirus interruptus* | California spiny lobster | 1 | - | 66.0 | 66.0 |
| *Pyromaia tuberculata* | tuberculate pea crab | 1 | 9 | 0.6 | 0.6 |
| | **Total:** | **137** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA016** **Survey Date: October 06 - 07, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| Atherinopsidae | silverside | 57 | 48-130 | 0.5-20.8 | 289.5 |
| *Seriphus politus* | queenfish | 47 | 35-98 | 1.0-14.8 | 222.3 |
| *Anchoa compressa* | deepbody anchovy | 35 | 45-95 | 1.0-10.7 | 141.8 |
| *Cymatogaster aggregata* | shiner surfperch | 19 | 57-82 | 5.0-13.7 | 175.2 |
| *Engraulis mordax* | northern anchovy | 17 | 50-103 | 1.2-8.9 | 30.5 |
| *Xenistius californiensis* | salema | 17 | 27-58 | 0.5-4.0 | 22.6 |
| *Anchoa delicatissima* | slough anchovy | 5 | 53-85 | 1.0-6.0 | 14.0 |
| *Sphyraena argentea* | California barracuda | 4 | 96-435 | 3.0-110 | 139.9 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 87-390 | 7.2-460 | 822.2 |
| *Heterostichus rostratus* | giant kelpfish | 2 | 72-275 | 1.0-195 | 196.0 |
| *Paralichthys californicus* | California halibut | 2 | 128-133 | 39.0-40.0 | 79.0 |
| *Strongylura exilis* | California needlefish | 2 | 73-82 | 0.3 | 0.7 |
| *Leuresthes tenuis* | California grunion | 1 | 68 | 2.0 | 2.0 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 29 | 1.5 | 1.5 |
| *Sardinops sagax* | Pacific sardine | 1 | 66 | 3.0 | 3.0 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 3 | 60-154 | 13.6-195 | 368.6 |
| *Myliobatis californica* | bat ray | 2 | 294 | 400 | 400.0 |
| **INVERTEBRATES** | | | | | |
| *Loligo opalescens* | market squid | 11 | 47-66 | 4.0-10.0 | 70.6 |
| *Portunus xantusii* | Xantus' swimming crab | 10 | 10-50 | 0.5-9.0 | 38.9 |
| *Taliepus nuttallii* | globose kelp crab | 2 | 5-6 | 0.5 | 1.0 |
| *Cancer* spp. | cancer crabs | 1 | 24 | 2.6 | 2.6 |
| *Pachygrapsus crassipes* | striped shore crab | 1 | 12 | 2.5 | 2.5 |
| *Pachygrapsus* spp. | shore crab | 1 | 15 | 0.9 | 0.9 |
| *Pugettia producta* | northern kelp crab | 1 | 8 | - | - |
| *Pyromaia tuberculata* | tuberculate pea crab | 1 | 6 | - | - |
| | **Total:** | **246** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA017** **Survey Date: October 13 - 14, 2004**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| Atherinopsidae | silverside | 5 | 55-65 | 1.2-3.0 | 2.0 |
| *Atractoscion nobilis* | white seabass | 2 | 252 | 140-144 | 1.2 |
| *Engraulis mordax* | northern anchovy | 2 | 48-51 | 1.2 | 2.4 |
| *Seriphus politus* | queenfish | 2 | 43-65 | 1.1-3.9 | 1.3 |
| *Anchoa compressa* | deepbody anchovy | 1 | 56 | 2.0 | 4.6 |
| *Anchoa delicatissima* | slough anchovy | 1 | 58 | 1.2 | 3.1 |
| *Cymatogaster aggregata* | shiner surfperch | 1 | 74 | 8.1 | 8.1 |
| *Sardinops sagax* | Pacific sardine | 1 | 77 | 3.1 | 11.9 |
| unidentified fish | unid. fish | 1 | - | 4.6 | 284.0 |
| *Xenistius californiensis* | salema | 1 | 44 | 1.3 | 5.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 20 | 23-41 | 2.6-12.9 | 113.4 |
| *Pugettia producta* | northern kelp crab | 1 | 80 | 5.4 | 5.4 |
| *Taliepus nuttallii* | globose kelp crab | | | | |
| | **Total:** | **38** | | | |

**Survey: EPSIA018** **Survey Date; October 20 - 21, 2004**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| Atherinopsidae | silverside | 114 | 52-193 | 1.4-32.0 | 905.9 |
| *Seriphus politus* | queenfish | 35 | 28-77 | 0.4-7.1 | 61.0 |
| *Xenistius californiensis* | salema | 32 | 30-50 | 0.4-2.0 | 30.0 |
| *Anchoa compressa* | deepbody anchovy | 18 | 40-68 | 1.3-3.7 | 41.0 |
| *Engraulis mordax* | northern anchovy | 16 | 54-70 | 1.8-4.0 | 42.6 |
| *Brachyistius frenatus* | kelp surfperch | 14 | 62-102 | 6.0-25.0 | 135.6 |
| *Atractoscion nobilis* | white seabass | 4 | 223-243 | 135.2-185.0 | 640.2 |
| *Lepomis cyanellus* | green sunfish | 4 | 104-126 | 26.0-68.0 | 194.7 |
| *Ameiurus natalis* | yellow bullhead | 3 | 162-175 | 65.0-80.0 | 220.0 |
| *Paralichthys californicus* | California halibut | 3 | 110-151 | 21.0-45.0 | 111.0 |
| *Strongylura exilis* | California needlefish | 3 | 370-397 | 67.0-84.0 | 221.0 |
| *Acanthogobius flavimanus* | yellowfin goby | 2 | 115-148 | 18.0-37.2 | 55.2 |
| *Anisotremus davidsonii* | sargo | 2 | 44-69 | 1.8-7.0 | 8.8 |
| *Anchoa* spp. | anchovy | 1 | - | 6.8 | 6.8 |
| *Cymatogaster aggregata* | shiner surfperch | 1 | 84 | 7.5 | 7.5 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 125 | 53.0 | 53.0 |
| *Paralabrax clathratus* | kelp bass | 1 | 48 | 2.0 | 2.0 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 47 | 1.0 | 1.0 |
| *Sardinops sagax* | Pacific sardine | 1 | 65 | 3.0 | 3.0 |
| *Sphyraena argentea* | California barracuda | 1 | 72 | 2.0 | 2.0 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 1 | 300 | 200 | 200.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 6 | 21-46 | 2.1-12.4 | 38.4 |
| *Pugettia producta* | northern kelp crab | 6 | 4-15 | 0.1-1.4 | 2.8 |
| *Loxorhynchus* spp. | spider crabs | 2 | 5 | 0.1-0.5 | 0.6 |
| Brachyuran unid. | unidentified crab | 1 | 8 | 0.4 | 0.4 |
| Caridean unid. | unidentified shrimp | 1 | 159 | 28.0 | 28.0 |
| | **Total:** | **274** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA019** **Survey Date: October 27 - 28, 2004**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| Atherinopsidae | silverside | 64 | 52-134 | 1.0-27.0 | 256.5 |
| *Xenistius californiensis* | salema | 41 | 19-45 | 0.3-1.7 | 43.8 |
| *Seriphus politus* | queenfish | 32 | 32-78 | 1.3-6.4 | 94.4 |
| *Lepomis cyanellus* | green sunfish | 10 | 95-117 | 30.5-77.5 | 442.8 |
| *Micropterus salmoides* | large mouth bass | 9 | 49-57 | 2.4-3.4 | 26.9 |
| *Cymatogaster aggregata* | shiner surfperch | 8 | 63-82 | 5.9-11.6 | 66.0 |
| *Engraulis mordax* | northern anchovy | 8 | 59-64 | 2.1-2.7 | 19.0 |
| *Strongylura exilis* | California needlefish | 5 | 392-577 | 70.0-230 | 635.0 |
| *Anchoa delicatissima* | slough anchovy | 4 | 42-66 | 1.7-7.1 | 22.2 |
| *Lepomis macrochirus* | bluegill | 3 | 34-121 | 1.8-55.5 | 111.3 |
| *Anchoa compressa* | deepbody anchovy | 2 | 60-77 | 2.5-5.7 | 8.2 |
| *Paralichthys californicus* | California halibut | 2 | 42-44 | 1.2-1.3 | 2.5 |
| *Phanerodon furcatus* | white surfperch | 2 | 89-119 | 13.5-27.4 | 40.9 |
| *Sphyraena argentea* | California barracuda | 2 | 48-63 | 0.9-1.6 | 2.5 |
| *Tilapia* spp. | tilapia | 2 | 27-46 | 2.4-4.2 | 6.6 |
| *Trachurus symmetricus* | jack mackerel | 2 | 37-38 | 1.1 | 2.2 |
| *Rhacochilus vacca* | pile surfperch | 1 | 263 | 465 | 465.0 |
| *Heterostichus rostratus* | giant kelpfish | 1 | 96 | 5.4 | 5.4 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 342 | 221 | 221.0 |
| *Porichthys notatus* | plainfin midshipman | 1 | 385 | 460 | 460.0 |
| *Syngnathus* spp. | pipefishes | 1 | 161 | 1.3 | 1.3 |
| unidentified fish, damaged | unid. damaged fish | 1 | - | 16.0 | 16.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 4 | 272-550 | 165-1,100 | 1,775.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 31 | 7-41 | 0.9-13.9 | 195.5 |
| *Octopus bimaculatus* | California two-spot octopus | 4 | - | 5.2-25.3 | 58.1 |
| *Loxorhynchus crispatus* | moss crab | 1 | 7 | 0.3 | 0.3 |
| *Pugettia* spp. | kelp crabs | 1 | 2 | 0.1 | 0.1 |
| | **Total:** | **243** | | | |

**Survey: EPSIA020** **Survey Date: November 03 - 04, 2004**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 35 | 37-85 | 0.9-7.1 | 101.6 |
| *Engraulis mordax* | northern anchovy | 30 | 57-76 | 1.9-4.6 | 85.8 |
| Atherinopsidae | silverside | 20 | 50-147 | 1.1-33.0 | 148.5 |
| *Seriphus politus* | queenfish | 9 | 34-66 | 0.8-4.3 | 19.8 |
| *Xenistius californiensis* | salema | 2 | 37-42 | 0.9-1.3 | 2.1 |
| *Cymatogaster aggregata* | shiner surfperch | 1 | 70 | 8.7 | 8.7 |
| *Trachurus symmetricus* | jack mackerel | 1 | - | 2.0 | 2.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 1 | 304 | 120 | 120.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 8 | 21-29 | 3.8-9.7 | 58.4 |
| Brachyuran unid. | unidentified crab | 1 | 17 | 2.8 | 2.8 |
| *Crangon* spp. | bay shrimp | 1 | 107 | 20.9 | 20.9 |
| *Loligo opalescens* | market squid | 1 | - | - | - |
| *Rhithropanopeus harrisii* | Harris' mud crab | 1 | 30 | 18.0 | 18.0 |
| | **Total:** | **111** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA021** **Survey Date: November 10 - 11, 2004**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| Atherinopsidae | silverside | 14 | 62-164 | 2.0-21.3 | 76.0 |
| *Seriphus politus* | queenfish | 5 | 46-82 | 1.4-7.1 | 13.9 |
| *Scorpaena guttata* | spotted scorpinfish | 1 | 110 | 38.0 | 38.0 |
| *Xenistius californiensis* | salema | 1 | 40 | 1.1 | 1.1 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 26 | 15-60 | 0.9-15.7 | 193.5 |
| *Pachygrapsus crassipes* | striped shore crab | 2 | 12-27 | 0.5 | 0.5 |
| *Cycloxanthops novemdentatus* | ninetooth pebble crab | 1 | 19 | 2.6 | 2.6 |
| | **Total:** | **50** | | | |

**Survey: EPSIA022** **Survey Date: November 17 - 18, 2004**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinopsis californiensis* | jacksmelt | 29 | 45-146 | 0.8-33.0 | 123.9 |
| *Seriphus politus* | queenfish | 18 | 37-89 | 0.8-11.1 | 41.6 |
| *Atherinops affinis* | topsmelt | 4 | 70-124 | 2.5-17.6 | 27.3 |
| *Hyperprosopon argenteum* | walleye surfperch | 2 | 135-160 | 61.5-101 | 162.0 |
| *Paralichthys californicus* | California halibut | 2 | 49-132 | 1.8-35.6 | 37.3 |
| *Anchoa compressa* | deepbody anchovy | 1 | 66 | 3.5 | 3.5 |
| *Cheilotrema saturnum* | black croaker | 1 | 127 | 38.6 | 38.6 |
| *Leuresthes tenuis* | California grunion | 1 | 63 | 1.7 | 1.7 |
| *Sarda chiliensis* | Pacific bonito | 1 | 336 | 500 | 500.0 |
| *Xenistius californiensis* | salema | 1 | 48 | 2.0 | 2.0 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 1 | 80 | 27.7 | 27.7 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 9 | 16-36 | 2.0-17.0 | 68.4 |
| *Pachygrapsus crassipes* | striped shore crab | 3 | 32-35 | 15.0-18.8 | 49.5 |
| | **Total:** | **73** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA023** **Survey Date; November 22 - 23, 2004**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Leuresthes tenuis* | California grunion | 12 | 59-155 | 1.6-31.2 | 70.1 |
| *Seriphus politus* | queenfish | 11 | 30-82 | 0.7-6.7 | 22.3 |
| *Anchoa compressa* | deepbody anchovy | 5 | 55-70 | 1.5-4.8 | 12.9 |
| *Atherinopsis californiensis* | jacksmelt | 3 | 62-160 | 2.3-45.3 | 56.1 |
| *Atractoscion nobilis* | white seabass | 2 | 255-291 | 200-302 | 502.1 |
| *Engraulis mordax* | northern anchovy | 2 | 65 | 2.0-2.9 | 4.9 |
| *Hypsoblennius* spp. | blennies | 1 | 50 | 3.5 | 3.5 |
| *Menticirrhus undulatus* | California corbina | 1 | 72 | 5.1 | 5.1 |
| *Micrometrus minimus* | dwarf surfperch | 1 | 70 | 8.3 | 8.3 |
| *Paralabrax clathratus* | kelp bass | 1 | 40 | 1.7 | 1.7 |
| *Paralichthys californicus* | California halibut | 1 | 50 | 1.7 | 1.7 |
| unidentified fish, damaged | unid. damaged fish | 1 | 250 | 200 | 200.0 |
| *Xenistius californiensis* | salema | 1 | 47 | 1.8 | 1.8 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 1 | 400 | 460 | 460.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 34 | 18-46 | 2.4-18.2 | 154.9 |
| *Cancer magister* | dungeness crab | 1 | - | - | - |
| *Pugettia richii* | cryptic kelp crab | 1 | 12 | 1.3 | 1.3 |
| *Pugettia* spp. | kelp crabs | 1 | - | - | - |
| | **Total:** | **80** | | | |

**Survey: EPSIA024** **Survey Date: December 01 - 02, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 801 | 50-112 | 0.7-12.1 | 2,471.4 |
| *Xenistius californiensis* | salema | 514 | 40-60 | 1.1-5.3 | 1,404.0 |
| *Seriphus politus* | queenfish | 320 | 29-100 | 0.5-19.3 | 1,941.7 |
| *Cymatogaster aggregata* | shiner surfperch | 212 | 61-94 | 5.1-18.1 | 2,343.6 |
| *Leuresthes tenuis* | California grunion | 65 | 31-125 | 0.3-18.5 | 265.2 |
| unidentified fish, damaged | unid. damaged fish | 6 | - | - | - |
| *Anisotremus davidsonii* | sargo | 4 | 51-70 | 2.9-8.3 | 22.5 |
| *Atherinops affinis* | topsmelt | 4 | 57-118 | 1.2-14.2 | 19.2 |
| *Atherinopsis californiensis* | jacksmelt | 4 | 63-108 | 2.2-10.5 | 19.8 |
| *Sardinops sagax* | Pacific sardine | 3 | 82-91 | 4.8-7.5 | 17.2 |
| *Genyonemus lineatus* | white croaker | 1 | 115 | 30.0 | 30.0 |
| *Heterostichus rostratus* | giant kelpfish | 1 | 65 | 5.3 | 5.3 |
| *Hypsoblennius gentilis* | bay blenny | 1 | 56 | 2.6 | 2.6 |
| *Hypsoblennius gilberti* | rockpool blenny | 1 | 70 | 4.3 | 4.3 |
| *Menticirrhus undulatus* | California corbina | 1 | 74 | 5.0 | 5.0 |
| *Paralichthys californicus* | California halibut | 1 | 160 | 60.1 | 60.1 |
| *Sphyraena argentea* | California barracuda | 1 | 115 | 7.4 | 7.4 |
| *Strongylura exilis* | California needlefish | 1 | 462 | 115.1 | 115.1 |
| *Syngnathus* spp. | pipefishes | 1 | 249 | 3.0 | 3.0 |
| *Umbrina roncador* | yellowfin croaker | 1 | 67 | 5.4 | 5.4 |
| **SHARKS/RAYS** | | | | | |
| *Platyrhinoidis triseriata* | thornback | 2 | 181-192 | 305-342 | 647.0 |
| *Urolophus halleri* | round stingray | 2 | 149-155 | 183-210 | 393.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 13 | 20-65 | 2.7-23.6 | 110.9 |
| *Loligo opalescens* | market squid | 4 | 88-114 | - | - |
| *Pachygrapsus crassipes* | striped shore crab | 3 | 6-35 | 0.2-19.5 | 31.3 |
| *Pugettia* spp. | kelp crabs | 1 | 9 | 0.3 | 0.3 |
| | **Total:** | **1,968** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA025** **Survey Date: December 08 - 09, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Leuresthes tenuis* | California grunion | 96 | 49-130 | 1.1-26.5 | 440.8 |
| *Seriphus politus* | queenfish | 90 | 27-175 | 0.5-58.9 | 512.7 |
| *Anchoa compressa* | deepbody anchovy | 71 | 53-111 | 0.9-12.6 | 223.8 |
| *Xenistius californiensis* | salema | 23 | 20-70 | 0.9-5.6 | 51.4 |
| *Cymatogaster aggregata* | shiner surfperch | 16 | 65-105 | 7.1-25.1 | 223.8 |
| *Sardinops sagax* | Pacific sardine | 10 | 73-108 | 3.7-13.3 | 70.9 |
| *Atherinops affinis* | topsmelt | 7 | 63-140 | 2.2-11.0 | 30.7 |
| unidentified fish, damaged | unid. damaged fish | 4 | - | 14.8 | 14.8 |
| *Strongylura exilis* | California needlefish | 2 | 455-482 | 120-125 | 245.0 |
| *Chromis punctipinnis* | blacksmith | 1 | 105 | 27.0 | 27.0 |
| *Micrometrus minimus* | dwarf surfperch | 1 | 54 | 4.4 | 4.4 |
| *Paraclinus integripinnis* | reef finspot | 1 | 65 | 3.7 | 3.7 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 1 | 305 | 400 | 400.0 |
| *Platyrhinoidis triseriata* | thornback | 1 | 490 | 650 | 650.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 14 | 23-60 | 3.0-19.0 | 101.5 |
| *Pachygrapsus crassipes* | striped shore crab | 4 | 5-40 | 0.1-20.9 | 29.7 |
| *Pugettia* spp. | kelp crabs | 2 | 10-13 | 0.4-1.1 | 1.5 |
| *Octopus* spp. | octopus | 1 | - | 200 | 200.0 |
| *Pyromaia tuberculata* | tuberculate pea crab | 1 | 22 | 2.3 | 2.3 |
| | **Total:** | **346** | | | |

**Survey: EPSIA026** **Survey Date: December 15 - 16, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Leuresthes tenuis* | California grunion | 99 | 20-124 | 0.6-21.2 | 341.8 |
| *Seriphus politus* | queenfish | 44 | 47-102 | 1.4-13.5 | 268.2 |
| *Xenistius californiensis* | salema | 28 | 38-57 | 1.1-3.5 | 55.3 |
| *Cymatogaster aggregata* | shiner surfperch | 11 | 64-83 | 7.8-16.5 | 112.9 |
| *Atractoscion nobilis* | white seabass | 8 | 229-295 | 150-310 | 1,655.0 |
| *Engraulis mordax* | northern anchovy | 6 | 38-109 | 0.5-13.6 | 24.1 |
| *Anchoa compressa* | deepbody anchovy | 5 | 55-92 | 1.0-8.6 | 15.4 |
| *Atherinops affinis* | topsmelt | 2 | 53-84 | 1.4-6.2 | 7.6 |
| *Chromis punctipinnis* | blacksmith | 1 | 39 | 1.0 | 1.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 1 | 140 | 75.4 | 75.4 |
| *Sardinops sagax* | Pacific sardine | 1 | 86 | 4.1 | 4.1 |
| *Umbrina roncador* | yellowfin croaker | 1 | 94 | 9.7 | 9.7 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 15 | 25-83 | 3.6-11.0 | 103.1 |
| *Pachygrapsus crassipes* | striped shore crab | 3 | 9-42 | 0.5-28.0 | 33.6 |
| *Loligo opalescens* | market squid | 1 | 52 | 24.1 | 24.1 |
| *Pugettia* spp. | kelp crabs | 1 | 9 | 0.5 | 0.5 |
| | **Total:** | **227** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA027** **Survey Date: December 20 - 21, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Seriphus politus* | queenfish | 25 | 23-95 | 0.5-11.7 | 102.4 |
| *Anchoa compressa* | deepbody anchovy | 16 | 40-112 | 0.8-14.3 | 93.7 |
| *Leuresthes tenuis* | California grunion | 10 | 57-113 | 1.5-10.3 | 37.5 |
| *Atherinopsis californiensis* | jacksmelt | 6 | 62-133 | 2.4-23.6 | 37.3 |
| Atherinopsidae | silverside | 3 | 73-105 | 2.3-8.3 | 13.5 |
| *Sardinops sagax* | Pacific sardine | 2 | 80-89 | 4.5-5.7 | 10.2 |
| *Anchoa delicatissima* | slough anchovy | 1 | 68 | 3.3 | 3.3 |
| *Atractoscion nobilis* | white seabass | 1 | 290 | 265 | 265.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 1 | 169 | 115 | 115.0 |
| *Xenistius californiensis* | salema | 1 | 37 | 1.0 | 1.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 17 | 23-61 | 2.8-19.6 | 166.1 |
| *Cancer* spp. | cancer crabs | 1 | 26 | 28.0 | 28.0 |
| *Pachygrapsus crassipes* | striped shore crab | 1 | 15 | 2.2 | 2.2 |
| *Pugettia* spp. | kelp crabs | 1 | 11 | 1.4 | 1.4 |
| | **Total:** | **86** | | | |

**Survey: EPSIA028** **Survey Date: December 29 - 30, 2004**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| Atherinopsidae | silverside | 721 | 43-145 | 1.2-28.2 | 2,746.2 |
| *Xenistius californiensis* | salema | 283 | 39-59 | 0.5-3.0 | 529.6 |
| *Anchoa compressa* | deepbody anchovy | 57 | 19-105 | 0.3-10.0 | 204.5 |
| *Cymatogaster aggregata* | shiner surfperch | 29 | 70-110 | 7.9-21.3 | 409.1 |
| *Sardinops sagax* | Pacific sardine | 21 | 72-85 | 2.8-5.2 | 83.7 |
| *Seriphus politus* | queenfish | 8 | 40-140 | 0.9-31.6 | 67.2 |
| *Strongylura exilis* | California needlefish | 5 | 400-508 | 79.4-160 | 532.0 |
| *Paralabrax clathratus* | kelp bass | 2 | 45-73 | 1.7-7.2 | 8.9 |
| *Syngnathus* spp. | pipefishes | 2 | 171-194 | 1.4-2.4 | 3.8 |
| *Atherinops affinis* | topsmelt | 1 | - | - | - |
| Chub unid. | unid. chub | 1 | 75 | 7.3 | 7.3 |
| *Citharichthys stigmaeus* | speckled sanddab | 1 | 69 | 4.6 | 4.6 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 225 | 250 | 250.0 |
| *Lepomis* spp. | sunfishes | 1 | 102 | 29.9 | 29.9 |
| *Micrometrus minimus* | dwarf surfperch | 1 | 56 | 4.5 | 4.5 |
| *Paralichthys californicus* | California halibut | 1 | 65 | 3.0 | 3.0 |
| *Phanerodon furcatus* | white surfperch | 1 | 69 | 9.4 | 9.4 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 73 | 3.3 | 3.3 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 6 | 337-478 | 425-1,100 | 4,395.0 |
| *Myliobatis californica* | bat ray | 3 | 321-500 | 255-500 | 1,135.0 |
| **INVERTEBRATES** | | | | | |
| *Cancer* spp. | cancer crabs | 18 | 16-33 | 0.1-2.3 | 18.7 |
| *Pachygrapsus crassipes* | striped shore crab | 8 | 10-31 | 0.2-9.5 | 26.8 |
| *Portunus xantusii* | Xantus' swimming crab | 8 | 21-58 | 0.2-24.9 | 55.4 |
| *Pugettia* spp. | kelp crabs | 5 | 5-22 | 0.1-4.1 | 7.4 |
| *Loligo opalescens* | market squid | 3 | 78-100 | 19.4-34.7 | 80.8 |
| *Taliepus nuttallii* | globose kelp crab | 2 | 7-8 | 0.2-0.5 | 0.7 |
| Brachyuran unid. | unidentified crab | 1 | - | - | - |
| | **Total:** | **1,191** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA029** **Survey Date: January 05 - 06, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 344 | 48-137 | 0.9-33.5 | 2,151.8 |
| *Leuresthes tenuis* | California grunion | 60 | 53-159 | 1.2-36.4 | 361.6 |
| *Xenistius californiensis* | salema | 42 | 41-55 | 1.1-3.3 | 80.9 |
| *Cymatogaster aggregata* | shiner surfperch | 14 | 78-100 | 6.5-27.2 | 240.6 |
| *Anchoa delicatissima* | slough anchovy | 10 | 55-81 | 1.6-4.4 | 24.8 |
| *Strongylura exilis* | California needlefish | 10 | 408-563 | 90.0-270 | 1,620.0 |
| unidentified fish, damaged | unid. damaged fish | 10 | 50-65 | 0.4-2.4 | 26.5 |
| *Sardinops sagax* | Pacific sardine | 7 | 44-88 | 0.7-4.7 | 25.1 |
| *Anisotremus davidsonii* | sargo | 4 | 48-81 | 2.5-11.6 | 30.1 |
| *Anchoa compressa* | deepbody anchovy | 3 | 60-100 | 2.0-12.2 | 23.7 |
| *Seriphus politus* | queenfish | 3 | 44-144 | 1.2-34.0 | 40.4 |
| *Atractoscion nobilis* | white seabass | 2 | 270 | 85.0-180 | 265.0 |
| *Engraulis mordax* | northern anchovy | 2 | 42-45 | 0.6 | 1.3 |
| *Paralabrax clathratus* | kelp bass | 2 | 62-64 | 2.8-5.1 | 7.9 |
| *Phanerodon furcatus* | white surfperch | 2 | 179-224 | 115-240 | 355.2 |
| *Hyperprosopon argenteum* | walleye surfperch | 1 | 98 | 20.7 | 20.7 |
| *Hyperprosopon* spp. | surfperch | 1 | 165 | 115 | 115.0 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 28 | 0.5 | 0.5 |
| *Lepomis macrochirus* | bluegill | 1 | 114 | 45.0 | 45.0 |
| *Lepomis* spp. | sunfishes | 1 | 106 | 35.6 | 35.6 |
| *Symphurus atricauda* | California tonguefish | 1 | 92 | 8.1 | 8.1 |
| *Syngnathus* spp. | pipefishes | 1 | 248 | 4.5 | 4.5 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 2 | 274-307 | 320-410 | 730.0 |
| *Ophichthus zophochir* | yellow snake eel | 2 | 489-520 | 120 | 240.0 |
| *Gymnura marmorata* | California butterfly ray | 1 | 465 | 648 | 648.0 |
| *Platyrhinoidis triseriata* | thornback | 1 | - | 178.0 | 177.9 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 22 | 19-55 | 2.6-19.7 | 198.2 |
| *Pachygrapsus crassipes* | striped shore crab | 5 | 10-31 | 0.4-10.2 | 18.7 |
| *Pugettia* spp. | kelp crabs | 3 | 7-25 | 1.1-6.1 | 8.7 |
| *Callianassa californiensis* | ghost shrimp | 2 | 41-49 | 1.0-1.9 | 2.9 |
| *Cancer jordani* | hairy rock crab | 2 | 21-30 | 1.3-5.8 | 7.1 |
| *Octopus* spp. | octopus | 2 | - | 20.4-114.8 | 135.2 |
| *Cancer antennarius* | brown rock crab | 1 | 21 | 2.3 | 2.3 |
| *Cancer productus* | red rock crab | 1 | 37 | 10.5 | 10.5 |
| *Pugettia producta* | northern kelp crab | 1 | 15 | 1.5 | 1.5 |
| *Taliepus nuttallii* | globose kelp crab | 1 | 10 | 0.5 | 0.5 |
| | **Total:** | **568** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA030** **Survey Date: January 12 - 13, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 2,551 | 35-184 | 0.5-67.1 | 23,391.9 |
| *Anchoa delicatissima* | slough anchovy | 861 | 38-127 | 0.9-17.0 | 2,654.2 |
| *Hyperprosopon argenteum* | walleye surfperch | 460 | 57-195 | 4.0-128 | 18,405.7 |
| *Anchoa compressa* | deepbody anchovy | 222 | 50-122 | 1.1-20.8 | 2,131.7 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 181 | 43-240 | 1.4-310 | 1,596.9 |
| *Cymatogaster aggregata* | shiner surfperch | 118 | 38-136 | 1.9-54.9 | 2,175.8 |
| *Seriphus politus* | queenfish | 86 | 37-225 | 0.7-165 | 773.4 |
| *Paralabrax clathratus* | kelp bass | 79 | 44-154 | 1.0-70.0 | 526.4 |
| *Micrometrus minimus* | dwarf surfperch | 47 | 54-91 | 4.0-19.8 | 484.8 |
| *Menticirrhus undulatus* | California corbina | 39 | 58-341 | 3.0-580 | 1,599.6 |
| *Phanerodon furcatus* | white surfperch | 38 | 83-227 | 13.9-350 | 2,830.4 |
| *Paralabrax nebulifer* | barred sand bass | 33 | 43-88 | 1.2-35.0 | 185.7 |
| *Amphistichus argenteus* | barred surfperch | 32 | 68-195 | 8.6-220 | 1,242.5 |
| *Paralichthys californicus* | California halibut | 28 | 45-255 | 1.1-261 | 593.3 |
| *Sardinops sagax* | Pacific sardine | 28 | 73-180 | 2.5-65.0 | 364.7 |
| *Xenistius californiensis* | salema | 26 | 36-74 | 0.6-6.5 | 45.0 |
| *Anisotremus davidsonii* | sargo | 21 | 51-244 | 2.0-370 | 834.4 |
| *Hypsopsetta guttulata* | diamond turbot | 15 | 22-240 | 14.1-310 | 2,128.0 |
| *Roncador stearnsi* | spotfin croaker | 15 | 51-421 | 2.0-1,500 | 5,531.5 |
| *Atractoscion nobilis* | white seabass | 12 | 127-316 | 26.4-350 | 2,846.4 |
| *Fundulus parvipinnis* | California killifish | 9 | 49-79 | 1.8-7.1 | 48.0 |
| *Engraulis mordax* | northern anchovy | 8 | 65-86 | 1.4-5.5 | 26.7 |
| *Umbrina roncador* | yellowfin croaker | 7 | 55-298 | 3.1-355 | 398.5 |
| Chub unid. | unid. chub | 4 | 62-81 | 4.5-7.6 | 24.5 |
| *Heterostichus rostratus* | giant kelpfish | 4 | 98-161 | 8.7-28.5 | 70.9 |
| *Citharichthys stigmaeus* | speckled sanddab | 3 | 49-65 | 1.5-3.6 | 6.6 |
| *Hermosilla azurea* | zebra perch | 3 | 66-71 | 7.3-11.9 | 27.3 |
| *Sphyraena argentea* | California barracuda | 3 | 198-224 | 55.4-68.5 | 181.4 |
| *Albula vulpes* | bonefish | 2 | 320-340 | 590-602 | 1,192.0 |
| Ictaluridae | unid. catfish | 2 | 162-177 | 55.0-100.5 | 155.5 |
| *Citharichthys sordidus* | Pacific sanddab | 1 | 50 | 0.5 | 0.5 |
| *Cynoscion parvipinnis* | shortfin corvina | 1 | 412 | 900 | 900.0 |
| *Rhacochilus vacca* | pile surfperch | 1 | 176 | 160 | 160.0 |
| *Genyonemus lineatus* | white croaker | 1 | 43 | 1.0 | 1.0 |
| *Hypsoblennius gentilis* | bay blenny | 1 | 65 | 5.0 | 5.0 |
| *Hypsoblennius gilberti* | rockpool blenny | 1 | 65 | 5.0 | 5.0 |
| *Scorpaena guttata* | spotted scorpinfish | 1 | 110 | 38.0 | 38.0 |
| *Strongylura exilis* | California needlefish | 1 | 716 | 90.0 | 90.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 33 | 275-525 | 185-1,520 | 24,459.0 |
| *Urolophus halleri* | round stingray | 10 | 146-206 | 180-630 | 3,834.0 |
| *Ophichthus zophochir* | yellow snake eel | 6 | 526-800 | 115-600 | 1,920.0 |
| *Mustelus californicus* | gray smoothhound | 3 | 442-687 | 300-1,100 | 1,850.0 |
| *Myliobatis californica* | bat ray | 3 | 355-447 | 640-1,300 | 3,240.0 |
| *Platyrhinoidis triseriata* | thornback | 1 | 186 | 550 | 550.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 73 | 13-58 | 1.5-42.0 | 492.1 |
| *Octopus* spp. | octopus | 10 | - | 40.0-700 | 2,011.5 |
| *Pachygrapsus crassipes* | striped shore crab | 5 | 11-35 | 0.5-9.0 | 25.7 |
| *Cancer productus* | red rock crab | 2 | 32-33 | 4.2-6.0 | 10.2 |
| *Cancer antennarius* | brown rock crab | 1 | 36 | 7.2 | 7.2 |
| *Lophopanopeus* spp. | black-clawed crabs | 1 | 80 | 8.0 | 8.0 |
| *Pandalus platyceros* | spot shrimp | 1 | 55 | 1.8 | 1.8 |
| *Pugettia richii* | cryptic kelp crab | 1 | 28 | 11.0 | 11.0 |
| *Sicyonia ingentis* | Ridgeback rock shrimp | 1 | - | 16.0 | 16.0 |
| | **Total:** | **5,096** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA031** **Survey Date: January 19 - 20, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 492 | 50-179 | 1.0-30.0 | 2,256.5 |
| *Sardinops sagax* | Pacific sardine | 32 | 55-127 | 2.5-15.5 | 180.4 |
| *Atractoscion nobilis* | white seabass | 18 | 80-235 | 40.0-160 | 1,521.0 |
| *Anchoa delicatissima* | slough anchovy | 12 | 55-79 | 1.0-5.0 | 29.7 |
| *Anchoa compressa* | deepbody anchovy | 8 | 60-96 | 2.5-10.0 | 36.0 |
| *Cymatogaster aggregata* | shiner surfperch | 6 | 69-110 | 9.0-35.0 | 103.0 |
| *Xenistius californiensis* | salema | 5 | 39-55 | 1.0-3.0 | 10.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 4 | 106-141 | 33.0-72.0 | 189.0 |
| *Paralabrax clathratus* | kelp bass | 4 | 53-66 | 3.0-6.0 | 20.0 |
| *Anisotremus davidsonii* | sargo | 2 | 55 | 2.5-7.0 | 9.5 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 2 | 65-79 | 4.5-9.5 | 14.0 |
| *Paralabrax nebulifer* | barred sand bass | 2 | 63-75 | 4.0-8.0 | 12.0 |
| *Seriphus politus* | queenfish | 2 | 47-74 | 1.0-5.0 | 6.0 |
| *Citharichthys stigmaeus* | speckled sanddab | 1 | 38 | 1.0 | 1.0 |
| *Hypsoblennius* spp. | blennies | 1 | 70 | 7.0 | 7.0 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 253 | 350 | 350.0 |
| *Leuresthes tenuis* | California grunion | 1 | 91 | 5.0 | 5.0 |
| *Micrometrus minimus* | dwarf surfperch | 1 | 67 | 7.5 | 7.5 |
| *Pleuronichthys ritteri* | spotted turbot | 1 | 70 | 6.5 | 6.5 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 2 | 182-404 | 460-850 | 1,310.0 |
| *Platyrhinoidis triseriata* | thornback | 2 | 159-349 | 200-260 | 460.0 |
| *Gymnura marmorata* | California butterfly ray | 1 | 392 | 380 | 380.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 40 | 12-60 | 1.0-22.0 | 286.0 |
| *Pachygrapsus crassipes* | striped shore crab | 5 | 12-33 | 1.0-10.0 | 24.5 |
| *Blepharipoda occidentalis* | spiny mole crab | 1 | 24 | 9.0 | 9.0 |
| *Cancer productus* | red rock crab | 1 | 35 | 7.0 | 7.0 |
| *Octopus bimaculatus* | California two-spot octopus | 1 | 80 | 110 | 110.0 |
| *Pugettia* spp. | kelp crabs | 1 | 32 | 7.5 | 7.5 |
| | **Total:** | 649 | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA032** **Survey Date; January 26 - 27, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 243 | 46-277 | 1.0-65.0 | 1,435.4 |
| *Anchoa compressa* | deepbody anchovy | 16 | 70-111 | 3.0-15.0 | 146.9 |
| *Seriphus politus* | queenfish | 11 | 35-96 | 1.0-13.0 | 75.5 |
| *Atractoscion nobilis* | white seabass | 9 | 159-284 | 50.0-210 | 722.0 |
| *Cymatogaster aggregata* | shiner surfperch | 5 | 62-110 | 7.0-38.0 | 86.0 |
| *Hypsopsetta guttulata* | diamond turbot | 3 | 162-225 | 85.0-310 | 615.0 |
| *Sardinops sagax* | Pacific sardine | 3 | 79-145 | 5.0-29.0 | 56.0 |
| *Xenistius californiensis* | salema | 3 | 38-52 | 1.5-3.0 | 6.5 |
| *Phanerodon furcatus* | white surfperch | 2 | 87-95 | 16.0-23.0 | 39.0 |
| *Anchoa delicatissima* | slough anchovy | 1 | 61 | 2.0 | 2.0 |
| *Heterostichus rostratus* | giant kelpfish | 1 | 75 | 3.1 | 3.1 |
| *Hyperprosopon argenteum* | walleye surfperch | 1 | 98 | 21.0 | 21.0 |
| *Micrometrus minimus* | dwarf surfperch | 1 | 74 | 16.0 | 16.0 |
| *Paralabrax clathratus* | kelp bass | 1 | - | 0.5 | 0.5 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 65 | 5.5 | 5.5 |
| unidentified fish, damaged | unid. damaged fish | 1 | 182 | 70.0 | 70.0 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 2 | 309-395 | 400-490 | 890.0 |
| *Gymnura marmorata* | California butterfly ray | 1 | 365 | 390 | 390.0 |
| *Torpedo californica* | Pacific electric ray | 1 | 311 | 3,750.0 | 3,750.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 30 | 24-51 | 1.5-23.5 | 325.0 |
| *Pachygrapsus crassipes* | striped shore crab | 4 | 12-50 | 2.0-18.0 | 42.0 |
| *Cancer* spp. | cancer crabs | 2 | 28-32 | 2.0-3.0 | 5.0 |
| *Cancer productus* | red rock crab | 1 | 35 | 5.0 | 5.0 |
| Caridean unid. | unidentified shrimp | 1 | - | 7.0 | 7.0 |
| *Panulirus interruptus* | California spiny lobster | 1 | - | 30.0 | 30.0 |
| | **Total:** | **345** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA033** **Survey Date: February 20 - 03, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 189 | 38-325 | 0.5-270 | 1,381.3 |
| *Sardinops sagax* | Pacific sardine | 19 | 66-124 | 4.8-16.0 | 153.7 |
| *Anchoa compressa* | deepbody anchovy | 10 | 62-116 | 3.0-16.0 | 70.5 |
| *Xenistius californiensis* | salema | 6 | 45-59 | 1.0-4.0 | 11.5 |
| *Hyperprosopon argenteum* | walleye surfperch | 5 | 122-165 | 50.0-100 | 339.6 |
| *Syngnathus* spp. | pipefishes | 4 | 162-224 | 1.1-4.0 | 9.3 |
| *Anisotremus davidsonii* | sargo | 3 | 57-69 | 4.0-7.0 | 17.5 |
| *Micrometrus minimus* | dwarf surfperch | 2 | 62-67 | 7.5-9.0 | 16.5 |
| *Anchoa delicatissima* | slough anchovy | 1 | 75 | 5.0 | 5.0 |
| *Atractoscion nobilis* | white seabass | 1 | 307 | 360 | 360.0 |
| *Cymatogaster aggregata* | shiner surfperch | 1 | 77 | 10.0 | 10.0 |
| *Rhacochilus vacca* | pile surfperch | 1 | 214 | 280 | 280.0 |
| *Paralabrax clathratus* | kelp bass | 1 | 65 | 5.6 | 5.6 |
| *Peprilus simillimus* | Pacific butterfish | 1 | 79 | 11.0 | 11.0 |
| *Phanerodon furcatus* | white surfperch | 1 | 87 | 15.0 | 15.0 |
| *Sarda chiliensis* | Pacific bonito | 1 | 362 | 510 | 510.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 17 | 20-58 | 2.0-18.0 | 137.8 |
| *Pugettia* spp. | kelp crabs | 4 | 6-23 | 0.4-9.0 | 11.9 |
| *Cancer jordani* | hairy rock crab | 1 | 33 | 8.5 | 8.5 |
| *Cancer productus* | red rock crab | 1 | 56 | 17.0 | 17.0 |
| *Dosidicus gigas* | jumbo squid | 1 | 625 | 500 | 500.0 |
| *Pachygrapsus crassipes* | striped shore crab | 1 | 10 | 0.2 | 0.2 |
| *Podochela hemphilli* | Hemphill's kelp crab | 1 | 20 | 3.0 | 3.0 |
| | **Total:** | **272** | | | |

**Survey: EPSIA034** **Survey Date: February 09 - 10, 2005**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 115 | 58-302 | 2.0-205 | 903.8 |
| *Anchoa delicatissima* | slough anchovy | 25 | 39-98 | 0.3-9.5 | 60.9 |
| *Anchoa compressa* | deepbody anchovy | 17 | 73-112 | 3.0-17.0 | 192.2 |
| *Seriphus politus* | queenfish | 16 | 45-112 | 1.0-20.0 | 82.7 |
| *Cymatogaster aggregata* | shiner surfperch | 14 | 70-113 | 11.0-31.0 | 251.6 |
| *Umbrina roncador* | yellowfin croaker | 8 | 74-96 | 7.0-14.5 | 82.5 |
| *Atractoscion nobilis* | white seabass | 5 | 190-265 | 70.0-245 | 675.0 |
| *Engraulis mordax* | northern anchovy | 5 | 42-89 | 1.0-5.5 | 14.4 |
| *Xenistius californiensis* | salema | 5 | 50-60 | 2.0-3.5 | 13.9 |
| *Hyperprosopon argenteum* | walleye surfperch | 4 | 101-135 | 45.0-70.0 | 235.0 |
| *Sardinops sagax* | Pacific sardine | 2 | 108-111 | 9.0-12.0 | 21.0 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 206 | 270 | 270.0 |
| *Paralabrax clathratus* | kelp bass | 1 | 65 | 5.0 | 5.0 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 51 | 2.0 | 2.0 |
| *Paralichthys californicus* | California halibut | 1 | 94 | 13.0 | 13.0 |
| *Roncador stearnsi* | spotfin croaker | 1 | 57 | 3.0 | 3.0 |
| *Syngnathus* spp. | pipefishes | 1 | 163 | 0.6 | 0.6 |
| unidentified fish, damaged | unid. damaged fish | 1 | - | 100 | 100.0 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 2 | 272-530 | 305-2,000 | 2,305.0 |
| *Ophichthus zophochir* | yellow snake eel | 1 | 638 | 295 | 295.0 |
| *Urolophus halleri* | round stingray | 1 | 140 | 170 | 170.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 14 | 16-78 | 3.0-14.0 | 99.6 |
| *Pachygrapsus crassipes* | striped shore crab | 3 | 8-18 | 0.4-3.0 | 4.9 |
| *Cancer productus* | red rock crab | 2 | 33-49 | 12.0-17.0 | 29.0 |
| | **Total:** | **246** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA035** **Survey Date: February 16 - 17, 2005**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 5 | - | 40.2 | 40.2 |
| *Seriphus politus* | queenfish | 5 | 44-52 | 3.0 | 15.0 |
| *Atherinops affinis* | topsmelt | 4 | - | 8.7 | 8.7 |
| *Hyperprosopon argenteum* | walleye surfperch | 2 | 131-134 | 45.0-81.0 | 126.0 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 2 | - | 14.6 | 14.6 |
| *Paralabrax nebulifer* | barred sand bass | 2 | 50-84 | 3.2-14.0 | 17.2 |
| *Atherinopsis californiensis* | jacksmelt | 1 | 273 | 160 | 160.0 |
| *Hypsoblennius jenkinsi* | mussel blenny | 1 | 57 | 4.3 | 4.3 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 380 | 800 | 800.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus* spp. | shore crab | 417 | - | 50.0 | 871.0 |
| *Pachygrapsus crassipes* | striped shore crab | 274 | 3-37 | 0.5-21.5 | 768.5 |
| *Cancer productus* | red rock crab | 13 | 10-55 | 1.0-22.0 | 130.1 |
| *Portunus xantusii* | Xantus' swimming crab | 7 | 20-35 | 2.0-7.0 | 30.0 |
| Brachyuran unid. | unidentified crab | 1 | - | 150-200 | 350.0 |
| *Pugettia producta* | northern kelp crab | 1 | 22 | 3.5 | 3.5 |
| *Pugettia* spp. | kelp crabs | 1 | - | 0.5 | 0.5 |
| | **Total:** | 737 | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPS1A036** **Survey Date: February 23 - 24, 2005**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 306 | 54-120 | 2.0-21.0 | 3,203.2 |
| *Atherinops affinis* | topsmelt | 304 | 57-171 | 1.2-54.7 | 4,887.9 |
| *Cymatogaster aggregata* | shiner surfperch | 189 | 72-188 | 8.9-61.0 | 5,211.9 |
| Chub unid. | unid. chub | 91 | 62-164 | 3.0-100 | 845.5 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 88 | 43-315 | 2.0-670 | 1,318.9 |
| *Paralabrax nebulifer* | barred sand bass | 64 | 42-94 | 2.0-15.0 | 439.8 |
| *Hyperprosopon argenteum* | walleye surfperch | 36 | 110-164 | 36.0-116.4 | 2,564.4 |
| Ictaluridae | unid. catfish | 33 | 124-259 | 60.0-300 | 4,123.0 |
| *Fundulus parvipinnis* | California killifish | 31 | 66-91 | 4.0-12.0 | 235.5 |
| *Anchoa delicatissima* | slough anchovy | 24 | 57-74 | 2.0-5.0 | 73.5 |
| *Seriphus politus* | queenfish | 21 | 49-172 | 2.0-79.0 | 410.5 |
| *Lepomis macrochirus* | bluegill | 16 | 42-135 | 2.0-86.9 | 513.7 |
| *Lepomis cyanellus* | green sunfish | 15 | 47-168 | 3.0-138 | 532.0 |
| *Anisotremus davidsonii* | sargo | 10 | 53-81 | 3.5-13.0 | 68.4 |
| *Hypsopsetta guttulata* | diamond turbot | 7 | 25-233 | 0.8-260 | 956.8 |
| *Paralichthys californicus* | California halibut | 6 | 47-221 | 1.5-170 | 200.8 |
| *Atractoscion nobilis* | white seabass | 4 | 239-432 | 155-260 | 775.0 |
| *Pylodictis olivaris* | flathead catfish | 4 | 158-210 | 90.0-170 | 480.0 |
| *Chromis punctipinnis* | blacksmith | 3 | 55-101 | 4.0-21.0 | 32.0 |
| *Phanerodon furcatus* | white surfperch | 3 | 156-191 | 85.8-180 | 385.8 |
| unidentified fish, damaged | unid. damaged fish | 3 | 40-95 | 1.0-60.0 | 62.5 |
| *Paralabrax clathratus* | kelp bass | 2 | 65-90 | 5.0-14.0 | 19.0 |
| *Ameiurus nebulosus* | brown bullhead | 1 | 149 | 100 | 100.0 |
| *Citharichthys stigmaeus* | speckled sanddab | 1 | 45 | 3.0 | 3.0 |
| *Embiotoca jacksoni* | black surfperch | 1 | 225 | 370 | 370.0 |
| *Heterostichus rostratus* | giant kelpfish | 1 | 183 | 50.0 | 50.0 |
| *Lepomis* spp. | sunfishes | 1 | 141 | 130 | 130.0 |
| *Micrometrus minimus* | dwarf surfperch | 1 | 57 | 5.0 | 5.0 |
| *Micropterus dolomieu* | smallmouth bass | 1 | 186 | 150 | 150.0 |
| Pleuronectiformes unid. | flatfishes | 1 | 38 | 0.5 | 0.5 |
| *Syngnathus* spp. | pipefishes | 1 | 105 | 1.0 | 1.0 |
| *Xenistius californiensis* | salema | 1 | 48 | 1.8 | 1.8 |
| **SHARKS/RAYS** | | | | | |
| *Ophichthus zophochir* | yellow snake eel | 4 | 549-769 | 150-450 | 1,380.0 |
| **INVERTEBRATES** | | | | | |
| *Octopus* spp. | octopus | 17 | 17-117 | 16.0-520 | 3,170.0 |
| *Portunus xantusii* | Xantus' swimming crab | 15 | 11-52 | 1.3-14.0 | 73.8 |
| *Pachygrapsus crassipes* | striped shore crab | 6 | 11-22 | 1.0-4.0 | 13.0 |
| *Octopus bimaculatus* | California two-spot octopus | 3 | 90-95 | 240-370 | 940.0 |
| *Blepharipoda occidentalis* | spiny mole crab | 1 | 18 | 3.0 | 3.0 |
| | **Total:** | **1,316** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA037** **Survey Date; March 02 - 03, 2005**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Seriphus politus* | queenfish | 18 | 47-74 | 1.2-5.5 | 45.4 |
| *Atherinops affinis* | topsmelt | 8 | 65-112 | 0.4-13.7 | 55.7 |
| *Roncador stearnsi* | spotfin croaker | 5 | 70-550 | 5.5-1,700 | 3,024.6 |
| *Anchoa compressa* | deepbody anchovy | 3 | 64-98 | 3.0-8.6 | 20.0 |
| *Phanerodon furcatus* | white surfperch | 3 | 79-175 | 10.9-130.8 | 179.1 |
| *Citharichthys stigmaeus* | speckled sanddab | 2 | 60-68 | 3.4-4.0 | 7.4 |
| *Anisotremus davidsonii* | sargo | 1 | 61 | 4.5 | 4.5 |
| *Cymatogaster aggregata* | shiner surfperch | 1 | 107 | 26.5 | 26.5 |
| *Dorosoma petenense* | threadfin shad | 1 | 69 | 3.4 | 3.4 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 215 | 226 | 226.0 |
| *Micrometrus minimus* | dwarf surfperch | 1 | 69 | 7.9 | 7.9 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 65 | 5.7 | 5.7 |
| *Paralichthys californicus* | California halibut | 1 | 128 | 30.3 | 30.3 |
| *Syngnathus* spp. | pipefishes | 1 | 127 | 0.5 | 0.5 |
| unidentified fish, damaged | unid. damaged fish | 1 | - | 1.2 | 1.2 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 13 | 19-48 | 1.3-15.2 | 84.2 |
| *Pachygrapsus crassipes* | striped shore crab | 6 | 8-42 | 0.6-48.5 | 73.9 |
| *Octopus* spp. | octopus | 1 | 95 | 266.5 | 266.5 |
| | **Total:** | **68** | | | |

**Survey: EPSIA038** **Survey Date: March 09 - 10, 2005**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Seriphus politus* | queenfish | 36 | 45-80 | 1.7-7.4 | 124.6 |
| *Atherinops affinis* | topsmelt | 25 | 60-152 | 2.0-33.5 | 299.9 |
| *Cymatogaster aggregata* | shiner surfperch | 17 | 76-119 | 12.0-35.5 | 350.7 |
| *Hypsopsetta guttulata* | diamond turbot | 10 | 185-235 | 160-281 | 2,126.3 |
| *Paralabrax clathratus* | kelp bass | 6 | 49-65 | 2.2-5.6 | 22.9 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 5 | 43-80 | 2.0-11.1 | 33.2 |
| *Paralabrax nebulifer* | barred sand bass | 4 | 50-83 | 2.5-14.1 | 27.5 |
| *Anchoa compressa* | deepbody anchovy | 3 | 90-110 | 9.1-12.8 | 34.7 |
| *Roncador stearnsi* | spotfin croaker | 3 | 67-81 | 4.8-9.5 | 20.4 |
| *Anchoa delicatissima* | slough anchovy | 2 | 58-62 | 2.3-2.8 | 5.1 |
| *Atherinopsis californiensis* | jacksmelt | 2 | 110-158 | 14.8-31.8 | 46.6 |
| *Engraulis mordax* | northern anchovy | 2 | 35-38 | 0.3-0.5 | 0.8 |
| *Anisotremus davidsonii* | sargo | 1 | 56 | 3.9 | 3.9 |
| *Citharichthys stigmaeus* | speckled sanddab | 1 | 60 | 5.2 | 5.2 |
| *Fundulus parvipinnis* | California killifish | 1 | 65 | 4.9 | 4.9 |
| *Gillichthys mirabilis* | longjaw mudsucker | 1 | 125 | 34.4 | 34.4 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 1 | 98 | 15.1 | 15.1 |
| *Micrometrus minimus* | dwarf surfperch | 1 | 64 | 7.3 | 7.3 |
| *Peprilus simillimus* | Pacific butterfish | 1 | 85 | 13.8 | 13.8 |
| *Phanerodon furcatus* | white surfperch | 1 | 123 | 35.9 | 35.9 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 330 | 500 | 500.0 |
| *Sardinops sagax* | Pacific sardine | 1 | 114 | 8.9 | 8.9 |
| unidentified fish | unid. fish | 1 | 39 | 0.9 | 0.9 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 2 | 347-423 | 362-671 | 1,032.7 |
| *Platyrhinoidis triseriata* | thornback | 2 | 196-395 | 365-371 | 735.8 |
| *Myliobatis californica* | bat ray | 1 | 343 | 647.0 | 647.3 |
| *Urolophus halleri* | round stingray | 1 | 180 | 448.0 | 447.7 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 66 | 16-46 | 1.1-9.4 | 260.7 |
| *Pachygrapsus crassipes* | striped shore crab | 5 | 10-40 | 0.5-36.8 | 49.7 |
| *Pyromaia tuberculata* | tuberculate pea crab | 2 | 5-8 | 0.2-0.4 | |
| *Octopus* spp. | octopus | 1 | 90 | 319.5 | 319.5 |
| | **Total:** | **206** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA039** **Survey Date: March 16 - 17, 2005**
**Sample Count: 13**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 6 | 76-138 | 4.2-28.4 | 138.6 |
| *Anchoa delicatissima* | slough anchovy | 3 | 63-72 | 2.7-3.8 | 9.5 |
| *Cymatogaster aggregata* | shiner surfperch | 3 | 40-120 | 1.4-45.6 | 83.4 |
| *Roncador stearnsi* | spotfin croaker | 3 | 57-71 | 4.7-7.1 | 17.8 |
| *Seriphus politus* | queenfish | 3 | 55-65 | 2.0-3.7 | 9.3 |
| *Hypsopsetta guttulata* | diamond turbot | 2 | 210-235 | 233-281 | 513.5 |
| *Anchoa compressa* | deepbody anchovy | 1 | 58 | 1.7 | 1.7 |
| *Brachyistius frenatus* | kelp surfperch | 1 | 80 | 17.0 | 17.0 |
| *Fundulus parvipinnis* | California killifish | 1 | 70 | 5.4 | 5.4 |
| *Hyperprosopon argenteum* | walleye surfperch | 1 | 129 | 51.2 | 51.2 |
| *Leuresthes tenuis* | California grunion | 1 | 74 | 3.1 | 3.1 |
| *Lyopsetta exilis* | slender sole | 1 | 124 | 25.9 | 25.9 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 54 | 2.7 | 2.7 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 62 | 3.9 | 3.9 |
| *Syngnathus* spp. | pipefishes | 1 | 190 | 1.8 | 1.8 |
| *Xenistius californiensis* | salema | 1 | 53 | 2.8 | 2.8 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 10 | 21-44 | 1.0-11.3 | 30.8 |
| *Pachygrapsus crassipes* | striped shore crab | 6 | 10-28 | 1.1-8.4 | 31.2 |
| | **Total:** | **46** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA040** **Survey Date: March 23 - 24, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 77 | 60-155 | 2.0-50.2 | 776.2 |
| *Cymatogaster aggregata* | shiner surfperch | 62 | 33-123 | 0.8-41.6 | 1,385.7 |
| *Seriphus politus* | queenfish | 31 | 35-111 | 1.3-14.0 | 155.4 |
| *Anchoa compressa* | deepbody anchovy | 25 | 54-80 | 1.6-5.4 | 73.2 |
| *Anchoa delicatissima* | slough anchovy | 14 | 55-70 | 2.3-3.7 | 40.6 |
| *Roncador stearnsi* | spotfin croaker | 9 | 64-83 | 3.0-12.4 | 57.6 |
| *Syngnathus* spp. | pipefishes | 9 | 183-235 | 1.6-3.5 | 22.0 |
| *Strongylura exilis* | California needlefish | 6 | 330-538 | 37.5-181 | 592.8 |
| *Genyonemus lineatus* | white croaker | 4 | 31-34 | 0.6 | 2.7 |
| *Leuresthes tenuis* | California grunion | 4 | 70-104 | 3.3-9.2 | 20.9 |
| *Paralabrax nebulifer* | barred sand bass | 4 | 59-64 | 3.8-5.2 | 18.3 |
| *Hypsopsetta guttulata* | diamond turbot | 3 | 205-224 | 184.4-203.0 | 574.8 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 3 | 60-105 | 3.3-18.8 | 28.6 |
| *Phanerodon furcatus* | white surfperch | 3 | 41-166 | 8.8-87.7 | 116.2 |
| *Anisotremus davidsonii* | sargo | 2 | 55-59 | 4.3-5.0 | 9.3 |
| *Chromis punctipinnis* | blacksmith | 2 | 119-125 | 32.7-35.0 | 67.7 |
| *Hyperprosopon argenteum* | walleye surfperch | 2 | 39-177 | 1.5-190 | 191.1 |
| *Paralabrax clathratus* | kelp bass | 2 | 74-76 | 5.6-8.0 | 13.6 |
| Pleuronectiformes unid. | flatfishes | 2 | 55-60 | 3.2-3.7 | 6.9 |
| *Citharichthys stigmaeus* | speckled sanddab | 1 | 60 | 2.9 | 2.9 |
| *Engraulis mordax* | northern anchovy | 1 | 87 | 3.9 | 3.9 |
| *Fundulus parvipinnis* | California killifish | 1 | 66 | 5.2 | 5.2 |
| *Hypsoblennius gilberti* | rockpool blenny | 1 | 70 | 6.3 | 6.3 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 53 | 2.6 | 2.6 |
| *Peprilus simillimus* | Pacific butterfish | 1 | 87 | 14.3 | 14.3 |
| *Pleuronichthys verticalis* | hornyhead turbot | 1 | 138 | 68.9 | 68.9 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 370 | 350 | 350.0 |
| *Umbrina roncador* | yellowfin croaker | 1 | 70 | 5.4 | 5.4 |
| unidentified fish | unid. fish | 1 | 156 | 77.6 | 77.6 |
| unidentified fish, damaged | unid. damaged fish | 1 | 65 | 1.6 | 1.6 |
| *Xenistius californiensis* | salema | 1 | 51 | 2.9 | 2.9 |
| **SHARKS/RAYS** | | | | | |
| *Ophichthus zophochir* | yellow snake eel | 2 | 750-752 | 393-457 | 849.4 |
| *Urolophus halleri* | round stingray | 2 | 119-120 | 95.2-98.0 | 193.2 |
| *Gymnura marmorata* | California butterfly ray | 1 | 395 | 185.0 | 185.0 |
| *Rhinobatos productus* | shovelnose guitarfish | 1 | 775 | 1,800.0 | 1,800.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 56 | 9-46 | 0.9-19.0 | 200.2 |
| *Pachygrapsus crassipes* | striped shore crab | 9 | 15-40 | 1.0-31.9 | 95.6 |
| | **Total:** | **347** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA041** **Survey Date: March 30 - 31, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 85 | 58-135 | 2.5-21.7 | 552.4 |
| *Seriphus politus* | queenfish | 44 | 40-130 | 1.8-33.4 | 258.7 |
| *Cymatogaster aggregata* | shiner surfperch | 36 | 32-125 | 0.6-43.9 | 798.4 |
| *Anchoa compressa* | deepbody anchovy | 13 | 65-111 | 1.6-17.3 | 98.9 |
| *Paralabrax nebulifer* | barred sand bass | 11 | 49-75 | 2.4-8.6 | 50.9 |
| *Hyperprosopon argenteum* | walleye surfperch | 8 | 27-43 | 0.5-1.8 | 10.8 |
| *Anchoa delicatissima* | slough anchovy | 5 | 58-69 | 2.0-3.4 | 13.3 |
| *Anisotremus davidsonii* | sargo | 5 | 54-68 | 3.8-7.0 | 26.7 |
| *Embiotoca jacksoni* | black surfperch | 5 | 46-64 | 3.0-6.8 | 20.5 |
| *Leuresthes tenuis* | California grunion | 5 | 64-131 | 1.2-17.0 | 43.3 |
| *Umbrina roncador* | yellowfin croaker | 5 | 65-108 | 4.8-20.0 | 45.2 |
| *Paralichthys californicus* | California halibut | 2 | 70-176 | 2.2-33.7 | 35.9 |
| *Phanerodon furcatus* | white surfperch | 2 | 41-50 | 1.8-2.5 | 4.3 |
| *Genyonemus lineatus* | white croaker | 1 | 45 | 1.6 | 1.6 |
| *Hypsoblennius gentilis* | bay blenny | 1 | 42 | 1.6 | 1.6 |
| *Menticirrhus undulatus* | California corbina | 1 | 262 | 277.5 | 277.5 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 80 | 9.6 | 9.6 |
| *Roncador stearnsi* | spotfin croaker | 1 | 77 | 7.5 | 7.5 |
| *Strongylura exilis* | California needlefish | 1 | 324 | 26.3 | 26.3 |
| *Syngnathus* spp. | pipefishes | 1 | 207 | 3.6 | 3.6 |
| *Xenistius californiensis* | salema | 1 | 55 | 3.1 | 3.1 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 2 | 330-398 | 305-550 | 855.2 |
| *Urolophus halleri* | round stingray | 2 | 104-108 | 56.0-62.1 | 118.1 |
| *Platyrhinoidis triseriata* | thornback | 1 | 279 | 1,500.0 | 1,500.0 |
| *Rhinobatos productus* | shovelnose guitarfish | 1 | 1126 | 4,400.0 | 4,400.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 20 | 15-58 | 0.9-16.8 | 77.1 |
| *Pachygrapsus crassipes* | striped shore crab | 17 | 5-40 | 0.3-31.9 | 85.4 |
| | **Total:** | 277 | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA042** **Survey Date: April 6 - 7, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 29 | 42-131 | 3.0-65.2 | 732.7 |
| *Atherinops affinis* | topsmelt | 23 | 60-127 | 3.0-24.0 | 238.0 |
| *Seriphus politus* | queenfish | 17 | 55-81 | 4.0-10.0 | 94.5 |
| *Hyperprosopon argenteum* | walleye surfperch | 6 | 40-161 | 2.0-100 | 204.0 |
| *Anchoa compressa* | deepbody anchovy | 4 | 68-78 | 4.0-6.5 | 19.0 |
| *Atherinopsis californiensis* | jacksmelt | 4 | 75-252 | 5.0-140 | 177.0 |
| *Leuresthes tenuis* | California grunion | 4 | 78-151 | 3.8-28.0 | 58.8 |
| *Embiotoca jacksoni* | black surfperch | 3 | 53-218 | 4.5-452 | 464.0 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 370-410 | 800-1,250 | 2,950.0 |
| *Paralabrax nebulifer* | barred sand bass | 2 | 50-56 | 3.0-4.0 | 7.0 |
| *Amphistichus argenteus* | barred surfperch | 1 | 42 | 2.0 | 2.0 |
| *Anchoa delicatissima* | slough anchovy | 1 | 63 | 3.5 | 3.5 |
| *Anisotremus davidsonii* | sargo | 1 | 68 | 8.5 | 8.5 |
| *Chromis punctipinnis* | blacksmith | 1 | 95 | 18.5 | 18.5 |
| *Engraulis mordax* | northern anchovy | 1 | 57 | 2.5 | 2.5 |
| *Genyonemus lineatus* | white croaker | 1 | 110 | 21.0 | 21.0 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 65 | 7.0 | 7.0 |
| *Sardinops sagax* | Pacific sardine | 1 | 128 | 19.5 | 19.5 |
| *Strongylura exilis* | California needlefish | 1 | 345 | 45.0 | 45.0 |
| *Syngnathus leptorhynchus* | bay pipefish | 1 | 208 | 4.0 | 4.0 |
| *Xenistius californiensis* | salema | 1 | 52 | 4.0 | 4.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 2 | 415-462 | 600-1,050 | 1,650.0 |
| *Urolophus halleri* | round stingray | 1 | 168 | 420 | 420.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 40 | 17-70 | 1.5-20.0 | 300.0 |
| *Pachygrapsus crassipes* | striped shore crab | 8 | 17-32 | 3.0-13.5 | 43.0 |
| Hippolytidae unid. | hippolytid shrimps | 1 | - | - | - |
| | **Total:** | **158** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA043** **Survey Date: April 13 - 14, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 93 | 48-143 | 6.9-59.8 | 1,565.9 |
| *Atherinops affinis* | topsmelt | 35 | 65-155 | 3.0-39.9 | 415.6 |
| *Anisotremus davidsonii* | sargo | 13 | 40-91 | 3.9-25.2 | 127.2 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 10 | 65-263 | 3.9-259.1 | 398.9 |
| *Anchoa compressa* | deepbody anchovy | 9 | 80-120 | 6.6-22.5 | 123.9 |
| *Leuresthes tenuis* | California grunion | 6 | 110-160 | 7.6-23.1 | 83.4 |
| *Hyperprosopon argenteum* | walleye surfperch | 5 | 40-50 | 1.6-2.5 | 10.1 |
| *Atherinopsis californiensis* | jacksmelt | 3 | 194-325 | 61.4-223 | 462.1 |
| *Paralabrax clathratus* | kelp bass | 3 | 65-75 | 3.2-5.6 | 12.5 |
| *Seriphus politus* | queenfish | 3 | 61-84 | 3.5-7.7 | 15.2 |
| *Chromis punctipinnis* | blacksmith | 2 | 154-156 | 106.6-143.1 | 249.7 |
| *Embiotoca jacksoni* | black surfperch | 2 | 56-58 | 4.3-4.4 | 8.7 |
| *Girella nigricans* | opaleye | 2 | 140-190 | 86.0-260.1 | 346.1 |
| *Hermosilla azurea* | zebra perch | 2 | 73-255 | 10.9-445 | 455.9 |
| *Hypsopsetta guttulata* | diamond turbot | 2 | 155-198 | 107.3-185.1 | 292.4 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 2 | 58-66 | 3.5 | 7.0 |
| *Porichthys myriaster* | specklefin midshipman | 2 | 263-352 | 271-673 | 943.5 |
| *Roncador stearnsi* | spotfin croaker | 2 | 80-222 | 9.5-174.1 | 183.6 |
| *Anchoa delicatissima* | slough anchovy | 1 | 70 | 3.8 | 3.8 |
| *Genyonemus lineatus* | white croaker | 1 | 169 | 92.6 | 92.6 |
| *Heterostichus rostratus* | giant kelpfish | 1 | 88 | 4.9 | 4.9 |
| *Hypsoblennius gentilis* | bay blenny | 1 | 58 | 4.7 | 4.7 |
| *Hypsoblennius jenkinsi* | mussel blenny | 1 | 91 | 13.0 | 13.0 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 221 | 266.7 | 266.7 |
| *Paralichthys californicus* | California halibut | 1 | 107 | 18.2 | 18.2 |
| *Phanerodon furcatus* | white surfperch | 1 | 213 | 215.1 | 215.1 |
| *Umbrina roncador* | yellowfin croaker | 1 | 60 | 4.6 | 4.6 |
| unidentified fish, damaged | unid. damaged fish | 1 | - | 91.8 | 91.8 |
| *Xenistius californiensis* | salema | 1 | 50 | 2.4 | 2.4 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 9 | 96-198 | 37.6-521.1 | 2,298.0 |
| *Gymnura marmorata* | California butterfly ray | 2 | 365-393 | 443.8-512.9 | 956.7 |
| *Myliobatis californica* | bat ray | 2 | 352-354 | 673-790 | 1,463.2 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 170 | 7-31 | 0.3-14.8 | 544.1 |
| *Portunus xantusii* | Xantus' swimming crab | 13 | 18-51 | 1.5-19.2 | 85.9 |
| *Cancer productus* | red rock crab | 1 | 19 | -1.4 | 1.4 |
| | **Total:** | **404** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA044** **Survey Date: April 20 - 21, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 32 | 43-122 | 1.9-31.8 | 477.6 |
| *Anchoa compressa* | deepbody anchovy | 16 | 65-119 | 3.2-18.7 | 159.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 11 | 41-225 | 1.7-275.3 | 465.4 |
| *Anisotremus davidsonii* | sargo | 7 | 60-75 | 4.8-9.0 | 46.8 |
| *Atherinops affinis* | topsmelt | 7 | 73-133 | 3.7-23.3 | 112.1 |
| *Seriphus politus* | queenfish | 6 | 68-99 | 4.7-15.7 | 48.3 |
| *Anchoa delicatissima* | slough anchovy | 4 | 65-74 | 2.6-4.9 | 14.9 |
| *Porichthys myriaster* | specklefin midshipman | 2 | 270-335 | 227-482 | 708.8 |
| *Cheilopogon pinnatibarbatus* | spotted flyingfish | 1 | 114 | 2.9 | 2.9 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 1 | 65 | 4.6 | 4.6 |
| *Leuresthes tenuis* | California grunion | 1 | 110 | 11.0 | 11.0 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 50 | 2.3 | 2.3 |
| *Phanerodon furcatus* | white surfperch | 1 | 36 | 1.0 | 1.0 |
| *Porichthys* spp. | midshipman | 1 | - | 200 | 200.0 |
| *Roncador stearnsi* | spotfin croaker | 1 | 77 | 8.6 | 8.6 |
| *Strongylura exilis* | California needlefish | 1 | 390 | 57.9 | 57.9 |
| unidentified fish, damaged | unid. damaged fish | 1 | - | 200 | 200.0 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 2 | 100 | 63.3-150 | 213.3 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 12 | 18-40 | 1.5-13.7 | 65.9 |
| *Pachygrapsus crassipes* | striped shore crab | 10 | 4-50 | 0.2-53.0 | 82.5 |
| *Octopus* spp. | octopus | 1 | - | 139.7 | 139.7 |
| | **Total:** | **119** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA045** **Survey Date: April 27 - 28, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 63 | 39-122 | 1.2-42.0 | 810.1 |
| *Atherinops affinis* | topsmelt | 10 | 78-136 | 6.1-23.7 | 135.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 5 | 39-115 | 1.1-49.3 | 103.2 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 4 | 70-80 | 4.9-7.7 | 27.5 |
| *Paralabrax nebulifer* | barred sand bass | 4 | 53-91 | 4.4-14.0 | 28.4 |
| *Anchoa compressa* | deepbody anchovy | 3 | 80-100 | 2.3-13.3 | 21.9 |
| *Anchoa delicatissima* | slough anchovy | 2 | 61-97 | 2.9-9.1 | 12.0 |
| *Anisotremus davidsonii* | sargo | 2 | 63-72 | 5.7-10.3 | 16.0 |
| *Paralabrax clathratus* | kelp bass | 2 | 61-76 | 5.1-8.1 | 13.2 |
| *Mugil cephalus* | striped mullet | 1 | 57 | 3.4 | 3.4 |
| *Paralichthys californicus* | California halibut | 1 | 101 | 14.6 | 14.6 |
| *Peprilus simillimus* | Pacific butterfish | 1 | 47 | 2.2 | 2.2 |
| *Porichthys myriaster* | specklefin midshipman | 1 | 252 | 190.0 | 189.5 |
| *Seriphus politus* | queenfish | 1 | 71 | 6.9 | 6.9 |
| *Xenistius californiensis* | salema | 1 | 70 | 7.6 | 7.6 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 1 | 566 | 2,500.0 | 2,500.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 6 | 19-33 | 1.8-4.9 | 18.1 |
| *Pachygrapsus crassipes* | striped shore crab | 2 | 11-12 | 2.9-3.4 | 6.3 |
| | **Total:** | 110 | | | |

**Survey: EPSIA046** **Survey Date: May 4 - 5, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 169 | 29-148 | 0.6-78.6 | 1,251.5 |
| *Anchoa compressa* | deepbody anchovy | 35 | 48-100 | 1.5-13.7 | 145.2 |
| *Atherinops affinis* | topsmelt | 23 | 60-126 | 2.0-26.0 | 211.4 |
| *Hyperprosopon argenteum* | walleye surfperch | 14 | 48-157 | 2.2-94.9 | 162.4 |
| *Seriphus politus* | queenfish | 6 | 60-91 | 2.6-10.3 | 38.0 |
| *Leuresthes tenuis* | California grunion | 5 | 71-112 | 3.5-17.4 | 37.3 |
| *Paralabrax nebulifer* | barred sand bass | 5 | 61-80 | 4.7-11.6 | 38.1 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 4 | 75-82 | 9.1-90.0 | 122.6 |
| *Sebastes atrovirens* | kelp rockfish | 4 | 68-90 | 5.6-16.4 | 39.8 |
| *Paralichthys californicus* | California halibut | 3 | 22-80 | 6.2-9.3 | 21.9 |
| *Citharichthys stigmaeus* | speckled sanddab | 2 | 70-79 | 5.5-6.4 | 11.9 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 2 | 73-84 | 5.3-7.3 | 12.6 |
| *Porichthys myriaster* | specklefin midshipman | 2 | 80-82 | 9.9-12.1 | 22.0 |
| *Anisotremus davidsonii* | sargo | 1 | 64 | 7.4 | 7.4 |
| *Heterostichus rostratus* | giant kelpfish | 1 | 85 | 2.9 | 2.9 |
| *Strongylura exilis* | California needlefish | 1 | 400 | 66.0 | 66.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 1 | 555 | 1,508.0 | 1,508.0 |
| *Ophichthus zophochir* | yellow snake eel | 1 | - | 17.8 | 17.8 |
| *Urolophus halleri* | round stingray | 1 | 204 | 525 | 525.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 4 | 10-30 | 1.3-4.8 | 9.2 |
| *Portunus xantusii* | Xantus' swimming crab | 3 | 40-50 | 2.2-11.9 | 19.4 |
| | **Total:** | 287 | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA047** **Survey Date: May 11 - 12, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 89 | 33-112 | 0.7-39.2 | 1,120.1 |
| *Phanerodon furcatus* | white surfperch | 30 | 30-161 | 0.7-90.6 | 179.2 |
| *Atherinops affinis* | topsmelt | 20 | 45-145 | 0.7-74.5 | 232.0 |
| *Anchoa compressa* | deepbody anchovy | 11 | 75-110 | 4.1-15.2 | 103.7 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 9 | 68-94 | 5.7-15.7 | 82.5 |
| *Seriphus politus* | queenfish | 8 | 71-91 | 4.6-12.5 | 64.5 |
| *Amphistichus argenteus* | barred surfperch | 4 | 53-62 | 3.7-6.0 | 18.1 |
| *Hyperprosopon argenteum* | walleye surfperch | 3 | 50-138 | 2.8-65.0 | 72.6 |
| *Leuresthes tenuis* | California grunion | 3 | 64-140 | 2.3-17.8 | 25.7 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 179-422 | 258-1,141 | 1,729.3 |
| *Xenistius californiensis* | salema | 3 | 56-70 | 3.7-7.4 | 18.1 |
| *Anchoa delicatissima* | slough anchovy | 2 | 60 | 2.3-2.4 | 4.7 |
| *Strongylura exilis* | California needlefish | 2 | 465-509 | 105-181 | 286.0 |
| *Anisotremus davidsonii* | sargo | 1 | 66 | 8.7 | 8.7 |
| *Engraulis mordax* | northern anchovy | 1 | 40 | 0.7 | 0.7 |
| *Hypsoblennius gentilis* | bay blenny | 1 | 40 | 1.5 | 1.5 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 73 | 6.9 | 6.9 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 76 | 8.7 | 8.7 |
| *Syngnathus leptorhynchus* | bay pipefish | 1 | 223 | 2.9 | 2.9 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 7 | 119-250 | 100-541 | 2,377.5 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 6 | 15-56 | 2.1-21.8 | 43.0 |
| *Pachygrapsus crassipes* | striped shore crab | 4 | 12-36 | 1.3-27.9 | 59.8 |
| *Octopus* spp. | octopus | 1 | 110 | 226.0 | 225.6 |
| | **Total:** | **211** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

Survey: EPSIA048
Sample Count: 19

Survey Date: May 18 - 19, 2005

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 211 | 30-127 | 0.5-34.9 | 782.1 |
| *Phanerodon furcatus* | white surfperch | 21 | 31-72 | 0.8-7.1 | 66.6 |
| *Anchoa compressa* | deepbody anchovy | 11 | 62-116 | 2.8-18.1 | 102.1 |
| *Hyperprosopon argenteum* | walleye surfperch | 11 | 33-117 | 0.8-31.2 | 69.0 |
| *Atherinops affinis* | topsmelt | 9 | 31-134 | 7.6-24.5 | 138.8 |
| *Porichthys myriaster* | specklefin midshipman | 9 | 245-315 | 167-392 | 2,419.8 |
| *Paralabrax nebulifer* | barred sand bass | 4 | 65-73 | 4.4-7.2 | 23.5 |
| *Seriphus politus* | queenfish | 4 | 70-83 | 4.8-8.4 | 25.2 |
| *Roncador stearnsi* | spotfin croaker | 3 | 59-76 | 3.5-7.4 | 16.9 |
| *Anchoa delicatissima* | slough anchovy | 2 | 65-77 | 3.4-4.8 | 8.2 |
| *Heterostichus rostratus* | giant kelpfish | 2 | 63-87 | 1.7-4.0 | 5.7 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 2 | 68-69 | 6.2-6.7 | 12.9 |
| *Anchoa* spp. | anchovy | 1 | - | 1.8 | 1.8 |
| *Anisotremus davidsonii* | sargo | 1 | 74 | 10.3 | 10.3 |
| *Atractoscion nobilis* | white seabass | 1 | 155 | 37.2 | 37.2 |
| *Citharichthys stigmaeus* | speckled sanddab | 1 | 63 | 3.6 | 3.6 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 53 | 3.6 | 3.6 |
| *Leuresthes tenuis* | California grunion | 1 | 40 | 0.7 | 0.7 |
| *Paralichthys californicus* | California halibut | 1 | 50 | 1.5 | 1.5 |
| *Strongylura exilis* | California needlefish | 1 | 470 | 145.0 | 145.2 |
| *Syngnathus leptorhynchus* | bay pipefish | 1 | 221 | 1.9 | 1.9 |
| *Umbrina roncador* | yellowfin croaker | 1 | 95 | 14.1 | 14.1 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 13 | 74-200 | 23.7-504 | 3,456.7 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 11 | 12-24 | 1.2-9.7 | 42.6 |
| *Portunus xantusii* | Xantus' swimming crab | 5 | 25-45 | 3.9-11.2 | 40.1 |
| *Cancer productus* | red rock crab | 1 | 24 | 2.2 | 2.2 |
| *Loxorhynchus crispatus* | moss crab | 1 | 5 | 0.2 | 0.2 |
| *Pugettia producta* | northern kelp crab | 1 | 20 | 5.2 | 5.2 |
| *Pugettia* spp. | kelp crabs | 1 | 23 | 6.3 | 6.3 |
| | **Total:** | **332** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA049** **Survey Date: May 25 - 26, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 94 | 33-110 | 0.9-30.1 | 539.1 |
| *Seriphus politus* | queenfish | 20 | 55-94 | 2.9-11.8 | 160.7 |
| *Anchoa compressa* | deepbody anchovy | 18 | 66-160 | 2.8-20.5 | 194.0 |
| *Atherinops affinis* | topsmelt | 14 | 47-132 | 1.0-32.8 | 151.8 |
| *Phanerodon furcatus* | white surfperch | 7 | 50-75 | 2.9-6.6 | 31.8 |
| *Hyperprosopon argenteum* | walleye surfperch | 6 | 55-147 | 3.6-88.1 | 184.8 |
| *Porichthys myriaster* | specklefin midshipman | 6 | 73-311 | 5.8-425 | 994.7 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 5 | 73-95 | 7.7-15.4 | 54.1 |
| *Roncador stearnsi* | spotfin croaker | 5 | 90-337 | 13.3-780 | 840.5 |
| *Amphistichus argenteus* | barred surfperch | 3 | 54-70 | 4.7-6.8 | 18.1 |
| *Anchoa delicatissima* | slough anchovy | 2 | 61-63 | 2.7-3.1 | 5.8 |
| *Strongylura exilis* | California needlefish | 2 | 281-367 | 22.8-58.4 | 81.2 |
| *Anisotremus davidsonii* | sargo | 1 | 81 | 11.9 | 11.9 |
| *Rhacochilus vacca* | pile surfperch | 1 | 71 | 10.1 | 10.1 |
| *Embiotoca jacksoni* | black surfperch | 1 | 65 | 7.1 | 7.1 |
| *Engraulis mordax* | northern anchovy | 1 | 77 | 3.3 | 3.3 |
| *Paralabrax clathratus* | kelp bass | 1 | 65 | 4.8 | 4.8 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 62 | 4.3 | 4.3 |
| *Paralabrax nebulifer* | barred sand bass | 1 | 111 | 30.4 | 30.4 |
| *Paralichthys californicus* | California halibut | 1 | 117 | 22.2 | 22.2 |
| *Sardinops sagax* | Pacific sardine | 1 | 165 | 47.7 | 47.7 |
| *Syngnathus* spp. | pipefishes | 1 | 85 | 0.2 | 0.2 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 2 | 119-176 | 87.3-378 | 465.1 |
| *Gymnura marmorata* | California butterfly ray | 1 | 395 | 581 | 580.9 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 13 | 10-40 | 0.4-40.0 | 82.6 |
| *Portunus xantusii* | Xantus' swimming crab | 5 | 23-29 | 1.1-5.7 | 18.2 |
| *Cancer productus* | red rock crab | 2 | 26-30 | 2.5-3.7 | 6.2 |
| | **Total:** | **215** | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA050** **Survey Date: June 1 - 2, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 140 | 27-110 | 1.2-29.4 | 693.4 |
| *Phanerodon furcatus* | white surfperch | 19 | 51-78 | 3.1-8.7 | 115.6 |
| *Atherinops affinis* | topsmelt | 11 | 86-130 | 4.6-26.9 | 105.4 |
| *Anchoa compressa* | deepbody anchovy | 9 | 76-105 | 4.8-14.2 | 90.2 |
| *Porichthys myriaster* | specklefin midshipman | 6 | 240-280 | 134-281 | 1,152.8 |
| *Seriphus politus* | queenfish | 6 | 38-81 | 0.7-7.6 | 17.7 |
| *Anchoa delicatissima* | slough anchovy | 5 | 35-67 | 0.8-3.2 | 8.2 |
| *Hyperprosopon argenteum* | walleye surfperch | 5 | 51-60 | 3.6-5.3 | 22.8 |
| *Paralichthys californicus* | California halibut | 4 | 40-155 | 2.9-41.1 | 106.3 |
| *Citharichthys stigmaeus* | speckled sanddab | 3 | 41-71 | 1.0-5.7 | 10.5 |
| *Paralabrax clathratus* | kelp bass | 3 | 57-75 | 3.8-6.2 | 15.8 |
| *Genyonemus lineatus* | white croaker | 2 | 82-86 | 9.0-10.7 | 19.7 |
| *Heterostichus rostratus* | giant kelpfish | 2 | 75-122 | 2.8-12.0 | 14.8 |
| *Paralabrax nebulifer* | barred sand bass | 2 | 63 | 4.2-5.9 | 10.1 |
| *Atractoscion nobilis* | white seabass | 1 | 441 | 980 | 980.0 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 55 | 3.0 | 3.0 |
| *Leuresthes tenuis* | California grunion | 1 | 51 | 1.1 | 1.1 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 250 | 293.0 | 292.5 |
| *Sardinops sagax* | Pacific sardine | 1 | 40 | 1.0 | 1.0 |
| **SHARKS/RAYS** | | | | | |
| *Gymnura marmorata* | California butterfly ray | 2 | 226-339 | 119-274 | 393.0 |
| *Urolophus halleri* | round stingray | 2 | 171-297 | 276-460 | 735.7 |
| *Myliobatis californica* | bat ray | 1 | 940 | 975 | 975.0 |
| *Rhinobatos productus* | shovelnose guitarfish | 1 | 374 | 160.8 | 160.8 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 10 | 12-25 | 1.5-3.6 | 26.9 |
| *Pyromaia tuberculata* | tuberculate pea crab | 4 | 10-18 | 1.0-3.3 | 7.8 |
| *Portunus xantusii* | Xantus' swimming crab | 2 | 30-37 | 3.9-8.6 | 12.5 |
| *Cancer* spp. | cancer crabs | 1 | 28 | 3.0 | 3.0 |
| Majidae | spider crabs | 1 | 13 | 1.8 | 1.8 |
| *Pugettia* spp. | kelp crabs | 1 | 11 | 0.9 | 0.9 |
| | **Total:** | 247 | | | |

## Encina Power Station Impingement Abundance: Traveling Screen and Bar Rack Survey Data

**Survey: EPSIA051** **Survey Date: June 8 - 9, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 129 | 30-93 | 1.1-19.1 | 491.1 |
| *Atherinops affinis* | topsmelt | 28 | 18-209 | 0.8-51.2 | 366.3 |
| *Anchoa compressa* | deepbody anchovy | 14 | 24-82 | 0.4-7.3 | 28.5 |
| *Paralichthys californicus* | California halibut | 11 | 50-128 | 2.1-30.3 | 163.3 |
| *Engraulis mordax* | northern anchovy | 10 | 36-110 | 0.2-10.5 | 19.9 |
| *Seriphus politus* | queenfish | 10 | 68-110 | 4.6-19.2 | 95.4 |
| *Porichthys myriaster* | specklefin midshipman | 7 | 235-413 | 156-739 | 1,796.8 |
| *Phanerodon furcatus* | white surfperch | 4 | 48-67 | 3.2-7.6 | 19.6 |
| *Amphistichus argenteus* | barred surfperch | 3 | 60-74 | 5.5-10.9 | 25.7 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 3 | 81-85 | 8.5-13.7 | 35.3 |
| *Strongylura exilis* | California needlefish | 3 | 368-534 | 42.3-225 | 430.6 |
| *Heterostichus rostratus* | giant kelpfish | 2 | 80-95 | 3.6-6.0 | 9.6 |
| *Sardinops sagax* | Pacific sardine | 2 | 131-132 | 23.7-25.6 | 49.3 |
| *Anchoa* spp. | anchovy | 1 | - | 8.5 | 8.5 |
| *Hyperprosopon argenteum* | walleye surfperch | 1 | 57 | 4.2 | 4.2 |
| *Hypsoblennius gentilis* | bay blenny | 1 | 69 | 6.4 | 6.4 |
| *Hypsopsetta guttulata* | diamond turbot | 1 | 54 | 3.7 | 3.7 |
| **SHARKS/RAYS** | | | | | |
| *Myliobatis californica* | bat ray | 2 | 206-255 | 188-290 | 477.8 |
| *Ophichthus zophochir* | yellow snake eel | 1 | 787 | 595.0 | 594.6 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 5 | 18-20 | 0.9-5.5 | 13.0 |
| | **Total:** | 239 | | | |

**Survey: EPSIA052** **Survey Date: June 15 - 16, 2005**
**Sample Count: 19**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 19 | 45-109 | 2.2-25.2 | 105.4 |
| *Engraulis mordax* | northern anchovy | 4 | 59-67 | 1.0-2.6 | 7.4 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 230-290 | 142-243 | 594.3 |
| *Atherinops affinis* | topsmelt | 2 | 90-95 | 4.5-5.3 | 9.8 |
| *Heterostichus rostratus* | giant kelpfish | 2 | 61-95 | 1.3-5.6 | 6.9 |
| *Anchoa compressa* | deepbody anchovy | 1 | - | 4.2 | 4.2 |
| *Atractoscion nobilis* | white seabass | 1 | 340 | 411 | 411.0 |
| *Citharichthys stigmaeus* | speckled sanddab | 1 | 70 | 4.9 | 4.9 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 1 | 300 | 761.0 | 761.4 |
| *Phanerodon furcatus* | white surfperch | 1 | 60 | 5.8 | 5.8 |
| *Seriphus politus* | queenfish | 1 | 50 | 1.6 | 1.6 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 7 | 15-27 | 0.5-6.6 | 18.4 |
| *Portunus xantusii* | Xantus' swimming crab | 1 | 35 | 6.1 | 6.1 |
| | **Total:** | 45 | | | |

## Encina Power Station Impingement Abundance: Heat Treatment Survey Data

**Survey: EPSTS001**
**Survey Date: July 03-04, 2004**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 6,554 | 47-115 | 2.9-31.1 | 31,301.3 |
| *Anchoa compressa* | deepbody anchovy | 6,439 | 65-120 | 2.2-20.5 | 61,726.7 |
| *Atherinops affinis* | topsmelt | 5,061 | 52-108 | 1.1-15.0 | 16,090.2 |
| *Sardinops sagax* | Pacific sardine | 4,401 | 47-106 | 0.8-8.5 | 8,798.2 |
| *Heterostichus rostratus* | giant kelpfish | 532 | 47-122 | 1.1-19.4 | 3,587.8 |
| *Atractoscion nobilis* | white seabass | 75 | 108-366 | 19.0-650 | 16,045.0 |
| *Girella nigricans* | opaleye | 72 | 44-221 | 3.0-390 | 6,223.0 |
| *Seriphus politus* | queenfish | 54 | 83-188 | 8.0-80.0 | 2,293.0 |
| *Strongylura exilis* | California needlefish | 53 | 102-630 | 1.0-480 | 806.0 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 49 | 100-358 | 30.0-980 | 8,941.7 |
| *Embiotoca jacksoni* | black surfperch | 39 | 82-197 | 17.0-270 | 1,754.0 |
| *Porichthys myriaster* | specklefin midshipman | 28 | 124-403 | 140-820 | 8,733.0 |
| *Chromis punctipinnis* | blacksmith | 26 | 65-163 | 6.0-140 | 720.0 |
| *Hypsoblennius gentilis* | bay blenny | 26 | 40-91 | 3.0-25.0 | 354.3 |
| *Syngnathus* spp. | pipefishes | 25 | 128-251 | 1.0-3.0 | 29.3 |
| *Hypsoblennius* spp. | blennies | 23 | 35-54 | 1.0-3.0 | 46.7 |
| *Ophichthus zophochir* | yellow snake eel | 14 | 488-790 | 110-650 | 4,750.0 |
| *Roncador stearnsi* | spotfin croaker | 12 | 80-145 | 11.0-48.0 | 395.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 8 | 78-150 | 12.0-60.0 | 366.0 |
| *Paralabrax nebulifer* | barred sand bass | 8 | 119-252 | 40.0-320 | 819.0 |
| *Hypsopsetta guttulata* | diamond turbot | 4 | 195-228 | 210-300 | 980.0 |
| *Hypsypops rubicundus* | garibaldi | 3 | 122-169 | 73.0-230 | 523.0 |
| *Trachurus symmetricus* | jack mackerel | 3 | 111-142 | 17.0-40.0 | 78.0 |
| *Umbrina roncador* | yellowfin croaker | 2 | 137-150 | 43.0-61.0 | 104.0 |
| *Xenistius californiensis* | salema | 2 | 88-98 | 17.0-60.0 | 77.0 |
| *Anisotremus davidsonii* | sargo | 1 | 130 | 44.0 | 44.0 |
| *Cheilotrema saturnum* | black croaker | 1 | 48 | 3.0 | 3.0 |
| *Paraclinus integripinnis* | reef finspot | 1 | 49 | 3.0 | 3.0 |
| *Paralabrax clathratus* | kelp bass | 1 | 157 | 82.0 | 82.0 |
| *Pleuronichthys ritteri* | spotted turbot | 1 | 152 | 98.0 | 98.0 |
| Scorpaenidae | scorpionfishes | 1 | 122 | 62.0 | 62.0 |
| *Sphyraena argentea* | California barracuda | 1 | 91 | 5.0 | 5.0 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 439 | 125-230 | 100-700 | 118,655.1 |
| *Myliobatis californica* | bat ray | 64 | 221-660 | 140-4,700 | 29,566.1 |
| *Gymnura marmorata* | California butterfly ray | 12 | 240-550 | 120-950 | 4,321.8 |
| *Mustelus californicus* | gray smoothhound | 1 | 575 | 520 | 520.0 |
| *Triakis semifasciata* | leopard shark | 1 | 411 | 260 | 260.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 49 | 32-46 | 22.0-45.0 | 269.0 |
| *Octopus* spp. | octopus | 20 | - | 2,500.0 | 2,500.0 |
| *Pyromaia tuberculata* | tuberculate pea crab | 19 | - | - | - |
| *Panulirus interruptus* | California spiny lobster | 1 | 176 | 120 | 120.0 |
| *Pugettia* spp. | kelp crabs | 1 | 42 | 26.0 | 26.0 |
| | **Total:** | **24,127** | | | |

**Encina Power Station Impingement Abundance: Heat Treatment Survey Data**

**Survey: EPSTS002**
**Survey Date: August 28, 2004**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 5,324 | 72-120 | 5.9-20.9 | 59,754.9 |
| *Atherinops affinis* | topsmelt | 3,201 | 51-100 | 1.0-10.6 | 17,701.4 |
| *Cymatogaster aggregata* | shiner surfperch | 2,801 | 56-104 | 5.0-24.5 | 28,011.1 |
| *Sardinops sagax* | Pacific sardine | 1,206 | 65-130 | 1.8-25.0 | 7,355.5 |
| *Leuresthes tenuis* | California grunion | 998 | 43-115 | 0.8-10.4 | 2,058.8 |
| *Heterostichus rostratus* | giant kelpfish | 299 | 78-185 | 2.9-53.6 | 3,440.4 |
| *Seriphus politus* | queenfish | 265 | 65-225 | 2.3-172.3 | 12,690.8 |
| *Atractoscion nobilis* | white seabass | 64 | 115-265 | 40.4-260.7 | 7,425.4 |
| *Cheilotrema saturnum* | black croaker | 38 | 64-155 | 4.8-53.2 | 617.9 |
| *Strongylura exilis* | California needlefish | 27 | 109-478 | 1.0-145.2 | 1,624.8 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 20 | 43-335 | 1.5-925 | 7,724.0 |
| *Hypsoblennius jenkinsi* | mussel blenny | 18 | 39-95 | 0.8-14.7 | 97.8 |
| Sciaenidae unid. | croaker | 17 | 120-200 | 32.8-138.0 | 1,212.0 |
| *Chromis punctipinnis* | blacksmith | 15 | 55-165 | 7.0-105 | 458.8 |
| *Girella nigricans* | opaleye | 14 | 55-211 | 4.5-321 | 1,567.7 |
| *Scomber japonicus* | Pacific mackerel | 14 | 67-187 | 14.5-86.8 | 650.0 |
| *Hermosilla azurea* | zebra perch | 13 | 35-68 | 1.1-8.7 | 41.8 |
| *Hypsoblennius gentilis* | bay blenny | 11 | 42-95 | 1.4-15.5 | 99.5 |
| *Paralabrax nebulifer* | barred sand bass | 11 | 160-278 | 82.3-490 | 2,866.9 |
| *Syngnathus* spp. | pipefishes | 11 | 154-208 | 1.0-2.0 | 16.0 |
| *Ophichthus zophochir* | yellow snake eel | 10 | 262-900 | 7.6-750 | 4,045.4 |
| *Hypsoblennius gilberti* | rockpool blenny | 8 | 55-101 | 3.2-29.4 | 77.1 |
| *Paralichthys californicus* | California halibut | 8 | 201-322 | 142-600 | 2,482.0 |
| *Embiotoca jacksoni* | black surfperch | 7 | 70-345 | 15.0-500 | 1,049.7 |
| *Hypsoblennius* spp. | blennies | 7 | 45-85 | 1.3-10.5 | 20.6 |
| *Anisotremus davidsonii* | sargo | 6 | 38-180 | 1.0-142 | 389.3 |
| *Paralabrax* spp. | sand bass | 6 | 43-75 | 1.5-5.8 | 18.5 |
| *Xenistius californiensis* | salema | 6 | 87-132 | 11.4-34.5 | 117.0 |
| Atherinopsidae | silverside | 5 | 47-55 | 1.1-2.9 | 11.3 |
| *Pleuronichthys ritteri* | spotted turbot | 5 | 197-220 | 200-250 | 1,158.0 |
| *Seriola lalandi* | yellowtail jack | 4 | 33-99 | 1.0-32.0 | 56.0 |
| *Sphyraena argentea* | California barracuda | 4 | 245-268 | 55.9-78.2 | 272.6 |
| *Trachurus symmetricus* | jack mackerel | 4 | 90-160 | 7.1-46.8 | 105.6 |
| *Engraulis mordax* | northern anchovy | 3 | 64-65 | 1.8-2.2 | 5.9 |
| *Porichthys myriaster* | specklefin midshipman | 3 | 255-328 | 151-260 | 586.0 |
| *Umbrina roncador* | yellowfin croaker | 2 | 150-165 | 43.9-63.3 | 107.2 |
| unidentified fish, damaged | unidentified damaged fish | 2 | 165-308 | 21.6-200 | 221.6 |
| *Hyperprosopon argenteum* | walleye surfperch | 1 | 140 | 64.2 | 64.2 |
| *Menticirrhus undulatus* | California corbina | 1 | 510 | 1,600.0 | 1,600.0 |
| *Paralabrax clathratus* | kelp bass | 1 | 138 | 48.6 | 48.6 |
| *Peprilus simillimus* | Pacific butterfish | 1 | 117 | 33.4 | 33.4 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 198 | 198-355 | 75.0-412 | 39,361.7 |
| *Myliobatis californica* | bat ray | 31 | 230-484 | 200-900 | 12,310.0 |
| *Gymnura marmorata* | California butterfly ray | 3 | 265-460 | 120-700 | 1,220.0 |
| *Mustelus californicus* | gray smoothhound | 2 | 805-905 | 1,400-1,600 | 3,000.0 |
| *Dasyatis dipterura* | diamond stingray | 1 | 274 | 850 | 850.0 |

*(table continued)*

**Encina Power Station Impingement Abundance: Heat Treatment Survey Data**

**Survey: EPSTS002 (continued)**
**Survey Date: August 28, 2004**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| INVERTEBRATES | | | | | |
| *Lophopanopeus spp.* | black-clawed crabs | 26 | 10-16 | 0.3-1.8 | 27.1 |
| *Octopus* spp. | octopus | 17 | 27-470 | 1.1-450 | 1,851.3 |
| *Pachygrapsus crassipes* | striped shore crab | 15 | 17-35 | 2.3-24.1 | 139.7 |
| *Panulirus interruptus* | California spiny lobster | 6 | 180-211 | 125-229 | 944.9 |
| *Cancer spp.* | cancer crabs | 5 | 21-32 | 1.7-6.2 | 16.9 |
| *Pugettia producta* | northern kelp crab | 2 | 12.5-25 | 1.3-8.7 | 10.0 |
| *Pandalus* spp. | unidentified shrimp | 1 | 42 | 0.7 | 0.7 |
| | **Total:** | **14,768** | | | |

**Encina Power Station Impingement Abundance: Heat Treatment Survey Data**

**Survey: EPSTS003**
**Survey Date: October 23, 2004**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinopsis californiensis* | jacksmelt | 4,450 | 59-150 | 1.7-37.9 | 44,009.9 |
| *Leuresthes tenuis* | California grunior | 4,296 | 56-124 | 1.5-22.5 | 25,732.5 |
| *Anchoa compressa* | deepbody anchovy | 1,694 | 67-114 | 3.7-19.8 | 20,669.4 |
| *Xenistius californiensis* | salema | 718 | 40-68 | 1.4-7.7 | 1,510.9 |
| *Cymatogaster aggregata* | shiner surfperch | 512 | 58-96 | 4.5-20.5 | 6,092.9 |
| *Sardinops sagax* | Pacific sardine | 507 | 65-242 | 3.2-150 | 6,274.8 |
| *Cheilotrema saturnum* | black croaker | 249 | 93-132 | 16.8-61.5 | 8,408.2 |
| *Paralabrax nebulifer* | barred sand bass | 207 | 55-173 | 4.5-160.7 | 4,308.5 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 188 | 45-170 | 2.1-122.3 | 3,038.3 |
| *Anisotremus davidsonii* | sargo | 185 | 54-95 | 2.6-28.8 | 1,974.4 |
| *Paralabrax clathratus* | kelp bass | 128 | 28-96 | 0.6-23.2 | 876.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 116 | 90-152 | 30.6-118.5 | 8,891.7 |
| *Atractoscion nobilis* | white seabass | 100 | 140-264 | 90.0-320 | 18,017.0 |
| *Hypsoblennius* spp. | blennies | 83 | - | - | 422.0 |
| *Hypsoblennius jenkinsi* | mussel blenny | 65 | 30-80 | 2.0-16.0 | 332.0 |
| *Engraulis mordax* | northern anchovy | 59 | 64-82 | 2.4-4.9 | 194.9 |
| *Heterostichus rostratus* | giant kelpfish | 58 | 80-200 | 5.1-79.4 | 1,531.1 |
| *Medialuna californiensis* | halfmoon | 49 | 43-117 | 2.5-54.6 | 1,278.5 |
| *Seriphus politus* | queenfish | 43 | 40-160 | 1.0-80.0 | 1,428.0 |
| *Hermosilla azurea* | zebra perch | 36 | 37-71 | 1.7-11.4 | 216.0 |
| *Sphyraena argentea* | California barracuda | 36 | 135-233 | 16.9-74.4 | 1,250.4 |
| *Girella nigricans* | opaleye | 24 | 49-256 | 2.8-740 | 6,270.3 |
| *Seriola lalandi* | yellowtail jack | 17 | 80-194 | 7.8-145.7 | 922.3 |
| *Strongylura exilis* | California needlefish | 17 | 400-574 | 80.0-360 | 2,650.0 |
| *Ophichthus zophochir* | yellow snake eel | 13 | 560-790 | 170-520 | 4,589.0 |
| *Phanerodon furcatus* | white surfperch | 11 | 69-120 | 8.6-39.3 | 195.0 |
| *Chromis punctipinnis* | blacksmith | 10 | 47-83 | 6.1-13.1 | 96.2 |
| *Hyperprosopon* spp. | surfperch | 7 | - | - | 552.0 |
| *Embiotoca jacksoni* | black surfperch | 6 | 78-163 | 13.7-171.1 | 525.3 |
| *Fundulus parvipinnis* | California killifish | 3 | - | - | 6.9 |
| *Menticirrhus undulatus* | California corbina | 3 | 210-340 | 110-550 | 860 |
| *Amphistichus argenteus* | barred surfperch | 1 | 96 | 25.4 | 25.4 |
| *Hyporhamphus rosae* | California halfbeak | 1 | - | - | - |
| *Mugil cephalus* | striped mullet | 1 | 152 | 53.9 | 53.9 |
| *Pleuronichthys ritteri* | spotted turbot | 1 | 185 | 180 | 180.0 |
| *Sarda chiliensis* | Pacific bonito | 1 | 340 | 540 | 540.0 |
| *Scomber japonicus* | Pacific mackerel | 1 | 250 | 230 | 230.0 |
| *Trachurus symmetricus* | jack mackerel | 1 | 144 | 39.6 | 39.6 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 55 | 230-350 | 130-560 | 13,610.0 |
| *Myliobatis californica* | bat ray | 4 | 280-480 | 320-1,700 | 2,930.0 |
| *Mustelus californicus* | gray smoothhound | 1 | 790 | 1,500.0 | 1,500.0 |
| **INVERTEBRATES** | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 375 | 20-40 | 1.5-10.1 | 2,489.6 |
| *Octopus bimaculatus* | California two-spot octopus | 74 | - | 2.1-230 | 2,805.9 |
| *Octopus* spp. | octopus | 36 | - | 1,562.0 | 1,562.0 |
| *Cancer antennarius* | brown rock crab | 18 | - | 18.0 | 18.0 |
| *Cancer productus* | red rock crab | 11 | 15-55 | 1.2-10.5 | 40.0 |
| *Pilumnus spinohirsutus* | retiring hairycrab | 4 | 9-23 | 0.6-2.5 | 4.6 |
| *Pugettia producta* | northern kelp crab | 4 | 21-28 | 1.7-4.3 | 11.3 |
| *Portunus xantusii* | Xantus' swimming crab | 2 | 45 | 4.0-6.1 | 10.1 |
| *Panulirus interruptus* | California spiny lobster | 1 | 21 | 8.1 | 8.1 |
| | **Total:** | **14,482** | | | |

**Encina Power Station Impingement Abundance: Heat Treatment Survey Data**

**Survey: EPSTS004**
**Survey Date: February 13-14, 2005**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Atherinops affinis* | topsmelt | 3,847 | 62-151 | 1.5-90.0 | 17,444.3 |
| Atherinopsidae | silverside | 2,100 | - | - | 8,650.0 |
| *Hyperprosopon argenteum* | walleye surfperch | 1,828 | 110-177 | 34.9-135 | 80,128.0 |
| *Atractoscion nobilis* | white seabass | 1,375 | 104-352 | 65.5-600 | 289,213.3 |
| *Anchoa compressa* | deepbody anchovy | 643 | 58-122 | 1.9-18.8 | 5,786.5 |
| *Xenistius californiensis* | salema | 602 | 43-70 | 1.4-10.0 | 2,102.3 |
| *Sardinops sagax* | Pacific sardine | 437 | 45-184 | 1.6-71.0 | 3,190.0 |
| *Paralabrax nebulifer* | barred sand bass | 416 | 50-127 | 2.4-43.4 | 3,323.5 |
| *Cymatogaster aggregata* | shiner surfperch | 343 | 11-134 | 1.1-72.8 | 10,082.7 |
| *Leuresthes tenuis* | California grunion | 330 | 56-82 | 1.4-4.8 | 706.0 |
| *Paralabrax clathratus* | kelp bass | 293 | 53-102 | 2.2-20.5 | 2,397.8 |
| *Hypsoblennius gentilis* | bay blenny | 288 | 38-102 | 1.3-23.7 | 1,334.3 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 271 | 43-265 | 1.4-440 | 3,222.3 |
| *Anisotremus davidsonii* | sargo | 195 | 49-352 | 3.4-1,300 | 33,558.2 |
| *Girella nigricans* | opaleye | 171 | 28-240 | 1.6-510 | 2,674.8 |
| *Seriphus politus* | queenfish | 57 | 38-292 | 0.1-225 | 641.0 |
| *Atherinopsis californiensis* | jacksmelt | 18 | 112-299 | 10.9-210 | 1,142.0 |
| *Roncador stearnsi* | spotfin croaker | 13 | 238-555 | 300-3,400 | 13,831.0 |
| *Hypsopsetta guttulata* | diamond turbot | 12 | 36-246 | 1.0-350 | 2,694.6 |
| *Syngnathus* spp. | pipefishes | 12 | 146-233 | 0.3-4.4 | 20.5 |
| *Chromis punctipinnis* | blacksmith | 11 | 46-102 | 2.2-79.5 | 179.2 |
| *Ophichthus zophochir* | yellow snake eel | 11 | 394-758 | 32.7-470 | 3,222.7 |
| *Embiotoca jacksoni* | black surfperch | 10 | 105-255 | 40.9-600 | 1,403.2 |
| *Amphistichus argenteus* | barred surfperch | 9 | 96-227 | 27.3-377.6 | 680.4 |
| *Heterostichus rostratus* | giant kelpfish | 9 | 90-225 | 5.1-110.0 | 322.1 |
| *Genyonemus lineatus* | white croaker | 8 | 80-95 | 8.2-14.3 | 68.8 |
| *Anchoa delicatissima* | slough anchovy | 7 | 51-60 | 0.9-1.9 | 9.7 |
| Chub, unid. | unid. chub | 7 | 68-81 | 4.5-7.8 | 43.7 |
| *Hermosilla azurea* | zebra perch | 7 | 50-365 | 2.8-590 | 2,481.3 |
| *Brachyistius frenatus* | kelp surfperch | 6 | 76-120 | 11.0-55.8 | 198.4 |
| *Engraulis mordax* | northern anchovy | 6 | 80-125 | 3.8-15.2 | 54.1 |
| *Pleuronichthys ritteri* | spotted turbot | 5 | 200-230 | 215-250 | 1,145.0 |
| *Mugil cephalus* | striped mullet | 4 | 345-400 | 800-1,100 | 3,800.0 |
| *Phanerodon furcatus* | white surfperch | 4 | 112-126 | 37.7-55.0 | 190.4 |
| *Umbrina roncador* | yellowfin croaker | 4 | 185-280 | 70.0-300 | 730.0 |
| *Paraclinus integripinnis* | reef finspot | 3 | 58-70 | 2.0-4.0 | 9.2 |
| *Paralichthys californicus* | California halibut | 3 | 222-350 | 113-700 | 1,433.0 |
| *Sphyraena argentea* | California barracuda | 3 | 167-222 | 21.9-65.0 | 127.6 |
| *Trachurus symmetricus* | jack mackerel | 3 | 95-110 | 10.0-17.0 | 42.4 |
| *Fundulus parvipinnis* | California killifish | 2 | 7.5-7.8 | 0.4 | 0.8 |
| *Porichthys myriaster* | specklefin midshipman | 2 | 395-396 | 820-900 | 1,720.0 |
| *Strongylura exilis* | California needlefish | 2 | 480-490 | 120-150 | 270.0 |
| *Albula vulpes* | bonefish | 1 | 380 | 900 | 900.0 |
| *Citharichthys* spp. | sanddabs | 1 | - | 3.4 | 3.4 |
| *Medialuna californiensis* | halfmoon | 1 | 234 | 410 | 410.0 |
| *Sarda chiliensis* | Pacific bonito | 1 | - | 0.1 | 0.1 |
| Scorpaenidae | scorpionfishes | 1 | 44 | 1.9 | 1.9 |
| unidentified fish, damaged | unidentified damaged fish | - | - | - | 1,543.2 |

*(table continued)*

**Encina Power Station Impingement Abundance: Heat Treatment Survey Data**

**Survey: EPSTS004 (continued)**
**Survey Date: February 13-14, 2005**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 10 | 135-245 | 101-530 | 2,576.1 |
| *Myliobatis californica* | bat ray | 4 | 335-460 | 200-1,500 | 3,130.0 |
| *Gymnura marmorata* | California butterfly ray | 2 | 430-450 | 800 | 1,600.0 |
| **INVERTEBRATES** | | | | | |
| *Portunus xantusii* | Xantus' swimming crab | 44 | 20-67 | 1.1-34.4 | 337.5 |
| *Cancer jordani* | hairy rock crab | 18 | 28-47 | 3.2-16.3 | 85.5 |
| *Octopus bimaculatus* | California two-spot octopus | 11 | 19-180 | 12-590 | 2,424.3 |
| *Pachygrapsus crassipes* | striped shore crab | 9 | 13-23 | 1.0-4.4 | 16.6 |
| *Cancer antennarius* | brown rock crab | 8 | 40-50 | 14.9-27.8 | 138.2 |
| *Cancer magister* | dungeness crab | 1 | 50 | 18.1 | 18.1 |
| Caridean unid. | unidentified shrimp | 1 | - | - | - |
| *Octopus* spp. | octopus | 1 | 30 | 300 | 300.0 |
| *Pandalus* spp. | unidentified shrimp | 1 | 12 | 2.3 | 2.3 |
| *Panulirus interruptus* | California spiny lobster | 1 | 93 | 150 | 150.0 |
| *Pugettia producta* | northern kelp crab | 1 | 17 | 1.8 | 1.8 |
| | **Total:** | **13,494** | | | |

**Encina Power Station Impingement Abundance: Heat Treatment Survey Data**

**Survey: EPSTS005**
**Survey Date: April 10, 2005**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| FISHES | | | | | |
| *Cymatogaster aggregata* | shiner surfperch | 2,372 | 90-120 | 18.0-46.0 | 93,799.4 |
| *Leuresthes tenuis* | California grunion | 1,443 | 75-145 | 3.5-37.9 | 12,351.6 |
| *Anchoa compressa* | deepbody anchovy | 1,112 | 58-120 | 2.0-21.0 | 10,598.8 |
| *Paralabrax nebulifer* | barred sand bass | 508 | 54-97 | 2.6-98.0 | 4,270.9 |
| *Seriphus politus* | queenfish | 306 | 56-152 | 3.1-49.6 | 2,284.2 |
| *Hyperprosopon argenteum* | walleye surfperch | 298 | 101-167 | 30.2-119 | 19,132.6 |
| *Paralabrax clathratus* | kelp bass | 181 | 50-94 | 3.4-18.3 | 1,546.0 |
| *Anisotremus davidsonii* | sargo | 180 | 55-100 | 3.6-30.3 | 22,582.2 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 139 | 50-185 | 3.0-140.3 | 2,564.2 |
| *Hypsoblennius jenkinsi* | mussel blenny | 92 | 25-90 | 1.1-11.6 | 516.3 |
| *Umbrina roncador* | yellowfin croaker | 90 | 73-290 | 7.4-474.2 | 20,568.5 |
| *Xenistius californiensis* | salema | 90 | 50-74 | 2.1-7.4 | 409.2 |
| *Girella nigricans* | opaleye | 72 | 33-197 | 1.4-309 | 13,859.1 |
| *Hypsopsetta guttulata* | diamond turbot | 51 | 75-260 | 11.2-424 | 11,199.9 |
| *Hypsoblennius gentilis* | bay blenny | 27 | 65-105 | 4.5-23.5 | 172.7 |
| *Porichthys myriaster* | specklefin midshipman | 24 | 320-440 | 100-1,300 | 20,380.0 |
| *Amphistichus argenteus* | barred surfperch | 19 | 110-130 | 26.2-66.4 | 1,562.7 |
| *Chromis punctipinnis* | blacksmith | 12 | 60-115 | 6.4-41.2 | 294.7 |
| *Brachyistius frenatus* | kelp surfperch | 9 | 95-145 | 20.9-65.7 | 324.9 |
| *Strongylura exilis* | California needlefish | 9 | 336-490 | 45.5-148.4 | 733.3 |
| *Engraulis mordax* | northern anchovy | 7 | 67-120 | 2.9-16.5 | 41.6 |
| *Hermosilla azurea* | zebra perch | 6 | 104-249 | 16.2-535 | 778.7 |
| *Syngnathus* spp. | pipefishes | 5 | 160-340 | 1.4-12.5 | 20.4 |
| *Roncador stearnsi* | spotfin croaker | 4 | 85-285 | 10.5-407 | 574.8 |
| *Atractoscion nobilis* | white seabass | 3 | 251-320 | 211-440 | 1,010.5 |
| *Embiotoca jacksoni* | black surfperch | 3 | 55-138 | 5.0-103 | 199.6 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 3 | 60-65 | 3.0-5.0 | 12.9 |
| *Medialuna californiensis* | halfmoon | 3 | 117-147 | 43.6-77.6 | 175.5 |
| *Trachurus symmetricus* | jack mackerel | 3 | 115-430 | 15.9-270 | 360.5 |
| *Ophichthus zophochir* | yellow snake eel | 2 | 379-664 | 29.4-319 | 348.7 |
| *Citharichthys stigmaeus* | speckled sanddab | 1 | 115 | 29.5 | 29.5 |
| *Fundulus parvipinnis* | California killifish | 1 | 53 | 3.2 | 3.2 |
| *Genyonemus lineatus* | white croaker | 1 | 79 | 10.0 | 10.0 |
| *Halichoeres semicinctus* | rock wrasse | 1 | 124 | 32.5 | 32.5 |
| *Heterostichus rostratus* | giant kelpfish | 1 | 176 | 46.1 | 46.1 |
| *Menticirrhus undulatus* | California corbina | 1 | 305 | 430 | 430.0 |
| *Phanerodon furcatus* | white surfperch | 1 | 115 | 56.0 | 56.0 |
| *Pleuronichthys ritteri* | spotted turbot | 1 | 175 | 163.7 | 163.7 |
| *Pleuronichthys verticalis* | hornyhead turbot | 1 | 55 | 3.7 | 3.7 |
| SHARKS/RAYS | | | | | |
| *Urolophus halleri* | round stingray | 25 | 100-450 | 50.0-634 | 8,199.8 |
| *Gymnura marmorata* | California butterfly ray | 12 | 256-568 | 150-1,714 | 6,682.1 |
| *Myliobatis californica* | bat ray | 6 | 258-420 | 230-2,189 | 5,049.5 |
| *Heterodontus francisci* | horn shark | 1 | 460 | 850 | 850.0 |
| *Mustelus californicus* | gray smoothhound | 1 | 975 | 1,800.0 | 1,800.0 |

*(table continued)*

**Encina Power Station Impingement Abundance: Heat Treatment Survey Data**

**Survey: EPSTS005 (continued)**
**Survey Date: April 10, 2005**

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| INVERTEBRATES | | | | | |
| *Pachygrapsus crassipes* | striped shore crab | 38 | 8-43 | 0.1-45.1 | 125.2 |
| *Cancer spp.* | cancer crabs | 31 | 20-30 | 1.2-3.4 | 70.4 |
| *Portunus xantusii* | Xantus' swimming crab | 13 | 20-50 | 2.1-18.1 | 95.4 |
| *Octopus bimaculatus* | California two-spot octopus | 6 | 25-80 | 5.6-100 | 233.7 |
| *Pugettia producta* | northern kelp crab | 2 | 20-30 | 4.0-11.5 | 15.5 |
| *Cancer antennarius* | brown rock crab | 1 | 46 | 14.2 | 14.2 |
| *Crangon nigromaculata* | spotted bay shrimp | 1 | 60 | 3.7 | 3.7 |
| | **Total:** | 7,219 | | | |

## Encina Power Station Impingement Abundance: Heat Treatment Survey Data

Survey: EPSTS006
Survey Date: June 05, 2005

| Taxon | Common Name | Survey Count | Length Range (mm) | Weight Range (g) | Total Weight (g) |
|---|---|---|---|---|---|
| **FISHES** | | | | | |
| *Anchoa compressa* | deepbody anchovy | 8,144 | 29-130 | 1.3-24.3 | 95,729.6 |
| *Cymatogaster aggregata* | shiner surfperch | 5,779 | 37-100 | 1.1-28.1 | 50,780.1 |
| *Atherinops affinis* | topsmelt | 3,587 | 30-105 | 0.2-12.5 | 16,261.1 |
| *Paralabrax maculatofasciatus* | spotted sand bass | 869 | 52-204 | 3.2-255 | 82,072.6 |
| *Paralabrax nebulifer* | barred sand bass | 843 | 60-115 | 5.4-42.0 | 17,169.5 |
| *Anisotremus davidsonii* | sargo | 396 | 44-135 | 1.2-42.6 | 9,980.1 |
| *Paralabrax clathratus* | kelp bass | 372 | 45-136 | 2.1-63.1 | 8,328.2 |
| *Hyperprosopon argenteum* | walleye surfperch | 296 | 20-159 | 0.3-300 | 16,851.8 |
| *Seriphus politus* | queenfish | 204 | 26-170 | 2.1-105 | 2,053.4 |
| *Porichthys myriaster* | specklefin midshipmar | 161 | 190-440 | 49.3-1,085 | 35,440.5 |
| *Xenistius californiensis* | salema | 159 | 45-175 | 4.7-60.5 | 1,937.9 |
| *Hypsoblennius gentilis* | bay blenny | 88 | 50-100 | 2.4-19.0 | 853.0 |
| *Chromis punctipinnis* | blacksmith | 77 | 60-186 | 8.0-100 | 2,682.2 |
| *Roncador stearnsi* | spotfin croaker | 77 | 85-140 | 15.1-55.2 | 2,359.5 |
| *Strongylura exilis* | California needlefist | 50 | 260-543 | 28.4-294 | 5,815.3 |
| *Hypsopsetta guttulata* | diamond turbot | 45 | 121-300 | 146-374 | 9,509.2 |
| *Phanerodon furcatus* | white surfperch | 37 | 60-100 | 5.0-23.1 | 381.5 |
| *Umbrina roncador* | yellowfin croaker | 29 | 95-125 | 16.3-42.7 | 889.7 |
| *Sardinops sagax* | Pacific sardine | 27 | 70-178 | 1.8-56.5 | 648.0 |
| *Engraulis mordax* | northern anchovy | 17 | 36-129 | 0.7-19.4 | 77.5 |
| *Menticirrhus undulatus* | California corbina | 11 | 125-388 | 30.4-806 | 2,034.7 |
| *Fundulus parvipinnis* | California killifish | 10 | - | - | 30.2 |
| *Paralichthys californicus* | California halibut | 10 | 72-264 | 6.7-172 | 854.2 |
| *Heterostichus rostratus* | giant kelpfish | 9 | 60-203 | 1.1-75.2 | 160.8 |
| *Amphistichus argenteus* | barred surfperch | 5 | 60-160 | 6.2-75.2 | 259.3 |
| *Embiotoca jacksoni* | black surfperch | 4 | 65-155 | 15.2-151 | 435.1 |
| *Syngnathus* spp. | pipefishes | 3 | 20-217 | 0.4-1.8 | 3.8 |
| *Brachyistius frenatus* | kelp surfperch | 2 | 115-130 | 23.1-51.9 | 75.0 |
| *Girella nigricans* | opaleye | 2 | 160-180 | 87.6-140.9 | 228.5 |
| *Hypsypops rubicundus* | garibaldi | 2 | 222-232 | 668-705 | 1,373.7 |
| *Leptocottus armatus* | Pacific staghorn sculpin | 2 | 75 | 5.2-8.3 | 13.5 |
| *Sphyraena argentea* | California barracuda | 2 | 95-105 | 4.7-6.6 | 11.3 |
| *Atractoscion nobilis* | white seabass | 1 | 252 | 345.0 | 344.8 |
| *Ophichthus zophochir* | yellow snake eel | 1 | 650 | 347 | 347.0 |
| *Pleuronichthys verticalis* | hornyhead turbot | 1 | 197 | 248.0 | 247.7 |
| *Trachurus symmetricus* | jack mackerel | 1 | 200 | 75.8 | 75.8 |
| Zoarcidae | eelpouts | 1 | 152 | 17.1 | 17.1 |
| **SHARKS/RAYS** | | | | | |
| *Urolophus halleri* | round stingray | 363 | 105-239 | 54.3-800 | 118,389.8 |
| *Gymnura marmorata* | California butterfly ray | 41 | 244-609 | 182-1,629 | 22,997.3 |
| *Myliobatis californica* | bat ray | 23 | 226-649 | 205-1,925 | 15,585.9 |
| *Mustelus californicus* | gray smoothhound | 17 | 460-882 | 225-2,100 | 13,056.0 |
| *Dasyatis dipterura* | diamond stingray | 1 | 275 | 618.0 | 617.6 |
| *Triakis semifasciata* | leopard shark | 1 | 455 | 428.0 | 428.4 |
| **INVERTEBRATES** | | | | | |
| *Cancer productus* | red rock crab | 491 | 10-55 | 1.8-12.8 | 2,835.9 |
| *Pachygrapsus crassipes* | striped shore crab | 8 | 19-29 | 3.7-10.5 | 61.3 |
| Majidae | spider crabs | 6 | 10-15 | 2.1-5.2 | 20.2 |
| *Octopus* spp. | octopus | 2 | 20-45 | 9.7-86.2 | 95.9 |
| *Pugettia producta* | northern kelp crab | 2 | 22-30 | 2.4-5.4 | 7.8 |
| | **Total:** | **22,279** | | | |

ATTACHMENT 3

# PROPOSAL FOR INFORMATION COLLECTION
# CLEAN WATER ACT SECTION 316(B)

## ENCINA POWER STATION
## CABRILLO POWER I LLC

## NPDES PERMIT NO. CA0001350

## APRIL 1, 2006

# PROPOSAL FOR INFORMATION COLLECTION
# CLEAN WATER ACT SECTION 316(B)

## ENCINA POWER STATION
## CABRILLO POWER I LLC

## NPDES PERMIT NO. CA0001350

**Project No. 1009704003**

**April 1, 2006**

**Prepared for:**

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## Acronyms and Abbreviations

| | |
|---|---|
| AEL | Adult Equivalent Loss |
| AFC | Application for Certification |
| AHL | Agua Hedionda Lagoon |
| amsl | above mean sea level |
| BTA | Best Technology Available |
| CCC | California Coastal Commission |
| CDFG | California Department of Fish & Game |
| CDS | Comprehensive Demonstration Study |
| CEC | California Energy Commission |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| CWA | Clean Water Act |
| CWIS | Cooling Water Intake Structure |
| DCTP | Design & Construction Technology Plan |
| E | entrainment |
| EAM | Equivalent Adult Model |
| EPA | Environmental Protection Agency |
| EPRI | Electric Power Research Institute |
| EPS | Encina Power Station |
| ETM | Empirical Transport Model |
| FH | Fecundity Hindcasting |
| F&WS | Fish and Wildlife Service |

## *Acronyms and Abbreviations (continued)*

| | |
|---|---|
| fps | feet per second |
| gpm | gallons per minute |
| HEA | Habitat Equivalency Analysis |
| hrs | hours |
| IM&E | Impingement Mortality and/or Entrainment |
| JWPCP | Joint Water Pollution Control Plant |
| MBC | MBC Applied Environmental Sciences |
| MGD | million gallons per day |
| mi | miles |
| min | minute |
| MLES | Marine Life Exclusion System |
| MLLW | mean lower low water |
| mm | millimeter |
| MW | megawatt |
| N | North |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic & Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| NRDA | National Resources Defense Council |
| O&M | Operation and Maintenance |
| OBGS | Ormond Beach Generating Station |
| PIC | Proposal for Information Collection |
| psig | pounds per square inch gauge |
| QA/QC | Quality Assurance/Quality Control |
| RP | Restoration Plan |
| SAP | sampling and analysis plan |
| SCE | Southern California Edison |
| SDG&E | San Diego Gas and Electric Company |
| SDRWQCB | San Diego Regional Water Quality Control Board |
| SGS | Scattergood Generating Station |
| TAG | Technical Advisory Group |
| TDD | Technical Development Document |
| TIOP | Technology Installation & Operation Plan |
| USFWS | U.S. Fish & Wildlife Service |
| W | West |
| $y^3$ | cubic yard |
| °F | degrees Fahrenheit |

# 1.0 Introduction

Section 316(b) of the Clean Water Act (CWA) requires that the location, design, construction, and capacity of cooling water intake structures (CWIS) reflect the best technology available (BTA) to minimize adverse environmental impacts due to the impingement (IM) of aquatic organisms (i.e., fish, shellfish, and other forms of aquatic life) on intake structures and the entrainment (E) of eggs and larvae through cooling water systems. On July 9, 2004, the U.S. Environmental Protection Agency (EPA) promulgated regulations in the Federal Register applicable to large existing power plants (Phase II facilities) that use large amounts of cooling water. These regulations, published in the Code of Federal Regulations (CFR) Chapter 40 Part 125 Subpart J, became effective on September 7, 2004.

The Phase II regulations establish performance standards for CWIS of existing power plants that withdraw more than 50 million gallons per day (MGD) of surface waters and use more than 25 percent of the withdrawn water for cooling purposes. The new rule requires all large existing power plants to reduce impingement mortality by 80 – 95 percent and to reduce the number of smaller aquatic organisms drawn through the cooling system by 60 – 90 percent. The water body type on which the facility is located, the capacity utilization rate, and the magnitude of the design intake flow relative to the waterbody flow determine whether a facility will be required to meet the performance standards for IM or both IM&E. The final rule allows these performance standards to be met through using a combination of the existing intake design, additional intake technologies, operational modifications, and using restoration measures. This approach also provides flexibility by allowing site-specific performance standards, if economic conditions do not justify the full cost of meeting the standards.

The EPA 316(b) Phase II rule requires that each affected facility develop and submit a *Proposal for Information Collection (PIC)* to the applicable permitting agency prior to implementation of data collection activities. The PIC must include the following key elements:

- A description of the proposed and/or implemented technologies, operational measures, and/or restoration measures to help develop a compliance strategy to meet the performance standards;
- A description of any historical studies characterizing IM&E and/or the physical and biological conditions in the vicinity of the CWIS and their relevance to the proposed study;
- A summary of any past or ongoing consultations with regulatory agencies and other stakeholders that are relevant to the study; and

- A sampling and analysis plan (SAP) for any new field studies needed to estimate IM&E.

This PIC serves as a study plan for a Comprehensive Demonstration Study (CDS), which provides the information to:

- Determine the baseline calculations of IM&E to be compared with performance standards;
- Evaluate combinations of technologies, operational measures and/or restoration measures, which may be implemented to meet the performance standards; and
- Evaluate whether a site-specific BTA determination is warranted and can be justified using a cost/cost or cost/benefit test.

## 1.1 Regulatory Applicability

The Encina Power Station (EPS) is located adjacent to the *Agua Hedionda Lagoon* (or AHL) on the Pacific Ocean. Because of its location near the ocean, the facility is subject to the following national performance standards (Table 1-1) for the reduction of IM&E resulting from the operation of the CWIS:

**Table 1-1**
**IM&E Performance Standards for Phase II Facilities**

| Standard | Reduction Requirement |
|---|---|
| Impingement mortality | 80 – 95% |
| Entrainment | 60 – 90% |

The EPA 316(b) Phase II rule generally requires that facilities subject to the rule submit the CDS with the application for renewal of the National Pollutant Discharge Elimination System (NPDES) permit. Facilities with NPDES permits expiring prior to July 9, 2008 may request an extension for submittal of the CDS no later than January 7, 2008. The current EPS NPDES permit has expired on February 5, 2005. A timely application for renewal was submitted to the San Diego Regional Water Quality Control Board (SDRWQCB) on June 23, 2004. The EPS has submitted a letter to the SDRWQCB on January 6, 2005 requesting the following schedule for submittal of the two reports required under the EPA 316(b) Phase II Rule:

- Proposal for Information Collection – submittal due April 1, 2006
- Comprehensive Demonstration Study – submittal due January 7, 2008

## 1.2 Purpose

The purpose of this document is to meet or exceed the requirement for the preparation and submittal of the PIC in accordance with 40 CFR 125.95(b)(1). This Plan is being submitted for agency review and comment in advance of implementation. However, information collection activities may be initiated prior to receipt of agency comments.

# 2.0 Facility Description

The EPS has been owned and operated by Cabrillo Power I LLC (Cabrillo) since May 22, 1999. The power plant was previously owned by San Diego Gas and Electric Company (SDG&E).

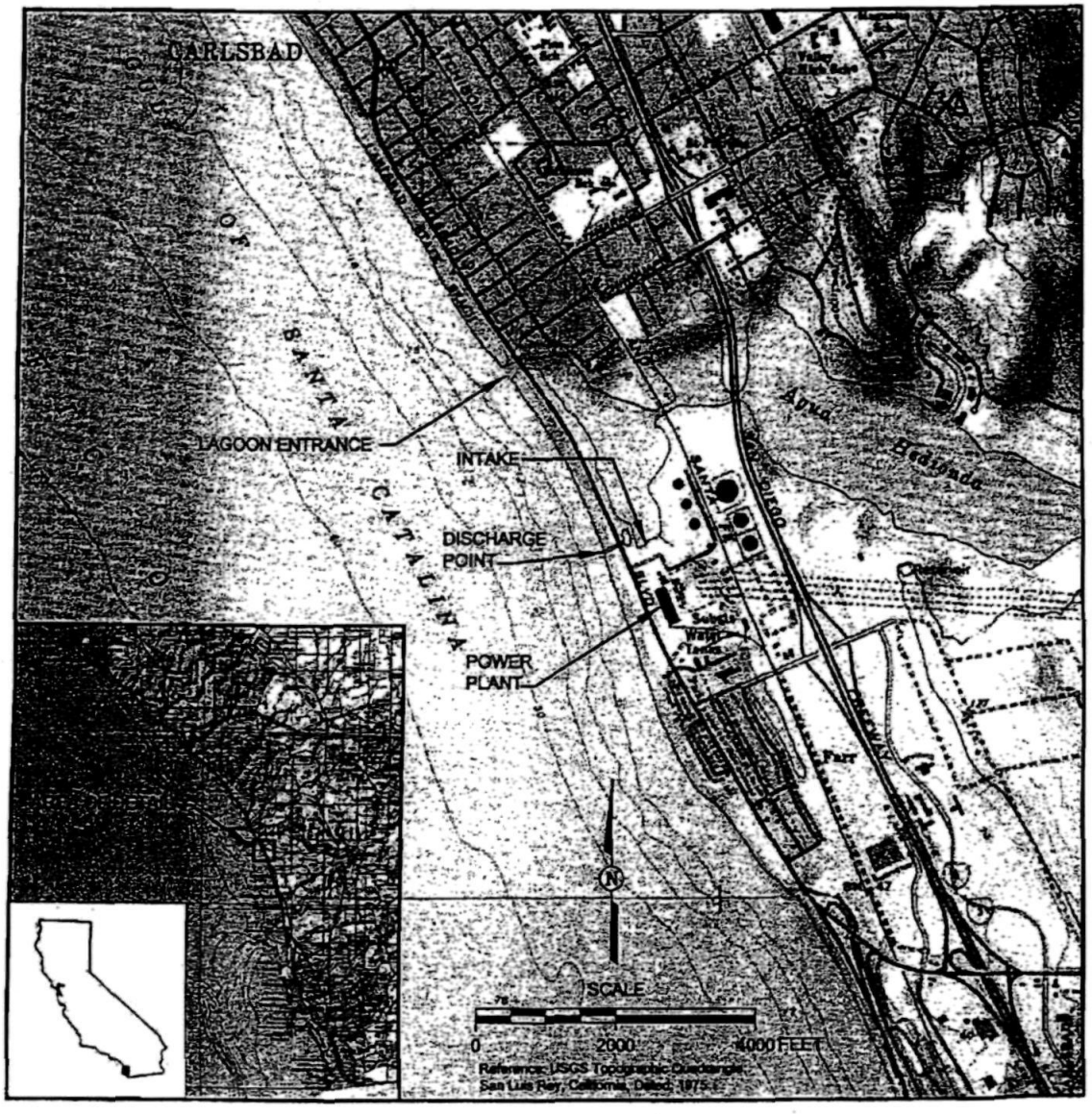
The EPS is a fossil-fueled steam electric power generating station that began operation in 1954. Thermal energy provided by the combustion of the fossil-fuels is used to generate steam to drive five steam turbine generators. The plant also has one air-cooled gas turbine generator achieving a combined nominal thermal energy output capacity for the plant of 939 megawatts. Waste heat generated at EPS is discharged to the Pacific Ocean. The combined cooling and service water design flow is 857.29 MGD.

Cooling water is withdrawn from the Pacific Ocean via the AHL. The cooling water intake structure complex is located approximately 2200 feet from the ocean inlet to the lagoon. Variations in the water surface due to tide range from a low of –3.52 feet to a high of +4.79 feet [elevation "0" being mean sea level, (msl)], based on measurements made by Coastal Environments (2005). The intake structure is located in the lagoon, in front of the generating units.

## 2.1 Facility Location

The EPS is located at 4600 Carlsbad Boulevard, in the southwest area of the City of Carlsbad, California, adjacent to the AHL on the Pacific Ocean in Section 18, Township 12 South, Range 4 West of the San Bernardino Baseline Meridian. Figure 2-1 depicts the location of the facility and the location of the cooling water intake and discharge points relative to the shoreline.

**Figure 2-1**
**Encina Power Station Location Map**




## 2.2 Source Water Body Description

The environmental setting of AHL, the primary source water body for the EPS, is discussed in detail in Bradshaw et al (1976), SDG&E (1980), and summarized in EA Engineering, Science and Technology (1997). The following is a description of the physical and ecological characteristics of the AHL, on which the EPS is located.

### 2.2.1 Physical Characteristics

Agua Hedionda is the third largest watershed within the Carlsbad Hydrologic Unit. The watershed, dominated by Agua Hedionda Creek, extends approximately 10.62 miles (mi) inland from the coast and is about 18,837 acres in area, comprising 14 percent of the Carlsbad Hydrologic Unit. Agua Hedionda Creek originates on the southwestern slopes of the San Marcos Mountains in west central San Diego County and discharges into the Pacific Ocean via AHL. The highest elevation within the watershed is 1,500 feet above mean sea level (amsl), located in the San Marcos Mountains.

The EPS is located on the AHL, which is a man-enhanced coastal lagoon that extends 1.7 mi inland and is up to 0.5 mi wide. The lagoon is located along the Pacific Coast in San Diego County approximately 26 mi north of the City of San Diego. The lagoon was constructed in 1954 to provide cooling water for the power plant. The construction enhancement involved a permanent opening of the connection of the lagoon with the ocean. Prior to this, the lagoon was ephemerally connected to the ocean when creek flows were high. A railroad trestle and the Interstate Highway 5 bridge separate AHL into three interconnected segments: an Outer, Middle, and Inner lagoon. The surface areas of the Outer, Middle, and Inner lagoons are 53, 24, and 190 acres, respectively based on measurements made by Coastal Environments (2005). The lagoon is separated from the ocean by Carlsbad Boulevard and a narrow inlet 151 feet wide and 9 feet deep at the northwest end of the Outer Lagoon that passes under the highway and allows tidal exchange of water with the ocean.

Circulation and input into AHL is dominated by semi-diurnal tides that bring approximately 1,454 acre feet of seawater through the entrance to the Outer Lagoon on flood tides based on measurements made by Coastal Environments (2005). Approximately half of this tidal volume flows into the Middle and Inner lagoons. On ebb tides this same tidal volume flows out through the entrance to the ocean. As a result of this tidal flushing, the lagoon is largely a marine environment. Although freshwater can enter the lagoon through Agua Hedionda Creek, which drains an 18,500 acre watershed, for most of the year freshwater flow is minimal. Heavy rainfall in the winter can increase freshwater flows, reducing salinity, especially in the Inner Lagoon. The lagoon system is kept open to the ocean by routine dredging of the Outer Lagoon and the channel to the ocean.

Bottom sediments in the lagoon reflect the speed and location of the periodic tidal currents. The Outer Lagoon sediments consist of coarser gravel and sands in areas of highest current velocities. The Middle Lagoon consists of an inter-tidal zone largely comprised of mud. The largest water body segment, the Inner Lagoon, consists of mostly finer sands, silt, and clay with organic detritus, especially at the far eastern end of the lagoon. Some narrow sand beaches and rock rip-rap substrate are also present in the Inner Lagoon.

AHL is tidally flushed through the small inlet in the Outer Lagoon by waters from the Pacific Ocean. The physical oceanographic processes of the southern California Bight that influence the lagoon includes, the tides, currents, winds, swell, temperature, dissolved oxygen, salinity, nutrients. These are most affected by the daily tidal exchange of coastal seawater. Near the mouth of the lagoon the mean tide range is 3.7 feet with a diurnal range of 5.3 feet. Waves breaking on the shore generally range in height from 2 to 4 feet, although larger waves (6 to 10 feet) are not uncommon. Larger waves exceeding 15 feet occur infrequently and are usually associated with winter storms. Surface water in the local area ranges from a minimum of 57 degrees Fahrenheit (°F) to a maximum of 72°F with an average annual temperature between 63°F and 66°F.

### 2.2.2 Agua Hedionda Lagoon Ecological Characteristics

The AHL is listed by the State of California as a Section 303(d) impaired waterbody largely due to sedimentation/siltation and coliform contamination resulting from multiple non-point source discharges in Agua Hedionda watershed. Sedimentation of the lagoon can occur both from sediment flows within the watershed and from tidal flows from the Pacific Ocean. The bacterial contamination is likely from multiple sources within the watershed.

In November of 2000, the U. S. Fish and Wildlife Service (F&WS), under the Endangered Species Act of 1973, as amended, designated AHL as critical habitat for the tidewater goby (*Eucyclogobius newberryi*), a federally listed endangered species. However, no tidewater gobies have been observed in the AHL since the 1950's when the lagoon was originally dredged as the power plant cooling water source and the lagoon is no longer viable habitat for the species. Based on that fact, Cabrillo Power I LLC filed for declaratory and injunctive relief in federal district court on August 31, 2001, against the F&WS for failing to base the AHL and Creek critical habitat designation on best scientific data and failing to analyze the economic and other impacts of the designation. On February 28, 2003, based upon a stipulated settlement, the United States District Court ordered that the tidewater goby critical habitat designation for AHL and Creek be vacated without prejudice.

Land use within the watershed is dominated by urban development. Natural habitats are scattered and occur in a matrix of agricultural and urban development, however, several relatively large patches of native vegetation occur in the eastern portion of the watershed and in the central area just inland from AHL.

A study on the ecological resources of Agua Hedionda showed that it has good water quality and supports diverse benthic infauna, bird, and fish communities (MEC Analytical 1995). Eelgrass was found in all three lagoon segments, but was limited in the Inner Lagoon to depths above approximately –6.5 feet mean lower low water (MLLW) because water turbidity reduced penetration of light for photosynthesis in deeper areas. The eelgrass beds provide a valuable

habitat for benthic organisms that are fed upon by birds and fishes. Although eelgrass beds were less well developed in areas of the Inner Lagoon, it was found to provide a wider range of habitats, including mud flats, salt marsh, and seasonal ponds than elsewhere in Aqua Hedionda. As a result, bird and fish diversity was highest in the Inner Lagoon.

A total of 35 species of fishes was found during the 1994 and 1995 sampling conducted by MEC (MEC Analytical 1995). The Middle and Inner lagoons had more species and higher abundances than the Outer Lagoon. During the 1995 survey, only four species were collected in the Outer Lagoon, compared to 14 to 18 species in the Middle and Inner lagoons. Silversides (Atherinopsidae) and gobies (Gobiidae) were the most abundant fishes collected. Silversides, including jacksmelt and topsmelt, that occur in large schools in shallow waters where water temperatures are warmest were most abundant in the shallower Middle and Inner lagoons. Gobies were most abundant in the Inner Lagoon, which has large shallow mudflat areas that are their preferred habitat.

An impingement and entrainment study was conducted at EPS in 1979-1980 (SDG&E 1980). In the impingement study, fishes and invertebrates were collected and quantified from the traveling screens and bar rack system of the power plant. Seventy-six species of fishes, 45 species of macroinvertebrates, and 7 species of algae and marine plants were impinged. There were also seven thermal treatments (intake tunnel heat shock treatments) sampled during the year and 90 percent of the fishes collected consisted of nine species: deepbody anchovy, topsmelt, northern anchovy, shiner surfperch, California grunion, walleye surfperch, queenfish, round stingray, and giant kelpfish.

The recent assessment of the ecological resources of Agua Hedionda (MEC Analytical 1995) did not find any tidewater gobies (*Eucyclogobius newberryi*). This federally endangered species was once recorded as occurring in the lagoon prior to construction of the Outer Lagoon in the early 1950s. The present marine-influenced environment in the lagoon would not tend to support tidewater gobies because they prefer brackish water habitats. No listed fish species were collected in the recent study.

### 2.2.3 Pacific Ocean Ecological Resources

The outer coast has a diversity of marine habitats and includes zones of intertidal sandy beach, subtidal sandy bottom, rocky shore, subtidal cobblestone, subtidal mudstone and water column. Organisms typical of sandy beaches include polychaetes, sand crabs, isopods, amphipods, and clams. California grunion utilize the beaches around EPS during spawning season from March through August. Numerous infaunal species occur in subtidal sandy bottoms with mollusks, polychaetes, arthropods, and echinoderms comprising the dominant invertebrate fauna. Typical fishes in the sandy subtidal include queenfish, white croaker, several surfperch species, speckled sanddab, and California halibut. Also, California spiny lobster and *Cancer* spp. crabs forage over

the sand. Many of the typically outer coast species can occasionally occur within AHL, carried by incoming tidal currents.

The rocky habitat at the discharge canal and on offshore reefs supports various kelps and invertebrates including barnacles, snails, sea stars, limpets, sea urchins, sea anemones, and mussels. Giant kelp (*Macrocystis*) forests are an important community in the area offshore from Agua Hedionda. Kelp beds provide habitat for a wide variety of invertebrates and fishes. The water column and kelp beds are known to support many fish species, including northern anchovy, jack smelt, queenfish, white croaker, garibaldi, rockfishes, kelp bass, white seabass, surfperches, and halibut.

Marine-associated wildlife that occur in the Pacific waters off AHL are numerous and include birds such as brown pelican, surf scoter, cormorants, western grebe, gulls, terns and loons. Marine mammals, including porpoise, sea lions, and migratory gray whales, also frequent the adjacent coastal area.

## 2.3 Cooling Water Intake Structure Design

Cooling water is withdrawn from the Pacific Ocean via the AHL. The CWIS complex is located approximately 2,200 feet from the ocean inlet to the lagoon. The intake structure is located on the lagoon, to the north of the generating units as shown on Figure A-1 included in Appendix A.

As the water flows into the intake structure, it passes through trash racks made up of metal bars spaced about 3½ inches apart, which prevent passage of large debris into the intake. The trash rack inlet structure is shown on Figure A-2 included in Appendix A. The intake downstream of the trash rack tapers into two, 12-foot wide intake tunnels. From these tunnels, the cooling water enters four six-foot wide conveyance tunnels. Cooling water for conveyance tunnels 1 and 2 passes through one of two vertical traveling screens to prevent fish, grass, kelp, and debris from entering pump intakes for generating units 1, 2, and 3.

Conveyance tunnels 3 and 4 carry cooling water to the intakes for generating units 4 and 5, respectively. Traveling water screens are located at the intake of pump 4 and the intake of pump 5. A detailed plan layout of the entire tunnel system is shown on Figure A-1 included in Appendix A.

Each cooling water intake consists of two circulating water pumps and one or two service pumps. During normal operation, one circulating water pump serves each half of the condenser, so when a unit is generating power, both pumps are in operation.

There are a total of seven traveling screens that remove any debris which has passed through the trash racks. Two screens service the combined flows of generating Units 1, 2, and 3. Unit 4 has two traveling water screens, while Unit 5 has three traveling water screens. The screens are

conventional through-flow, vertically rotating, single entry, band-type screens, mounted in the screen wells of the intake channels. Each screen consists of a series of baskets or screen panels attached to a chain drive. Since the screens are designed to prevent the passage of particles large enough to clog the condenser tubes, the screening surface is made of 3/8-inch meshed stainless steel wire, with the exception of Unit 5 screens, which have 5/8-inch square openings. Cooling water passes through the wire mesh screening surface and floating or suspended matter is retained on the screens. The screens rotate automatically when the debris buildup causes a predetermined pressure differential across the screen (or the difference in sea water level before and after the screen increases to a set level). As the screens revolve, the material is lifted from the front of the intake screenwell by the upward travel of the baskets. The screens travel 3 feet per minute, making one complete revolution in about 20 minutes. A screen wash system in the traveling screen structure provides water (sea water from the intake tunnel) to wash the debris from the traveling screen. At the head of the screen, matter is removed from the baskets by a spray of water, which is evenly distributed over the entire basket width. The jet spray washes the accumulated material into a trough and the trough conveys the debris into debris collection baskets. Accumulated organic debris is discharged to the outfall structure.

Characteristics and specifications of the CWIS are presented in Table 2-1.

**Table 2-1**
**Design Characteristics of EPS Cooling Water Intake Structure**

| | Unit 1 | Unit 2 | Unit 3 | Unit 4 | Unit 5 |
|---|---|---|---|---|---|
| Latitude | 33° 08' 16" N | 33° 08' 16" N | 33° 08' 16" N | 33° 08' 16" N | 33° 08' 16" N |
| Longitude | 117° 20' 16" W | 117° 20' 16" W | 117° 20' 16" W | 117° 20' 16" W | 117° 20' 16" W |
| Number of circulating water pumps | 2 | 2 | 2 | 2 | 2 |
| Pump capacity (per pump) | 24,000 gpm | 24,000 gpm | 24,000 gpm | 100,000 gpm | 104,000 gpm |
| Service water | 3000 gpm | 3000 gpm | 6000 gpm | 13,000 gpm | 18,200 gpm |
| Trash bar opening | 3 ½ inch | 3 ½ inch | 3 ½ inch | 3 ½ inch | 3 ½ inch |
| Number of traveling water screens | 2 (shared) | 2 (shared) | 2 (shared) | 2 | 3 |
| Screen type | Standard through flow | Standard through flow | Standard through flow | Standard through flow | Standard through flow |
| Screen mesh opening | 3/8 inch | 3/8 inch | 3/8 inch | 3/8 inch | 5/8 inch |
| Screen height (in water, high tide) | 24.8 feet | 24.8 feet | 24.8 feet | 24.8 feet | 24.8 feet |
| Approach velocity (low tide) | 1.2 fps | 1.2 fps | 1.2 fps | 1.6 fps | 1.1 fps |
| Through-screen velocity (low tide) | 2.1 fps | 2.1 fps | 2.1 fps | 2.9 fps | 2.0 fps |
| Screen rotation | Automatic on ΔP | Automatic on ΔP | Automatic on ΔP | Automatic on ΔP | Automatic on ΔP |
| Screen wash pressure | 70 psig | 70 psig | 70 psig | 70 psig | 70 psig |

## 2.4 *Cooling Water Intake Structure Operation*

During normal operation, one circulating water pump serves each half of the condenser, so when a unit is generating power, both pumps are in operation.

Traveling water screens normally are set on automatic, starting up when the differential pressure across the screen exceeds the set point. At the beginning of each work shift (0600, 1800), the screens are turned on and the automatic start is checked to ascertain that the screens are functioning properly.

The plant produces its own sodium hypochlorite electrolytically from seawater for use in chlorination of the cooling water system. A bromide additive (sodium bromide), which reacts

with chlorine to form hypobromous acid, and a bio-dispersant are also used with the sodium hypochlorite as enhancers.

The treatment solution is injected to the channel immediately upstream of the once-through cooling water and saltwater service pump suctions for each unit. Each injection point is individually controlled. Chlorination is conducted for about five minutes per hour per unit on a timed cycle each day. This method of chlorination results in a minimal chlorine residual in the cooling water being discharged to the ocean.

The intake tunnels are thermally treated (tunnel re-circulation) approximately every five weeks. Encrusting organisms in the early stages of development are small enough to pass through the trash racks and screens and enter the intake tunnels, attach themselves to the tunnel walls, traveling water screens, and other parts of the cooling-water system. If not removed, the encrusting organisms grow and accumulate at a rate of approximately 1000 $yd^3$ over a six-month period. These accumulations restrict the flow of cooling water to and through the condensers, causing a rise in the condenser operating temperature and the temperature of the discharged circulating water. A thermal tunnel re-circulation treatment process prevents encrusting organisms from developing to any significant size or quantity. The treatment causes the encrusting organisms to release from the surfaces and wash through the condensers to the ocean with the circulating water discharge, reducing the need for maintenance outages for normal cleaning of the circulating water inlet tunnels and condensers. This practice also helps to maintain the lowest possible temperature rise across the condensers, thereby improving plant efficiency and reducing thermal load to the ocean.

Thermal treatment is performed by restricting the flow of cooling water from the lagoon and re-circulating the condenser discharge water through the conveyance tunnels and condensers until an inlet water temperature of approximately 105°F is attained. Maintaining a temperature of 105°F in the intake tunnels for approximately two hours has proven to be effective in removing encrusting organisms. The total time required for the thermal treatment operation, including temperature buildup and cool down, is approximately six hours.

## 2.5 Calculation Baseline

EPA, in its 316(b) Phase II rule for existing facilities, requires reductions in IM&E when compared against a "calculation baseline." This calculation baseline is the level of IM&E that would occur if the CWIS were designed with the following characteristics:

- Once-through cooling system;
- Opening of CWIS located at, and the face of the traveling screens is oriented parallel to, the shoreline near the surface of the source waterbody;

- Conventional traveling screens with 3/8 inch mesh; and
- No structural or operational controls to reduce IM&E.

The EPS intake system is equivalent in terms of entrainment of aquatic organisms and impingement of organisms on screens to the baseline shoreline intake with no fish protection features defined by the Environmental Protection Agency in the new Section 316(b) Phase II Existing Facilities Rule (National Pollutant Discharge Elimination System-Final Regulations). The EPS CWIS design has a few deviations from these baseline conditions. The traveling water screens on Unit 5 have 5/8" screens and each of the 7 sets of traveling water screens are set well back from the shoreline of the lagoon. The recent IM&E study performed at the EPS will provide the necessary information for determining a representative calculation baseline for the station.

# 3.0 Historical Studies

EPA Phase II 316(b) regulations [40 CFR 125.95(b)(1)(ii)] require that the PIC includes a list and description of any historical studies characterizing IM&E, as well as physical and biological conditions in the vicinity of the facility CWIS. The following sections provide a summary of previous entrainment and impingement studies conducted at the EPS and within AHL.

The following sections also present a discussion of the relevance of the data to the current conditions and the IM&E studies at the EPS.

## 3.1 EPS Impingement Mortality and Entrainment Characterization Studies

The following sections summarize previous IM&E characterization studies performed at the EPS.

### 3.1.1 1980 EPS 316(b) Demonstration

In 1980, SDG&E owned and operated the EPS (SDG&E, 1980). A 316(b) demonstration was conducted for the facility (SDG&E 1980) as required at the time by the SDRWQCB. The study included descriptions of the facility, descriptions of the physical and biological environment of AHL and surroundings, studies of entrainment, impingement, and entrainment survival at the plant, and an environmental impact assessment that also evaluated the feasibility of alternative intake technologies to reduce IM&E.

A list of taxa ("critical species") that included 16 fishes, 11 ichthyoplankton, and one zooplankter, were selected based on six criteria and approved by the SDRWQCB for detailed study during the program (Table 3-1). Some additional species that were found to be common in the subsequent sampling were also added to the list. The report reviewed the life histories of the critical species.

#### 3.1.1.1 Entrainment

A one-year entrainment and source water characterization study was conducted beginning in 1979 as part of the 316(b) demonstration studies at the EPS. Plankton samples were collected monthly at five offshore stations using 505 and 335 micron mesh nets attached to a 2 feet diameter bongo net system. Collections were also made monthly in the Middle and Upper lagoon segments and every two weeks in the Outer Lagoon using 1.6 feet diameter nets (505 and 335 micron mesh size). The procedures specified the use of a depressor weight connected to the towing apparatus but there was no indication at what depths the plankton samples were typically taken. Tows were targeted at 10 minutes at a speed of 1.5 to 2 knots. Entrainment samples were also collected every two weeks using a plankton pumping system in front of the intakes.

Although most samples were collected during daylight hours some samples were occasionally taken in the evening or early morning hours.

**Table 3-1**
**Critical Species Studied During 1979-1980**

| "Critical Species" | Common Name |
|---|---|
| ***Adult fishes*** | |
| *Engraulis mordax* | northern anchovy |
| *Atherinops affinis* | topsmelt |
| *Paralabrax clathratus* | kelp bass |
| *Paralabrax maculatofasciatus* | potted sand bass |
| *Paralabrax nebulifer* | barred sand bass |
| *Cynoscion nobilis* | white seabass |
| *Menticirrhus undulatus* | California corbina |
| *Seriphus politus* | queenfish |
| *Amphistichus argenteus* | barred surfperch |
| *Hyperprosopon argenteum* | walleye surfperch |
| *Semicossyphus pulcher* | California sheephead |
| *Mugil cephalus* | striped mullet |
| *Citharichthys sordidus* | Pacific sanddab |
| *Paralichthys californicus* | California halibut |
| *Pleuronichthys verticalis* | hornyhead turbot |
| *Heterostichus rostratus* | giant kelpfish |
| ***Ichthyoplankton*** | |
| *Anchoa compressa* | deepbody anchovy |
| *Engraulis mordax* | northern anchovy |
| Cottidae | sculpins |
| Serranidae | sea basses |
| Sciaenidae | croakers |
| *Coryphopterus nicholsi* | blackeye goby |
| Gobiidae | gobies |
| *Citharichthys stigmaeus* | spotted sanddab |
| *Paralichthys californicus* | California halibut |
| Pleuronectidae | righteye flounders |
| *Hypsopsetta guttulata* | diamond turbot |
| Atherinopsidae | silversides |
| ***Zooplankton*** | |
| *Acartia tonsa* | copepods |

Anchovies (primarily deep body and northern) were the most abundant larval forms in both the source water and entrainment samples, followed by croakers and sanddabs (Table 3-2). There were fewer fish eggs and more goby larvae in the entrainment samples whereas kelp and sand bass larvae were substantially more abundant in the combined source water samples from the Lagoon and offshore. Overall the average composition between the entrainment and source water data sets were very similar for the ten most abundant taxa. Only English sole, *Parophrys vetulus*, larvae were among the top ten entrainment taxa not represented in the top ten source water taxa.

**Table 3-2**
**Average Annual Densities of the Ten Most Abundant Ichthyoplankton Taxa per 100 $m^3$ (26,417 gal) In Source Water (lagoon and offshore stations combined) & Entrainment (pump sampling) Collections for 335µ Mesh Nets During 1979**

| | Taxon | Source Water | Entrainment |
|---|---|---|---|
| anchovies | Engraulidae | 952.7 | 855.2 |
| croakers | Sciaenidae | 341.7 | 400.6 |
| speckled sanddab | *Citharichthys* sp. | 73.2 | 82.7 |
| fish eggs | unidentified fish egg | 33.8 | 20.2 |
| gobies | Gobiidae | 29.2 | 42.9 |
| silversides | Atherinidae | 8.3 | 10.8 |
| wrasses | Labridae | 6.4 | 4.0 |
| combtooth blennies | *Hypsoblennius* sp. | 6.1 | 5.7 |
| sea basses | Serranidae | 5.1 | 0.9 |
| rockfishes | *Sebastes* sp. | 2.8 | 2.5 |
| English sole | *Parophrys vetulus* | 0 | 1.9 |

*Note: English Sole not collected in source waterbody.*

Entrainment losses were calculated for each two-week sampling interval by multiplying the average plankton densities at the intake by the volume of cooling water drawn through the plant during that period. Annual, monthly, and daily rates were estimated by averaging the entrainment estimates for all sampling periods and calculating values for the indicated duration. Annual estimates for total zooplankton entrainment were $7.4 \times 10^9$ (505µ net data) and $30.9 \times 10^9$ (335µ net data) individuals. The copepod *Acartia tonsa* was the most abundant species in the entrainment collections (Table 3-3).

Annual estimates of the abundance of ichthyoplankton entrained through the power plant were $4.15x10^9$ (505µ net data) and $6.66x10^9$ (335µ net data) individuals per year. Fish eggs comprised 98 percent and 86 percent of the total annual ichthyoplankton entrainment using the 505µ and 335µ net estimates, respectively. Through-plant entrainment mortality was assumed to be 100% for larvae and 60% for eggs based on survival experiments that were conducted. The report presented average annual densities of the critical species by net type and daily entrainment estimates for selected plankton groups (Table 3-3).

**Table 3-3**
**Average Daily Entrainment Estimates at EPS Based On Daily Plant Circulating Water Flow of 795 MGD**

| | Daily Entrainment | | Mean Percent |
|---|---|---|---|
| Plankton Group | 335 µ | 505 µ | of Total |
| *Acartia tonsa* (copepod) | $4.77x10^7$ | $7.63x10^6$ | 41.2% |
| fish eggs | $1.57x10^7$ | $1.11x10^7$ | 19.9% |
| Decapoda | $1.32x10^7$ | $4.44x10^6$ | 13.1% |
| other Copepoda | $8.47x10^6$ | $2.16x10^6$ | 7.9% |
| other Crustacea | $6.95x10^6$ | $2.70x10^6$ | 7.2% |
| other Zooplankton | $5.68x10^6$ | $4.55x10^5$ | 4.6% |
| Chaetognatha | $1.83x10^6$ | $1.56x10^6$ | 2.5% |
| fish larvae | $2.52x10^6$ | $2.46x10^5$ | 2.1% |
| Mysidacea | $6.70x10^5$ | $1.34x10^6$ | 1.5% |
| | | | 100.0% |

Entrainment impacts were assessed by qualitative comparisons of entrainment losses to the estimated numbers of larvae in nearby source waters, comparisons of additional power plant mortality to natural mortality rates, entrainment probabilities based on current studies, and primary productivity studies. It was concluded that the entrainment of $1.82x10^7$ fish larvae and eggs daily was small compared to the egg and larval concentrations measured in monthly plankton tows in the source water body. It was estimated that average daily losses of planktonic organisms amounted to about 0.2% of the plankton available within one day's travel time from the power plant by current transport. At the seaward entrance to AHL, a water parcel was estimated to have a 34% probability of entering the lagoon. The 10% probability of entrainment isopleth was calculated to lie near the northern and eastern extremities of AHL, and the 70% and 90% entrainment probability isopleths were calculated to be near the intakes and well within the

southern third of the Outer Lagoon. The modeled isopleths shifted toward the seaward entrance on a flood tide and toward the Middle Lagoon on an ebb tide. Using the 70% entrainment probability isopleth to define intake effects, it was shown that the maximum extent of intake effects was about 1000 feet into the southern end of the Outer Lagoon segment. With natural mortality rates assumed to be 99% for egg and larval stages of most marine fish species it was concluded that additional mortality from the EPS was not significant. There was no modeling of entrainment impacts on larvae using demographic or proportional loss models. It was also concluded, based on results of light-dark bottle experiments, that entrainment effects on source water primary productivity were negligible.

#### *3.1.1.2 Impingement*

Impingement of fishes and invertebrates on the traveling screens and bar rack system of the EPS were monitored daily during normal operations for 336 consecutive days in 1979. The main method was to obtain abundance and weights from samples accumulated over two 12-hour periods (daylight and night) each day for all three screening systems at the plant. During this period there were a total of 79,662 fishes from 76 taxonomic categories weighing a total of 3,076 lbs collected (Table 3-4). The six highest-ranking fishes by numbers impinged were queenfish, deepbody anchovy, topsmelt, California grunion, northern anchovy, and shiner surfperch. These are all open water forms that occur in schools. These six species represented 82% of all fishes impinged during normal operations sampling.

There were also seven heat treatments conducted during the study period. Heat treatments are operational procedures designed to eliminate mussels, barnacles, and other fouling organisms growing in the cooling water conduit system. During a heat treatment, heated effluent water from the discharge is redirected to the intake conduit via cross-connecting tunnels until the water temperature rises to approximately 105°F in the screenwell area. This water temperature is maintained for at least one hour, during which time all biofouling organisms, as well as fishes and invertebrates living within the cooling water system, succumb to the heated water. During heat treatment surveys, all material impinged onto the traveling screens are removed from the forebay. Fishes and macroinvertebrates were separated from incidental debris, identified, and counted. During the 1979 studies, the total weight of fishes impinged during these operations was 5,340 lb (Table 3-4). Over 90% of the fishes collected consisted of nine species: deepbody anchovy, topsmelt, northern anchovy, shiner surfperch, California grunion, walleye surfperch, queenfish, round stingray, and giant kelpfish. The numbers of fishes resident in the tunnels during heat treatments was greatest in winter and least in summer.

Macroinvertebrates that ranked high in the total numbers impinged included yellow crab (*Cancer anthonyi*) with 2,540 individuals, swimming crab (*Portunus xantusii*) with 884, lined shore crab (*Pachygrapsus crassipes*) with 866, and market squid (*Loligo opalescens*) with 522. The yellow crab and market squid both have commercial fishery value whereas the other two species are

small and are not fished commercially. California spiny lobster, the most valuable invertebrate in the local commercial fishery, was rare in the samples with only two individuals impinged during the entire year-long study period.

**Table 3-4**
**Impingement Summary Of Fishes Collected During Normal And Heat Treatment Surveys Conducted From January 1979 To January 1980 at the EPS**

| | | Normal | | Heat Treatment | |
|---|---|---|---|---|---|
| Common Name | Scientific Name | Count | Weight (lb [kg]) | Count | Weight (lb [kg]) |
| queenfish | *Seriphus politus* | 18,681 | 201 (91.3) | 3,483 | 212 (96.3) |
| deepbody anchovy | *Anchoa compressa* | 13,299 | 142 (64.3) | 23,142 | 402 (182.2) |
| topsmelt | *Atherinops affinis* | 10,915 | 248 (112.3) | 21,788 | 366 (166.1) |
| California grunion | *Leuresthes tenuis* | 8,583 | 75 (33.8) | 9,671 | 180 (81.7) |
| northern anchovy | *Engraulis mordax* | 7,434 | 32 (14.6) | 19,567 | 207 (94.0) |
| shiner surfperch | *Cymatogaster aggregata* | 6,545 | 118 (53.3) | 12,326 | 607 (275.5) |
| walleye surfperch | *Hyperprosopon argenteum* | 1,877 | 111 (50.4) | 8,305 | 1153 (522.8) |
| white surfperch | *Phanderodon furcatus* | 1,751 | 37 (17.0) | 604 | 19 (8.6) |
| round stingray | *Urolophus halleri* | 1,686 | 410 (185.9) | 1,685 | 891 (404.2) |
| California halibut | *Paralichthys californicus* | 1,215 | 126 (57.1) | 329 | 117 (53.0) |
| all others | | 7,676 | 1,577 (715.2) | 7,200 | 1,366 (619.7) |
| Total | | 79,662 | 3,076 (1,395.2) | 108,102 | 5,340 (2,422.4) |

*Note: The top 10 species by number are listed.*

Impacts caused by impingement were assessed by comparing the numbers and biomass of fishes lost to plant operations to the abundance and biomass of fishes resident in the nearby source waters of AHL, nearshore habitats, and the San Diego coastal area. Samples of adult and juvenile fishes in the nearby source water were collected monthly with beach seines, otter trawls and gill nets. Seventeen of the 27 fish species were taken by all three types of gear. The role of gear selectivity in determining actual population sizes of the critical species was recognized. The ten most abundant species collected by all types of gear were California grunion (49%), topsmelt (17%), deepbody anchovy (7%), slough anchovy (6%), northern anchovy (3%), queenfish (3%), walleye surfperch (2%), speckled sanddab (2%), shiner surfperch (1%), and California halibut (1%). Most of the species removed by the power plant are widespread along the southern California and Baja California coasts and losses were small relative to these populations. On a local scale, it was calculated that the average daily power plant removal, including normal operations and heat treatment operations averaged throughout the year, was about 0.02% of the

estimated standing crop in the local study area that extended along a shoreline distance of 3.6 miles out to a depth of 60 feet (1,211 acres). The removals also represented about 0.07% of local commercial fish landings by weight (excluding tuna) from the area between San Clemente and the Mexican border, and less than 7% of the recreational fishing landings by numbers annually in the area between Dana Point and the Mexican border.

### 3.1.2 1997 EPS Supplemental 316(b) Assessment Report

The SDRWQCB issued Order 94-58 in 1994 requiring SDG&E to conduct additional analyses of data from the 316(b) study conducted in 1979-1980 (EA Science and Technology, 1997). The supplemental analyses were completed in 1997. The purpose of the study was to further evaluate the effects of the EPS cooling water intake on the designated beneficial uses of AHL and the Southern California Bight using additional analysis methods. The three Special Conditions of the Order were:

1. Analysis of Family-Specific Entrainment Losses of Fish Eggs and Larvae—*Analysis shall include the estimated monthly and annual entrainment losses for each ichthyoplankton RIF (Representative Important Families) (i.e. identify the specific fish larvae and egg removals for each ichthyoplankton family considered in this study).*

2. Estimation of Combined Impingement Losses for Each of the Target Species—*The specific ichthyoplankton losses shall be evaluated using such factors as the importance of that species in food web structure, natural mortality, and plant selectivity for that species, and potential mitigating factors to reduce the kill of that species.*

3. Estimation of Annual Equivalent Adult Losses From Both Entrainment And Impingement—*Ichthyoplankton losses shall be evaluated using such factors as the importance of that species in the marine food web and its importance as a commercial or recreational species. This assessment shall include the use of a time reference for impact assessment longer than the 1-day entrainment zone. SDG&E may use the existing zone. SDG&E may use the existing data collected during the original demonstration project, but shall propose an alternative approach to assess the long-term effect of plankton removal.*

Estimates of loss were calculated for 17 selected species that included the original 16 "critical species" identified in the original 316(b) report and also tidewater goby, the only endangered aquatic species likely to occur in the area. Estimates of adult equivalent loss were calculated for the three representative species with the highest estimates of entrainment or impingement loss: northern anchovy, topsmelt, and queenfish. The modeling uses life stage-specific estimates of

total mortality and yields estimates of the number of individual adult fishes which would have resulted from the young lost to entrainment and impingement under the conservative assumption of equal survival.

In order to put the entrainment losses in perspective and evaluate the magnitude of potential impacts, the report considered the life history characteristics of each target species (reproductive ability, geographic distribution, migratory capabilities) as well as estimates of current population size or harvest by commercial or sport fishermen. Although the original report touched on these topics, the 1997 report went into greater detail to evaluate potential impacts. Impacts were considered at three levels: individual population, overall community, and designated beneficial uses of the source waterbody.

The report concluded that the potential for adverse impacts from the EPS CWIS on individual target species was small compared to the sizes of the existing populations and the effects of fisheries. It similarly concluded that operation of the EPS cooling water intake has not, and will not, adversely affect the continued maintenance of balanced aquatic communities or designated beneficial uses of AHL or the Pacific Ocean in the vicinity of the EPS. Finally, the report stated that since the existing intake is not causing any adverse environmental impacts as defined under the CWA 316(b) guidelines that were in effect in 1997, it should be designated as best technology available.

### *3.1.3 2004-2005 EPS 316(b) Demonstration*

In 2004 the EPS initiated new IM&E studies prior to the publication of the new Phase II rules to take advantage of sampling synergies associated with the permitting of a desalination facility planned for construction on the EPS property. A study plan for the desalination facility studies was submitted to the San Diego Regional Water Quality Control Board (SDRWQCB) staff. The desalination facility study plan was designed to provide information on the larval fish and target invertebrates contained in the source of feedwater for the desalination facility, which is the power plant's cooling water discharge, that would be at risk to entrainment by the desalination plant, and information on the larval fish and target invertebrates contained in the power plant's source waterbody and intake flows. Data being collected for the desalination facility on the power plant's source population of entrainable larval fish and target invertebrates was similar to the information required under the new Phase II rules.

A plan for IM&E studies that directly addressed the requirement of 316(b) was submitted to the San Diego Regional Water Quality Control Board in September 2004 following the final publication of the new Rules in July 2004. The IM&E study plan was submitted as a first step in the facility's compliance with the new Phase II rule. The study plan was reviewed by the Board staff and their consultants, Tetra Tech Inc., and was approved contingent on certain comments and questions. Comments on the study plan were resolved and the studies continued through

June 2005 under the direction of a Technical Advisory Group comprised of staff from the Board, state and federal resource agencies, EPS, and their consultants. A summary of the 2004-2005 IM&E studies is presented in Section 9.0. The final report on the studies is being prepared and will be submitted as part of the CDS.

## 3.2 Survey of Ecological Resources of Agua Hedionda Lagoon (MEC Analytical Systems, Inc., 1995)

A series of field studies was completed in 1995 in AHL to characterize ecological resources of the lagoon prior to a proposed maintenance dredging project. The study delineated the extent of eelgrass and saltmarsh habitats in the lagoon, and provided quantitative information on the distribution and abundance of birds, fishes and benthic invertebrates. The studies occurred over a 14-month period from April 1994 to June 1995.

The fish surveys were conducted during two different seasons, spring and summer. A total of 29 species of fishes were collected during the two surveys (Table 3-5). Fewer taxa occurred in the Outer Lagoon compared to the Middle and Inner lagoons. The species composition recorded was indicative of the proximity of each lagoon segment to the outer coast with a higher proportion of nearshore species found in the Outer Lagoon samples and more estuarine/bay species in the Inner Lagoon. Mean total densities ranged from 0.016 fish per $m^2$ (10.76 $feet^2$) in the Outer Lagoon in April 1995 to 7.90 per $m^2$ (10.76 $feet^2$) in the east Inner Lagoon, also in April 1995. Overall densities were higher in the April than July for all lagoon segments. Silversides and gobies comprised over 90% of the individuals collected. The high densities recorded in the spring survey were due to recruitment of juveniles.

Although 29 species of fishes were found in the 1994-1995 surveys by MEC Analytical Systems, earlier studies (Bradshaw et al. 1976) reported a total of 42 species from occasional surveys and from intake screen collections from the power plant. A similar distribution pattern of increased diversity in the Inner Lagoon compared to the Outer Lagoon was also found in the SDG&E study. MEC Analytical Systems (1995) noted a lower abundance of California halibut in the lagoon than in previous surveys. California halibut were one of the most abundant species reported by Bradshaw and Estberg (1973), and were only collected in the Inner Lagoon in their survey. Studies by Kramer (1990) demonstrated the importance of the Middle and Inner lagoons as nursery habitat for California halibut.

**Table 3-5**
**Mean Density per $m^2$ and Percent Composition Of Fish Species Collected In Aqua Hedionda Lagoon During Two Surveys By Benthic Trawl, Beach Seine, And Otter Trawl**

| Species | Common Name | AHL Mean | Percent |
|---|---|---|---|
| Gobiidae (< 25 mm) | gobies (< 25 mm) | 0.550 | 31.54 |
| Atherinopsidae (< 25 mm) | silversides (< 25 mm) | 0.520 | 29.80 |
| *Atherinops affinis* | topsmelt | 0.325 | 18.64 |
| Gobiidae | goby, unid. | 0.076 | 4.33 |
| *Acanthogobius flavimanus* | yellowfin goby | 0.050 | 2.87 |
| *Hypsopsetta guttulata* | diamond turbot | 0.040 | 2.30 |
| *Clevlandia ios* | arrow goby | 0.037 | 2.15 |
| *Quietula y-cauda* | shadow goby | 0.021 | 1.21 |
| *Fundulus parvipinnis* | California killifish | 0.019 | 1.06 |
| *Cymatogaster aggregata* | shiner surfperch | 0.013 | 0.75 |
| *Syngnathus* sp. | pipefish, unid. | 0.013 | 0.75 |
| *Heterostichus rostratus* | giant kelpfish | 0.013 | 0.74 |
| *Paralichthys californicus* | California halibut | 0.012 | 0.70 |
| *Gillichthys mirabilis* | longjaw mudsucker | 0.012 | 0.67 |
| *Leptocottus armatus* | staghorn sculpin | 0.010 | 0.54 |
| *Paralabrax maculatofasciatus* | spotted sandbass | 0.009 | 0.52 |
| *Syngnathus auliscus* | barred pipefish | 0.005 | 0.28 |
| *Engraulis mordax* | northern anchovy | 0.005 | 0.27 |
| *Hypsoblennius gentilis* | bay blenny | 0.004 | 0.22 |
| *Ilypnus gilberti* | cheekspot goby | 0.004 | 0.20 |
| *Syngnathus leptorhynchus* | bay pipefish | 0.003 | 0.19 |
| *Seriphus politus* | queenfish | 0.003 | 0.17 |
| *Anchoa compressa* | deepbody anchovy | 0.002 | 0.10 |
| *Mustelus californicus* | grey smoothhound shark | • | |
| *Gymnura marmorata* | California butterfly ray | • | |
| *Paralabrax clathratus* | kelp bass | • | |
| *Micropterus dolomieui* | small mouth bass | • | |
| *Umbrina roncador* | yellowfin croaker | • | |
| *Sphyraena argentea* | California barracuda | • | |
| *Citharichthys stigmaeus* | speckled sanddab | • | |

**Table 3-5 (Continued)**
**Mean Density per $m^2$ and Percent Composition Of Fish Species Collected In Aqua Hedionda Lagoon During Two Surveys By Benthic Trawl, Beach Seine, And Otter Trawl.**

| Species | Common Name | AHL Mean | Percent |
|---|---|---|---|
| *Pleuronichthys ritteri* | spotted turbot | * | |
| *Symphurus atricauda* | California tonguefish | * | |

**Indicates species with no quantitative summary data included in report (from MEC 1995, Table 3.5).*
*$M^2$ = 10.76 $feet^2$*

Tidewater gobies (*Eucyclogobius newberryi*) were collected from AHL historically, but were not found in the 1994–1995 sampling. It is thought that the dredging and opening of the lagoon to higher saline marine waters in the 1950s significantly affected the tidewater goby population, which is adapted to primarily brackish water conditions.

A total of 143 macroinvertebrate taxa were collected with beam trawls in AHL during the MEC study. Very few of these taxa would be susceptible to impingement from EPS because of their primarily benthic habitat requirements. The most abundant taxa included the cockle (*Laevicardium substriatum*), a non-native mussel (*Musculista senhousi*); bubble snails (*Acteocina inculta, Bulla gouldiana, Haminaea vesicular*), mud dwelling snails, and several species of small crustaceans including amphipods, isopods, mysids, and shrimps. Differences in abundance of several taxa among the three lagoon segments was noted in the sampling and was attributed mainly to predominantly coarser sediments in the Outer Lagoon and finer sediments in the eastern inner portion of the Inner Lagoon.

A total 76 infaunal taxa was collected using a small coring apparatus with the sediments sieved through a 0.04 inches mesh screen. It was concluded that benthic infaunal populations were generally more diverse and abundant in the eelgrass beds than in non-vegetated sediments or in areas where currents deposited littoral sands.

Speckled scallop, *Argopecten circularis*, is a protected species that was known to occur in AHL. Only one individual was collected by MEC during the 1994-95 studies. The species had been studied previously by the California Department of Fish and Game (CDF&G) at AHL from March 1984 to October 1986 to obtain basic life history data (Haaker et al. 1988). Monthly samples of scallops were collected, measured, and released to obtain length frequency data for estimates of growth, life span, and spawning period. In 1984 large concentrations of speckled scallops were found on the sand-silt bottom of the lagoon, closely associated with eelgrass. During the course of the study the numbers of scallops declined, until their virtual disappearance at the end of 1986. Monthly length frequency plots from 24,375 scallop measurements indicate that this is a rapidly growing species with a short life span.

Special studies were done in conjunction with the new IM&E studies done in 2004 and 2005 to supplement the information on fishes provided in the MEC report. The MEC studies did not include sampling of mudflats in the Inner Lagoon and rocky habitat in the Outer Lagoon. The fishes in these two habitats produce large numbers of larvae at risk to entrainment. The data from these studies will be combined with data from the MEC study to provide more accurate estimates of the populations of fishes in the lagoon that will help provide some context for the estimates of EPS entrainment.

# 4.0 Agency Consultations

As required by the EPA 316(b) Phase II regulation [40 CFR 125.95 (b)(1)(iii)], a summary of any past and ongoing consultations with federal and state Fish and Wildlife Agencies relevant to the development of the PIC for this facility is presented in this section. All communications related to the IM&E issues at the EPS have been conducted through the SDRWQCB with federal and state resource agencies providing input on the IM&E studies as described below.

IM&E studies at EPS were started in June 2004 prior to the publication of the new Phase II rules to take advantage of entrainment sampling that was being done as part of the permitting for a desalination facility planned for construction on the EPS property. A plan for IM&E studies that directly addressed the requirements of 316(b) under the new Phase II rule was submitted to the San Diego Regional Water Quality Control Board on September 2, 2004. The IM&E study plan was submitted as a first step in the facility's compliance with the new Phase II rule. The study plan was reviewed by the Board staff and their consultants, Tetra Tech Inc., and was approved contingent on certain comments and questions that did not affect the sampling procedures being used in the studies. A copy of the September 30, 2004 Tetra Tech review of the study is included as in Attachment B. A copy of the EPS response to the Tetra Tech comments, dated January 10, 2005 is included in Attachment B.

One of the recommendations of the Tetra Tech review was that the SDRWQCB staff and other resource agencies be involved in approving certain aspects of the study including the selection of the target organism that would be used in the final assessment of cooling water system effects. In response to these comments a Technical Advisory Group (TAG) was formed to provide guidance on the IM&E studies. The TAG consists of staff from the SDRWQCB, the National Marine Fisheries Service, the CDF&G, the EPS and their consultants, Tenera Environmental and Dr. Scott Jenkins, an oceanographer from the University of California, San Diego Scripps Institute of Oceanography. The functions of the TAG included the following:

- providing input and review on selection of target organisms for assessment;
- providing input and review on the definition of the source water for entrainment assessment modeling;
- providing input on special studies and other data sources that may be available for assessing source water populations; and
- providing review on reports.

The SDRWQCB and resource agencies' staff participated in three TAG meetings in March, June and in September of 2005. Details on discussion topics of PICs and conclusions from each

meeting are presented in Table 4-1. Based on preliminary analyses of the IM&E data, a suite of target fishes and shellfishes for detailed analysis in the IM&E Characterization Study Final Report were selected by the TAG at the September 2005 meeting.

On January 6, 2005, EPS submitted a letter to the SDRWQCB requesting a schedule for submittal of information required to comply with the EPA 316(b) Phase II rule. The letter requested a schedule for submittal of the PIC on April 1, 2006 and for submittal of the CDS on January 7, 2008. A copy of the subject correspondence is included in Attachment B.

**Table 4-1**
**Technical Advisory Group Meetings Held on Impingement Mortality and Entrainment Studies at EPS**

| Date | Attendees | Discussion Topics | Conclusions |
|---|---|---|---|
| March 14, 2005 | Tim Hemig, Sheila Henika - EPS<br>John Steinbeck, David Mayer - Tenera<br>John Phillips, Peter Michael - SDRWQCB<br>Bob Hoffman - NMFS<br>Bill Paznokas - CDF&G | Discussion of study design, assessment models, and methods for defining the source water for the study. Description of special studies on fishes of Agua Hedionda Lagoon that will help fill in data gaps from previous studies. | Agency representatives agreed with the sampling design since it follows the same model used for the South Bay Power Plant and Huntington Beach Generating Station studies. |
| June 13, 2005 | Tim Hemig, Sheila Henika - EPS<br>John Steinbeck, David Mayer - Tenera<br>John Phillips, Paul Richter - SDRWQCB<br>Bob Hoffman - NMFS<br>Bill Paznokas - CDF&G<br>Scott Jenkins - Scripps | Updates on impingement and entrainment sampling, and special studies. Presentation of population model for source water target organisms that accounts for the reduced residency time in Agua Hedionda Lagoon which limits the period of time that larvae are exposed to entrainment. | Agency representatives agreed with the need for more complicated population model and approach used for special studies |
| Sept. 29, 2005 | Tim Hemig, Sheila Henika - EPS<br>John Steinbeck, David Mayer, John Hedgepeth - Tenera<br>Charles Cheng - SDRWQCB<br>Bob Hoffman - NMFS<br>Bill Paznokas - CDF&G<br>Scott Jenkins - Scripps | Presentation of preliminary impingement and entrainment sampling results and recommendations for target organisms that will be analyzed in final report. Presentation of results from studies on the hydrodynamics of AH Lagoon and the use of the results in assessment models. | Agreement on target organisms that will be analyzed in detail for cooling water system effects in the final report. |

# 5.0 Evaluation of Intake Technology Alternatives

The EPA Phase II 316(b) regulation requires in 40 CFR 125.95(b)(1(i) that the PIC include a description of technologies which will be evaluated further to determine feasibility of implementation and effectiveness in meeting IM&E performance standards at the facility. The EPS CWIS, being located on a tidal/estuarine waterbody, must meet the performance standards for reduction in both IM&E.

A preliminary screening of technologies has been conducted to determine which alternatives offer the greatest potential for application at the EPS facility and therefore warrant further evaluation. Technologies have been screened based upon feasibility for implementation at the facility, biological effectiveness (i.e. ability to achieve reductions in both IM&E), and cost of implementation (including capital, installation, and annual operations and maintenance costs). Table 5-1 includes a list of technologies for which a preliminary screening was conducted.

**Table 5-1**
**Fish Protection Technologies**

| Technology | Fish Protection Potential | |
|---|---|---|
| | Impingement Mortality | Entrainment |
| Modified traveling screens with fish return | Yes | No |
| Replacement of existing traveling screens with fine mesh screens | Yes | Yes |
| New fine mesh screening structure | Yes | Yes |
| Cylindrical wedge-wire screens – fine slot width | Yes | Yes |
| Fish barrier net | Yes | No |
| Aquatic filter barrier (e.g. Gunderboom) | Yes | Yes |
| Fine mesh dual flow screens | Yes | Yes |
| Modular inclined screens | Yes | No |
| Angled screen system – fine mesh | Yes | Yes |
| Behavior barriers (e.g. light, sound, bubble curtain) | Maybe | No |

In a cursory analysis of the industry costs of implementing the new 316(b) Performance Rule, the EPA has selected retrofit of Fish Screens and a Fish Handling and Return Systems as an applicable technology for the EPS intake system.

The technologies selected for further consideration, which address both impingement and entrainment, as well as those determined not to warrant further consideration are discussed below.

## 5.1 Technologies Selected For Further Evaluation

A technology, which may be feasible for achieving performance standards, in whole or in part, for reduction in IM&E will be evaluated on the basis of the following:

- Ability to achieve required reductions in both IM&E for all species, taking into account variations in abundance of all life stages;
- Feasibility of implementation at the facility;
- Cost of implementation (including installed costs and annual O&M costs); and
- Impact upon facility operations.

The evaluation will involve the following:

- Comprehensive review of facility CWIS design and operation;
- Engineering design of proposed CWIS upgrades and/or equipment replacements;
- Development of design drawings;
- Analysis of capital and installation costs; and
- Assessment of level of IM&E reductions expected.

After reviewing the site conditions, the following design and construction technologies were selected for further evaluation for the feasibility of implementation to meet, in whole or in part, IM&E reduction standards:

- Modified traveling screens with fish return
- New fine mesh screening structure

### 5.1.1 Fish Screens, Fish Handling, and Return Systems

Traveling screens that are modified to enhance fish survival are designed with the latest fish removal features, including the Fletcher type buckets on the screen baskets, dual pressure spray systems (low pressure to remove fish, and high pressure to remove remaining debris), and separate sluicing systems for discarding trash and returning the impinged fish back to the water body. Impingement survival may be improved with the use of continuously operating modified traveling water screens. A fish return system is required as part of this system to transport fish washed from the screens alive back to the water body to a location where they would not be subject to re-entrainment into the intake.

Installation of modified Ristroph traveling screens at the EPS CWIS would consist of replacing the existing traveling water screens within the tunnel system with the screens as described above. A fish return system would be installed to return fish collected on the traveling water screens to the lagoon. The replacement screens would be equipped with the same 3/8 inch mesh size as the existing traveling screens.

The feasibility of replacing the existing traveling screens at the EPS CWIS with modified Ristroph traveling screens with conventional 3/8 inch mesh, fish handling and fish return systems will be evaluated. The evaluation will include an assessment of the additional reduction in IM that may be expected through implementation of this technology. Additionally, the feasibility of transporting the collected fish back to a location that would be an appropriate habitat and not result in likely re-entrainment into the intake will be assessed.

### *5.1.2 New Fine Mesh Screening Structure*

Fine mesh traveling water screens have been tested and found to retain and collect fish larvae alive with some success. Fine mesh traveling water screens have been installed at a few large-scale steam electric cooling intakes including marine applications at Big Bend Station in Tampa, Florida (EPRI, 1986), and at an operating nuclear generating station at Prairie Island on the Mississippi River (Kuhl, 1988). Results from field studies of fine-mesh traveling water screens generally show higher survival at lower approach velocities and with shorter impingement duration (EPRI, 1986). In addition, many regulatory agencies have in the past adopted an expectation that traveling water screen approach velocities should be 0.5 feet per second (fps) or less. The National Pollutant Discharge Elimination System - Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Facilities in Section VII A states a maximum through screen design intake velocity of 0.5 fps as the acceptable design standard. This would require a screen approach velocity of 0.25 fps or less depending on the percent open area of the screen mesh used.

Application of fine mesh traveling water screen technology for EPS would likely require a complete new screen structure constructed at the south shore of the lagoon, including both trash racks and fine mesh traveling screen systems and fish collection and return systems; and would replace the existing trash rack structure with a much larger screening structure. It appears that there may be adequate space at the shore for a new fine mesh screen structure, but additional evaluation is still necessary. The approach velocities to the existing traveling screens, as discussed in subsection 2.3 above, are currently well above 0.5 fps and adding sufficient additional screens to the intake tunnel system to reduce approach velocities to 0.5 fps or less would require major modifications to the tunnel system, which may not be feasible. Additionally, an appropriate and suitable location to return collected fish, shellfish, and their eggs and larvae

would have to be identified, as well as an assessment of the feasibility of constructing such a return system.

Design layouts and cost estimates for implementation and operation and maintenance will be developed for the above described fine mesh screen structure, as part of the CDS evaluation.

## 5.2 Technologies Considered Infeasible and Eliminated From Further Evaluation

### 5.2.1 Replacement of Existing Traveling Screens with Fine Mesh Screens

As discussed above in section 5.1.2, simple replacement of the existing traveling screens in the tunnel system with fine mesh Ristroph screens is not feasible due to high screen approach velocities. Therefore, further evaluation of this technology for implementation at the EPS CWIS will not be conducted.

### 5.2.2 Cylindrical Wedge-Wire Screens – Fine Slot Width

Wedge-wire screens are passive intake systems, which operate on the principle of achieving very low approach velocities at the screening media. Wedge-wire screens installed with small slot openings may enable a facility to meet performance standards for both IM&E. The wedge-wire screen is an EPA-approved technology for compliance with the EPA 316(b) Phase II rule provided the following conditions exist:

- The cooling water intake structure is located in a freshwater river or stream;
- The cooling water intake structure is situated such that sufficient ambient counter currents exist to promote cleaning of the screen face;
- The through screen design intake velocity is 0.5 fps or less;
- The slot size is appropriate for the size of eggs, larvae, and juveniles of any fish and shellfish to be protected at the site; and
- The entire main condenser cooling water flow is directed through the technology.

Wedge-wire screens are designed to be placed in a water body where significant prevailing ambient cross flow current velocities ($\geq$ 1 fps) exist. This cross flow allows organisms that would otherwise be impinged on the wedge-wire intake to be carried away with the flow. An integral part of a typical wedge-wire screen system is an air burst back-flush system, which directs a charge of compressed air to each screen unit to blow off debris and impinged organisms back into the water body where they would be carried away from the screen unit by the ambient cross flow currents.

The EPS CWIS, located on the tidal AHL would not meet the first two EPA criteria discussed above. The intake is not located on a freshwater river and there are not sufficient ambient crosscurrents in the lagoon to sweep organisms and debris away from the screen units. Debris and organisms back-flushed from the screens would immediately re-impinge on the screens following the back-flush cycle because the principal water current in the outer lagoon would be the station intake flow toward the screen units. For these reasons, wedge-wire screen technology is not considered feasible for application at the EPS.

### 5.2.3 Fish Barrier Net

A fish net barrier, as it would be applied to a power station intake system, is a mesh curtain installed in the source water body in front of intake structures such that all flow to the intakes passes through the net, blocking entrance to the intake of all aquatic life forms large enough to be blocked by the net mesh. The net barrier is sized large enough to have very low approach and through net velocities to preclude impingement of juvenile fish with limited swimming ability. The mesh size must be large enough to preclude excessive fouling during normal station operation while at the same time small enough to effectively block entrainment of organisms into the intake system. These conditions typically limit the mesh size such that adult and a percentage of juvenile fish can be blocked. The mesh is not fine enough to block most larvae and eggs. The fish net barrier could potentially meet the performance requirements of the EPA Phase II Existing Facilities Rule for impingement; however, it would not meet the performance requirements for reduction of entrainment of eggs and larvae.

The fish net barrier technology is still experimental, with very few successful installations at power station intakes. Using a 20 gpm/ft$^2$ design loading rate, a net area of approximately 30,000 feet$^2$ would be required for EPS. Maintaining such a large net moored in the lagoon is not practical. In addition, the fish barrier is a passive screening device, which is subject to fouling and has no means for self-cleaning. This technology would be rapidly clogged due to fouling. The services of a diving contractor would be required to remove the net for cleaning onshore and to replace the fouled net with a clean net on each cleaning cycle. For these reasons, this technology is not practically feasible for implementation at EPS and further evaluation is not warranted.

### 5.2.4 Aquatic Filter Barrier

An aquatic filter barrier system, such as the Gunderboom Marine Life Exclusion System (MLES)™ (Gunderboom), is a moored water permeable barrier with fine mesh openings that is designed to prevent both impingement and entrainment of ichthyoplankton and juvenile aquatic life. An integral part of the MLES is an air-burst back flush system similar in concept to the air burst system used with wedge-wire screen systems to back flush impinged organisms and debris into the water body to be carried away by ambient cross currents.

A MLES has been installed and tested at the Lovett Station on the Hudson River. This test installation was applied to a cooling system of significantly smaller capacity than the EPS intake system and in a very different environment on the Hudson River, as opposed to the lagoon intake of the EPS.

Although the MLES has much smaller mesh openings and will block fish eggs and larvae from being entrained into the intake, these smaller organisms will be impinged permanently on the barrier due to the lack of cross currents to carry them away. This system therefore offers no significant advantage over other technologies such as the fish net barrier concept and would offer no biological improvement over the barrier net design. For these reasons, this technology is not practically feasible for implementation at EPS and further evaluation is not warranted.

### *5.2.5 Fine Mesh Dual Flow Screens*

A modified dual flow traveling water screen is similar to the through flow design, but the screen would be turned 90 degrees so that its two faces would be parallel to the incoming water flow. When equipped with fine mesh screening media, the average 0.5 fps approach velocity to the screen face would have to be met by the dual flow screen design. Water flow enters the dual flow screen through both the ascending and the descending screen faces, and then flows out between the two faces. All of the fish handling features of the Ristroph screen design would be incorporated in the dual flow screen design. However, the dual flow screen configuration has been shown to produce low survival rates for fish larvae. This is because of the longer impingement time endured by organisms impinged on the descending face of the screen. This longer impingement time is suspected to result in higher mortality rates than similar fine mesh screens with a flow through screen design.

The primary advantage of this screen configuration is the elimination of debris carryover into the circulating water system. Also, because both ascending and descending screen faces are utilized, there is greater screening area available for a given screen width than with the conventional through-flow configuration. However, the flow pattern and therefore the velocity distribution along the screen face is not uniform and is concentrated toward the back or downstream end of the screen. The dual flow screen can also create adverse flow conditions in the approach flow to the circulating water pumps. The flow exiting the dual flow screens is turbulent with an exit velocity of greater than 3 fps. Modifications to the pump bays downstream of the screens, usually in the form of baffles to break up and laterally distribute the concentrated flow prior to reaching the circulating water pumps, are usually required. This would not be the case for EPS if a new fine mesh dual flow screen structure were constructed at the lagoon, similar to the through flow fine mesh screen structure discussed in Section 5.1 above.

For similar reasons, as discussed above for through flow fine mesh screens, implementation of this technology to the EPS CWIS would require an entirely new screen structure similar to the fine mesh through flow screen structure discussed in Section 5.1 above. The dual flow fine mesh screen configuration offers no advantages in terms reduction of impingement and entrainment mortality as compared to through flow fine mesh traveling screens discussed above and in fact would probably not perform as well as the through flow design. The design concept for the dual flow screen structure would be similar to the through flow fine mesh screen structure with trash racks, coarse mesh traveling screens and fine mesh traveling screens in each screen train. The implementation cost and operation and maintenance costs for this facility would be of the same order of magnitude as for the through flow screen structure. Dual flow screen technology does not offer a significant performance or cost advantage as compared with through flow screen technology. Therefore, further evaluation of this technology for the EPS is not warranted.

### *5.2.6 Modular Inclined Screens*

Modular Inclined Screen (MIS) is a fish protection technology for water intakes developed and tested by the Electric Power Research Institute (EPRI) (Amaral, 1994). This technology was developed specifically to bypass fish around turbines at hydro-electric stations. The MIS is a modular design including an inclined section of wedge-wire screen mounted on a pivot shaft and enclosed within a modular structure. The pivot shaft enables the screen to be tilted to back-flush debris from the screen. The screen is enclosed within a self-contained module, designed to provide a uniform velocity distribution along the length of the screen surface. Transition guide walls taper in along the downstream third of the screen, which guide fish to a bypass flume. A full size prototype module would be capable of screening up to 800 cfs (360,000 gpm) at an approach velocity of 10 fps.

The MIS design underwent hydraulic model studies and biological effectiveness testing at Alden Research Laboratory to refine the hydraulic design and test its capability to divert fish alive. Eleven species of freshwater fish were tested including Atlantic salmon smolt, coho salmon, Chinook salmon, brown trout, rainbow trout, blueback herring, American shad and others. After some refinements in the design were made during this testing, the results showed that most of these species and sizes of fish can be safely diverted (Amaral, 1994).

Following laboratory testing the MIS design was field tested at the Green Island Hydroelectric Project on the Hudson River in New York in the fall of 1995 (Shires, 1996). In addition to the MIS, the effectiveness of a strobe light system was also studied to determine its ability to divert blueback herring from the river to the MIS. Results for rainbow trout, golden shiner and blueback herring, which were released directly into the MIS module were similar to the laboratory test results in terms of fish survivability. The limited amount of naturally entrained blueback herring did not allow reliable evaluation of test results (Amaral, 1994).

The MIS technology, as tested, does not address entrainment of eggs and larvae. Also, this technology has never been tested for, or installed in, a power station with a seawater intake system. Further research would be required to evaluate the efficacy of this technology for application to a seawater intake system. MIS is not a suitable and proven technology, at this time, for retrofit to the EPS intake system. Therefore, further evaluation of this technology for the EPS is not warranted.

### 5.2.7 Angled Screen System – Fine Mesh

Angled screens are a special application of through-flow screens where the screen faces are arranged at an angle of approximately 25 degrees to the incoming flow. The conventional through-flow screen arrangement would place the screen faces normal or 90 degrees to the incoming flow. The objective of the angled-screen arrangement is to divert fish to a fish bypass system without impinging them on the screens. Most fish would not be lifted out of the water but would be diverted back to the receiving water by screw-type centrifugal or jet pumps. Using fine screen mesh on the traveling screens minimizes entrainment, but increases potential for impingement of organisms that would have otherwise passed through the condenser.

Application of this technology would require construction of new angled screen structure at the south shore of the lagoon similar to the fine mesh screen structure discussed above in Section 5.1. The angled screen facility would not provide a significant performance advantage in terms of reducing IM&E as compared to the proposed fine mesh screen structure as presented above and would be at least as large and a significantly more complex structure. This facility would be potentially more costly to implement and maintain than the fine mesh screen facility. Therefore, further evaluation of this technology for the EPS is not warranted.

### 5.2.8 Behavior Barriers

A behavioral barrier relies on avoidance or attraction responses of the target aquatic organisms to a specific stimulus to reduce the potential of entrainment or impingement. Most of the stimuli tested to date are intended to repulse the organism from the vicinity of the intake structure. Nearly all the behavioral barrier technologies are considered to be experimental or limited in effectiveness to a single target species. There are a large number of behavioral barriers that have been evaluated at other sites, and representative examples these are discussed separately below.

**Offshore Intake Velocity Cap** – This is a behavioral technology associated with a submerged offshore intake structure(s). The velocity cap redirects the area of water withdrawal for an offshore intake located at the bottom of the water body. The cap limits the vertical extent of the offshore intake area of withdrawal and avoids water withdrawals from the typically more productive aquatic habitat closer to the surface of the water body.

This technology operates by redirecting the water withdrawal laterally from the intake(rather than vertically from an intake on the bottom), and as a result, water entering the intake is accelerated laterally and more likely to provide horizontal velocity cues that allow fish to respond and move away from the intake. Potentially entrainable fish are able to identify these changes in water velocity as a result of their lateral line sensory system and are able to respond and actively avoid the highest velocity areas near the mouth of the intake structure.

This technology reduces impingement of fish by stimulating a behavioral response. The technology does not necessarily reduce entrainment, except when the redirected withdrawal takes water from closer to the bottom of the water body and where that location has lower plankton abundance.

Application of this technology to the EPS CWIS, to be fully effective, would require development of an entirely new intake system with a submerged intake structure and connecting intake conduit system installed out into the Pacific Ocean similar to the offshore intake system at the El Segundo Generating Station (Weight, 1958). This is not a practically feasible consideration for the EPS. Also, this technology would probably not be capable of meeting the performance requirements of the EPA Phase II Existing Facilities Rule for reduction of entrainment of larvae, eggs and plankton. Therefore, this technology is not potentially applicable for the EPS CWIS and further evaluation of this technology is not warranted.

**Air Bubble Curtain** – Air bubble curtains have been tested alone and in combination with strobe lights to elicit and avoidance response in fish that might otherwise be drawn into the cooling water intake. Generally, results of testing the bubble curtain have been poor (EPRI, 1986). Tests have been conducted with smelt, alewife, striped bass, white perch, menhaden, spot, gizzard shad, crappie, freshwater drum, carp, yellow perch, and walleye. Many species exhibited some avoidance response to the air bubble or the combination air bubble and light combination. However, there has been little if no testing of species common to the AHL.

This technology has some potential to enhance fish avoidance response in some species of fish. However, there is no reliable data for the species that are subject to impingement at the EPS and no way to estimate what type of reaction fish would have to the existing intake with the addition of a bubble curtain. Unless some type of testing were conducted, this technology does not appear suitable for the EPS. As a result, there is no basis to recommend an air curtain as an enhancement to reduce impingement or entrainment at the EPS CWIS. Therefore, further evaluation of this technology for the EPS is not warranted.

**Strobe Lights** – There has been a great deal of research with this stimulus over the last 15 years to guide fish away from intake structures. The Electric Power Research Institute has co-funded a series of research projects (EPRI 1988, EPRI 1990, EPRI 1992) and reviewed the results of

research in this field by others (EPRI 1986, EPRI 1999). In both laboratory studies and field applications strobe lights were shown to effectively move selected species of fish away from the flashing lights. Most of the studies conducted to date have been with riverine fish species and for projects associated with hydroelectric generating facilities. One early study was conducted at the Roseton Generating Facility on the Hudson River in New York, another study was conducted on Lake Cayuga in New York, and others for migratory stages of Atlantic and Pacific salmon. Few species similar to those occurring in the AHL have been tested for avoidance response either in the lab or in actual field studies.

Laboratory testing was done for an application of strobe lights for the San Onofre Nuclear Generating Facility. Testing was conducted for white croaker, Pacific sardine and northern anchovy. Limited availability of test specimens and limited testing demonstrated no conclusive results and the California Coastal Commission (2000) found this device not useful at this station.

Before strobe lights could be seriously considered for use at the EPS CWIS, a series of lab and or field studies on their effectiveness for the species most likely to be entrained into the EPS CWIS would need to be completed. Based on studies of strobe lights conducted to date, it is likely that these studies would show differential effectiveness based on background light conditions (day vs. night), ambient seawater turbidity, and most likely there would also be great differences in species specific response. As a result there is no basis to recommend these strobe lights as an enhancement to reduce impingement or entrainment at the EPS CWIS. Therefore, further evaluation of this technology for the EPS is not warranted.

**Other Lighting** – Incandescent and mercury vapor lights have also been tested as a behavioral stimulus to direct fish away from an intake structure. Mercury lights have generally been tested as a means of drawing fish to a safe bypass of the intake structure as generally the light has an attractive effect on fish. Tests have not demonstrated a uniform and clearly repeatable pattern of attraction for all fish species. The mercury lights have been somewhat effective in attracting European eel, Atlantic salmon, and Pacific salmon. But results with other species including American shad, blue back herring and alewife had more variable results. One test with different life stages of Coho salmon shows both attraction and repulsion from the mercury light for the different life stages of the coho.

Testing with incandescent, sodium vapor and fluorescent lamps was more limited but also had variable and species specific results.

Other lighting systems, as with most all the behavioral barrier alternatives, have not been tested with the species of fish common in AHL. As a result, there is no basis to recommend these lights systems as an enhancement to reduce impingement or entrainment at the EPS CWIS. Therefore, further evaluation of this technology for the EPS is not warranted.

**Sound** – Sound has also been extensively tested in the last 15 years as a method to alter fish impingement rates at water intake structures. Three basic groups of sound systems including percussion devices (hammer, or poppers), transducers with a wide range of frequency output, and low frequency or infrasound generators, have all been tested on a variety of fish species.

Of all the recently studied behavioral devices the sound technology has demonstrated some clear success with at least one group of fish species. Clupeids, such as alewife, demonstrate a clear repulsion to a specific range of high frequency sound. A device has been installed in the Fitzpatrick Nuclear Generating station on Lake Ontario in New York State, which has been effective in reducing impingement of landlocked alewives. The results were repeated with alewife at a coastal site in New Jersey. Similar results with a high frequency generator also reported a strong avoidance response for another clupeid species, the blue back herring, in a reservoir in South Carolina. Testing of this high frequency device on many other species including weakfish, spot, Atlantic croaker, bay anchovy, American shad, blue back herring, alewife, white perch, and striped bass only demonstrated a similar and strong avoidance response by American shad and blue back herring.

Alewife and sockeye salmon have also been reported to be repelled by a hammer percussion device at another facility. But testing of this same device at other facilities with alewife did not yield similar results.

Although high frequency sound has potential for eliciting an avoidance response by the Alosid family of fish species, there is no data to demonstrate a clear avoidance response for the species of fish common to the AHL. Therefore there is no basis to recommend sound as a method to reduce impingement of fish at the EPS CWIS. Therefore, further evaluation of this technology for the EPS is not warranted.

# 6.0 Evaluation of Operational Measures

The EPA 316(b) Phase II regulation [40 CFR 125.95(b)(1)(i)] requires that the PIC should include a description of operational measures which will be evaluated further to determine feasibility of implementation and effectiveness in meeting IM&E performance standards at the facility. A preliminary screening of such measures has been conducted to determine those which offer the greatest potential for application at the facility and therefore warrant further evaluation. Operational measures have been screened based upon feasibility for implementation at the facility, biological effectiveness (i.e. ability to achieve reductions in IM&E), and cost of implementation (including additional power requirements and loss in generating capacity and unit availability).

Several operational measures have been proven effective in reducing IM&E at CWIS. Such measures include:

- CWIS flow reductions (e.g. capping capacity utilization rate)
- Variable speed drives for CWIS pumps
- Other cooling water efficiency improvements

The following is a discussion of operational measures for which further evaluation will be conducted in the CDS to determine their potential for reducing IM&E at EPS. The results of the evaluation of such measures will be utilized to develop the plan for implementation of technologies, operational and/or restoration measures that will be proposed to achieve IM&E performance standards at the facility. Upon selection of the most appropriate operational measures, engineering design calculations and drawings, as well as estimates of expected reductions in IM&E and a schedule for implementation will be developed. This information will become part of the Design and Construction Technology Plan (DCTP) (or Site-Specific Technology Plan in the event that the facility chooses to seek a site-specific determination of BTA) and Technology Installation and Operation Plan (TIOP) that will be included in the CDS to be submitted for the facility. The DCTP explains the intake technologies or operational measures selected for use at EPS to meet the E&I performance standards for the Phase II Rule. The compliance with the performance standards will be measured and monitored through documentation of the TIOP.

## 6.1 Circulating Water Flow Reduction / Caps

Circulating water flow caps are an operational control measure which would include administratively limiting the total withdrawal of cooling water from the AHL to an agreed upon value. The flow reductions may be scheduled for periods of the year when entrainment or impingement are highest to achieve a greater reduction to impingement and entrainment. Any

reduction in flow reduces both entrainment and impingement effects associated with the operation of the plant. If flow reductions are concentrated during the seasons of the year that plankton life stages of species of concern are present, the overall seasonal reductions in fisheries impacts can greatly exceed the quantity of the flow reduction. Utilizing variable speed drive technology on the circulating water pumps could be an effective means of controlling total annual flow withdrawal.

## 6.2 Variable Speed Drives For Circulating Water Pumps

Variable-speed drives for circulating water pumps allow reduction in cooling water flow during periods when the unit is not operating at full-rated capacity, or during known periods of high entrainment. With this technology it would be possible to vary the speed of the motor from 10% to 100% and reduce the cooling water intake flow by up to 90%. Any reduction in flow reduces both entrainment and impingement effects associated with the operation of the plant. The lower pumping capacity allows for a lower approach velocity at the traveling screens and reduces the number of entrainable organisms drawn into the cooling water system. In addition, if flow reductions are concentrated during the seasons of the year that plankton life stages of species of concern are present, the overall seasonal reductions in fisheries impacts can greatly exceed the quantity of the flow reduction. The installation of variable speed drives will be evaluated further to determine the effectiveness in reducing IM&E at the EPS CWIS.

## 6.3 Heat Treatment Operational Changes

Potential operational and procedural enhancements to reduce impingement during heat treatment events will also be evaluated. In the CDS, EPS will evaluate a couple of alternative biofouling control measures that might reduce the number, or eliminate the need for, heat treatments in the intake tunnels. In addition, EPS will also evaluate a couple of modifications of the existing heat treatment procedures that might reduce the numbers of fish impinged during these events, but still provide effective heat treatment removal of fouling organisms in the intake and intake tunnels.

# 7.0 Evaluation of Restoration Alternatives

The EPA Phase II 316(b) regulation [40 CFR 125.95(b)(1)(i)] allows the consideration of restoration measures as one of the options that may be implemented, either alone or in combination with technology and/or operational measures, to achieve performance standards for reduction in IM&E losses. Facilities may propose restoration measures that will result in increases in the numbers of fishes and shellfishes in the waterbody that would be similar to those achieved with meeting performance standards through the implementation of technologies and/or operational measures. EPS will conduct an evaluation of potential restoration measures that may be implemented in the event that it is determined that meeting performance standards through the implementation of technologies and/or operational measures alone is less feasible, less cost-effective, or less environmentally desirable than use of restoration measures.

## 7.1 Potential Restoration Measures

This section introduces the type of habitat restoration projects that could potentially be used to offset IM&E losses at EPS. The offsets that will later be calculated for each project will be based on a numerical comparison of IM&E losses resulting from the operation of EPS, and the expected production of equivalent adults of the affected species resulting from the restoration efforts using various habitat models.

Any specific conservation, enhancement, or restoration project that is to be used for this purpose should have a nexus (i.e. relationship between the environmental impacts and the proposed project) to the impingement and entrainment effects of the power plant. The projects that will be evaluated to offset potential EPS IM&E losses fall into three general categories:

- Projects that would directly restore or enhance habitat in AHL;
- Projects that would preserve, restore, or enhance the AHL watershed; and
- Projects that enhance the nearshore coastal environment in the vicinity of EPS Power Station.

The following is a list of some of the potential restoration measures, in each of the above categories, which will be evaluated to determine their feasibility of implementation, and potential efficacy in meeting IM&E performance standards at the EPS:

I. **Restoration or Enhancement of AHL**

- Invasive species removal and prevention
- Restoration of historic sediment elevations to promote reestablishment of eelgrass beds
- Enhancement of AHL State Reserve
- Marine fish hatchery enhancement
- Community outreach soliciting public agency and landowner participation

II. **Restoration or Enhancement of Agua Hedionda Watershed**

- Erosion control projects along upland watercourses
- Construction of catchment basins, swales, and other sediment containment features
- Land acquisition for purposes of creating conservation easements
- Minimizing runoff from development activities
- Restoration of floodplain habitat
- Invasive species removal and prevention

III. **Restoration or Enhancement of Nearshore Coastal Areas**

- Marine fish hatchery stocking program
- Artificial reef development
- Marine Protected Area establishment
- Kelp bed enhancement

The "value" of the ecological services or benefits that will result from implementation of any of these restoration projects will be assessed using various habitat models to demonstrate that the ecological "credits" gained through restoration will outweigh the ecological "debits" caused by the IM&E losses. A preliminary screening of these potential restoration measures will be conducted to determine which projects warrant further evaluation. Selected projects will be evaluated further based upon the criteria described below.

## *7.2 Project Selection Criteria*

A set of restoration project selection criteria has been developed to aid in the evaluation of potential projects. The project selection criteria include:

- Location
- Nexus to EPS IM&E effects
- Basic need or justification for project
- Nature and extent of ecological benefits
- Stakeholder acceptance
- Consistency with ongoing resource agency work and environmental planning

- Administrative considerations
- Implementation costs
- Cost effectiveness
- Ability to measure performance
- Success of comparable projects
- Length of time before benefits accrue
- Technical feasibility
- Opportunities for leveraging of funds/availability of matching funds
- Legal requirements (e.g., permits, access)
- Likely duration of benefits

Depending on the nature of a particular project, the relative importance and weighting of these criteria may vary. As a general proposition, however, projects will be selected so as to maximize the ecological benefits to AHL and adjacent nearshore areas. This process will ensure that the most effective projects are assigned the highest priority.

# 8.0 Other Compliance Options for EPS

Two additional compliance alternatives that EPS may pursue in the course of developing the most appropriate CDS for the EPS CWIS include a site-specific determination of BTA and a trading approach for cooperative restoration solutions. The site-specific determination option would be undertaken if the implementation of some combination of an intake technology, operation change or restoration is significantly greater in cost than that estimated by US EPA or the costs are significantly greater than the benefits of such measures. The trading program compliance alternative would involve EPS teaming with other water users in the area to develop a more comprehensive solution to reduce or mitigate for IM&E with a cooperatively funded technology or restoration alternative. EPS has no specific plans and has not developed potential teaming partners to pursue this compliance alternative at this time. However, EPS will remain open to exploring this compliance alternative if the right opportunity is identified prior to submittal of the CDS.

## 8.1 Site-Specific Determination of BTA

The intent of the EPS approach to compliance is to meet the entrainment and impingement performance standards established by the EPA when the new rule was promulgated. That is, EPS hopes to demonstrate that the EPS intake has reduced the effects of entrainment by 60 to 90% and reduced the effects of station operation on impingement mortality by 80 to 95% from the calculation baseline. However, EPS also recognizes that if the costs of reaching these goals cannot reasonably be achieved that the EPA 316(b) Phase II regulation allows a somewhat lower IM&E reduction standard. Specifically the new rule would allow EPS to demonstrate that the EPS facility is eligible for a site-specific determination of BTA to minimize IM&E and that EPS has selected, installed, and is properly operating and maintaining, or will install and properly operate and maintain, design and construction technologies, operational measures, and/or restoration measures that the Director has determined to be the BTA to minimize adverse environmental impact of the EPS cooling water operations.

This compliance alternative allows the EPS facility to request a site-specific determination of BTA for minimizing IM&E if EPS can demonstrate that the costs for compliance with the new rule are significantly greater than those considered by EPA in the development of the rule (cost/cost test) or that the costs associated with compliance are significantly greater than the benefits (cost/benefit test) that would accrue to the environment.

### 8.1.1 Cost/Cost Test

If EPS chooses to seek a site-specific determination of BTA, a cost/cost test will be performed to compare the cost of implementing options to achieve full compliance with the 316(b) Phase II standards to costs estimated by the EPA for the EPS facility for achieving full compliance. In the 316 (b) Phase II rule, the EPA has assumed that the EPS facility would add a fish handling and return system to the existing traveling water screen system. There was no expectation in that recommendation that the EPS facility would need to meet the entrainment performance standards. Therefore EPA has projected compliance capital costs for the EPS facility of $2,841,330 (Federal Register, Vol. 69 – 7/9/2004, page 41677 – see Facility ID# AUT0625). This same source cites an expected existing baseline O&M annual cost of $104,168 and a post construction O&M annual cost of $380,113 for EPS.

If pursuit of this compliance option is justified, EPS will conduct its evaluation following a three-step method, as follows:

1. Identification of feasible options for achieving full compliance (e.g. combinations of engineering, operational, and restoration actions);
2. Estimation of the dollar costs of implementing these actions (including capital, O&M, and lost generation revenue due to extended outages); and
3. Comparison of the total estimated cost of compliance based upon the compliance options identified with EPA's estimated cost of compliance for the facility in question.

One thing that has not been fully resolved by EPA is what constitutes "significant" compared to the costs that EPA projected for the EPS. EPS will develop its perspective on what constitutes significant during the development of the CDS. It is likely that significance will be judged from the perspective of the capital and operating costs and revenues from the operation of EPS.

### 8.1.2 Cost/Benefit Test

A cost/benefit test may also be performed for EPS to compare the total costs of achieving compliance with the environmental benefits through implementation of the required technologies, operational, and/or restoration measures. Costs are the sum of direct costs and the indirect costs of any intake, operational or restoration mitigation actions. Direct costs include the costs of implementing compliance alternatives, including capital, O&M, and lost generation revenue due to extended outages. Indirect costs include any costs associated with impairment of navigation, higher energy prices, and negative ecological effects of the mitigation actions on the waterbody. An initial phase of the cost/benefit test will identify whether any of these indirect cost elements are relevant at the EPS. The cost/benefit test would specify the nature of the relevant direct and indirect cost components at the facility.

The benefits arise from reducing IM&E by the full amount of the 316(b) Phase II rule's performance standard relative to baseline conditions. The economic benefits of reductions in IM&E have been specified by the EPA in its evaluation of the national benefits of the rule. The classes of benefits identified by EPA in its assessment include direct use benefits (e.g. those from commercial and recreational fishing), indirect use benefits (e.g. increased forage organisms), and existence, or passive use benefits (e.g. improved biodiversity). These benefits are based on standard definitions of value used by economists in cost/benefit analysis. Methods for quantifying benefits to commercial and recreational fishing and other changes in natural resources have been widely employed by environmental and natural resource economists over the past several decades.

The exact nature of the data and methods required for a cost/benefit analysis will vary depending upon the magnitude of the potential IM&E effects on a local and regional scale, the availability of existing economic benefit studies that may be applied, as well as the comments of the regulators and natural resource agencies involved with reviewing this PIC. These can vary widely and will not really be well understood until the results of the IM&E study are complete. When the IM&E study is complete, the numbers of each species affected by operation of the intake can be quantified, and then a value for each species affected by IM&E at the EPS CWIS can be developed.

The benefit studies would be undertaken using a phased approach. Following an initial scoping phase to determine the approach to conducting a cost/benefit analysis, an outline of a benefits assessment approach will be determined. EPS will develop an approach to conducting a benefits valuation for use in supporting a site-specific determination of BTA if that becomes the selected approach for meeting compliance with the new rule. The approach will address the following requirements for such a study as outlined in the Phase II rule:

1. Description of the methodologies to be used to value commercial, recreational, and other ecological benefits;
2. Documentation of the basis for any assumptions and quantitative estimates; and
3. Analysis of the effects of significant sources of uncertainty.

If restoration is a component of the compliance approach, the ability of the restoration project(s) to generate benefits to offset impingement and/or entrainment effects must be demonstrated. This requires specification of a metric that can be used to quantify restoration benefits in a manner comparable to entrainment and impingement effects in the ecosystem.

Habitat assessment methods will be used for assessing the relative value of restoration actions. The approach taken will be to:

1. Identify the key species of concern affected by the facility;
2. Identify critical factors or habitat needs for those species;
3. Identify technically feasible and cost-effective restoration actions that address such critical factors and needs factors; and
4. Choose an appropriate ecological metric for scaling effects of mitigation and/or enhancing habitat needs within the adjacent ecosystem or area.

For example, if it is determined that the restoration project needs to compensate for entrainment of a species for which spawning habitat is a limiting factor, then creation of sufficient new spawning habitat to increase the population by the amount of entrainment would be required for full compliance with the Rule. This would then translate to acreage of created habitat with certain required structural characteristics.

If entrainment losses are of key concern, and the population of associated fish is of less concern, then biomass could also serve as the metric. The present value of the entrained biomass would be computed as the ecological debit. Then, a wetland or other habitat creation project could be scaled in size to produce the equivalent present value of biomass from the primary productivity of the wetland or new habitat.

### 8.1.3 Evaluation of a Site-Specific BTA

The 316(b) Phase II Rule allows facilities to seek site-specific determinations of BTA if it can be demonstrated that the costs of achieving full compliance with the IM&E performance criteria at a facility are either:

1. Significantly greater than those considered by the EPA in development of the rule (cost/cost test), or
2. Significantly greater than the net environmental benefits to be achieved (cost/benefit test).

If either of these methods is implemented, EPS may propose this as the compliance approach if the costs are significantly higher than either the expected costs at the time the rule was promulgated or, for the amount of benefits that would be derived.

## 8.2 Trading For Cooperative Mitigation Solutions

In the preamble to the EPA 316(b) Phase II rule, as published in the Federal Register (Vol. 69, No. 131, pgs 41576 - 41693), there is a discussion of the role of trading under the rule (VII. F.2). The preamble describes how trading "...raises complex issues on how to establish appropriate

units of trade and how to measure these units effectively given the dynamic nature of the populations of aquatic organisms subject to impingement mortality and entrainment." However, EPA suggests that delegated authorities responsible for implementing the 316(b) Phase II rule wishing to develop trading options "...would be best off focusing on programs based on metric of compatibility between fish and shellfish gains and losses among trading facilities.". This section of the rule also states that if the delegated NPDES authority can demonstrate to the EPA Administrator that they have adopted a NPDES program within a watershed that provides for comparable reductions in IM&E, then the EPA Administrator must approve such alternative compliance alternative requirements.

EPS may consider a watershed-approach trading program as a possible compliance alternative if the right combination of coastal water users identify mutual goals for achieving compliance, either in whole or in part, with the new rule. EPS has not developed any specific alliance of water dependent organizations to implement such a watershed-approach trading compliance alternative. However, EPS expects that after field studies have characterized CWIS effects, that restoration may be the most feasible and cost-effective measure to meet the performance standards. This might be done alone, or in combination with other intake technologies or operational modifications. However, it might well be that different technologies implemented to achieve CWIS compliance at different electric generating facilities may result in mutual benefits for the regional ecosystem. If mutual benefits of mitigation are identified among different generating facilities, then EPS would then consider establishing a trading program with other generating facilities to achieve the lowest cost, most comprehensive and effective method to comply with the new 316 b rule.

EPS will remain open to seeking comprehensive solutions to the IM&E issues in the region and develop a plan for compliance with the possible cooperation of other water users such that the issue is addressed in the most comprehensive manner for the regional ecosystem.

# 9.0 Impingment Mortality & Entrainment Sampling

An IM&E sampling program was conducted to characterize the fishes and shellfishes affected by impingement and entrainment by the CWIS at the EPS. The data from the study will be used in calculating baseline levels of IM&E against which compliance with performance standards will be measured. A detailed IM&E sampling plan was developed for the IM&E studies (Attachment C) and was previously submitted to the SDRWQCB in August 2004. The sampling plan was approved by the SDRWQCB and the sampling was done for one year starting in June 2004 and continued into June 2005. The report is in the final stages of preparation.

As required in 40 CFR 125.95(b)(3), the results of the IM&E sampling program will be summarized in a report submitted as part of the CDS that includes the following:

- Taxonomic identifications of all life stages of fishes, shellfishes, and any threatened or endangered species collected in the vicinity of the CWIS and are susceptible to IM&E;
- Characterization of all life stages of the target taxa in the vicinity of the CWIS and a description of the annual, seasonal, and diel variations in IM&E; and
- Documentation of the current level of IM&E of all life stages of the target taxa.

The goal of the study was to characterize the fishes and shellfishes affected by impingement and entrainment by the EPS CWIS. The studies examined losses at the EPS resulting from impingement of juvenile and adult fishes and macroinvertebrates on traveling screens during normal operations and during heat treatment operations and entrainment of ichthyoplankton and invertebrates into the cooling water intake system. The sampling methodologies and analysis techniques were derived from recent impingement and entrainment studies conducted for the AES Huntington Beach Generating Station (MBC and Tenera 2005), and the Duke Energy South Bay Power Plant (Tenera 2004). The studies at Huntington Beach were performed as part of the CEC California Environmental Quality Act (CEQA) process for permitting power plant modernization projects, while the South Bay project was for 316(b) compliance.

## 9.1 Assessment of Cooling Water Intake System Effects

Considerable effort among regulatory agencies and the scientific community has been expended on the evaluation of power plant intake effects over the past three decades. Power plant intake effects occur due to impingement of larger organisms onto the intake screens and entrainment of smaller organisms through the CWIS that are smaller than the screen mesh on the intake screens. For the purposes of the EPS study we assumed that both processes lead to mortality of all impinged and entrained organisms. The variety of approaches developed to assess the CWIS

impacts reflects the many differences in power plant locations and resource settings (MacCall et al. 1983). The various approaches have been divided into those that offer a judgment on the presence or absence of impact and those that describe the sensitivity of populations to varying operational conditions. These efforts have helped to establish the context for the modeling approaches being used to estimate impingement and entrainment effects at the EPS.

Impact assessment approaches that will be used in the analysis of the entrainment data include:

- Adult-Equivalent Loss (*AEL*) (Horst, 1975; Goodyear, 1978);
- Fecundity Hindcasting (*FH*) proposed by Alec MacCall, NOAA/NMFS, and is related to the adult-equivalent loss approach; and
- Empirical Transport Model (ETM), which is similar to the approach described by MacCall et al. (1983), and used by Parker and DeMartini (1989).

The application of several models to estimate power plant effects is not unique (Murdoch et al. 1989; PSE&G 1993; Tenera 2000a; Tenera 2000b). Equivalent Adult Modeling (*AEL* and *FH*) is an accepted method that has been used in many 316(b) demonstrations (PSE&G 1993; Tenera 2000a; Tenera 2000b). The advantage of demographic models like *AEL* and *FH* is that they translate losses into adult fishes that are familiar units to resource managers. Estimates of entrainment losses from these demographic models can be combined with estimated losses to adult and juvenile organisms due to impingement to provide combined estimates of cooling water system effects. The U.S. Fish and Wildlife Service proposed the empirical transport model (*ETM*) to estimate mortality rates resulting from cooling water withdrawals at power plants (Boreman et al. 1978, 1981). The *ETM* estimates the conditional mortality due to entrainment while accounting for spatial and temporal variability in distribution and vulnerability of each life stage to power plant withdrawals. The *ETM* provides an estimate of power plant effects that may be less subject to inter-annual variation than demographic model estimates. It also provides an estimate of population-level effects not provided by demographic approaches. But the *ETM* calculations require information about the composition and abundance of larval organism from the source water, necessitating the collection of samples from additional stations. A description of each of these models and how they will be used to evaluate data collected in the IM&E study is included in the study plan (Attachment C).

The assessment approach used in the final report in the CDS for the EPS will also depend upon the facility's baseline calculations and its method(s) of compliance with the 316(b) Phase II performance standards for reductions in impingement mortality and entrainment. Compliance at EPS may be achieved by implementing either singly, or in combination the following: technological or operational changes to the CWIS (TIOP), restoration methods, or site-specific BTA standards. To demonstrate compliance through the TIOP it is only necessary to analyze

impingement and entrainment data to determine baseline levels and assess those levels against the improvements achieved through the implementation of the TIOP. In the case where restoration is limited to only commercially or recreationally important species (use species), impingement and entrainment data may also be adequate to assess the levels of restoration necessary to offset impingement and entrainment losses, assuming that scientifically valid population models exist for the species providing the lost benefits. In assessing compliance with the performance standard in whole or in part through restoration of habitat to include non-recreational and non-commercial species (non-use species) in addition to the losses of use species it is necessary to assess the impingement and entrainment losses also from the source water using a combination of assessment methods to determine the commensurate level of restoration. The same source water and entrainment data, and assessment methods would also be used to determine a site-specific BTA standard based on cost-benefit analysis of entrainment losses to all use and non-use species. Source water data would not be necessary for cost-benefit analysis based simply on the value of use species losses.

## 9.2 Target Species

Analysis of CWIS effects will be done on the most abundant organisms in the samples, and commercially or recreationally important species from entrainment and impingement samples. All fishes and shellfishes during the impingement sampling were identified and up to fifty individuals of each species of fishes, crabs, shrimp, lobsters, octopus, and squid were measured and weighed. In instances where more than fifty individual of any one species were collected, the first fifty were measured and the rest were counted and then weighted as a group. All other invertebrates were recorded as present. The following marine organisms were sorted, identified and enumerated from entrainment intake and source water plankton samples:

**Vertebrates:**

- Fishes (all life stages beyond egg)

**Invertebrates:**

- Rock crab megalopal larvae (*Cancer* spp.)
- California spiny lobster phyllosoma larvae (*Panulirus interruptus*)

These groups were also analyzed in most of the recent entrainment studies in southern California, including the AES Huntington Beach Generating Station. Fishes and rock crab larvae were selected because of their respective ecological roles or commercial and/or recreational fisheries importance. The California spiny lobster was selected because of its commercial and/or recreational importance in the area.

The organisms analyzed will be limited to taxa that are sufficiently abundant to provide reasonable assessment of impacts. For the purposes of this study plan, we will limit the analysis to the most abundant taxa that comprise 90 percent of all larvae entrained and/or juveniles and adults impinged by the EPS. The most abundant organisms are used in the assessment because they provide the most robust and reliable estimates of CWIS effects. Since the most abundant organisms may not necessarily be the organisms that experience the greatest effects on the population level, the data will be examined carefully before the final selection of target species to determine if additional species should be included in the assessment. This may include commercially or recreationally important species, and species with limited habitats.

## 9.3 Impingement

The following is a summary of the methods used to collect impingement samples at the EPS. More complete details are included in the attached 316(b) Cooling Water Intake Effects Entrainment and Impingement Sampling Plan (Attachment C). Sampling was completed during both normal operations periods and tunnel recirculation (heat treatment) events.

Each normal operations impingement survey was conducted over a 24-hour period one day each week from mid June 2004 through mid June 2005. Prior to each survey any accumulated debris and organisms on the bar racks and traveling screens was removed and discarded. Each 24-hour survey was divided into six 4-hour cycles. The traveling screens at EPS take approximately 30-35 minutes to complete a complete rotation and washing. The traveling screens generally remained stationary for a period of about 3.5 hours and then are rotated and washed for 30-35 minutes depending on traveling screen rotation speed. All impinged material rinsed from the traveling screens was rinsed into its respective collection basket. The impinged material was removed from these baskets and all organisms removed from the debris. Due to the design of the intake traveling screens, there are three collection basket assemblies, one for Units 1-3, one for Unit 4, and one for Unit 5. All impinged material from each set of screens was processed and recorded separately. Length and weight of up to 50 individual of each taxa of impinged fishes, crabs, lobsters, shrimp, gastropods, some pelecypods, octopus, and squid were recorded. If more than 50 individuals of any taxa were impinged on any set of screens during a single cycle, this extra group was counted and its total bulk weight was determined and recorded. All other invertebrates were recorded as present when observed. The amount and general identity of the debris collected during each screen cycle was also recorded. The number of circulating water pumps in operation during each survey, obtained from operator logs was used to calculate the volume of water passing through the traveling screens during each survey. The number of screens rotated during each cycle was also recorded during the screen washing periods.

EPS conducts tunnel recirculations to control biofouling organisms growing on the intake conduits. During these events, all impinged organism washed off the traveling screens and rinsed into the collection baskets were removed from debris and identified, counted, and measured using the same procedures used during the normal operations surveys. A total of six tunnel recirculations took place during this 2004-2005 study period.

The abundance and biomass of the organisms impinged during the once per week normal operations sampling will be used to estimate the impingement for the entire year by first estimating the weekly impingement. This is done by combining the information on the impinged organisms with the total circulating water flow for the period between surveys. These weekly estimates are then combined to estimate the annual impingement rate during normal operations. All organism impinged during tunnel recirculation events are combined with those impinged during normal operations to generate an estimate of the overall annual impingement of the CWS.

## 9.4 Entrainment

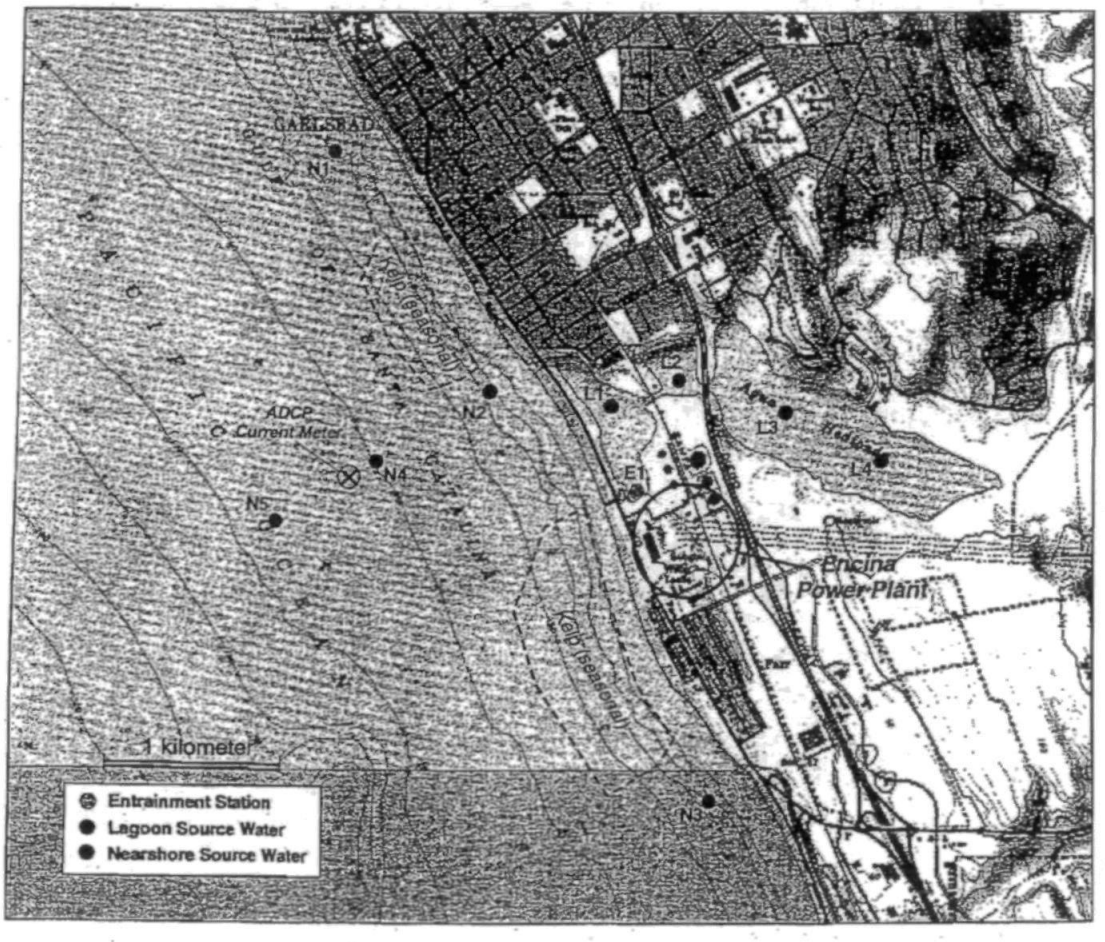
The following is a summary of the methods used to collect entrainment and source water plankton samples at the EPS. More complete details are included in the attached 316(b) Cooling Water Intake Effects Entrainment and Impingement Sampling Plan (Attachment C).

Sampling to determine the composition and abundance of larval fishes, *Cancer* spp. megalopae, and spiny lobster larvae at the EPS intake structure and in the local vicinity began in June 2004. The sampling was completed monthly thereafter, with the final sampling being completed in May 2005. Samples during each of these monthly surveys were collected over a 24-hour period, with sampling being divided into four 6-hour periods. Sampling was conducted near the intake structure to estimate larval entrainment, and at eight nearby stations in two sub-areas (~~three~~ Four stations in the AHL and five stations in the nearshore) to estimate larvae in the source water (Figure 7-1).

The samples at the entrainment location (E1), at all the nearshore stations (N#), and at the Outer Lagoon station (L1) were collected using a bongo net frame equipped with two 0.71 m (2.33 feet) diameter opening with attached 335 µm (0.013 in) mesh plankton nets and codends. Each net had a calibrated flowmeter that was used to determine the volume of water filtered during sample collection. Samples were collected by first lowering the frame and nets from the surface to as close to the bottom as practical without contacting it, and then moving the boat forward and retrieving the nets at an oblique angle. The target volume of the combined volume filter through both nets was at least 2,120 feet$^3$ (60 m$^3$). After retrieving the nets from the water, all collected material was rinsed into the codend. The collected material from both nets was placed into a labeled jar and preserved.

Due to the shallow depths in the vicinity of the Middle (L2) and Inner Lagoon (L3 and L4) stations, especially during low tides, samples at these stations were collected using a different sampling protocol. These stations are sampled using a single plankton net and frame attached to the bow of a small boat that pushes the net through the water and collects a sample from approximately the upper 1 meter of water. By placing the net on the bow of the boat, the net collects a sample from undisturbed water. The collected material was rinsed into the codend and then placed into a labeled jar and preserved.

**Figure 9-1**
**Location of EPS Entrainment (E1) and Source Water Stations (L1 through L4, and N1 through N5).**



# 10.0 Summary

This PIC has been prepared in accordance with 40 CFR 125.95(b)(1) and is being submitted to the SDRWQCB prior to implementation of information collection activities. The following is a brief summary of the information collection activities described in this document that will be undertaken to support the development of the CDS, the plan for compliance with IM&E performance standards outlined in the EPA 316(b) Phase II Rule.

## 10.1 Evaluation of IM&E Reduction Measures

The EPS has selected several intake technologies, operational measures, and restoration measures that will be evaluated to determine effectiveness and feasibility of implementation, either alone or in combination, to achieve the required reductions in IM&E. In summary, these include the following:

Intake Technologies:

- Modified traveling screens with fish return
- New fine mesh screening structure

Operational Measures:

- Circulating water flow reductions / caps
- Variable speed drives for circulating water pumps
- Heat Treatment Operational Changes

Restoration Measures:

- Restoration or Enhancement of AHL various)
- Restoration or Enhancement of Agua Hedionda Watershed (various)
- Restoration or Enhancement of Nearshore coastal projects (various)

Preliminary assessments of these IM&E reduction measures will be conducted to determine those which warrant further evaluation. A more detailed evaluation of those measures will be conducted and a combination of the most feasible measures proposed to meet IM&E performance standards will be presented in the CDS.

## 10.2 Impingement Mortality & Entrainment Sampling Plan

The IM&E Characterization Study Plan that was the basis for the 2004-2005 EPS IM&E Study is included in Attachment C. The study plan described the collection, analysis, and evaluation methodologies for the twelve months of impingement and entrainment sampling data at the EPS.

The following are the main components of the sampling effort:

Impingement:

1. Weekly impingement sampling at each CWIS during normal plant operations
2. Impingement sampling at the CWIS during each heat treatment cycle

Entrainment:

1. Monthly entrainment sampling at the CWIS
2. Source waterbody sampling at five near shore source water locations and four lagoon source water locations

The characterization study plan also describes the sampling, quality assurance / quality control (QA/QC), and data management procedures that will be used in the study. Results of the study will be used to:

1. Determine the current level of IM&E occurring at the CWIS.
2. Compare the level of IM&E occurring due to the location, design, and operation of each existing CWIS with that which would occur if the CWIS were designed as a "calculation baseline" intake.
3. Determine the additional level of reduction in IM&E that would be required to meet performance standards.
4. Assist in the determination of the most feasible combination of intake technologies, operational measures, and/or restoration measures that may be implemented to reduce IM&E to vulnerable species.

## 10.3 Agency Review of PIC

As required by the EPA 316(b) Phase II regulation, this PIC is being submitted in accordance with the schedule requested by EPS in a letter dated January 6, 2005 to the SDRWQCB. The regulation requires that the SDRWQCB *"provide their comments expeditiously (i.e. within 60 days) to allow facilities time to make response modifications in their information collection plans"* (Federal Register, Vol. 69, No. 131, Pg. 41635). EPS has completed the IM&E sampling following its approved plan (Attachment C) and is working toward completing the final study report. The EPS PIC represents the rest of the requirement information to comply with the PIC requirements of Phase II 316(b) and EPS respectfully requests that SCRWQCB approve the PIC within 60 days such that work may begin on the CDS in order to meet the January 8, 2008 due date.

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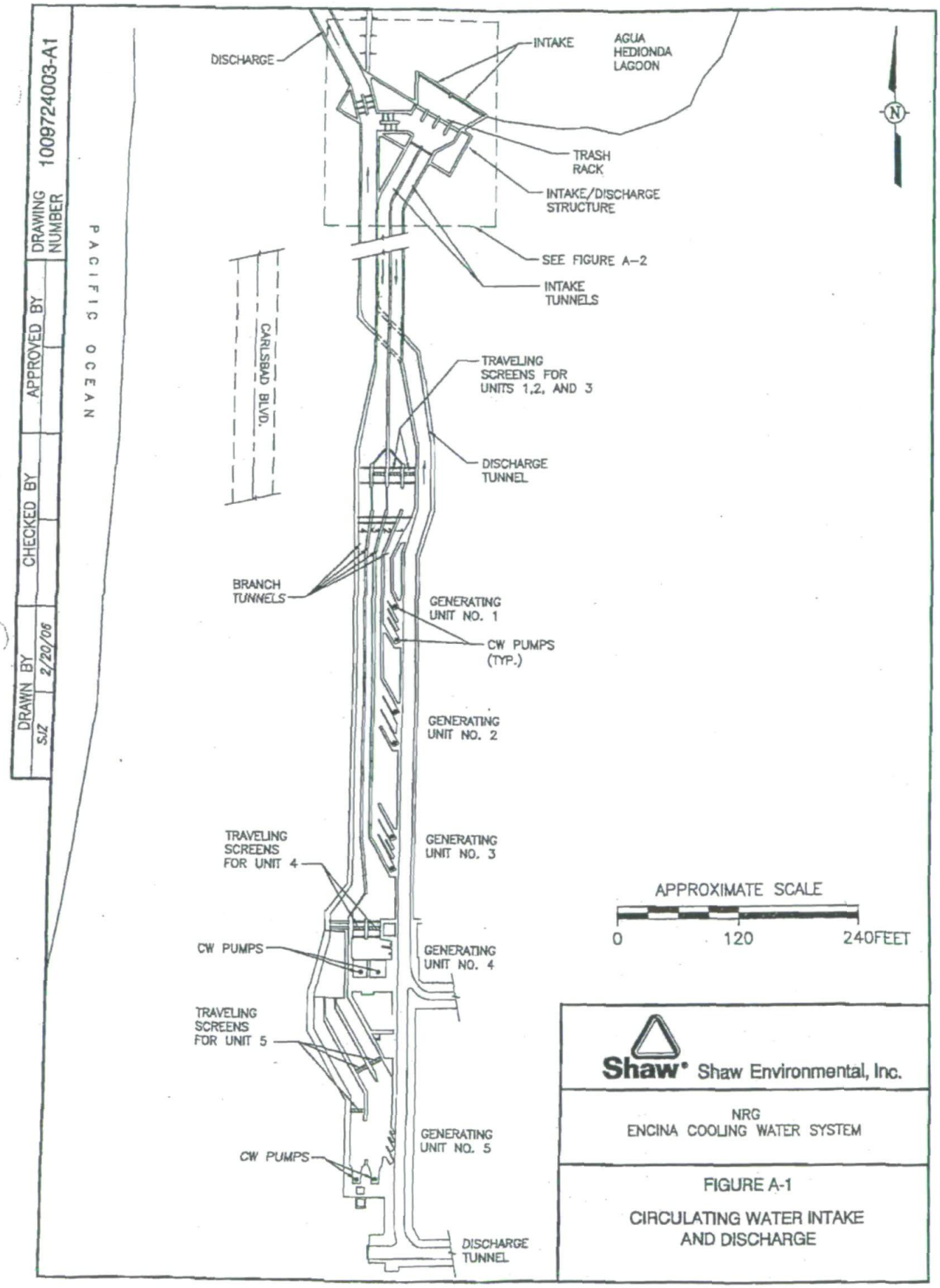
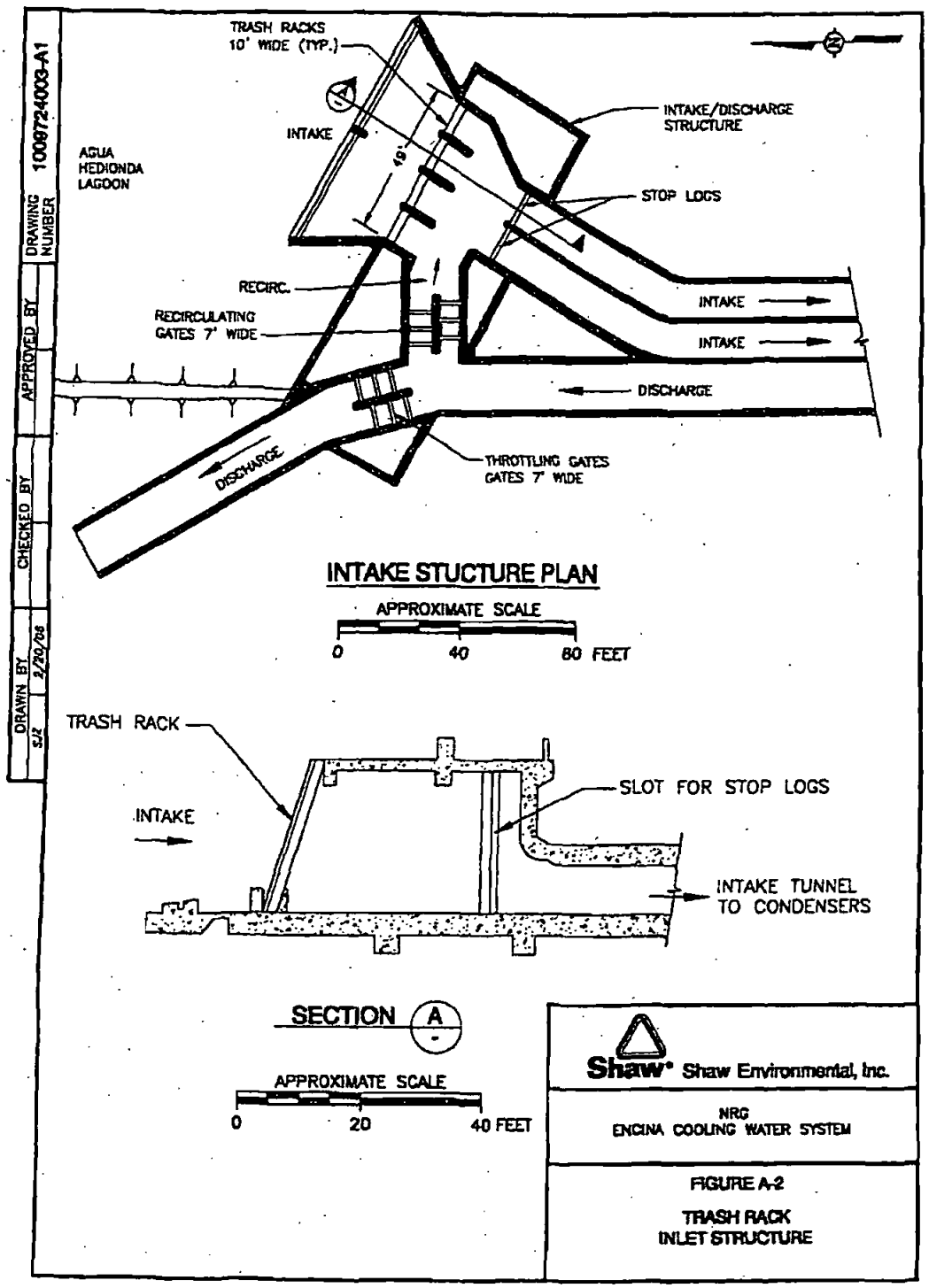
# *Attachment A*
# *Structural Design Drawings*


DISCHARGE
INTAKE
AGUA HEDIONDA LAGOON
TRASH RACK
INTAKE/DISCHARGE STRUCTURE
SEE FIGURE A–2
INTAKE TUNNELS
CARLSBAD BLVD.
TRAVELING SCREENS FOR UNITS 1,2, AND 3
DISCHARGE TUNNEL
BRANCH TUNNELS
GENERATING UNIT NO. 1
CW PUMPS (TYP.)
GENERATING UNIT NO. 2
GENERATING UNIT NO. 3
TRAVELING SCREENS FOR UNIT 4
CW PUMPS
GENERATING UNIT NO. 4
TRAVELING SCREENS FOR UNIT 5
GENERATING UNIT NO. 5
CW PUMPS
DISCHARGE TUNNEL
PACIFIC OCEAN
N
APPROXIMATE SCALE
0
120
240FEET
DRAWN BY SJZ 2/20/06
CHECKED BY
APPROVED BY
DRAWING NUMBER 1009724003-A1
Shaw Shaw Environmental, Inc.
NRG
ENCINA COOLING WATER SYSTEM
FIGURE A-1
CIRCULATING WATER INTAKE AND DISCHARGE


DRAWING NUMBER 100972400 3-A1
APPROVED BY
CHECKED BY
DRAWN BY SJZ 2/20/08
TRASH RACKS 10' WIDE (TYP.)
INTAKE
AGUA HEDIONDA LAGOON
INTAKE/DISCHARGE STRUCTURE
STOP LOGS
RECIRC.
RECIRCULATING GATES 7' WIDE
INTAKE
INTAKE
DISCHARGE
DISCHARGE
THROTTLING GATES GATES 7' WIDE
INTAKE STUCTURE PLAN
APPROXIMATE SCALE
0 40 80 FEET
TRASH RACK
INTAKE
SLOT FOR STOP LOGS
INTAKE TUNNEL TO CONDENSERS
SECTION A
APPROXIMATE SCALE
0 20 40 FEET
Shaw Shaw Environmental, Inc.
NRG
ENCINA COOLING WATER SYSTEM
FIGURE A-2
TRASH RACK
INLET STRUCTURE

Encina Power Station
4600 Carlsbad Boulevard
Carlsbad, CA 92008-4301

Direct: (760) 268-4000
Fax: (760) 268-4026

NRG CABRILLO POWER OPERATIONS INC.

January 10, 2005

Mr. John Phillips
San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340

**RE: Cabrillo Power I LLC – Encina Power Station;**
**Request for Schedule to Submit Information to Comply with the Phase II 316(b) Rule (40 CFR Part 125 Subpart J)**

**Ref: NPDES Permit Number CA0001350, Order No. 2000-03**

Dear Mr. Phillips,

By this letter Cabrillo Power I LLC (Cabrillo) requests a schedule for submitting the information required by EPA's new Phase II 316(b) Rule for cooling water intake structures for the Encina Power Station (EPS). For the reasons to be presented in the following letter, Cabrillo requests your approval to allow the information required by 40 CFR 125.95 to be submitted to you no later than January 7, 2008. In our circumstances, this date is as "expeditious as practicable." The basis for our request is explained below.

As you know, on July 9, 2004, EPA published its final rule prescribing how "existing facilities" may comply with Section 316(b) of the Clean Water Act.[1] For most existing facilities, this rule will require a large amount of data to establish "best technology available" for the facility's intake structure and to demonstrate compliance with the rule.

EPS is a "Phase II existing facility" within the meaning of 40 CFR 125.91. As such, it is required to comply with the Phase II rule, and in particular to submit the studies and information required by 40 CFR 125.95.

Section 125.95 of the new rule requires detailed studies and other information to establish what intake structure technology or other measures will be used to comply with the rule. Ordinarily this material is to be submitted with the facility's next application for renewal of its NPDES permit.[2] For permits that expire less than four years after the rule was published on July 9, 2004 (that is, before July 9, 2008), the facility may have up to three and half years to submit the information, so long as it is submitted "as expeditiously as practicable."[3] The facility may

[1] 69 Fed. Reg. 41575, 41683 (July 9, 2004).
[2] 40 CFR 125.95, 122.21(r)(1)(ii), 122.21(d)(2).
[3] 40 CFR 125.95(a)(2)(ii).

have even longer, until the end of the permit term, under 40 CFR 122.21(d)(2)(i), if the permitting agency agrees.

The current NPDES permit for EPS expires on February 9, 2005, well before July 9, 2008. Therefore, Cabrillo hereby requests that you authorize the information called for in 125.95 to be submitted as expeditiously as practicable, which, as explained below, will require until January 7, 2008.

In order to satisfy the "expeditiously as practicable" requirement, it should be noted that Cabrillo began the process of collecting the necessary information even before the final rule was published. Cabrillo actually began as early as 2003 to begin collecting information and conducting internal evaluations on how the, at that time draft, requirements could be complied with at EPS. Such information collection included preliminary technology assessments and research into existing data and information. Cabrillo also initiated an impingement and entrainment sampling program in June 2004 that is scheduled to conclude toward the end of 2005.

Despite our early efforts, we will still need until January 7, 2008, to complete the studies and collect the information required by 40 CFR 125.95. Our detailed explanation is presented below by first summarizing the significant number of informational requirements that must be submitted and then concludes by presenting the schedule by which the information would be submitted.

**Cooling Water System Data**

First, all facilities covered by the Phase II Rule must submit "cooling water system data" as required by 40 CFR 122.21(r)(5). This includes a narrative description of the operation of the cooling water system, its relationship to cooling water intake structures, the proportion of the design intake flow that is used in the system, the number of days of the year the cooling water system is in operation, and the seasonal changes in the operation of the system, if applicable. It also includes design and engineering calculations prepared by a qualified professional and supporting data to support the description of the operation of the cooling water system.[4] This information must be submitted at the same time as the Comprehensive Demonstration Study as discussed below.[5]

**Proposal for Information Collection**

Under 40 CFR 125.95(a)(1), Cabrillo must also submit a Proposal for Information Collection (PIC). Preparing the PIC is a large undertaking. The PIC must contain the items listed in 40 CFR 125.95(b)(1), including a description of proposed and/or implemented technologies, operational measures, and/or restoration measures to be evaluated, a list and description of historical studies characterizing impingement mortality and entrainment and/or the

[4] 40 CFR 122.21(R)(5)(i) and (ii).
[5] 40 CFR 125.95(a)(2).

physical and biological conditions in the vicinity of the cooling water intake structures and their relevance to the proposed study. For existing data, it must demonstrate the extent to which the data are representative of current conditions and that the data were collected using appropriate quality assurance/quality control procedures. The PIC must also include a summary of past or ongoing consultations with federal, state and tribal fish and wildlife agencies and a copy of their written comments, as well as a sampling plan for any new field studies describing all methods and quality assurance/quality control procedures for sampling and data analysis. As you know, Cabrillo already submitted the sampling plan portion of the PIC on September 2, 2004, which was later approved by the San Diego Regional Water Quality Control Board (Regional Board). The impingement and entrainment sampling actually commenced in June 2004 and is expected to conclude toward the end of 2005.

Because of the magnitude and specialized nature of the information to be submitted in the PIC, Cabrillo will have to contract with an outside consulting firm to obtain qualified personnel to perform the work and to handle the increased workload. Cabrillo's contractor procurement process has precise steps that must be undertaken to conform to internal policies and procedures and applicable law.

Including the time it takes to contract with a qualified consulting firm and to develop the PIC using the impingement and entrainment data collected during 2004 and 2005, Cabrillo believes a comprehensive PIC could not be submitted for the Regional Board's review and approval any earlier than April 1, 2006. Cabrillo asks that the Regional Board either approve it or advise us of any needed changes within 60 days as described in 40 CFR 125.95(a)(1), 125.95(b)(1).

**Comprehensive Demonstration Study**

The Comprehensive Demonstration Study (CDS), as described in 40 CFR 125.95(b), includes many mandatory sections that require substantial effort and time to develop and submit. Many sections of the CDS require that the information collection process described in the PIC be completed prior to being able to initiate those sections of the CDS. Because the PIC data collection will not be completed until early 2006, as described below in the Impingement Mortality and/or Entrainment Characterization Study section, much of the CDS will have to be completed during calendar years 2006 and 2007. This will most likely be a significant time constraint due to the level of work required by the Phase II 316(b) regulation. Below, ESP will describe each section of the CDS in detail, providing ample justification that Cabrillo's proposed complete CDS submission schedule is "as expeditiously as practicable."

Source Water Flow Information

Because EPS does not operate on a river or a lake, no specific source waterbody flow information is required to be submitted.[6]

Impingement Mortality and/or Entrainment Characterization Study

Cabrillo must provide, pursuant to 40 CFR 125.95(b)(3), an Impingement Mortality and/or Entrainment Characterization Study. This study must include (i) taxonomic identifications of all life stages of fish, shellfish, and any species protected under federal, state, or tribal law that are in the vicinity of the cooling water intake structures and are susceptible to impingement and entrainment; (ii) a characterization of all life stages of fish, shellfish, and any protected species, including a description of the abundance and temporal and spatial characteristics in the vicinity of the cooling water intake structures, based on sufficient data to characterize annual, seasonal, and diel variations in impingement mortality and entrainment (e.g., related to climate and weather differences, spawning, feedings, and water column migration). These may include historical data that are representative of current operation of the facility and of biological conditions at the site.

Cabrillo must also document the current impingement mortality and entrainment of all life stages of fish, shellfish, and protected species and provide an estimate of impingement mortality and entrainment to be used as the "calculation baseline."[7] This may include historical data representative of the current operation of the facility and of biological conditions at the site. Impingement mortality and entrainment samples to support the calculations must be collected during periods of representative operational flows for the cooling water intake structure, and the flows associated with the samples must be documented.

Cabrillo expects to submit, within the PIC document, justification for using the historical and representative impingement and entrainment data as well as the new data being collected during calendar years 2004 and 2005. As described above, impingement and entrainment sampling at EPS was initiated in June 2004 and is expected to continue through the end of 2005, which includes the necessary time to complete taxonomic identification, modeling, and development of draft and final reports.

Cabrillo plans on submitting its final PIC after submittal and review of the Impingement and Entrainment Characterization Study Final Report so that all of the collected information and its results can be incorporated into the development of the PIC. This appears to be the most efficient and complete way to produce the PIC, as the information from that study is necessary to complete the other components of the PIC, as described above. Since the Impingement and Entrainment Characterization Study Final Report is not expected to be complete until the end of 2005, the most expeditious submittal date for the final PIC is April 1, 2006.

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[6] 40 CFR 125.95(b)(2) only requires source water information for facilities that withdraw water from rivers or lakes other than the Great Lakes. Although not specifically required, a characterization of the source water will be provided in the report on the results of the Impingement and Entrainment Characterization Study.
[7] 40 CFR 125.95(b)(3)(iii).

Design and Construction Technology Plan

Another analysis that must be provided is the Design and Construction Technology Plan.[8] If Cabrillo decides to use design and construction technologies and/or operational measures to comply with the Phase II rule, a plan must be submitted that provides the capacity utilization rate for the intake structure at EPS and provide supporting data (including the average annual net generation of the facility in MWh) measured over a five-year period (if available) of representative operating conditions and the total net capacity of the facility in MW, along with the underlying calculations. The plan must explain the technologies and/or operational measures that Cabrillo has in place and/or have selected to meet the requirements of the rule.

This Design and Construction Technology Plan must contain a large amount of information, as described in 40 CFR 125.95(b)(4)(A)-(D). This information includes (A) a narrative description of the design and operation of all design and construction technologies and/or operational measures, including fish handling and return systems, and information that demonstrates the efficacy of the technologies and/or operational measures; (B) a narrative description of the design and operation of all design and construction technologies and/or operational measures and information that demonstrates the efficacy of the technologies and/or operational measures for entrainment; (C) calculations of the reduction in impingement mortality and entrainment of all life stages of fish and shellfish that would be achieved by the technologies and/or operational measures we have selected; and (D) design and engineering calculations, drawings, and estimates prepared by a qualified professional to support the descriptions described above.

Technology Installation and Operation Plan (TIOP)

Assuming Cabrillo decides that the best way to comply with the Phase II rule is to use design and construction technologies and/or operational measures, in whole or in part, we must submit to you the following information, in accordance with 40 CFR 125.95(b)(4)(ii): (A) A schedule for the installation and maintenance of any new design and construction technologies; (B) a list of operational and other parameters to be monitored and the location and frequency that we will monitor them; (C) a list of activities we will undertake to ensure to the degree practicable the efficacy of installed design and construction technologies and operational measures and our schedule for implementing them; (D) a schedule and methodology for assessing the efficacy of any installed design and construction technologies and operational measures in meeting applicable performance standards or site-specific requirements, including an "adaptive management plan" for revising design and construction technologies, operational measures, operation and maintenance requirements, and/or monitoring requirements in the event the assessment indicates that applicable performance or site-specific requirements are not being met; and (E) if Cabrillo chooses the compliance alternative in 125.94(a)(4) (wedge-wire screens or a technology approved by the state), documentation that the appropriate site conditions described in 125.99(a) or (b) exist at our facility.

[8] 40 CFR 125.95(b)(4).

Restoration Plan

If Cabrillo determines that restoration measures are the best method to comply with the new rule, in whole or in part, then a Restoration Plan must be submitted in the CDS. This plan must include the information described in 40 CFR 125.95(b)(5). It must include a plan using an adaptive management method for implementing, maintaining, and demonstrating the efficacy of the restoration measures that are selected and for determining the extent to which the restoration measures, or the restoration measures in combination with design and construction technologies and operational measures, have met the applicable performance standards.

Site-Specific Requirements

If Cabrillo determines that site-specific requirements are appropriate because the cost of complying with the Phase II rule will be "significantly greater" than either the cost that EPA considered in its rulemaking or the benefits of complying with the rule, then Cabrillo will have to submit the information described in 40 CFR 125.95(b)(6). This includes a Comprehensive Cost Evaluation Study and, for the cost-benefit analysis, a Benefits Evaluation Study. Cabrillo must also include a Site-Specific Technology Plan describing and justifying the site-specific requirements.

Verification Monitoring Plan

Finally, Cabrillo must prepare a Verification Monitoring Plan as part of a complete CDS.[9] This is a plan to conduct, at a minimum, two years of monitoring to verify the full-scale performance of the proposed or already implemented technologies and/or operational measures.

**PIC and CDS Schedule**

The first official submittal (besides this request for a schedule) that Cabrillo will make to the Regional Board in compliance with the Phase II 316(b) regulation will be the PIC. For the reasons explained above, Cabrillo proposes to submit a comprehensive PIC for the Regional Board's review and approval by April 1, 2006. Cabrillo asks that the Regional Board either approve the PIC or advise us of any needed changes within 60 days as described in 40 CFR 125.95(a)(1), 125.95(b)(1).

Because Cabrillo plans to collect substantial new information as part of the expected PIC, and since the report presenting the results of the new impingement and entrainment data collected in 2004 and 2005 will not be finalized until the end of 2005, and allowing for the period of time the Regional Board has to review and approve the PIC, it is unlikely that the information needed to commence the majority of the sections of the CDS (including the Design and Construction Technology Plan, the Technology Installation and Operation Plan, the

[9] 40 CFR 125.95(b)(7).

Restoration Plan (if applicable), the Site Specific Requirements (if applicable), and the Verification Monitoring Plan) will be available until mid to late 2006.

Due to the step by step process by which the data must be collected, processed, evaluated, and then turned into a detailed plan of action to achieve the new Phase II 316(b) standards, Cabrillo does not believe a comprehensive CDS can be submitted earlier than January 7, 2008. It is for these important reasons that Cabrillo believes the most expeditious schedule possible for submittal of a comprehensive CDS is by January 7, 2008.

**Conclusion**

Collecting, generating, compiling, and analyzing the large amount of information required by the Phase II 316(b) rule will require a substantial effort. Cabrillo will have to collect and review the large volumes of already-existing data on the plant and the source waterbody, as well as integrate the substantial new biological information currently being collected.

Because the Phase II rule is new and untried, we foresee the need to coordinate closely with your department as we collect the necessary information, analyze it, and determine what combination of technology, operational measures, or restoration measures will best meet the Phase II rule for EPS. Cabrillo hopes your staff will be available to consult with us throughout this schedule as we complete these efforts.

For the above reasons, we request that we be allowed until January 7, 2008, to submit the information required for a permit application by the Phase II Rule, 40 CFR Part 125 Subpart J.

Sincerely,
Cabrillo Power I LLC
By: Its Authorized Agent,

By: NRG Cabrillo Power Operations Inc.
Gregory J. Hughes
Regional Plant Manager

cc: [redacted]
Sheila Henika (Cabrillo)
John Steinbeck (Tenera)
Pedro Lopez (Cabrillo)
Hashim Navrozali (Regional Board)

# *Attachment C*
# *Impingement Mortality & Entrainment Characterization Study Sampling Plan*

Encina Power Station
4600 Carlsbad Boulevard
Carlsbad, CA 92008-4301

Direct: (760) 268-4000
Fax: (760) 268-4026

**NRG CABRILLO POWER OPERATIONS INC.**

September 2, 2004

Mr. John R. Phillips, P.E.
Senior Water Resource Control Engineer
San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340

Subject: **Cabrillo Power I LLC - Encina Power Station;**
**Phase II 316(b) Entrainment and Impingement Sampling Plan**

Dear Mr. Phillips;

Cabrillo Power I LLC (Cabrillo) is pleased to submit a plan to conduct entrainment and impingement sampling for the Encina Power Station (EPS) to comply with the US EPA's recently published Phase II rule for compliance with Section 316(b) of the Clean Water Act. The approval of the EPS Entrainment & Impingement Sampling Plan (E&I Plan) is one of the early steps in the facility's compliance with the Phase II rule. Cabrillo requests expedited review and approval of this E&I Plan in order to optimize the sampling synergies available by virtue of the data collection efforts already underway on behalf of Poseidon Resources (Poseidon) for their proposed desalination project at EPS.

This sampling plan was prepared by Tenera Environmental (Tenera), which is the same firm that prepared the desalination sampling plan submitted to the San Diego Regional Water Quality Control Board (San Diego RWQCB) on behalf of Poseidon in July 2004. Consistent with that sampling plan, Poseidon has already collected several complete sets of entrainment and source water samples at EPS. The Poseidon study plan and collected data will produce information on the larval fish and target invertebrates contained in Poseidon's source of desalination feedwater (the power plant's cooling water discharge), as well as information on the larval fish and target invertebrates contained in the power plant's source waterbody and intake flows.

Data being collected for Poseidon on the power plant's source population of entrainable larval fish and target invertebrates is identical to the information Cabrillo will be required to collect and analyze for EPS Phase II 316(b) studies. Tenera has prepared this sampling plan to seamlessly and consistently continue the collection of the Poseidon entrainment data. In that way, Cabrillo can continue the sampling effort for compliance with the new Phase II performance standards in an efficient and cost-effective manner.

In the past five years, Tenera has completed 316(b) resource assessments for the Diablo Canyon Nuclear Power Plant, Moss Landing Power Plant, Morro Bay Power Plant and Potrero Plant. Tenera study design and assessment methods are also being employed in the ongoing 316(b) studies for the Huntington Beach Generating Station. Throughout these projects, Tenera has worked closely with State and Federal agencies in the development of their field study, impact assessment, and benefits evaluation methods. Tenera has also just recently completed a 316(b) resource assessment for the South Bay Power Plant that has been presented in final form to the San Diego RWQCB. Cabrillo's proposed E&I Plan has been developed in consideration of, and in keeping with, the 316(b) study rationales, content, sampling methodology, analysis and reporting that were used in the South Bay Power Plant 316(b) Assessment (Duke Energy South Bay, May 2004), as well as all of the power plants listed above.

This submission of the EPS E&I Plan is intended to meet part of the requirements for the Proposal for Information Collection (PIC) section of the Phase II 316(b) regulation, but not to address all of the PIC requirements at this time. All of the sampling plan requirements specified in Section 125.95(b)(1)(iv) are incorporated into the EPS E&I Plan. At a later date, Cabrillo will submit the remainder of the PIC requirements pursuant to Section 125.95(b)(1). Cabrillo requests approval of this E&I Plan specifying how new E&I data will be collected, but acknowledges that the San Diego RWQCB will be able to review the other portions of the PIC once submitted by Cabrillo.

Therefore, in order to provide continuous, efficient and cost-effective sampling at EPS, Cabrillo requests that the San Diego RWQCB expedite review and approval of this E&I Plan. Cabrillo understands that San Diego RWQCB is considering retaining an outside consultant in order to provide timely response to this request. Cabrillo is available and prepared to work with your staff and the consultant to provide any additional clarification necessary to obtain timely approval.

Please contact Tim Hemig directly at 760.268.4037 if there are any questions.

Sincerely,
Cabrillo Power I LLC
By: Its Authorized Agent,

Gregory J. Hughes

By: NRG Cabrillo Power Operations Inc.
Gregory J. Hughes
Regional Plant Manager

cc: Tim Hemig, Sheila Henika, John Steinbeck (Tenera)

Cabrillo Power I LLC, Encina Power Station

# 316(b) Cooling Water Intake Effects Entrainment and Impingement Sampling Plan

*Submitted to the California Regional Water Quality Control Board – San Diego Region for Compliance with Section 316(b) of the Clean Water Act*

**September 2, 2004**

*Prepared by:*
**Tenera Environmental**
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225 Prado Rd. Suite D
San Luis Obispo, CA 93401

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# 1.0 INTRODUCTION

## 1.1 Development of the 316(b) Sampling Plan

This document presents a sampling plan for conducting the entrainment and impingement sampling necessary for a cooling water intake assessment required under Section 316(b) of the Federal Clean Water Act (CWA). Our sampling plan is based on a survey and compilation of available background literature, results of completed Encina Power Station (EPS) intake studies, and cooling water system studies at other power plants. The data from this study will form the basis of demonstrating compliance with the new Phase II regulations recently developed by the U.S. Environmental Protection Agency (USEPA).

## 1.2 Overview of the 316(b) Program

Section 316(b) of the Clean Water Act requires that "the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact" (USEPA 1977). Because no single intake design can be considered to be the best technology available at all sites, compliance with the Act requires a site-specific analysis of intake-related organism losses and a site-specific determination of the best technology available for minimizing those losses. Intake-related losses include losses resulting from entrainment (the drawing of organisms into the cooling water system) and impingement (the retention of organisms on the intake screens).

### *1.2.1 Target Organisms Selected for Study*

The USEPA in its original 316(b) lists several criteria for selecting appropriate target organisms for assessment including the following:

1. representative, in terms of their biological requirements, of a balanced, indigenous community of fish, shellfish, and wildlife;
2. commercially or recreationally valuable (e.g., among the top ten species landed—by dollar value);
3. threatened or endangered;
4. critical to the structure and function of the ecological system (i.e., habitat formers);
5. potentially capable of becoming localized nuisance species;
6. necessary, in the food chain, for the well-being of species determined in 1–4; and
7. meeting criteria 1–6 with potential susceptibility to entrapment/impingement and/or entrainment.

In addition to these USEPA criteria there are certain practical considerations that limit the selection of target organisms such as the following:

- identifiable to the species level;
- collected in sufficient abundance to allow for impact assessment, i.e., allowing the model(s) constraints to be met and confidence intervals to be calculated; and
- having local adult and larval populations (i.e., source not sink species). For example, certain species that may be relatively abundant as entrained larvae may actually occur offshore or in deep water as adults.

These criteria, results from the previous 316(b) studies at EPS completed in 1980, results from a supplemental 316(b) study completed in 1997 (EA Engineering 1997), results from more recent studies on the ecological resources of Aqua Hedionda Lagoon (MEC Analytical Systems 1995), and data collected from studies described in this document will be used to determine the appropriate target organisms that will be evaluated in detail. The final target taxa will include the fishes that are found to be most abundant in the entrainment and impingement samples. In addition to large invertebrates that may be abundant in impingement, megalopal (final) larval stage of all species of cancer crabs (*Cancer* spp., which includes the edible species of rock crabs) and the larval stages of California spiny lobster will be identified and enumerated from all processed entrainment and source water plankton samples.

## 1.3 Sampling Plan Organization

This sampling plan first describes the EPS environment, design, and operating characteristics. The methods for obtaining updated information on the types and concentrations of planktonic marine organisms entrained by the power plant's CWIS are then discussed. A discussion of the theoretical considerations behind the assessment methods for the entrainment and impingement data is then presented. The final 316(b) report will also include an overview of alternative intake technologies and an analysis of feasible alternatives and their cost-effectiveness to minimize adverse entrainment and impingement effects of the EPS CWIS.

# 2.0 DESCRIPTION OF THE ENCINA POWER STATION AND CHARACTERISTICS OF THE SOURCE WATER BODY

## 2.1 Background

The Encina Power Station (EPS) is situated on the southern shore of the outer segment of the Agua Hedionda Lagoon in the city of Carlsbad, California, approximately 193 km (85 miles) south of Los Angeles and 16 km (35 miles) north of San Diego. EPS is a gas- and oil-fueled generating plant with five steam turbine generators (Units 1 through 5), which all use the marine waters of Agua Hedionda Lagoon for once-through cooling, and a small gas turbine generator. EPS began withdrawing cooling water from Agua Hedionda Lagoon in 1954 with the startup of commercial operation of Unit 1. Unit 2 began operation in 1956, Unit 3 in 1958, Unit 4 in 1973, and Unit 5 in 1978. The gas turbine was installed in 1968, which does not use cooling water in its operation. The combined net generation capacity of EPS is 966 megawatts electric (Mwe) (**Table 1**).

### *2.1.1 Plant Cooling Water System Description and Operation*

Cooling water for the five steam electric generating units are supplied by two circulating and one or two service water pumps for each unit. The quantity of cooling water circulated through the plant is dependent upon the number of units in operation. With all units in full operation, the cooling water flow through the plant is 2,253 $m^3$/min (595,200 gallons per minutes [gpm]) or 3,244,430 $m^3$/day (857 million gallons per day [mgd]) based on the manufacturer ratings for the cooling water pumps (**Table 1**).

**Table 1.** Encina Power Station generation capacity and cooling water flow volume.

| Unit | Gross Generation (MWe) | Cooling Water Flow $m^3$/min (gpm) | Daily Flow $m^3$/day (mgd) |
|---|---|---|---|
| 1 | 107 | 193 (51,000) | 278,000 (73) |
| 2 | 104 | 193 (51,000) | 278,000 (73) |
| 3 | 110 | 204 (54,000) | 294,350 (78) |
| 4 | 300 | 806 (213,000) | 1,161,060 (307) |
| 5 | 325 | 856 (226,200) | 1,233,010 (326) |
| Gas Turbine | 20 | | |
| Total | 966 | 2,252 (595,200) | 3,244,430 (857) |

Cooling water for all five steam-generating units is supplied through a common intake structure located at the southern end of the outer segment of Aqua Hedionda Lagoon, approximately 854

m (2,800 ft) from the opening of the lagoon to the ocean (**Figure 1**). Cooling water from the system is discharged into a small discharge pond that is located to the west of the intake structure. Water from the discharge pond flows through a culvert under Carlsbad Blvd and through a discharge canal across the beach and out to the ocean.

Seawater entering the cooling water system passes through metal trash racks on the intake structure that are spaced 8.9 cm (3½ in) apart and keep any large debris from entering the system. The trash racks are cleaned periodically. Behind the trash racks the intake tapers into two 3.7 m (12 ft) wide tunnels that further splits into four 1.8 m (6 ft) wide conveyance tunnels (**Figure 2**). Conveyance tunnels 1 and 2 provide cooling water for Units 1, 2 and 3, while conveyance tunnels 3 and 4 supply cooling water to Units 4 and 5, respectively. Vertical traveling screens prevent fish and debris from entering the cooling water system and potentially clogging the condensers. There are two traveling screens for Units 1, 2 and 3, two screens for Unit 4, and three screens for Unit 5. The mesh size on the screens for Units 1 through 4 is 0.95 cm (3/8 in), while the mesh size for Unit 5 is 1.6 cm (5/8 in).

The traveling screens can be operated either manually or automatically when a specified pressure differential is detected across the screens due to the accumulation of debris. When the specified pressure is detected the screens rotate and the material on the screen is lifted out of the cooling water intake. A screen wash system (70-100 psi), located at the head of the screen, washes the debris from each panel into a trough, which empties into collection baskets where it is accumulated until disposal.

The velocity of the water as it approaches the traveling screens has a large effect on impingement and entrainment and varies depending on the number of pumps operating, tidal level, and cleanliness of the screen faces. Approach velocities at high and low tide with all pumps operating were presented in the previous 316(b) study conducted in 1979 and 1980 (**Table 2**).

**Table 2.** Approach velocities at traveling screens for Encina Power Station with all circulating water and service water pumps in operation.

| | Estimated Mean Approach Velocity (fps) | |
|---|---|---|
| **Unit** | **High Tide** | **Low Tide** |
| 1 | 0.7 | 1.2 |
| 2 | 0.7 | 1.2 |
| 3 | 0.7 | 1.2 |
| 4 | 1.0 | 1.6 |
| 5 | 0.7 | 1.1 |

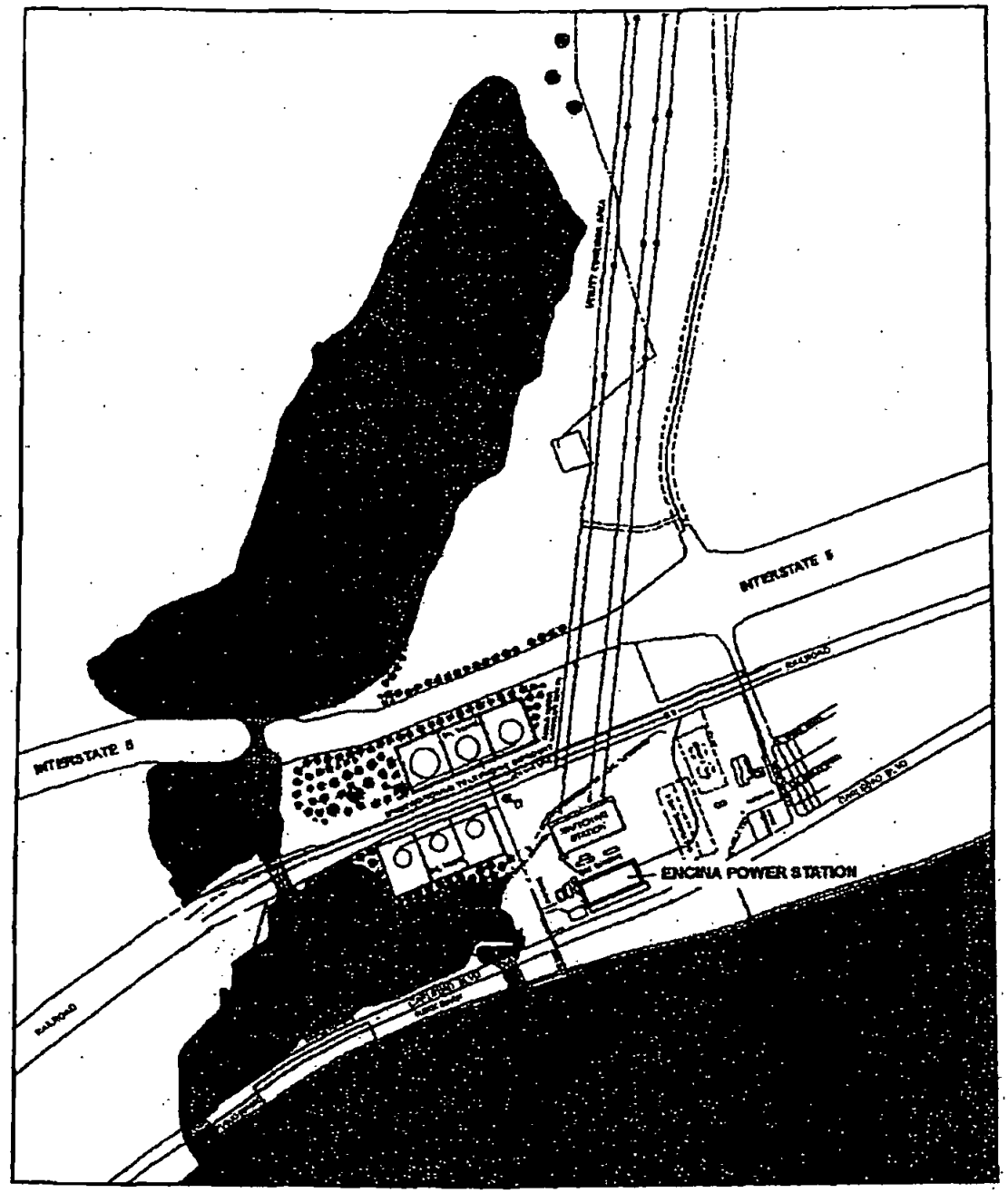


**Figure 1.** Location of Encina Power Station in Carlsbad, California

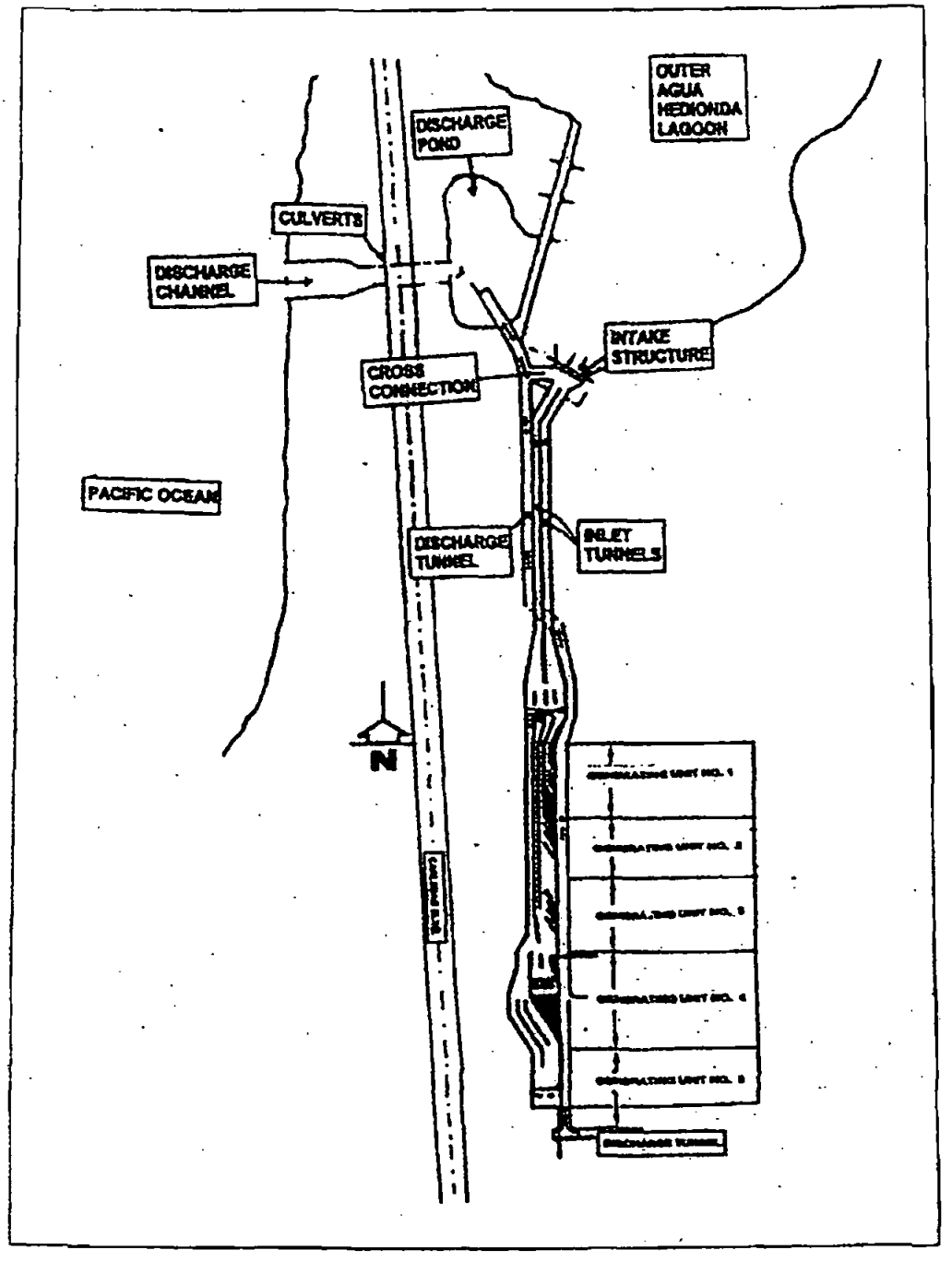


Figure 2. Schematic of Encina Power Station cooling water intake system.

## 2.2 Aquatic Biological Resources in the Vicinity of EPS

### 2.2.1 Agua Hedionda Lagoon

The Encina Power Station (EPS) is located on Agua Hedionda Lagoon, which is a man-made coastal lagoon that extends 2.7 km (1.7 miles) inland and is up to 0.8 km (0.5 mi) wide. The lagoon was constructed in 1954 to provide cooling water for the power plant. A railroad trestle and the Interstate Highway 5 bridge separate Agua Hedionda Lagoon into three interconnected segments: an Outer, Middle, and Inner lagoon. The surface areas of the Outer, Middle, and Inner lagoons are 26.7 (66 acres), 9.3 (23 acres), and 79.7 (197 acres) hectares, respectively. The lagoon is separated from the ocean by Carlsbad Boulevard and a narrow inlet 46 m [151 ft] wide and 2.7 m [9 ft] deep at the northwest end of the Outer Lagoon that passes under the highway and allows tidal exchange of water with the ocean.

Circulation and input into Aqua Hedionda Lagoon is dominated by semi-diurnal tides that bring approximately 2.0 million $m^3$ of seawater through the entrance to the Outer Lagoon on flood tides. Approximately half of this tidal volume flows into the Middle and Inner lagoons. On ebb tides this same tidal volume flows out through the entrance to the ocean. As a result of this tidal flushing the lagoon is largely a marine environment. Although freshwater can enter the lagoon through Buena Creek, which drains a 7,500 hectare (18,500 acres) watershed, for most of the year freshwater flow is minimal. Heavy rainfall in the winter can increase freshwater flows, reducing salinity, especially in the Inner Lagoon.

A study on the ecological resources of Agua Hedionda showed that it has good water quality and supports diverse infaunal, bird, and fish communities (MEC Analytical 1995). Eelgrass was found in all three lagoon segments, but was limited to shallower depths in the Inner Lagoon because water turbidity reduces photosynthetic light penetration in deeper areas. The eelgrass beds provide a valuable habitat for benthic organisms that are fed upon by birds and fishes. Although eelgrass beds were less well developed in areas of the Inner Lagoon, it also provides a wider range of habitats, including mud flats, salt marsh, and seasonal ponds that are not found elsewhere in Aqua Hedionda. As a result bird and fish diversity was highest in the Inner Lagoon.

A total of 35 species of fishes was found during the 1994 and 1995 sampling conducted by MEC (MEC Analytical 1995). The Middle and Inner lagoons had more species and higher abundances than the Outer Lagoon. During the 1995 survey only four species were collected in the Outer Lagoon, compared to 14 to 18 species in the Middle and Inner lagoons. The sampling did not include any surveys of the rocky revetment lining the Outer Lagoon that would increase the abundance and number of species collected. Silversides (Atherinopsidae) and gobies (Gobiidae)

were the most abundant fishes collected. Silversides, including jacksmelt and topsmelt, that occur in large schools in shallow waters where water temperatures are warmest were most abundant in the shallower Middle and Inner lagoons. Gobies were most abundant in the Inner Lagoon which has large shallow mudflat areas that are their preferred habitat.

### *Special Status Species*

The recent assessment of the ecological resources of Agua Hedionda did not collect any federally endangered tidewater goby (*Eucyclogobius newberryi*) that was once recorded from the lagoon (MEC Analytical 1995). The record of the occurrence may not be accurate or may predate the construction of the Outer Lagoon that provided a direct connection with the ocean. The current marine environment in the lagoon would not generally support tidewater gobies because they prefer brackish water habitats. No other listed fish species were collected in the study.

## *2.2.2 Pacific Ocean*

Agua Hedionda Lagoon is tidally flushed through the small inlet in the Outer Lagoon by waters from the Pacific Ocean. The physical oceanographic processes of the southern California Bight that influence the lagoon include tides, currents, winds, swell, temperature, dissolved oxygen, salinity and nutrients through the daily tidal exchange of coastal seawater. Near the mouth of the lagoon the mean tide range is 3.7 ft (1.1 m) with a diurnal range of 5.3 ft (1.6 m). Waves breaking on the shore generally range in height from 2 to 4 ft (0.6 to 1.2 m), although larger waves (6 to 10 ft [1.8 to 3.0 m]) are not uncommon. Larger waves exceeding 15 ft (4.6 m) occur infrequently, usually associated with winter storms. Surface water in the local area ranges from a minimum of 57°F (13.9°C) to a maximum 72°F (22.2°C) with an average annual temperature between 63°F (17.2°C) and 66°F (18.9°C).

The outer coast has a diversity of marine habitats and includes zones of intertidal sandy beach, subtidal sandy bottom, rocky shore, subtidal cobblestone, subtidal mudstone and water column. Organisms typical of sandy beaches include polychaetes, sand crabs, isopods, amphipods, and clams. Grunion utilize the beaches around EPS during spawning season from March through August. Numerous infaunal species have been observed in subtidal sandy bottoms. Mollusks, polychaetes, arthropods, and echinoderms comprise the dominant invertebrate fauna. Sand dollars can reach densities of 1,200 per square meter. Typical fishes in the sandy subtidal include queenfish, white croaker, several surfperch species, speckled sanddab, and California halibut. Also, California spiny lobster and *Cancer* spp. crabs forage over the sand. Many of the typically outer coast species can occasionally occur within Agua Hedionda Lagoon, carried by incoming tidal currents.

The rocky habitat at the discharge canal and on offshore reefs supports various kelps and invertebrates including barnacles, snails, sea stars, limpets, sea urchins, sea anemones, and mussels. Giant kelp (*Macrocystis*) forests are an important habitat-forming community in the area offshore from Agua Hedionda. Kelp beds provide habitat for a wide variety of invertebrates and fishes. The water column and kelp beds are known to support many fish species, including northern anchovy, jack smelt, queenfish, white croaker, garibaldi, rockfishes, surfperches, and halibut.

Marine-associated wildlife that occur in the Pacific waters off Agua Hedionda Lagoon are numerous and include brown pelican, surf scoter, cormorants, western grebe, gulls, terns and loons. Marine mammals, including porpoise, sea lions, and migratory gray whales, also frequent the adjacent coastal area.

# 3.0 ENTRAINMENT STUDY AND ASSESSMENT METHODS

Entrainment studies were previously conducted in 1979 and 1980 at the EPS as part of the plant's initial Section 316(b) Demonstration requirement. The original study was conducted using pump sampling for plankton at the intake structure and net sampling of plankton at three source water stations in the Outer Lagoon (SDG&E 1980). For this study, plankton net sampling at the intake station and at an array of source water stations will be used to collect data for impact models that will be used to update the previous 316(b) Demonstration study. The following questions will be addressed by the entrainment and source water studies:

- What is the baseline entrainment mortality?
- What are the species composition and abundance of larval fishes, cancer crabs, and lobsters entrained by the EPS?
- What are the estimates of local species composition, abundance and distribution of source water stocks of entrainable larval fishes, cancer crabs, and spiny lobsters in Agua Hedionda Lagoon and the nearshore oceanic source waters?

The basis for estimation of entrainment effects is accurate knowledge of the composition and densities of planktonic organisms that are at risk of entrainment through the power plant cooling water system. Recent studies addressing 316(b) issues have focused on larval fishes and commercially important crustacean species (Tenera 2001, 2004). The basic study design involves the collection of plankton samples directly from the intake cooling water flow (entrainment sampling) and comparing the densities of various target species from plankton samples taken concurrently from the source water body (source water sampling). In the case of Encina Power Station (EPS), two areas contribute to the source water body; the lagoon sub-area and the nearshore sub-area, each having a unique contribution to the cooling water flows in terms of species composition and probability of entrainment.

## 3.1 Entrainment Study

Field data on the composition and abundance of potentially entrained larval fishes, *Cancer* spp. megalopae, and larval spiny lobster *Panulirus interruptus* will provide a basis to estimate the total number and types of these organisms passing through the power plant's cooling water intake system. For the purposes of modeling and calculations, through-plant mortality will be assumed to be 100 percent; unless otherwise determined through a San Diego RWQCB approved

entrainment mortality study. Monthly entrainment and source water surveys started in June 2004 will be continued on a monthly basis through May 2005.

### 3.1.1 Entrainment Sampling Methods

This study was designed to quantify the composition and abundance of entrained larval fishes, *Cancer* spp. megalopae, and spiny lobster larvae. A map of the station locations that were sampled starting in June 2004 is shown in Figure 3. These stations will continued to be sampled through May 2005 on a monthly basis.

Sample collection methods are similar to those developed and used by the California Cooperative Oceanic and Fisheries Investigation (CalCOFI) in their larval fish studies (Smith and Richardson 1977) but modified for sampling in the shallow areas of Agua Hedionda Lagoon. Two replicate entrainment samples are collected from a single station (E1) located in front of the EPP intakes by towing plankton nets from a small boat. A net frame is equipped with two 0.71 m (2.33 ft) diameter openings each with a 335 µm (0.013 in) mesh plankton net and codend. The start of each tow begins close to the intake structure, proceeds in a northerly direction against the prevailing intake current, and ends approximately 100 m from the structure. It is assumed that all of the water sampled at the entrainment station would have been drawn through the EPS cooling water system.

The tows are done by first lowering the nets as close to the bottom as practical without contacting the substrate. Once the nets are near the bottom, the boat is moved forward and the nets retrieved at an oblique angle (winch cable at approximately 45° angle) to sample the widest strata of water depths possible. Total time of each tow is approximately two minutes at a speed of 1 kt during which a combined volume of at least $60m^3$ ($2,119\ ft^3$) of water is filtered through both nets. In similar studies conducted by Tenera, this volume has been shown to typically provide a reasonable number and diversity of larvae for data modeling. The water volume filtered is measured by calibrated flowmeters (General Oceanics Model 2030R) mounted in the openings of the nets. Accuracy of individual instruments differed by less than 5% between calibrations. The sample volume is checked when the nets reach the surface. If the target volume is not collected, the tow was repeated until the targeted volume is reached. The nets are then retrieved from the water, and all of the collected material rinsed into the codend. The contents of both nets are combined into one sample immediately after collection. The sample is placed into a labeled jar and preserved in 10 percent formalin. Each sample is given a serial number based on the location, date, time, and depth of collection. In addition, the information is logged onto a sequentially numbered data sheet. The sample's serial number is used to track it through laboratory processing, data analyses, and reporting.

Entrainment samples are collected over a 24-hour period, with each period divided into four 6-hour sampling cycles. Larval fishes show day-night differences in abundances related to their vertical migratory behavior and spawning periodicity, and the 24-hr sampling regime allows these differences to be averaged for assessing entrainment abundances. Concurrent surface water temperatures and salinities are measured with a digital probe (YSI Model 30).

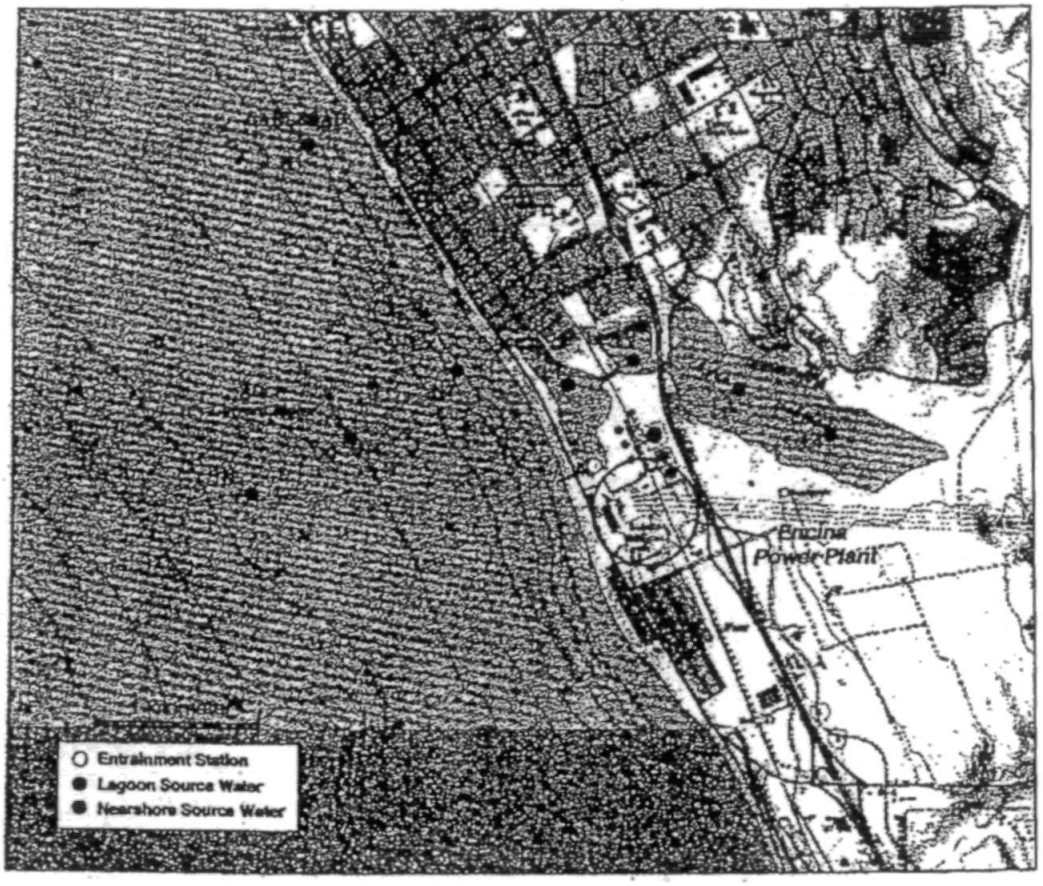


**Figure 3.** Location of Encina Power Station entrainment (E1) and source water stations (L1 through L4, and N1 through N5).

## 3.2 Source Water Study

This study was designed to quantify the local source water composition and abundance of larval fishes, *Cancer* spp. megalopae, and larval *Panulirus interruptus* in Agua Hedionda Lagoon and the nearshore source waters. The source water is partitioned into lagoon and nearshore sub-areas for modeling cooling water withdrawal effects (**Figure 3**). Collection methods are identical to the entrainment sample collection, with the exception that a single paired-net sample is collected at each station and the nearshore samples are be collected from a larger vessel capable of

navigating open coastal waters in all weather conditions, day or night. The shallow waters in the Middle and Inner lagoons required a different sampling protocol than the oblique tows used at the Outer Lagoon and nearshore stations. The Inner Lagoon is sampled using a single frame plankton net mounted on the bow of a small boat which pushes the net through the water thereby eliminating any obstructions in front of the net during sampling. The net is raised and lowered during sampling to sample the range of depths available in the shallow Inner Lagoon.

The stations are stratified to include four lagoon stations within the inner (2), middle (1), and outer lagoons (1), and five nearshore stations that cover a depth range of 5–30 m (16–98 ft). The array of locations and depths was chosen to assure that all potential source water community types are represented. For example, stations in the inner lagoon will have a greater proportion of larvae from species with demersal eggs, such as gobies, that spawn in quiet water environments, while nearshore stations will have more larvae of species that spawn in open water such as California halibut and white seabass. The study will allow comparison to earlier larval fish studies done for the original EPS 316(b) in 1979-80 (SDG&E 1980).

A current meter is placed in the nearshore between Stations N4 and N5. The data from the meter will be used to characterize currents in the nearshore area that would directly affect the dispersal of planktonic organisms that could be entrained by the power plant. The data will be used to define the size of the nearshore component of the source water by using the current speed and the estimated larval durations of the entrained organisms.

The number of source water stations will be evaluated as data become available to determine if fewer stations can be sampled. For example, a reduction in the number of stations may be recommended if analysis indicates that only one station is necessary to characterize the Inner Lagoon, or the Middle Lagoon is sufficiently similar to the Inner Lagoon that it does not need to be sampled separately. Analysis of current meter data may also indicate that Station N5 does not need to be sampled because the current is predominantly alongshore and can be adequately characterized using the other stations closer to shore.

### 3.2.1 Source Water Sampling Methods

Sampling is conducted using the same methods and during the same time period described earlier for the entrainment collections (Section 3.1.1) with target volumes for the oblique tows of approximately 60 $m^3$ (2–3 minute tow at approximately 1 knot).

## 3.3 Laboratory Processing and Data Management

Laboratory processing will remove all larval fishes, megalopal stages of *Cancer* spp., and larvae of spiny lobster from the samples. Fish eggs will not be sorted from the samples. Although many marine fish eggs are described in the scientific literature, most identifications are difficult and very time consuming, and impact models can be adequately parameterized without egg density data. Larval fishes and all species of cancer crab megalopae will be identified to the lowest taxonomic level possible by Tenera's taxonomists. In addition, the developmental stage of fish larvae (yolk-sac, preflexion, flexion, postflexion, transformation) will be recorded on the data sheet. A laboratory quality control (QC) program for all levels of laboratory sorting and taxonomic identification will be applied to all samples. The QC program will also incorporate the use of outside taxonomic experts to provide taxonomic QC and resolve identification uncertainties.

Many larval fish cannot be identified to the species level; these fish will be identified to the lowest taxonomic classification possible (e.g., genus and species are lower orders of classification than order or family). Myomere and pigmentation patterns are used to identify many species; however, this can be problematic for some species. For example, sympatric members of the family Gobiidae share similar characteristics during early life stages (Moser 1996), making identifications to the species level uncertain. Those gobiids that we are unable to identify to species will be grouped into an "unidentified goby" category.

Laboratory data sheets will be coded with species or taxon codes. These codes will be verified with species/taxon lists and signed off by the data manager. The data will be entered into a computer database for analysis.

Length measurements will be taken on a representative sample of the target larval fish taxa. Approximately 100 fish from each taxon will be measured using a video capture system and Optimus™ image analysis software. The 100 fish from each taxon will be selected from the entrainment station based on the percentage frequency of occurrence of a taxon in each survey. For example, if 20 percent of the California halibut larvae for the entire year-long study were collected from during the June survey then 20 fish will be measured from that survey.

## 3.4 Assessment Methods

Potential cooling water intake system (CWIS) entrainment effects will be evaluated using a suite of methods, with no single method being superior to any others. The potential entrainment effects of the EPS CWIS, assuming 100 percent through-plant mortality, will be estimated using the site-specific field data collected in this proposed study. The potential for any such CWIS

effects to cause long-term population level impacts will be evaluated through the use of three analytical techniques: proportional entrainment (*PE*), adult equivalent loss (*AEL*), and fecundity hindcasting (*FH*). The results of these analytical steps will support assessments with respect to species population demographics (e.g., standing stock, age structure stability, fishery trends, and sustainable harvest management plans).

### 3.4.1 Demographic Approaches (FH and AEL)

The fecundity hindcasting or *FH* analysis approach (Horst 1975) compares larval entrainment losses with adult fecundity to estimate the amount of adult female reproductive output eliminated by entrainment. It thereby hindcasts the numbers of adult females effectively removed from the reproductively active population. The accuracy of these estimates of effects is dependent upon such factors as accurate estimates of age-specific mortality from the egg and early larval stages to entrainment, and also on age-specific estimates of adult fecundity, spawning periodicity, and reproductive lifespan. If it is assumed that the adult population has been stable at some current level of exploitation and that the male:female ratio is known and constant, then fecundity and mortality are integrated into an estimate of loss by converting entrained larvae back into females (i.e., hindcasting). In making this conversion, the number of eggs, derived from the number of larvae adjusted for egg to larvae mortality, are divided by the average number of eggs produced by each age class (size) of reproductive females in the stable population's ideal age structure. However this degree of information is rarely available for a population. In most cases, a simple range of eggs per females is reported without age-specificity.

An advantage of *FH* is that survivorship need only be estimated for a relatively short period of the larval stage (i.e., egg to larva). This method does not require source water sampling in addition to estimates of larval entrainment concentrations. This method assumes that the loss of a single female's reproductive potential is equivalent to the loss of adults. For the purpose of the resource assessment, if EPS-induced entrainment losses are to be equated to population level units in terms of fractional losses, it is still necessary to estimate the size of the population of interest. To this end, our assessment will employ any available, scientifically acceptable sources of information on fisheries stock or population estimates of unexploited species entrained by the EPS.

The adult equivalent loss or *AEL* approach (Goodyear 1978) uses age-specific estimates of the abundance of entrained or impinged organisms to project the loss of equivalent numbers of adults based on mortality schedules and age at recruitment. The primary advantage of this approach is that it translates power plant-induced, early life-stage mortality into equivalent numbers of adult fishes, the units used by resource managers. Adult equivalent loss does not necessarily require source water estimates of larval abundance in addition to entrainment

estimates, as required in *PE*. This latter advantage may be offset by the need to gather age-specific mortality rates to predict adult losses and the need for information on the adult population of interest for estimating population-level effects (i.e., fractional losses). However, the need for age-specific mortality estimates can be reduced by various approximations as shown by Saila et al. (1987), who used six years of entrainment and two years of impingement data for winter flounder *Pleuronectes americanus*, red hake *Urophycis chuss*, and pollock *Pollachius virens* at the Seabrook Station in New Hampshire. Their model assumed an adult population at equilibrium, a stable age distribution, a constant male:female ratio, and an absence of density-dependent (i.e., compensatory) mortality between entrainment and recruitment to the adult or fished stocks. Input data to their model parameters were gathered in field surveys of spawning populations, egg and larval production, and local hydrology.

Declining populations can be accounted for in both the *AEL* and *FH* approaches by using age-specific adult mortality estimates from fishery catch data and by assuming no compensatory mortality. However, we know that this is not an assumption that fits the reality of population dynamics. The removal (mortality) of any life stage will have an effect if it exceeds the number of reproductive adults required to produce that number of larvae. That is, the adult population will decline one for one with every larva lost. This is clearly not the case, nor does every larva survive to become an adult. Although we have essentially no way of estimating the degree to which a population can sustain losses and remain stable, it is an important issue when estimating long-range effects. The effect, known as density-dependence (sometimes called compensation), can affect the vital rates of impacted organisms. Density-dependence is not confined to acting through mortality; growth and fecundity may also be density-dependent. In fisheries management models, which we will take as our working models in forecasting long-term population trends, the level of compensation possible in species can be examined empirically by the response of its population to harvest rates.

Some entrainment studies have assumed that compensation is not acting between entrainment and the time when adult recruitment would have taken place, and further, that this specific assumption resulted in conservative estimates of projected adult losses (Saila et al. 1987). Others, such as Parker and DeMartini (1989), did not include compensatory mortality in estimates of equivalent adult losses because of a lack of consensus on how to include it in the models and, more importantly, uncertainty about how compensation would operate on the populations under study. The uncertainty arises because the effect of compensation on the ultimate number of adults is directly related to which of the vital processes (fecundity, somatic growth, mortality) and which life stages are being affected. In particular, Nisbet et al. (1996) showed that neglecting compensation does not always lead to conservative long-term estimates of equivalent adult losses.

### 3.4.2 Empirical Transport Model (ETM)

The *PE* approach (Boreman et al. 1978, Boreman et al. 1981) will provide an estimate of incremental (conditional, Ricker 1975) mortality imposed by EPS on local source water larval populations by using empirical data (plankton samples) rather than relying solely on hydrodynamic and demographic calculations. Consequently, *PE* requires an additional level of field sampling to characterize abundance and composition of larvae using results from the larval fish surveys defined in this document (Section 3.2.1). These estimates of species-specific fractional losses (entrainment losses relative to source water abundance) can then be expanded to predict regional effects on appropriate adult populations using an empirical transport model (*ETM*), as described below. Required parameters for the *PE* approach include the rate of cooling water withdrawal, estimates of entrained larval fish concentrations, and estimates of the larval fish concentrations in the source waters.

The use of *PE* as an input to the empirical transport model (*ETM*) has been proposed by the U.S. Fish and Wildlife Service to estimate mortality rates resulting from cooling water withdrawals by power plants (Boreman et al. 1978, and subsequently in Boreman et al. 1981). Variations of this model have been discussed in MacCall et al. (1983) and have been used to assess impacts at a southern California power plant (Parker and DeMartini 1989). The *ETM* has also been used to assess impacts at the Salem Nuclear Generating Station in Delaware Bay, New Jersey (PSE&G 1993) as well as other power stations along the East Coast. Empirical transport modeling permits the estimation of annual conditional mortality due to entrainment while accounting for the spatial and temporal variability in distribution and vulnerability of each life stage to power plant withdrawals. The generalized form of the *ETM* incorporates many time-, space-, and age-specific estimates of mortality as well as information regarding spawning periodicity and duration, many of which are limited or unknown for the marine taxa being investigated at EPS. The applicability of the *ETM* to the present study at EPS will be limited by a lack of either empirically derived or reported demographic parameters needed as input to the model. However, the concept of summarizing *PE* over time that originated with the *ETM* can be used to estimate entrainment effects over appropriate temporal scales either through modeling or by making assumptions about species-specific life histories. We will employ a *PE* approach that is similar to the method described by MacCall et al. (1983) and used by Parker and DeMartini (1989) in their final report to the California Coastal Commission (Murdoch et al. 1989), as an example for the San Onofre Nuclear Generating Station (SONGS). This estimate can then be summarized over appropriate blocks of time in a manner similar to that of the *ETM*.

# 4.0 IMPINGEMENT EFFECTS

The two primary ways cooling water withdrawal can affect aquatic organisms are through impingement and entrainment. Larger organisms are subjected to impingement on the screening system on the power plant's cooling water intake system (CWIS) that excludes debris from the circulating water pumps. EPS presently has seven sets of vertical traveling screens in three separate areas. Approach velocities vary from approximately 0.7 fps at high tide to 1.6 fps at low tide. Impingement occurs when an organism larger than the traveling screen mesh size is trapped against the screens. These impinged organisms are assumed to undergo 100 percent mortality for the purposes of this study. The following questions will be addressed by the impingement study:

- What is the baseline impingement mortality?
- What are the species composition and abundance of fishes and macroinvertebrates impinged by EPS?

## 4.1 Review of 1980 Impingement Study

In earlier impingement studies at EPS, fish samples were collected from screen washes during high and low impingement periods for one year (SDG&E 1980). Samples were collected over two-12 hour periods during each day to represent daytime and nighttime impingement. Since samples were collected every day the study provides a direct measure of EPS impingement. During the one-year period during normal plant operations 76 species of fishes and 45 species of macro-invertebrates totaling 85,943 individuals and weighing 1,548 kg (3,414 lb) were impinged. During the seven heat treatments conducted during the sampling period 108,102 fishes weighing 2422 kg (5,341 lb) were collected. The most abundant fishes collected in impingement samples were actively swimming, open-water schooling species such as deepbody and northern anchovy, topsmelt, and California grunion. Other abundant species included queenfish and shiner surfperch. During heat treatments larger fishes were collected that were less common during normal impingement. These larger fishes probably live in the CWIS and are able to avoid impingement during normal plant operation, but succumb to the warmer temperatures during heat treatment. Marine plants, largely eelgrass and giant kelp, made up the largest component of material in impingement samples.

Impingement losses at EPS were much less when compared with impingement at other coastal plant in southern California. Impingement was much greater at the Redondo Beach Generating Station and San Onofre Nuclear Generating Station Unit 1, even though the cooling water flows

at those two facilities are less than the flow at EPS (673 and 500 MGD, respectively compared with 828 mgd at EPS). The intake approach velocities at the screenwells at EPS are lower than the velocities at these other facilities allowing most fishes to avoid impingement by continuous or burst swimming. The SDG&E report (SDG&E 1980) and a later evaluation (EA 1997) both concluded that the biological impact of EPS was insignificant in terms of impingement losses.

## 4.2 Impingement Study Methods

The purpose of the proposed 316(b) impingement study will be to characterize the juvenile and adult fishes and selected macroinvertebrates (e.g., shrimps, crabs, lobsters, squid, and octopus) impinged by the power plant's CWIS. The sampling program is designed to provide current estimates of the abundance, taxonomic composition, diel periodicity, and seasonality of organisms impinged at EPS. In particular, the study will focus on the rates (i.e., number or biomass of organisms per $m^3$ water flowing per time into the plant) at which various species of fishes and macroinvertebrates are impinged. The impingement rate is subject to tidal and seasonal influences that vary on several temporal scales (e.g., hourly, daily, and monthly) while the rate of cooling water flow varies with power plant operations and can change at any time. A review of the previous impingement study at EPS will provide context for interpreting changes in the magnitude and characteristics of the present day impingement effects. Studies of the Agua Hedionda fish assemblages independent of EPS (e.g., MEC Analytical 1995) will also provide information regarding the marine environment in southern and central Agua Hedionda Lagoon.

In accordance with procedures employed in similar studies, impingement sampling will occur over a 24-hour period one day per week. Before each sampling effort, the trash racks will be cleaned and the traveling screens will be rotated and washed clean of all impinged debris and organisms. The sluiceways and collection baskets will also be cleaned before the start of each sampling effort. The operating status of the circulating water pumps on an hourly basis will be recorded during the collection period. Each 24-hour sampling period at the traveling screens will be divided into six 4-hour cycles. The traveling screens will remain stationary for a period of 3.5 hours then they will be rotated and washed for 30 minutes. The trash racks will be cleaned once every 24 hours. The impinged material from the traveling screens will be rinsed into the collection baskets associated with each set of screens and the impinged material from the trash racks will be collected in the bin on the rake apparatus. The debris and organisms rinsed from each set of traveling screens and the trash racks will be kept separate and processed according to the procedures presented in the following section.

If the traveling screens are operating in the continuous mode, then sampling will be coordinated with the intake crew so samples can be collected safely. A log containing hourly observations of the operating status (on or off) of the circulating water pumps for the entire study period will be

obtained from the power plant operation staff. This will provide a record of the amount of cooling water pumped by the plant, which will then be used to calculate impingement rates. The same procedure will be used to coordinate additional sampling efforts at the trash racks in case they need to be cleaned more frequently than once every 24 hours. The sampling at each of the three sets of traveling screens will be offset by one hour to allow screen wash and collection to occur at each set of screens separately.

Impingement sampling will also be conducted during heat treatment "tunnel shock" operations. Procedures for heat treatment will involve clearing and rinsing the traveling screens prior to the start of the heat treatment procedure. At the end of the heat treatment procedure normal pump operation is resumed and the traveling screens rinsed until no more fish are collected on the screens. Processing of the samples will occur using the same procedures used for normal impingement sampling. We anticipate that up to eight heat treatments will occur during the one-year study period.

A quality control (QC) program will be implemented to ensure the correct identification, enumeration, length and weight measurements of the organisms recorded on the data sheet. Random cycles will be chosen for QC re-sorting to verify that all the collected organisms were removed from the impinged material.

Depending on the number of individuals of a given target species present in the sample, one of two specific procedures is used, as described below. Each of these procedures involves the following measurements and observations:

1. The appropriate linear measurement for individual fishes and motile invertebrates is determined and recorded. These measurements are made in millimeters to the nearest 1 mm. The following standard linear measurements are used for the animal groups indicated:

| | |
|---|---|
| Fishes | Total body length for sharks and rays and standard lengths (fork length) for bony fishes. |
| Crabs | Maximum carapace width. |
| Shrimps & Lobsters | Carapace length, measured from the anterior margin of carapace between the eyes to the posterior margin of the carapace. |
| Gastropod & Pelecypod Molluscs | Maximum shell length or maximum body length. |
| Octopus | Maximum "arm" spread, measured from the tip of one tentacle to the tip of the opposite tentacle. |
| Squid | Maximum body length, measured from the tip of one tentacle to the posterior end of the body. |

2. The wet body weight of individual animals is determined after shaking loose water from the body. Total weight of all individuals combined is determined in the same manner. All weights are recorded to the nearest 1 g.

3. The qualitative body condition of individual fishes and macroinvertebrates is determined and recorded, using codes for decomposition and physical damage. These codes are shown on the attached form.

4. Other non-target, sessile macroinvertebrates are identified to species and their presence recorded, but they are not measured or weighed. Rare occurrences of other impinged animals, such as dead marine birds, are recorded and their individual weights determined and recorded.

5. The amount and type of debris (e.g., *Mytilus* shell fragments, wood fragments, etc.) and any unusual operating conditions in the screen well system are noted by writing specific comments in the "Notes" section of the data sheet.

The following specific procedures are used for processing fishes and motile invertebrates when the number of individuals per species in the sample or subsample is $\leq 29$ :

1. For each individual of a given species the linear measurement, weight, and body condition codes are determined and recorded on separate lines.

The following specific subsampling procedures are used for fishes and motile invertebrates when the number of individuals per species is > 29:

1. The linear measurement, individual weight, and body condition codes for a subsample of 30 individuals are recorded on individual lines of the data sheet. The individuals selected for measurement should selected after spreading out all of the individuals in a sorting container, making sure that they are well mixed and not segregated into size groups. Individuals with missing heads or other major body parts are eliminated from consideration, since linear measurements of them are not representative.

2. The total number and total weight of all the remaining individuals combined are determined and recorded on a separate line.

### 4.2.1 Sampling Frequency

Results from the previous impingement study indicated that the impingement is much greater during the heat treatment "tunnel shock" events. Almost 60 percent of the total impinged fishes (over 60 percent by weight) were collected during the seven tunnel shock events. Impingement

rates during normal operations were much less. Although we have proposed to sample normal impingement weekly, we will evaluate the potential to reduce the sampling frequency to once every two weeks. The analysis will be done using the weekly data collected at EPS during this study and data from other southern California power plants with shoreline intake structures. The reduced sampling frequency may provide an adequate estimate of impingement especially since we will continue to sample impingement during each of the tunnel shock events when impingement is highest.

# 5.0 COOLING WATER SYSTEM IMPACT ASSESSMENT

The entrainment and impingement effects of the cooling water intake system for the EPS project will be assessed on the basis of historical studies and 12 months of recent plankton and 12 months of impingement survey information. The assessment will consider the effects of entraining larval fishes, crabs and lobsters, and impinging larger fishes and invertebrates in the CWIS. The three methods for assessing CWIS effects are fecundity hindcasting (*FH*), adult equivalent loss (*AEL*) and empirical transport modeling (*ETM*). These methods were explained in Section 3.5—Assessment Methods. The report will contain estimates of *AEL* and *FH* where data are available to parameterize these demographic approaches.

The impacts of impingement and entrainment on source water populations can be evaluated by estimating the fractional losses to the population attributable to the CWIS. Impingement rates and biomass estimates from the study will provide estimates of impingement losses that can then be translated directly to estimate potential impingement effects on local fisheries. Estimated entrainment losses are extrapolated to fishery losses using *FH* and *AEL* estimates. One constraint in the modeling approach is that life history data are available for only a portion of the entrained taxa and commercial fishery statistics will also only be available for a few of the entrained species (e.g., California halibut, northern anchovy, white croaker). Many of the fishes that have historically been entrained in highest numbers are small fishes that are not the focus of any recreational or commercial fishery.

Present-day findings on the EPS CWIS entrainment effects will be reviewed and assessed for the most abundant larval fish taxa, megalopal cancer crabs, and larval spiny lobster. By comparing the number of larvae and megalopae withdrawn by the power plant to the number available (i.e., at risk to entrainment), an estimate of the conditional mortality due to entrainment (*PE*) can be generated for each taxon or species. These estimates of conditional mortality will be combined in the *ETM* model to provide an estimate of the annual probability of mortality due to entrainment ($P_m$) that can be used for determining CWIS effects and the potential for long-term population declines. Fishery management practices and other forms of stock assessments will provide the context required to interpret $P_m$. In the case of a harvested species, $P_m$ must be considered in addition to these harvest losses when assessing impacts and any potential for population decline.

## 5.1 Entrainment Effects Assessment

The assessment will focus on entrainment effects to the most abundant and to commercially or recreationally important fish taxa, cancer crab megalops and lobster larvae. Larval fishes

analyzed will tentatively be the Goby complex, three Engraulid species, three Atherinopsid species, California halibut, white croaker, black croaker, spotted sand bass, and barred sand bass. These taxa likely comprise over 90 percent of all the entrained larval fishes based on earlier studies. Other species, which may occur in lower abundances, may also be included in the assessment because they represent species of commercial or recreational importance

## 5.2 Summary of Entrainment Effects

The length of time that a larval fish is in the plankton and subject to entrainment is a key parameter in *ETM* calculations. Length measurements taken from representative samples of the larval fish taxa presented in Section 4.0 will be used to estimate the number of days that larvae (for a specific taxon) are at risk to entrainment. Reports on larval duration from the scientific literature are likely to overestimate the period of time that larvae are exposed to entrainment. This is because ontogenetic changes during larval development result in increased swimming ability or behavioral changes, such as association with the bottom or other pre-settlement microhabitats. Possible outliers are eliminated by basing the minimum and maximum lengths on the central 98 percent of the length distribution for a taxon and excluding the lengths of the top and bottom percentiles. Estimates of larval growth rates (mm/day) are then used on this range to estimate the number of days the larvae are exposed to entrainment. The estimates of growth rates and their source from the literature will be presented in the impact assessment section for the different taxa. The average duration of entrainment risk for a taxon is calculated from the bottom percentile value to the mean value, while the maximum duration is calculated from the bottom percentile value to the 99 percentile value. Our estimates of the period of entrainment risk for cancer crabs and spiny lobster will be derived from literature values on the average age of the stages for each crustacean species.

## 5.3 Summary of Impingement Effects

Impingement effects in relation to source water fishery resources and potential ecological effects will be summarized based on data summarized from the earlier impingement study (SDG&E 1980), data on fish populations in Agua Hedionda Lagoon (MEC 1995), and CDF&G catch records for sport and commercial fishery resources.

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NRG CABRILLO POWER OPERATIONS INC.

January 10, 2005

Mr. John Phillips
San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4340

**Subject: Cabrillo Power I LLC Response to Comments from Tetra Tech to San Diego Regional Water Quality Control Board on the Encina *316(b) Cooling Water Intake Effects Entrainment & Impingement Sampling Plan***

Dear Mr. Phillips:

Cabrillo Power I LLC (Cabrillo) appreciates the opportunity to respond to the comments from Tetra Tech on the *316(b) Cooling Water Intake Effects Entrainment and Impingement Sampling Plan* for the Encina Power Station (EPS) submitted to the San Diego Regional Water Quality Control Board (Regional Board) on September 2, 2004. Tenera Environmental prepared the plan for the EPS 316(b) studies, and Cabrillo had them respond to comments from Tetra Tech. The responses from Tenera are incorporated into this letter and identified accordingly.

The Tetra Tech comments generally call for further clarification of the study plan or additions to the plan that will not affect the sampling procedures currently being used. The Tetra Tech comments (numbered the same as on the Tetra Tech memo) with specific questions of Cabrillo have responses that are highlighted in boldface type. Tetra Tech also made several suggestions that we have responded to in the final section of this letter.

**TETRA TECH COMMENTS AND CABRILLO RESPONSES:**

1) *Page 2*: The authors state that they will use EPA's criteria for selecting appropriate target organisms for assessment, results from previous 316(b) studies, Aqua Hedionda Lagoon ecological surveys, and results from the upcoming study to "determine the appropriate target organisms that will be evaluated in detail." Final selection of target organisms should involve consultation with the appropriate resource agencies. Will the California Regional Water Quality Control Board (and others) be contacted to approve target organism selection before commencement of assessment analyses?

*Response*: **The final selection of the specific target organisms will be made in collaboration with the Regional Board and other appropriate agencies. The**

**sampling and processing is currently focused on fishes and selected macroinvertebrates; the same groups of organisms that were studied in San Diego Bay in 2001–2003 at the Duke Energy South Bay Power Plant in San Diego. The final list of target organisms will be based largely on their abundances in the entrainment and impingement samples. The impact assessment will be restricted to the most abundant taxa to ensure that there is have reasonable confidence in the results.**

3) *Page 7*: The MEC Analytical (1995) ecological surveys will be used to provide "data on fish populations in Aqua Hedionda Lagoon" (see page 24) for the evaluation of EPS impingement effects in relation to source water fishery resources. The authors mention that the MEC Analytical sampling "did not include any areas of the rocky revetment lining the Outer Lagoon that would increase the abundance and number of species collected." It appears that the surveys focused on the Middle and Inner Lagoons. Since the MEC Analytical data will be used for impingement effects analyses, the search for and/or collection of supplemental information for Outer Lagoon fishes may be warranted (however, it should be noted that we have not reviewed the contents of the MEC Analytical report).

*Response*: **The MEC study utilized multiple gear types that effectively sampled most of the habitats in Aqua Hedionda Lagoon. Cabrillo is currently evaluating if supplemental studies of the habitats not sampled in the MEC study are necessary and will propose those to the Regional Board if warranted. These habitats include the shallow mudflats areas that are common in the middle and inner lagoon, the rocky habitat that lines the boundary of the outer lagoon, and the artificial substrates on the piers, docks and floats of the outer lagoon. Gobies that occur in burrows on the mudflats and combtooth blennies, garibaldi and rockfishes that occur on the rocky habitat and artificial substrates in the outer lagoon were not effectively sampled by any of the gear types used in the MEC study. The larvae from these fishes will likely be abundant in the entrainment samples and this study will provide an estimate of their adult source water populations that will be used in the assessment of cooling water intake system (CWIS) effects.**

6) *Page 11*: The authors state that entrainment sampling began in June 2004 and will continue through May 2005. Has this proposed index period changed, or was approval received for sampling commencement prior to the preparation and review of this sampling plan (Plan is dated September 2004)? Did source water sampling also begin before this plan was written?

*Response*: Both entrainment and source water sampling began in June 2004. The sampling started before a sampling plan was submitted to the Regional Board to take advantage of studies of the cooling water system that were being conducted in association with the permitting for the desalination facility being proposed for construction at the plant site by Poseidon Resources. The original proposal for the Poseidon study did not include the more extensive source water sampling in the final study plan. The scope of the study was expanded to conform to other 316(b) demonstration studies Tenera has completed in California including the study recently completed at the Duke Energy South Bay Power Plant in San Diego Bay. This provided Cabrillo the opportunity to continue the sampling in response to EPA's recently published Phase II rule for compliance with Section 316(b) of the Clean Water Act.

7) *Page 11*: Entrainment samples will be collected from the lagoon, near the intake structure. Is entrainment sampling not possible from a location within the EPS CWIS?

*Response*: Entrainment sampling conducted at ocean and estuarine power plants over the last ten years in California has been done in the source waters as near as possible to the intakes. This sampling location has been used because studies at the Diablo Canyon Power Plant in central California showed that large losses of planktonic organisms such as larval fishes can occur as a result of filtering by biofouling organisms that grow on the surfaces inside the power plant cooling water intake system. Studies have shown reductions in densities of greater than 90 percent between intake and discharge samples that have been attributed to biofouling losses. Although the entrainment sampling proposed for the EPS with plankton nets in the source waters at the power plant intake structure requires the assumption that the densities of organisms in the source waters are representative of the densities of organisms that are entrained, sampling inside the power plant introduces additional assumptions, sampling problems, and the known problem of cropping by biofouling organisms. One of these problems involves obtaining representative, well-mixed samples and sampling in rapidly flowing water. In addition, sampling inside the plant cooling water system usually requires pump sampling methods that are different than the towed net sampling used in the source waters, therefore introducing additional assumptions affecting comparisons between density estimates. All of these issues have resulted in the recommendation that entrainment sampling be done in the lagoon using nets towed as close as practical to the intake structure.

8) *Page 11*: As part of the description of entrainment sampling methods, the authors mention that the "accuracy of individual instruments differed by less than 5% between calibrations." This is mentioned as a statement. Is it intended to be a quality standard?

*Response*: **No, it is not intended as a quality standard, it is just a statement that the difference in rotor constants between calibrations was generally less than 5%. In addition to maintaining the flowmeters before and after each survey, they are calibrated every three months to recalculate a new rotor constant, which is used to calculate the flow of water through the net. If the value of a constant changes greater than 10% between calibrations, which is almost never the case, the readings from the field data sheets are reviewed to determine when the change occurred. If the change in the flowmeter can be detected from the data, the values will be adjusted using the average difference between the two flowmeters used on the bongo frame prior to that sample; otherwise the flowmeter reading for the instrument that is within the 10% calibration range will be used to estimate the volume of seawater filtered through both nets on the bongo frame.**

9) *Page 11*: The authors state that if the target volume of water is not filtered during the entrainment tow, the tow will be repeated until the targeted volume is reached. Will the tow distance be extended to accomplish this, or will the tow truly be "repeated?"

*Response*: **The tow will be continued at the lagoon and entrainment stations by extending the tow, covering the vertical depth of the water column until the target volume is collected. Some of the deeper nearshore samples cannot simply be extended because it would not be possible to collect an unbiased sample that extended across all depths without greatly increasing the sample volume. In these cases, or if flowmeters are fouled with kelp, the samples are discarded and the sampling is repeated at the station.**

10) *Page 12*: The source water sampling methods are said to be "identical to the entrainment sample collection" (with a few noted exceptions). Does that mean that all source water stations will be sampled concurrently with entrainment sampling, and during the same (four) six-hour cycles? Is the source water sampling index period the same as the June 2004-May 2005 entrainment period?

*Response*: **Yes, all of the stations, source water and entrainment, are sampled during the same four six-hour blocks on the day the survey is conducted. All of the stations are usually sampled within a 2-3 hour period. All of the**

**stations have been sampled since June 2004 with a total of eight surveys collected as of December 2004.**

11) *Page 13*: The Inner Lagoon will be sampled with a single pushnet. Will the targeted volume of water be the same as the paired net (oblique) samples taken in the Outer Lagoon and nearshore ocean areas?

***Response*: Yes. The targeted volume for the lagoon source water and entrainment samples is approximately 50 $m^3$. The volumes for samples from the nearshore stations may be greater, especially at the deepest stations, N4 and N5, where the minimum sample volume may exceed 50 $m^3$ because the nets are lowered through the entire water column and then retrieved.**

13) *Page 13*: The authors mention that "the number of source water stations will be evaluated as data become available to determine if fewer stations can be sampled." More information may be warranted to explain this process, and in particular, to explain whether reviewing agencies will be included in the decision process.

***Response*: A proposal for this or any other change in the sampling program would first be submitted to the Regional Board for review. Any changes would only be implemented after review and approval by Regional Board and other reviewing agencies.**

14) *Page 14*: The authors state that, "A laboratory quality control (QC) program...will be applied to all samples." Is this a printed and approved QA/QC plan? If so, it should be cited. If not, what are the specific data quality objectives for laboratory processing (e.g., sorting efficiencies, taxonomic agreement, etc.)?

***Response*: The laboratory QC program is an internal Tenera document that was not cited in the study plan. The QC program includes a procedure for preserving, transferring, splitting, and sorting plankton samples. There is a separate procedure for identification of the organisms from the samples. The following data quality objectives are used for sorting:**

1. **The first ten samples that are sorted by an individual are completely resorted by a designated QC sorter. A sorter is allowed to miss one target organism when the original sorted count is 1-19. For original counts above 20 a sorter must maintain a sorting accuracy of 90%.**
2. **After the sorter has passed 10 consecutive sorts, the program is switched to a '1 sample in 10' QC program for that sorter. After the sorter has**

**completed another 10 samples, one sample is randomly selected by the designated QC sorter for a QC resort.**

3. **If the sorter maintains the 90% accuracy sorting rate for this sample, then the sorter continues in the '1 sample in 10' QC mode.**
4. **If a sample does not meet the 90% accuracy rate their subsequent samples will be resorted until 10 consecutive samples meet the criteria.**

**A similar QC procedure is used for taxonomic identification except that the taxonomist must maintain an accuracy level of 95% for the identifications.**

16) *Page 15*: The FH model requires specific input parameter data (e.g., age-specific mortality) that may not be readily available. The authors state that, "...this degree of information is rarely available for a population." They also mention that "...our assessment will employ any available, scientifically acceptable sources of information on fisheries stock or population estimates of unexploited species entrained by the EPS." Will adequate input parameter data be available, or is it too early in the process to tell?

*Response*: **The initial review of the data showed that many of the same fish taxa that were analyzed from other studies were also abundant in the EPS samples. Also, similar to other studies, the majority of the fishes were small, forage species that do not have direct commercial/recreational fishery values. Therefore, while it has been possible to parameterize the adult equivalent models (FH and AEL) for many of these species in past studies, estimates of their adult populations that were necessary to interpret the results of the modeling efforts were usually not available. The MEC study on the fishes of Aqua Hedionda Lagoon and results from supplemental studies on adult fishes will help provide some of this information.**

19) *Page 19*: The impingement study methods do not mention an index period. Has impingement sampling begun, and will the sampling period coincide with entrainment sampling (June 2004-May 2005)?

*Response*: **Yes, impingement sampling began in early July 2004 and will continue through June 2005. Although it does not exactly coincide with entrainment sampling, it is close enough to capture the same seasonal changes in fish and target invertebrate abundance that will be present in the entrainment sampling. The sampling was started in July to take advantage of studies at the plant being conducted in association with the permitting for the desalination facility being proposed for construction at the plant site by Poseidon Resources (See *Tenera Response* to Comment 6).**

20) *Page 20:* The authors mention a quality control (QC) program for impingement sampling. Is this a printed and approved QA/QC plan? If so, it should be cited. If not, what are the "random cycles for re-sorting" and the specific quality objectives (e.g., for sorting efficiency)?

*Response*: **Tenera has written procedures for conducting the impingement sampling at EPS that all participating samplers are required to follow. A quality control plan is part of this procedure. Each impingement sampling team is comprised of two qualified biologists familiar with the fish and invertebrate fauna likely to be impinged. The goal of the sampling is to correctly identify, and accurately count and weigh all impinged organisms according to the criteria in the sampling protocol. In addition to ongoing quality control checks by samplers (e.g., consultations among team members, supervisor involvement, preservation of specimens of uncertain identity), Tenera personnel will check the counts and identifications from two cycles of impinged material on a quarterly basis. Unlike the laboratory identification process where a 90% sorting accuracy objective is specified, a specific quantitative objective for the impingement QC program is not feasible because of the variability in the quantity and types of impinged material. The objective is 100% accuracy. Tenera will document the results of the QC checks and implement any corrective actions necessary to ensure compliance with the written procedures.**

21) *Page 22*: The authors state that, "Although we have proposed to sample normal impingement weekly, we will evaluate the potential to reduce the sampling frequency to once every two weeks." More information may be warranted to explain this process, and in particular, to explain whether reviewing agencies will be included in the decision process.

*Response*: **See response to Comment 13.**

22) *Page 23*: The authors state that, "Fishery management practices and other forms of stock assessments will provide the context required to interpret [the estimate of the annual probability of mortality due to entrainment]." The data types mentioned may not be available for some of the most frequently entrained fishes (e.g., non-commercial /non-recreational species). Will adequate evaluation data be available, or is it too early in the process to tell?

*Response*: **See response to Comment #16. The MEC study on the fishes of Agua Hedionda Lagoon will help provide this information for the small,**

**estuarine, forage species that are not targeted by commercial or recreational fisheries.**

23) *Page 23 and 24*: Potential target organisms are mentioned. Comment 1 (above) applies here. Will the California Regional Water Quality Control Board (and others) be contacted to approve target organism selection before commencement of assessment analyses?

*Response*: **See response to Comment 1.**

SUGGESTIONS

- The governing regulatory/resource agencies should be given the opportunity to consider and approve/reject: the selection process for representative species (mentioned in comments 1 and 23, above); the possible reduction in the number of source water sampling stations (comment 13); and the possible reduced impingement sampling frequency.

  *Response*: **See responses to comments 1, 13, and 23. Proposals for these, or any other, change to the sampling program would first be submitted to the Regional Board for review. Any changes would only be implemented after review and approval by the Regional Board.**

- The temporal aspects of the study questioned in comments 6, 10 and 19 (above) need to explained in more detail.

  *Response*: **See responses to Comments 6 and 19.**

- The quality control program needs to be described in more detail (see comments 14 and 20), or the QA/QC plan should be cited and/or attached as an appendix.

  *Response*: **Procedures for the sampling and laboratory processing will be submitted as attachments to the study plan.**

- As mentioned previously, the study plan was obviously developed by qualified and experienced contractors, and we think that their study design is conceptually valid. Most comments listed above represent the need for relatively minor clarifications or additions.

Thank you again for the opportunity to respond to the comments from Tetra Tech. The study being conducted by Tenera Environmental is based on the design used for the entrainment and impingement studies at the Duke Energy South Bay Power Plant in San

Diego Bay. These studies were required for the plant's NPDES permit that was recently approved by the Regional Board. Therefore, we are confident that the study will provide the information necessary for Cabrillo Power I LLC to comply with EPA's recently published Phase II rule for Section 316(b) of the Clean Water Act. We look forward to working with you and the other Regional Board staff on this project and would be available to discuss our responses to these comments at your convenience.

If you have any questions or comments, please contact Mr. Tim Hemig at (760) 268-4037.

Sincerely,
Cabrillo Power I LLC
By: Its Authorized Agent,

Gregory J. Hughes

By: NRG Cabrillo Power Operations Inc.
Gregory J. Hughes
Regional Plant Manager

cc: Tim Hemig (Cabrillo)
Sheila Henika (Cabrillo)
John Steinbeck (Tenera)
Pedro Lopez (Cabrillo)
Hashim Navrozali (Regional Board)

**ATTACHMENT 4**

**UPDATED IMPINGEMENT AND ENTRAINMENT ASSESSMENT**

**TENERA ENVIRONMENTAL**

**MAY 2007**

TENERA Environmental

CARLSBAD SEAWATER DESALINATION PROJECT

**Technical Memorandum**

# ASSESSMENT OF POTENTIAL IMPINGEMENT AND ENTRAINMENT ATTRIBUTED TO DESALINATION PLANT OPERATIONS AND ASSOCIATED AREA OF PRODUCTION FORGONE

Prepared

By Tenera Environmental, Inc.

For

Poseidon Resources Channelside, LLC

May 2007

## INTORDUCTION

The purpose of this technical memorandum (TM) is to present an estimate to of the maximum impingement and entrainment of marine organisms that could be attributed to the operations of the 50 MGD Carlsbad Seawater Desalination Facility (CDF) based on the most recent data collection study completed during the period of June 1, 2004 to May 31, 2005 at the Encina Power Generation Station (EPS). This memorandum also provides an estimate of the maximum area (acreage) of production forgone (APF) associated with the operation of the intake of the desalination plant under a stand-alone operational condition, when the plant collects 304 MGD of seawater through the existing system of the EPS to produce 50 MGD of drinking water and the power plant does not generate energy.

The data collected during the June'04/May'05 period and used for this study represent the most contemporary data on entrainment and impingement applicable to the CDF project. These impingement and entrainment data were collected in accordance with a published study plan (see Appendix 1), which plant was reviewed and approved by the San Diego Regional Water Quality Control Board, representatives of the California Department of Fish and Game, the National Marine Fisheries Service, and by an EPA-appointed independent consultant. The study plan, as appended to this technical memorandum, includes a review of the previous impingement and entrainment study results and methods completed in 1980 and a rationale, plan, and methods for completion of the 2004/2205 study results of which are used in this memorandum.

## ASSESSMENT OF ENTRAINMENT EFFECT AND APF

The analysis presented in this TM employed entrainment impacts expressed as proportional losses as calculated using the empirical transport modeling (ETM) method (see Appendix 1- Study Plan, for description of model and formula). The ETM method is widely approved by numerous State and Federal agencies, and ETM results have been employed recently by these agencies in combination with an mitigation method referred to as area of production foregone (APF), as is also done in this TM.

All of the ETM values computed for this analysis were based on a total flow of 304 mgd collected through the existing EPS intake system. Of this total flow of 304 mgd, an average of 104 mgd would be used for production of drinking water and 200 mgd for dilution of concentrated seawater. The results of the ETM calculations are summarized in Table 1.

**Table 1.** ETM values for Encina Power Station larval fish entrainment for the period of 01 Jun 2004 to 31 May 2005, based on steady annual intake flow of 304 mgd.

| | ETM Estimate | ETM Std.Err. | ETM + SE | ETM - SE |
|---|---|---|---|---|
| ETM Model Data for 3070 - Gobies | 0.21599 | 0.30835 | 0.52434 | -0.09236 |
| ETM Model Data for 1495 - Blennies | 0.08635 | 0.1347 | 0.22104 | -0.04835 |
| ETM Model Data for 1849 - Hypsopops | 0.06484 | 0.13969 | 0.20452 | -0.07485 |
| AVERAGE | **0.122393** | | | |
| | | | | |
| ETM Model Data for 3062 – White Croaker | 0.00138 | 0.00281 | 0.00419 | -0.00143 |
| ETM Model Data for 1496 – Northern Anchovy | 0.00165 | 0.00257 | 0.00422 | -0.00092 |
| ETM Model Data for 1219 – California Halibut | 0.00151 | 0.00238 | 0.00389 | -0.00087 |
| ETM Model Data for 1471 - Queenfish | 0.00365 | 0.00487 | 0.00852 | -0.00123 |
| ETM Model Data for 1494 – Spot Fin Croaker | 0.00634 | 0.01531 | 0.02165 | -0.00896 |
| AVERAGE | **0.002906** | | | |

The average ETM for the three most commonly entrained species living in Agua Hedionda Lagoon (gobies, blennies and hypsopops) of 0.122393 (i.e., 12.2 %) was used to assess the potential area of impact of the intake operations. This approach makes it possible to establish a definitive habitat value for the source water, and is consistent with the approach taken by the California Energy Commission and their independent consultants for the Morro Bay Power Plant (MBPP) in assessing and mitigating the entrainment effects of the proposed combined cycle project. In this case, as is the case at the CDF and EPS in Agua Hedionda, the MBPP is located inside the harbor near the bay's ocean entrance and the primarily entrained species are bay species of larvae. The average Pm value used was based on the three lagoon species was 12.2 % (0.122393 was rounded to 12.2 % to reflect ~~the accuracy of data collection~~).

In order to calculate the Area of Production Foregone (in acres), the number of lagoon habitat acres used by the three most commonly entrained lagoon species was multiplied by the average Pm of the three species. The estimated acres of lagoon habitat for these species are based on a 2000 Coastal Conservancy inventory of Agua Hedionda Lagoon habitat (see Table 2).

**Table 2. Wetland Profile: Agua Hedionda Lagoon[1]**

Approximate Wetland Habitat Acreage 330 (11)
Approximate Historic Acreage 695

| Habitat | Acres | Vegetation | Source |
|---|---|---|---|
| Brackish/ Freshwater | 3 | Cattail, bulrush and spiny rush were dominant | (11[2], 1[3]) |
| Mudflat/Tidal Channel | 49 | Not specified | (1) |
| | | *Estuarine flats* | |
| Open Water | 253 | Eelgrass occurred in all basins | (11,1) |
| Riparian | 11 | Not specified | (11) |
| Salt Marsh | 14 | (11,1) | |
| Upland | 61 | (11) | |
| | 391 | (brackish/freshwater, riparian, saltmarsh and upland not included) | |

The calculation of APF (acres of lagoon habitat, Table 2, multiplied by the average Pm, Table 1) excluded the lagoon's acres of upland habitat (61 acres), riparian habitat (11 acres), salt marsh habitat (14 acres) and brackish/freshwater habitat (3 acres), a total of 89 acres. These habitats were excluded from the estimate because they would not contribute to the species that were found to be entrained by the EPS intake. Using the average Pm value of 12.2 % for the three lagoon species of entrained larvae and the estimated 302 acres of Agua Hedionda habitat supporting these species' larval populations, the APF value is 36.8 acres (302 acres x 0.122 = 36.8 acres).

## IMPINGEMENT ASSESSMENT

A number of juvenile and adult fishes and other marine life are impinged on the existing screens across the intake flow. The amount of impinged organisms generally varies with the amount of flow, but it not in a direct or linear manner. The daily biomass of

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The Southern California Watershed Inventory is a project of the California State Coastal Conservancy. The Watershed Inventory compiles existing data that has not been independently verified. This information is not suitable for any regulatory purpose, and should not be the basis for any determination relating to impact assessment or mitigation.

This file last modified on June 12, 2000

[2] MEC Analytical Systems Inc.. 1993. San Dieguito Lagoon restoration project Lagoon restoration project regional coastal lagoon resources summary 56 pp and appendix. This report provides a summary of habitat types, fish, bird and benthic invertebrate populations at 16 coastal wetlands south of Anaheim Bay. It is primarily a synopsis of existing information; sources used in identifying and quantifying habitat types include aerial photographs taken in early 1993. It discusses restoration of habitats at San Dieguito Lagoon given present and historic conditions of other coastal wetlands in the region. This report was prepared as part of the San Dieguito Restoration Project undertaken by Southern California Edison to mitigate for damage to coastal marine resources from the operation of the San Onofore Nuclear Generating Station.

[3] MEC Analytical Systems Inc.. 1995. 1994 and 1995 field survey report of the ecological resources of Agua Hedionda Lagoon. 47 pp., plus appendices. *This report summarizes the results of field surveys conducted between April 1994 and June 1995 at Agua Hedionda Lagoon. The surveys collected data on eelgrass, salt marsh vegetation, birds, fish, and benthic inveriebrates. Data were also collected for water quality. The surveys were designed to provide adequate environmental information to support agency review of a dredging project. The survey design and methods were developed in consultation with state and federal regulatory agencies.*

impinged fish during normal power plant operations declined from the previous February 1979 to January1980 study that reported a rate of 2.46 kg/day, to impingement rates during June 2004 to June 2005 of 0.96 kg/day. The results of the June 2004 to June 2005 impingement study are summarized in Table 3 for the abundance and weight of sampled fish. Table 3 pr esents impingement losses during both normal operations and heat treatment operations. It should be noted that as described in the certified Environmental Impact Report for the Carlsbad seawater desalination project, the desalination plant will be shut down during periods of tunnel heat treatment. Therefore, the desalination plant operations do not contribute to the heat-treatment related impingement losses. The results of the 2004-2005 impingement survey indicate that by not heat treating CDF will reduce the number of impinged fish sampled by approximately 80 percent and the weight of impinged fish sampled by approximately 83 percent.

Analysis of the impingement data presented in Table 3 indicates that the impingement effect attributed to the desalination plant operation would be minimal. The total daily weight of the impinged marine organisms when the desalination plant is operating on a stand-alone basis at 304 MGD and the power plant is not operating is estimated at 1.92 lbs/day (0.96 kg/day). To put this figure in perspective, it is helpful to note that 1.92 lbs/day of impinged organisms represents 0.0000001 percent of the total volume of material flowing through the intake.

**TABLE 3** Number and weight of fishes, sharks, and rays impinged during normal operation and heat treatment surveys at EPS from June 2004 to June 2005.

| | | | Normal Operations Sample Totals | | | | Heat Treatment | |
|---|---|---|---|---|---|---|---|---|
| | Taxon | Common Name | Sample Count | Sample Weight (g) | Bar Rack Count | Bar Rack Weight (g) | Sample Count | Sample Weight (g) |
| 1 | *Atherinops affinis* | topsmelt | 5,242 | 42,299 | 10 | 262 | 15,696 | 67,497 |
| 2 | *Cymatogaster aggregata* | shiner surfperch | 2,827 | 28,374 | - | - | 18,361 | 196,568 |
| 3 | *Anchoa compressa* | deepbody anchovy | 2,079 | 11,606 | 2 | 21 | 23,356 | 254,266 |
| 4 | *Seriphus politus* | queenfish | 1,304 | 7,499 | 2 | 17 | 929 | 21,390 |
| 5 | *Xenistius californiensis* | salema | 1,061 | 2,390 | - | - | 1,577 | 6,154 |
| 6 | *Anchoa delicatissima* | slough anchovy | 1,056 | 3,144 | - | - | 7 | 10 |
| 7 | Atherinopsidae | silverside | 999 | 4,454 | - | - | 2,105 | 8,661 |
| 8 | *Hyperprosopon argenteum* | walleye surfperch | 605 | 23,962 | 1 | 21 | 2,547 | 125,434 |
| 9 | *Engraulis mordax* | northern anchovy | 537 | 786 | - | - | 92 | 374 |
| 10 | *Leuresthes tenuis* | California grunion | 489 | 2,280 | - | - | 7,067 | 40,849 |
| 11 | *Heterostichus rostratus* | giant kelpfish | 344 | 2,612 | - | - | 908 | 9,088 |
| 12 | *Paralabrax maculatofasciatus* | spotted sand bass | 303 | 4,604 | - | - | 1,536 | 107,563 |
| 13 | *Sardinops sagax* | Pacific sardine | 268 | 1,480 | - | - | 6,578 | 26,266 |
| 14 | *Roncador stearnsi* | spotfin croaker | 182 | 8,354 | 2 | 3,000 | 106 | 17,160 |
| 15 | *Paralabrax nebulifer* | barred sand bass | 151 | 1,541 | - | - | 1,993 | 32,759 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 16 | *Gymnura marmorata* | Calif. butterfly ray | 146 | 60,629 | 1 | 390 | 70 | 36,821 |
| 17 | *Phanerodon furcatus* | white surfperch | 144 | 4,686 | - | | 53 | 823 |
| 18 | *Strongylura exilis* | California needlefish | 135 | 6,025 | - | | 158 | 11,899 |
| 19 | *Paralabrax clathratus* | kelp bass | 111 | 680 | - | | 976 | 13,279 |
| 20 | *Porichthys myriaster* | specklefin midshipman | 103 | 28,189 | - | | 218 | 66,860 |
| 21 | unidentified chub | unidentified chub | 96 | 877 | - | | 7 | 44 |
| 22 | *Paralichthys californicus* | California halibut | 95 | 1,729 | - | | 21 | 4,769 |
| 23 | *Anisotremus davidsoni* | sargo | 94 | 1,662 | - | | 963 | 68,528 |
| 24 | *Urolophus halleri* | round stingray | 79 | 20,589 | - | | 1,090 | 300,793 |
| 25 | *Atractoscion nobilis* | white seabass | 70 | 11,295 | 6 | 872 | 1,618 | 332,056 |
| 26 | *Hypsopsetta guttulata* | diamond turbot | 66 | 10,679 | 1 | 85 | 112 | 24,384 |
| 27 | *Micrometrus minimus* | dwarf surfperch | 57 | 562 | - | - | - | |
| 28 | *Syngnathus spp.* | pipefishes | 55 | 161 | - | | 56 | 90 |
| 29 | *Atherinopsis californiensis* | jacksmelt | 54 | 1,152 | - | | 4,468 | 45,152 |
| 30 | *Myliobatis californica* | bat ray | 50 | 19,899 | 4 | 5,965 | 132 | 68,572 |
| 31 | *Menticirrhus undulatus* | California corbina | 43 | 1,906 | - | | 16 | 4,925 |
| 32 | *Amphistichus argenteus* | barred surfperch | 43 | 1,306 | - | | 34 | 2,528 |
| 33 | *Fundulus parvipinnis* | California killifish | 43 | 299 | - | | 16 | 41 |
| 34 | unidentified fish, damaged | unid. damaged fish | 36 | 1,060 | 1 | 70 | 8 | 262 |
| 35 | Ictaluridae | catfish unid. | 35 | 4,279 | - | - | - | |
| 36 | *Leptocottus armatus* | Pacific staghorn sculpin | 32 | 280 | - | | 5 | 26 |
| 37 | *Sphyraena argentea* | California barracuda | 29 | 397 | - | | 46 | 1,667 |
| 38 | *Lepomis cyanellus* | green sunfish | 29 | 1,170 | - | - | - | |
| 39 | *Umbrina roncador* | yellowfin croaker | 28 | 573 | - | | 127 | 22,399 |
| 40 | *Lepomis macrochirus* | bluegill | 20 | 670 | - | - | - | |
| 41 | *Ophichthus zophochir* | yellow snake eel | 18 | 5,349 | - | | 51 | 17,303 |
| 42 | *Citharichthys stigmaeus* | speckled sanddab | 17 | 62 | - | | 1 | 30 |
| 43 | *Brachyistius frenatus* | kelp surfperch | 16 | 182 | - | | 17 | 598 |
| 44 | *Cheilotrema saturnum* | black croaker | 15 | 103 | - | | 288 | 9,029 |
| 45 | *Embiotoca jacksoni* | black surfperch | 14 | 1,240 | - | | 69 | 5,367 |
| 46 | *Genyonemus lineatus* | white croaker | 12 | 171 | - | | 9 | 79 |
| 47 | *Platyrhinoidis triseriata* | thornback | 11 | 4,731 | 1 | 1,500 | - | |
| 48 | *Chromis punctipinnis* | blacksmith | 10 | 396 | - | | 151 | 4,431 |
| 49 | unidentified fish | unidentified fish | 10 | 811 | - | - | - | |
| 50 | *Porichthys notatus* | plainfin midshipman | 9 | 1,792 | - | - | - | |
| 51 | *Hermosilla azurea* | zebra perch | 9 | 1,097 | - | | 62 | 3,518 |
| 52 | *Micropterus salmoides* | large mouth bass | 9 | 27 | - | - | - | |
| 53 | *Trachurus symmetricus* | jack mackerel | 7 | 7 | - | | 15 | 702 |
| 54 | *Hypsoblennius gentilis* | bay blenny | 7 | 37 | - | | 440 | 2,814 |
| 55 | *Heterostichus* spp. | kelpfish | 7 | 48 | - | - | - | |
| 56 | Engraulidae | anchovies | 6 | 3 | - | - | - | |
| 57 | *Anchoa* spp. | anchovy | 6 | 27 | - | - | - | |
| 58 | *Peprilus simillimus* | Pacific butterfish | 5 | 91 | - | | 1 | 33 |
| 59 | *Rhacochilus vacca* | pile surfperch | 4 | 915 | - | - | - | |
| 60 | *Sebastes atrovirens* | kelp rockfish | 4 | 40 | - | - | - | |
| 61 | *Pleuronichthys verticalis* | hornyhead turbot | 4 | 190 | - | | 2 | 251 |
| 62 | *Pylodictis olivaris* | flathead catfish | 4 | 480 | - | - | - | |
| 63 | Pleuronectiformes unid. | flatfishes | 4 | 62 | - | - | - | |
| 64 | *Syngnathus leptorhynchus* | bay pipefish | 3 | 9 | - | - | - | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 65 | *Hypsoblennius gilberti* | rockpool blenny | 3 | 16 | - | - | | 8 | 77 |
| 66 | *Mustelus californicus* | gray smoothhound | 3 | 1,850 | - | - | | 22 | 19,876 |
| 67 | *Cheilopogon pinnatibarbatus* | smallhead flyingfish | 3 | 604 | - | - | - | - | |
| 68 | *Ameiurus natalis* | yellow bullhead | 3 | 220 | - | - | - | - | |
| 69 | *Lepomis* spp. | sunfishes | 3 | 196 | - | - | - | - | |
| 70 | *Girella nigricans* | opaleye | 2 | 346 | - | - | | 355 | 30,824 |
| 71 | *Rhinobatos productus* | shovelnose guitarfish | 2 | 461 | 2 | 6,200 | - | - | |
| 72 | *Acanthogobius flavimanus* | yellowfin goby | 2 | 55 | - | - | - | - | |
| 73 | *Scomber japonicus* | Pacific mackerel | 2 | 10 | - | - | | 15 | 880 |
| 74 | *Hypsoblennius* spp. | blennies | 2 | 11 | - | - | | 113 | 489 |
| 75 | *Hypsoblennius jenkinsi* | mussel blenny | 2 | 17 | - | - | | 175 | 946 |
| 76 | *Paralabrax* spp. | sand bass | 2 | 2 | - | - | | 6 | 19 |
| 77 | *Scorpaena guttata* | Calif. scorpionfish | 2 | 76 | - | - | - | - | |
| 78 | *Hyporhamphus rosae* | California halfbeak | 2 | 23 | - | - | | 1 | - |
| 79 | *Symphurus atricauda* | California tonguefish | 2 | 15 | - | - | - | - | |
| 80 | *Tilapia* spp. | tilapias | 2 | 7 | - | - | - | - | |
| 81 | *Sarda chiliensis* | Pacific bonito | 2 | 1,010 | - | - | | 2 | 540 |
| 82 | *Albula vulpes* | bonefish | 2 | 1,192 | - | - | | 1 | 900 |
| 83 | Sciaenidae unid. | croaker | 2 | 3 | - | - | | 17 | 1,212 |
| 84 | *Oxylebius pictus* | painted greenling | 1 | 5 | - | - | - | - | |
| 85 | *Lyopsetta exilis* | slender sole | 1 | 26 | - | - | - | - | |
| 86 | *Citharichthys sordidus* | Pacific sanddab | 1 | 1 | - | - | - | - | |
| 87 | *Gibbonsia montereyensis* | crevice kelpfish | 1 | 8 | - | - | - | - | |
| 88 | *Pleuronichthys ritteri* | spotted turbot | 1 | 7 | - | - | | 13 | 2,745 |
| 89 | *Gillichthys mirabilis* | longjaw mudsucker | 1 | 34 | - | - | - | - | |
| 90 | *Dorosoma petenense* | threadfin shad | 1 | 3 | - | - | - | - | |
| 91 | *Porichthys* spp. | midshipman | 1 | 200 | - | - | - | - | |
| 92 | *Cynoscion parvipinnis* | shortfin corvina | 1 | 900 | - | - | - | - | |
| 93 | *Mugil cephalus* | striped mullet | 1 | 3 | - | - | | 5 | 3,854 |
| 94 | *Paraclinus integripinnis* | reef finspot | 1 | 4 | - | - | | 4 | 12 |
| 95 | *Hyperprosopon* spp. | surfperch | 1 | 115 | - | - | | 7 | 552 |
| 96 | *Ameiurus nebulosus* | brown bullhead | 1 | 100 | - | - | - | - | |
| 97 | *Micropterus dolomieu* | smallmouth bass | 1 | 150 | - | - | - | - | |
| 98 | *Citharichthys* spp. | sanddabs | - | - | - | - | | 1 | 3 |
| 99 | *Triakis semifasciata* | leopard shark | - | - | - | - | | 2 | 688 |
| 100 | *Medialuna californiensis* | halfmoon | - | - | - | - | | 53 | 1,864 |
| 101 | *Torpedo californica* | Pacific electric ray | - | - | | 1 | 3,750 | - | - |
| 102 | Scorpaenidae | scorpionfishes | - | - | - | - | | 2 | 64 |
| 103 | *Halichoeres semicinctus* | rock wrasse | - | - | - | - | | 1 | 33 |
| 104 | *Hypsypops rubicundus* | garibaldi | - | - | - | - | | 5 | 1,897 |
| 105 | *Seriola lalandi* | yellowtail jack | - | - | - | - | | 21 | 978 |
| 106 | *Dasyatis dipterura* | diamond stingray | - | - | - | - | | 2 | 1,468 |
| 107 | *Heterodontus francisci* | horn shark | - | - | - | - | | 1 | 850 |
| 108 | Zoarcidae | eelpouts | - | - | - | - | | 1 | 17 |
| | | | 19,408 | 351,672 | 34 | 22,152 | | 94,991 | 2,034,900 |

**ATTACHMENT 5**

**CARLSBAD DESALINATION PROJECT**

# SUMMARY OF FISH AND TARGET SHELLFISH LARVAE COLLECTED FOR ENTRAINMENT AND SOURCE WATER STUDIES IN THE VICINITY OF AGUA HEDIONDA LAGOON FROM JUNE 2005 THROUGH MAY 2006

# Carlsbad Desalination Facility – Encina Power Station

Summary of Fish and Target Shellfish Larvae
Collected for Entrainment and Source Water Studies
in the Vicinity of Agua Hedionda Lagoon
from June 2005 through May 2006

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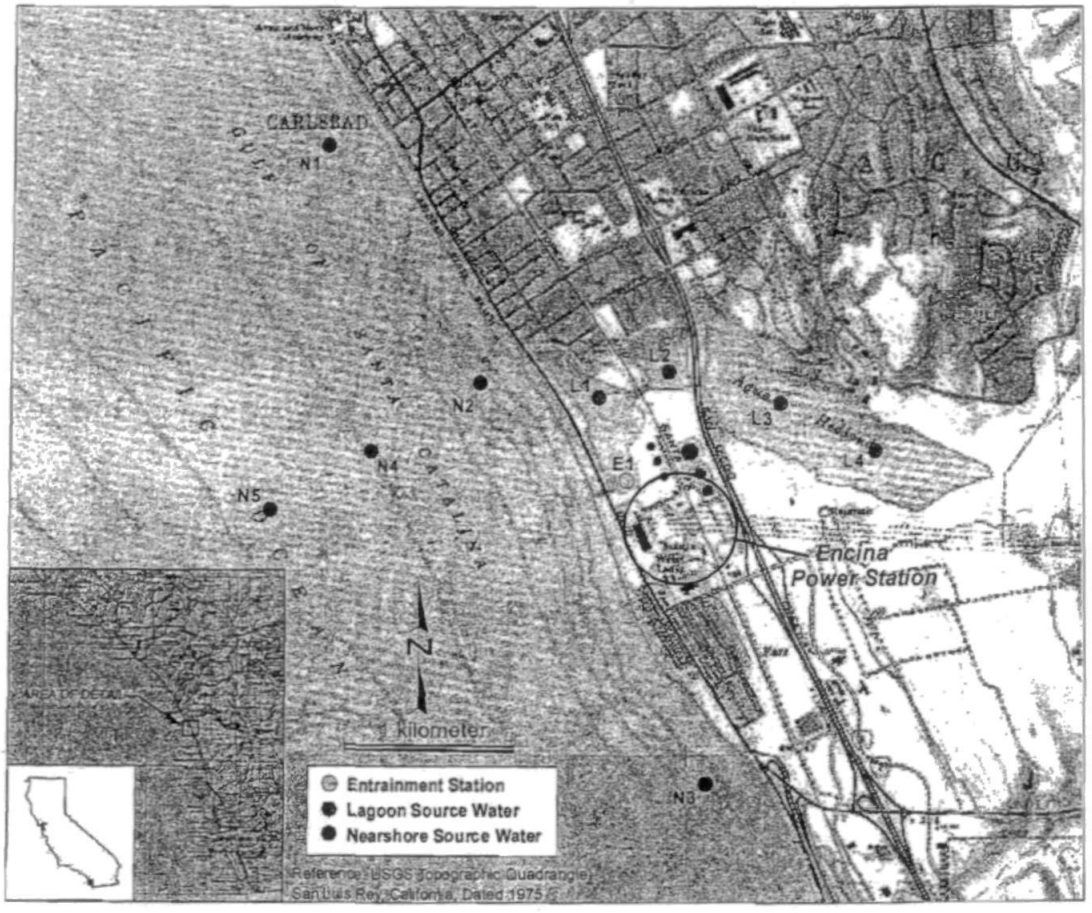



**Figure 1.** Location of entrainment (E1) and source water (L1–L4; N1–N5) plankton sampling stations.

Table 1. Average concentration and total number collected of larval fishes and target shellfishes in entrainment samples collected in Agua Hedionda Lagoon (Station E1), June 2004–May 2005.

| Taxon | Common Name | Average Concentration (# / 1,000 $m^3$) | Total Count | Percentage of Total | Cumulative Percentage |
|---|---|---|---|---|---|
| Gobiidae (CIQ complex) | gobies | 2,222.93 | 12,763 | 61.95 | 61.95 |
| *Hypsoblennius spp.* | blennies | 1,107.67 | 5,838 | 28.34 | 90.29 |
| Engraulidae | anchovies | 134.29 | 819 | 3.98 | 94.27 |
| *Hypsypops rubicundus* | garibaldi | 40.99 | 188 | 0.91 | 95.18 |
| *Typhlogobius californiensis* | blind goby | 24.65 | 148 | 0.72 | 95.90 |
| *Gibbonsia* spp. | clinid kelpfishes | 22.45 | 125 | 0.61 | 96.51 |
| Labrisomidae. | labrisomid kelpfishes | 17.65 | 81 | 0.39 | 96.90 |
| Syngnathidae | pipefishes | 16.06 | 83 | 0.40 | 97.30 |
| *Acanthogobius flavimanus* | yellowfin goby | 14.41 | 87 | 0.42 | 97.72 |
| larvae, unid. fish fragment | unid. larval fishes | 9.65 | 56 | 0.27 | 98.00 |
| Atherinopsidae | silversides | 9.18 | 54 | 0.26 | 98.26 |
| larvae, unid. yolksac | unid. yolksac larvae | 8.36 | 39 | 0.19 | 98.45 |
| *Roncador stearnsii* | spotfin croaker | 8.33 | 42 | 0.20 | 98.65 |
| *Rimicola* spp. | kelp clingfishes | 7.92 | 43 | 0.21 | 98.86 |
| *Genyonemus lineatus* | white croaker | 7.04 | 44 | 0.21 | 99.07 |
| *Seriphus politus* | queenfish | 5.50 | 29 | 0.14 | 99.21 |
| *Paraclinus integripinnis* | reef finspot | 4.95 | 31 | 0.15 | 99.36 |
| *Paralichthys californicus* | California halibut | 3.73 | 21 | 0.10 | 99.47 |
| *Sardinops sagax* | Pacific sardine | 2.66 | 16 | 0.08 | 99.54 |
| *Citharichthys* spp. | sanddabs | 2.24 | 14 | 0.07 | 99.61 |
| *Gillichthys mirabilis* | longjaw mudsucker | 2.14 | 13 | 0.06 | 99.67 |
| Sciaenidae | croakers | 1.86 | 11 | 0.05 | 99.73 |
| *Paralabrax* spp. | sea basses | 1.86 | 11 | 0.05 | 99.78 |
| *Hypsopsetta guttulata* | diamond turbot | 1.78 | 10 | 0.05 | 99.83 |
| larvae, unid. post-yolksac | larval fishes | 1.61 | 10 | 0.05 | 99.88 |
| Pleuronectiformes | flatfishes | 0.63 | 4 | 0.02 | 99.90 |
| *Heterostichus rostratus* | giant kelpfish | 0.54 | 3 | 0.01 | 99.91 |
| *Clinocottus analis* | wooly sculpin | 0.51 | 3 | 0.01 | 99.93 |
| *Stenobrachius leucopsarus* | northern lampfish | 0.37 | 2 | 0.01 | 99.94 |
| *Cheilotrema saturnum* | black croaker | 0.35 | 2 | 0.01 | 99.95 |
| *Scomber japonicus* | Pacific mackerel | 0.35 | 1 | <0.01 | 99.95 |
| Ophidiidae | cusk-eels | 0.21 | 1 | <0.01 | 99.96 |
| Gobiesocidae | clingfishes | 0.20 | 1 | <0.01 | 99.96 |
| *Diaphus theta* | Calif. headlight fish | 0.19 | 1 | <0.01 | 99.96 |
| *Semicossyphus pulcher* | California sheephead | 0.19 | 1 | <0.01 | 99.97 |
| *Menticirrhus undulatus* | California corbina | 0.18 | 1 | <0.01 | 99.97 |
| Haemulidae | grunts | 0.18 | 1 | <0.01 | 99.98 |
| Labridae | wrasses | 0.17 | 1 | <0.01 | 99.98 |
| Myctophidae | lanternfishes | 0.16 | 1 | <0.01 | 99.99 |
| *Symbolophorus californiensis* | California lanternfish | 0.16 | 1 | <0.01 | 99.99 |
| *Oxyjulis californica* | señorita | 0.14 | 1 | <0.01 | 100.00 |
| | | | **20,601** | | |
| *Cancer* spp. (megalops) | cancer crabs | 0.17 | 1 | | 0.07 |

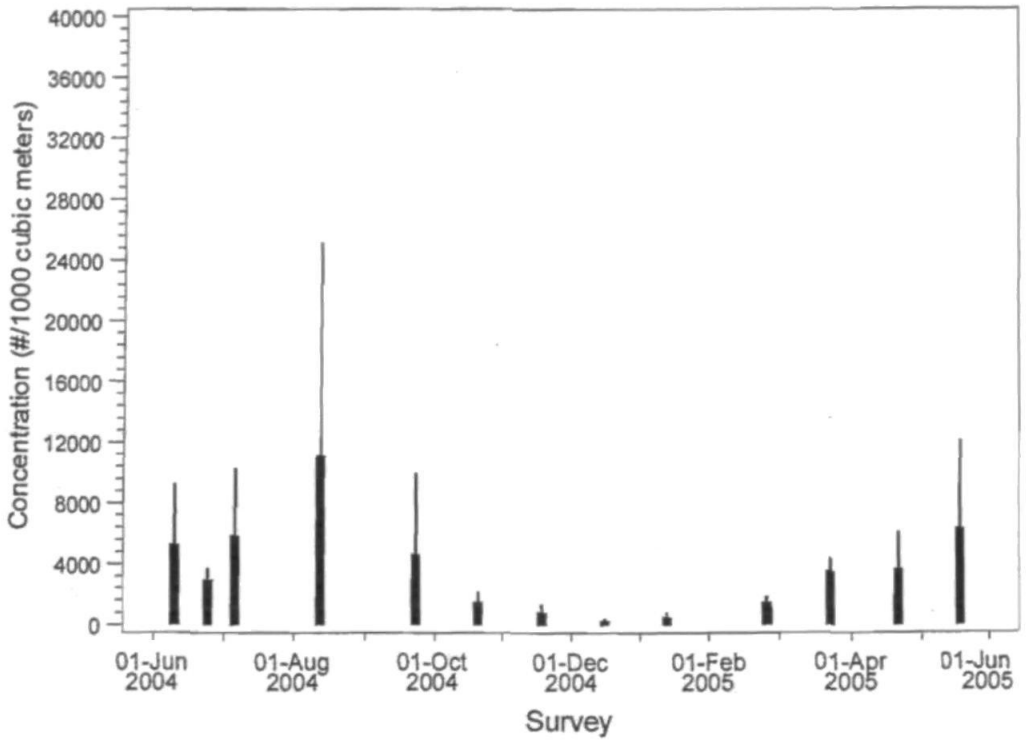



**Figure 2**. Mean concentration (# / 1,000 $m^3$ [264,172 gal]) and standard error of all larval fishes collected at entrainment Station E1 during monthly surveys, June 2004–May 2005.

**Table 2.** Average concentration of larval fishes and target shellfishes in source water samples collected at Agua Hedionda Lagoon and nearshore stations, June 2004–May 2005.

| | | Nearshore | | Lagoon | |
|---|---|---|---|---|---|
| Taxon | Common Name | Average Concentration (# / 1,000 $m^3$) | Total Count | Average Concentration (# / 1,000 $m^3$) | Total Count |
| **Fishes** | | | | | |
| Engraulidae | anchovies | 525.48 | 7,631 | 103.41 | 1,210 |
| *Hypsoblennius* spp. | blennies | 137.56 | 1,966 | 467.32 | 4,725 |
| Gobiidae (CIQ complex) | gobies | 69.12 | 921 | 2,718.58 | 30,270 |
| *Genyonemus lineatus* | white croaker | 64.66 | 921 | 4.25 | 54 |
| larvae, unidentified yolksac | unid. yolksac larvae | 45.82 | 678 | 3.12 | 32 |
| *Paralichthys californicus* | California halibut | 42.91 | 601 | 1.93 | 22 |
| *Paralabrax* spp. | sand basses | 24.88 | 372 | 0.68 | 8 |
| *Seriphus politus* | queenfish | 23.79 | 365 | 2.40 | 26 |
| Sciaenidae | croaker | 22.55 | 306 | 6.56 | 73 |
| *Citharichthys* spp. | sanddabs | 21.70 | 334 | 1.14 | 15 |
| *Roncador stearnsii* | spotfin croaker | 20.17 | 286 | 6.82 | 74 |
| *Gibbonsia* spp. | clinid kelpfishes | 19.29 | 277 | 16.74 | 182 |
| Labrisomidae | labrisomid kelpfishes | 16.36 | 219 | 35.30 | 366 |
| *Sardinops sagax* | Pacific sardine | 13.21 | 202 | 0.74 | 9 |
| larval fish fragment | unid. larval fishes | 10.50 | 145 | 15.02 | 174 |
| Haemulidae | grunts | 8.80 | 116 | 0.17 | 2 |
| *Scomber japonicus* | Pacific mackerel | 7.07 | 110 | - | - |
| *Hypsypops rubicundus* | garibaldi | 7.03 | 110 | 35.12 | 352 |
| larval/post-larval fish unid. | larval fishes | 6.81 | 93 | 1.36 | 16 |
| *Oxyjulis californica* | senorita | 5.55 | 79 | 0.75 | 8 |
| *Paralabrax nebulifer* | barred sand bass | 5.08 | 82 | - | - |
| *Sphyraena argentea* | California barracuda | 3.74 | 59 | 0.17 | 2 |
| *Xenistius californiensis* | salema | 3.61 | 55 | 0.30 | 3 |
| *Lepidogobius lepidus* | bay goby | 3.59 | 56 | 0.09 | 1 |
| *Stenobrachius leucopsarus* | northern lampfish | 3.26 | 51 | - | - |
| Atherinopsidae | silversides | 3.09 | 39 | 29.73 | 348 |
| *Pleuronichthys verticalis* | hornyhead turbot | 2.79 | 43 | - | - |
| *Umbrina roncador* | yellowfin croaker | 2.62 | 39 | 0.09 | 1 |
| Ophidiidae | cusk-eels | 2.61 | 37 | 0.09 | 1 |
| *Pleuronichthys ritteri* | spotted turbot | 2.51 | 34 | 0.17 | 2 |
| Pleuronectidae unid. | flounders | 2.28 | 35 | 0.08 | 1 |
| *Xystreurys liolepis* | fantail sole | 1.97 | 27 | 0.21 | 2 |
| *Hypsopsetta guttulata* | diamond turbot | 1.97 | 30 | 0.55 | 7 |
| *Rimicola* spp. | kelp clingfishes | 1.79 | 22 | 3.28 | 34 |
| *Peprilus simillimus* | Pacific butterfish | 1.78 | 28 | - | - |
| *Cheilotrema saturnum* | black croaker | 1.71 | 24 | 0.36 | 4 |
| *Semicossyphus pulcher* | California sheephead | 1.49 | 21 | - | - |
| *Diaphus theta* | Calif. headlight fish | 1.46 | 24 | - | - |
| *Acanthogobius flavimanus* | yellowfin goby | 1.46 | 22 | 38.98 | 499 |
| Pleuronectiformes | flatfishes | 1.25 | 21 | 0.07 | 1 |
| *Menticirrhus undulatus* | California corbina | 1.21 | 16 | 0.47 | 5 |
| *Atractoscion nobilis* | white seabass | 1.18 | 18 | 0.08 | 1 |
| *Sebastes* spp. | rockfishes | 1.09 | 18 | - | - |

*(table continued)*

**Table 2** (continued). Average concentration of larval fishes and target shellfishes in source water samples collected at nearshore stations and Agua Hedionda Lagoon, June 2004-May 2005.

| | | Nearshore | | Lagoon | |
|---|---|---|---|---|---|
| Taxon | Common Name | Average Concentration (# / 1,000 m³) | Total Count | Average Concentration (# / 1,000 m³) | Total Count |
| *Girella nigricans* | opaleye | 1.06 | 16 | - | - |
| Syngnathidae | pipefishes | 1.02 | 13 | 5.31 | 53 |
| *Typhlogobius californiensis* | blind goby | 0.99 | 15 | 9.63 | 118 |
| *Trachurus symmetricus* | jack mackerel | 0.96 | 17 | - | - |
| *Halichoeres semicinctus* | rock wrasse | 0.95 | 15 | - | - |
| Labridae | wrasses | 0.83 | 11 | - | - |
| *Paraclinus integripinnis* | reef finspot | 0.81 | 14 | 2.88 | 31 |
| *Symphurus atricaudus* | California tonguefish | 0.77 | 11 | - | - |
| *Triphoturus mexicanus* | Mexican lampfish | 0.73 | 12 | 0.16 | 2 |
| *Nannobrachium* spp. | lanternfishes | 0.57 | 9 | - | - |
| *Medialuna californiensis* | halfmoon | 0.53 | 7 | - | - |
| *Gillichthys mirabilis* | longjaw mudsucker | 0.51 | 8 | 5.17 | 62 |
| *Chilara taylori* | spotted cusk-eel | 0.50 | 7 | - | - |
| *Heterostichus rostratus* | giant kelpfish | 0.50 | 7 | - | - |
| Paralichthyidae | lefteye flounders | 0.44 | 7 | - | - |
| *Parophrys vetulus* | English sole | 0.30 | 5 | - | - |
| Myctophidae | lanternfishes | 0.30 | 4 | - | - |
| *Hippoglossina stomata* | bigmouth sole | 0.29 | 5 | - | - |
| *Zaniolepis frenata* | shortspine combfish | 0.25 | 5 | - | - |
| *Ruscarius creaseri* | roughcheek sculpin | 0.22 | 3 | - | - |
| Clupeiformes | herrings and anchovies | 0.21 | 3 | - | - |
| Gobiesocidae | clingfishes | 0.18 | 3 | 0.64 | 7 |
| Clupeidae | herrings | 0.18 | 3 | - | - |
| *Lyopsetta exilis* | slender sole | 0.16 | 3 | - | - |
| Pomacentridae | damselfishes | 0.14 | 2 | - | - |
| *Rhinogobiops nicholsii* | blackeye goby | 0.14 | 2 | - | - |
| *Nannobrachium ritteri* | broadfin lampfish | 0.13 | 2 | - | - |
| *Cyclothone* spp. | bristlemouths | 0.13 | 2 | - | - |
| *Chromis punctipinnis* | blacksmith | 0.13 | 2 | - | - |
| *Icelinus* spp. | sculpins | 0.13 | 3 | - | - |
| *Anisotremus davidsonii* | sargo | 0.12 | 2 | - | - |
| *Sebastes jordani* | shortbelly rockfish | 0.10 | 2 | - | - |
| Blennioidei | blennies | 0.08 | 1 | 0.36 | 4 |
| Clinidae | clinid kelpfishes | 0.08 | 1 | - | - |
| Chaenopsidae | tube blennies | 0.07 | 1 | - | - |
| *Leptocottus armatus* | Pacific staghorn sculpin | 0.07 | 1 | 0.51 | 6 |
| Cynoglossidae | tongue soles | 0.07 | 1 | - | - |
| Kyphosidae | sea chubs | 0.07 | 1 | - | - |
| *Cyclothone acclinidens* | benttooth bristlemouth | 0.07 | 1 | - | - |
| Hexagrammidae | greenlings | 0.06 | 1 | - | - |
| *Bathylagus ochotensis* | popeye blacksmelt | 0.06 | 1 | - | - |
| *Hypsoblennius gentilis* | bay blenny | 0.05 | 1 | - | - |
| *Rimicola eigenmanni* | slender clingfish | - | - | 4.13 | 53 |
| *Clinocottus analis* | wooly sculpin | - | - | 0.31 | 4 |
| *Clinocottus* spp. | sculpins | - | - | 0.07 | 1 |
| *Semicossyphus pulcher* | California sheephead | - | - | 0.06 | 1 |
| | | | 16,763 | | 38,872 |
| **Shellfishes** | | | | | |
| *Cancer* spp. (megalops) | cancer crabs | 9.29 | 158 | 0.17 | 2 |
| *Panulirus interruptus* (larval) | California spiny lobster | 7.04 | 98 | 0.21 | 2 |
| *Cancer gracilis* (megalops) | slender crab | 2.93 | 48 | | |

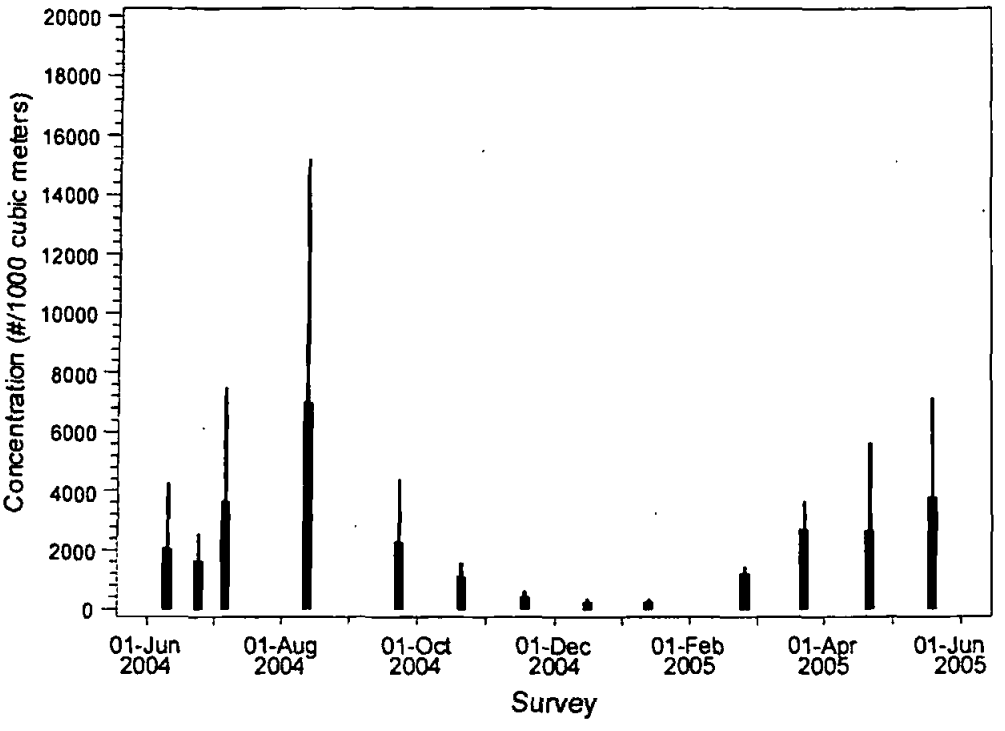



**Figure 3.** Comparison among surveys of mean concentration (#/1,000 $m^3$ [264,172 gal]) of CIQ goby complex larvae at entrainment Station E1.

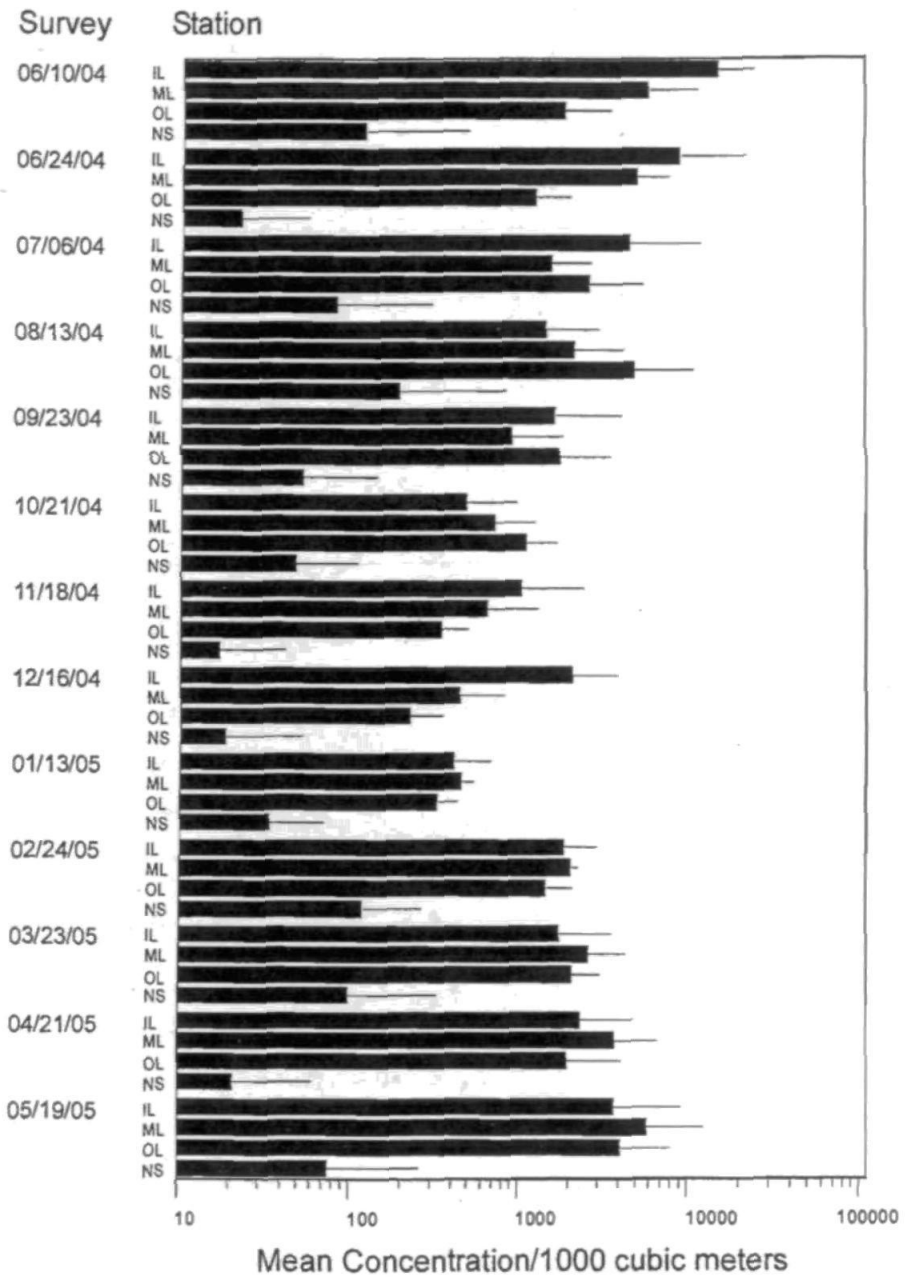



**Figure 4.** Mean concentration (#/1,000 $m^3$ [264,172 gal]) and standard error of CIQ goby complex larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods. Note logarithmic abundance scale.

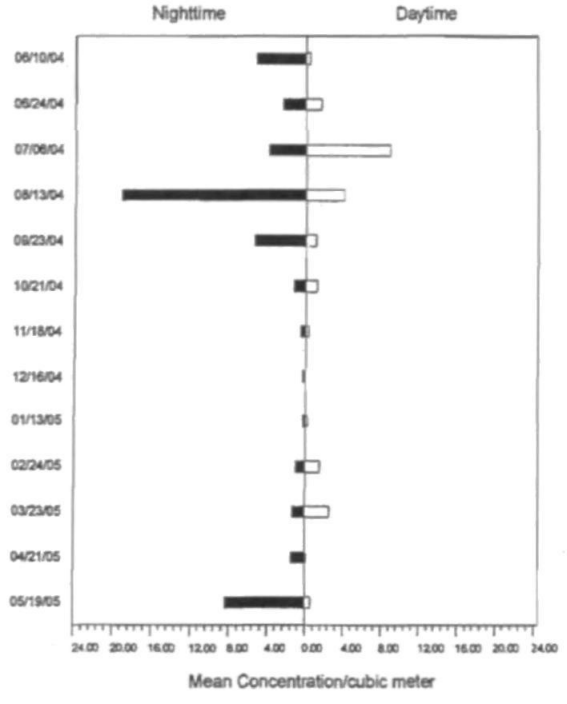



**Figure 5.** Mean concentration (#/1.0 $m^3$ [264 gal]) of CIQ goby complex larvae at entrainment Station E1 during night (Cycle 3) and day (Cycle 1) sampling.

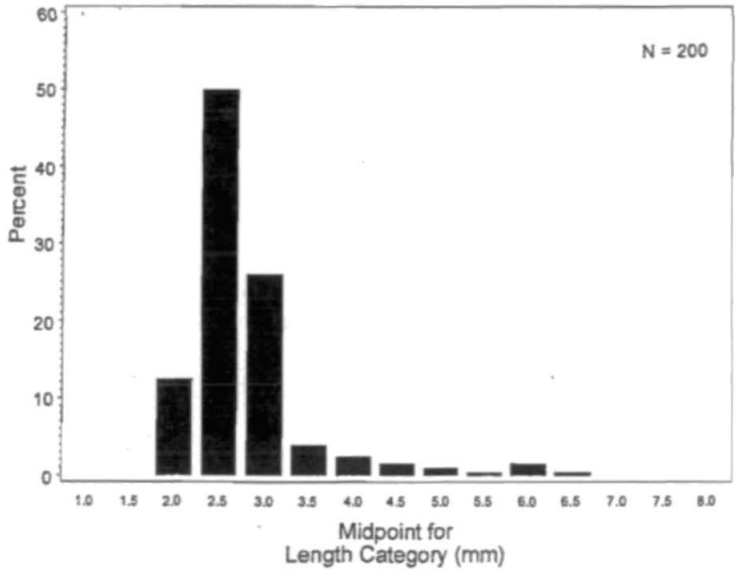



**Figure 6.** Length frequency of CIQ goby complex larvae at entrainment Station E1. Data from sub-samples of all surveys in 2004–2005.

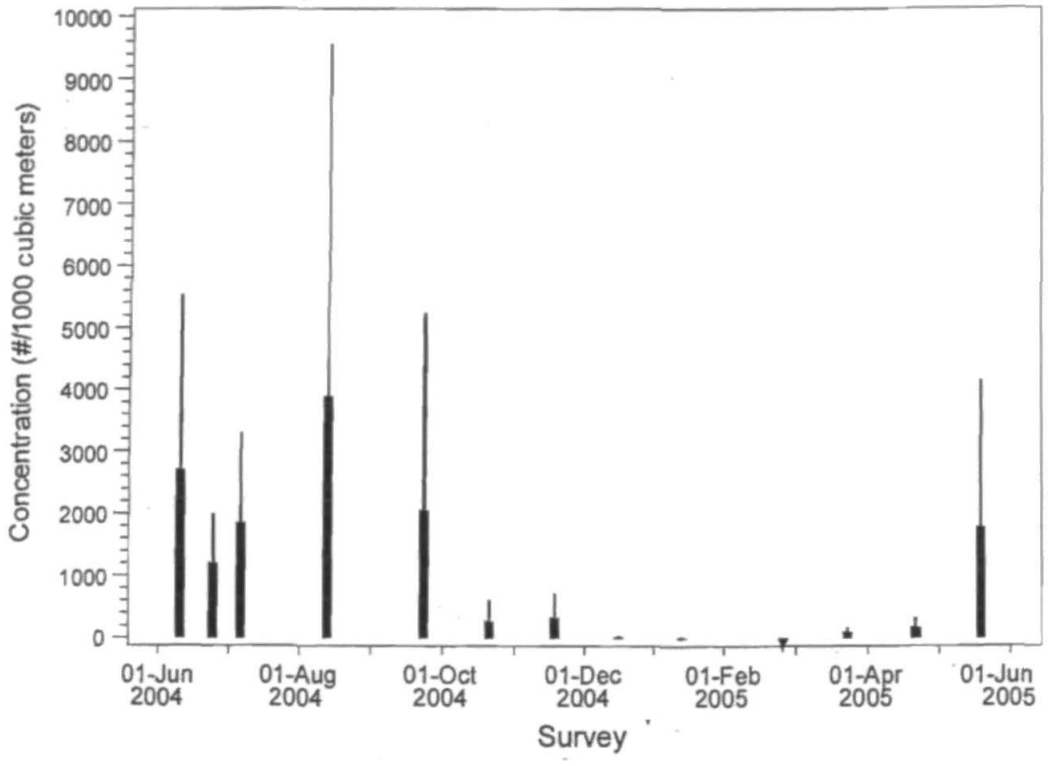



**Figure 7.** Comparison among surveys of mean concentration (#/1000 $m^3$ [264,172 gal]) of combtooth blenny larvae at entrainment Station E1. Note: downward pointing triangle indicates survey with no larvae collected.

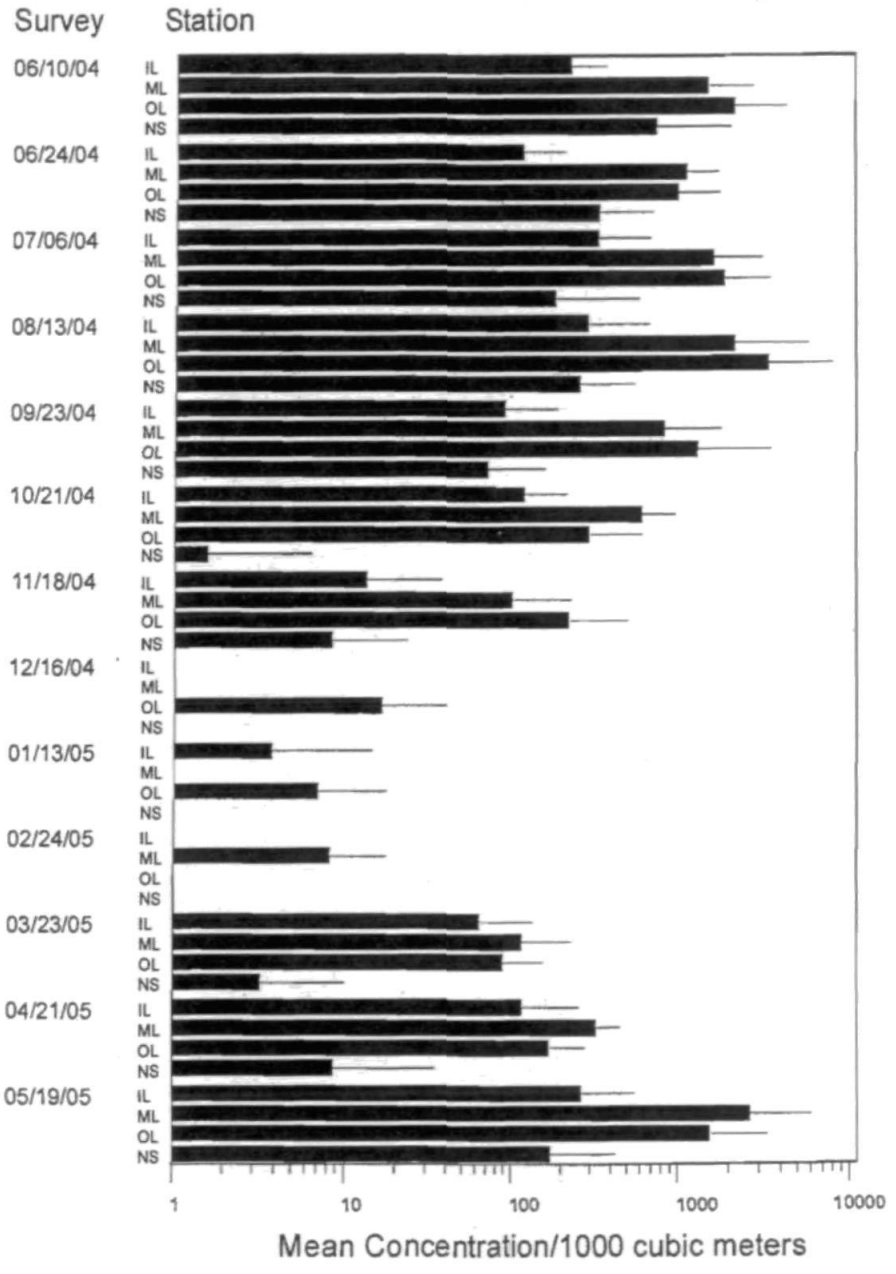



**Figure 8.** Mean concentration (#/1000 $m^3$ [264,172 gal]) and standard error of combtooth blenny larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods. Note logarithmic scale for mean concentration.

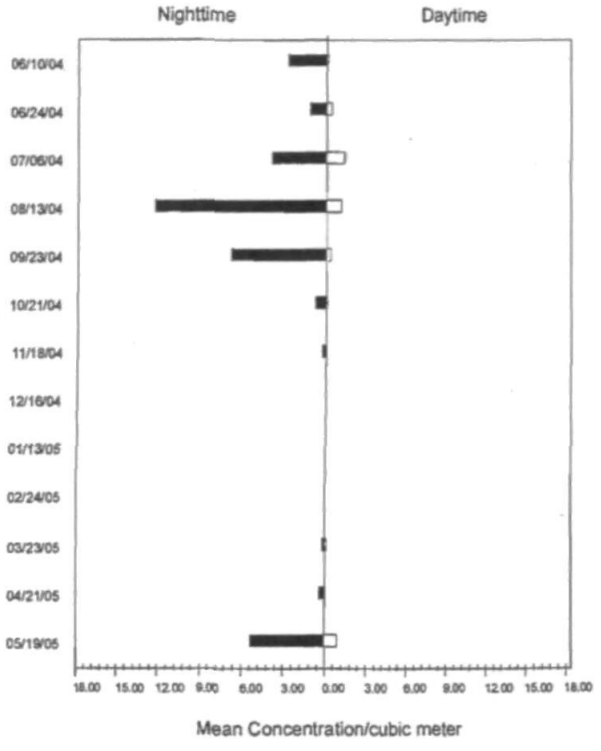



**Figure 9.** Mean concentration (#/1.0 $m^3$ [264 gal]) of combtooth blenny larvae at entrainment Station E1 during night (Cycle 3) and day (Cycle 1) sampling.

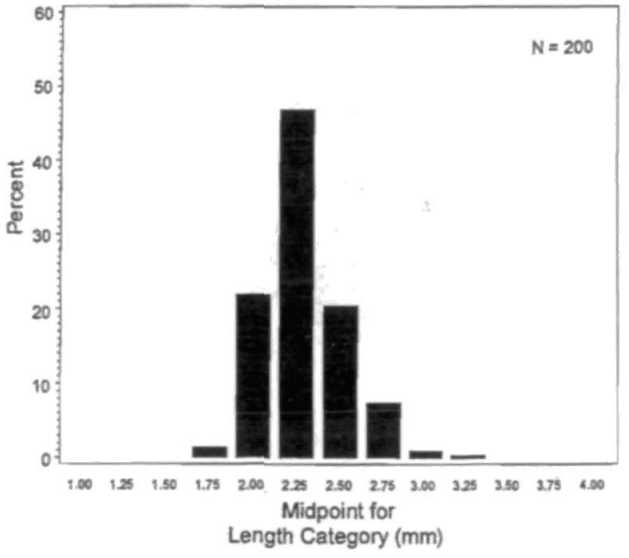



**Figure 10.** Length frequency of combtooth blenny larvae at entrainment and all source water stations combined. Data from sub-samples of all surveys in 2004–2005.

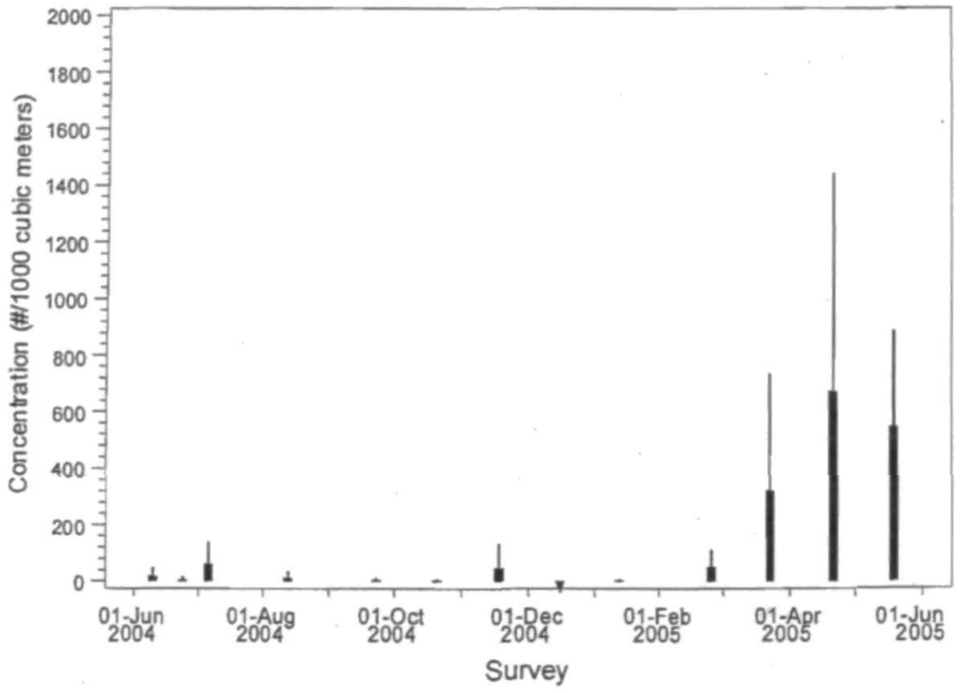



**Figure 11**. Comparison among surveys of mean concentration (#/1000 $m^3$ [264,172 gal]) of anchovy larvae at entrainment Station E1. Note: downward pointing triangle indicates survey with no larvae collected.

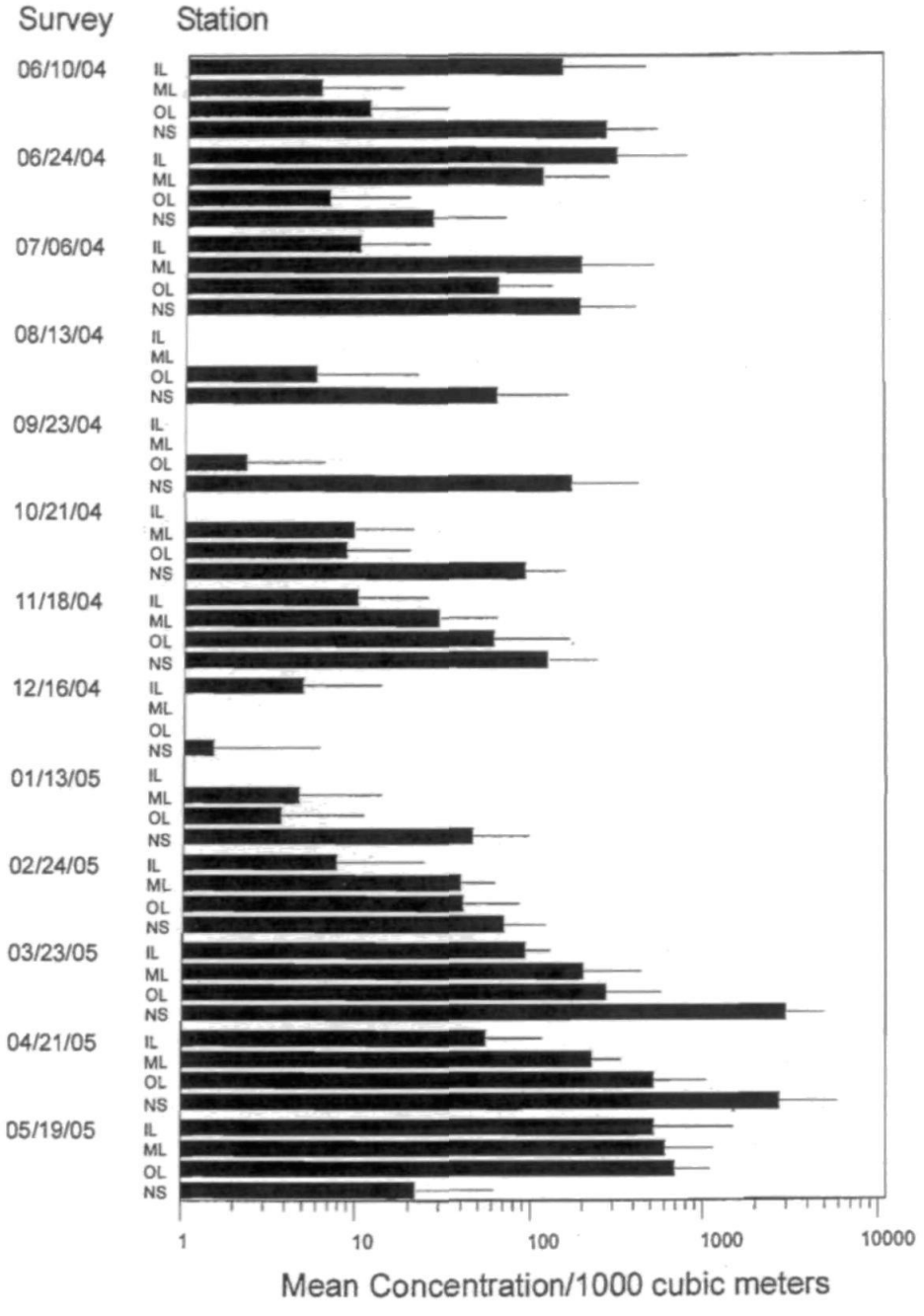



**Figure 12.** Mean concentration (#/1000 $m^3$ [264,172 gal]) and standard error of anchovy larvae at Agua Hedionda Lagoon (inner, middle, and outer) and nearshore source water stations during the 2004 and 2005 sampling periods. Note logarithmic abundance scale.

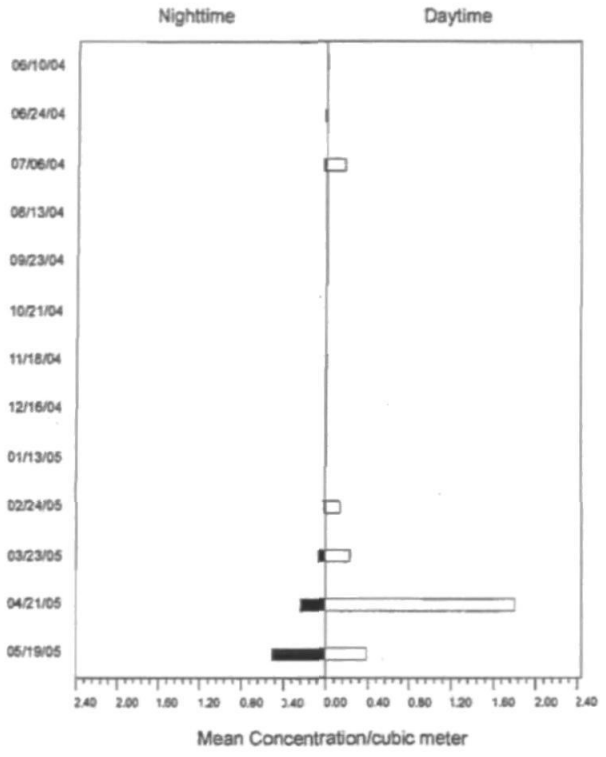



**Figure 13.** Mean concentration (#/1.0 $m^3$ [264 gal]) of anchovy larvae at entrainment Station E1 during night (Cycle 3) and day (Cycle 1) sampling.

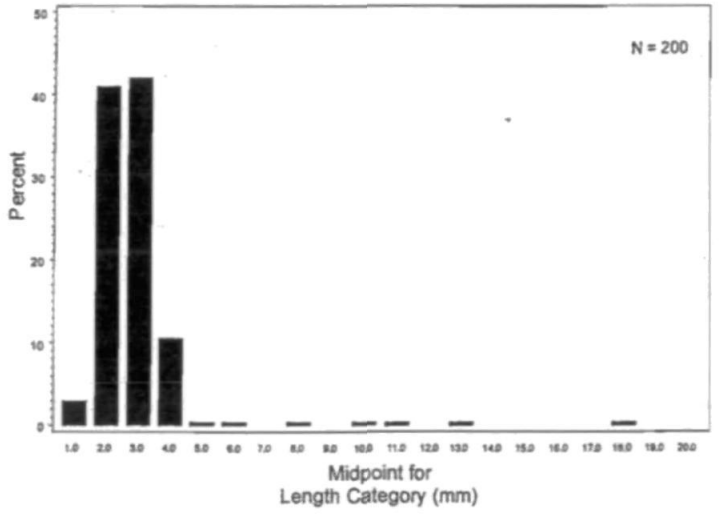



**Figure 14.** Length frequency of anchovy larvae at entrainment Station E1. Data from sub-samples of all surveys in 2004–2005.

# Appendix A

## Entrainment and Source Water Sampling Results by Survey

A1 – Entrainment

A2 – Source Water: Agua Hedionda Lagoon

A3 – Source Water: Nearshore

**Table A1.** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at entrainment Station E1.

| | | | Survey Number: | | 1 | | 2 | |
|---|---|---|---|---|---|---|---|---|
| | | | Survey Date: | | 06/10/04 | | 06/24/04 | |
| | | | Sample Count: | | 8 | | 8 | |
| | Taxon | Common Name | Total Count | Mean Conc. | Count | Conc. | Count | Conc. |
| | Fishes | | | | | | | |
| 1 | Gobiidae unid. | gobies | 12,762 | 2,222.69 | 609 | 2,059.68 | 576 | 1,622.60 |
| 2 | *Hypsoblennius* spp. | combtooth blennies | 5,838 | 1,107.67 | 784 | 2,712.14 | 438 | 1,197.26 |
| 3 | *Engraulis mordax* | northern anchovy | 505 | 84.40 | 6 | 17.86 | - | - |
| 4 | Engraulidae unid. | anchovies | 314 | 49.88 | - | - | 2 | 5.15 |
| 5 | *Hypsypops rubicundus* | garibaldi | 188 | 40.99 | 79 | 268.68 | 8 | 23.41 |
| 6 | *Typhlogobius californiensis* | blind goby | 148 | 24.65 | 2 | 4.80 | - | - |
| 7 | *Gibbonsia* spp. | clinid kelpfishes | 125 | 22.45 | 3 | 11.11 | 2 | 5.24 |
| 8 | Labrisomidae unid. | labrisomid kelpfishes | 81 | 17.65 | 26 | 92.41 | 10 | 28.36 |
| 9 | *Acanthogobius flavimanus* | yellowfin goby | 87 | 14.41 | - | - | - | - |
| 10 | larval fish fragment | larval fishes | 56 | 9.65 | 8 | 25.54 | - | - |
| 11 | larvae, unidentified yolksac | yolksac larvae | 39 | 8.36 | 5 | 16.62 | 6 | 18.21 |
| 12 | *Roncador stearnsi* | spotfin croaker | 42 | 8.33 | 1 | 2.40 | 1 | 2.57 |
| 13 | *Syngnathus leptorhynchus* | bay pipefish | 36 | 8.20 | 7 | 21.36 | 8 | 22.75 |
| 14 | *Atherinopsis californiensis* | jacksmelt | 47 | 7.99 | - | - | - | - |
| 15 | *Rimicola* spp. | kelp clingfishes | 43 | 7.92 | 3 | 9.95 | 1 | 2.49 |
| 16 | *Syngnathus* spp. | pipefishes | 47 | 7.85 | 2 | 6.39 | - | - |
| 17 | *Genyonemus lineatus* | white croaker | 44 | 7.04 | - | - | - | - |
| 18 | *Seriphus politus* | queenfish | 29 | 5.50 | 2 | 6.65 | - | - |
| 19 | *Paraclinus integripinnis* | reef finspot | 31 | 4.95 | - | - | - | - |
| 20 | *Paralichthys californicus* | California halibut | 21 | 3.73 | 1 | 2.40 | - | - |
| 21 | *Sardinops sagax* | Pacific sardine | 16 | 2.66 | - | - | - | - |
| 22 | *Gillichthys mirabilis* | longjaw mudsucker | 13 | 2.14 | - | - | - | - |
| 23 | Sciaenidae unid. | croaker | 11 | 1.86 | - | - | 1 | 2.49 |
| 24 | *Hypsopsetta guttulata* | diamond turbot | 10 | 1.78 | - | - | - | - |
| 25 | larval/post-larval fish unid. | larval fishes | 10 | 1.61 | 1 | 2.40 | - | - |
| 26 | *Citharichthys stigmaeus* | speckled sanddab | 8 | 1.33 | - | - | - | - |
| 27 | *Paralabrax* spp. | sand bass | 7 | 1.15 | - | - | - | - |
| 28 | Atherinopsidae unid. | silverside | 5 | 0.82 | - | - | - | - |
| 29 | *Citharichthys sordidus* | Pacific sanddab | 5 | 0.79 | - | - | - | - |
| 30 | *Paralabrax clathratus* | kelp bass | 4 | 0.71 | - | - | - | - |
| 31 | Pleuronectiformes unid. | flatfishes | 4 | 0.63 | - | - | - | - |
| 32 | *Heterostichus rostratus* | giant kelpfish | 3 | 0.54 | 1 | 2.40 | - | - |
| 33 | *Clinocottus analis* | wooly sculpin | 3 | 0.51 | - | - | - | - |
| 34 | *Stenobrachius leucopsarus* | northern lampfish | 2 | 0.37 | - | - | - | - |
| 35 | *Atherinops affinis* | topsmelt | 2 | 0.36 | - | - | - | - |
| 36 | *Cheilotrema saturnum* | black croaker | 2 | 0.35 | - | - | - | - |
| 37 | *Scomber japonicus* | Pacific mackerel | 1 | 0.35 | 1 | 4.51 | - | - |
| 38 | *Quietula y-cauda* | shadow goby | 1 | 0.25 | - | - | - | - |
| 39 | Ophidiidae unid. | cusk-eels | 1 | 0.21 | - | - | - | - |
| 40 | *Gobiesox* spp. | clingfishes | 1 | 0.20 | - | - | 1 | 2.66 |
| 41 | *Diaphus theta* | California headlight fish | 1 | 0.19 | - | - | - | - |
| 42 | *Semicossyphus pulcher* | California sheephead | 1 | 0.19 | - | - | - | - |
| 43 | *Menticirrhus undulatus* | California corbina | 1 | 0.18 | - | - | - | - |
| 44 | Haemulidae unid. | grunts | 1 | 0.18 | - | - | - | - |
| 45 | Labridae unid. | wrasses | 1 | 0.17 | - | - | - | - |
| 46 | Myctophidae unid. | lanternfishes | 1 | 0.16 | - | - | - | - |
| 47 | *Symbolophorus californiensis* | California lanternfish | 1 | 0.16 | - | - | - | - |
| 48 | *Oxyjulis californica* | senorita | 1 | 0.14 | - | - | - | - |
| 49 | *Citharichthys* spp. | sanddabs | 1 | 0.13 | - | - | - | - |
| | Invertebrates | | | | | | | |
| | *Cancer anthonyi* (megalops) | yellow crab | 1 | 2.21 | - | - | - | - |
| | | | 20,602 | | 1,541 | | 1,054 | |

**Table A1 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at entrainment Station E1.

| Survey Number: | 3 | | 4 | | 5 | | 6 | |
|---|---|---|---|---|---|---|---|---|
| Survey Date: | 07/06/04 | | 08/13/04 | | 09/23/04 | | 10/21/04 | |
| Sample Count: | 8 | | 8 | | 8 | | 8 | |
| **Taxon** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** |
| **Fishes** | | | | | | | | |
| Gobiidae unid. | 1,349 | 3,651.19 | 3,347 | 6,989.90 | 992 | 2,259.40 | 454 | 1,118.40 |
| *Hypsoblennius* spp. | 615 | 1,857.95 | 1,843 | 3,900.14 | 917 | 2,056.02 | 115 | 275.79 |
| *Engraulis mordax* | 7 | 19.60 | - | - | 2 | 4.55 | 2 | 4.43 |
| Engraulidae unid. | 17 | 41.45 | 6 | 11.44 | - | - | - | - |
| *Hypsypops rubicundus* | 24 | 76.54 | 8 | 16.58 | - | - | - | - |
| *Typhlogobius californiensis* | 1 | 3.57 | - | - | - | - | - | - |
| *Gibbonsia* spp. | - | - | 1 | 1.85 | - | - | 16 | 42.17 |
| Labrisomidae unid. | 20 | 52.50 | 2 | 4.38 | 20 | 45.30 | 1 | 2.62 |
| *Acanthogobius flavimanus* | - | - | - | - | - | - | - | - |
| larval fish fragment | - | - | 3 | 6.62 | 4 | 8.90 | 8 | 19.52 |
| larvae, unidentified yolksac | 16 | 46.61 | - | - | 3 | 7.57 | - | - |
| *Roncador stearnsi* | 11 | 34.26 | 1 | 2.09 | 28 | 67.03 | - | - |
| *Syngnathus leptorhynchus* | 19 | 57.50 | - | - | - | - | 1 | 2.83 |
| *Atherinopsis californiensis* | - | - | - | - | - | - | - | - |
| *Rimicola* spp. | 12 | 29.44 | 15 | 31.44 | 3 | 6.87 | 9 | 22.75 |
| *Syngnathus* spp. | - | - | 32 | 67.29 | 13 | 28.39 | - | - |
| *Genyonemus lineatus* | - | - | 1 | 1.93 | 7 | 16.59 | - | - |
| *Seriphus politus* | - | - | 3 | 6.38 | 22 | 53.74 | 2 | 4.77 |
| *Paraclinus integripinnis* | - | - | 31 | 64.39 | - | - | - | - |
| *Paralichthys californicus* | - | - | 1 | 2.09 | 5 | 13.58 | 2 | 5.23 |
| *Sardinops sagax* | - | - | - | - | - | - | - | - |
| *Gillichthys mirabilis* | - | - | - | - | - | - | - | - |
| Sciaenidae unid. | 1 | 3.20 | - | - | 3 | 6.64 | 1 | 2.62 |
| *Hypsopsetta guttulata* | - | - | - | - | 3 | 7.81 | - | - |
| larval/post-larval fish unid. | 1 | 2.39 | 5 | 9.76 | - | - | - | - |
| *Citharichthys stigmaeus* | - | - | - | - | - | - | 2 | 5.54 |
| *Paralabrax* spp. | - | - | 3 | 5.69 | 4 | 9.26 | - | - |
| Atherinopsidae unid. | - | - | - | - | - | - | - | - |
| *Citharichthys sordidus* | - | - | - | - | - | - | - | - |
| *Paralabrax clathratus* | - | - | - | - | 4 | 9.21 | - | - |
| Pleuronectiformes unid. | - | - | - | - | - | - | - | - |
| *Heterostichus rostratus* | - | - | - | - | - | - | - | - |
| *Clinocottus analis* | - | - | - | - | - | - | - | - |
| *Stenobrachius leucopsarus* | - | - | - | - | - | - | - | - |
| *Atherinops affinis* | 1 | 2.50 | - | - | - | - | - | - |
| *Cheilotrema saturnum* | 1 | 2.50 | 1 | 2.02 | - | - | - | - |
| *Scomber japonicus* | - | - | - | - | - | - | - | - |
| *Quietula y-cauda* | 1 | 3.20 | - | - | - | - | - | - |
| Ophidiidae unid. | - | - | - | - | - | - | 1 | 2.71 |
| *Gobiesox* spp. | - | - | - | - | - | - | - | - |
| *Diaphus theta* | - | - | - | - | - | - | - | - |
| *Semicossyphus pulcher* | - | - | - | - | - | - | - | - |
| *Menticirrhus undulatus* | 1 | 2.39 | - | - | - | - | - | - |
| Haemulidae unid. | - | - | - | - | 1 | 2.29 | - | - |
| Labridae unid. | - | - | - | - | 1 | 2.19 | - | - |
| Myctophidae unid. | - | - | - | - | - | - | - | - |
| *Symbolophorus californiensis* | - | - | - | - | - | - | - | - |
| *Oxyjulis californica* | - | - | - | - | - | - | - | - |
| *Citharichthys* spp. | - | - | - | - | - | - | - | - |
| **Invertebrates** | | | | | | | | |
| *Cancer anthonyi* (megalops) | - | - | - | - | - | - | - | - |
| | 2,097 | | 5,303 | | 2,032 | | 614 | |

**Table A1 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at entrainment Station E1:

| Survey Number: | 7 | | 8 | | 9 | | 10 | |
|---|---|---|---|---|---|---|---|---|
| Survey Date: | 11/16/04 | | 12/16/04 | | 01/13/05 | | 02/24/05 | |
| Sample Count: | 8 | | 8 | | 8 | | 8 | |
| Taxon | Count | Conc. | Count | Conc. | Count | Conc. | Count | Conc. |
| Fishes | | | | | | | | |
| Gobiidae unid. | 203 | 411.13 | 102 | 233.48 | 118 | 263.27 | 555 | 1,179.31 |
| *Hypsoblennius* spp. | 151 | 320.89 | 5 | 11.75 | 4 | 8.53 | - | - |
| *Engraulis mordax* | 26 | 48.05 | - | - | 1 | 2.22 | 25 | 51.06 |
| Engraulidae unid. | - | - | - | - | - | - | - | - |
| *Hypsypops rubicundus* | - | - | - | - | - | - | - | - |
| *Typhlogobius californiensis* | - | - | - | - | - | - | 4 | 8.61 |
| *Gibbonsia* spp. | 7 | 13.96 | 6 | 13.51 | 61 | 141.98 | 11 | 22.93 |
| Labrisomidae unid. | 1 | 1.75 | - | - | - | - | - | - |
| *Acanthogobius flavimanus* | - | - | - | - | 19 | 44.01 | 63 | 133.24 |
| larval fish fragment | 2 | 3.95 | - | - | 1 | 2.28 | 4 | 8.48 |
| larvae, unidentified yolksac | - | - | - | - | - | - | - | - |
| *Roncador stearnsi* | - | - | - | - | - | - | - | - |
| *Syngnathus leptorhynchus* | - | - | - | - | - | - | - | - |
| *Atherinopsis californiensis* | - | - | 2 | 4.93 | 13 | 29.82 | 22 | 47.31 |
| *Rimicola* spp. | - | - | - | - | - | - | - | - |
| *Syngnathus* spp. | - | - | - | - | - | - | - | - |
| *Genyonemus lineatus* | 4 | 7.92 | 1 | 2.47 | 3 | 6.50 | 13 | 26.67 |
| *Seriphus politus* | - | - | - | - | - | - | - | - |
| *Paraclinus integripinnis* | - | - | - | - | - | - | - | - |
| *Paralichthys californicus* | 1 | 1.75 | 1 | 2.22 | 2 | 4.40 | 3 | 5.75 |
| *Sardinops sagax* | 2 | 3.49 | - | - | - | - | 5 | 10.93 |
| *Gillichthys mirabilis* | 3 | 7.07 | 1 | 2.15 | 1 | 2.22 | 5 | 10.56 |
| Sciaenidae unid. | 1 | 1.85 | - | - | - | - | - | - |
| *Hypsopsetta guttulata* | 2 | 4.02 | 1 | 1.71 | 4 | 9.59 | - | - |
| larval/post-larval fish unid. | - | - | - | - | 3 | 6.33 | - | - |
| *Citharichthys stigmaeus* | 4 | 7.32 | - | - | - | - | - | - |
| *Paralabrax* spp. | - | - | - | - | - | - | - | - |
| Atherinopsidae unid. | - | - | - | - | - | - | 2 | 4.61 |
| *Citharichthys sordidus* | 3 | 5.24 | - | - | - | - | - | - |
| *Paralabrax clathratus* | - | - | - | - | - | - | - | - |
| Pleuronectiformes unid. | 3 | 5.70 | - | - | - | - | - | - |
| *Heterostichus rostratus* | 1 | 2.18 | - | - | - | - | 1 | 2.41 |
| *Clinocottus analis* | - | - | 1 | 2.20 | 1 | 2.28 | 1 | 2.15 |
| *Stenobrachius leucopsarus* | - | - | - | - | 2 | 4.82 | - | - |
| *Atherinops affinis* | - | - | - | - | - | - | - | - |
| *Cheilotrema saturnum* | - | - | - | - | - | - | - | - |
| *Scomber japonicus* | - | - | - | - | - | - | - | - |
| *Quietula y-cauda* | - | - | - | - | - | - | - | - |
| Ophidiidae unid. | - | - | - | - | - | - | - | - |
| *Gobiesox* spp. | - | - | - | - | - | - | - | - |
| *Diaphus theta* | - | - | - | - | - | - | - | - |
| *Semicossyphus pulcher* | - | - | - | - | - | - | - | - |
| *Menticirrhus undulatus* | - | - | - | - | - | - | - | - |
| Haemulidae unid. | - | - | - | - | - | - | - | - |
| Labridae unid. | - | - | - | - | - | - | - | - |
| Myctophidae unid. | - | - | - | - | - | - | - | - |
| *Symbolophorus californiensis* | - | - | - | - | - | - | - | - |
| *Oxyjulis californica* | - | - | - | - | - | - | - | - |
| *Citharichthys* spp. | - | - | - | - | - | - | - | - |
| Invertebrates | | | | | | | | |
| *Cancer anthonyi* (megalops) | - | - | 1 | 2.21 | - | - | - | - |
| | 414 | | 121 | | 233 | | 714 | |

**Table A1 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at entrainment Station E1

| Survey Number: | 11 | | 12 | | 13 | |
|---|---|---|---|---|---|---|
| Survey Date: | 03/23/05 | | 04/21/05 | | 05/19/05 | |
| Sample Count: | 8 | | 8 | | 8 | |
| **Taxon** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** |
| Fishes | | | | | | |
| Gobiidae unid. | 1,357 | 2,700.63 | 1,314 | 2,649.98 | 1,786 | 3,755.99 |
| *Hypsoblennius* spp. | 49 | 99.47 | 86 | 174.14 | 831 | 1,785.69 |
| *Engraulis mordax* | 89 | 182.27 | 284 | 642.95 | 63 | 124.21 |
| Engraulidae unid. | 60 | 140.57 | 14 | 28.03 | 215 | 421.84 |
| *Hypsypops rubicundus* | - | - | 15 | 30.54 | 54 | 117.11 |
| *Typhlogobius californiensis* | 110 | 238.12 | 17 | 34.38 | 14 | 31.01 |
| *Gibbonsia* spp. | 12 | 26.60 | 2 | 3.96 | 4 | 8.59 |
| Labrisomidae unid. | - | - | - | - | 1 | 2.13 |
| *Acanthogobius flavimanus* | 5 | 10.08 | - | - | - | - |
| larval fish fragment | 12 | 24.32 | 4 | 8.17 | 10 | 17.70 |
| larvae, unidentified yolksac | 1 | 2.43 | 3 | 7.12 | 5 | 10.12 |
| *Roncador stearnsi* | - | - | - | - | - | - |
| *Syngnathus leptorhynchus* | - | - | - | - | 1 | 2.21 |
| *Atherinopsis californiensis* | 10 | 21.80 | - | - | - | - |
| *Rimicola* spp. | - | - | - | - | - | - |
| *Syngnathus* spp. | - | - | - | - | - | - |
| *Genyonemus lineatus* | 5 | 9.18 | 10 | 20.28 | - | - |
| *Seriphus politus* | - | - | - | - | - | - |
| *Paraclinus integripinnis* | - | - | - | - | - | - |
| *Paralichthys californicus* | 1 | 1.82 | 3 | 7.12 | 1 | 2.13 |
| *Sardinops sagax* | 1 | 1.86 | 8 | 18.35 | - | - |
| *Gillichthys mirabilis* | 2 | 3.89 | 1 | 1.88 | - | - |
| Sciaenidae unid. | 2 | 3.67 | - | - | 2 | 3.75 |
| *Hypsopsetta guttulata* | - | - | - | - | - | - |
| larval/post-larval fish unid. | - | - | - | - | - | - |
| *Citharichthys stigmaeus* | - | - | 2 | 4.37 | - | - |
| *Paralabrax* spp. | - | - | - | - | - | - |
| Atherinopsidae unid. | - | - | 2 | 3.89 | 1 | 2.21 |
| *Citharichthys sordidus* | - | - | 2 | 4.98 | - | - |
| *Paralabrax clathratus* | - | - | - | - | - | - |
| Pleuronectiformes unid. | - | - | 1 | 2.49 | - | - |
| *Heterostichus rostratus* | - | - | - | - | - | - |
| *Clinocottus analis* | - | - | - | - | - | - |
| *Stenobrachius leucopsarus* | - | - | - | - | - | - |
| *Atherinops affinis* | - | - | - | - | 1 | 2.21 |
| *Cheilotrema saturnum* | - | - | - | - | - | - |
| *Scomber japonicus* | - | - | - | - | - | - |
| *Quietula y-cauda* | - | - | - | - | - | - |
| Ophidiidae unid. | - | - | - | - | - | - |
| *Gobiesox* spp. | - | - | - | - | - | - |
| *Diaphus theta* | - | - | 1 | 2.49 | - | - |
| *Semicossyphus pulcher* | - | - | 1 | 2.49 | - | - |
| *Menticirrhus undulatus* | - | - | - | - | - | - |
| Haemulidae unid. | - | - | - | - | - | - |
| Labridae unid. | - | - | - | - | - | - |
| Myctophidae unid. | - | - | 1 | 2.14 | - | - |
| *Symbolophorus californiensis* | - | - | 1 | 2.14 | - | - |
| *Oxyjulis californica* | - | - | - | - | 1 | 1.78 |
| *Citharichthys* spp. | 1 | 1.72 | - | - | - | - |
| Invertebrates | | | | | | |
| *Cancer anthonyi* (megalops) | - | - | - | - | - | - |
| | 1,717 | | 1,772 | | 2,990 | |

**Table A2.** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations L1-L4 in Agua Hedionda Lagoon.

| | | Survey Number: | | 1 | | 2 | |
|---|---|---|---|---|---|---|---|
| | | Survey Date: | | 06/10/04 | | 06/24/04 | |
| | | Sample Count: | | 16 | | 16 | |
| | Taxon | Common Name | Total Count | Mean Conc. | Count | Conc. | Count | Conc. |
| | **Fishes** | | | | | | | |
| 1 | Gobiidae unid. | gobies | 30,229 | 2,714.74 | 7,936 | 9,400.29 | 4,466 | 5,925.43 |
| 2 | *Hypsoblennius* spp. | combtooth blennies | 4,725 | 467.32 | 614 | 901.83 | 398 | 547.24 |
| 3 | Engraulidae unid. | anchovies | 652 | 57.90 | 54 | 72.86 | 141 | 182.94 |
| 4 | *Engraulis mordax* | northern anchovy | 558 | 45.51 | 2 | 2.79 | 1 | 1.33 |
| 5 | *Acanthogobius flavimanus* | yellowfin goby | 499 | 38.98 | - | - | - | - |
| 6 | Labrisomidae unid. | labrisomid kelpfishes | 366 | 35.30 | 166 | 220.73 | 71 | 93.10 |
| 7 | *Hypsypops rubicundus* | garibaldi | 352 | 35.12 | 94 | 134.38 | 53 | 76.48 |
| 8 | *Atherinopsis californiensis* | jacksmelt | 279 | 23.93 | - | - | - | - |
| 9 | *Gibbonsia* spp. | clinid kelpfishes | 182 | 16.74 | 8 | 11.54 | 4 | 5.44 |
| 10 | larval fish fragment | unid. larval fishes | 174 | 15.02 | 17 | 19.27 | 21 | 30.99 |
| 11 | *Typhlogobius californiensis* | blind goby | 118 | 9.63 | 2 | 2.79 | - | - |
| 12 | *Roncador stearnsi* | spotfin croaker | 74 | 6.82 | 1 | 1.29 | - | - |
| 13 | Sciaenidae unid. | croakers | 73 | 6.56 | 23 | 29.17 | - | - |
| 14 | *Gillichthys mirabilis* | longjaw mudsucker | 62 | 5.17 | - | - | - | - |
| 15 | *Genyonemus lineatus* | white croaker | 54 | 4.25 | 2 | 2.14 | - | - |
| 16 | *Rimicola eigenmanni* | slender clingfish | 53 | 4.13 | - | - | - | - |
| 17 | Atherinopsidae unid. | silversides | 41 | 3.40 | 3 | 3.43 | - | - |
| 18 | *Rimicola* spp. | kelp clingfishes | 34 | 3.28 | - | - | 2 | 2.98 |
| 19 | *Syngnathus leptorhynchus* | bay pipefish | 33 | 3.19 | 12 | 15.60 | 9 | 11.57 |
| 20 | larvae, unidentified yolksac | unid. yolksac larvae | 32 | 3.12 | 5 | 8.47 | - | - |
| 21 | *Paraclinus integripinnis* | reef finspot | 31 | 2.88 | - | - | - | - |
| 22 | *Seriphus politus* | queenfish | 26 | 2.40 | 1 | 1.64 | 5 | 5.51 |
| 23 | *Atherinops affinis* | topsmelt | 28 | 2.40 | 5 | 7.00 | 4 | 5.54 |
| 24 | *Quietula y-cauda* | shadow goby | 26 | 2.38 | 5 | 5.45 | 5 | 6.68 |
| 25 | *Syngnathus* spp. | pipefishes | 19 | 2.01 | - | - | 2 | 2.99 |
| 26 | *Paralichthys californicus* | California halibut | 22 | 1.93 | 2 | 2.63 | - | - |
| 27 | larval/post-larval fish unid. | larval fishes | 16 | 1.36 | - | - | - | - |
| 28 | *Ilypnus gilberti* | cheekspot goby | 14 | 1.35 | - | - | - | - |
| 29 | *Oxyjulis californica* | senorita | 8 | 0.75 | 2 | 2.36 | - | - |
| 30 | *Sardinops sagax* | Pacific sardine | 9 | 0.74 | - | - | - | - |
| 31 | *Citharichthys stigmaeus* | speckled sanddab | 9 | 0.73 | - | - | - | - |
| 32 | *Paralabrax* spp. | sand basses | 8 | 0.68 | - | - | - | - |
| 33 | *Hypsopsetta guttulata* | diamond turbot | 7 | 0.55 | - | - | - | - |
| 34 | *Leptocottus armatus* | Pacific staghorn sculpin | 6 | 0.51 | - | - | - | - |
| 35 | *Gobiesox* spp. | clingfishes | 5 | 0.49 | - | - | 2 | 3.29 |
| 36 | *Menticirrhus undulatus* | California corbina | 5 | 0.47 | - | - | - | - |
| 37 | *Cheilotrema saturnum* | black croaker | 4 | 0.36 | - | - | - | - |
| 38 | Blennioidei unid. | blennies | 4 | 0.36 | 1 | 1.11 | 1 | 1.40 |
| 39 | *Citharichthys sordidus* | Pacific sanddab | 5 | 0.34 | - | - | - | - |
| 40 | *Clinocottus analis* | wooly sculpin | 4 | 0.31 | - | - | - | - |
| 41 | *Xenistius californiensis* | salema | 3 | 0.30 | - | - | - | - |
| 42 | *Xystreurys liolepis* | fantail sole | 2 | 0.21 | - | - | - | - |
| 43 | *Pleuronichthys ritteri* | spotted turbot | 2 | 0.17 | - | - | - | - |
| 44 | Haemulidae unid. | grunts | 2 | 0.17 | - | - | - | - |
| 45 | *Sphyraena argentea* | California barracuda | 2 | 0.17 | - | - | - | - |
| 46 | *Triphoturus mexicanus* | Mexican lampfish | 2 | 0.16 | - | - | - | - |
| 47 | Gobiesocidae unid. | clingfishes | 2 | 0.15 | - | - | - | - |
| 48 | *Clevelandia ios* | arrow goby | 1 | 0.11 | - | - | - | - |
| 49 | Syngnathidae unid. | pipefishes | 1 | 0.11 | - | - | - | - |
| 50 | Ophidiidae unid. | cusk-eels | 1 | 0.09 | - | - | - | - |
| 51 | *Umbrina roncador* | yellowfin croaker | 1 | 0.09 | - | - | - | - |
| 52 | *Lepidogobius lepidus* | bay goby | 1 | 0.09 | - | - | - | - |
| 53 | *Pleuronichthys* spp. | turbots | 1 | 0.08 | - | - | - | - |
| 54 | *Atractoscion nobilis* | white seabass | 1 | 0.08 | - | - | - | - |
| 55 | Pleuronectiformes unid. | flatfishes | 1 | 0.07 | - | - | - | - |
| 56 | *Clinocottus* spp. | sculpins | 1 | 0.07 | - | - | - | - |
| 57 | *Citharichthys* spp. | sanddabs | 1 | 0.06 | - | - | - | - |
| 58 | *Semicossyphus pulcher* | California sheephead | 1 | 0.06 | 1 | 0.78 | - | - |
| | **Invertebrates** | | | | | | | |
| | *Panulirus interruptus* (larvae) | California spiny lobster | 2 | 0.21 | - | - | - | - |
| | *Cancer antennarius* (megalops) | brown rock crab | 1 | 0.09 | - | - | - | - |
| | *Cancer anthonyi* (megalops) | yellow crab | 1 | 0.08 | - | - | - | - |
| | | Totals: | 38,876 | | 8,958 | | 5,185 | |

**Table A2 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations L1-L4 in Agua Hedionda Lagoon.

| Survey Number: | 3 | | 4 | | 5 | | 6 | |
|---|---|---|---|---|---|---|---|---|
| Survey Date: | 07/06/04 | | 08/13/04 | | 09/23/04 | | 10/21/04 | |
| Sample Count: | 16 | | 16 | | 20 | | 16 | |
| Taxon | Conc. | Count | Count | Conc. | Count | Conc. | Count | Conc. |
| Fishes | | | | | | | | |
| Gobiidae unid. | 3,034.53 | 30,229 | 1,498 | 1,925.13 | 1,115 | 1,272.53 | 550 | 690.51 |
| *Hypsoblennius* spp. | 1,053.95 | 4,725 | 1,004 | 1,421.30 | 360 | 398.18 | 245 | 290.58 |
| Engraulidae unid. | 57.39 | 652 | - | - | - | - | - | - |
| *Engraulis mordax* | 12.07 | 558 | - | - | - | - | 4 | 5.58 |
| *Acanthogobius flavimanus* | - | 499 | - | - | - | - | - | - |
| Labrisomidae unid. | 44.54 | 366 | 23 | 29.27 | 68 | 70.20 | - | - |
| *Hypsypops rubicundus* | 122.15 | 352 | 1 | 1.38 | - | - | - | - |
| *Atherinopsis californiensis* | 1.15 | 279 | - | - | - | - | - | - |
| *Gibbonsia* spp. | 4.46 | 182 | 1 | 1.38 | 3 | 3.04 | 12 | 19.17 |
| larval fish fragment | 4.41 | 174 | 9 | 10.98 | 3 | 3.48 | 8 | 9.95 |
| *Typhlogobius californiensis* | 11.38 | 118 | - | - | - | - | - | - |
| *Roncador stearnsi* | 34.73 | 74 | - | - | 48 | 51.42 | - | - |
| Sciaenidae unid. | 10.27 | 73 | 4 | 4.85 | 17 | 17.20 | - | - |
| *Gillichthys mirabilis* | - | 62 | - | - | - | - | - | - |
| *Genyonemus lineatus* | - | 54 | 4 | 4.85 | 6 | 6.58 | 1 | 1.81 |
| *Rimicola eigenmanni* | - | 53 | - | - | 53 | 53.73 | - | - |
| Atherinopsidae unid. | 1.15 | 41 | - | - | - | - | 3 | 3.66 |
| *Rimicola* spp. | 6.03 | 34 | - | - | 9 | 9.96 | 10 | 13.61 |
| *Syngnathus leptorhynchus* | 7.04 | 33 | - | - | 5 | 4.97 | 1 | 1.33 |
| larvae, unidentified yolksac | 12.08 | 32 | 6 | 7.87 | 2 | 2.11 | - | - |
| *Paraclinus integripinnis* | - | 31 | 31 | 37.45 | - | - | - | - |
| *Seriphus politus* | 6.58 | 26 | 1 | 1.26 | 8 | 8.51 | 6 | 7.72 |
| *Atherinops affinis* | 1.15 | 28 | - | - | - | - | - | - |
| *Quietula y-cauda* | 2.29 | 26 | 4 | 5.80 | 1 | 1.01 | - | - |
| *Syngnathus* spp. | - | 19 | 15 | 20.83 | - | - | 1 | 1.09 |
| *Paralichthys californicus* | 1.63 | 22 | 1 | 1.21 | 7 | 7.51 | 2 | 3.18 |
| larval/post-larval fish unid. | - | 16 | 2 | 2.42 | 3 | 3.03 | - | - |
| *Ilypnus gilberti* | - | 14 | 3 | 4.46 | - | - | - | - |
| *Oxyjulis californica* | - | 8 | 5 | 6.24 | - | - | - | - |
| *Sardinops sagax* | - | 9 | - | - | - | - | - | - |
| *Citharichthys stigmaeus* | 1.36 | 9 | 1 | 1.20 | 2 | 2.12 | - | - |
| *Paralabrax* spp. | - | 8 | 3 | 3.63 | 5 | 5.24 | - | - |
| *Hypsopsetta guttulata* | - | 7 | - | - | 2 | 2.20 | - | - |
| *Leptocottus armatus* | - | 6 | - | - | - | - | - | - |
| *Gobiesox* spp. | - | 5 | - | - | - | - | - | - |
| *Menticirrhus undulatus* | 1.63 | 5 | 1 | 1.21 | 3 | 3.33 | - | - |
| *Chellotrema saturnum* | 1.32 | 4 | 1 | 1.21 | 2 | 2.19 | - | - |
| Blennioidei unid. | - | 4 | - | - | - | - | - | - |
| Citharichthys sordidus | - | 5 | - | - | - | - | - | - |
| *Clinocottus analis* | - | 4 | - | - | - | - | - | - |
| *Xenistius californiensis* | - | 3 | - | - | 2 | 2.03 | 1 | 1.81 |
| *Xystreurys liolepis* | 2.77 | 2 | - | - | - | - | - | - |
| *Pleuronichthys ritteri* | - | 2 | - | - | 2 | 2.20 | - | - |
| Haemulidae unid. | - | 2 | 1 | 1.21 | 1 | 0.96 | - | - |
| *Sphyraena argentea* | - | 2 | 1 | 1.17 | 1 | 0.99 | - | - |
| *Triphoturus mexicanus* | - | 2 | - | - | 1 | 1.10 | - | - |
| Gobiesocidae unid. | - | 2 | - | - | - | - | 2 | 2.01 |
| *Clevelandia ios* | - | 1 | 1 | 1.45 | - | - | - | - |
| Syngnathidae unid. | - | 1 | - | - | - | - | 1 | 1.38 |
| Ophidiidae unid. | - | 1 | 1 | 1.21 | - | - | - | - |
| *Umbrina roncador* | - | 1 | - | - | 1 | 1.21 | - | - |
| *Lepidogobius lepidus* | - | 1 | - | - | - | - | - | - |
| *Pleuronichthys* spp. | - | 1 | - | - | 1 | 1.10 | - | - |
| *Atractoscion nobilis* | - | 1 | - | - | - | - | - | - |
| Pleuronectiformes unid. | - | 1 | - | - | - | - | - | - |
| *Clinocottus* spp. | - | 1 | - | - | - | - | - | - |
| *Citharichthys* spp. | - | 1 | - | - | - | - | - | - |
| *Semicossyphus pulcher* | - | 1 | - | - | - | - | - | - |
| Invertebrates | | | | | | | | |
| *Panulirus interruptus* | 2.73 | 2 | - | - | - | - | - | - |
| *Cancer antennarius* (megalops) | - | 1 | - | - | - | - | - | - |
| *Cancer anthonyi* (megalops) | - | 1 | - | - | 1 | 1.01 | - | - |
| | | 38,876 | 2,622 | | 1,732 | | 847 | |

**Table A2 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations L1-L4 in Agua Hedionda Lagoon.

| Survey Number: | 7 | | 8 | | 9 | | 10 | |
|---|---|---|---|---|---|---|---|---|
| Survey Date: | 11/18/04 | | 12/16/04 | | 01/13/05 | | 02/24/05 | |
| Sample Count: | 16 | | 16 | | 16 | | 16 | |
| Taxon | Total Count | Conc. | Count | Conc. | Count | Conc. | Count | Conc. |
| **Fishes** | | | | | | | | |
| Gobiidae unid. | 706 | 734.73 | 1,032 | 1,201.76 | 368 | 402.81 | 1,873 | 1,867.75 |
| *Hypsoblennius* spp. | 59 | 61.74 | 4 | 5.26 | 3 | 3.22 | 2 | 2.05 |
| Engraulidae unid. | 2 | 2.12 | - | - | 2 | 2.42 | - | - |
| *Engraulis mordax* | 30 | 28.07 | 2 | 2.43 | - | - | 21 | 21.19 |
| *Acanthogobius flavimanus* | - | - | - | - | 140 | 152.20 | 300 | 288.81 |
| Labrisomidae unid. | - | - | - | - | - | - | - | - |
| *Hypsypops rubicundus* | - | - | - | - | - | - | - | - |
| *Atherinopsis californiensis* | 5 | 5.80 | 16 | 18.84 | 52 | 61.60 | 187 | 185.66 |
| *Gibbonsia* spp. | 13 | 13.30 | 56 | 65.83 | 43 | 52.02 | 21 | 20.79 |
| larval fish fragment | 11 | 11.11 | 11 | 12.69 | - | - | 49 | 48.54 |
| *Typhlogobius californiensis* | - | - | 2 | 2.23 | - | - | 8 | 8.22 |
| *Roncador stearnsi* | - | - | - | - | - | - | - | - |
| Sciaenidae unid. | - | - | - | - | 3 | 3.65 | - | - |
| *Gillichthys mirabilis* | 4 | 4.25 | 21 | 24.94 | 14 | 14.54 | 15 | 15.16 |
| *Genyonemus lineatus* | 1 | 0.95 | - | - | 2 | 2.27 | 23 | 21.56 |
| *Rimicola eigenmanni* | - | - | - | - | - | - | - | - |
| Atherinopsidae unid. | 4 | 4.47 | - | - | - | - | 12 | 11.64 |
| *Rimicola* spp. | 1 | 1.14 | 5 | 5.82 | - | - | - | - |
| *Syngnathus leptorhynchus* | - | - | - | - | - | - | 1 | 0.94 |
| larvae, unidentified yolksac | - | - | 1 | 1.31 | - | - | - | - |
| *Paraclinus integripinnis* | - | - | - | - | - | - | - | - |
| *Seriphus politus* | - | - | - | - | - | - | - | - |
| *Atherinops affinis* | - | - | - | - | - | - | 12 | 12.21 |
| *Quietula y-cauda* | 2 | 2.24 | 4 | 4.22 | - | - | 3 | 3.18 |
| *Syngnathus* spp. | 1 | 1.28 | - | - | - | - | - | - |
| *Paralichthys californicus* | 2 | 1.67 | - | - | 2 | 2.31 | 2 | 1.80 |
| larval/post-larval fish unid. | - | - | - | - | 10 | 11.33 | 1 | 0.89 |
| *Ilypnus gilberti* | 1 | 0.86 | 5 | 5.99 | 5 | 6.28 | - | - |
| *Oxyjulis californica* | 1 | 1.12 | - | - | - | - | - | - |
| *Sardinops sagax* | - | - | - | - | 1 | 1.23 | 4 | 4.40 |
| *Citharichthys stigmaeus* | 1 | 0.81 | - | - | - | - | - | - |
| *Paralabrax* spp. | - | - | - | - | - | - | - | - |
| *Hypsopsetta guttulata* | 2 | 1.68 | - | - | 1 | 1.34 | 1 | 1.01 |
| *Leptocottus armatus* | - | - | - | - | 5 | 6.63 | - | - |
| *Gobiesox* spp. | - | - | - | - | - | - | 3 | 3.04 |
| *Menticirrhus undulatus* | - | - | - | - | - | - | - | - |
| *Cheilotrema saturnum* | - | - | - | - | - | - | - | - |
| Blennioidei unid. | - | - | 1 | 1.24 | - | - | 1 | 0.94 |
| *Citharichthys sordidus* | 4 | 3.66 | - | - | - | - | 1 | 0.77 |
| *Clinocottus analis* | - | - | 2 | 2.27 | - | - | 2 | 1.74 |
| *Xenistius californiensis* | - | - | - | - | - | - | - | - |
| *Xystreurys liolepis* | - | - | - | - | - | - | - | - |
| *Pleuronichthys ritteri* | - | - | - | - | - | - | - | - |
| Haemulidae unid. | - | - | - | - | - | - | - | - |
| *Sphyraena argentea* | - | - | - | - | - | - | - | - |
| *Triphoturus mexicanus* | 1 | 0.95 | - | - | - | - | - | - |
| *Gobiesocidae unid.* | - | - | - | - | - | - | - | - |
| *Clevelandia ios* | - | - | - | - | - | - | - | - |
| Syngnathidae unid. | - | - | - | - | - | - | - | - |
| Ophidiidae unid. | - | - | - | - | - | - | - | - |
| *Umbrina roncador* | - | - | - | - | - | - | - | - |
| *Lepidogobius lepidus* | - | - | - | - | 1 | 1.18 | - | - |
| *Pleuronichthys* spp. | - | - | - | - | - | - | - | - |
| *Atractoscion nobilis* | - | - | - | - | - | - | - | - |
| Pleuronectiformes unid. | - | - | - | - | - | - | - | - |
| *Clinocottus* spp. | - | - | 1 | 0.93 | - | - | - | - |
| *Citharichthys* spp. | 1 | 0.81 | - | - | - | - | - | - |
| *Semicossyphus pulcher* | - | - | - | - | - | - | - | - |
| **Invertebrates** | | | | | | | | |
| *Panulirus interruptus* | - | - | - | - | - | - | - | - |
| *Cancer antennarius* (megalops) | - | - | 1 | 1.22 | - | - | - | - |
| *Cancer anthonyi* (megalops) | - | - | - | - | - | - | - | - |
| | 852 | | 1,164 | | 653 | | 2,522 | |

**Table A2 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations L1-L4 in Agua Hedionda Lagoon.

| Survey Number: | 11 | | 12 | | 13 | |
|---|---|---|---|---|---|---|
| Survey Date: | 03/23/05 | | 04/21/05 | | 05/19/05 | |
| Sample Count: | 16 | | 16 | | 16 | |
| **Taxon** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** |
| Fishes | | | | | | |
| Gobiidae unid. | 1,923 | 1,908.93 | 2,314 | 2,455.55 | 3,980 | 4,471.69 |
| *Hypsoblennius* spp. | 81 | 80.32 | 175 | 181.27 | 1,013 | 1,128.18 |
| Engraulidae unid. | 57 | 55.27 | 22 | 22.80 | 331 | 356.88 |
| *Engraulis mordax* | 104 | 98.45 | 151 | 155.03 | 235 | 264.72 |
| *Acanthogobius flavimanus* | 54 | 50.65 | 3 | 2.95 | 2 | 2.12 |
| Labrisomidae unid. | - | - | - | - | 1 | 1.06 |
| *Hypsypops rubicundus* | - | - | 52 | 63.71 | 48 | 58.49 |
| *Atherinopsis californiensis* | 38 | 37.99 | - | - | - | - |
| *Gibbonsia* spp. | 4 | 4.30 | 4 | 4.07 | 10 | 12.22 |
| larval fish fragment | 16 | 15.83 | 14 | 14.73 | 12 | 13.31 |
| *Typhlogobius californiensis* | 85 | 84.34 | 10 | 10.82 | 4 | 5.36 |
| *Roncador stearnsi* | - | - | 1 | 1.18 | - | - |
| Sciaenidae unid. | 7 | 6.96 | 6 | 9.27 | 6 | 6.88 |
| *Gillichthys mirabilis* | 5 | 5.20 | 3 | 3.16 | - | - |
| *Genyonemus lineatus* | 2 | 1.95 | 12 | 12.02 | 1 | 1.12 |
| *Rimicola eigenmanni* | - | - | - | - | - | - |
| Atherinopsidae unid. | 6 | 7.09 | 7 | 7.50 | 5 | 5.29 |
| *Rimicola* spp. | - | - | - | - | 3 | 3.09 |
| *Syngnathus leptorhynchus* | - | - | - | - | - | - |
| larvae, unidentified yolksac | 5 | 4.69 | - | - | 4 | 4.10 |
| *Paraclinus integripinnis* | - | - | - | - | - | - |
| *Seriphus politus* | - | - | - | - | - | - |
| *Atherinops affinis* | 1 | 0.81 | 2 | 2.23 | 2 | 2.27 |
| *Quietula y-cauda* | - | - | - | - | - | - |
| *Syngnathus* spp. | - | - | - | - | - | - |
| *Paralichthys californicus* | 2 | 1.92 | 1 | 1.18 | - | - |
| larval/post-larval fish unid. | - | - | - | - | - | - |
| *Ilypnus gilberti* | - | - | - | - | - | - |
| *Oxyjulis californica* | - | - | - | - | - | - |
| *Sardinops sagax* | - | - | 4 | 3.93 | - | - |
| *Citharichthys stigmaeus* | 1 | 1.05 | 3 | 2.97 | - | - |
| *Paralabrax* spp. | - | - | - | - | - | - |
| *Hypsopsetta guttulata* | 1 | 0.89 | - | - | - | - |
| *Leptocottus armatus* | - | - | - | - | - | - |
| *Gobiesox* spp. | - | - | - | - | - | - |
| *Menticirrhus undulatus* | - | - | - | - | - | - |
| *Cheilotrema saturnum* | - | - | - | - | - | - |
| Blennioidei unid. | - | - | - | - | - | - |
| *Citharichthys sordidus* | - | - | - | - | - | - |
| *Clinocottus analis* | - | - | - | - | - | - |
| *Xenistius californiensis* | - | - | - | - | - | - |
| *Xystreurys liolepis* | - | - | - | - | - | - |
| *Pleuronichthys ritteri* | - | - | - | - | - | - |
| Haemulidae unid. | - | - | - | - | - | - |
| *Sphyraena argentea* | - | - | - | - | - | - |
| *Triphoturus mexicanus* | - | - | - | - | - | - |
| Gobiesocidae unid. | - | - | - | - | - | - |
| *Clevelandia ios* | - | - | - | - | - | - |
| Syngnathidae unid. | - | - | - | - | - | - |
| Ophidiidae unid. | - | - | - | - | - | - |
| *Umbrina roncador* | - | - | - | - | - | - |
| *Lepidogobius lepidus* | - | - | - | - | - | - |
| *Pleuronichthys* spp. | - | - | - | - | - | - |
| *Atractoscion nobilis* | - | - | 1 | 0.99 | - | - |
| Pleuronectiformes unid. | - | - | 1 | 0.93 | - | - |
| *Clinocottus* spp. | - | - | - | - | - | - |
| *Citharichthys* spp. | - | - | - | - | - | - |
| *Semicossyphus pulcher* | - | - | - | - | - | - |
| Invertebrates | | | | | | |
| *Panulirus interruptus* | - | - | - | - | - | - |
| *Cancer antennarius* (megalops) | - | - | - | - | - | - |
| *Cancer anthonyi* (megalops) | - | - | - | - | - | - |
| | 2,392 | | 2,796 | | 5,657 | |

**Table A3.** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations N1-N5 in nearshore area.

| | | | Survey Number: | | 1 | | 2 | |
|---|---|---|---|---|---|---|---|---|
| | | | Survey Date: | | 06/10/04 | | 06/24/04 | |
| | | | Sample Count: | | 20 | | 19 | |
| | Taxon | Common Name | Total Count | Mean Conc. | Count | Conc. | Count | Conc. |
| | Fishes | | | | | | | |
| 1 | *Engraulis mordax* | northern anchovy | 6,318 | 423.31 | 285 | 211.27 | 27 | 24.69 |
| 2 | *Hypsoblennius* spp. | combtooth blennies | 1,959 | 137.11 | 936 | 747.96 | 325 | 335.32 |
| 3 | Engraulidae unid. | *anchovies* | 1,313 | 102.17 | 80 | 54.22 | 2 | 1.74 |
| 4 | Gobiidae unid. | gobies | 920 | 69.06 | 150 | 118.83 | 22 | 22.51 |
| 5 | *Genyonemus lineatus* | white croaker | 921 | 64.66 | - | - | 3 | 2.82 |
| 6 | larvae, unidentified yolksac | unid. yolksac larvae | 678 | 45.82 | 86 | 68.17 | 45 | 40.04 |
| 7 | *Paralichthys californicus* | California halibut | 601 | 42.91 | 39 | 28.28 | 45 | 40.90 |
| 8 | *Seriphus politus* | queenfish | 365 | 23.79 | 81 | 59.98 | 126 | 109.01 |
| 9 | Sciaenidae unid. | croaker | 306 | 22.55 | 52 | 36.56 | 17 | 15.94 |
| 10 | *Roncador stearnsi* | spotfin croaker | 286 | 20.17 | 105 | 84.11 | 66 | 63.55 |
| 11 | *Citharichthys stigmaeus* | speckled sanddab | 309 | 20.01 | 7 | 5.17 | 11 | 10.03 |
| 12 | *Gibbonsia* spp. | clinid kelpfishes | 277 | 19.29 | 36 | 29.62 | 5 | 6.93 |
| 13 | Labrisomidae unid. | labrisomid kelpfishes | 219 | 16.36 | 87 | 73.38 | 47 | 48.08 |
| 14 | *Paralabrax clathratus* | kelp bass | 213 | 14.12 | 29 | 20.88 | 43 | 36.99 |
| 15 | *Sardinops sagax* | Pacific sardine | 202 | 13.21 | 3 | 1.99 | - | - |
| 16 | *Paralabrax* spp. | sand bass | 159 | 10.76 | 12 | 9.46 | 8 | 7.03 |
| 17 | larval fish fragment | unid. larval fishes | 145 | 10.50 | 13 | 9.98 | 11 | 9.51 |
| 18 | Haemulidae unid. | grunts | 116 | 8.80 | 10 | 6.71 | 4 | 3.34 |
| 19 | *Scomber japonicus* | Pacific mackerel | 110 | 7.07 | 32 | 25.62 | 9 | 7.39 |
| 20 | *Hypsypops rubicundus* | garibaldi | 110 | 7.03 | 84 | 66.63 | 6 | 5.73 |
| 21 | larval/post-larval fish unid. | larval fishes | 93 | 6.81 | 8 | 5.67 | 5 | 4.57 |
| 22 | *Oxyjulis californica* | senorita | 79 | 5.55 | 12 | 8.05 | 2 | 1.98 |
| 23 | *Paralabrax nebulifer* | barred sand bass | 82 | 5.08 | - | - | 2 | 1.67 |
| 24 | *Sphyraena argentea* | California barracuda | 59 | 3.74 | 8 | 6.51 | 8 | 6.60 |
| 25 | *Xenistius californiensis* | salema | 55 | 3.61 | - | - | 31 | 25.82 |
| 26 | *Lepidogobius lepidus* | bay goby | 56 | 3.59 | - | - | - | - |
| 27 | *Stenobrachius leucopsarus* | northern lampfish | 51 | 3.26 | - | - | - | - |
| 28 | *Pleuronichthys verticalis* | hornyhead turbot | 43 | 2.79 | - | - | 3 | 2.56 |
| 29 | *Atherinopsis californiensis* | jacksmelt | 35 | 2.78 | - | - | - | - |
| 30 | *Umbrina roncador* | yellowfin croaker | 39 | 2.62 | 1 | 0.71 | 24 | 21.89 |
| 31 | *Pleuronichthys ritteri* | spotted turbot | 34 | 2.51 | - | - | - | - |
| 32 | *Xystreurys liolepis* | fantail sole | 27 | 1.97 | - | - | - | - |
| 33 | *Hypsopsetta guttulata* | diamond turbot | 30 | 1.97 | - | - | - | - |
| 34 | *Rimicola* spp. | kelp clingfishes | 22 | 1.79 | - | - | - | - |
| 35 | *Peprilus simillimus* | Pacific butterfish | 28 | 1.78 | - | - | 15 | 12.77 |
| 36 | *Cheilotrema saturnum* | black croaker | 24 | 1.71 | 6 | 4.76 | 4 | 3.79 |
| 37 | *Semicossyphus pulcher* | California sheephead | 21 | 1.49 | 6 | 4.23 | - | - |
| 38 | *Ophidion scrippsae* | basketweave cusk-eel | 22 | 1.48 | - | - | - | - |
| 39 | *Diaphus theta* | California headlight fish | 24 | 1.46 | 1 | 0.76 | 1 | 0.83 |
| 40 | *Acanthogobius flavimanus* | yellowfin goby | 22 | 1.46 | - | - | - | - |
| 41 | *Pleuronichthys* spp. | turbots | 19 | 1.30 | - | - | 1 | 0.83 |
| 42 | Pleuronectiformes unid. | flatfishes | 21 | 1.25 | - | - | - | - |
| 43 | *Menticirrhus undulatus* | California corbina | 16 | 1.21 | 4 | 3.04 | 4 | 4.05 |
| 44 | *Atractoscion nobilis* | white seabass | 18 | 1.18 | 2 | 1.48 | 9 | 8.43 |
| 45 | Ophidiidae unid. | cusk-eels | 15 | 1.14 | - | - | - | - |
| 46 | *Sebastes* spp. | rockfishes | 18 | 1.09 | - | - | - | - |
| 47 | *Girella nigricans* | opaleye | 16 | 1.06 | 2 | 1.36 | 1 | 0.80 |
| 48 | *Typhlogobius californiensis* | blind goby | 15 | 0.99 | 4 | 3.24 | 1 | 0.81 |
| 49 | *Citharichthys sordidus* | Pacific sanddab | 16 | 0.99 | - | - | 1 | 0.83 |
| 50 | Pleuronectidae unid. | flounders | 16 | 0.98 | - | - | - | - |
| 51 | *Trachurus symmetricus* | jack mackerel | 17 | 0.96 | 13 | 9.40 | - | - |
| 52 | *Halichoeres semicinctus* | rock wrasse | 15 | 0.95 | - | - | - | - |
| 53 | *Syngnathus* spp. | pipefishes | 10 | 0.84 | - | - | 1 | 0.81 |
| 54 | Labridae | wrasses | 11 | 0.83 | - | - | - | - |

**Table A3 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations N1-N5 in nearshore area.

| | | | Survey Number: | | 1 | | 2 | |
|---|---|---|---|---|---|---|---|---|
| | | | Survey Date: | | 06/10/04 | | 06/24/04 | |
| | | | Sample Count: | | 20 | | 19 | |
| | Taxon | Common Name | Total Count | Mean Conc. | Count | Conc. | Count | Conc. |
| | Fishes | | | | | | | |
| 55 | *Paraclinus integripinnis* | reef finspot | 14 | 0.81 | 7 | 4.25 | - | - |
| 56 | *Symphurus atricauda* | California tonguefish | 11 | 0.77 | - | - | - | - |
| 57 | *Triphoturus mexicanus* | Mexican lampfish | 12 | 0.73 | - | - | 1 | 0.83 |
| 58 | *Citharichthys* spp. | sanddabs | 9 | 0.70 | - | - | 1 | 0.83 |
| 59 | *Nannobrachium* spp. | lanternfishes | 9 | 0.57 | - | - | - | - |
| 60 | *Medialuna californiensis* | halfmoon | 7 | 0.53 | 2 | 1.69 | - | - |
| 61 | *Gillichthys mirabilis* | longjaw mudsucker | 8 | 0.51 | - | - | - | - |
| 62 | *Chilara taylori* | spotted cusk-eel | 7 | 0.50 | - | - | - | - |
| 63 | *Heterostichus rostratus* | giant kelpfish | 7 | 0.50 | 1 | 1.00 | 1 | 1.39 |
| 64 | *Hypsoblennius jenkinsi* | mussel blenny | 7 | 0.46 | - | - | - | - |
| 65 | Paralichthyidae unid. | lefteye flounders & sandd | 7 | 0.44 | - | - | - | - |
| 66 | Atherinopsidae | silverside | 4 | 0.31 | - | - | - | - |
| 67 | *Parophrys vetulus* | English sole | 5 | 0.30 | - | - | - | - |
| 68 | Myctophidae unid. | lanternfishes | 4 | 0.30 | - | - | - | - |
| 69 | *Hippoglossina stomata* | bigmouth sole | 5 | 0.29 | - | - | - | - |
| 70 | *Zaniolepis frenata* | shortspine combfish | 5 | 0.25 | - | - | - | - |
| 71 | *Ruscarius creaseri* | rouchcheek sculpin | 3 | 0.22 | - | - | - | - |
| 72 | Clupeiformes | herrings and anchovies | 3 | 0.21 | 2 | 1.92 | - | - |
| 73 | *Syngnathus leptorhynchus* | bay pipefish | 3 | 0.18 | 3 | 2.37 | - | - |
| 74 | Clupeidae unid. | herrings | 3 | 0.18 | - | - | - | - |
| 75 | *Lyopsetta exilis* | slender sole | 3 | 0.16 | - | - | - | - |
| 76 | Pomacentridae | damselfishes | 2 | 0.14 | - | - | - | - |
| 77 | *Rhinogobiops nicholsi* | blackeye goby | 2 | 0.14 | - | - | - | - |
| 78 | *Nannobrachium ritteri* | broadfin lampfish | 2 | 0.13 | - | - | - | - |
| 79 | *Cyclothone* spp. | bristlemouths | 2 | 0.13 | - | - | - | - |
| 80 | *Chromis punctipinnis* | blacksmith | 2 | 0.13 | - | - | - | - |
| 81 | *Icelinus* spp. | sculpins | 3 | 0.13 | - | - | - | - |
| 82 | Gobiesocidae unid. | clingfishes | 2 | 0.12 | 1 | 0.88 | - | - |
| 83 | *Anisotremus davidsonii* | sargo | 2 | 0.12 | - | - | - | - |
| 84 | *Sebastes jordani* | shortbelly rockfish | 2 | 0.10 | - | - | - | - |
| 85 | Blennioidei | blennies | 1 | 0.08 | - | - | - | - |
| 86 | Clinidae unid. | clinid kelpfishes | 1 | 0.08 | 1 | 1.00 | - | - |
| 87 | Chaenopsidae unid. | tube blennies | 1 | 0.07 | - | - | - | - |
| 88 | *Leptocottus armatus* | Pacific staghorn sculpin | 1 | 0.07 | - | - | - | - |
| 89 | Cynoglossidae | tongue soles | 1 | 0.07 | - | - | - | - |
| 90 | Kyphosidae | sea chubs | 1 | 0.07 | - | - | - | - |
| 91 | *Cyclothone acclinidens* | bent tooth bristlemouth | 1 | 0.07 | - | - | - | - |
| 92 | *Ilypnus gilberti* | cheekspot goby | 1 | 0.06 | - | - | - | - |
| 93 | *Gobiesox* spp. | clingfishes | 1 | 0.06 | - | - | - | - |
| 94 | Hexagrammidae unid. | greenlings | 1 | 0.06 | - | - | - | - |
| 95 | *Bathylagus ochotensis* | popeye blacksmelt | 1 | 0.06 | - | - | - | - |
| 96 | *Hypsoblennius gentilis* | bay blenny | 1 | 0.05 | 1 | 0.64 | - | - |
| | Invertebrates | | | | | | | |
| | *Panulirus interruptus* (larvae) | California spiny lobster | 98 | 7.04 | 1 | 0.82 | 71 | 64.80 |
| | *Cancer anthonyi* (megalops) | yellow crab | 80 | 4.74 | - | - | 2 | 2.38 |
| | *Cancer antennarius* (megalops) | brown rock crab | 71 | 4.11 | - | - | 3 | 3.15 |
| | *Cancer gracilis* (megalops) | slender crab | 48 | 2.93 | 2 | 1.35 | - | - |
| | *Cancer* spp. (megalops) | cancer crabs | 4 | 0.23 | - | - | - | - |
| | Cancer productus (megalops) | red rock crab | 3 | 0.22 | - | - | - | - |
| | | Totals: | 17,067 | | 40,384 | | 39,197 | |

**Table A3 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations N1-N5 in nearshore area.

| | 3<br>07/06/04<br>20 | | 4<br>08/13/04<br>20 | | 5<br>09/23/04<br>20 | | 6<br>10/21/04<br>20 | |
|---|---|---|---|---|---|---|---|---|
| Taxon | Count | Conc. | Count | Conc. | Count | Conc. | Count | Conc. |
| Fishes | | | | | | | | |
| *Engraulis mordax* | 214 | 168.35 | 73 | 62.19 | 204 | 167.31 | 94 | 81.59 |
| *Hypsoblennius* spp. | 183 | 181.20 | 234 | 255.74 | 64 | 66.94 | 1 | 0.90 |
| Engraulidae unid. | 24 | 19.48 | - | - | 3 | 2.95 | 8 | 9.23 |
| Gobiidae unid. | 86 | 82.38 | 154 | 190.83 | 48 | 52.35 | 44 | 48.00 |
| *Genyonemus lineatus* | 13 | 10.58 | 12 | 14.77 | 300 | 280.83 | 33 | 25.28 |
| larvae, unidentified yolksac | 347 | 291.29 | 72 | 75.56 | 60 | 58.18 | 16 | 15.29 |
| *Paralichthys californicus* | 194 | 173.39 | 37 | 38.97 | 170 | 171.01 | 32 | 30.06 |
| *Seriphus politus* | 50 | 42.17 | 8 | 6.62 | 97 | 88.33 | 2 | 1.94 |
| Sciaenidae unid. | 102 | 99.70 | 25 | 28.73 | 39 | 38.37 | 6 | 4.90 |
| *Roncador stearnsi* | 52 | 47.53 | 10 | 10.18 | 53 | 56.79 | - | - |
| *Citharichthys stigmaeus* | 16 | 14.03 | 5 | 4.29 | 158 | 124.03 | 93 | 85.55 |
| *Gibbonsia* spp. | 4 | 4.35 | 3 | 3.96 | 2 | 2.46 | 11 | 11.57 |
| Labrisomidae unid. | 46 | 46.77 | 22 | 27.32 | 15 | 15.46 | 1 | 0.90 |
| *Paralabrax clathratus* | 34 | 27.63 | 2 | 1.75 | 105 | 96.31 | - | - |
| *Sardinops sagax* | 9 | 8.07 | 5 | 4.93 | 25 | 22.04 | 3 | 2.47 |
| *Paralabrax* spp. | 50 | 40.52 | 31 | 29.86 | 55 | 50.38 | 2 | 1.92 |
| larval fish fragment | 41 | 35.90 | 16 | 19.10 | 29 | 30.59 | 6 | 5.77 |
| Haemulidae unid. | 5 | 4.12 | 4 | 2.79 | 91 | 95.77 | 2 | 1.68 |
| *Scomber japonicus* | 39 | 30.95 | - | - | 29 | 27.04 | 1 | 0.89 |
| *Hypsypops rubicundus* | 13 | 11.43 | 1 | 1.32 | - | - | - | - |
| larval/post-larval fish unid. | 39 | 34.86 | 14 | 17.27 | 16 | 16.26 | 6 | 5.81 |
| *Oxyjulis californica* | 17 | 15.21 | 16 | 16.22 | 17 | 17.56 | 9 | 7.70 |
| *Paralabrax nebulifer* | - | - | - | - | 80 | 64.38 | - | - |
| *Sphyraena argentea* | 27 | 20.12 | 9 | 8.12 | 7 | 7.31 | - | - |
| *Xenistius californiensis* | - | - | 2 | 1.90 | 22 | 19.24 | - | - |
| *Lepidogobius lepidus* | - | - | 1 | 1.18 | 3 | 2.32 | - | - |
| *Stenobrachius leucopsarus* | - | - | - | - | - | - | - | - |
| *Pleuronichthys verticalis* | 10 | 7.29 | 3 | 3.18 | 18 | 15.33 | 2 | 1.69 |
| *Atherinopsis californiensis* | - | - | - | - | - | - | - | - |
| *Umbrina roncador* | 14 | 11.41 | - | - | - | - | - | - |
| *Pleuronichthys ritteri* | 4 | 3.41 | 5 | 5.87 | 15 | 14.28 | 6 | 5.25 |
| *Xystreurys liolepis* | 12 | 11.12 | 1 | 1.14 | 9 | 9.07 | 3 | 2.82 |
| *Hypsopsetta guttulata* | - | - | 2 | 1.93 | 8 | 7.31 | 6 | 4.26 |
| *Rimicola* spp. | 2 | 1.96 | - | - | 12 | 13.28 | 3 | 3.20 |
| *Peprilus simillimus* | 6 | 4.66 | - | - | 4 | 3.42 | - | - |
| *Cheilotrema saturnum* | 10 | 9.25 | 1 | 0.80 | 3 | 3.60 | - | - |
| *Semicossyphus pulcher* | 1 | 1.05 | 3 | 2.95 | 8 | 8.18 | 2 | 2.27 |
| *Ophidion scrippsae* | - | - | 6 | 6.04 | 11 | 8.98 | 4 | 3.21 |
| *Diaphus theta* | 1 | 0.81 | - | - | 3 | 2.41 | 1 | 0.89 |
| *Acanthogobius flavimanus* | - | - | - | - | - | - | - | - |
| *Pleuronichthys* spp. | 1 | 0.52 | 1 | 1.14 | 11 | 9.76 | 3 | 3.18 |
| Pleuronectiformes unid. | - | - | - | - | 1 | 0.78 | 5 | 3.67 |
| *Menticirrhus undulatus* | - | - | 2 | 2.14 | 6 | 6.54 | - | - |
| *Atractoscion nobilis* | 5 | 3.58 | - | - | - | - | - | - |
| Ophidiidae unid. | - | - | 1 | 0.93 | 5 | 5.38 | 8 | 7.74 |
| *Sebastes* spp. | - | - | 1 | 1.14 | 2 | 1.85 | - | - |
| *Girella nigricans* | - | - | - | - | 3 | 2.62 | 6 | 5.49 |
| *Typhlogobius californiensis* | - | - | 1 | 0.60 | - | - | - | - |
| *Citharichthys sordidus* | - | - | - | - | 2 | 1.53 | 2 | 1.89 |
| Pleuronectidae unid. | - | - | - | - | 1 | 0.76 | - | - |
| *Trachurus symmetricus* | - | - | - | - | - | - | 2 | 1.76 |
| *Halichoeres semicinctus* | 1 | 0.81 | - | - | 10 | 8.07 | 4 | 3.52 |
| *Syngnathus* spp. | - | - | 6 | 7.95 | 1 | 0.78 | - | - |
| Labridae | 7 | 6.83 | 1 | 1.34 | - | - | 1 | 0.68 |

**Table A3 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations N1-N5 in nearshore area.

| | 3<br>07/06/04<br>20 | | 4<br>08/13/04<br>20 | | 5<br>09/23/04<br>20 | | 6<br>10/21/04<br>20 | |
|---|---|---|---|---|---|---|---|---|
| **Taxon** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** |
| **Fishes** | | | | | | | | |
| *Paraclinus integripinnis* | - | - | 7 | 6.28 | - | - | - | - |
| *Symphurus atricauda* | - | - | - | - | 10 | 8.81 | 1 | 1.23 |
| *Triphoturus mexicanus* | - | - | 1 | 0.60 | 6 | 5.23 | 2 | 1.30 |
| *Citharichthys* spp. | - | - | 1 | 1.14 | - | - | 3 | 3.36 |
| *Nannobrachium* spp. | - | - | - | - | - | - | - | - |
| *Medialuna californiensis* | - | - | 4 | 4.48 | - | - | 1 | 0.68 |
| *Gillichthys mirabilis* | - | - | - | - | - | - | - | - |
| *Chilara taylori* | - | - | - | - | - | - | 6 | 5.72 |
| *Heterostichus rostratus* | - | - | - | - | - | - | - | - |
| *Hypsoblennius jenkinsi* | - | - | 1 | 0.70 | 5 | 4.55 | 1 | 0.68 |
| Paralichthyidae unid. | 2 | 1.04 | - | - | 1 | 1.11 | - | - |
| Atherinopsidae | - | - | - | - | - | - | - | - |
| *Parophrys vetulus* | - | - | - | - | - | - | - | - |
| Myctophidae unid. | 1 | 1.21 | - | - | 1 | 0.75 | - | - |
| *Hippoglossina stomata* | - | - | 1 | 0.78 | 2 | 1.52 | - | - |
| *Zaniolepis frenata* | - | - | - | - | - | - | - | - |
| *Ruscarius creaseri* | - | - | - | - | - | - | - | - |
| Clupeiformes | - | - | - | - | - | - | - | - |
| *Syngnathus leptorhynchus* | - | - | - | - | - | - | - | - |
| Clupeidae unid. | 1 | 0.71 | - | - | - | - | 1 | 0.89 |
| *Lyopsetta exilis* | - | - | - | - | - | - | - | - |
| Pomacentridae | - | - | 1 | 0.97 | - | - | 1 | 0.90 |
| *Rhinogobiops nicholsi* | - | - | - | - | 1 | 1.01 | - | - |
| *Nannobrachium ritteri* | - | - | - | - | - | - | - | - |
| *Cyclothone* spp. | - | - | - | - | 1 | 0.77 | - | - |
| *Chromis punctipinnis* | - | - | - | - | - | - | 1 | 0.83 |
| *Icelinus* spp. | - | - | - | - | - | - | - | - |
| Gobiesocidae unid. | - | - | - | - | - | - | - | - |
| *Anisotremus davidsonii* | 1 | 0.67 | - | - | 1 | 0.90 | - | - |
| *Sebastes jordani* | - | - | - | - | - | - | - | - |
| Blennioidei | 1 | 1.05 | - | - | - | - | - | - |
| Clinidae unid. | - | - | - | - | - | - | - | - |
| Chaenopsidae unid. | - | - | - | - | - | - | - | - |
| *Leptocottus armatus* | - | - | - | - | - | - | - | - |
| Cynoglossidae | - | - | - | - | - | - | 1 | 0.89 |
| Kyphosidae | - | - | - | - | - | - | 1 | 0.89 |
| *Cyclothone acclinidens* | - | - | - | - | - | - | - | - |
| *Ilypnus gilberti* | - | - | - | - | - | - | - | - |
| *Gobiesox* spp. | - | - | - | - | - | - | - | - |
| Hexagrammidae unid. | - | - | - | - | 1 | 0.75 | - | - |
| *Bathylagus ochotensis* | - | - | - | - | - | - | - | - |
| *Hypsoblennius gentilis* | - | - | - | - | - | - | - | - |
| **Invertebrates** | | | | | | | | |
| *Panulirus interruptus* | 19 | 18.79 | 5 | 5.56 | 2 | 1.49 | - | - |
| *Cancer anthonyi* (megalops) | 29 | 22.66 | 17 | 11.75 | 16 | 12.25 | 1 | 0.63 |
| *Cancer antennarius* (megalops) | 1 | 0.67 | 50 | 35.14 | 4 | 3.35 | 2 | 2.08 |
| *Cancer gracilis* (megalops) | - | - | 33 | 26.49 | 6 | 4.92 | - | - |
| *Cancer* spp. (megalops) | - | - | 4 | 2.93 | - | - | - | - |
| *Cancer productus* (megalops) | - | - | 1 | 1.32 | - | - | - | - |
| | 39,931 | | 39,152 | 959 | 40,160 | | 38,757 | |

**Table A3 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations N1-N5 in nearshore area.

| | 7<br>11/18/04<br>20 | | 8<br>12/16/04<br>20 | | 9<br>01/13/05<br>20 | | 10<br>02/24/05<br>20 | |
|---|---|---|---|---|---|---|---|---|
| Taxon | Count | Conc. | Count | Conc. | Count | Conc. | Count | Conc. |
| Fishes | | | | | | | | |
| *Engraulis mordax* | 153 | 122.98 | 2 | 1.47 | 43 | 35.34 | 82 | 68.40 |
| *Hypsoblennius* spp. | 10 | 8.40 | 1 | 0.76 | - | - | - | - |
| Engraulidae unid. | - | - | - | - | 11 | 10.07 | 2 | 1.62 |
| Gobiidae unid. | 22 | 17.02 | 21 | 17.62 | 38 | 33.74 | 125 | 118.27 |
| *Genyonemus lineatus* | 78 | 63.14 | 8 | 6.99 | 46 | 38.44 | 143 | 124.31 |
| larvae, unidentified yolksac | 1 | 0.76 | - | - | 8 | 6.08 | 11 | 9.22 |
| *Paralichthys californicus* | 11 | 8.76 | 3 | 2.80 | 5 | 4.30 | 20 | 17.53 |
| *Seriphus politus* | - | - | - | - | - | - | - | - |
| Sciaenidae unid. | 1 | 0.67 | - | - | 6 | 5.75 | 3 | 3.04 |
| *Roncador stearnsi* | - | - | - | - | - | - | - | - |
| *Citharichthys stigmaeus* | 12 | 10.73 | 2 | 1.75 | - | - | 1 | 0.67 |
| *Gibbonsia* spp. | 6 | 5.19 | 40 | 32.33 | 61 | 57.65 | 52 | 48.45 |
| Labrisomidae unid. | - | - | - | - | - | - | - | - |
| *Paralabrax clathratus* | - | - | - | - | - | - | - | - |
| *Sardinops sagax* | 5 | 4.12 | - | - | - | - | 34 | 26.67 |
| *Paralabrax* spp. | - | - | - | - | - | - | - | - |
| larval fish fragment | 7 | 6.37 | 1 | 0.89 | 2 | 1.69 | 4 | 3.60 |
| Haemulidae unid. | - | - | - | - | - | - | - | - |
| *Scomber japonicus* | - | - | - | - | - | - | - | - |
| *Hypsypops rubicundus* | - | - | - | - | - | - | - | - |
| larval/post-larval fish unid. | - | - | - | - | 2 | 1.90 | - | - |
| *Oxyjulis californica* | - | - | - | - | 1 | 0.81 | - | - |
| *Paralabrax nebulifer* | - | - | - | - | - | - | - | - |
| *Sphyraena argentea* | - | - | - | - | - | - | - | - |
| *Xenistius californiensis* | - | - | - | - | - | - | - | - |
| *Lepidogobius lepidus* | 13 | 9.84 | 4 | 4.20 | 20 | 16.88 | 4 | 3.75 |
| *Stenobrachius leucopsarus* | - | - | - | - | 41 | 34.59 | - | - |
| *Pleuronichthys verticalis* | 1 | 1.08 | - | - | - | - | - | - |
| *Atherinopsis californiensis* | - | - | 3 | 2.10 | 10 | 9.29 | 7 | 6.78 |
| *Umbrina roncador* | - | - | - | - | - | - | - | - |
| *Pleuronichthys ritteri* | - | - | - | - | 2 | 1.77 | - | - |
| *Xystreurys liolepis* | 1 | 0.77 | - | - | - | - | - | - |
| *Hypsopsetta guttulata* | 2 | 1.51 | 1 | 1.05 | 8 | 6.75 | 2 | 1.60 |
| *Rimicola* spp. | - | - | 1 | 1.05 | 3 | 2.59 | 1 | 1.15 |
| *Peprilus simillimus* | - | - | - | - | - | - | - | - |
| *Cheilotrema saturnum* | - | - | - | - | - | - | - | - |
| *Semicossyphus pulcher* | - | - | - | - | - | - | - | - |
| *Ophidion scrippsae* | 1 | 0.95 | - | - | - | - | - | - |
| *Diaphus theta* | - | - | - | - | - | - | - | - |
| *Acanthogobius flavimanus* | - | - | - | - | 11 | 8.45 | 8 | 8.00 |
| *Pleuronichthys* spp. | - | - | - | - | - | - | - | - |
| Pleuronectiformes unid. | 10 | 7.45 | - | - | - | - | - | - |
| *Menticirrhus undulatus* | - | - | - | - | - | - | - | - |
| *Atractoscion nobilis* | - | - | - | - | - | - | - | - |
| Ophidiidae unid. | 1 | 0.76 | - | - | - | - | - | - |
| *Sebastes* spp. | 7 | 5.29 | 6 | 4.35 | - | - | - | - |
| *Girella nigricans* | 4 | 3.47 | - | - | - | - | - | - |
| *Typhlogobius californiensis* | - | - | - | - | - | - | 2 | 1.80 |
| *Citharichthys sordidus* | 9 | 7.31 | - | - | - | - | - | - |
| Pleuronectidae unid. | 1 | 0.88 | - | - | - | - | - | - |
| *Trachurus symmetricus* | - | - | - | - | - | - | - | - |
| *Halichoeres semicinctus* | - | - | - | - | - | - | - | - |
| *Syngnathus* spp. | - | - | 1 | 0.74 | 1 | 0.66 | - | - |
| Labridae | - | - | - | - | - | - | - | - |

**Table A3 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations N1-N5 in nearshore area.

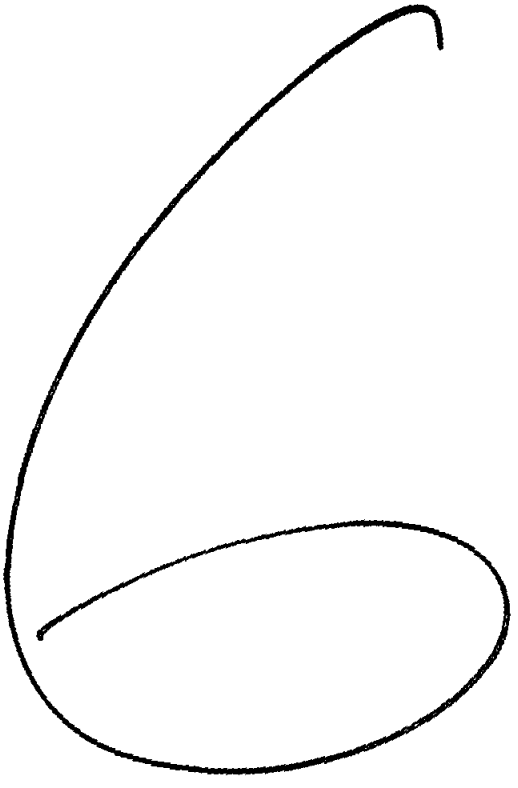
| | 7<br>11/18/04<br>20 | | 8<br>12/16/04<br>20 | | 9<br>01/13/05<br>20 | | 10<br>02/24/05<br>20 | |
|---|---|---|---|---|---|---|---|---|
| **Taxon** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** |
| **Fishes** | | | | | | | | |
| *Paraclinus integripinnis* | - | - | - | - | - | - | - | - |
| *Symphurus atricauda* | - | - | - | - | - | - | - | - |
| *Triphoturus mexicanus* | 2 | 1.54 | - | - | - | - | - | - |
| *Citharichthys* spp. | - | - | 1 | 0.89 | 2 | 1.60 | - | - |
| *Nannobrachium* spp. | 1 | 0.76 | 1 | 0.84 | 4 | 3.51 | 1 | 0.90 |
| *Medialuna californiensis* | - | - | - | - | - | - | - | - |
| *Gillichthys mirabilis* | - | - | 1 | 0.72 | 4 | 3.37 | 3 | 2.59 |
| *Chilara taylori* | 1 | 0.81 | - | - | - | - | - | - |
| *Heterostichus rostratus* | 2 | 1.83 | 1 | 0.88 | 2 | 1.35 | - | - |
| *Hypsoblennius jenkinsi* | - | - | - | - | - | - | - | - |
| Paralichthyidae unid. | 2 | 1.95 | - | - | 1 | 1.01 | 1 | 0.61 |
| Atherinopsidae | 1 | 0.84 | - | - | - | - | - | - |
| *Parophrys vetulus* | - | - | - | - | - | - | - | - |
| Myctophidae unid. | - | - | - | - | 1 | 0.96 | - | - |
| *Hippoglossina stomata* | 2 | 1.49 | - | - | - | - | - | - |
| *Zaniolepis frenata* | - | - | 1 | 0.64 | 2 | 1.33 | 1 | 0.70 |
| *Ruscarius creaseri* | - | - | - | - | 1 | 0.68 | - | - |
| Clupeiformes | - | - | - | - | - | - | 1 | 0.78 |
| *Syngnathus leptorhynchus* | - | - | - | - | - | - | - | - |
| Clupeidae unid. | - | - | - | - | - | - | 1 | 0.67 |
| *Lyopsetta exilis* | - | - | - | - | - | - | - | - |
| Pomacentridae | - | - | - | - | - | - | - | - |
| *Rhinogobiops nicholsi* | 1 | 0.85 | - | - | - | - | - | - |
| *Nannobrachium ritteri* | 2 | 1.75 | - | - | - | - | - | - |
| *Cyclothone* spp. | - | - | - | - | - | - | 1 | 0.90 |
| *Chromis punctipinnis* | 1 | 0.82 | - | - | - | - | - | - |
| *Icelinus* spp. | - | - | - | - | - | - | - | - |
| Gobiesocidae unid. | - | - | 1 | 0.72 | - | - | - | - |
| *Anisotremus davidsonil* | - | - | - | - | - | - | - | - |
| *Sebastes jordani* | - | - | - | - | 2 | 1.33 | - | - |
| Blennioidei | - | - | - | - | - | - | - | - |
| Clinidae unid. | - | - | - | - | - | - | - | - |
| Chaenopsidae unid. | - | - | - | - | - | - | 1 | 0.97 |
| *Leptocottus armatus* | - | - | - | - | - | - | 1 | 0.90 |
| Cynoglossidae | - | - | - | - | - | - | - | - |
| Kyphosidae | - | - | - | - | - | - | - | - |
| *Cyclothone acclinidens* | 1 | 0.85 | - | - | - | - | - | - |
| *Ilypnus gilberti* | - | - | 1 | 0.84 | - | - | - | - |
| Gobiesox spp. | - | - | - | - | - | - | - | - |
| Hexagrammidae unid. | - | - | - | - | - | - | - | - |
| *Bathylagus ochotensis* | - | - | - | - | - | - | - | - |
| *Hypsoblennius gentilis* | - | - | - | - | - | - | - | - |
| **Invertebrates** | | | | | | | | |
| *Panulirus interruptus* | - | - | - | - | - | - | - | - |
| *Cancer anthonyi* (megalops) | 8 | 5.93 | 2 | 1.26 | 3 | 2.96 | 1 | 1.01 |
| *Cancer antennarius* (megalops) | 4 | 2.91 | 1 | 1.12 | - | - | - | - |
| *Cancer gracilis* (megalops) | 2 | 1.44 | 2 | 1.73 | 1 | 1.05 | - | - |
| *Cancer* spp. (megalops) | - | - | - | - | - | - | - | - |
| *Cancer productus* (megalops) | - | - | - | - | - | - | - | - |
| | **38,722** | | **38,471** | | **38,736** | | **38,950** | |

**Table A3 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations N1-N5 in nearshore area.

| | 11 03/23/05 15 | | 12 04/21/05 20 | | 13 05/19/05 20 | |
|---|---|---|---|---|---|---|
| Taxon | Count | Conc. | Count | Conc. | Count | Conc. |
| Fishes | | | | | | |
| *Engraulis mordax* | 1,767 | 1,805.85 | 3,356 | 2,740.48 | 18 | 13.11 |
| *Hypsoblennius* spp. | 3 | 3.31 | 11 | 8.69 | 191 | 173.15 |
| *Engraulidae unid.* | 1,163 | 1,211.29 | 10 | 8.62 | 10 | 8.93 |
| Gobiidae unid. | 98 | 99.04 | 21 | 20.98 | 91 | 76.18 |
| *Genyonemus lineatus* | 234 | 235.43 | 45 | 33.43 | 6 | 4.54 |
| larvae, unidentified yolksac | 19 | 20.47 | 2 | 1.58 | 11 | 9.07 |
| *Paralichthys californicus* | 28 | 27.91 | 11 | 9.12 | 6 | 4.78 |
| *Seriphus politus* | - | - | 1 | 1.22 | - | - |
| Sciaenidae unid. | 38 | 44.51 | 6 | 5.95 | 11 | 9.01 |
| *Roncador steamsi* | - | - | - | - | - | - |
| *Citharichthys stigmaeus* | 2 | 1.93 | 2 | 2.00 | - | - |
| *Gibbonsia* spp. | 15 | 15.39 | 2 | 2.29 | 40 | 30.54 |
| Labrisomidae unid. | - | - | 1 | 0.74 | - | - |
| *Paralabrax clathratus* | - | - | - | - | - | - |
| *Sardinops sagax* | - | - | 118 | 101.46 | - | - |
| *Paralabrax* spp. | - | - | 1 | 0.69 | - | - |
| larval fish fragment | 5 | 5.02 | 8 | 6.78 | 2 | 1.32 |
| Haemulidae unid. | - | - | - | - | - | - |
| *Scomber japonicus* | - | - | - | - | - | - |
| *Hypsypops rubicundus* | - | - | 1 | 0.94 | 5 | 5.36 |
| larval/post-larval fish unid. | - | - | 2 | 1.69 | 1 | 0.55 |
| *Oxyjulis californica* | 1 | 1.20 | 4 | 3.35 | - | - |
| *Paralabrax nebulifer* | - | - | - | - | - | - |
| *Sphyraena argentea* | - | - | - | - | - | - |
| *Xenistius californiensis* | - | - | - | - | - | - |
| *Lepidogobius lepidus* | 3 | 2.73 | 2 | 1.99 | 6 | 3.84 |
| *Stenobrachius leucopsarus* | - | - | 10 | 7.78 | - | - |
| *Pleuronichthys verticalis* | 4 | 3.45 | 2 | 1.74 | - | - |
| *Atherinopsis californiensis* | 15 | 17.97 | - | - | - | - |
| *Umbrina roncador* | - | - | - | - | - | - |
| *Pleuronichthys ritteri* | 1 | 1.34 | 1 | 0.74 | - | - |
| *Xystreurys liolepis* | - | - | - | - | 1 | 0.75 |
| *Hypsopsetta guttulata* | 1 | 1.20 | - | - | - | - |
| *Rimicola* spp. | - | - | - | - | - | - |
| *Peprilus simillimus* | - | - | 3 | 2.33 | - | - |
| *Cheilotrema saturnum* | - | - | - | - | - | - |
| *Semicossyphus pulcher* | - | - | - | - | 1 | 0.75 |
| *Ophidion scrippsae* | - | - | - | - | - | - |
| *Diaphus theta* | - | - | 13 | 10.38 | 4 | 2.94 |
| *Acanthogobius flavimanus* | 3 | 2.58 | - | - | - | - |
| *Pleuronichthys* spp. | - | - | 1 | 0.74 | 1 | 0.75 |
| Pleuronectiformes unid. | - | - | 3 | 1.94 | 2 | 2.42 |
| *Menticirrhus undulatus* | - | - | - | - | - | - |
| *Atractoscion nobilis* | - | - | 2 | 1.91 | - | - |
| Ophidiidae unid. | - | - | - | - | - | - |
| *Sebastes* spp. | - | - | 1 | 0.77 | 1 | 0.75 |
| *Girella nigricans* | - | - | - | - | - | - |
| *Typhlogobius californiensis* | 2 | 1.94 | 2 | 2.17 | 3 | 2.30 |
| *Citharichthys sordidus* | - | - | 2 | 1.29 | - | - |
| Pleuronectidae unid. | 1 | 0.93 | 13 | 10.21 | - | - |
| *Trachurus symmetricus* | - | - | 2 | 1.38 | - | - |
| *Halichoeres semicinctus* | - | - | - | - | - | - |
| *Syngnathus* spp. | - | - | - | - | - | - |
| Labridae | - | - | 2 | 1.88 | - | - |

**Table A3 (continued).** Monthly abundance and mean concentration (#/1,000 $m^3$) of larval fishes and target invertebrates at source water Stations N1-N5 in nearshore area.

| | 11<br>03/23/05<br>15 | | 12<br>04/21/05<br>20 | | 13<br>05/19/05<br>20 | |
|---|---|---|---|---|---|---|
| **Taxon** | **Count** | **Conc.** | **Count** | **Conc.** | **Count** | **Conc.** |
| **Fishes** | | | | | | |
| *Paraclinus integripinnis* | - | - | - | - | - | - |
| *Symphurus atricauda* | - | - | - | - | - | - |
| *Triphoturus mexicanus* | - | - | - | - | - | - |
| *Citharichthys* spp. | - | - | - | - | 1 | 1.24 |
| *Nannobrachium* spp. | - | - | 1 | 0.65 | 1 | 0.75 |
| *Medialuna californiensis* | - | - | - | - | - | - |
| *Gillichthys mirabilis* | - | - | - | - | - | - |
| *Chilara taylori* | - | - | - | - | - | - |
| *Heterostichus rostratus* | - | - | - | - | - | - |
| *Hypsoblennius jenkinsi* | - | - | - | - | - | - |
| Paralichthyidae unid. | - | - | - | - | - | - |
| Atherinopsidae | 3 | 3.21 | - | - | - | - |
| *Parophrys vetulus* | - | - | 5 | 3.93 | - | - |
| Myctophidae unid. | - | - | 1 | 0.94 | - | - |
| *Hippoglossina stomata* | - | - | - | - | - | - |
| *Zaniolepis frenata* | - | - | - | - | 1 | 0.55 |
| *Ruscarius creaseri* | 2 | 2.15 | - | - | - | - |
| Clupeiformes | - | - | - | - | - | - |
| *Syngnathus leptorhynchus* | - | - | - | - | - | - |
| Clupeidae unid. | - | - | - | - | - | - |
| *Lyopsetta exilis* | - | - | 3 | 2.04 | - | - |
| Pomacentridae | - | - | - | - | - | - |
| *Rhinogobiops nicholsi* | - | - | - | - | - | - |
| *Nannobrachium ritteri* | - | - | - | - | - | - |
| *Cyclothone* spp. | - | - | - | - | - | - |
| *Chromis punctipinnis* | - | - | - | - | - | - |
| *Icelinus* spp. | - | - | - | - | 3 | 1.65 |
| Gobiesocidae unid. | - | - | - | - | - | - |
| *Anisotremus davidsonii* | - | - | - | - | - | - |
| *Sebastes jordani* | - | - | - | - | - | - |
| Blennioidei | - | - | - | - | - | - |
| Clinidae unid. | - | - | - | - | - | - |
| Chaenopsidae unid. | - | - | - | - | - | - |
| *Leptocottus armatus* | - | - | - | - | - | - |
| Cynoglossidae | - | - | - | - | - | - |
| Kyphosidae | - | - | - | - | - | - |
| *Cyclothone acclinidens* | - | - | - | - | - | - |
| *Ilypnus gilberti* | - | - | - | - | - | - |
| *Gobiesox* spp. | - | - | - | - | 1 | 0.75 |
| Hexagrammidae unid. | - | - | - | - | - | - |
| *Bathylagus ochotensis* | - | - | 1 | 0.75 | - | - |
| *Hypsoblennius gentilis* | - | - | - | - | - | - |
| **Invertebrates** | | | | | | |
| *Panulirus interruptus* | - | - | - | - | - | - |
| *Cancer anthonyi* (megalops) | - | - | - | - | 1 | 0.77 |
| *Cancer antennarius* (megalops) | - | - | - | - | 6 | 4.99 |
| *Cancer gracilis* (megalops) | - | - | - | - | 2 | 1.10 |
| *Cancer* spp. (megalops) | - | - | - | - | - | - |
| *Cancer productus* (megalops) | - | - | - | - | 2 | 1.54 |
| | 41,868 | | 42,167 | | 38,953 | |



Item 7, Supporting Document 5
April 9, 2008

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March 7, 2008

Mr. Eric Becker
San Diego Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, CA 92123-4353

RE: NCR: 02-1429.02:ebecker

Dear Mr. Becker:

Enclosed are the Carlsbad Desalination Project revised Flow, Entrainment and Impingement Minimization Plan (Plan) dated March 6, 2008, as well as Poseidon's detailed responses to your comment letter dated February 19, 2008. Poseidon respectfully requests that the Regional Board review and approve the revised Plan pursuant to Order R9-2006-0065.

If you have any questions please feel free to contact me at (619) 595-7802.

Sincerely,

Peter M. MacLaggan
Senior Vice President

Poseidon Resources Corporation
501 West Broadway Suite 840 San Diego, CA 92101 USA
619 595 7802 Fax 619 595 7802

Project Office 4600 Carlsbad Boulevard Carlsbad, CA 92008

**Poseidon Resources March 7, 2008 Response**
**San Diego Regional Water Quality Control Board Letter dated February 19, 2008**
**(NCR: 02-1429.02ebecker**

**1. The Plan does not yet integrate all the elements of the statutory requirements of California Water Code (CWC) Section 13142. The proposed project only includes "mitigation", while the statute CWC Section 13142.5(b) also requires that dischargers implement best available technology and mitigation measures. The Plan does not appear to include technology measures for the intake structure to reduce impingement and entrainment (I&E).**

**Response:** Water Code Section 13142.5(b) requires industrial facilities using seawater for processing to use the best available site, design, technology, *and* mitigation feasible to minimize impacts to marine life. The Plan has been reorganized so to sequentially analyze the steps that have been take by Poseidon to address each of these provisions:

- Chapter 2 identifies best available site feasible to minimize Project related impacts to marine life;
- Chapter 3 identifies best available design feasible to minimize Project related impacts to marine life;
- Chapter 4 evaluates identifies best available technology feasible to minimize Project related impacts to marine life;
- Chapter 5 quantifies the unavoidable impacts to marine life; and
- Chapter 6 identifies best available mitigation feasible to minimize Project related impacts to marine life

**2. The Plan provides an evaluation of impacts based upon one year of data, 2004-05 with record rainfall, but does not explicitly evaluate the on-going impacts from Poseidon's operations.**

**Response:** As described in Chapter 5 of the Plan, the potential entrainment impacts from Poseidon's seawater intake were explicitly assessed using the facility's permitted intake flows of 304 MGD and the potential impingement impacts were assessed assuming these reduced flows and discontinued power plant heat treatment effects.

**3. The Carlsbad desalination project's (CDP) listing of impacts appears to omit specific impacts to target invertebrates.**

**Response:** The requested information has been included in Chapter 5 and Attachments 2 and 5 of the revised Plan.

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**4. The proposed mitigation project does not appear to account for all pertinent impacts resulting from impingement of invertebrates, entrainment of invertebrates, discharges of brine, etc.**

**Response:** Poseidon is using all feasible methods to minimize or reduce its entrainment and impingement impacts. These methods are likely to reduce the Project related impacts to marine life well below the levels identified in Chapter 5 of the Plan. To minimize unavoidable Project related impacts to marine life, Poseidon has voluntarily committed to a state-agency coordinated process to identify the best available mitigation feasible. The objective of the mitigation portion of this plan is to identify mitigation needs, set forth mitigation goals, and present a plan and approach for achieving the goals.

As shown in Chapter 6, the proposed mitigation strategy includes the implementation of project a coastal wetlands restoration plan that will be developed pursuant to the state-agency coordinated process; long-term preservation of Agua Hedionda Lagoon; and/or other activities which will benefit the coastal environment in San Diego County. The proposed restoration plan will be enforceable through conditions of approval of the project and the program's success will be monitored through performance standards, monitoring and reporting.

**5. The CHREP did not identify and evaluate the possible mitigation projects located within the same watershed, prior to proposing the out of watershed mitigation in San Dieguito Lagoon. The best mitigation for impacting the lagoon would be to replace lost functions by restoring current upland acreage to the historic wetland condition, or by creating new wetlands where there were none historically.**

**Response:** Investigations to date have not identified any mitigation opportunities within Agua Hedionda Lagoon (see Section 6.5) that meet the goals of the program. As a result, the proposed mitigation plan includes a core offsite mitigation program that meets the plan goals and objectives that is being developed in parallel with Poseidon's continued effort to identify feasible mitigation opportunities in Agua Hedionda Lagoon.

Poseidon recognizes the Regional Board would prefer to see mitigation in Agua Hedionda Lagoon if feasible. Accordingly, while Section 6.6 of this plan identifies a core offsite mitigation project, the mitigation plan also presents an implementation action schedule that includes additional coordination activities to either (1) confirm the lack of opportunities, or (2) identify if new mitigation options exist within Agua Hedionda Lagoon.

Poseidon and will be contacting the Department of Fish & Game to more fully assess the potential for restoration opportunities in Agua Hedionda Lagoon. If subsequent Agua Hedionda Lagoon mitigation is determined to be feasible, Poseidon will coordinate with

regulatory agencies to implement such mitigation. If Agua Hedionda Lagoon mitigation is confirmed as infeasible, Poseidon will implement the proposed offsite mitigation project.

**6. The proposed mitigation ratio of 1:1 isn't fully supported. The Plan should be revised to include an evaluation of other mitigation options that may be available within the watershed. The proposed mitigation ratio appears inadequate in light of several factors generally considered by the Regional Board:**

**Response:** See the response to the previous comment regarding Poseidon's plans to further investigation restoration opportunities in the Agua Hedionda Lagoon watershed. Poseidon recognizes that the degree of mitigation required will be dependent on mitigation ratio requirements of the various regulatory agencies. As a result the proposed Plan (Chapter 6) provides for additional coordination with the regulatory agencies to finalize agency-mandated acreage requirements. Poseidon intends to prepare and submit a restoration project implementation plan to the Executive Director of the Regional Board: for review and approval which will contain the following:

- Goals, objectives, performance criteria and maintenance and monitoring to ensure the success of the proposed Restoration Plan.
- Identification of specific creation, restoration, or enhancement measures that will be used at each site, including grading and planting plans, the timing of the mitigation measures, monitoring that will be implemented to establish baseline conditions and to determine whether the sites are meeting performance criteria.
- Identification of contingency measures that will be implemented should any of the mitigation sites not meet performance criteria.
- As-built plans for each site included in the Restoration Project.
- Annual monitoring reports for no less than five years or until the sites meet performance criteria.
- Legal mechanism(s) proposed to ensure permanent protection of each site – e.g., conservation easements, deed restriction, or other methods.

**6. a - The proposed mitigation project is located within a different watershed (the San Dieguito Lagoon) instead of the Agua Hedionda Lagoon. A higher ratio may be appropriate for this project because the referenced mitigation project is out-of-kind (i.e., discharger is not actually replacing the lost resources and functions).**

**Response:** See responses 5 and 6 above.

**6.b It is not clear that the proposed one-time mitigation is adequate to compensate for the long-term ongoing impacts to beneficial uses, resources, and functions present in Agua Hedionda Lagoon.**

**Response:** As described in Chapter 6, the primary objective of the restoration plan is to create or restore coastal habitat similar to that of Agua Hedionda Lagoon, which will provide measurable long term environmental benefits adequate to fully mitigate unavoidable impingement and entrainment impacts associated with CDP operations. The restoration plan will rely on well-established methods, techniques and technologies for development and nurturing of coastal habitat of high productivity and long-term sustainability. The restoration plan will target coastal restoration and enhancement activities with clearly defined methodology to measure performance and success.

**6.c The mitigation project is for restoration of coastal wetland habitat, rather than the lagoon habitat impacted by the operation of the CDP.**

**Response:** As indicated previously, the intent of the restoration plan is to create habitat comparable to that in Agua Hedionda Lagoon.

**7. Poseidon might benefit from convening a joint meeting with the resources agencies (including California Dept Fish and Game, US Fish and Wildlife Service, Army Corps of Engineers, National Marine Fisheries) to discuss the impacts to beneficial uses, resources, and functions by the proposed project, and on the preferred mitigation project so they can discuss agency concerns/comments.**

**Response:** Chapter 6 of the revised Plan includes an action plan and schedule for coordinating with regulatory and resource agencies to finalize locations and acreages selected for the proposed mitigation. Additionally, Poseidon intends to prepare and submit a restoration project implementation plan to the Executive Director of the Regional Board and the Coastal Commission for review and approval which will contain the following:

- Goals, objectives, performance criteria and maintenance and monitoring to ensure the success of the proposed Restoration Plan.
- Identification of specific creation, restoration, or enhancement measures that will be used at each site, including grading and planting plans, the timing of the mitigation measures, monitoring that will be implemented to establish baseline conditions and to determine whether the sites are meeting performance criteria.
- Identification of contingency measures that will be implemented should any of the mitigation sites not meet performance criteria.

- As-built plans for each site included in the Restoration Project.
- Annual monitoring reports for no less than five years or until the sites meet performance criteria.
- Legal mechanism(s) proposed to ensure permanent protection of each site – e.g., conservation easements, deed restriction, or other methods.

*Specific Comments on the Plan*

**8. The assessment should address the seasonal and/or daily variations in impingement impacts.**

**Response:** The results of impingement surveys are summarized in Table 5-1 and the weekly sampling data has been included in Attachment 2 of the revised Plan. These survey data are used in conjunction with intake flows coincident with each that is recorded by the power plant in order to interpolate impingement effects between each of the weekly surveys. These weekly totals are summarized for the annual totals by species including impinged invertebrate species of a size that could be identified in the field. Samples of unknown or unrecognizable impinged species were collected for laboratory verification.

Impingement survey results not only reflect the presence of impingeable fish and invertebrates in the area of the intake screens, but also reflect the variability in their susceptibility to impingement. Many factors, such as debris on the intake screens, turbidity and local currents influence the potential impingement of each species. The majority of these factors have little or no weekly periodicity only a mild seasonality.

**9. The assessment needs to include results of an impingement study for target invertebrates. Table 3.2 includes only results for fish during 2004-05.**

**Response:** Attachment 2 contains all impingement data for invertebrates collected during the 2004/2005 impingement study. Review of the this data indicates that bothe the number and the total weight of impinged invertebrates was less than 0.1 kgs/day.

**10. The assessment states that: "The total amount of impinged organisms for the individual sampling events is presented in Table 3-2" (p.19). The Plan, however, does not clearly identify individual sampling events. The interpretation of the results is hampered by the absence of a presentation of results for impinged organisms (including invertebrates) with dates, times, and flow rates of sampling events.**

**Response:** Attachment 2 of the Plan includes the requested information.

**11. The assessment states that, "The daily biomass of impinged fish during normal operations is 0.96 kgs/day (1.92 lbs/day) for an intake flow of 304 MGD" (p.19). The text discussion should clarify how this figure is determined and how the total conversion discrepancy since 0.96 kgs converts to 2.12 lbs, not 1.92 lbs as indicated in the Plan.**

**Response:** The Plan has been revised to reflect that 0.96 kgs converts to 2.12 lbs, not 1.92 lbs as previously indicated.

The daily biomass of impinged fish, sharks and rays during normal operations of 0.96 kgs/day was calculated by dividing the total annual sample weight of 351,672 grams (see last row of the second column of the Table 5-1 summarizing all impingement data) by the total number of days per year (i.e., 351,672 grams/365 days = 963.48 grams/day = 0.96 kgs/day.

The total annual sample weight of 351,672 grams of all fish was determined based on 24-hr composite samples collected each week during the sampling period of June 2004 of June 2005. The sample accounted for all fish captured at the intake screens over 24-hr period of plant operations during the day of sampling. During each sampling event, the actual amount of the impinged fish contained in the daily sample was counted and weighted as reported in Attachment 2. In addition, the actual power plant flow during the 24-hr sampling period was noted. Than the total sample count and weight for fish of given taxon was calculated as a sum of the individual sample counts of this taxon for all sampling events. Similarly, the total flow for the sampling period was calculated as the sum of the power plant intake flows of each of the sampling events. The unit number and weight of each taxon was calculated by dividing the total number and weight of fish of a given taxon by the power plant intake flow on the day of the sample was collected. Than the unit number and weight for a given taxon was multiplied by the desalination plant intake flow of 304 MGD to calculate the projected number and weight of impinged marine organisms under the stand-alone desalination facility operation. These values are presented in Table 5-1 by taxon.

**12. The assessment of impacts from entrainment assessment appears to include larval fish but does not clearly include impacts to fish eggs and invertebrates. It is the understanding of the Regional Board that the 2004-05 study was to include monitoring of (at least) entrained Cancer crab megalops and lobster larvae, but the assessment does not appear to include these data. Also, it is unclear that sampling followed a protocol approved by the Regional Board as stated (p.22).**

**Response:** The study was conducted according to sampling a protocol reviewed and approved by the Regional Board. Prior to approving the study plan, the Board engaged an outside, independent consultant under contract and funded by the EPA, to review and

comment on the plan. The Board's consultant suggested a number of changes that were accepted and incorporated in the final Board approved study plan and protocol. The approved protocol, including sampling and sample processing methods and techniques of data analysis and modeling to assess intake effects were followed as described in the final protocol. A copy of the final protocol has been included as Attachment 3 of the Plan. Attachment 5 provides the monthly entrainment survey results of fish and target invertebrate larvae.

**13. The Plan does not clearly identify the supporting data or an explanation of underlying assumptions and calculations that were used to estimate proportional mortality values for larval fish as presented (p.23) in the Plan. Therefore, the Regional Board could not objectively evaluate the validity of the estimated *proportional entrainment mortality (12.2%) presented in the Plan.***

**Response:** Section 5.3 of the revised Plan provides a detailed explanation of the underlying assumptions, methodology and supporting data used to estimate the entrainment impact of this study.

**14. Impacts are based upon the few most commonly entrained (most abundant) species. It is unclear how much more severe impacts may be when populations are small.**

**Response:** In most cases, the more abundant a species of larvae is in an entrainment sample, the closer the intake is to the species' habitat or a center of its spawning population(s). Many of the larval fish species occurring in low numbers in the Poseidon study entrainment samples are ocean species, and conversely larval fish entrained in the highest number were lagoon species.

**15. The Regional Board has the following comments regarding the estimated number of lagoon acres impacted, as presented in the plan since:**

**a. The estimate of the number of lagoon acres used by the three most commonly entrained species is based on a 2000 Coastal Conservancy Inventory (Table 4-2, p.23). It is unclear if this document is accurate or appropriate for the purpose of determining such an important component of the area of habitat production forgone (APF). The reference document (Attachment 4, Table 2), includes the footnote caveat "...This information is not suitable for any regulatory purpose and should not be the basis for any determination relating to impact assessment or mitigation." An accurate delineation of lagoon habitats should be used for this critical component of the APF.**

**Response:** In order to calculate the APF, the number of lagoon habitat acreage occupied by the three most commonly entrained lagoon fish larvae[1] was multiplied by the average Proportional Entrainment Mortality (PM) for the three lagoon species. The estimated acres of lagoon habitat for these species are based on a 2000 Coastal Conservancy Inventory of Agua Hedionda Lagoon habitat shown in Table 5-5. The actual acreage will be confirmed through a survey of the lagoon habitats that will be conducted during the final design of Poseidon's restoration plan. To the extent that the lagoon habitat acreage established in the survey is higher or lower than that included in the 2000 Inventory, Poseidon's wetlands restoration plan will be proportional adjusted to account for the actual acreage identified in the survey.

**b. The estimate of the number of lagoon acres used by the three most commonly entrained species appears to exclude salt marsh and brackish freshwater acreage (p.23). Excluding these intertidal habitats may result in the analysis underestimating this component of the APF.**

**Response:** The areas of Agua Hedionda Lagoon that have potential to be impacted by the CDP operations are those habitats occupied by the three most commonly entrained lagoon fish larvae.[2] These habitats include 49 acres of mudflat/tidal channel and 253 acres of open water. It is not appropriate to include the other lagoon habitats in the APF calculation, such as brackish/freshwater, riparian, salt marsh or upland habitats, that are not occupied by the impacted species.

**c. The calculation of the APF (p.23) appears to use values for mortality and lagoon acreage that are not fully supported.**

**Response:** Section 5.3 of the revised Plan includes the calculations in support of the estimate of APF.

**d. The text should be revised to include a clear explanation of how the estimated lagoon acreage for commonly entrained species was adjusted to include only impacts associated with operations of CDP, rather than impacts from operation of the Encina Power Station.**

**Response:** Section 5.3 of the revised Plan includes an explanation of how the estimated lagoon acreage for commonly entrained species was adjusted to reflect stand-alone operations of CDP

[1] Ninety-eight percent of the fish larvae that would be entrained by the CDP stand-alone operations are gobies, blennies and hypsopops.
[2] Ninety-eight percent of the fish larvae that would be entrained by the CDP stand-alone operations are gobies, blennies and hypsopops.

**16. The evaluation concludes that the small fraction of marine organisms lost to entrainment would have "no effect on the species' ability to sustain their population" and goes on to describe the natural rates of high mortality (p. 24). But the argument that that there are "excess" larvae appears to omit an important consideration. Besides contributing to marine food webs, the naturally high production of larvae serves as a buffer against catastrophic and cumulative impacts to populations. These are important 'ecological services' that must not be taken lightly or given away without adequate mitigation.**

**Response:** Comment noted.

**17. The Regional Board prefers that the evaluation of the impact be presented as a rate (loss of x-amount of organisms per year, or impact/year). The proposed mitigation is a fixed amount ($3 to $4 million). It seems unlikely that a fixed amount would adequately compensate for a loss that is a rate over multiple, future years. It appears more likely that a proposed fixed amount really only accounts for mitigation for just one year of operation. The Regional Board may find a fixed amount to be acceptable, provided that:**

**a. The average annual impact could be reasonably determined and reasonably translated into a dollar amount, and that amount (or correct share) is paid every year of operation - but that is not what is proposed in the Plan or the CHREP.**

**Response:** Attachments 2 and 5 of the revised Plan includes the requested presentation of the impingement and entrainment data, respectively.

To minimize the unavoidable Project related impacts to marine life, Poseidon has voluntarily committed to a state-agency coordinated process to identify the best available mitigation feasible. The objective of the mitigation portion of the Plan is to identify mitigation needs, set forth mitigation goals, and present a plan and approach for achieving these goals.

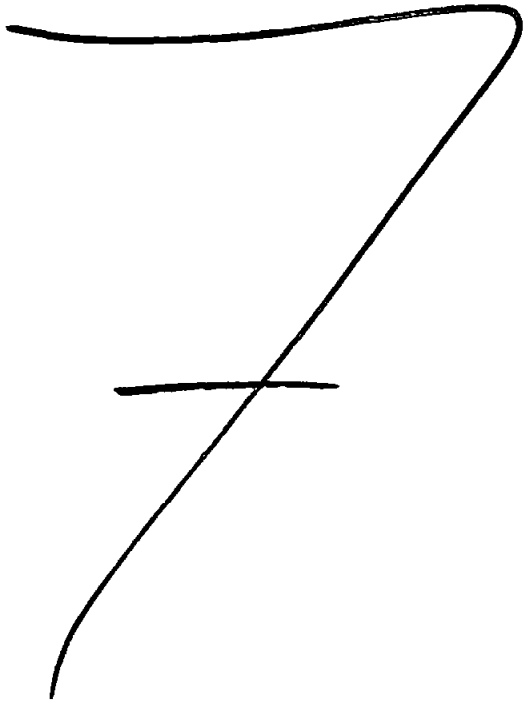
As described in Chapter 6 of the revised Plan, the proposed mitigation strategy includes the implementation of project a coastal wetlands restoration plan that will be developed pursuant to a state-agency coordinated process; long-term preservation of Agua Hedionda Lagoon; and/or other activities which will benefit the coastal environment in San Diego County. The proposed restoration plan will be enforceable through conditions of approval of the project and the program's success will be monitored through performance standards, monitoring and reporting. The Regional Board, Coastal Commission and State Lands Commission have ongoing jurisdiction over the proposed Project to insure the adequacy of the proposed restoration plan.

Additionally, ten years after the lease is issued, that the CDP will be subject to further environmental review by the State Lands Commission (SLC) to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. SLC may require additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations.

This approach will insure that the stand-alone CDP operations continue to use the best available site, design, technology and mitigation feasible to minimize Project related impacts to marine life.

**b. A fixed amount might also be reasonable if the CDP mitigates its share by increasing lagoon acreage via restoration or creation. Such in-kind mitigation would (if functional) replace the productivity lost to the operation of the CDP, and the impact would be fully mitigated.**

**Response:** See previous response.



From: Eric Becker [mailto:EBecker@waterboards.ca.gov]
Sent: Friday, March 07, 2008 1:58 PM
To: Tom Luster; wpaznokas@dfg.ca.gov; Sharon_Taylor@fws.gov; Peter MacLaggan; bruce@sdcoastkeeper.org; gabe@sdcoastkeeper.org; Judy Brown; rwilson@surfrider.org
Cc: John Odermatt; Mike McCann
Subject: Poseidon Revised Flow, Entrainment, & Impingement Plan &Response to Regional Board Comments

All-

We have just received a revised plan and a response to our February 19, 2008 comments. The new documents can be found at:

http://www.waterboards.ca.gov/sandiego/misc/desalination/desalination.html

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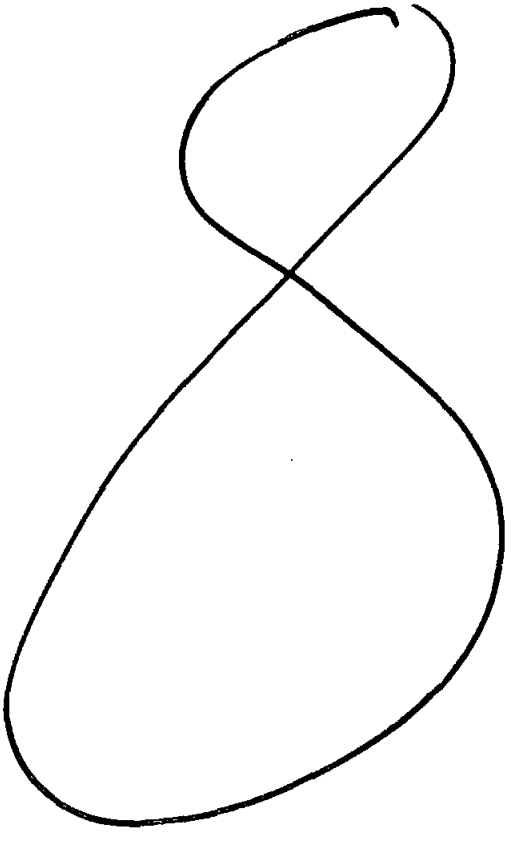

> From: Sara Townsend
> Sent: Wednesday, April 02, 2008 2:33 PM
> To: Sara Townsend; Judy Brown; ebecker@waterboards.ca.gov; WPaznokas@dfg.ca.gov; Amber Pairis; bryant.chesney; Monica.Deangelis@noaa.gov; Marci_Koski@fws.gov; Meleah Ashford; jelli@ci.carlsbad.ca.us; jgaru@ci.carlsbad.ca.us; kgr@sandag.org; ble@sandag.org; Matt Zafonte; Steve Hampton; Pierre duVair; pmaclaggan@poseidonl.com; Alison Dettmer; Tom Luster
> Subject: Marine Life Mitigation Plan Meeting for Poseidon Desal Plant
> When: Thursday, May 01, 2008 10:00 AM-1:30 PM (GMT-08:00) Pacific Time (US & Canada).
> Where: Agua Hedionda Lagoon Foundation offices in Carlsbad
>
>
> Greetings!
>
> I have spoken directly with most of you, but would like to cordially invite you to participate in an interagency working group meeting on Thursday May 1 to address potential mitigation options for impacts to marine life from impingement and entrainment by Poseidon's desal plant.
>
> Last November the Coastal Commission approved a coastal development permit for Poseidon Resources, contingent upon the completion of a Marine Life Mitigation Plan (Special Condition 8). We would like to inform you where we are in this process and seek your input in an effort to promote more efficient and effective communciation among the many agencies either directly or indirectly involved. We anticipate at least a half-day meeting, beginning at 10 am and breaking for lunch by 1 or 2 pm. After lunch, we will resume the meeting if necessary or go on site visits if possible.
>
> This meeting is not open to the general public and we would like to limit the number of participants to 2 for each agency. If there are others you think should be included, please let me know. Although we would like to, we do not currently have the funds to provide lunch. I will most likely arrange for lunch to be delivered and each person would be responsible for covering their portion of the cost (I'm open to other ideas as well).
>
> Details, such as the agenda, directions, and a more concrete plan for lunch, will follow. We look forward to meeting each of you and thank you in advance for taking the time to participate and lend your expertise. We are hopeful that this meeting will yield good contacts among agencies and a reduction in the amount of time it takes to complete our respective tasks. If you have any questions or concerns, please give me a call.
>
> Cheers,
> Sara
>
>
>
> SARA TOWNSEND
> Coastal Program Analyst
>
>
>
> CALIFORNIA COASTAL COMMISSION
> 45 FREMONT STREET
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http://www.waterboards.ca.gov/sandiego


## TECHNICAL REPORT

**TO:** John H. Robertus
Executive Officer
**SAN DIEGO REGIONAL WATER QUALITY CONTROL BOARD**

**FROM:** Chiara Clemente, Senior Environmental Scientist, Central Watershed Unit
Deborah Woodward, PhD, Environmental Scientist
Michael Porter, Engineering Geologist

**DATE:** April 4, 2008

**SUBJECT:** Review of Carlsbad Seawater Desalination Plant Flow, Entrainment, and Impingement Minimization Plan, Poseidon Resources Corporation, dated March 6, 2008

### Executive Summary

On March 7, 2008, Poseidon submitted a revised version of the subject Plan, and written responses to the Regional Board's comments from a letter dated February 19, 2008. The revised Plan includes an assessment of impacts from impingement and entrainment of marine organisms, and a process for the selection of a specific mitigation alternative. The Central Watershed Unit (CWU) has reviewed the subject plan, focusing on the validity of the assessment of impacts, and suitability of the mitigation process proposed, and alternatives reviewed. In summary, the CWU staff conclude that adoption of the Plan, as currently drafted, would be premature for the following reasons:

1. The proposed plan does not describe a process for agency approval of the calculations and variables used to assess impacts from impingement and entrainment.
2. The proposed mitigation process does not clearly identify the method for the final selection and agency concurrence of the preferred mitigation alternative.
3. There is insufficient sampling data to accurately determine the impacts of impingement and entrainment.
4. The proposed process seems to favor a pre-determined outcome (*i.e. mitigation* in San Dieguito Lagoon). Other mitigation alternatives (e.g. kelp bed enhancement and artificial reef construction) should be considered and evaluated equally as viable mitigation possibilities.

## I. Assessment of Impacts

A. Sampling Data
Impacts to marine resources attributable to the Carlsbad Desalination Plant (CDP) are described in Chapter 5 of the Plan. Impact calculations are based on results from a one-year sampling program of impingement and entrainment at the Encina Power Station (EPS). This sampling set is likely to be skewed because it does not account for annual variability and the data were collected during a year that was atypical with regards to rainfall.

It is important that ecological impacts are correctly determined because the Empirical Transport Model (used to estimate larval mortality rates) and calculation of Acres Production Foregone (used to establish the mitigation requirement) directly rely on the sampling results. If impacts are underestimated due to sampling during an atypically wet year, then subsequent modeling and calculations will lead to underestimated mortality and mitigation requirements.

B. Calculations
The Acres of Production Foregone (APF) is an estimate used by Poseidon to calculate the amount of acreage that would compensate for the entrainment loss of fish larvae (and other planktonic organisms) due to operation of the CDP. Its derivation is discussed in Chapter 6 of the Plan. However, the data used to derive this calculation are preliminary, and lack statistical power. Further justification for the values selected to calculate the Acres Production Foregone (APF) is warranted, and, after proper validation of these inputs, the APF should be recalculated. The Plan currently estimates that the restoration area needed to fully mitigate the CDP contribution to entrainment is 36.8 acres.

## II. Assessment of Mitigation Process

Poseidon's Plan describes a process to follow for evaluating mitigation alternatives that will compensate for impacts to beneficial uses of Agua Hedionda Lagoon from entrainment and impingement of marine organisms by operations at the CDP. Poseidon's proposed process contains a schedule of actions to identify the appropriate type and amount of mitigation. One of these actions is to convene a meeting with the relevant resource and regulatory agencies, prior to finalizing their specific mitigation alternative. The proposed process is unclear as to how additional alternatives (not currently listed in the Plan) will be considered or what the agency approval mechanism would be for the final selection of the specific mitigation alternative. The Plan does state that if Alternatives 2 through 8 are deemed infeasible, Poseidon will proceed with implementation of Alternative 1 (i.e. Offsite Mitigation Program – San Dieguito Lagoon), described below.

**III. Assessment of Proposed Mitigation**

The main objective of the mitigation will be to implement one or more activities that will preserve, restore and enhance existing wetlands, lagoons or other high-productivity near-shore coastal areas located in the vicinity of Agua Hedionda and/or elsewhere in San Diego County.

A. Types of Mitigation Alternatives
Poseidon's proposed Plan states that types of activities that may be included in their final specific mitigation alternative include:

1. Wetland Restoration.
2. Coastal Lagoon Restoration.
3. Restoration of Historic Sediment Elevation to Promote Reestablishment of Eelgrass Beds.
4. Marine Fish Hatchery Stocking Program.
5. Artificial Reef Development.
6. Kelp Bed Enhancement.

Each of these activities has the *potential* to compensate for the direct loss of fish, larvae, and eggs.

B. Habitat Restoration Goals:
Poseidon's proposed habitat restoration plan goals are:

1. Creation or restoration of coastal habitat.
2. Development of a technically feasible project.
3. Stakeholder acceptance for selected project.
4. Ability to measure performance.

These goals are typical of plans developed to mitigate impacts to beneficial uses of surface waters resources.

C. Alternatives:
Poseidon has identified eight alternatives to be considered and further evaluated for selection in their final preferred specific mitigation alternative. These alternatives include:

1. San Dieguito Lagoon Coastal Habitat Restoration.
   This mitigation would be out-of-watershed and includes the restoration of 37-acres of tidal prism and salt water marsh in San Dieguito Lagoon. This restoration would be good for San Dieguito Lagoon, but would provide very limited compensation for impacts to fish, larvae, and eggs in Aqua Hedionda Lagoon – which is located 12-miles north of San Dieguito Lagoon.

2. City of Oceanside Loma Alta Lagoon Restoration.
This mitigation would be out-of-watershed and Poseidon did not provide the Regional Board with any details on this alternative. This restoration potentially could create positive effects on Loma Alta Lagoon located approximately 5 miles north of Aqua Hedionda Lagoon. The project would provide very limited compensation for impacts to fish, larvae, and eggs in Aqua Hedionda Lagoon.

3. Agua Hedionda Lagoon – Land Acquisition for Expansion of an Ecological Reserve.
This mitigation alternative includes the "acquisition and preservation of land near the Agua Hedionda Lagoon's Ecological Reserve to serve as coastal habitat for wildlife and migratory birds." This mitigation alternative would benefit the waterfowl population, but potentially reduce the amount of fish and larvae due to increased waterfowl predation.

4. Agua Hedionda Lagoon – Eradication of Invasive Plants and Restoration of Native Vegetation. The mitigation alternative proposes to "remove exotic, invasive (terrestrial) plant species and replace these species with appropriate native plants to restore the protective function (surface water quality cleansing) of the lagoon watershed vegetation." Removing exotic, invasive plant species from a watershed is always desirable. However, it is unclear that the increased amount of biomass in the Lagoon from slightly improved water quality would adequately compensate for the biomass loss from impingement and entrainment by operations at the CDP.

5. Carlsbad Aquafarm at Agua Hedionda Lagoon – Abalone Stock Enhancement.
This mitigation alternative proposes to "create a stock of 100,000 abalone at the Carlsbad Aquafarm located in the Aqua Hedionda Lagoon and the use the stock to replenish the population of abalone near the intake to the lagoon and project discharge area." With respect to improving the near shore ecosystem, abalones are known to consume algae on rocks and reefs, potentially creating habitat opportunities for less competitive species. Juvenile, attached abalones are also a food source for octopus, Cabazon, and Ling cod. This mitigation would directly benefit the abalone population but do nothing to mitigate for the hundreds of other species that suffer mortality from operations at the CDP.

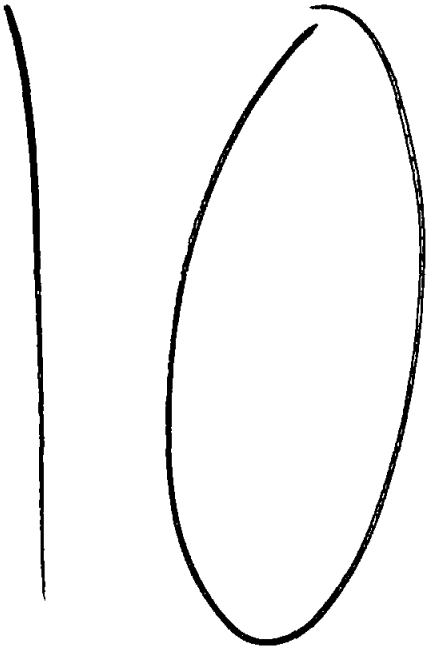
6. Buena Vista Lagoon Ecological Reserve – Completion of Restoration/Enhancement Plan Environmental Analysis.
This mitigation would be out-of-watershed and Poseidon did not provide the Regional Board with any details on this mitigation alternative. Completion of an Analysis would have limited compensation for impacts to fish, larvae, and eggs in

Aqua Hedionda Lagoon – which is located approximately 5-miles south of Buena Vista Lagoon.

7. Frazee State Beach – Coastal Bluff Habitat Restoration.
Poseidon did not provide any details on this alternative.

8. Additional Agua Hedionda Lagoon Restoration Opportunities. Poseidon's Plan indicates they investigated additional mitigation alternatives, but reportedly did not find any opportunities. Based on this conclusion, Poseidon appears to favor Mitigation Alternative No.1 – the San Dieguito Lagoon Coastal Habitat Restoration. This is unfortunate because the alternatives that are best suited to directly mitigate impacted ecological functions are normally located within the same area (watershed). In addition, the proposed mitigation ratio is lower than that normally accepted for out-of-watershed mitigation projects.

Additional alternatives (e.g. artificial reef development, kelp bed enhancement, marine fish hatchery stocking, or reestablishment of eelgrass in Agua Hedionda Lagoon) that have been found suitable and viable for mitigation of similar impacts elsewhere, do not appear to be included for consideration in the current version of the Plan. The CWU staff conclude that Poseidon should include these additional alternatives for evaluation as part of their proposed process for the selection of a specific mitigation alternative.



CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

In the Matter of the Public Hearing

RE: All items on the agenda, including, but not limited to, Poseidon Resources Corporation, Proposed Desalination Project.

CERTIFIED COPY

# PARTIAL TRANSCRIPT OF PROCEEDINGS

San Diego, California

Wednesday, April 9, 2008

Reported by:

GIDGETTE NIEVES

CSR No. 10142

Job No.:

A8287WQSD(F)

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CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

SAN DIEGO REGION

| | |
|---|---|
| In the Matter of the Public Hearing<br><br>RE: All items on the agenda, including, but not limited to, Poseidon Resources Corporation, Proposed Desalination Project. | ) |

PARTIAL TRANSCRIPT OF PROCEEDINGS, taken at 9174 Sky Park Court, San Diego, California, commencing on Wednesday, April 9, 2008, heard before THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, reported by GIDGETTE NIEVES, CSR No. 10142, a Certified Shorthand Reporter in and for the State of California.

APPEARANCES:

| | |
|---|---|
| CHAIRPERSON: | Richard Wright |
| VICE CHAIRPERSON: | David King |
| BOARD MEMBERS: | Susan Ritschel<br>Eric Anderson<br>Elizabeth Pearson Schneider<br>Wayne Weber |
| EXECUTIVE OFFICER: | John Robertus |
| LEGAL COUNSEL: | Catherine George |





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San Diego, California, Wednesday, April 9, 2008

(Partial transcript)

MR. WRIGHT: I would also say the same thing for the other organized presentations. And I know you'll do everything in organized presentations to keep comments brief and lacking representations. So at this point, let's hear staff presentation. And approximately how much time?

MR. KELLEY: Probably 15 minutes.

MR. WRIGHT: No more than 15 minutes.

MR. KELLEY: Mr. Chairman, members of the board, my name is Brian Kelley. I'm a senior water resource control engineer in charge of the new core regulatory unit. And the purpose of this item is to consider approval of a revised flow entrainment and impingement minimization plan dated March 6, 2008 as required by Order Number R9-2006-0065; MPDS number CA0109223 for the Poseidon Resources Corporation Carlsbad desalination or desal project. Because of the voluminous amount of information regarding this matter, I would first like to provide a brief list of items that are included in your agenda materials.

You have in your first agenda packet for this item the executive officer summary report project location





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map and the flow schematic. Copy of order number R9-2006-0065; copy of a regional board comment letter dated February 19, 2008 regarding the original flow entrainment and impingement minimization plan. A copy of Poseidon's revised flow entrainment and impingement minimization plan dated March 6, 2008; including attachments, which is the plan that you will be considering for adoption today. And also copies of the four comment letters that we received through March 28, which was the first mail out of agenda material to the Regional Board.

Then in the second agenda mailing sent on April four, you have a supplemental executive officer summary report. A tentative resolution number R9-2008-0039; a regional board technical report dated April 4, 2008, and copies of additional comments received since the date of the first agenda mailing up until the deadline for written comments, which was the close of business on Wednesday, April 2, 2008. Two letters, one from the San Diego County Farm Bureau and one from the Santa Fe Irrigation District, who inadvertently left out both agenda mailings. Copies of these have been handed out to you today.

I would now like to provide a brief description of the proposed Carlsbad Desalination Project and the background of the Regional Board's regulation of water

quality aspects of the project.

The proposed project would need approximately 304 million gallons per day for MGD of seawater on the Encina Power Station once through cooling water system affluent. The Encina Power Station intake is located in the southwest corner of the Agua Hedionda Lagoon. Can you see it's right in here. The powerplant is here. This is the opening to the lagoon. And then here's the discharge channel. The Carlsbad desalination facility would produce up to 50 MGD of potable water, up to 57 MGD of combined concentrated saline waste water and filter backwash waste water from the facility of with commingle of at least 200 MGD of pass through cooling water from the powerplant, and the combined flow would be discharged to the Pacific Ocean via the current Encina Power Station discharge channel across the beach. So you can see the intake structure here coming back down through the desalination plant. The 50 MGD will go into the potable water and the remaining backwash and filter will come up this way and come back into here. Commingle with the remaining discharge through the powerplant and then be discharged to the ocean.

As originally proposed, the Encina Power Station seawater intake cooling flows needs would have far exceeded that of the Carlsbad Desal Facility, the 304 MGD. More recently however it appears that the flow needed for





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power generation has been less than the 304 MGD needed for the desal facility. Last year, based on flow data from the power station, the cooling water intake flow volume dropped below the 304 MGD approximately 40 percent at a time. Regarding regional board regulation of the Carlsbad desal project, on August 16, 2006, the Regional Board adopted order Number R9-2006-0065 for the discharge of waste water from the Poseidon Carlsbad Desal Facility with the effective date of October 1st, 2006 and an expiration date of October 1st, 2011, a five year permit.

Section 6C2E of the order required Poseidon to submit for approval by the Regional Board a flow entrainment and impingement minimization plan within 180 days of adoption of the order. This plan was required in order to comply with California Water Code Section 13142.5, which mandates that new or expanded industrial installations used best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality; in other words, entrainment and impingement of all forms of marine life. Approval of this specific plan, however, is currently not a condition in the permit for commencement of the discharge from the Carlsbad Desal Facility. I would also like to point out that the permit does not provide for the situation when the desal project is operating in absence of the

powerplant operations. The current permit would need to be modified or a new permit would need to be issued to incorporate requirements for stand-alone operation of the desal project.

For reference, the Encina Power Station intake and discharge are regulated under order number R9-2006-0043, and PDES number CA 0001350, which was adopted on the same day as the Carlsbad desal permit on August 16, 2006. And both permits have the same expiration date of October 1st, 2011. The order contains a flow rate limitation of 864 MGD. Since the powerplant has a thermal discharge, it is subject to the requirements of Section 316B of the Clean Water Act. This requires that the location design, construction, and capacity of cooling water intake structures reflect the best available technology for minimizing adverse environmental impact.

Unlike the Water Code Section 13142.5B, the Clean Water Act Section does not include mitigation as a measure to minimize impacts.

On February 13, 2007, Poseidon submitted the first version of the flow entrainment and impingement minimization plan. Following regional board and other interested parties comments on the first plan, Poseidon submitted a revised plan dated June 29, 2007. To supplement this plan, Poseidon also submitted a coastal

habitat restoration and enhancement plan dated November 2007 as required by the California Coastal Commission.

The reason the board sent a letter to Poseidon dated February 19, 2008 identifying seven general comments and ten specific comments on the plans submitted up to that date.

On March 7, 2008 Poseidon, submitted a revised minimization plan dated March 6, 2008. As I mentioned, this is the plan that's being considered for approval today. Page six, dash, three of the revised plan contains a table showing an implementation approach and schedule. Following regional board approval of the plan the proposed schedule includes elements for contacting the California Department of Fish and Game. Contacts with other resource agencies, convening meetings with all agencies, distribution of mitigation program details, modification and finalization of the mitigation program, and final consideration and approval of the mitigation project or projects by the coastal provision in July 2008.

Furthermore, as stated on Page six, dash, 18, the State Land's Commission refers the right to terminate the lease if Poseidon is not using best available design, technology of mitigation measures at all times as determined by the regional board or any other federal, state, or local entity.

Based on regional board staff review of the revised plan and as described in the technical report from Kiara Clemente, senior environmental scientist for the central water unit John Robertus dated 2008 resolve concerning the data and calculations used to determine the impacts to marine life. The conclusions derived and the process for agency approval of impact assessment and final litigation alternative or alternatives. Written comments have been received from several interested parties, and copies of these comments are included in your agenda packet as previously mentioned. The comments from the California Assembly Member Martin Garrett, the City of Coronado, and the California State Land's Commission were received after the written comment deadline. And I have copies of those letters, if the board would like to accept them for consideration. Two of the letters are one page in length mostly promoting--urging the board to move forward with this project. The other one is four pages and has some specific issues regarding the revised plan.

I can hand those out if you would like to receive them.

MR. RAY: I'd like to see them.

MR. WRIGHT: If you would. Would you also provide a copy of that table. Is it in here.

MR. KELLEY: That is not in here. We prepared

that after the materials. And we can provide that to you too.

Finally, a copy of tentative resolution R9-2008-0039 has been prepared for your consideration of adoption. And as currently worded, the resolution would approve the revised flow entrainment and impingement minimization plan dated March 6, 2008 with conditions.

The first condition is that Poseidon would be required to submit an amendment to the plan subject to the approval of the Regional Board Executive Officer. That includes a specific proposal for mitigation of the impacts on marine organisms resulting from the intake of seawater from Agua Hediondа Lagoon, and resolves the concerns identified by the Regional Board to date.

And the second condition would be that the plan and any amendments approved by the executive officer are of limited duration until such time as the Encina Power Station ceases operations, and the Carlsbad Desal Facility becomes a stand-alone project. At that time minimization measures including mitigation need to be re-evaluated for appropriateness.

That concludes my formal presentation. If you have any questions regarding the plan, I can refer those to the appropriate regional board staff person, if I can't answer them myself. Otherwise, I'm available to answer

any questions the board may have for me at this time.

MR. WRIGHT: Board members, do you have any questions of Mr. Kelley at this time? Thank you.

Let's move to the presentation first by Poseidon Mr. MacLaggan, Mr. Jenkins, Mr. Mayer, Mr. Nordby, and Mr. Garrett.

Before you begin your presentation, Mr. MacLaggan, Mr. King had a couple of questions staff.

MR. KING: I had a question, Ms. George, in terms of the condition that's imposed upon us whether or not there would be work done by Mr. Robertus to see whether the subsequent submissions resolve the concerns identified in the February 19th letter. If the subsequent acts by John Robertus are going to be ministerial, and we've got a duty that's defined as resolving concerns, do we need to do that with a little more specificity? And if we need to start working on an amendment so more specific language right now that sets forth exactly what he is going to checklist off rather than leaving something that sounds discretionary and vague, I would rather refine that. And if we need to make an amendment, go ahead and have that language prepared as we're talking through all this.

MS. GEORGE: Well, I think that you can allow the executive officer. He has delegated authority from

the Regional Board to undertake variety of action. But it would certainly be appropriate to have more specificity in terms of what he would be -- what the criteria would be that he would use to evaluate whether the condition has been met. So we could work on some language to that effect.

MR. KING: Is this something we can be working on right now that we can get some language with more specificity, cause that is the concern that I'd rather raise now than raise later in the show.

MR. KELLEY: I think we could work on some language, maybe some bullet items, that would be a little bit more specific than the generalities start that.

MR. KING: Thank you.

MR. WRIGHT: The assumption is we would go along with this language provides by the executive officer may very well be or another alternative would be that we would decide we don't want that to happen. That the board itself would then take on that role--final approval.

MR. ROBERTUS: Is that a possibility?

MS. GEORGE: Yes. The permit conditions specifies the plan should be submitted for regional board approval so that's what the permit says. The executive officer can carry out that function. If you want to reserve that specifically for the board, that's certainly

your prerogative.

MR. KING: In order to define this as a ministerial duty as clear -- we want that as an option to be able to leave it in the hands of the executive officer. My preference would be to have more specificity within that particular condition. We can go any number of ways in regarding to making our final decisions on resolution before us here. But in terms of where we're going, I would rather have some language ready to be able to kick that around.

MS. SCHNEIDER: I agree with that. But I do think for the sake of being efficient that if we could get the language and we could approvE the conditions that he signs off on after our approval that would be more efficient probably. So I agree with your approach.

MR. WRIGHT: Mr. Robertus.

MR. ROBERTUS: Yes, I would like to point out that what I envision that if you delegate to me the work to continue on the plan after this date, the board will approve the plan. The plan is essentially a process by which the mitigation -- the mitigation determination resulted from that process. And as it's been presented to us by Poseidon, in order to initiate the plan, the board has to take an approval action. It's not clear in the order that the approval of the plan to initiate

implementation of the plan enclosed the approval by the board of the actual mitigation. I can oversee that process and do that on your behalf, or I can oversee that process and when the determination is made with the decision on the mitigation bring it to you for the part of the approval along with the other agency.

The question there would be to what extent would the approval of the board by your decision today be a condition of the approval of the mitigation itself. I could -- whether you want to delegate that to me or bring that back to you.

MR. WRIGHT: Just for sake of efficiency, if you can follow Mr. King's suggestion.

All right. Now Mr. MacLaggan.

MR. MACLAGGAN: Good afternoon, Mr. Chairman, members of the board. Peter MacLaggan, Poseidon Resources.

It's a pleasure to be back before you with respect to the Carlsbad desalination project eight years in the making. It's a critically needed supply element for the region, and this is one project that we all can be proud of.

Let me just say right up-front with respect to the discussion you just had, Mr. Chairman, board members, is our understanding with the respect to the proposed

tentative resolution that it does require the final plan to come back before you for approval. You're in support of that position. And if there's interest in adding additional specificity as a board member King had suggested to clarify exactly what it is that needs to be done now, and then we also are in favor of that recommendation.

And, Mr. Chairman, with respect to your request that we contain our presentation to 15 minutes, I will do everything humanly possible to do so. I'm going to skip over some matters. I've asked some of our speakers on the speaker slips before you also to waive their time. So that stack of cards will diminish as a result.

Let me jump right into --

MR. WRIGHT: Thank you.

MR. MACLAGGAN: There are eight matters that we're going to discuss. And I'm going to skip over Item one project summary in an effort to move this along. We'll discuss why the matter is before the board. What the plan entails. Why it is a conservative approach. Why the plan is responsive to the permit requirements. And the water code requirements. What are the environmental benefits. And the next steps, our recommendation.

So I'd like to take you to Page seven of your handout, if you will. And we will start there with the

question of why this matter is before the board. And your staff has correctly indicated that the plan is not required as a precondition of Poseidon's ability to commence the discharge. It's absolutely right. However, what's important to us is that the permit does require that the Regional Water Quality Control Board approve the plan as a pre-condition of the signs and building to access seawater when the powerplant is not operating. And in particular as mentioned by staff due to the intermittent operation of the powerplant. Action by the Regional Water Quality Control Board is necessary at this time to specify the conditions under which Poseidon will be able to access seawater under the permit.

Additionally, State Land's Commission has delayed its approval of Poseidon's lease for use of the existing intake and outfall until the Regional Water Quality Control Board approves the plan.

Both the City of Carlsbad and the Coastal Commission have evaluated the impacts of the project without the operation of the Encina Power Station and approved conditions for this mode of operation. An approval of the plan that's before you, conceptual approval, that it's being considered at this afternoon will facilitate ongoing coordination of uninterested state agencies and ensure that the Regional Water Quality

Control Board's requirements are being addressed.

Purpose of the plan. An anticipation that the powerplant might not always satisfy the desalination facility source water needs. Regional board required to sign and prepare a flow entrainment and impingement minimization plan to assess the feasibility of site specific plans and procedures, practices, implementations and/or mitigation measures taken together to minimize the impacts to marine organism when the project requirements exceed the volume of water being discharged by the Encina Power Station. This is the question that's before you. The adequacy of this plan and whether or not it meets the objective--the permit requirements. Again, it's a feasibility study of basic investigation of key elements of the water code, site design, technology, and mitigation to minimize the impacts to marine organisms.

With respect to development, this plan has been under development now for 13 months. We've been through three drafts and 13 months of public review and comment period. There was initial 45 day of comment period followed by a nine month comment period and the most recent draft has been out for 30 days. The point here is that there's been a lot of activity over the extended period of time, and we think that the plan has addressed the basic requirements of the water code, which is to

identify the best available site, design, technology to estimate the unavoidable impacts after taking into consideration those measures confirmed that mitigation is feasible, which we have established a state agency coordinated process for that identification of a preferred mitigation plan. In terms of the best available site requirement, this site has been given extensive scrutiny by both the City of Carlsbad and the Coastal Commission is the one site that has compatible zoning and land use; the least environmental impact; the least disruption to the community. And both the Coastal Commission and the Carlsbad EIR concluded that there are no feasible less environmentally damaging sites available for the proposed project.

With respect to design features, there are several that have been included. But the first and foremost is that we will use the discharge of the powerplant as the source water to the extent it is available, which eliminates the impacts altogether. In 2007, 61 percent of our water would have come from the powerplant leaving the desalination plant needing to pump the remaining 39 percent. For its purposes under which case we would initiate the efforts to minimize through design features the mortality of marine life related to reduction of flow, temperature of the seawater, slowing

down the velocity of that water moving through the plant. All of those minimize the mortality of the marine organisms, who will be eliminated to keep treatment processes associated with the powerplant operations.

With respect to technology, we have included a variety of technology measures to provide a broad means of minimizing the impacts. And rather than going to the specific details, let me point out for you the conclusion that the Coastal Commission reached last November on our Coastal Development Permit; wherein they found that Poseidon is using all feasible methods to minimize the reduces impact to marine organisms. With respect to impingement, the Coastal Commission found that the impacts were diminimus and insignificant. And then we considered a number of opportunities to modify the intake to the powerplant and look at alternative intakes such as subsurface wells. We've considered four types of wells. And we looked at these systems from every possible angle. And here again the alternative intake systems were determined by the City of Carlsbad as well as the Coastal Commission not to be the environmentally preferred alternative. And in the interest of brevity here, I'm going to leave it at that point. We have more details to share with you if there's any questions as to how we reach that conclusion. The point here is that these systems

will not work for a facility this size or anything close, and they have been given careful scrutiny and that conclusion has been reached by two separate regulatory bodies.

In terms of the plant itself, we think it's an extremely conservative look at how to address this problem. In that we have overestimated the entrainment and impingement impact associated with the project and accounting for how much mitigation we would require. And the reason why we did that is we decided it will take all of the use of the powerplant water. Assume it didn't happen. Assume that the technology features and the design features to slow down the water to lessen the impacts are not providing any benefit. And we assume that all of the water needed to be moved by the desalination facility, and that there will be 100 percent mortality to all the organisms in that water. This is a two, three, four-fold overestimate of the actual impacts of the project. And the significance here is for the purposes of establishing the mitigation requirement, we estimated the level of impact is considerably greater than anything that would actually occur. It's very conservative. It piles a worse case, upon worse case, upon worse case.

Moving on to the mitigation approach itself, we view this as a two-step process. The first step is to

take that conservative estimate of the impact we just described and consider where we might be able to do the mitigation. Both in Agua Hedionda Lagoon and offsite mitigation were considered. This is what I refer to as the feasibility step that is in the plan before you. The purpose of that plan again being to conduct a feasibility assessment. We last August issued a request for proposals for weapons restoration opportunities, and we canvassed the entire San Diego County community of interested folks and organizations and professionals and regulators, city governments, and so on to help us shape this plan. And they came back with eight proposals. We had a stated preference that Agua Hedionda Lagoon was our preferred sites since that's the side of the project where we'd like to do the restoration. Unfortunately, none of the projects that came back related to Agua Hedionda Lagoon. We're looking at (inaudible) high tide line. And our obligation to restore wetlands is to create a marine organisms comparable to those that we impact the operation of the intake. And so we concluded that at this juncture there was no feasible opportunities in Agua Hedionda Lagoon and begin looking offsite.

But we are about to embark with your staff and with the Coastal Commission, State Land's Commission staff, Fish and Game, other resource agencies on step two

of the process, which will lead to selection of the actual mitigation project and implementation. And here we will convene a coordinated meeting where we'll identify additional opportunities on Agua Hedionda Lagoon and elsewhere to the extent they're available. Jointly we will work through a consensus based process with the state agencies to reach a conclusion on the select preferred mitigation site and finalize the mitigation plan and bring it back per the resolution before you to your board for approval within six months.

Agua Hedionda Lagoon is a rather unique water body. In that it is a man-made resource 388 acres of perstene (sic) wetlands. And it has the greatest number of beneficial uses of any lagoon in San Diego County. And it's the only one that's a working lagoon as well as a recreational lagoon as well as a natural resource. It has fish hatcheries, fish farms. It has recreation and boating, that's not allowed in any other lagoons. And it has all the natural attributes of a marine wetland in its entirety exchange. And it's kept that way through dredging by the powerplant. The powerplant shuts down if the desalination plant does not step in as a stewart of this lagoon moving forward. The lagoon will revert back to its natural state which is closed off from the ocean and not supporting much of any of those existing

beneficial uses that have been there for the last 55 years.

We are not waiting for the plant to step into our role as a stewart. We are already in the process of working with the Agua Hedionda Lagoon Foundation. Created an educational program for the third and fourth graders. It's called the Agua Hedionda Lagoon Foundation and Academy for Environmental Science, and we're educating school kids year round on how to protect a watershed. And absent ongoing stewardship that we committed to after the powerplant shuts down we think that this lagoon will revert back to something far less than it is in its current state. So this is, in our view, part of the overall mitigation plan that's before you. A commitment to preserve this resource regardless of whether or not we do any restoration at this site or whether we do it elsewhere.

We firmly believe that the plan is responsive to your permit. I've asked our experts to share with you briefly why that's the case. Address some of the questions in the staff report. We have first Dr. Scott Jenkins from Scripps Institute of Oceanography. Just so you understand his expertise and involvement on this project, Dr. Jenkins has been with Scripps Institute of Oceanography since 1967. Shortly after receiving his Ph.D





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in 1980, he began conducting studies on Agua Hedionda Lagoon. He's conducted numerous studies since then right up to the present. He's been working with Poseidon on analyzing our project related impacts and management of the resource since 2000.

Following Scott will be David Mayer. David Mayer is the foremost expert on the west coast on entrainment and impingement studies. He basically wrote the book on how to conduct these studies. Has been involved in virtually every entrainment and impingement studies that's been conducted up and down the west coast since 1979.

David will be followed by Chris Nordby. Chris is environmental wetlands restoration specialist. For many years he was the manager of the Gasteren (sic) Research Lab at San Diego State University. He's been actively involved in the restoration projects down in the Tijuana River Valley and the Biona (sic) wetlands. And he's been brought on board here with us at Poseidon to help us identify our weapons restoration program in how we would implement such a project.

I'm going to turn it over to them and then just a few brief closing remarks when they get done, Mr. Chairman.

MR. MACLAGGAN: Mr. Jenkins.

MR. WRIGHT: He already used up 15 minutes, so next speakers please keep your comments brief.

MR. JENKINS: I'm going to address a concern in the staff report regarding the entrainment study, which started in '04 and went to '05. And a large portion of that study was conducted in water year 2005. And the staff report expressly concerns that 2005 was a year of abnormally high rainfall. And the implied worry in that comment was that the high rainfall produced in at a normal lagoon environment that was unsuitable to sustain the salt water organisms the entrainment study was targeting. I want to explain why that's not the case in this particular lagoon. There's two fundamental reasons for it. Number one it's a very small water shed. Number two, the Agua Hedionda Lagoon holds a very large volume of seawater. Now, in the upper portion of this figure, this table three of Page nine of the Tetra (sic) Tech study recently completed on the Agua Hedionda water shed. And the numbers for 2005 appear across the top. I'm going to take the maximum daily discharge measured in 2005 from the Agua Hedionda creek, and I'm going to apply that maximum daily discharge against the delusion capacity of this lagoon and show you that the resulting change of the salinity of the lagoon is very small. So then taking the 144 cubic feet per seconds maximum flow rate of the creek and applying it

over a day that would be an influx of 285 acre feet of storm water into the lagoon. Now, it's a very deep lagoon. There's over 1700 acre feet below tide of seawater in this lagoon. In addition, there's an additional 1750 feet of high (inaudibly) exchange. That would be additional water between low tide and high tide. So the total salt water volume of the lagoon is over 3,450 acre feet. So even the worse case scenario in 2005 the maximum daily discharge will only result in eight percent of lagoon water being comprised of storm water. That would depress the salinity only down to about 30.75 parts per thousand. That's about a 2.7 part per thousand depression in salinity. Now, the fluctuation of salinity in the ocean reaches those levels many times as well in the coastal ocean around the lagoon.

So in conclusion, the lagoon was not transformed into a fresh water lagoon during the 2005 rainy period. It still remained a predominantly seawater body.

I'm now going to pass the presentation off to Dr. David Mayer, who's going to explain whether these kinds of salinity depressions during the 2005 peek runoff were significant, and he will also show you how his analysis method of the entrainment losses is independent of the fluctuations of the population of these seawater organisms.

MR. MAYER: Thank you, Dr. Jenkins.

David Mayer. And board members and Chairman Wright. My background is marine biology and fishery science trained at the University of Washington.

Some decade ago I was doing work at the Yellow River and where I was using a model there to help assess entrainment affects of a powerplant that were being proposed. And the model was called Empirical Transport Model. It occurred to me at that time that it might be useful on the Pacific Coast we're looking at entrainment affects from our coastal powerplants, which are ongoing rivers, but the Pacific Ocean being regarded in some places as river flowing past these large intakes. So I imported this model into the Regional Water Quality Control Board and later the CC comprehension mission process of looking at assessing entrainment affects. And that model over these past ten years has been developed by a number of renowned university professors in mathematics and statistics at University of Washington and Santa Barbara. Most currently Dr. Amundi (sic), that I've worked with over there a long period of time at U.C. Santa Cruz, continues to work on this model. There's just some background to the kind of work that ended up to generate a number that will later be discussed by Mr. Nordby on how this mitigation fits together with offsetting the

entrainment losses.

Scott Jenkins told you our study again in 2004, and continued for a year on a monthly basis. We collected samples that are wide number of locations in both the upper and middle and lower lagoons and the open ocean. When we sample, we sample over 24 hour basis so we're able to capture the kinds of larval fish that we're focusing on a very long-term and very intensive basis.

Our findings basically lead us--and you probably heard this before. The nine percent of all the larval fish that are entrained at the existing seawater intake for the powerplant are made up by three species. And the most of one is a very small species of fish called a gobie that lives in various tiny mud burrows. The adult gobie never gets any bigger than about an inch long. It's not surprising to think that the enormous number of mud flats in the upper lagoon that those products of their reproduction are carried down into the lower lagoon where the intakes located. None of the entrained species are a major threatened that we found in none of them. Less than one percent catalase are supported commercial interest from importance. And the project has no impact on the species' ability to maintain populations but the loss of these larvaes going through the powerplant we recognize as something that could be mitigated, and that's what's being

proposed, is to create a body or an acreage of wetlands or habitat that the fish in those areas of new production will create larvaes to offset the losses through the project and partly. Question.

MR. ANDERSON: What were the other two species?

MR. MAYER: A blenie, which is again a very small fish. Probably get's no bigger than about two inches long. We believe that 90 percent of its population is found in the aquaculture pet set up in front of the intake where they're growing muscles and oysters. And these are fish that live in those little crevices.

And the third one is the garaboley (sic), which is the large fish you see bright yellow on reefs. They apparently have learned to live in large numbers on the rocky reef of the breakwater right in front of the intake. There's a very, very large population there. So those two species are actually there sort of an artificial habitat setting.

So we look at the entrainment side what's going through a very small to the powerplant and the proposed desal project. We use the result of those to scale up to the proposed volume of the desal project. We use that in a modeling to come to our conclusions. We also looked at fish and other ordinances that are actually screened out by these existing screens and the screens that we use

during the Poseidon operation, and that's known as impingement. We came to very similar conclusions at the Coastal Commission. We are finding that the losses due to this are diminimus and insignificant.

In general, we believe our results from this model I described to you, the ETM, its result is used as a portion to find an estimate of how many acres of habitat need to be replaced in order to offset the entrainment losses.

As I mentioned earlier, Dr. Amundi, who has worked with us throughout this decade in Santa Cruz continues to do so. He conceived of an idea of taking our result from this model and using the estimated acreages of habitat--and I'll be heading on as an example where we did this. And we've done this in many other places along the coast now--to come up with a number of acres. And this is referred to a perry (phonetic) production foregone. It's not that habitat is being destroyed out there. Is that if we were to try to create habitat to create enough larval fish that are being entrained that we're assuming 100 percent of them are lost. They're not all lost, but we assume that for conservatism. How many acres would we do? So we came up with a result of using this method of 37 acres. This would completely offset 100 percent of all the entrained larval fish.

What I want to leave this spot with you before I turn it over to Mr. Nordby is that we are focused on larval fish. We assume 100 percent of those are lost going through the intake. Along with every 100 gallons of water going in there's one larval fish for every 100 gallons of water. But along with those larval fish there are thousand -- tenths of thousand frankly of zoea planktons, which are crustaceans. And there's nearly millions of phytoplankton that go through essentially untouched because they are a hard body, have very hard shells. Unlike larval fish, they are kind of naked going through. So in that sense all of that goes through unharming yet this new marsh or restoration acres will produce more zoea plankton and phytoplankton. And I'm not sure what amounts but in very large quantities, so you have kind of a doubling of that affect. We're offsetting something that isn't really being affected. As well as many other animals that will be described that utilize these weapons that aren't even affected by any of the project intakes, seawater intake.

Any questions?

MR. WRIGHT: I appreciate all the expertise that's coming before us. But I just want to remind all the speakers that a mitigation plan is not before us. That's something that is supposed to be produced at a

later time.

Chris.

MR. GARRETT: I was here to talk about the environmental benefits of the restoration plan, and I'll skip right to it since it's not supposed to be before you today.

We have come up as Peter said Poseidon did look extensively for restoration potential at Agua Hedionda. We're unable to come up with any viable alternatives. Looking offsite we saw an opportunity to compliment the ongoing restoration of San Dieguito Lagoon currently being constructed by Southern California Edison. And one of the places we've identified as potentially creating this 37 or 38 acres of weapons is this magenta line that you see. here. I want to stress that this is a conceptual level mitigation. We'll bring it back before you if you endorse our attempts to take it forward. And here is our conceptual restoration. Again, I want to stress that this is conceptual. It has been modeled hydraulically. It's shown to be feasible and complimentary with the Southern California Edison project, and I hope you support it for further development.

And with that I'll turn it over to Chris Garrett to discuss some legal implications.

I want to go through this quickly. I think this

fits in the framework of why this is in front of you. As we have consistently said to all the agencies that have voted on this project, this board is the agency that the State and the Water Code and the Coastal Act give primary jurisdiction to deal with the issues of entrainment and impingement. It's under Water Code 13142.5B. So we agree with the number of the opposition letters you received. This is the statute that you should look to. And in your consideration today, you should make sure that the plan is being presented responsive to the condition and the permit approval we got in 2006 to develop a feasibility discussion of the plan that would meet Water Code 13142.5B.

So you have primary jurisdiction. Mr. MacLaggan mentioned a number of other agencies which have taken action on this. But I want to stress it's your board not the Coastal Commission, and not the City of Carlsbad, not State Land's Commission, which has given the authority under state law to implement and enforce 13142.5B under the Coastal Act. The Coastal Commission under 3412B, the Coastal Act is told to defer to the Regional Board and the State board on this issue.

The other thing I would say is when you hear from the opponents today, you received a number of letters, they simply disagree with the plan, but they have

not presented any evidence of their own or feasible sites, designs, or mitigation measures. And it is within the purview of your board to consider those issues. They have been considered by other agencies as well, and we hope you reach the same conclusion that we have the best available site, design, technology, and mitigation measures provided for in the plan that's in front of you today.

The other thing I want to say is that this is -- approval of this plan provides a framework for coordination with other agencies. We agree with the executive officer's recommendation today. It does allow you to coordinate with the other agencies, but it is this board which has the final decision-making authority under this issue under state law, and you will exercise that through the subsequent approval of the final mitigation plan that the executive officer provided for in the tentative offer -- order in front of you.

I'm going to skip over. Very briefly I think our speakers today have addressed the issues that were raised by your staff in the central water shed unit technical report. The data that we used is not atypical even though there was a higher rainfall when the data was collected. I think Dr. Jenkins addressed that. We do provide for final recalculation of the ATF, which was another question that your staff had in some of the

comments.

Another comment from your central water shed unit was what was the agency approval mechanism for final selection of specific mitigation alternative. And I believe it's been answered by your executive officer. The agency approval mechanism will be the approval of the final mitigation plan consistent with the plan you're approving today that will be back in front of you when we submit it within the next six months. We believe the plan that we put in front of you does provide for full evaluation mitigation alternatives.

In conclusion, your decision today is not a re-vote on whether the project should receive approval from the Regional Board. We received that in 2006. That decision by the way was appealed by all the number of the opponents in the room today. That appeal was rejected by the State Board. Their lawsuit against the City of Carlsbad for approving the project was also rejected by the courts. They still have pending a lawsuit against the Coastal Commission. But there's nothing in any of that litigation that precludes you from moving forward today.

The other thing I want to stress is we agree with the executive officer that the approval of this framework plan today is not a final vote on the mitigation plan. Perhaps in an ideal world it would make sense to

try to have a set of ministerial conditions that only the executive officer would need to check off and comply would not have to come back to the board. But I think given all the facts and issues that are in front of you, the comments of your staff, and the primary jurisdiction that the Board has on this issue, we endorse executive officer's tentative order, which would provide for the final plan to come back to this board.

MR. KING: Mr. Garrett, I think I misread the condition here in terms of describing in as the subsequent ministerial duty. But do you agree that it would still be helpful in terms of, you know, right now we've got a dispute over a domaining of the San (inaudible) feasibility analysis. Wouldn't it still be more helpful to go through the February 19th letter and identify exactly which concerns we want you to come back and address?

MR. GARRETT: It certainly wouldn't hurt. More clarification would be better. But we would say we feel first of all that we're in accordance with the staff recommendation. And secondly, the February 19th letter is fairly specific. And we do feel that we have addressed all those specific items or will be able to where the staff has any lingering questions. For example, this question about the reciprocality of the data 2005 that was

one of the specific questions that was raised in their February letter, and we feel we'll be able to address that as we have today.

MR. WRIGHT: Thank you.

Mr. MacLaggan, somehow you squeezed out your 30 minutes and more I might add.

MR. MACLAGGAN: I think we have several speakers who will not be addressing this so hopefully we'll make up for lost time.

Mr. Chairman, let me just jump to what's going to happen after today.

We will be working -- we've decided we will be working with the Regional Board Staff, Coastal Commission Staff, and other resource agencies to meet and reach consensus on the mitigation goals and objectives identifying that may have been overlooked in Agua Hedionda and other opportunities. This will lead to selection of a preferred mitigation site plan finalize project scope locations implementation. Bring all of that back to you in the next six months; set up future meeting date, and we'll also be going back to the Coastal Commission.

So with that let me just conclude and state that you asked us to go out and prepare a feasibility state, look at site specific plans procedures, methodologies to be implemented and/or mitigation opportunities the

feasibility thereof minimizing (inaudible) organisms. We believe we addressed that requirement per the permit conditions, and we respectfully request that the Board adopt the resolution that's before you. We thank you.

MR. WRIGHT: Can you go back to the previous illustration. In Item 1A through E, it seems like what you're saying is very different than what Mr. Garrett says when he indicated that the plan finds for full evaluation of mitigation alternatives. And you have -- here it's not what you're saying. It sounds like there's a lot more that needs to be done before you have a full evaluation of the mitigation alternatives.

MR. MACLAGGAN: We are not aware of any other opportunities. But we have heard from your staff; we've heard from the staff of other entities that they want to make sure we take a hard look at Agua Hedionda to ensure we haven't overlooked an opportunity. That's the purpose of the meeting that will be taking place next month with all of the state agencies together in one room. We're actually going to meet at the lagoon there in Agua Hedionda to see if there isn't something that had been overlooked as part of the solution.

MR. WRIGHT: Thanks.

And in all the alternatives -- and I think it came up before and you told me the answer and I still want

to make sure it's still not a possibility that I think in the analysis that they ask you to use reclaim waters as superior alternative to seawater. There's no way to get reclaimed water to your --

MR. MACLAGGAN: To our facility?

This project -- you might be aware of this being a grower in Carlsbad. Carlsbad is piped throughout with recycled water. Carlsbad is actually the most aggressive user of recycled water in this county. Where 20 percent of their water supply comes from that system. This project is intended to provide potable drinking water as supplement to that program. So it's part of the solution. Conservation, recycling, and the desalination project are intended to ensure that the full compliment of water uses of Carlsbad are commute from reliable locally generated sources.

Thank you, Mr. Chairman.

MR. WRIGHT: We have a number of elected officials who have been very patient waiting their turn. We'll start out with Mayor Lewis. Mr. Lewis is the mayor of the City of Carlsbad. Welcome.

MR. LEWIS: Thank you, Mr. Chairman, I appreciate being here this afternoon. My name is Bud Lewis. I'm a member of the City of Carlsbad. I'm here to speak on behalf of my 100,000 plus residence of our city.

As a current vice chair of the City Water Authority and a former member of the Metropolitan Water Board of Directors, I've spent 14 years working on this regional water issue, and tentative has been on desalination.

I notice when you gentlemen mentioned that you're concerned about loss of your hair. I've already lost mine. I think my eyebrows might be short as we keep going into this.

The water delivery system is unreliable. I'm sure you're all aware of that. I want to supply (inaudible) drought; above all restrictions global climate change, and intense competition for water resources. Seawater desalination offers San Diego County the most viable opportunity to create a local supply of water. This local supply is more dependable than the water we currently receive from the Delta or the Colorado River. And I'm sure you're well aware of what's happened to the Colorado River, and what's happened to the Delta next to the federal judge up there. We intentionally located the desalination project next to the powerplant at Agua Hedionda Lagoon because it is the most available and environmentally preferred location. Carlsbad is the only city in the state that had really good (inaudible) within its boundaries. We recognize that our lagoon is environmentally and recreational treasures and that the





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long time stageability is crucial to our citizen's quality of life. And Poseidon is also (inaudible) safe as ourselves. This plan that we have before you today is comprehensively addressed to the needs to protect the Pacific Ocean and Agua Hedionda Lagoon and ecological system. And once again, we rely totally upon our staff and the reports they have as far as getting this information to you.

I personally take you, too, with the repeated opposition to the project from the staff of the California Coast Commission and certain representatives of the Environmental Community.

Three years ago I was at a conference with Peter Douglas in Santa Barbara on desalination. I've known Peter for a long time, and after the presentation, which was very negative, we had a discussion. And his basic thought pattern was this. Number one, we want no more migration in California. Number two, we want no more jobs because jobs create migration. So the real issue is not so much to me what is being discussed here to a degree, but it's more or less a personal attitude that's taken place. And Peter was very open about this. If you ask him about it, he'll tell you. But my family is second, and third, fourth generation Californians, and we need jobs for my children, my grandchildren, and those coming

after.

So if we bound to all these regulatory agencies without looking at the prospects -- because I've been in government for 38 years as a local official, and I know what -- if a staff takes a very strong position with the few -- the board members one way or the other -- the thing is dead. I've seen it in the city government all the way through. I've seen it on the county level all the way through. So to me you do the best for the most. And this is what this project is all about. Because I, as a policy maker, am partially responsible for bringing new jobs, number one; maintaining the jobs that we have, number two; and number three, being able to rise above these areas to keep our folks here in California. Water is the name of the game. You folks pay a major reason. Some of you are elected officials on City Council. You know the importance of water. And so the idea that a small group can hamper the mast majority, I think that it is something you have to look at very, very closely.

MR. WRIGHT: Mr. Lewis, if you can summarize. Thank you very much.

MR. LEWIS: Thank you very much.

MR. WRIGHT: Councilwoman Ann Kulchin from the City of Carlsbad.

MS. KULCHIN: Mr. Chairman and members of the

board, hello, my name is Ann Kulchin. I've had the privilege of serving on the Carlsbad City Council for 28 years. I'm not as old as the mayor. He refers to me as a kid and I really like it.

During my tenure on the city council, I've worked diligently to assure that the Carlsbad desalination project before you today would provide a dependable local source of water to our region while meeting all applicable environmental regulations.

For its beginning the 1998 to today the desalination project has had ten years of study and public debate.

Today I'm here before you speaking in support of the proposed minimization plan for the Poseidon desalination project. As your staff report says, this has been a controversial project. And that controversy has created an environment where strong emotions rather than good science have often become the center attention. We are all stewards of the Public Trust, Council Members, Regional Board Members, State Land's commissioners, and Coastal Commissioners. We cannot let our feelings or emotions guide the public debate or the decisions that we as representatives of the public must make. We public officials find that emotions is brought into the equation from many sources; including ourselves, our staff, and

even our consultants. Sorting through what is fact and what is opinion is a complex and time consuming process; particularly when you are dealing with something as complex as this project. And although this is a complex project, the plan before you was submitted in February of 2007.

Your staff has done much analysis in providing many comments on the plan. The public has reviewed the plan and provided many comments. And the opponents of the project have reviewed the plan and provided many comments. And the plan has been amended to reflect these comments.

After more than a year review and comment, it is time for this board to take action based on the facts. The plan before you comprehensively addresses the feasibility of the best available site, the best design, the best technology, and the necessary mitigation for protection of the Pacific Ocean and the Agua Hedionda Lagoon.

It is time for action. I urge you to support the plan. Thank you for hearing me.

MR. WRIGHT: Thank you for focusing your comments.

Councilwoman Julie Nygaard also from the City of Carlsbad.

MS. NYGAARD: Thank you, chairman and members of





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the board.

I'm Julie Nygaard, and I've been a member of the Carlsbad City Council for over 13 years. I've also served as a member of the Water Quality Control Board so it's kind of nice to be home with all of you. And I do understand what you're being asked to do and with regard to this project.

My comments to you today are perhaps from a slightly different perspective than most of the speakers that you'll hear.

I want to address success that Carlsbad and the powerplant operator have had over the past 60 years in being stewards of the Agua Hedionda Lagoon.

Long before the Regional Water Quality Control Board existed, San Diego Gas & Electric built a powerplant on the coast in Carlsbad. Agua Hedionda Lagoon did not exist in its current form. Its natural state is a mud flat that was filled with stinking water, and because of that it's called stinking water Agua Hedionda. Agua Hedionda is manmade, and it's been maintained by a private power company that's part of the operation for almost 60 years. The healthy echo system you see in the lagoon today is a result of good stewardship by a private power company and a local government; not the result of mandates by state boards and commissions. Carlsbad has been

approved -- has a proven track record as a stewardship with regard to the Agua Hedionda. As an example of this when the Agua Hedionda was threatened with caulerpa taxifolia, it was Carlsbad and the power company that stepped forward to protect the environment and heal the lagoon.

The annual dredging of the outer lagoon, which is essential to the health of the whole lagoon system, has been provided by the power company all these years.

Two lagoons are proposed to be managed by the state agency--Buena Vista and Batiguitos has suffered from neglect and have received little or no maintenance effort on the part of state agencies responsible for their health. And we see no hope of change in that attitude in the near future.

Before you today is a project that can help continue the health and vitality of the Agua Hedionda Lagoon echo system. The once through cooling of Encina Power Station will eventually cease. The need for dredging is part of an operation of the powerplant will cease, and the responsibility for maintenance of the lagoon will fall upon the state. With a less and stella record, state agencies have the stewardship of the lagoon. This prospect is very disturbing to all of us on the council and in our community as well.

I understand the importance of the minimization plan. I also understand the eliminating one through cooling and replacing the existing system with reduced impact of the desalination plant will only improve the quality of the lagoon echo system. And the desalination plant will provide the necessary stewardship of the lagoon that has historically been provided by the powerplant operator.

You have an opportunity to take a leadership position to protect the long-term health of the Agua Hedionda Lagoon by approving this plan. I urge you to take heart and move forward with it, and thank you for your consideration.

MR. WRIGHT: Thank you.

Mr. Jerome Kern and council member from the City of Oceanside.

MR. KERN: Good afternoon. Thank you for your time. My name is Jerry Kern. I'm council member of the City of Oceanside. As an elected official of the third largest city in San Diego County, I have the obligation to provide water to 175,000 people. And to fulfill this obligation, the City of Oceanside has become the newest partner in the desal partner project.

Last month I toured Colorado and witnessed the tremendous stress that Colorado is undergoing. And as you

all aware the quantifications limited agreement will limit the water that we get from the Colorado River, and it will cap the amount of water we receive.

The state water project is also under enormous strain both environmentally and through regulation. Casting a doubt over how much water we can consistently expect from the Delta. All of these challenges make the Carlsbad desalination project crucial in diversifying our water supply. In fact, it's probably the most important water infrastructure power tech in San Diego in recent (inaudible). The project will produce about 56,000 acre feet of water of reliable high quality water at a cost that is assured. This is enough for 300,000 San Diegians, about ten percent of the current population. The Carlsbad desalination project is a positive step in the right direction in our region for future water supply. Poseidon Resources has demonstrated that their project will be environmentally responsible and proactive in minimizing any potential impacts. The longer this project is delayed the further we go down the road of endangering all our water supply in California. We need this immediately.

On behalf of the City of Oceanside, I urge you to approve the resolution before you this afternoon. Thank you.

MR. WRIGHT: Thank you for your brevity.





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Mitch Beauchum chairman of the Sweetwater Authority. And where is your hip helmet?

MR. BEAUCHUM: I left it back there. Thank you, members of the board. My name is Mitch Beauchum. I'm the chairman of the Sweetwater Authority Board of Directors.

Sweetwater currently provides water service approximately to 180,000 people in National City and the western part of Chula Vista. Sweetwater has recently been named the most reliable waterage in San Diego County because of the diversity of our water supply. While we have instituted many conservation measures with our customer, we believe that seawater desalination is an important part of the solution in the region long-term water reliability need.

As a member of the San Diego desal partners, nine of us now in Oceanside, our agreement to purchase water from the Carlsbad project will increase Sweetwater's Authority drought tolerance supply to 36 percent by 2010. You may ask why a water agency 50 miles from this plant is involved. We see benefit to the region that we're participating in that it also benefits us as an agency, so we're stepping forward as the other partners have done so. This new water supply will replace for a one point basis the water we currently import through the San Diego County Water Authority over the hill from catastrophes or from

Colorado.

Poseidon Resources desalination project can gain enthusiastic support from the water agencies, cities, businesses, residence, and elected officials including our entire, our entire state and federal delegation. Had you been at the Coastal Commission hearing, you couldn't believe it. I couldn't believe that that consensus was there. But the entire organization is behind us.

We appreciate the due diligence that regulatory agencies have taken to ensure that this is the most environmentally benign project possible. We believe that it has been thoroughly vented, as you saw from the technicians that presented their story here, and utilizes every possible avenue for reducing impact to the marine environment. Every step of the way some within the regulatory community have attempted to delay the project, that's been mentioned today already. If they had been successful, we would be many years, not months, away from the completion of this project. Thankfully they have been largely unsuccessful because their arguments do not hold water.

The Sweetwater Authority Board of Directors ask you to make the right decision -- sorry -- the correct decision and approve the tentative resolution for the flow entrainment and impingement minimization plan for the





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Carlsbad desal plant. Thank you for your time.

MR. WRIGHT: Mr. Beauchum, thanks for your brevity.

Again, I'd just like to urge or let the speakers know that all members of this board are very sensitive to the needs for augmenting our local water supplies through reclamation, desalination, conservation, and so on. So we don't need to focus on that as much as you would like to perhaps. But I don't think you need to sell -- I guess what I'm saying is I don't think you need to sell the Regional Board on the importance of increasing our local water supplies.

With that I'd like to hear from Gail Newton.

MS. NEWTON: Good afternoon, Chairman Wright and board members. I'm Gail Newton. I'm the chief of the division of environmental planning and management for the State Land's Commission. And I came down today to make sure that our letter was in your record, and I heard it just got admitted, so I will be brief. I will not read it. I also want to start off with I'm neither in support of opposition. I filled out a green card. You didn't have a beige neutral card.

My commission has not taken the final action on this issue yet. My staff is still reviewing materials provided by Poseidon and others. And more importantly

we're still involved in the inter agency cooperation with the commission, your staff, and the resource agencies. So some of the high points in the letter, we're still looking at minimization efforts to make sure that all minimizations efforts have been taken. And that's item number one of our letter.

And breezing through this. We're very concerned about the adequacy of mitigation and that it truly mitigate once they get there for the impacts. Those impacts are adequately quantified. We're working with the Coastal Commission Staff, and they have hired an expert to review the calculations and look more deeply into detail of this.

We're concerned about the speed with which we've gone to offsite mitigation as opposed to on site within the local lagoon, and adopt the mitigation ratios. So we're concerned that usually typically a two to one is usually used and we're down already to one to one basically.

And probably lastly is to reiterate that all the agencies are meeting on May first and second down here in San Diego to go through all the information and to come to a consensus on exactly what should be happening with minimization and with all the litigation on site.

So with that also I will make sure that my staff

includes the recommendation or action you take today in our staff's report to our commission, and that would be heard fairly soon within the next couple months. Thanks.

MR. WRIGHT: Thank you for your letter and your presentation.

And I would like to especially thank the State Land's Commission for being engaged in the quality of water down in San Diego. I was trying to figure out what side of the fence you were on. I couldn't figure out from your letter.

MS. NEWTON: We are concerned about our public trust responsibilities.

MR. WRIGHT: I understand.

Just raising the issues many of which have been brought out in other letters as well.

Mr. Eric Dietz representing Assemblyman George Plusher.

Rachel Solorzano. Field representative for assembly member Mary Salice.

MS. SOLORZANO: Good afternoon. Thank you for the opportunity to be here. I'm representing assembly member Mary Salice. And I'll read a very condensed version of the letter of support that she has.

MR. WRIGHT: Would you correct your name for me.

MS. SOLORZANO: Solorzano.

MR. WRIGHT: Solorzano. Thank you.

MS. SOLORZANO: This letter is to inform you of my support for the Carlsbad desalination plan, and request that you finalize the discharge permit by approving the key permit conditionS that requires the project to minimize marine impacts.

I am pleased to support Sweetwater Authority who provides water to thousands of my constituents and their bid to increase their drop tolerance supplies of 36 percent by 2010 and be less depended on imported water.

In 2006, Sweetwater Authority contracted Poseidon Resources to purchase 2400 acre feet of water annually. It will be produced at the Carlsbad desalination plant. This water will account for approximately ten percent of Sweetwater's annual gain almost by enough water for about 4800 families each year. The water produced will give the highest quality meeting or exceeding all drinking water regulatory standards under the law. It is also guaranteed never to cost more than the rate set by the San Diego County Water Authority. Ensuring that Sweetwater will pass up exceedingly high water rates to their customers. And this is from the vigorous passing of public scrutiny to ensure that the plant will be environmentally friendly and efficiently

operated. The project developers made every effort by the state and federal environmental regulations and has long since approved their project will not harm the Agua Hedionda or ocean. In fact, their proposal proposed the mitigation measures or resources of 37 acers of wetlands habitat, and will provide for the annual maintenance of the lagoon.

I am proud to support the successful public private partnership between Poseidon Resources with the City of Carlsbad, and I urge you to approve this project. Thank you.

MR. WRIGHT: Thank you.

Cameron Durckel Director of the San Diego office of the governor.

MR. DURCKEL: Good afternoon. It's a pleasure to be here and thank you for your service. My name is Cameron Durckel. I'm with the governor's office here in San Diego. I'll be very brief.

The governor supports desal as a critical component of the state's water plan. Specifically the public private partnership in Carlsbad here. And I will stave off my comments on public private partnerships and jobs. But please keep this in context. A very important project to move forward with in an environmentally sensitive manner.

And again, thank you for your time in addressing this matter.

MR. WRIGHT: Thank you for your time. And thank you to the governor.

Mr. Jonathan Hardy. Where is Mr. Hardy?

He's a district representative in the office of Senator Dick Chaney. We have a letter from the senator.

Ken Wiseberg or Weinberg. Couldn't read your writing.

MR. WEINBERG: Oh, it's very poor. The kids do a better job than I do.

Thank you, Chairman Wright. I will be brief.

I'm Ken Weinberg. I'm the director of Water Resources for the San Diego County Water Authority. And I was going to remark on some of the supply issues before you, but Chairman Wright really hit on the first three things that are really on the top of our list for local supply development; conservation, recycling, and seawater desalination.

I'd like to thank your board for your past support of local supply development. It's very important to this region. And I think what I will stress is that we are doing all three of those things. We are doing them all aggressively, but there is a sense of urgency. I mean, some of the previous speakers spoke about the

federal decision that limits pumping through the Delta.

These next several years are going to be extremely precarious for us in terms of supply reliability. And we were counting on this project to be online by 2011 or so. So there is a sense of urgency here. It's going to take years for the state to work through the issues in the Delta and fix the Delta. Through the course of my career, last almost 20 years, the state's been working on that issue.

So, yes, we need this for supply reliability, but there is a pressing need, and our board would really urge the Regional Board to continue to support this project and to move it forward through the process. Thank you.

MR. WRIGHT: Thanks very much.

Marcela Escobar. President of Atlantis Group.

MS. ESCOBAR: Thank you, Chairman Wright. And I will keep my comments brief. I also have a letter.

I'm here today before you requesting that you support the plan as presented by your staff. As a former planning director for the City of Carlsbad and as a Carlsbad resident, I have over 21 years experience as a regulator enforcing wetland use matters.

When I worked for the City of Carlsbad, I experienced firsthand how important this project would be,

not just for our city but for all of the region in order to be able to meet our daily water supplies. We examined all of the alternatives very closely, and we feel that the project before you is an environmentally responsible solution to meet the needs for the region. That's why we can be comfortable that the plan that is before you that is being recommended by your staff with those conditions is one that will be able to be approved consistent with all of the regulations.

And there are other comments in my letter, but I wanted to try to keep it brief. Thank you.

MR. ANDERSON: Excuse me. Could you identify yourself.

MS. ESCOBAR: Marcela Escobar.

MR. WRIGHT: We have a number of speakers representing water districts. We've already heard from elected officials. We have a number of -- can't tell for sure whether Mr. Munoz is from the Agua Hedionda Lagoon Foundation. I'll hold off on that one.

Oh, I'm sorry. You're already there so go ahead. I was trying to lump like groups together here and make this more organized. Go ahead, though.

MR. MUNOZ: Thank you very much for allowing me to jump up at that half opportunity there.

I'm president of the Agua Hedionda Lagoon

Foundation. We've been around since 1989, 1990. But in the past couple years we've really expanded our growth about three or four times over, and we've gotten a lot of visibility in the community. We are very supportive of the desalination project, and specifically with what's before you this afternoon, the plan.

This plan required for Poseidon to look at feasibility mitigation, and they've done that. This is a milestone. We think this milestone should be approved at this point. While they did look offsite, believe me no one would like the mitigation to occur in our lagoon more than our group. And sometimes on these complexed situations we need to look at things two or three times. Well, by approving this plan, we'll get that second chance because we're going to have a major meeting, as was noted to you earlier, to look again and exhaust any possibilities for mitigation in our lagoon or closer to home, if you will. And this is something that we're all very excited about. We're going to participate very aggressively in this.

The last call or solicitation to look at this mitigation plan last August, you know, it had some limited success. But we think with this new round there's going to be some new things that could be uncovered. There's been some opportunities at the regional level with RP's

that have just gone out in the last handful of weeks that we add new components and new opportunities for us to mitigate within public urinals and closer to the site of the desalination project.

Having said that, I do want to point out for those who have been around the county and the area for more than 15 years or so offsite mitigation is not a total failure. Batiguitos Lagoon would not be restored as it is today if it were not for the impacts at the Port of Los Angeles, and that's 90 miles away. Here we're talking about nine miles away. So I think you have enough to show that they met the feasibility for the mitigation plan and allow us to take a second look and make sure there's nothing closer to home that we can find out as far as the mitigation plan that can then come to you later as well. If you need a progress report before then or something, that might be fine. But we think it's important to take advantage of the balance point right now as other speakers have mentioned, elected officials, times passing, and that's creating issues. The time that has past me allow more mitigation options to surface, and then if not you can go forward with what's been laid out.

So we think you're at a balance point and the Lagoon Foundation is very much in support as our council members have spoken were being supportive in a parallel





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manner and urge you to approve what's before you today so that the mitigations can go from feasibility to a final plan.

MR. WRIGHT: Will you identify yourself for the court reporter and spell your last name.

MR. MUNOZ: Eric Munoz, M-u-n-o-z. President of the Agua Hedionda Lagoon Foundation.

MR. WRIGHT: Thank you.

Mr. Michael Barden. While Mr. Barden is coming forward. I don't see him.

I know Dennis is here. Dennis Bostad. While Dennis is coming forward, Rua Petty, Gary Arant, and William Rucker if you'd be ready.

MR. BOSTAD: Dennis Bostad, general manager of Sweetwater Authority. I have nothing further to add other than to urge you to pass the resolution. Thank you.

MR. WRIGHT: Wow, thank you.

Hard to follow.

MR. PETTY: Rua Petty. I'm president of the rainfall Municipal Water District and also on the board of directors of the San Diego County Water Authority. I'll abbreviate my comments to the fact that my agency is part of the agencies that are under contract with Poseidon. Seventy percent of our water is agricultural. And right now you're looking at an individual that is living the

problem of our water supply here in California. If you're not aware of it, the agricultural community has cut back 30 percent here in San Diego.

And my comment is that time is of the essence. Jobs are five billion dollar industry here in San Diego is at risk, and part of that is because of our lack of water. So I'm here to urge you to support moving forward post taste because providing water here in San Diego is not an easy task. Thank you.

MR. WRIGHT: Thank you.

Mr. Arant.

MR. ARANT: Gary Arant, Valley Center Municipal Water District. I'm the general manager of that agency. I'm also a director from the San Diego County Water Authority Board of Directors. And I'm formerly a member of this body. I served from 1983 to 1997. I don't want to discourage you when I tell you that in the 14 years I've served on this board and the 11 years since then the Tijuana River pollution, the Regional Board restructuring, and under funding the Regional Board programs, and the San Diego Bay cleanup, and how we are going to get the Port Authority involved were issues that we dealt with my entire time on the board. You do have some new things, and I'm kind of jealous. And that is you're not dealing with expandable diapers and bird waste removal from

beaches, so that's interesting.

But you're also dealing with this desal project, and as a rural points out Valley Center is an agricultural agency. And knowing what I know about water and the sound of the chainsaws moving the avocado trees and citrus trees, we have a serious water problem right now. Not two years from now or three years from now, but we have a water problem right now.

As one of the nine agencies under contract with the desal water, I can't emphasize how important this is. You all know that it's been explained that your adoption of this resolution today is not a parallel effort, but it's in the critical path of moving this project forward.

So with that I will urge you to adopt resolution R9-2006-0065. Thank you very much.

MR. WRIGHT: Thanks very much.

William Rucker.

MR. RUCKER: Yes, I am William Rucker. The general manager with Vallecitos Water District with about 30 years service at Vallecitos. And we serve a little over 81,000 people. We're one of the nine member agencies that have entered into long-term contract to meet 44 percent of our demand.

We would urge you to adopt this minimization plan and keep this thing moving forward. Thank you.

MR. WRIGHT: Thank you.

Mr. Robert Simmons.

MR. SIMMONS: Mr. Chairman and members of the board, will somebody give me a verbal cue when I'm about 30 seconds away from running out of time.

MR. WRIGHT: I'll do that, sir.

MR. SIMMONS: Thank you very much.

My name is Robert Simmons. I'm former chief trial lawyer for the Sierra Club in a number of federal court litigation matters over the years that concerns water supply and the protection of coastal marine recovery agencies on issues that are very similar to those before you now. In addition to that over the last 20 years, I've emphasized environmental and water issues both as professor of law as well as environmental attorney.

I feel incompetent to stand here and express my strong support for the Poseidon plan. I think it responds soundly and directly to the request you've made, the conditions that you've expressed after your last hearing. It complies with all applicable laws. It's a good plan, and I urge you to endorse it today.

I know that there are a number of opponents. Colleagues of mine or at least former colleagues of mine in the environmental community who will soon come up before you and argue that you shouldn't take action today.

You should postpone consideration by some future date. I just want to remind you that these are the same people who have been actively opposing the entire project for the past five years in and out of court every step of the way until today, and they failed each step because they have not had any good sound legal as well as factual arguments. I know that they're not in the mainstream of the environmental community. I know where that community is. I know that the majority of environmentalists in this economy as well as the overwhelming majority of the public in this area agree with me, and that is that reasonable impacts to coastal geniuses is not inconsistent. Doesn't conflict with the production of new water supply to serve this water starving area.

I know, Mr. Chairman, you don't want me to talk about water supply, but let me approach it briefly from this perspective.

And that is this. The Poseidon plant will produce water that will serve 110,000 families in this region, and we need it as soon as possible.

MR. WRIGHT: Mr. Simmons, you have 30 seconds.

MR. SIMMONS: Beyond that there's a critical long-term need to divorce ourselves from the near total dependance upon imported water. Water conservation alone nor with water recycling; they won't accomplish this goal.

But add desalination to the other two strategies and we can achieve this dream of goal of water self sufficiency.

Gentlemen and ladies, maybe not in bylaw tact, but certainly yours in the lifetimes of our children. If we move fast, we need to do that. And I appeal you to endorse this plan today and move that certainty along so that we can rely upon it. Thank you.

MR. WRIGHT: Next we have Steve Cedie followed by Douglas Metz, Bill Clavenger, Bill Smith.

Is Mr. Cedie here? Mr. Metz.

MR. METZ: Thank you, Chairman Wright and members of the board. My name is Douglas Metz, M-e-t-z.

I appear in my capacity as a member of the infrastructure committee of the San Diego Regional Chamber of Commerce.

I urge that the board without further delay approve Poseidon's proposed flow entrainment and impingement plan. This decision will be amply supported by several findings. I'll summarize only three in my one page as submission.

First of all, the project sponsors and local governments have exercised due diligence in undertaking environmental studies evidencing minimal adverse impact. In particular the plan has been under review for 12 months and was extensively revised on two occasions in response





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to the comments received from the board staff and the public. The plan assures, utilizes rather, best available site design, technology, and mitigation measures.

Second, the plan assures maintenance of the water quality of a well functioning lagoon and of the surrounding marine habitat, and is augmented by mitigation measures to be implemented subsequently.

Last and very important of equal by preceding speaker, time is of the essence. And I urge that the project after over eight years in the making not be further delayed by being burdened with conditions requiring experimentation with untested water intake and discharge technologies. Thank you very much.

MR. METZ: Thank you Mr. Metz. Bill Clavenger.

MR. KING: If I can disclose for the record Doug King Law Group. This is completely individual capacity that he is here. We're not representing any individual clients on this matter.

MR. WRIGHT: Mr. Schmidt.

MR. SCHMIDT: Chairman and members, Jim Schmidt, retired banker attorney. I've served in three positions in the state government, and I now serve on four public boards all without pay by the way.

Anyway, an overriding issue I think is that we

must have more sources of water you've heard that. The opponents -- one thing about growth, which I know the opponents oppose growth. The reason we're growing is besides foreign immigration people are living too long, that's one of the reasons. There's births over deaths. So are they going to oppose the use of prescription drugs. I'm worried about that. Because my cholesterol is way down 100 points because of prescription drug, if you want to cut down drug.

Anyway, we face a water shortage. It's not just Carlsbad; as indicated it's Sweetwater and other areas.

In my article I gave you, which I wrote last year before I testified, I talked about the horror stories of Monterey, and Santa Barbara the horror stories. I'll never will forget in Monterey and Carmel--I left there about 30 years--ago every place you went to a men's room and above the urinal it said do not flush. You can't forget things like that.

Now the Coastal Commission and the same opponents you'll have today, the same people, but labor business were there, Chamber of Commerce, local government all in favor. The night of three voting included both members of the San Diego City area. Both members of San Diego were in favor. This will be the 11th plant in California. Not the first one, the 11th plant. The

governor is pushing it, and again all the assembly members, all the state senators, all the members of congress support this.

So I would just urge you very strongly to support this. Make it happen.

We have to have water. I want to be able to water my lawn. That is one of the things I saw up in Santa Barbara. My friends told me they couldn't water their lawns. The company that sprays lawns green made a lot of money. That's unfortunate. Thank you very much.

MR. WRIGHT: Thank you.

Chuck Badger followed by Mike Madigan, Gary Knight and an Angelika Villagrana.

MR. BADGER: Good afternoon, Chairman Wright and other board members. My name is Chuck Badger, B-a-d-g-e-r. I'm a third generation citrus farmer from the North County.

My grandfather first came here in 1922, and he came here to farm. He soon realized that water was going to be his most important challenge. He also started the Santa Fe irrigation district. He also served on the Metropolitan Water Board.

My father continued to farm and be involved in water. In fact, he served on this board a few years ago and the seat is now being occupied by Mr. Anderson.

Eric Larson our executive director sent you a letter. In that he details the drought in the Colorado River you already know about. The couple of the regulatory drought at the Delta, and of course the 30 percent cut back that you've already heard about.

One thing I haven't heard discussed a lot about today is the failure of our state legislators to put any water bonds on ballots this year that will help bring us need of water. But really that's why it's very important for local government agencies and regulatory agencies to help us with water here in San Diego. You know that we need the water.

I was making decisions today on which lemon groves not to water and which ones should get water because of the drought. It's been very difficult for a lot of us.

All I want to do is conclude by saying if we want agriculture in San Diego to continue to provide abundant local products for San Diegans as well as providing viable open space we need reliable water. My father and grandfather worked hard to secure water for my future, and I'm working hard to secure water for my children's future. So I hope that you can help by approving this resolution. Thank you.

MR. WRIGHT: Congratulations on your position as

president of the Farm Bureau.

MR. ANDERSON: I need to disclose that I'm a member of the Farm Bureau Board.

MR. WRIGHT: Mr. Madigan.

MR. MADIGAN: Thank you, Mr. Chairman. My name is Mike Madigan. I'm a past chair of the San Diego County Water Authority Board. I'm a past chair of the California Water Commission, and for seven years chairman of the Bay Delta advisory council to the CalFed process.

I'm here to do two things. First, I have letters in support from Senator Mark Whiland, Assembly Member Shirley Martin, Assembly Member George Plusher, and Assembly Member Martin Garrett whose staff members were here earlier and not able to stay. I'd like to deliver these to your staff, if that's acceptable. Thank you.

Secondly, to urge you to approve this plan in support of which I will offer you the following four reasons. One, obviously you have asked for this plan, and it is now submitted to you as requested, and it identifies that multiple mitigation plans are feasible.

Two, your action on this item today will bring you into alignment with the current status of the desalination project of both the Coastal Commission and the City of Carlsbad, and will allow you to both exercise your statutory role on entrainment mitigation and work

jointly with those other agencies on the selection for the final mitigation plan.

Three, a continuance, a delay will only serve the cause of delay.

And four, for all the reasons which you well understand this project is even more important today than it was when it was first brought to you.

Thank you for listening.

MR. WRIGHT: Thank you.

Mr. Gary Knight.

MR. KNIGHT: Chairman Wright and all board members, cut my comments about why we need water you know why. The point I want to make this day is there will be no project that we can put forward to you that will have zero impacts. We know desalination projects running and operating throughout the world. I presented Monday to a trade delegation from Sweden. When I told them about these meetings and other meetings occurring on this, they looked at me and asked why can't you get it done. The rest of the world has been able to.

So we look at this project as being submitted to you for the impacts. They have minimized it by using best practices, and they provide the mitigation as requested. We would urge you that you approve this resolution and help us get the water that we already know we need. Thank





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you.

MR. WRIGHT: Angelika Villagrana.

MS. VILLAGRANA: Thank you, Mr. Chairman and members of the board, Mr. Robertus. My name is Angelica Villagrana representing the San Diego Regional Chamber of Commerce; our 3,000 member companies and their 400,000 employees.

Water reliability for our region has always been one of our most important goals. And therefore, we're very interested in any alternative that minimizes our dependence of imported water and diversifies our water supply portfolio. We believe desalination is one such alternatives and a good one. In our opinion, Poseidon Resources has designed a project with minimal environmental impacts. We believe by preparing the flow entrainment and impingement minimization plan Poseidon Resources has provided a road map as to how the project can move forward using the best available site, design, technology, and mitigation feasible to minimize impacts on marine life. Reliable new water needed and the development of local supply makes sense.

Additional infrastructure for importing more water could cost lots and lots of money with limited assurance of water supply reliability. At the time when the entire state in south were suffering from drought in

environmental water supply issues, we have the opportunity to bring online an environmentally responsible source of drinking water right here in our backyard. Let's not waste that opportunity. It is in all of our interest to move this important water supply alternative forward, (inaudible) water supply in your support.

And our letter of support is in your agenda package. And if I may, Mr. Chairman, (inaudible) wanted to be here in support, but they are in Sacramento at a legislative meeting. Mr. Joe (inaudible) President and chairman, and he has asked me to supply you with a letter of their support, if that's permissible. And for your information by Derrick 550 life sciences companies here in the San Diego region, I have copies of the letter for you. Thank you very much.

MR. WRIGHT: Thank you.

Lanie Lutar, Kevin Sharrar, Evelyn Peterson, and Gina McBride.

MS. LUTAR: Good afternoon. My name is Lani Lutar. I represent the San Diego County Taxpayer's Association.

The Board of the Taxpayer's Association stands strongly in support of the Carlsbad desalination project. What is most appealing to our organization is the fact that this project is being billed as a public/private

partnership between the Poseidon and the nine San Diego County Public Water agencies. The private sector's involvement has ensured that the region to taxpayers have been insulated from postulated cost increases and the risk associated with permitting a mutifaceted infrastructure project.

Additionally, the 30 year contract signed by the public water agencies guaranteed a price of water accounts and will never exceed what the rate pairs with otherwise paid for imported water. This is a significant protection and will guarantee rate pairs are not subject to price fluctuation, and it's very important to the Taxpayer's Association.

After ten years in the process, we believe it's time to approve Carlsbad desalination plan and would urge you for your support. Thank you very much.

MR. WRIGHT: Ted Owen followed by Kevin Sharrar.

MS. MCBRIDE: Good afternoon, Mr. Chairman and members, I'm not Ted Owen. Ted apologizes he had to leave. I am Gina McBride. I am chair elect of the Carlsbad Chamber of Commerce. Ted is the president and CEO.

I'm here to speak for our chamber in support of the Carlsbad desalination project. We represent more than

75,000 workers in our 1700 member organizations across the area.

The plan to minimize environmental impacts that is before you today meets all of the requirements of the permit this board issued nearly two years ago. The chamber believes that developing an environmentally responsible solution to the region's water need is a key component to achieving our goal of water reliability. This is why we support the City of Carlsbad public private partnership with Poseidon Resources to build an operated desalination plant at no risk to the city or its taxpayers.

For the City of Carlsbad, the desalination project is a water supply, water storage environment, and enhancement project. The Agua Hedionda Lagoon is a vital resource for our city. Many companies and individuals depend on the Lagoon and nearby beaches including a thriving agricultural farm, help SeaWorld Research Institute, and several water recreational facilities. In fact, the entire business community has a stake in preserving the natural habitat and the coastal environment that make north county a great place to visit or do business.

The business community along with the state and congressional delegation, public water agencies,

environmental group, and everyday rate payers including according to a public opinion poll 81 percent of the San Diego County registered voters standing united in support of moving forward on the Carlsbad desalination project.

Finally, the Chamber recently awarded their first ever Environmental and Spirit Award to Poseidon Resources because of the projects demonstrated commitment to the environment; especially to the Agua Hedionda Lagoon.

We need to move forward on this project now, and we urge your approval today. Thank you for your consideration.

MR. WRIGHT: Kevin Sharrar.

MR. SHARRAR: Thanks for the opportunity to speak to you today. My name is Kevin Sharrar, and this is my eleven year old daughter Savannah.

MR. WRIGHT: Welcome Savannah.

MR. SHARRAR: Savannah and her brother and mother and I are very fortunate enough to live in which I believe is the greatest community in the country and that's in Carlsbad. We have beaches and lagoons and we can all see today the flower fields, and so many other places to enjoy our national environment. My family really loves it here. My wife and I hope that when

Savannah and her brother Braden go off to college and find themselves families that they come home and call Carlsbad their home as well. Quite honestly I worry about San Diego County and some of the challenges we face in the future that holds for my daughter and my son. The devastating wildfires last year reminded all of us that we certainly have our fair share of challenges.

I don't believe that enough attention is paid to our water supply. Something too many of us I think take for granted. Our water supply depends on outside sources and that the Colorado River and Northern California. We don't have enough water supply to call our own. To be candid, we just can't continue to keep our heads in the sand collectively. I acknowledge that this board's commitment to that. That being said, we can't just go on hoping everything will be okay. It's up to all of us now to fix these problems so that future generations like Savannah's will be afforded to live in the San Diego that we all come to enjoy. We need a water supply that's dependable and environmentally sensitive. The longer we wait the worse the situation will get.

I believe Savannah has something to ask of you today.

MS. SAVANNAH SHARRAR. I respectfully ask you to please approve the Carlsbad water project today. Thank





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you.

MR. WRIGHT: Savannah, I thank you for your presentation.

Evelyn Peterson.

MS. PETERSON: Good afternoon, members of the board. I'm Evelyn Peterson. I'm here representing the Industrial Environmental Association, the IEA, which endorsed the Carlsbad desalination project in 2005.

The IEA promotes environmentally responsibility through effective communication and interaction with our members, government regulatory agencies, business, and the community. Our members endeavor to achieve a balanced relationship between environmental protection, public health, and economically sustainable growth. We believe that an affordable and reliable supply of water is imperative to the future of San Diego's industrial community, which provides jobs for thousands of San Diegans.

In October 2006, your board issued a discharge permit for this project but required a flow entrainment and impingement minimization plan be submitted to provide additional regulatory safeguard. We believe that the plan before you today prepared by Poseidon clearly meets the requirements under the permit you issued. Approval from your board is necessary to move the project forward to the

State Land's Commission and the California Coastal Commission for the final project approval. San Diego water supply conditions continue to worsen and time is not on our side. We cannot afford further delays.

The IEA strongly urges you to approve the tentative resolution and allow this project to move forward. Thank you.

Gina McBride.

MR. WRIGHT: At this time I'd like to take a ten minute break. And we need to give our court reporter some rest. I think all of us need to stretch.

(Brief Recess.)

MR. WRIGHT: Meeting to order.

We have an organized presentation whereby Gabriel Solmer, Joe Geever, and Livia Borak. I don't know if Ed Kimura is a part of that. He's not.

But seating time the organized presentation, and I assume Ed Kimura, Lori Porter, Sara Craisha, Bruce Resnick, Connor Revrick, Dan Hortell, Jerod Griswald, Lana McGuire, Jill Hickman, Julie Truhn, Ben McCue, Christin Mendosa, Angelina Callahan, Rachel Dorfman, Ellen Chuhn, and Marty Benson.

Okay. Ms. Solmer, we're ready for you. How much time do you need?

MS. SOLMER: We just request 15 minutes for the

presentation.

MR. WRIGHT: Fifteen minutes is fine.

MS. SOLMER: Thank you so much. I thank you for your patience today. It's been a long day. Thank you for granting this ordinance presentation. I think is the best way to get information across to you. As you've heard, we've had 20 people exceed their time to this presentation; groups like Wild Coast Desal Response Group, Residence for Responsible Desalination, and all the individuals that you've heard. We've all joined San Diego Coastkeeper and Surfrider today.

I will start off this organized presentation, and I'll give it over to Joe Geever from the Surfrider Foundation to tell you a little bit more about our concerns with the plan. We're not going to go into the project today. I think you've had more than enough information on that issue.

Then we'll go to Livia Borak to talk about some of the legal ramifications of today's decision, and then I'll come back up to wrap up.

So I think in the fever to get to the new sources of water we've gotten ahead of ourselves. And so let's just go through some facts that are before you.

You have a mandate of Section 13225 of Port of Cologne to coordinate with other agencies, and we think

that that's very important for that reference to be provided in the presentation as well. There's an agency coordination meeting. You've heard this again scheduled for May first and May second where these issues are going to be discussed. That's why it's a little perplexing to us why you are poised to make a decision two weeks -- two and a half weeks before that meeting occurs. You need to coordinate not just because of the mandate of Port of Cologne but to take advantage of the agency resources and expertise on this issue. We certainly don't support the overly restrictive proposal within the plan itself of how you should move forward. We think that how you move forward should be decided in consultation with the other agencies. And again that plan and any proposals within it are not before you. They certainly weren't noticed for this agenda, so we don't need to get into that. And with all due respect, that proposed schedule would only take affect if you approve to the plan sort of closing the barn doors after the cow has already been out.

You've heard arguments a lot today about prejudice to citizens, to the applicant if you wait on this issue. Let me make it clear, you don't have a valid plan that has been adequately noticed before you to vote on. Even if, as we all do, we would want to move ahead on a legally noticed plan, that's not before you today. So

there's nothing that you can do today to slow or speed up the process in anyway, so those comments really shouldn't come into your decision-making. Again, you're not slowing down the process by not moving through today no matter how other people would like to spin that.

Just on a practical matter, I think most of you have heard that the Coastal Commission has canceled its June meeting where they were to decide some of these issues, so again you have plenty of time to bring this issue back before you, if you did want to legally notice the plan for your approval before we get to the Coastal Commission and before any of this gets held up.

And indeed it does make sense to wait to that time since there is a lot of new information. I don't know how many of you have seen the state board scoping document and its policy for intake on powerplants. That certainly goes to the heart of the matter of these intake issues. There's a lot of useful information. Those workshops are taking place this and next month; certainly direct your attention to that process.

Again, before turning it over to Joe Geever, I just want to talk a little bit about the public review of this process. This plan, and I think we should all be clear about what we are talking about, the flow impingement and entrainment minimization plan has not been

available to you for a year. It's been available to you for just about a month in its revised form.

And the technical report that is on the agenda today that is before you, although we certainly agree with its conclusion that says the plan is lacking in a number of areas, it was only written on Friday, five days ago, and wasn't available to the public until after the public comment period had closed.

So given the emphasis that you gave on the last issue, if you can remember back to issue six on your agenda, that you wanted to make sure that all responses to comments were before this board before it acted. We're perplexed that you consider an issue where not only do we not have responses from the staff to our comments; we weren't even able to comment on what's before you today.

So I'll turn it over to Joe Geever for more detail on our underlying concerns and be back up for a wrap up. Thank you.

MR. GEEVER: Chairman Wright and board members, thank you very much. My name is Joe Geever I'm a California policy coordinator for Surfrider Foundation. I hope you've had a chance to read our comment letter of April first that outlined our concerns about the substance of the draft revised plan. I just note that we have not yet received a response to those comments.

I think the race to get this item on the agenda has resulted in a confusing set of documents what's conflicting language in the staff's document entitled technical report and the tentative resolution. Language in the agenda didn't help because it said you will be considering only the technical report. The technical report dated April fourth recommends against approving the plan, if the resolution recommends approving the draft plan and delegating final approval for the executive director.

As you've heard State Land's Commission Staff, Coastal Commission Staff, and your staff recommend against prematurely approving this draft plan. We are also very concerned about the board prematurely voting to approve this draft plan. By its own admission, the plan as a regard to compensatory restoration project is still a draft proposal not ready for approval. It also seems as if the vote today would approve other aspects of the plan that may be considered final. For example, the plan seems final in its conclusions about technologies to reduce the intake and mortality of marine life. However, the technologies discussed in the plan have not been subject to review and are unproven. More disturbing, this draft plan seems to be final in its conclusion that after the fact restoration is both legally sufficient and the only

feasible alternative. We disagree. In fact, the draft plan identified alternative intake systems that eliminate the intake and mortality of marine life. They just refuse to pay for them.

Given the staff's conclusion that the plan is insufficient, we're left wondering what it is that you're voting to approve. What is gained by your action today? Again, today is the first we've heard that this is not a vote on the technical report as stated in the agenda.

So is this a final vote on the conclusions about the best available design and technology to minimize intake and mortality of marine life. Is it a vote that assumption studies and conclusion in the draft plan are final. We want to remind you that any decision today cannot be possibly be a final decision that after the fact restoration is legal. That would be patently incongruent with Port of Cologne. Set of timeless process of the not. We recommend that you grant Poseidon an extension of the deadline prescribed in the MPDES permit, that seems prudent. We wouldn't oppose an extension of time to complete a coordinated multi agency review in fact we believe an extension will likely result in a quicker process towards final approval of the project by the several agencies.

Therefore, once again we employ you to postpone

any decision on the revised plan until the several agencies have coordinated their actions. We are only talking about a couple of months delay. Thank you very much.

MS. BORAK: Good afternoon. I'm Livia Borak with San Diego Coastkeeper. And to build upon what Joe said there has been a lot of confusion today. To be clear, I'm going to be referencing the plan, the impingement and entrainment flow minimization plan. It's not clear if this plan is an assessment of impact or what it's assessing or what's being approved today. But we should be clear about what the permit, MPS (sic) permit, that's been granted to Poseidon actually says. And that permit requires to assess the feasibility of sites, specific plans, procedures, practices to implement or mitigation members to minimize impact marine organisms.

Now, this is different from Port of Cologne. Port of Cologne requires minimization of entrainment and impingement. This is different. We need to be clear about the difference between mitigation and minimization. Port of Cologne requires minimization and mitigation as well as best technology, best design, and best site are all ways to minimize impacts.

As you've heard, the State Water Board has acknowledged the difference between 316B and Port of

Cologne. And we acknowledge that they are different. And one thing we are all in agreement staff, the state board, and Poseidon is that Port of Cologne applies to this project. And this has to be assessed. The state board -- this board has the duty to assess whether or not Poseidon has minimized intake mortality, not minimize impacts, not minimize mitigation. As Poseidon states and as staff states in the letter to Poseidon from Regional Board Staff, it's not clear that this plan has even addressed Port of Cologne and addressed minimization. And it's clear from Poseidon's response that they feel they don't need to do that. That they've addressed best available site, design, technology to minimize project related impacts. That's not the dictate -- that's not what's dictated by Port of Cologne. And just to reiterate, mitigation is not the same as minimization. One is before the fact and one is after the fact. Minimization happens before. Mitigation is supposed to be something that takes care of all the impacts after the fact, after all minimization has been done that is feasible. There is no analysis like this that is contained in this plan. So that's a separate requirement from what Poseidon is telling you. And as far as what analysis is required, it's not supposed to be fragmented and sequential as it is in Poseidon's letter states that they sequentially

analyzed the steps that have been taken by Poseidon to address the provision that they feel they need to address. They've fragmented the whole process. Port of Cologne requires a holistic approach to inviting impact. Not putting a horse before the cart or a cart before the horse. The plan basically says this is our site. We need to produce this much water we require 300 for MGD, so this is what we can afford and this is what we're going to do to mitigate not mandate the Port of Cologne. And that basically takes the mandate of Port of Cologne and turns it on its head allowing a project proponent to choose what exactly they what to mitigate and say for us this is not the best, that's not what best available means. Legally defensible plan will not only meet the requirement that you've imposed on Poseidon and the MPS permit for this plan, but also meet the mandate for Port of Cologne, which has not been done. As the Regional Board, you require this information, you deserve all this information, not only because it's required but also you need to analyze impact of the project. You need to analyze what is possible for the project to minimize impact before you can decide what mitigation actually is.

One other speaker said we can't put our head in the sand. I think that's true. And what we would like to say is nobody should put their head in the sand about what

impacts or what minimization is required by this project. Everything needs to be analyzed before anything can be approved. And I would like to now turn over the rest of the presentation for conclusion by Ms. Gabriel Solmer. Thank you.

MS. SOLMER: Thanks so much Livia.

Just to wrap up and just to make sure that it's absolutely clear, I think I didn't realize Coastkeeper was a mainstream environmental organization. And certainly that hasn't been my experience. But, you know, I think that the environmental groups have been a little more aligned in this process.

We don't have an objection to a legally sufficient plan moving forward. If that was sufficient today, you know you wouldn't hear any objection from us except for maybe on the noticing issue, which we do think is a problem. But let's just be clear. The future and the timetable is in Poseidon's hands. They were directed to give you a legal sufficient plan that hadn't happened yet. When that happens, we have no reservations with you correctly noticing that, giving adequate time to comment on it, and then voting on it. We certainly will stand by those points.

Just to wrap up quickly, again the revised plan is still incomplete. I think you've heard that from a

number of people. Even in Poseidon's own words it is not right for final approval. They want you to approve this intermediary process. Which they're calling a plan, proponents call it a plan, but it's not the same as this plan called for in your permit.

And again, contrary to the argument that this delay today will reduce delays with the final project, we think it's only going to create more delay. It's going to create more confusion on this project.

Just again to finally correct some apprehensions made. I won't go through all of them. But an important one is you heard a lot of people say this project has been approved by a number of different agencies. Any time that you've heard the words that the Coastal Commission has found anything. That's not accurate. The Coastal Commission is voting on revised findings next month. So until they do that, unless anyone can see the future, it's not correct to say that the Coastal Commission made those findings.

In conclusion, we would urge your very careful and consideration on all these issues. Again, we very specifically did not get into the permits of desal and the project, the underlying project. But please consider how and when to act for the best use of all of us. Thanks.

MR. WRIGHT: Questions of Ms. Solmer.

MR. ANDERSON: Yes, I do.

I was kind of curious about the Riverkeeper case, and I think I understand the context as the focus should be on minimization of impacts. But do you mind providing the board with the actual judgment or ruling so we can kind of analyze it and make sure it's in context.

MS. SOLMER: Did you want a summary of it now or actual --

MR. ANDERSON: Either one. Maybe executive summary with the rulings.

MS. SOLMER: We can certainly give you the ruling. If you'd like the summary, I'll have Livia Borak, who's our president give you a 30 second review if you'd like on how that impacts your decision today. But I can certainly get you the rule itself.

MR. ANDERSON: I'll leave the other part to the chair's discretion.

MR. WRIGHT: Do you have a question of Ms. Solmer and Ms. Borak?

MR. RAYFIELD: In your written comments, I believe you mention Coastkeeper was planning on contracting with an outside expert to review the plan. Is that still the idea or are you still -- is Coastkeeper still going to go ahead and do that?

MS. SOLMER: Yeah, that's a joint project





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between Coastkeeper and Feder (inaudible) Foundation. We have a contract with that contractor in Colorado.

MR. RAYFIELD: That was my next question.

MS. SOLMER: And Joe Geever can provide you specific information about that contractor. But specifically we were concerned that they didn't have the time to look at the revised plan, the one that was submitted just a month ago.

MR. RAYFIELD: Do you have a completion date since you've already contracted with whatever organizations?

MS. SOLMER: Yeah, I think we're in the weeks to months range. Not any longer than that. But Joe can give you something more specific.

MR. RAYFIELD: I'd appreciate a more definitive time frame. Thank you.

MR. WRIGHT: Mr. Geever.

MR. GEEVER: Yeah, we've been talking with -- I'll try to answer both of your questions, if that's okay. We've been talking with the consulting firm that worked with USCPA on the 316B rule. They are going to be reviewing the documents and the plan and the mitigation proposal. And that's why they haven't gotten engaged in reviewing the mitigation proposal because there is none. There is nothing to review. And so giving a date on when

that review would be final is just kind of hard. I think it's almost the same thing as approving this plan right now. There is no plan to approve and there is no plan for us to review. But I can tell you that they're awaiting that. They are going to turn around as quickly as possible. We want that for -- you know, cause these other agencies are going to be coming right behind you so we need that in preparation for everyone's decision. But until we have a mitigation proposal in front of us it's impossible to review.

Briefly about the Riverkeeper case. We agree with Poseidon that Riverkeeper applies only to cooling water intakes. And that's because the federal law only deals with cooling water intakes. But the state law deals with cooling, heating, any industrial use of ocean water. But it does include cooling. So the decision in the Riverkeeper case the rule that EPA had promulgated included exclusions from what they call their performance standards, which was to reduce entrainment by 90 percent, reduce these standards that they were using for minimizing entrainment and impingement. A lot of that rule got remanded back to USCPA to rewrite it. But a couple of the provisions in there were strictly prohibited from the remand. So using a cost benefit analysis was thrown out. And they can't put that back in the rule according to

Riverkeeper two. And using after the fact restoration was also thrown out. And a lot of what this plan kind of relies on is using after the fact restoration and then using a cost benefit analysis to show that any of the other alternative intakes are infeasible or whatever. Port of Cologne doesn't distinguish between cooling, heating, or any other industrial process. So if you take the ruling from Riverkeeper two, apply it to cooling water in Port of Cologne or anything else, there's no distinction between cooling, heating, and industrial processes for Port of Cologne. So arguably that ruling in Riverkeeper two applies for Port of Cologne as well. Which would prohibit them from using cost benefit analysis or after-the-fact restoration.

Does that get it what you're --

MR. WRIGHT: Ms. Borak, you have 30 seconds worth of clarity for us.

MS. BORAK: Yeah, just to add to what Joe said, I would just add Riverkeeper two though it does apply to Clean Water Act 316B. The facts that they -- Clean Water Act also is a technology enforcing statue of 316B and it requires best available technology. And in the decision the court basically said that EPA was defined a beacon, as you will, of what the technology is. And in doing that costs benefit analysis was not appropriate. And in

finding that whatever the best technology is, that is cost effectiveness can be utilized after that in finding out what kind of rages for technology that EPA can have as a substitute for this best technology. The best performing technology is it. So the best available technology is what is the best technology that can be reasonably born by the industry. And that would lend courts for interpreting Port or Cologne kind of an analysis to go by.

MR. WRIGHT: Mr. MacLagan, you have three minutes.

MS. SOLMER: I'm sorry. I believe you have one more speaker. He'd still like to speak.

MR. WRIGHT: I'm sorry, I didn't realized he was here.

MR. KIMURA: I raised my hand. My name is Ed Kimura with the Sierra Club San Diego Chapter.

Chairman Wright and members of the board, we reviewed the Poseidon Resource flow minimization and pension plan and we find totally inadequate, and I can explain the reason.

First as I explained in my letter nor in their fish management Group, as well as the State of California Marine Life Management Act now requires a holistic approach to evaluate the impacts on the marine life. And in order to ensure the protection of the health of the





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marine resources. The equal systems approach evaluates the many interaction in the like various marine organisms when subjected to stresses human or natural. This holistic approach is the departure from the past, which is directed to the evaluation of stress on individual species. This time it's taken the whole group of impacts.

Now, here are some of the objections. First the plan fails to follow this equal system approach. The impingement and entrainment plan not only focuses primarily on the fish and fish larval, it fails to integrate the interactions among all the marine organisms from the bottom of the food chain all the way up to the top. And when they are subjected to losses from impingement and entrainment, the plant concludes that the impingement and losses are, quote, diminimus in deciding that this amounts to 2.1 pounds of fish per day. However, it fails to point out that in the yearly basis there are over 19,000 fishes and over 96 species that were killed by impingement. The plan provides very little information on other important marine organisms besides fish larval and entrain.

Second, the plan fails to provide a comprehensive monitoring program that evaluates the current health of the marine equal systems within the impacted area, as well as a reference area not impacted by

the seawater intakes.

Third, the plant proposes they micro screen to minimize entrainment losses, but it has no plan on how they're going to evaluate this or when they were going to implement it.

And fourth, the proposed mitigation plan not only focuses on fish but fails to off set the losses of the rest of the marine organisms. The powerplant diverts seawater from Agua Hedionda which contains both residence species of marine organisms as well as non residence that come in from the coastal areas. The plan provides no information on these marine organisms such as the species and abundance. Without this information, we doubt whether any mitigation plan can succeed. So we ask you not to approve of this plan, and we have some real concerns about the proposed alternative condition requirements resolution. Thank you.

MR. WRIGHT: Thank you Mr. Kimura.

Mr. McLaggan, do you have some brief comments?

MR. GARRETT: Within Mr. McLaggans time, I just want to take 30 seconds to address two points that we just heard. One is the notice question and the second is a river key Port of Cologne what legal standards are you looking at question.

On the notice question, I'm looking at the board

agenda. I think it's very clear the plan in front of you is the plan that was dated March 6, 2008, that's what the agenda says. Which your staff report said was submitted to the staff on March seventh, that's the plan you are approving, that's what was agendized. It seems like many other people who spoke on the project had no trouble understanding what plan was in front of the board for your approval today. Again, this is a plan that has been available that we revised in response to staff questions, and it has been available for several months if not years. And since the board established the condition which required the plan, I think the opponents have been on notice that this type of plan was going to be in front of the board. And they've had two years since 2006 to hire whatever experts they wanted on whatever alternative plan they wanted to have the board adopt.

On the Riverkeeper question, I agree with Joe Geever. I'm not sure Joe Geever agrees with everybody else that presented. Riverkeeper doesn't apply here. One of the issues in 2006 was the whole question about rules for powerplants, the 316B rules, and Riverkeeper, which is a federal court case interpreting federal rules for powerplant intakes. Do those apply to a desalination plan? The answer from your board at that time was no they do not. Instead Port of Cologne Section 13142.5 does

apply. Your staff had a very nice chart showing the two different regulatory regiments in pointing out the differences between Riverkeeper and the federal statutes and 316B and the Port of Cologne Act 13142.5. That section of the water code, which again gives you primary jurisdiction over all other agencies to decide issues on impingement and entrainment does provide for balancing. You are to be looking at the framework which is put forth in our plan as to best available technology and a feasible mitigation. Those are the standards that are at Port of Cologne. They're not necessarily in Riverkeeper or 316B.

MR. WRIGHT: Mr. MacLaggan, he used part of your time.

MR. MACLAGGAN: Very briefly, Mr. Chairman, I thank you for your patient this afternoon.

Just by way of rebuttal to the Surfrider Coastkeeper presentation. A few points.

First of all, Mr. Geever stated that Poseidon ruled out service intake solely due to cost reason and that's absolutely incorrect. There are three reasons. Cost being one of the three but the other two being more important. First of all, we don't have adequate sediment cover offshore to put sub-service intakes in the area that Carlsbad plant. Consequently, we would have to dig up hundreds of acres of sea floor; basically, kelp bed, hard





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bottom, habitat land to the sea floor plumbing system that looks like a reverse leech field, cover that with sand and pump water on that and process marine destroying several hundred acres of offshore habitat, valuable habitat, as well as putting pump stations on the beach--several; either ten or 20 pump stations. All of which were concluded at the Coastal Commission as well as the City of Carlsbad. Not to be the most environmentally responsible alternative. The existing intake or use of the existing intake both entities found to be most environmentally responsible preferred alternative.

Second point, the comment was made that the Surfrider Coastkeepers only had 30 days to review the draft plan. I will remind you that the second draft plan was not on the Regional Board's website for nine months. We received no comments whatsoever except from your staff. And the third draft was responsive to those comments in the fashion we simply added more information, more details. So the plan itself has not changed for almost a year now. There was ample opportunity for comment, and all we did was boast on what was there. So if it was fine before adding more information, not changing the substance of the recommendation shouldn't change the acceptability of that plan. We see no reason for delay. The plan before you is not contrary to your permit requirements as

suggested. We met the feasibility requirement of our charge under the permit. We have an opportunity to prepare now a final mitigation plan that will be back before you in the months ahead. If we wait for a perfect solution, we will never see the benefits of this water supply project. This is precisely why the Port of Cologne Act is referred to as a balancing statute. Your charge as a board is to look at the environmental impacts and the need to support the economy and housing and all the other beneficial uses of water supply and balance those two and come to a reasonable decision that protects both. You need to support human life in the area along with the need to protect environment. We think we struck a balance in that regard if the plan moves in that direction.

Consistent with Port of Cologne 13142.5B has a feasibility component, and it provides for mitigation after you've exhausted your feasible technology measures. Our plan has exhausted the feasible technology measures. City of Carlsbad EIR, the Coastal Commission decision agree with that. They said there are no additional feasible measures be taken. We are now all focused on mitigation. So what you do by your action today by approving the draft resolution, you bring your staff to the same point with the other two entities are as we move forward with this joint statewide coordination. You say





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to your staff by conceptionally approving this plan we're pass the mitigation design components. We're focusing our attention now on how we mitigate, and make sure we have enough mitigation. We've got the right site. The implementation scheduled the planning consistent with --

MR. WRIGHT: Will you wrap up, Mr. MacLaggan.

MR. MACLAGGAN: Yes, Mr. Chairman, we respectfully request that the board approve resolution. The resolution is before you. Thank you very much.

MR. WRIGHT: Mr. King has a question.

MR. KING: A question for Mr. Garrett. Did you have a black line comparison to the second and third draft of the plan?

MR. GARRETT: No, I don't.

MR. MACLAGGAN: Mr. MacLaggan. Just a comment on the black line. Black line will not be helpful because one of the comments we got from your staff was to provide greater clarity as to how we addressed each of the elements on statute. We did a wholesale reorganization on the plan breaking it down into new chapter format. So if I did a black line it would look like it's an entirely different report. It's just we took information and reorganized it in its presentation. Well, there isn't a tremendous amount of new information. I can highlight what's new between the two drafts if that would be

helpful. If you did a side by side black line, it would look like we did a wholesale rework of the report. It's just reorganization is what that amounted to.

MR. ANDERSON: Just a real quick question.

On your analysis you analyzed an awful lot of minimization technologies and some of those are new. As this process moves forward, you may discover some actually more feasible at a later date. I would encourage you to consider using them as they become feasible.

My second thing, some analysis of the reclaim water option would make me feel a lot happier, but everything else it generally supports.

MR. MACLAGGAN: May I just make one quick point regarding Dr. Anderson's comment about future technologies?

MR. WRIGHT: You're pushing limits here.

MR. MACLAGGAN: I understand. I just want to make sure the board understands.

What your staff is working on is an interim solution on the powerplant continues to operate. We are inherently limited under those conditions. The powerplant ceases altogether all the new technologies are back before you, and your staff has full authority to require of us.

MR. WRIGHT: Another question, Mr. MacLaggan.

MR. RAYFIELD: Yeah, I'm sorry.





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That's the way I understood the report. And I learned today that you're Guaranteeing the price or someone is guaranteeing the price of the water produced by the plant to be the same as imported water cost. And I find those two statements that, you know, that we are back to ground zero and technology and the like when the powerplant shuts down, but yet you have a financial cap, if you will, on the cost of the produced water. How do you do that?

MR. MACLAGGAN: That's our inherent risk as a developer of this project to make sure we continue to produce water at an affordable price. If the technology is required of us ten years from now is deemed available and feasible, presumably it has a reasonable cost to implement as well and we won't be able to afford to do it. Recognizing again that this statute has feasibility component. Part of that is cost. Part of it is that does the technology work? Is it environmental --

MR. RAYFIELD: Sure. Lots of issues there.

MR. MACLAGGAN: We think that that's part of the question that will be before you when you require us of that. Is it affordable in a reasonable sense. That doesn't mean our enterprise has to continue to be one that is profitable from your perspective.

MR. RAYFIELD: As I understand the conditions.

MR. MACLAGGAN: There is an upper limit as to what the cost would be we consider feasible.

MR. RAYFIELD: As part of that guarantee, if you will, competitive price for your water versus the imported water? Is there a substantiation in there from your group that helps with that?

MR. MACLAGGAN: There is. And just so you understand. What we have committed to do is never charge more for the water. The price of the awarded purchase of imported water plus an increment of $250 per acre foot that is available to our customers from the Metropolitan Water District to offset a demand on the imported water systems and substantiate to encourage things just like we are trying to do.

MR. RAYFIELD: So the matter is substantive into the $250 per feet.

MR. MACLAGGAN: For the first 25 years of operation.

MR. RAYFIELD: So when we are talking about caps too, I heard someone say that there is a cap on the mitigation measure costs.

MR. MACLAGGAN: No, sir, that was a misinterpretation of our report. We recognize that we have an obligation to mitigate to the extent feasible. We've identified via --

MR. RAYFIELD: In that case feasibility being

technical and not financial?

MR. MACLAGGAN: Feasibility being the information that Mr. Mayer walked you through showed you how we arrived at the 37 acres of restoration required of the project. Now it's our challenge to go find a site where we can do that in a affordable fashion. I don't have any expectation that that number is going to go down. If anything, it's going to go up. We did not set -- we suggested in the State Land's letter we set a $3 million cap on mitigation. I can assure you we are going to pay a lot more than $3 million dollars mitigation for we have not set any financial. For limits, we just said our commitment is to provide at least 37 acers to what was restoration. And the location to be determined, we identified feasible sites we think that can occur.

MR. RAYFIELD: I understand that. But somewhere during this session today I did hear the statement that there was a cap on mitigation.

MR. MACLAGGAN: It was suggested by the State Land's Commission staff, and that was incorrect interpretation of our proposal.

MR. RAYFIELD: Thank you.

MR. WRIGHT: Mr. Kelley.

MR. KELLEY: Just to clarify the agenda notice language, the words "technical report" refer to the March

sixth revised flow entrainment/impingement minimization plan. They do not refer to the staff technical report dated April fourth, that's a different document.

And I would just refer the staff's recommendation over to Mr. Robertus.

MR. RAYFIELD: Are you saying we made an error on the notice and called the document by the wrong name; is that what you're fundamentally saying?

MR. KELLEY: I guess we consider it a technical report. You could call it different things.

MR. RAYFIELD: Yeah, but there was something called a technical report out there or they came out? I'm just trying to get this --

MR. KELLEY: Yeah, later a staff technical report did come out.

MR. RAYFIELD: But that's not what it meant by the words --

MR. KELLEY: We also refer to the plan as a technical report. Maybe that was a misnomer.

MR. RAYFIELD: Okay, one other question. We had a February 19th letter that raised issues in question and so forth. Was every one of those issues addressed to your satisfaction?

MR. KELLEY: Not at this time. And I will say one additional comment on that. And that although

Poseidon provided all the additional attachments and specific data based on our review over the last 30 days, since that has come in, it has raised a couple of additional questions that we didn't include in that February letter as well. Because really now we can see the actual data, but then it raises questions on how they use that data to come up with the actual number. So that's still a question for us. We'd like clarification for that.

MR. RAYFIELD: Thank you. One last question.

Are you convinced that what we have in front of us in fact represents the best available technology?

MR. KELLEY: I would say for the cooperation where the Poseidon project is in conjunction with the cooling water discharge and the powerplant has its own requirements for the best available technology and they're using the same ones, then I would say yes. But once that ends and ceases, then I would say we'd have to reevaluate it.

MR. RAYFIELD: Mayer question mark after that.

So you're okay with the best available technology, but there's still outstanding issues that need clarification analysis or whatever?

MR. KELLEY: That's my understanding.

MR. RAYFIELD: Thank you.

MR. WRIGHT: Mr. King.

MR. KING: You stated earlier that 40 percent of the time the intake water from the power station is below what would be the 300 million gallons per day. How far below.

MR. KELLEY: Gosh, I didn't get a number on the minimum and maximum. I'd have to look that up and see if I could get that. Sometimes with the plant it goes down fairly low, so it could be, you know, maybe 90 percent they would need to makeup, so it does fluctuate throughout the day and depending on the power needs of the regions. Maybe Mr. MacLaggan has some details on here.

So there are times when the actual flow goes to almost zero. I think those are times when maybe they have to do some work on the plan or they have to shut it down for heat treatment and things like that, so with those do occur.

MR. KING: What it means zero is correlated with 40 percent of the time or zero is one day out of the year?

MR. KELLEY: It's just a short period of time.

MR. KING: Cause 40 percent of the time is quite a bit of a time. And I'm wondering how far below is the typical level when it's below the 300 MGD.

MR. KELLEY: It looks like somewhere between 100 and 200 MGD would be the majority of the time when a coastal level, as looking at the graphs.

MR. WRIGHT: Mr. Geever, did you have a table to share some light on that. Why don't you give it to Mr. Kelley.

MR. KING: Couple other questions quickly. This is part of what we were covering today. But is it true that the powerplant shuts down and the desal plant doesn't happen, does the lagoon just lies fallow and turns back into its natural state which is not a lagoon?

MR. KELLEY: Most likely if there is no other agency or project that would keep it open then it would just revert back to its natural state or original state.

MR. KING: Can we kind of back to the issue of the notice. More the substantive issue of the notice here. The changes between the second and third draft; a lot of restructuring or would you say that degree of substantive changes between those two drafts can --

MR. KELLEY: Yeah. I would say as mentioned earlier that the majority of it was providing detailed data to support what was in the first draft and the second draft. So it gives us the data so that we can go look and see if the amount of the mitigation is comparable to what impacts they're actually having. And we're still really evaluating that. It is difficult to do in 30 days.

MR. WRIGHT: I think we're ready to turn this over to Catherine.

MS. GEORGE: I may want to respond briefly to some of the legal points raised.

Would you like that before you hear from Mr. Robertus.

MR. WRIGHT: Yes.

MS. GEORGE: Just on the legal notice issue raised by Coastkeeper. I do think that there's been adequate legal notice for this proceeding. And I realize that the technical report by staff was not circulated until the fourth. There is certainly an opportunity for oral comments and also late comments. Written comments are routinely received when there's a good reason for that. So I think that's been adequately addressed.

I don't think that -- if you go forward and approve the tentative resolution with some changes that you requested earlier today, I don't think that you are precluding the kind of joint agency coordination process referred to in Water Code Section 13225. I think you're allowing that to go forward in meeting that requirement.

With regard to the Riverkeeper case, I agree for the most part with Coastkeeper and with a Poseidon representative that the Riverkeeper two case does not apply directly to the desalination facility. I do agree that you're required to comply with Water Code Section 13142.5 in making a final approval of the plan that you

receive from Poseidon. And you're not making that final approval today.

Let's see. I wanted to point out that I disagree with Coastkeeper in the context of Section 13142.5 that all mitigation is considered after the fact restoration. That was the subject of the Riverkeeper case. The mitigation can constitute minimization and meet that requirement in Section 13142.5. At least at this point, there was a recent court of appeals -- state court decision whereas the wetlands that exclusively recognize that. Came after Riverkeeper two. Although that case has been with the Supreme Court. The California Supreme Court has granted petition for review. So we'll see we may have more clarity in the future.

And I did want to just remind you that the permit provides that you can direct Poseidon to modify their plan in the future, so you retain that right. And also that there will be a need to comply anew with Section 13142.5 at the Point Encina Power Station completely ceases operation.

And then lastly, it looks like one of the representatives, I think, Mr. Garrett mentioned that the Regional Board has primary jurisdiction over all issues regarding impingement and entrainment. I can't confirm that that statement is completely accurate. Although I do

agree that the Regional Board has the authority to implement and comply with Section 13142.5.

If there are any questions, I'd be happy to answer them.

MR. ANDERSON: I think you did address, I didn't quite catch it, the feasibility versus whether it's economically feasible. There was some decision about that or just flat out feasible. And your opinion was?

MS. GEORGE: I didn't express an opinion on that. I probably don't have one.

MR. ANDERSON: Okay.

MR. WRIGHT: The economic feasibility is not before us at any rate. I mean, we haven't gone into any kind of discussion on that aspect of it looking at subsidies and so on and so on.

Mr. Robertus.

MR. ROBERTUS: I recommend action today to approve the plan. And I know that the technical report was misconstrude. I think that the plan may be better expressed as a process. I'm concerned that if the board doesn't take action today it will exacerbate any attempts to get the right parties together and to take action to drive this to a conclusion. There are about 40 months left on the permit that this board has already adopted. There is virtually no action that you take to approve or

disapprove this fully opposition study that pertains to the ability to the discharge for the next 40 months. As you've heard, it will make a difference when they start the period subsequent to that when the Poseidon -- when it comes to pass, if it comes to pass, is operating in a stand-alone mode. Then the question of minimization and mitigation will be brought fully to bear on the Poseidon facility. And the other consideration of 316B wants to (inaudible) entrainment that's taking place in the facility at this time. That complicates the issue while they're co-operating an electrical powerplant with one MPDS permit and then the perspective -- and the Poseidon facility operating with another MPDS permit. That's the subject of the flow minimization issue today.

So my practical recommendation is to adopt this so that the process will move forward. I am not convinced that the parties will come to the table as highlighted in the schedule that Poseidon had. We have a tentative resolution with an errata sheet.

MR. WRIGHT: Do you have a copy of that?

MR. ROBERTUS: Yes, I have a copy. I will pass that at this time and request that you review it. My recommendation is you adopt it with the errata.

MS. SCHNEIDER: We will be approaching if we go that route.

MR. WRIGHT: Members of the board, have you had a chance to digest the errata sheet in the light of extensive testimony we heard today and as well as the reading of the voluminous materials?

MR. GARRETT: Mr. Chairman, would there be an opportunity for the applicant to respond to one of the items in errata that we haven't seen before?

MR. WRIGHT: Yes. But make it brief please. We'LL also hear from Ms. Solmer.

MR. GARRETT: My name is Chris Garrett, a lawyer that works for Poseidon. I wanted to just address Item C in the errata. You may vaguely recall my statement that the board has primary jurisdiction on these issues. That both the Water Code and the Coastal Act give the Water Code -- give the Water Board responsibility. And my concern is that this might be misinterpreted as requiring approval from other agencies and/or their staff before the Regional Board could take action.

So I would suggest that deletion of Item C or to have that rephrased so that it's considering of the input from participating agencies. Perhaps make it clear with the agencies or their staff as well. But as phrased here, my concern is that this would require before the Regional Board could act that you would have to have the other agencies approve it, and we would not want to get stuck in

that loop. Nor do we think it's consistent with the primary jurisdiction of the board.

MR. WRIGHT: We need to run it by our attorney.

MS. GEORGE: I'm not familiar with the Coastal Act provision that Mr. Garrett -- the specific provision. I can't review it to determine what it says. I think the wording there may be some way to modify it so it addresses his concern and still allows you to achieve the kind of joint coordination that you're looking for. So I'm trying to think while I'm talking about some alternative language. Although, I don't think consensus necessarily implies approval by other agencies.

MR. ROBERTUS: Would coordination as required by the supported code and section?

MS. GEORGE: That would be terrific, yes.

MR. WRIGHT: Consensus has changed to coordination.

MR. RAYFIELD: And as required by the Port of Cologne. It's siting that specific section.

MS. GEORGE: So C would read: Coordination among participating agencies for the amendment of the plan as required by Section 13225 of the California Water Code.

MR. WRIGHT: What's the section again.

MS. GEORGE: 13225.

Ms. Solmer.

MR. GARRETT: You're catching us off guard with these last minutes. I guess the one thing I want a little bit of clarification. The other parts of the revised plan that do seem final, you know, their conclusions, studies all that other stuff. That is a final act?

MR. WRIGHT: I don't say it's final at all. This is a process.

MR. KING: You still have the extensive range of comments on the February 11th letter. We haven't signed off on any of those.

MR. GEEVER: What are we approving. I'm not sure how this advances anything, and why you're approving anything.

I guess I'd like to make one comment about -- without identifying what the best design of the facility is and what the best available technology to meet that design are prior to, you know, in contemplation of the cooling water intake not being available, you're allowing a design that would preclude the use of the best available technology for -- actually, just eliminating the intake and mortality of marine life. So I mean, I think it requires looking a little bit ahead into the future, and ensuring that the design of the facility, especially a

$300 million facility, is designed in a way that allows the use of the best available technology when that becomes required. And I guess I take a little bit of --

MR. KING: Could you limit this to the errata. Look at what's blacked line.

MR. GARRETT: Okay.

MS. SOLMER: I think we can resolve this. The concern is under the number two of the via resolved the San Diego Board hereby conditionally approves the plan. I think that that's confusing. Because after that you said that you're going to require in six months an amendment to this plan. So, if we can change number two to say that we -- that the board hereby approves this process that's been described. What we don't want what happened today where different people are referring to different documents of the same thing. And, again, you know, please don't insult our intelligence that you provide a document called a technical report and then you say actually this plan that we provided is called a technical report and we didn't mean to submit this. So I think that if we can change that number two to say that we're conditionally approving this process with the errata, that would make sense and, you know, put everyone on the same page and would not delay anything. Then we have the same six month period that we're going to come back and we're certainly

okay with the consensus in the errata.

MS. GEORGE: What about the San Diego Water Board hereby conditionally approve the plan subject to the following conditions being satisfied.

MS. SOLMER: I think the concern there is you're approving a plan that has a lot of information; 300 pages of information. And I don't think that you can condition out all of those different things. I think rather than conditioning out what you don't want to approve, just in plain language just say what you are approving which is this process which I think is otherwise understood by the other resolution, and then you're going to come back with the information that hasn't been provided in that six month period.

MR. KING: Just get a last round what we are doing here. Let's look at one errata at a time. We propose specific changes to this particular section here. And we've proposed changes to Section C. Otherwise nobody has commented on there's a change in line one of paragraph three. Shall submit to the Regional Board executive officer for the approval by the Regional Board. And nobody's commented on that change?

MS. SCHNEIDER: That's correct.

MR. KING: And the additional changes and the following additional concerns that are listed in A through





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E. And then paragraph four we've stricken through executive officer so that the subsequent changes will come back to the board instead of the executive officer. So if question can hammer out any changes --

MS. SCHNEIDER: I don't have any changes on that.

MR. KING: We are talking about different things at a time.

MR. WRIGHT: If we can zero in on the Errata sheet.

MR. RAYFIELD: I do have one concern on the errata sheet. Not the Regional Board part, but the last sentence. In paragraph three that says shall resolve the concerns identified in the Regional Board's February 19 letter.

And we heard from Brian earlier that there are additional concerns that they've uncovered. And I don't know that there's items listed as A, B, C, D, and E. I think -- are they, Brian?

MR. KELLEY: Yes, that was the intent.

MR. RAYFIELD: And is that the full set?

MR. KELLEY: I believe so.

MR. RAYFIELD: I guess that's okay.

Also Item D, appropriateness of mitigation sounds really open to interpretation and rather vague to

me. I'm not sure what we mean by that. And if we could remember what we meant by that six months from now.

Can you elaborate what we're measuring here. I mean, this is kind of -- we're setting a standard or measurement. We're going to measure for appropriateness, but what are we really going to look at.

MR. WRIGHT: Mr. King, do you have a --

MR. KING: I do. The more legal term of art is adequacy of mitigation. Appropriateness. I agree with the adequacy is it sufficient.

MR. RAYFIELD: Is it sufficient. That was the word I was looking at too. So that would work for me. And actually that's to the extent of my --

MR. WRIGHT: Sufficiency.

MR. RAYFIELD: My comments are sufficiency.

MR. KING: No, adequacy.

MR. WRIGHT: Is George adequacy?

MS. GEORGE: Okay.

MR. WRIGHT: Any other comments about the errata sheet?

Do we need to -- I guess we need to take some action on -- well, before we do that I really think that we ought to deal with that as part of the larger motion and take a look at the resolved section of the board, the order.





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I agree with the concern that's been raised about Item two under the resolve section. That's preceded by a statement that says the plan dated da-da-da does not include specific implementation provisions as required in section so on, so on. And does not as yet resolve the concerns noted in the Regional Board's February 19, 2008 letter. Poseidon Resources.

And then in the next sentence Item two it says the San Diego Water Board hereby conditionally approves the plan. So I have a hard time resolving those two paragraphs, and that's why I think that we're really talking more about a process. And even then I have some questions about the process. But it's a little -- to call it a plan, when it's not a plan. I guess it's a plan to plan a plan.

MR. KING: If I could jump. We should read the whole resolution section together and try to read it harmoniously here.

If -- it says specifically why in paragraph one that the word "conditional" is in paragraph number two. And in paragraph three and four we say how the conditions were to play out. Three gives exactly what the condition is. And four is not related to the conditional section of it. But there's no such thing right now as a define term of a process. I don't want to throw another word in there

as something new, even though we are trying to split the baby here and make everybody happy. But it's adding vagaries into an operative document here. Three paragraphs together say something clear, if you read it together for harmony. There's a reason why we're attaching conditions to an approval. This is what the condition is. And it's a conditional approval and this is what the condition is.

MR. WRIGHT: I hear what you're saying. I'm just still uneasy about how we're throwing around the use of the word "plan." Even if I'm reading all of these items I wonder if --

MS. SCHNEIDER: But title of the resolution. That means we need to change the title of the resolution if we don't. It says it's conditional -- the title is a tentative resolution in a number of conditional approval of revised flow entrainment and impingement minimization plan. So we would need to change the title if we're not going to approve the plan, the minimization plan.

MS. RITSCHEL: I'd like to jump in and just agree with Mr. King. I don't think at this point no one knows what the process means and what it's referring to, so you can't just say we approved the process. We haven't defined what that is. I think if there is going to be an approval, it is appropriate to approve what has been put

before us. The latest version of the document -- approve this plan except for this, this, and this. Or subject to this condition and this condition. And that's I believe what is before us. Is it written the best possible way? I mean, maybe there could be some slight words missing. I think Ms. George suggested slight words were missing from Item number two.

I agree with Mr. King you can not simply approve something that we have no definition of.

MR. KING: On that note, I'd like to make a motion to adopt the errata sheet as written with the exceptions that the word "consensus" in Paragraph three Subsection C change to coordination.

MS. RITSCHEL: Coordination among.

MR. KING: The word "consensus" is stricken through and substitution the word "coordination" is written. Inserted at the word plan as required under Section --

MS. SCHNEIDER: 13225.

MR. KING: Is it 1322.5?

MS. GEORGE: No, 13225.

MR. KING: 13225 of the California Water Code. The word appropriateness stricken from Subsection D and change to adequacy, and otherwise adopted as written.

MS. RITSCHEL: Second.

MS. GEORGE: Third. You're voting on the errata?

MR. KING: The errata.

MS. GEORGE: That would be incorporated into a motion eventually?

MR. KING: Correct.

MS. SCHNEIDER: I second to that.

MR. WRIGHT: Is there a motion made by Mr. King in the section -- made by Elizabeth Schneider.

I'm getting groggy here.

Is there a discussion to the motion? All those in favor of the motion All say aye.

MR. ANDERSON: Aye.

MR. KING: Aye.

MR. WEBER: Aye.

MR. RAYFIELD: Aye.

MS. RITSCHEL: Aye.

MS. SCHNEIDER: Aye.

MR. WRIGHT: The motion is approved unanimously.

Now, we're ready for vote on the tentative resolution as modified with the errata sheet. So is there a motion to approve the tentative resolution number R9-2008-0039?

MS. SCHNEIDER: I move to conditionally approve





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the Resolution Number R9-2008-0039 as amended.

MR. RAYFIELD: Second.

MS. GEORGE: Can I make a clarification. I believe you said conditionally approve the resolution. And it should be that you approve resolution --

MR. KING: Adopt.

MS. GEORGE: Adopt the resolution.

MS. SCHNEIDER: Accepted.

MR. ANDERSON: Second.

MR. WRIGHT: Are you speaking to the motion?

MR. RAYFIELD: Well, I'm speaking to the motion, yeah. Actually, I share your concern about approves the plan. And a concern that was mentioned by some of our comments. What we're really doing is accepting this plan to forward it on to a joint agency meeting and so forth. And I'm wondering if the person that made the motion would -- if we could change approve, because we're really not we are expecting some additional stuff, to accept the plan. A little different twist. And I don't mean to --

MS. SCHNEIDER: Do you need approval on the resolution, John? That was my motion to approve the resolution.

MR. RAYFIELD: I was just talking about a wording change in the resolution that we're approving.

MR. KING: Is there a vote on this motion?

MR. WRIGHT: That is the motion.

MS. SCHNEIDER: No, it's discussion. I'm asking a question before I --

John, did you ask us to approve the resolution today?

MR. ROBERTUS: Yeah, the word -- operative word I believe is "approve." That's in the language of the MPS permit. The word "approve."

MR. WRIGHT: And you're simply offering an editorial change.

MR. RAYFIELD: Well, actually I think it's more than an editorial.

MS. SCHNEIDER: We either approve or deny the resolution. So I motion to approve, and he second it.

MR. KING: A motion to call the question.

MR. WRIGHT: The question has been called for. My inclination is not to support the resolution. I am continued to be concerned about the word "plan." And I'm also concerned that it may appear that we are approving the plan that presumably is going to be considered by a number of other agencies, and it makes us look as though we're very supportive of the plan, and I don't think that's the case at least. At least I don't feel the plan is ripe enough, let's put it that way, to receive our approval.





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Any other comments?

MR. KING: I call the question.

MR. WRIGHT: The question has been called for all those in favor say aye.

MR. ANDERSON: Aye.

MR. KING: Aye.

MS. RITSCHEL: Aye.

MR. WEBER: Aye.

MS. SCHNEIDER: Aye.

MR. WRIGHT: Those against say no.

MR. RAYFIELD: No.

MR. WRIGHT: Motion carries five to two.

MS. RITSCHEL: And there were no extensions?

MR. WRIGHT: No extensions, no.

Well, there being no other matters motion to adjourn. We have a motion to adjourn. We are adjourned.

(End of partial transcript)

REPORTER'S CERTIFICATE

I, GIDGETTE NIEVES, CSR NO. 10142, A CERTIFIED SHORTHAND REPORTER FOR THE STATE OF CALIFORNIA, DO HEREBY CERTIFY:

THAT THE FOREGOING TRANSCRIPT OF PROCEEDINGS WAS TAKEN BEFORE ME ON April 9, 2008 AT THE TIME AND PLACE THEREIN SET FORTH, WAS TAKEN DOWN BY ME IN SHORTHAND, AND THEREAFTER TRANSCRIBED INTO TYPEWRITING UNDER MY DIRECTION AND SUPERVISION;

AND I HEREBY CERTIFY THAT THE FOREGOING TRANSCRIPT OF PROCEEDINGS IS A FULL, TRUE AND CORRECT TRANSCRIPT OF MY SHORTHAND NOTES SO TAKEN.

I FURTHER CERTIFY THAT I AM NEITHER COUNSEL FOR NOR RELATED TO ANY PARTY TO SAID ACTION, NOR IN ANYWISE INTERESTED IN THE OUTCOME THEREOF.

IN WITNESS THEREOF, I HAVE HEREUNTO SUBSCRIBED MY NAME THIS 12th DAY OF December, 2008

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# COMMENTS ON CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD'S REVIEW OF POSEIDON RESOURCES CORPORATION'S MARINE LIFE MITIGATION PLAN FOR COMPLIANCE WITH RESOLUTION NO. R9-2008-0039

REGIONAL
QUALITY
BOARD
4: 54

Submitted by:

Date: January 26, 2009

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REGIONAL
QUALITY
BOARD
4: 54

## APPENDIX VOLUME 2, Tabs 11 - 29

# APPENDIX A

# EXHIBITS TO COMMENTS ON CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD'S REVIEW OF POSEIDON RESOURCES CORPORATION'S MARINE LIFE MITIGATION PLAN FOR COMPLIANCE WITH RESOLUTION NO. R9-2008-0039

## Comments Submitted by Latham & Watkins LLP, January 26, 2009 – February 11, 2009 San Diego Regional Board Meeting, Item 6 - Poseidon Resources Corporation, Proposed Carlsbad Desalination Project (Order No. R9-2006-0065, NPDES No. CA0109223)

## Volume 1

| Tab No. | Date | Description |
|---|---|---|
| 1. | November 14, 2008 | Poseidon Resources Marine Life Mitigation Plan |
| 2. | n/a | PowerPoint Presentation Prepared by Dr. Raimondi: Review of Carlsbad Seawater Desalinization Project (CDP) |
| 3. | January 2008 | Clean Water Act Section 316(b) Impingement Mortality and Entrainment Characterization Study, Cabrillo Power I LLC, Encina Power Station, January 2008. Tenera Environmental. |
| 4. | February 19, 2008 | Regional Board Comment Letter on 2/12/07 Revised Plan |
| 5. | March 6, 2008 | Revised Flow, Entrainment, and Impingement Minimization Plan |
| 6. | March 7, 2008 | Poseidon Response to February 19, 2008 Regional Board Comments |
| 7. | March 7, 2008 | Email from Eric Becker to Tom Luster; wpaznokas@dfg.ca.gov; Sharon_Taylor@fws.gov; Peter MacLaggan; bruce@sdcoastkeeper.org; gabe@sdcoastkeeper.org; Judy Brown; rwilson@surfrider.org, copied to John Odermatt; Mike McCann. Subject: Poseidon Revised Flow, Entrainment, & Impingement Plan & Response to Regional Board Comments |
| 8. | April 2, 2008 | Email from S. Townsend to various people, including E. Becker. Subject: Marine Life Mitigation Plan Meeting for Poseidon Desla Plant |
| 9. | April 4, 2008 | RWQCB Technical Report, Review of Carlsbad Seawater Desalination Plant Flow, Entrainment, and Impingement Minimization Plan |
| 10. | April 9, 2008 | Reporter's Transcript of Proceedings, California Regional Waater Quality Control Board, San Diego Region, Partial Transcript of Proceedings, Public Hearing |

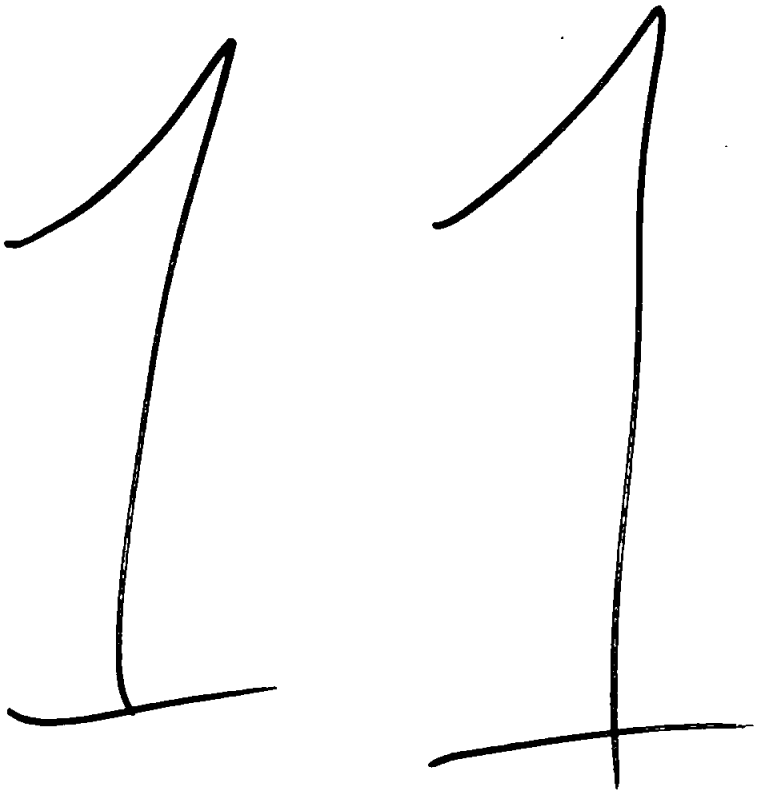
# APPENDIX A

## Volume 2

| Tab No. | Date | Description |
|---|---|---|
| 11. | April 10, 2008 | Email from P. MacLaggan to J. Robertus. Subject: Re: Update on Attendees for May 1-2 Meetings |
| 12. | April 10, 2008 | Email from P. MacLaggan to J. Robertus. Subject: Subject: May 1 Desal Mitigation Meeting |
| 13. | April 17, 2008 | Email from C. Clemente to P. MacLaggan. Subject: Poseidon's CDP Plan - questions regarding IM & E assessments |
| 14. | April 22, 2008 | Email from J. Steinbeck to P. Raimondi |
| 15. | April 24, 2008 | Email from J. Steinbeck to D. Mayer |
| 16. | April 30, 2008 | Email from P. MacLaggan to C. Clemente, copied to Brian Kelley; David Barker; Deborah Woodward; Mike McCann. Subject: Re: Poseidon's CDP Plan – questions regarding IM & E assessments |
| 17. | July 8, 2008 | Email from S. Townsend to various people, including J. Robertus. Subject: Poseidon' Marine Life Mitigation Plan |
| 18. | August 5, 2008 | Email from G. Newton to J. Brown. Subject: Fwd: RE: Coordination re: Poseidon? |
| 19. | August 6, 2008 | California Coastal Commission Final Adopted Findings (Item W4a). Application File No. E-06-013. Permittee: Poseidon Resources (Channelside) LLC / Cabrillo Power II LLC |
| 20. | August 6, 2008 | Reporter's Transcript of Proceedings, California Coastal Commission Meeting, Agenda Items Nos. 4.a., 5.a., 5.b., Vol. 2 of 2, pgs 163 – 347. |
| 21. | August 22, 2008 | State Lands Commission Final Lease Amendment No. PRC 8727.1 |
| 22. | November 21, 2008 | California Coastal Commission Recommended Revised Condition Compliance Findings (Item W16a). Condition Compliance for CDP No. E-06-013 – Poseidon Resources (Channelside), LLC; Special Condition 8: Submittal of a Marine Life Mitigation Plan |
| 23. | December 2, 2008 | Letter from RWQCB to Poseidon re: Review of Proposed Poseidon Resources Carlsbad Desalination Plant Marine Life Mitigation Plan, Resolution No. R9-2008-0039 |
| 24. | April 2007 | Updated 2005 Urban Water Management Plan, San Diego County water Authority. |
| 25. | December 18, 2001 | National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities, Final Rule. 66 Fed. Reg. 65256 |

# APPENDIX A

| Tab No. | Date | Description |
|---|---|---|
| 26. | July 9, 2004 | National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities, Final Rule. 69 Fed. Reg. 41576 |
| 27. | July 9, 2007 | National Pollutant Discharge Elimination System—Suspension of Regulations Establishing Requirements for Cooling Water Intake Structures at Phase II Existing Facilities. 72 Fed. Reg. 37107 |
| 28. | n/a | 40 C.F.R. 125.84 |
| 29. | n/a | 40 C.F.R. 125.94 |



**From:** Peter MacLaggan [mailto:pmaclaggan@poseidon1.com]
**Sent:** Thursday, April 10, 2008 12:30 PM
**To:** John Robertus
**Subject:** May 1 Desal Mitigation Meeting

John,

Here is the May 1 meeting invitation from CCC staff. You can disregard the comment about having to pay for your own lunch, Poseidon is going to provide lunch for the group.

Peter

> _____
> From: Sara Townsend
> Sent: Wednesday, April 02, 2008 2:33 PM
> To: Sara Townsend; Judy Brown; ebecker@waterboards.ca.gov; WPaznokas@dfg.ca.gov; Amber Pairis; bryant.chesney; Monica.Deangelis@noaa.gov; Marci_Koski@fws.gov; Meleah Ashford; jelli@ci.carlsbad.ca.us; jgaru@ci.carlsbad.ca.us; kgr@sandag.org; ble@sandag.org; Matt Zafonte; Steve Hampton; Pierre duVair; pmaclaggan@poseidonl.com; Alison Dettmer; Tom Luster
> Subject: Marine Life Mitigation Plan Meeting for Poseidon Desal Plant
> When: Thursday, May 01, 2008 10:00 AM-1:30 PM (GMT-08:00) Pacific Time (US & Canada).
> Where: Agua Hedionda Lagoon Foundation offices in Carlsbad
>
>
> Greetings!
>
> I have spoken directly with most of you, but would like to cordially invite you to participate in an interagency working group meeting on Thursday May 1 to address potential mitigation options for impacts to marine life from impingement and entrainment by Poseidon's desal plant.
>
> Last November the Coastal Commission approved a coastal development permit for Poseidon Resources, contingent upon the completion of a Marine Life Mitigation Plan (Special Condition 8). We would like to inform you where we are in this process and seek your input in an effort to promote more efficient and effective communciation among the many agencies either directly or indirectly involved. We anticipate at least a half-day meeting, beginning at 10 am and breaking for lunch by 1 or 2 pm. After lunch, we will resume the meeting if necessary or go on site visits if possible.
>
> This meeting is not open to the general public and we would like to limit the number of participants to 2 for each agency. If there are others you think should be included, please let me know. Although we would like to, we do not currently have the funds to provide lunch. I will most likely arrange for lunch to be delivered and each person would be responsible for covering their portion of the

cost (I'm open to other ideas as well).
>
> Details, such as the agenda, directions, and a more concrete plan for lunch, will follow. We look forward to meeting each of you and thank you in advance for taking the time to participate and lend your expertise. We are hopeful that this meeting will yield good contacts among agencies and a reduction in the amount of time it takes to complete our respective tasks. If you have any questions or concerns, please give me a call.
>
> Cheers,
> Sara
>
>
>
> SARA TOWNSEND
> Coastal Program Analyst
>
>
>
> CALIFORNIA COASTAL COMMISSION
> 45 FREMONT STREET
> SUITE 2000
> SAN FRANCISCO CA 94105
> T: 415.904.5295
> F: 415.904.5400
>
>
>

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***Peter M. MacLaggan***
*Senior Vice President*
*Poseidon Resources*
*501 W. Broadway # 1260*
*San Diego, CA 92101*
*Ph. 619-595-7802*
*Fax 619-595-7892*
*pmaclaggan@poseidon1.com*



**From:** Peter MacLaggan [mailto:pmaclaggan@poseidon1.com]
**Sent:** Thursday, April 10, 2008 12:25 PM
**To:** John Robertus
**Subject:** FW: Update on Attendees for May 1-2 Meetings

John,

Attached is the list of confirmed attendees for the May 1 coordination meeting on the desal project wetlands mitigation plan. In addition to those on the list Poseidon will be sending a delegation of staff, scientists and some of the water agency reps. Sara Townsend from CCC is coordinating the meeting. Her contact info is included below. The location of the meeting is the Agua Hedionda Lagoon Foundation Discovery Center 1580 Cannon Road. I will forward you via a separate email her original meeting invitation. Let me know if you need any additional information.

Peter

---

***Peter M. MacLaggan***
*Senior Vice President*
*Poseidon Resources*
*501 W. Broadway # 1260*
*San Diego, CA 92101*
*Ph. 619-595-7802*
*Fax 619-595-7892*
*pmaclaggan@poseidon1.com*

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**From:** Sara Townsend [mailto:stownsend@coastal.ca.gov]
**Sent:** Wednesday, April 09, 2008 5:26 PM
**To:** Peter MacLaggan
**Cc:** Alison Dettmer
**Subject:** Update on Attendees for May 1-2 Meetings

Here is a current list of responses I have received so far. Looking pretty good!

Thanks,
Sara

# San Diego Meetings

*May 1 & 2*

| Person | Affiliation |
|---|---|
| Day 1- Marine Life Mitigation Plan | |
| **Judy Brown** | State Lands Commission |
| **Gail Newton** | State Lands Commission |
| **Steven Mindt** | State Lands Commission |
| **Mark Meier** | State Lands Commission |
| **Eric Becker** | Regional Board |
| | Regional Board |
| Bill Paznokas | Fish & Game |
| Amber Pairis | Fish & Game |
| Bryant Chesney | NMFS |
| Monica DeAngeles | NMFS |
| Dr. Marci Koski | USFWS |
| Meleah Ashford | City of Vista |
| Jim Elliot | City of Carlsbad |
| Mike Grim | City of Carlsbad |
| Keith Greer | SANDAG |
| Bob Leiter | SANDAG |
| Steve Hampton | OSPR |
| Matt Zafonte | OSPR |
| Pierre duVair | CEC |
| Peter McLaggen | Poseidon |
| Tom Luster | CCC |
| Sara Townsend | CCC |
| | |
| | |
| Day 2- Greenhouse Gas Emission Reduction Plan | |
| **Judy Brown** | State Lands Commission |
| **Gail Newton** | State Lands Commission |
| **Steven Mindt** | State Lands Commission |
| **Mark Meier** | State Lands Commission |
| **Andy Hamilton** | SDAPCD |
| Pierre duVair | CEC |
| Patrick Gaffney | CARB |
| Brian Holland | SANDAG |
| Bob Leiter | SANDAG |
| Doug Wickizer | CA Dept Forestry |
| Jim Elliot | City of Carlsbad |
| Joe Garuba | City of Carlsbad |
| Bryant Chesney | NMFS |
| Monica DeAngeles | NMFS |
| Dr. Marci Koski | USFWS |
| Meleah Ashford | City of Vista |
| Bill Paznokas | Fish & Game |
| Amber Pairis | Fish & Game |
| Steve Hampton | OSPR |

| | |
|---|---|
| Matt Zafonte | OSPR |
| Peter McLaggen | Posiedon |
| Tom Luster | CCC |
| Sara Townsend | CCC |

| Confirmed | |
|---|---|
| | |
| YES | |
| YES | |
| YES | |
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| YES | |
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| YES | |
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| YES | |
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| YES | |
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| YES | |
| NO | |
| MAYBE | |
| NO | |
| NO | |
| NO | |
| YES | |
| YES | |
| YES | |
| | Lani Adams?? |
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| NO | |
| YES | |
| MAYBE | |
| YES | |
| YES | |
| YES | |
| MAYBE | |
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| YES | |
| | |
| YES | |
| NO | |
| NO | |

| |
|---|
| NO |
| YES |
| YES |
| YES |

13

From: Chiara Clemente [mailto:CClemente@waterboards.ca.gov]
Sent: Thursday, April 17, 2008 9:48 AM
To: pmaclaggan@poseidon1.com
Cc: Brian Kelley; David Barker; Deborah Woodward; Mike McCann
Subject: Poseidon's CDP Plan - questions regarding IM & E assessments

Dear Mr. MacLaggan,

After discussing the issue with Debbie Woodward, we thought that perhaps a meeting isn't necessary to obtain the clarifications we need to proceed with our analysis. Rather, it would be most helpful if you, or your consultant(s), could confirm/clarify a couple aspects of the entrainment and impingement assessments in the Flow, Entrainment and Impingement Minimization Plan (March 6, 2008) via e-mail, in the next couple of days. Please see below.

1. ENTRAINMENT

Based on our review of the entrainment assessment in the Plan, it appears that the assessment...

(a) characterizes larval concentration in entrained water using in-plant samples, i.e., two, 24-hour samples collected near the CDP intake in the EPS discharge stream on June 10, 2004 and May 19, 2005;

(b) characterizes larval concentration in source water using source water samples, i.e., thirteen, 24-hour sample events per station collected at four lagoon (L1-4) and five nearshore (N1-5) stations, monthly from June 10, 2004 through May 19, 2005;

(c) does not draw upon the monthly samples taken in the lagoon near the entrance to the EPS intake structure (station E1); and,

(c) therefore, is for CDP/EPS co-operation rather than CDP stand-alone operation.

Is this understanding correct? Do you concur that the entrainment assessment provided in the Plan is for co-operation rather than stand-alone operation?

2. IMPINGEMENT

Based on our review of the impingement assessment in the Plan, it appears that the daily biomass of impinged fish (0.96 kgs/day) may have been incorrectly calculated.

(a) Attachment 2 appears to present counts and weights of impinged organisms found during each of the 24-hour sample events conducted weekly from June 24, 2004 through June 15, 2005, i.e., 52 sample events, each representing 24-hour impingement;

(b) Table 5-1 appears to present - not annual count and weight totals prorated to 304 MGD as indicated by the caption - but rather line totals (by taxa) of the counts and weights from Attachment 2, i.e., Table 5-1 appears to present 52-day totals with no adjustment for flow

on the day of sampling, no interpolation for the days between sample events, and no prorating to 304 MD; and,

(c) therefore, calculation of the daily biomass of impinged fish by dividing the un-interpolated, un-prorated Table 5-1 total weight (351,672 grams) by 365 days appears to be in error.

Is the above staff interpretation correct? If not, then could you please let me know which of the above statements regarding Attachment 2 and/or Table 5-1 is wrong, and why?

Thank you for your time and attention on this matter,

Chiara

Chiara Clemente
Senior Environmental Scientist
Regional Water Quality Control Board
9174 Sky Park Court, Suite 100
San Diego, CA 92123
(858) 467-2359

cclemente@waterboards.ca.gov
http://www.waterboards.ca.gov/sandiego

Please take the time to fill out our electronic customer service survey located at http://www.calepa.ca.gov/Customer/CSForm.asp.

14

**From:** John Steinbeck [jsteinbeck@tenera.com]
**Sent:** Tuesday, April 22, 2008 11:07 AM
**To:** Pete Raimondi
**Cc:** Dave Mayer
**Subject:** Variance Calculations

Hi Pete,
The ETM variances in the Encina study were calculated using the weighted (same survey weights used in ETM calcs) average CV from the PE estimates which integrates the entrainment and source water variances. The source water variances for the nearshore and lagoon were calculated separately and then added into the total for the final variance calculation.

John

><<++> * <++>< ><++> * <++><
John Steinbeck
Tenera Environmental
141 Suburban Rd., Suite A2
San Luis Obispo, CA 93401
805-541-0310 ph
805-541-0421 fax
www.tenera.com
><++> * <++>< ><++> * <++><

15

**From:** John Steinbeck [jsteinbeck@tenera.com]
**Sent:** Thursday, April 24, 2008 6:05 PM
**To:** Dave Mayer
**Subject:** ETM Numbers

Dave - Numbers given to Pete over the phone...
Grid length = 6.3 km
PS Values
CA halibut - 0.17
Spotfin Croaker - 0.34
Queenfish - 0.23
Anchovy - 0.30
White Croaker - 0.14

><++> * <++>< ><++> * <++><

John Steinbeck
Tenera Environmental
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805-541-0310 ph
805-541-0421 fax
www.tenera.com

><++> * <++>< ><++> * <++><

16

-----Original Message-----
From: Peter MacLaggan [mailto:pmaclaggan@poseidon1.com]
Sent: Wednesday, April 30, 2008 4:13 PM
To: Chiara Clemente
Cc: Brian Kelley; David Barker; Deborah Woodward; Mike McCann
Subject: RE: Poseidon's CDP Plan - questions regarding IM & E assessments

Chiara,

I see that some of the staff on your original email were not included in my earlier response so I'm resending it to everyone.

Attached is Poseidon's response to staff's questions on the Flow, Entrainment and Impingement Plan for the Carlsbad Desalination Project. Please feel free to contact me if you have any additional questions.

Peter

Peter M. MacLaggan
Senior Vice President
Poseidon Resources
501 W. Broadway #840
San Diego, CA 92101
Ph. 619-595-7802
Fax 619-595-7892
pmaclaggan@poseidon1.com

-----Original Message-----
From: Chiara Clemente [mailto:CClemente@waterboards.ca.gov]
Sent: Thursday, April 17, 2008 9:48 AM
To: pmaclaggan@poseidon1.com
Cc: Brian Kelley; David Barker; Deborah Woodward; Mike McCann
Subject: Poseidon's CDP Plan - questions regarding IM & E assessments

Dear Mr. MacLaggan,

After discussing the issue with Debbie Woodward, we thought that perhaps a meeting isn't necessary to obtain the clarifications we need to proceed with our analysis. Rather, it would be most helpful if you, or your consultant(s), could confirm/clarify a couple aspects of the entrainment and impingement assessments in the Flow, Entrainment and Impingement Minimization Plan (March 6, 2008) via e-mail, in the next couple of days. Please see below.

1. ENTRAINMENT

Based on our review of the entrainment assessment in the Plan, it appears that the assessment...

(a) characterizes larval concentration in entrained water using in-plant samples, i.e., two, 24-hour samples collected near the CDP intake in the EPS discharge stream on June 10, 2004 and May 19, 2005;

(b) characterizes larval concentration in source water using source water samples, i.e., thirteen, 24-hour sample events per station

collected at four lagoon (L1-4) and five nearshore (N1-5) stations, monthly from June 10, 2004 through May 19, 2005;

(c) does not draw upon the monthly samples taken in the lagoon near the entrance to the EPS intake structure (station E1); and,

(c) therefore, is for CDP/EPS co-operation rather than CDP stand-alone operation.

Is this understanding correct? Do you concur that the entrainment assessment provided in the Plan is for co-operation rather than stand-alone operation?

2. IMPINGEMENT

Based on our review of the impingement assessment in the Plan, it appears that the daily biomass of impinged fish (0.96 kgs/day) may have been incorrectly calculated.

(a) Attachment 2 appears to present counts and weights of impinged organisms found during each of the 24-hour sample events conducted weekly from June 24, 2004 through June 15, 2005, i.e., 52 sample events, each representing 24-hour impingement;

(b) Table 5-1 appears to present - not annual count and weight totals prorated to 304 MGD as indicated by the caption - but rather line totals (by taxa) of the counts and weights from Attachment 2, i.e., Table 5-1 appears to present 52-day totals with no adjustment for flow on the day of sampling, no interpolation for the days between sample events, and no prorating to 304 MD; and,

(c) therefore, calculation of the daily biomass of impinged fish by dividing the un-interpolated, un-prorated Table 5-1 total weight (351,672 grams) by 365 days appears to be in error.

Is the above staff interpretation correct? If not, then could you please let me know which of the above statements regarding Attachment 2 and/or Table 5-1 is wrong, and why?

Thank you for your time and attention on this matter,

Chiara

Chiara Clemente
Senior Environmental Scientist
Regional Water Quality Control Board
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1. ENTRAINMENT

*RRWQCB Comment: Based on our review of the entrainment assessment in the Plan, it appears that the assessment...*

*(a) characterizes larval concentration in entrained water using in-plant samples, i.e., two, 24-hour samples collected near the CDP intake in the EPS discharge stream on June 10, 2004 and May 19, 2005;*
*(b) characterizes larval concentration in source water using source water samples, i.e., thirteen, 24-hour sample events per station collected at four lagoon (L1-4) and five nearshore (N1-5) stations, monthly from June 10, 2004 through May 19, 2005;*
*(c) does not draw upon the monthly samples taken in the lagoon near the entrance to the EPS intake structure (station E1); and,*
*(c) therefore, is for CDP/EPS co-operation rather than CDP stand-alone operation.*
*Is this understanding correct? Do you concur that the entrainment assessment provided in the Plan is for co-operation rather than stand-alone*
*operation?*

**Response:** The entrainment assessment included in the *Flow, Entrainment and Impingement Minimization Plan* (Plan) for the Carlsbad Desalination Project relies on the monthly samples taken in the lagoon near the entrance to the EPS intake structure (station E1); and therefore it is representative of stand-alone operation.

The entrainment assessment in the Plan is based entirely on a 12-month study from June 2004 to June 2005. Entrainment and source water sampling was conducted monthly from June 2004 through May 2005 except that two surveys were done in June 2004 separated by a two-week interval. The thirteen surveys provided a complete year of seasonal data for 2004–2005. The details of both the study methods and findings are presented in their entirety in the report titled, "CLEANWATER ACT SECTION 316(b) IMPINGEMENTMORTALITY AND ENTRAINMENT CHARACTERIZATION STUDY Effects on the Biological Resources of Agua Hedionda Lagoon and the Nearshore Ocean Environment January 2008 Prepared by: Tenera Environmental, and submitted to the San Diego Regional Water Quality Control Board January 2008.

Entrainment samples were collected from a single station located in front of the EPS intakes (E1). They were collected using a bongo frame with paired 0.71 m (2.33 ft) diameter openings each equipped with 335 µm (0.013 in) mesh plankton nets and codends. The start of each tow began approximately 30 m (98 ft) in front of the intake structure and proceeded in a northwesterly direction against the prevailing intake current, ending approximately 150 m (492 ft) from the intake structure.

Source water Plankton samples were also collected monthly at four source water stations in Agua Hedionda Lagoon and five nearshore stations adjacent to the EPS. The source water stations ranged in depth from approximately –1.8 m (–5.9 ft) MLLW and to-34.1 m (–111.9 ft) MLLW. The stations were stratified to include stations in the Inner, Middle and Outer Lagoon, and at varying distances upcoast, downcoast, and offshore from the lagoon mouth lagoon.

A total of 20,601 larval fishes representing 41 taxa were collected from the EPS entrainment station E1 during 13 monthly surveys in the 2004 to 2005 sampling period. Gobies (CIQ goby complex) and blennies comprised over 90% of all specimens collected.

The results from a separate in-plant entrainment mortality study referred to in Staff's review were not used in the entrainment assessment for stand-alone operation of the desalination facility. This information was used to calculate the incremental mortality associated with the desalination facility operations when operating jointly with the power plant.

2. IMPINGEMENT

*RWQCB Comment: Based on our review of the impingement assessment in the Plan, it appears that the daily biomass of impinged fish (0.96 kgs/day) may have been incorrectly calculated.*

*(a) Attachment 2 appears to present counts and weights of impinged organisms found during each of the 24-hour sample events conducted weekly from June 24, 2004 through June 15, 2005, i.e., 52 sample events, each representing 24-hour impingement;*

*(b) Table 5-1 appears to present - not annual count and weight totals prorated to 304 MGD as indicated by the caption - but rather line totals (by taxa) of the counts and weights from Attachment 2, i.e., Table 5-1 appears to present 52-day totals with no adjustment for flow on the day of sampling, no interpolation for the days between sample events, and no prorating to 304 MD; and,*

*(c) therefore, calculation of the daily biomass of impinged fish by dividing the un-interpolated, un-prorated Table 5-1 total weight (351,672 grams) by 365 days appears to be in error.*

*Is the above staff interpretation correct? If not, then could you please let me know which of the above statements regarding Attachment 2 and/or Table 5-1 is wrong, and why?*

**Response:** The weights and taxa collected during the 52 week samples shown in Table 5.1 are correct. Therefore, the total amount of impinged species collected over the 13-month sample period of 3,651,179 grams (3,651.179 kg) is accurate. However, staff is correct that there is an error in the calculation used to convert this information to a daily amount.

In response to staff's request, we have revised the estimate of the daily impingement effect of the intake operations. Figure 1 (below) shows the average daily flow rate and impinged biomass for 50 of the 52) weekly surveys collected during the impingement survey period. The two remaining samples were outliers and therefore were not included in the analysis in order to get more accurate statistical correlation of the impingement results.

As shown in Figure 1, the sampling period flow rate consistently exceeded the stand-alone desalination plant flow of 304 MGD. However, from this information we are able to extrapolate an average daily impingement effect of 1.56 kg the desalination plant stand-alone operations at 304 MGD using the statistically significant relationship between the impingement effects and flows measured under normal power plant operations that occurred during the June 2004 to June 2005 impingement survey.

It is important to note that 6 of the 13 samples collected for plant intake flows at or below 550 MGD had impingement effect approximately equal to or less than the initially estimated daily impingement effect 0.96 kg/day. Another trend that can be noted in Figure 1 is that the opposite is true for flows above 550 MGD -- the majority of the impingement results are above the average of the curve.

This observation is consistent with other nationwide findings on the relationship of intake volume, velocity, and impingement that indicate an impingement effects threshold at or above a velocity of approximately 2 fps. Below this velocity, impingement effects decline rapidly. The impingement effects continue to dramatically decline as the intake approach velocity nears 0.5 fps and below. The desalination plant stand-alone operations at 304 MGD will mirror these conditions -- intake approach velocities at bar racks will be approximately of 0.5 fps. Consequently, we expect to observe a velocity driven impingement reduction effect that will result in actual impingement rates that are below the statistical projection of 1.56 kg/d and possibly below 1.0 kg/d.

Although the estimated daily impingement rate of 1.56 kg/d is slightly higher than previously indicated, the total amount of impinged species collected over the 13-month sample period of 3,651,179 grams is unchanged. This level of impingement, along with the adjusted daily estimate continues to represent a *de minimis* impingement effect.

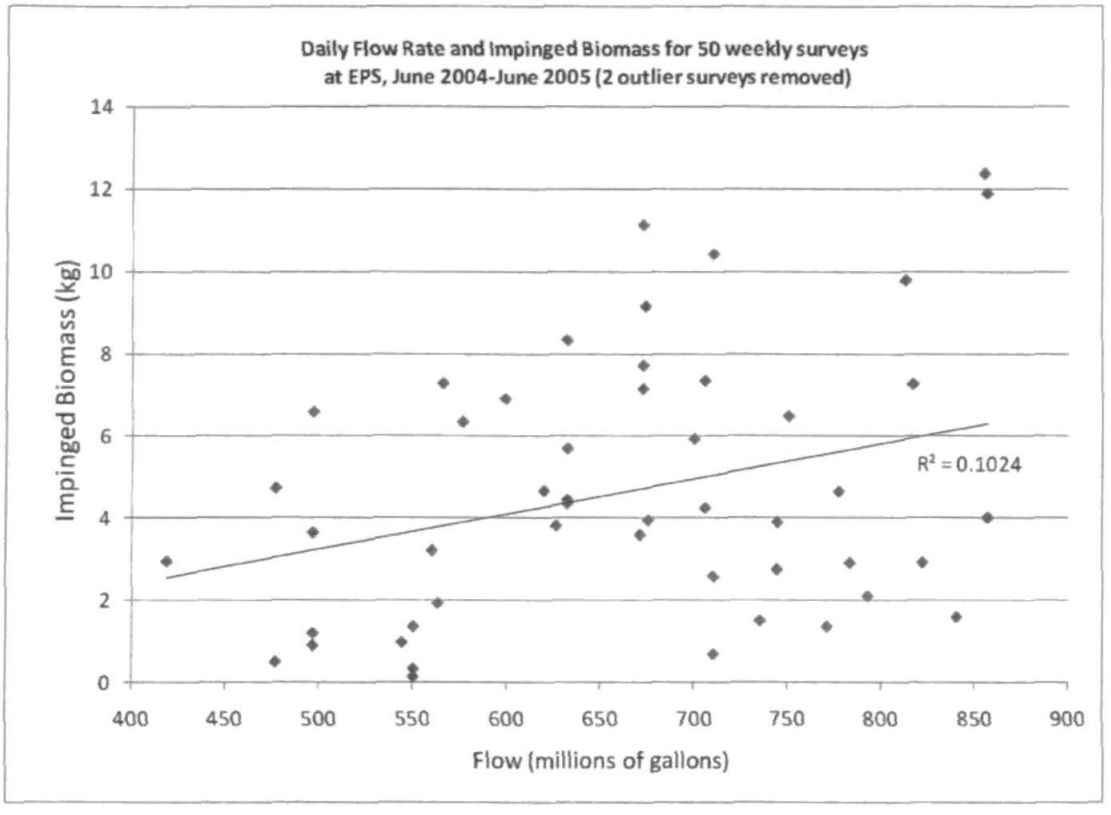
Daily Flow Rate and Impinged Biomass for 50 weekly surveys
at EPS, June 2004-June 2005 (2 outlier surveys removed)
Impinged Biomass (kg)
Flow (millions of gallons)
R² = 0.1024
0
2
4
6
8
10
12
14
400
450
500
550
600
650
700
750
800
850
900

Figure 1.

17

Y

**From:** "Sara Townsend" <stownsend@coastal.ca.gov>
**To:** "wpaznokas@dfg.ca.gov" <'wpaznokas@dfg.ca.gov'>, "jrobertus@waterboards....
**CC:** "Tom Luster" <tluster@coastal.ca.gov>
**Date:** 07/08/2008 1:39 PM
**Subject:** Poseidon's Marine Life Mitigation Plan
**Attachments:** MLMP 1 of 4.pdf; MLMP 2 of 4.pdf; MLMP 3 of 4.pdf; MLMP 4 of 4.pdf

Greetings!

As a follow up to our May 1 meeting in Carlsbad regarding marine life mitigation, we have attached Poseidon's new Marine Life Mitigation Plan for your review. This Plan consists of 4 parts, attached.

We will bring this Plan before the Commission next month, therefore please get any comments to us as soon as possible (within the next two weeks). Any questions--please don't hesitate to call.

Many thanks,

Sara

SARA TOWNSEND

*Coastal Program Analyst*

CALIFORNIA COASTAL COMMISSION

45 FREMONT STREET

SUITE 2000

SAN FRANCISCO CA 94105

T: 415.904.5295

F: 415.904.5400

18

**From:** Gail Newton
**To:** Judy Brown; Steven Mindt
**CC:** Barbara Dugal; Paul Thayer
**Date:** 08/05/2008 11:26 AM
**Subject:** SDRWQCB

Just got off the phone with San Diego RWQCB. They have had absolutely no contact from Poseidon since the April meeting. They are watching us and CCC and waiting and reading CCC's staff reports.--gn



STATE OF CALIFORNIA—THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, *GOVERNOR*

CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105-2219
VOICE AND TDD (415) 904-5200
FAX (415) 904-5400

# W4a

## FINAL ADOPTED FINDINGS

| | |
|---|---|
| **APPLICATION FILE NO.:** | E-06-013 |
| **PERMITTEE:** | Poseidon Resources (Channelside) LLC / Cabrillo Power II LLC |
| **PROJECT LOCATION:** | On the Encina Power Plant site, adjacent to Agua Hedionda Lagoon, in the City of Carlsbad, San Diego County. |
| **PROJECT DESCRIPTION:** | Construction and operation of a 50 million gallon per day seawater desalination facility. |
| **ADOPTED:** | August 6, 2008 |
| **SUBSTANTIVE FILE DOCUMENTS:** | See Appendix A |
| **EXHIBIT 1:** | Location Map |
| **EXHIBIT 2:** | Site Layout |
| **EXHIBIT 3:** | Aerial View of Site |
| **EXHIBIT 4:** | Diagram of Subsurface Intakes |
| **ATTACHMENT 1:** | November 15, 2007 Hearing Transcript. Note: attached transcript includes Commission deliberations only. |
| **ATTACHMENT 2:** | Staff Proposed Conditions of November 14, 2007 and Poseidon Proposed Conditions of November 15, 2007. |
| **ATTACHMENT 3:** | *Ex Parte* Forms. |
| **ATTACHMENT 4:** | June 25, 2008 letter from Latham & Watkins with requested revisions to Revised Findings. |
| **ATTACHMENT 5:** | June 11, 2008 e-mail from Latham & Watkins with requested revisions to Revised Findings. |
| **ATTACHMENT 6:** | May 22, 2008 Applicant's Requested Revisions to Revised Findings. |

# EXECUTIVE SUMMARY

**Project Description:** The proposed project is a seawater desalination facility to be constructed and operated at the site of the Encina Power Plant in Carlsbad, San Diego County. The facility would be owned and operated by Poseidon Resources (Channelside) LLC. It would withdraw about 304 million gallons per day (MGD) of water from Agua Hedionda Lagoon (the Lagoon), a coastal estuary, to produce about 50 MGD of potable water for sale and distribution.

The project was originally proposed to co-locate with the power plant in order to use some of the several hundred million gallons per day of water the power plant pumped from Agua Hedionda. However, the power plant owner announced in September 2007 that it intends to shut down the existing plant and build a new one elsewhere on the site that would not use seawater for cooling. During the last few years, the power plant has operated at a substantially reduced level over its historical rate of use, and it is expected to operate only sporadically for a few more years once the new facility is built. As a result, the desalination facility would now operate as a "stand-alone" facility, and the analyses in these Findings are based on these "stand-alone" operations.

**Key Coastal Act Issues:**

- *Protection of Marine Life and Water Quality*: The project as proposed and conditioned herein will be consistent with policies of Coastal Act Sections 30230 and 30231 meant to protect marine life and water quality. Results of Poseidon's entrainment study show the entrainment caused by the project's use of an open-water intake within Agua Hedionda would result in a loss of productivity in the Lagoon equal to that produced in no less than 37 acres of wetland and open water habitat.

  The Commission finds that the certified project EIR determined that the project's discharge into coastal waters of its waste stream would result in levels of salinity higher than the natural variability of these waters in an area ranging from about eight to over 40 acres of benthic habitat, but would not cause significant adverse impacts to marine life, and that the San Diego Regional Water Quality Board (Regional Board) studied the project's expected discharge before issuing the project's NPDES permit, and that the Regional Board adequately conditioned all potential discharge-related impacts to ensure compliance with applicable Clean Water Act criteria and the California Ocean Plan. As documented in the certified EIR prepared for the project by the City of Carlsbad, the desalination facility would not cause significant impingement or entrainment impacts when it operates while the power plant is using at least 304 million gallons per day (MGD) of cooling water (i.e., "co-located" operations). Operating stand-alone – that is, when the power plant is using little or no cooling water – the EIR found that the desalination facility would not cause significant impacts. Poseidon's entrainment study results show that the desalination facility's entrainment impacts would result in a loss of productivity in the Lagoon equal to that produced in approximately 37 acres of wetland and open water habitat.

To address these impacts, Poseidon submitted a conceptual plan to restore 37 acres of lost wetland and upland habitat productivity.[1] The Commission is requiring through **Special Condition 8** that Poseidon submit its full entrainment study and develop a Marine Life Mitigation Plan for further Commission review and approval that fully documents the facility's anticipated entrainment and impingement impacts, mitigates those impacts to the maximum extent feasible through creation, enhancement, or restoration of aquatic and wetland habitat, and ensures long-term performance, monitoring, and protection of the approved mitigation measures in a manner consistent with the policies of Coastal Act Sections 30230 and 30231. The Commission is also requiring through **Special Condition 9** that Poseidon obtain an amendment to its coastal development permit if it proposes or is required to withdraw more than the currently anticipated 304 million gallons per day of estuarine water from Agua Hedionda Lagoon. Further, the project is subject to continuing review by the Regional Board to ensure conformity to federal Clean Water Act and state Porter-Cologne Act requirements related to protection of water quality impacts. **Special Condition 4** requires Poseidon to submit, prior to construction, documentation that it has received final approvals from the Regional Board and other agencies for project construction and operations. For the reasons set forth more fully below in these Findings and in Poseidon's submissions, the Commission finds that alternative intakes that would avoid or reduce entrainment and impingement impacts are infeasible or would cause greater adverse impacts.

With implementation of these **Special Conditions**, the Commission finds the project will conform to applicable provisions of Coastal Act Sections 30230 and 30231 by ensuring that marine resources are maintained, enhanced, and restored.

- *Energy Use and Greenhouse Gas Emissions*: The project's electrical use would cause emissions of carbon dioxide of about an estimated 130 million to 200 million pounds (approximately 61,000 to 90,000 metric tonnes) per year[2], which would result in adverse impacts to a wide range of coastal resources, as described in Section 4.5.5 of these Findings. Poseidon has agreed to "go carbon-neutral" – i.e., to reduce its emissions through various measures so that its facility would contribute net zero greenhouse gas emissions, but it has not yet demonstrated how it would implement this mitigation proposal. To ensure the project conforms to Coastal Act Section 30253(4) and other applicable policies, and avoids or minimizes its effects on coastal resources, the Commission is requiring through **Special Condition 10** that Poseidon develop an Energy Minimization and Greenhouse Gas Reduction Plan for further Commission review and approval.

[1] Poseidon has also submitted the plan to the San Diego Regional Water Quality Control Board (Regional Board) as required by its conditional NPDES permit. The Regional Board reviews various water quality issues and will ensure compliance with its regulations and policies via its review and approval of the plan.

[2] As described more fully in Section 4.5.5 herein, Commission staff estimates that the project will emit 90,000 metric tonnes (200,000,000 pounds) of carbon dioxide per year, while Poseidon, relying on the California Climate Action Registry's certified protocol, estimates 61,000 metric tonnes (134,500,000 pounds) of carbon emissions.

- *Dredging and Protection of Coastal Waters and Wetlands*: The project may require future dredging to ensure its continued use of the existing intake structure, and the Commission, through imposition of **Special Condition 12** requiring Poseidon to obtain separate coastal development permits for any future proposed dredging activities, has ensured that any needed dredging will conform to applicable Coastal Act policies.

  However, the project represents a use and alteration of Agua Hedionda Lagoon that is not permitted under Coastal Act Section 30233(c). That Coastal Act policy identifies Agua Hedionda as one of 19 coastal estuaries in which alterations are allowed for just a limited set of uses, including "...very minor incidental public facilities, restorative measures, [and] nature study...", and the project's removal and use of water from Agua Hedionda does not fall within the set of allowable uses or alteration. The Commission therefore finds the project is not consistent with the use prohibitions of Coastal Act Section 30233(c). Even so, because the project is a coastal-dependent industrial facility, the Commission can approve the project, notwithstanding its nonconformity to Coastal Act Section 30233(c), if the Commission finds that it meets the requirements of Section 30260, as described below.

- *Application of Coastal Act Section 30260:* Because the proposed project is a coastal-dependent industrial facility, its inconsistencies with Coastal Act Section 30233(c) may be "overridden" pursuant to Coastal Act Section 30260. That policy allows the Commission to approve coastal-dependent industrial facilities that are not consistent with other Coastal Act policies contained in Chapter 3 if the proposal meets three tests. Those tests require: (1) that there be no feasible and less environmentally damaging location for the proposed project; (2) that the project's adverse environmental impacts be mitigated to the maximum extent feasible; and, (3) that not permitting the proposed project would adversely affect the public welfare. In applying these tests to the proposed project, the Commission finds, as discussed in detail in Section 4.5.7 of these Findings, the following:

  - There are no feasible and less environmentally damaging alternative locations to draw in the needed seawater (e.g., subsurface or offshore, as further described in Section 4.2.1 of these Findings) that would avoid nonconformity to the use prohibitions of Section 30233(c). For reasons set forth more fully below in these findings, the Commission finds that slant wells are infeasible because the water quality available from such intakes would make it difficult, if not impossible, to treat for desalination purposes, and that the construction impacts associated with this alternative render it environmentally inferior to the proposed project. The Commission also finds that an infiltration gallery is environmentally inferior to the proposed project because this alternative would disrupt public access to marine resources, require frequent dredging, and would require the destruction of 150 acres of coastal habitat, and that the alternative is economically infeasible. The Commission further finds that an offshore intake system would result in greater environmental impacts and that construction of an offshore intake would render the project economically infeasible.

- **Special Conditions 4, 8, 9, 10, 11, 12, 15, 16,** and **17,** ensure the project's adverse effects to Agua Hedionda Lagoon are mitigated to the maximum extent feasible. The Commission finds that the required development of the necessary mitigation plans, the limitation on water withdrawals, prohibition of dredging without further Commission review and approval, and imposition of water quality best management practices, will ensure that the project is mitigated to the maximum extent feasible.

- Denial of the proposed project would adversely affect the public welfare for a number of reasons. As set forth in the project's EIR and described herein and elsewhere in the Commission's record, the project would provide public benefits in the form of a local water supply in an area where current and anticipated water imports are expected to decline. Although it is a privately funded project, the water produced by the project will be put to public use by eight public water districts. The sale of water to public water districts is expected to both alleviate expected water supply shortfalls and augment other supply options such as recycled water and conservation. It also provides public benefits to those districts and their ratepayers because they will not be expected to pay directly for more than $300 million of the project's start-up and construction costs. The project also includes public benefits in the form of increased public access opportunities to both Agua Hedionda Lagoon and to the Pacific Ocean.

**Commission Action:** On August 6, 2008, the Commission approved, as conditioned, proposed project E-06-013 as described herein.

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## GLOSSARY

**Terms Used:**

- Acre-foot: An acre-foot is equal to about 326,000 gallons, which is enough to supply from one to four households for a year.
- Kilowatt-hour (kWh): As used in these findings, it refers to the amount of electricity needed to produce one kilowatt for one hour.
- Megawatt-hour (mWh): As used in these findings, it refers to the amount of electricity needed to produce one megawatt for one hour. A megawatt is 1,000 kilowatts.
- Million gallons per day (MGD): A million gallons is equal to about three acre-feet.

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# 1.0 MOTION AND RESOLUTION

**Motion**

Staff recommends the Commission adopt the following findings in support of its actions on November 15, 2007 to approve Coastal Development Permit E-06-013.

*I move that the Commission adopt the Revised Findings in support of the Commission's actions on November 15, 2007 concerning the Commission's Coastal Development Permit E-06-013.*

**Resolution**

*The Commission hereby adopts the Findings set forth below regarding Coastal Development Permit E-06-013.*

## 2.0 STANDARD CONDITIONS

1) **Notice of Receipt and Acknowledgment:** This permit is not valid until a copy of the permit is signed by the Permittee or authorized agent, acknowledging receipt of the permit and the acceptance of the terms and conditions, and is returned to the Commission office.

2) **Expiration:** Construction activities for the proposed project must be initiated within two years of issuance of this permit. This permit will expire two years from the date on which the Commission approved the proposed project if development has not begun. Construction of the development shall be pursued in a diligent manner and completed in a reasonable period of time. Application for extension of the permit must be made at least six months prior to the expiration date.

3) **Interpretation:** Any questions of intent or interpretation of any condition will be resolved by the Executive Director of the Commission (hereinafter, "Executive Director") or the Commission.

4) **Assignment:** The permit may be assigned to any qualified person, provided the assignee files with the Commission an affidavit accepting all terms and conditions of the permit.

5) **Terms and Conditions Run with the Land:** These terms and conditions shall be perpetual, and it is the intention of the Commission and the Permittee to bind all future owners and possessors of the subject property to the terms and conditions.

## 3.0 SPECIAL CONDITIONS

1) **Liability for Costs and Attorneys Fees:** The Permittee shall reimburse the Coastal Commission in full for all Coastal Commission costs and attorneys fees – including (1) those charged by the Office of the Attorney General, and (2) any court costs and attorneys fees that the Coastal Commission may be required by a court to pay – that the Coastal Commission incurs in connection with the defense of any action brought against the Coastal Commission, its officers, employees, agents, successors and assigns challenging the approval or issuance of this permit. The Coastal Commission retains complete authority to conduct and direct the defense of any such action against the Coastal Commission.

2) **Proof of Legal Interest:** PRIOR TO ISSUANCE OF THE PERMIT, the Permittee shall provide for Executive Director review and approval documentation of the Permittee's legal interest in all property within the coastal zone needed to construct and operate the project, including:
   - Lease(s) from the California State Lands Commission for structures on state tidelands. Any conflicts between conditions of the lease(s) and those adopted by the Coastal Commission shall be presented to the Coastal Commission for resolution.
   - Lease(s) or other forms of approval from the power plant owner allowing the Permittee to use portions of the power plant site and Agua Hedionda Lagoon.
   - Lease(s) or other forms of approval from the City of Carlsbad and other local governments for the project's water delivery pipelines.

3) **Lease and Deed Restriction:** PRIOR TO ISSUANCE OF THE PERMIT, the applicant shall provide to the Executive Director for review and approval documentation demonstrating that the applicant has executed and recorded against its leasehold interest(s) in the property governed by this permit a lease restriction (in which any private owner of the fee interest in such property shall join or to which it shall agree to be bound), in a form and content acceptable to the Executive Director (a) indicating that, pursuant to this permit, the California Coastal Commission has authorized development on the Property, subject to terms and conditions that restrict the use and enjoyment of the Property; and (b) imposing all of the Special Conditions of this permit as covenants, conditions and restrictions on the use and enjoyment of the Property. The restriction shall include a legal description of the Property. It shall also indicate that, in the event of an extinguishment or termination of the deed restriction for any reason, the Standard and Special Conditions of this permit shall continue to restrict the use and enjoyment of the Property so long as either this permit or the development it authorizes – or any part, modification, or amendment thereof – remains in existence on or with respect to the Property.

4) **Other Approvals:** PRIOR TO COMMENCEMENT OF CONSTRUCTION, the Permittee shall submit to the Executive Director for review and approval documentation showing that the project has obtained final approvals for project construction and operation from the City of Carlsbad, the Regional Water Quality Control Board, the California Department of Health Services, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service, or documentation showing that these approvals are not needed.

5) **Assumption of Risk and Waiver of Liability:** The Permittee acknowledges and agrees, on behalf of itself and all successors and assigns: (i) that the project site may be subject to hazards from seismic events, liquefaction, storms, waves, floods and erosion; (ii) to assume the risks to the Permittee and the property that is the subject of this permit of injury and damage from such hazards in connection with this permitted development; (iii) to unconditionally waive any claim of damage or liability against the Commission, its officers, agents, and employees for injury or damage from such hazards; and (iv) that any adverse effects to property caused by the permitted project shall be fully the responsibility of the landowner.

6) **Limits of Development:** This permit authorizes the construction and operation of the Poseidon Carlsbad Desalination Project and associated infrastructure as described in the project description of this staff report, as clarified and modified by these conditions.

7) **Final Plans**: PRIOR TO COMMENCEMENT OF CONSTRUCTION, the Permittee shall submit to the Executive Director for review and approval final plans for the project components located in the coastal zone. The Permittee shall undertake development in accordance with the approved plans and any changes shall be reported to the Executive Director. No material changes within the coastal zone shall occur without a Commission-approved amendment to this coastal development permit unless the Executive Director determines that no amendment is necessary. Changes to the project requiring review for amendment would include changes in the physical, operational, or delivery capacity increases, or extension of water supply distribution pipelines beyond those shown on the final plans.

8) **Marine Life Mitigation Plan:** PRIOR TO ISSUANCE OF THE PERMIT, the Permittee shall submit to and obtain from the Commission approval of a Marine Life Mitigation Plan (the Plan) that complies with the following:
   a) Documentation of the project's expected impacts to marine life due to entrainment and impingement caused by the facility's intake of water from Agua Hedionda Lagoon. This requirement can be satisfied by submitting a full copy of the Permittee's Entrainment Study conducted in 2004-2005 for this project.
   b) To the maximum extent feasible, the mitigation shall take the form of creation, enhancement, or restoration of aquatic and wetland habitat.
   c) Goals, objectives and performance criteria for each of the proposed mitigation sites. It shall identify specific creation, restoration, or enhancement measures that will be used at each site, including grading and planting plans, the timing of the mitigation measures, monitoring that will be implemented to establish baseline conditions and to determine whether the sites are meeting performance criteria. The Plan shall also identify contingency measures that will be implemented should any of the mitigation sites not meet performance criteria.
   d) Requires submittals of "as-built" plans for each site and annual monitoring reports for no less than five years or until the sites meet performance criteria.
   e) Defines legal mechanism(s) proposed to ensure permanent protection of each site – e.g., conservation easements, deed restriction, or other methods.

   The Permittee shall comply with the approved Plan. Prior to implementing the Plan, the Permittee shall submit a proposed wetlands restoration project that complies with the Plan in the form of a separate coastal development permit application for the planned wetlands restoration project.

9) **Change in Seawater Withdrawal:** If at any time during the life of the project Poseidon proposes or is required to withdraw more than an average flow of 304 MGD of seawater, it must obtain first an amendment to this permit.

10) **Energy Minimization and Greenhouse Gas Reduction Plan:** PRIOR TO ISSUANCE OF THE PERMIT, the Permittee shall submit to the Commission a Revised Energy Minimization and Greenhouse Gas Reduction Plan that addresses comments submitted by the staffs of the Coastal Commission, State Lands Commission and the California Air Resources Board. The permit shall not be issued until the Commission has approved a Revised Energy Minimization and Greenhouse Gas Reduction Plan after a public hearing.

11) **Public Access Enhancements:** PRIOR TO COMMENCEMENT OF OPERATIONS, Poseidon shall cause to be dedicated, in accordance with the City of Carlsbad's Precise Development Plan PDP 00-02, the below-described parcels of land. The dedications shall be in the form of easements, title transfers, and/or deed restrictions, whose purpose is to further Coastal Act goals of maximizing public access and recreational opportunities along the coast in the South Carlsbad Coastal Resource Redevelopment Area and maintaining, restoring and enhancing marine resources. The four sites are:
   - Fishing Beach: public access and parking easement in favor of the City of Carlsbad covering approximately 2.4 acres of land along the west shore of Agua Hedionda Lagoon.

- Bluff Area: approximately 10.2 acres of land on the west side of Carlsbad Boulevard opposite the power plant, which shall be dedicated in fee title to the City of Carlsbad for recreational and coastal access uses.
- Hubbs Site: approximately 2 acres of land along the north shore of Agua Hedionda Lagoon to be used for a fish hatchery, aquatic research, and public access, which shall be deed restricted to uses such as fish hatchery, aquatic research, and trails.
- South Power Plant Parking Area: an access easement over approximately 0.3 acres of land on the east side of Carlsbad Boulevard near the south entrance of the power plant that shall be dedicated to the City of Carlsbad for public parking.

12) **Dredging:** This permit does not authorize dredging that may be needed to maintain flows to the desalination facility's intake structure. The Permittee shall submit separate coastal development permit applications for proposed dredging operations.

13) **Visual Resources:** PRIOR TO COMMENCEMENT OF CONSTRUCTION, the Permittee shall submit to the Executive Director for review and approval a Screening Plan. Desalination plant exterior mechanical equipment and facilities, including tanks, heating, air conditioning, refrigeration equipment, plumbing lines, duct work and transformers, shall be screened from view on all sides visible to the public. The design and material used for screening shall be architecturally compatible with the building.

14) **Lighting Plan**: PRIOR TO COMMENCEMENT OF CONSTRUCTION, the Permittee shall submit a Lighting Plan to the Executive Director for review and approval. Exterior lighting for the desalination facilities shall serve the purpose of operations, security and safety only. The Lighting Plan shall demonstrate that project lighting is shielded from surrounding areas, and that only the minimum amount of lighting required for safety purposes is provided to avoid adverse effects on surrounding areas. In general, lighting fixtures shall be shielded downward and away from the ocean, Lagoon and adjacent properties. Construction of the desalination plant and related facilities and improvements shall be in conformance with the approved plan.

15) **Construction Plan:** PRIOR TO COMMENCEMENT OF CONSTRUCTION, the Permittee shall submit to the Executive Director for review and approval a Construction Plan. The Construction Plan shall identify the specific location of all construction areas, all staging areas, and all construction access corridors in site plan view in the coastal zone. The Plan shall identify any expected disruptions to public access to the shoreline and shall include measures to avoid, minimize, or mitigate for those disruptions.

The Plan shall also identify the type and location of erosion control/water quality best management practices that will be implemented during construction to protect coastal water quality, including the following:

- Silt fences, or equivalent apparatus, shall be installed at the perimeter of the construction areas to prevent construction-related runoff and/or sediment from entering the dunes and/or the Pacific Ocean.
- Grading and land alteration outside of the approved construction zone is prohibited.

- Equipment washing, refueling, and/or servicing shall not take place on the beach or sandy dune area. All construction equipment shall be inspected and maintained at an off-site location to prevent leaks and spills of hazardous materials at the project site.
- The construction site shall maintain good construction housekeeping controls and procedures (e.g., clean up all leaks, drips, and other spills immediately; keep materials covered and out of the rain (including covering exposed piles of soil and wastes); dispose of all wastes properly, place trash receptacles on site for that purpose, and cover open trash receptacles during wet weather; remove all construction debris from the beach).
- All erosion and sediment controls shall be in place prior to the commencement of construction as well as at the end of each workday. A copy of the approved Construction Plan shall be kept at the construction job site at all times and all persons involved with the construction shall be briefed on its content and meaning prior to commencement of construction. The Permittee shall notify the Executive Director at least three working days in advance of commencement of construction, and immediately upon completion of construction. The Permittee shall undertake construction in accordance with the approved Construction Plan. Any proposed changes to the approved Construction Plan shall be reported to the Executive Director. No material changes to the approved Construction Plan shall occur without a Commission amendment to this coastal development permit unless the Executive Director determines that no amendment is necessary.

16) **Storm Water Pollution Prevention Plan:** PRIOR TO COMMENCEMENT OF CONSTRUCTION, the Permittee shall submit for Executive Director review and approval a Storm Water Pollution Prevention Plan (SWPPP). At minimum the SWPPP shall include the following Best Management Practices (BMPs):
- Gravel bags, silt fences, etc. shall be placed along the edge of all work areas as determined appropriate by the City's construction inspector in order to contain particulates prior to contact with receiving waters.
- All concrete washing and spoils dumping will occur in a designated location.
- Construction stockpiles will be covered in order to prevent blow-off or runoff during weather events.
- A pollution control education plan developed by the General Contractor and implemented throughout all phases of development and construction.
- Severe weather event erosion control materials and devices shall be stored onsite for use as needed.

17) **Water Quality Technical Report:** PRIOR TO COMMENCEMENT OF CONSTRUCTION, the Permittee shall submit for Executive Director review and approval a Water Quality Technical Report as specified in the City of Carlsbad Standard Urban Stormwater Mitigation Plan (April 2003) (Carlsbad SUSMP) for the post construction desalination facility, prepared by a licensed Civil Engineer, which shall include plans, descriptions and supporting calculations. The Storm Water Management Plan shall incorporate all feasible Best Management Practices (BMPs) designed to reduce, to the maximum extent practicable, the volume, velocity and pollutant load of stormwater leaving the developed areas of the site. The plan shall include the following criteria:
- Post-Development peak runoff rates and average volumes shall not exceed pre-development conditions.

- Runoff from all parking areas, turnouts, driveways and other impermeable surfaces (e.g., roofs) shall be collected and directed through a system of structural BMPs including vegetated and/or gravel filter strips or other media filter devices or other equivalent means. The filter elements shall be designed to 1) trap sediment, particulates and other solids and 2) remove or mitigate contaminants through infiltration and/or biological uptake. The drainage system shall also be designed to convey runoff in excess of this standard from the developed site in a non-erosive manner.
- Provisions for maintaining the drainage and filtration systems so that they are functional throughout the life of the approved development. Such maintenance shall include the following: 1) the drainage and filtration system shall be inspected, cleaned and repaired prior to the onset of the storm season, but not later than September 30th each year and 2) should any of the project's surface or subsurface drainage/filtration structures fail or result in increased erosion, the applicant/landowner or successor-in-interest shall be responsible for any necessary repairs to the drainage/filtration system and restoration of the eroded area.
- A drainage system approved by the City Engineer to ensure that runoff resulting from 10-year frequency storms of 6 hours and 24 hours duration under developed conditions, are equal to or less than the runoff from a storm of the same frequency and duration under existing developed conditions. Both 6-hour and 24-hour storm durations shall be analyzed to determine the detention basin capacities necessary to accomplish the desired results.

The Permittee shall implement and maintain the Plan for the life of the project.

# 4.0 FINDINGS AND DECLARATIONS

## 4.1 PROJECT PURPOSE AND DESCRIPTION

The proposed project is a seawater desalination facility proposed by Poseidon Resources (Channelside) LLC (referred to herein as Poseidon). Poseidon's proposed facility would use about 304 million gallons per day (MGD) of water drawn from Agua Hedionda Lagoon (the Lagoon) in Carlsbad, San Diego County (see Exhibit 1), to produce 50 MGD of potable water for local and regional use.[3] At 50 MGD, Poseidon's proposed project would be the largest seawater desalination facility in the United States and in the Western Hemisphere. The proposed development also includes pipelines and pump stations necessary to deliver the produced water to a water reservoir in Carlsbad. The project's objectives include providing a local and reliable source of water, reducing local dependence on imported water, and providing water at or below the cost of imported water supplies. Poseidon has announced agreements to sell various amounts of its desalinated water to water districts in San Diego County for up to about 90 years.

**Project Setting:** The project would be located at the Encina power plant in Carlsbad on a site leased from the power plant owner, Cabrillo Power II, LLC (Cabrillo) (see Exhibit 2). During the past half-century, the power plant used water from Agua Hedionda Lagoon to cool its generating units. Poseidon's project as initially proposed in 1999 would have used some of the hundreds of millions of gallons of estuary water the power plant drew in from Agua Hedionda Lagoon to cool its generating units; however, Cabrillo recently proposed replacing the existing power plant with a new plant to be located elsewhere on the site, and which Cabrillo expects will be operating by 2010.[4] This new power plant would use dry cooling instead of using water from Agua Hedionda. Cabrillo proposes to keep two of the five units in the existing plant available for a few years beyond 2010 to provide additional grid reliability if needed. Although they represent about two-thirds of the plant's generating capacity,[5] Cabrillo anticipates that these two units would operate only a few weeks per year. The power plant's generating capacity is subject to "Reliability Must Run" status, as contracted by the California Independent System Operator (Cal-ISO), which is meant to provide electrical grid reliability. At the October 2007 State Lands Commission meeting, a Cabrillo representative testified that the units would remain in service indefinitely and that Cal-ISO would determine when they are no longer needed for grid stability.

Cabrillo's announced change in the power plant's operations represents a change in how Poseidon's facility was originally proposed. Poseidon's project would no longer function as a co-located desalination facility – that is, it would not re-use the estuarine water already used by the power plant – but instead would be a new "stand-alone" facility, drawing in water just for desalination. The project's EIR prepared by the City of Carlsbad analyzed the project's impacts

[3] The project would use about 100 MGD in the desalination process to create about 50 MGD of potable water and about 50 MGD of a high salinity discharge. The total amount would vary based on project operations – e.g., during maintenance, periods of start-up, etc. – and could be as high as 129 MGD. To reduce the salinity concentrations of its discharge, Poseidon would pump an additional 200 MGD into its intake and discharge system for dilution. This is discussed in more detail in Section 2.5.1 of these Findings.

[4] On September 14, 2007, Cabrillo submitted to the California Energy Commission its *Application For Certification* to start the review process needed to replace the existing power plant (Application #07-AFC-06).

[5] Poseidon Resources Corporation, Response to Staff Report, November 9, 2007, Exh. B, at p. 2.

as both a co-located and a stand-alone facility. The EIR determined that as a stand-alone facility, the project would cause less entrainment and impingement losses than the existing power plant's operations and would have no significant impacts.[6] Poseidon's lease with the power plant owner would allow it to operate the power plant's pumps when the power plant is shut down and would allow the proposed desalination facility to operate for up to 90 years. These Findings evaluate Poseidon's proposal as a "stand-alone" facility and the analyses herein are based on the coastal resource impacts that would result from the "stand-alone" project.

A key environmental feature of the proposed project site is Agua Hedionda Lagoon. Several sections of these Findings address project-related impacts to the Lagoon's water quality and habitat values and the measures imposed to mitigate those impacts and ensure conformity to the Coastal Act. The description below provides a brief introduction to the Lagoon and subsequent sections provide additional relevant details.

Agua Hedionda Lagoon is a coastal estuary that extends about 1.7 miles inland and is up to about one-half mile wide. It is at the downstream end of Agua Hedionda Creek, which has a watershed of about 29 square miles. The Lagoon has been altered substantially over the past century or so. It has been bridged several times – in the late 1800s for a railroad, in 1919 for the Pacific Coast Highway, and in 1967 for Interstate 5. It now consists of three main "lobes" – an Outer Basin of about 66 acres, a Middle Basin of about 23 acres, and an Inner Basin of about 167 acres. The Lagoon's mouth is about 3,000 feet north of the power plant, and is maintained by two jetties extending a few hundred feet into the ocean. The jetties are on State tidelands and are leased by the State Lands Commission to Cabrillo. The power plant also has a State Lands lease for use of its discharge structure, which crosses a state beach and state tidelands to the south of the Lagoon mouth (see Exhibit 3).

Before the mid-1950s, Agua Hedionda Lagoon was a shallow coastal wetland that was periodically shut off from tidal flows (the name is Spanish for "stinky water"). In the mid-1950s, Southern California Edison purchased much of the Lagoon and dredged about four million cubic yards of material to create an intake channel for the power plant's cooling water system.[7] Edison sold the power plant in 1999. The power plant has operated since the mid 1950s using up to about 850 million gallons per day of water from the estuary, although its water use has declined significantly in recent years. It has required regular dredging during that time to maintain the power plant's intake channel, with at least 25 separate dredging events occurring during the power plant's history. The estuary is also used for other purposes, including aquaculture (sea bass net pens, and a mussel farm), recreation (primarily boating and beach use), and ocean research (Hubbs-Seaworld Research Institute). Cabrillo, the current owner, also allows use of the Lagoon for various scientific research and monitoring activities. A study submitted by Dr. Scott Jenkins on September 28, 2007 on behalf of Poseidon indicates that if the Lagoon is not regularly dredged, it would close in about five to seven years and slowly revert to its pre-dredging condition, which consisted largely of shallow marshy channels with hyper-saline water. In that condition, many of the Lagoon's current uses, such as recreation, fishing, and aquaculture

[6] See also Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at pp. 9-11; see Project EIR Section 4.3.

[7] In 1999, Southern California Edison sold most of the power plant property and Agua Hedionda Lagoon to Cabrillo, although it continues to own land along the lagoon's shoreline.

would be eliminated or reduced.[8] Past dredging of the Lagoon has also provided sand to maintain Carlsbad State Beach, grunion spawning habitat, and a popular surfing break.

The state's water quality standards identify Agua Hedionda Lagoon's listed beneficial uses as the power plant's industrial use, recreational uses, aquaculture, and habitat. The estuary is also listed as impaired, pursuant to Section 303(d) of the federal Clean Water Act, due to excess sedimentation and coliform bacteria. Additionally, the Carlsbad Watershed Management Plan[9] identifies the Lagoon as being further impaired due to habitat fragmentation and the presence of invasive species. During the past several years, the Lagoon experienced an outbreak of the highly invasive *Caulerpa taxifolia*, but in 2006 local and state efforts to eradicate *Caulerpa* from the Lagoon were deemed successful. Monitoring for *Caulerpa* continues, however.

Despite these impacts and the degraded water quality, Agua Hedionda continues to provide significant habitat values. The California Department of Fish and Game (DFG) includes it in a list of 19 "high-priority" coastal wetlands and DFG manages a Marine Ecological Reserve within the Lagoon that provides habitat for a number of listed sensitive species. These features are described in more detail in Section 4.5.1 of these Findings.

**Need for the Project:** The project would provide an important and much-needed source of potable water for Southern California. Since Poseidon filed its Coastal Development Permit ("CDP") application, the water supply situation in the State of California – already bad – has substantially deteriorated. Poseidon has previously provided the Commission with newspaper reports that recognize a looming water crisis and clearly identify the need for California, and more specifically San Diego County, to lessen its demand on the State Water Project and Colorado River watersheds, which were critically dry in 2007.[10]

There is a convergence of warnings that California's water supply will continue to shrink. Climate change brought on by global warming could disrupt weather patterns, leaving the state vulnerable to punishing drought. There is a possibility that 2007 will be the beginning of a multi-year drought. If 2008 offers hydrologic conditions similar to those this year, some significant sources of water for Southern California may not be available. The most recent example of the deteriorating supply situation occurred in May 2007, when state water officials temporarily turned off the pumps that send water to Southern California from the Sacramento-San Joaquin Delta to protect the endangered smelt and salmon.[11]

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[8] *Comparative Analysis of Intake Flow Rate on Sand Influx Rates at Agua Hedionda Lagoon: Low Flow vs. No-Flow Alternatives*, Dr. Scott Jenkins, September 28, 2007.

[9] The Carlsbad Watershed Plan was published in 2002 pursuant to an NPDES permit issued in 2001 by the State Water Resources Control Board to the cities of San Diego County. The permit requires participating cities to develop a cooperative and coordinated watershed approach to address water quality issues. The Plan's goals include the following: "*Protect coastal and wetland resources*: Extra credit should be given to "Action Items" that serve to protect the wetland resources, sensitive species and fragile ecosystems associated with coastal lagoons and riverine resources. These resources are not only sensitive and highly valued, but they support a great diversity of species and tend to be "sink holes" where water quality problems become much greater."

[10] See Poseidon Resources Corporation, Response to Staff Report, November 9, 2007, Exh. A at p. 5.

[11] See id.

In the summer of 2007, the Metropolitan Water District put San Diego County Agriculture on notice that it will cut agricultural water deliveries by 30 percent beginning January 1, 2008. With $1.4 billion in annual revenue, San Diego County is the twelfth largest agricultural economy among all counties in the nation, and it could be severely harmed by this reduction in water supply. The Metropolitan Water District also has warned municipal and industrial water users to anticipate water rationing if 2008 – like preceding years – is a dry year. Rationing of municipal and industrial supplies would be highly disruptive to San Diego's $150 billion annual economy.[12]

Moreover, State, regional, and local water plans all have confirmed that the immediate and pressing water needs are so great, that they cannot be met by conservation and recycled water alone and that a substantial investment in seawater desalination, including the project, is required. The project's capacity of 56,000 AFY of new water supply for the San Diego region is about ten percent of 500,000 AFY of desalinated water identified by the California Department of Water Resources as needed by 2030, as stated in its 2006 Water Plan Update. This Update lists the project as a potential source of desalinated water. The Metropolitan Water District of Southern California's Integrated Water Resources Plan identified a need for 150,000 AFY of seawater desalination (including 56,000 AFY from the Carlsbad project) to ensure regional water supply reliability. In addition, the San Diego County Water Authority updated its 2005 Urban Water Management Plan in April 2007 specifically to reaffirm the need for 56,000 AFY of seawater desalination from the project by 2011. The project is a central component of state, regional and local water supply planning to meet already-identified demand.[13] Recognizing the importance of the project, eight water agencies – Carlsbad Municipal Water District, Valley Center Municipal Water District, Rincon del Diablo Municipal Water District, Sweetwater Authority, Rainbow Municipal Water District, Santa Fe Irrigation District, Vallecitos Water District, and Olivenhain Municipal Water District – have already contracted to purchase 100% of the project's capacity, and have identified the project's water supply as a component of their water plans.[14]

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[12] See id.

[13] See id. at p. 6.

[14] See id. at p. 6-7.

## 4.2 BACKGROUND

### *Seawater Desalination's Role in California's Water Portfolio*

Both California and the Coastal Commission have recognized that environmentally and economically appropriate seawater desalination is an acceptable method for providing part of the state's water supply. There are currently about a dozen facilities operating along the California coast, mostly providing relatively small amounts of water to local users or to certain industrial facilities. During the past few years there has been increased interest in seawater desalination, due largely to recent advances in desalination technology, concerns about increasing the reliability over local water supplies, and interest in reducing dependence on imported supplies. There are now about twenty proposals for new facilities to be built along the coast to serve both local and regional water needs.

The 2005 Update of California's State Water Plan expects seawater desalination to provide about 200,000 acre-feet of water by 2030. Both the Metropolitan Water District of Southern California (MWD) and the San Diego County Water Authority (SDCWA, or Authority) have included seawater desalination as part of their long-term water supply portfolio. The Authority has established a goal that seawater desalination provide 89,600 acre-feet of its water supply by 2030. Even the Southern Nevada Water Authority has identified seawater desalination as part of its long-term water supply, with its idea being that water from the Colorado River would be used in Nevada in exchange for the Nevada water users paying for desalinated water to be produced along the California coast.

Several recent initiatives in California illustrate this increased interest:

- **State Desalination Task Force:** In 2003, pursuant to AB 2717, the California Department of Water Resources convened an interagency task force[15] to report to the Legislature on potential opportunities and impediments for using seawater and brackish water desalination, and to examine what role, if any, the state should play in furthering the use of desalination technology. Based on information provided during a series of workshops around the state, the task force developed recommendations and guidelines for desalination projects proposed in California. Some key task force findings applicable to this proposed project include:

  - *Desalination can provide a reliable supply during California's periodic droughts.*
  - *Many communities and water districts are interested in developing desalination facilities as a local, reliable source of water to reduce their dependence on imported water and/or*

[15] Task Force members included representatives from: State agencies – California Department of Water Resources, Coastal Commission, State Water Resources Control Board, Central Coastal Regional Water Quality Control Board, Energy Commission, Department of Health Services, Resources Agency, California Environmental Protection Agency, Department of Food and Agriculture, CALFED, Bay Conservation and Development Commission, Department of Fish and Game, University of California; federal agencies – Bureau of Reclamation, Monterey National Marine Sanctuary; local governments and water agencies – Monterey County Health Department, City of Long Beach Water Department, League of Cities, County Supervisor Association of California, Central Basin and West Basin Municipal Water Districts, Marin Municipal Water District, Inland Empire Utilities Agency; and interest groups – California Building Industry Association, Surfrider, American Membrane Technology Association, National Water Research Institute, Clean Water Action and Clean Water Fund.

*to meet existing or projected demand. Some communities see desalination as a way to reduce their diversions from rivers and streams, thus contributing to ecosystem restoration.*

- *Technologically, desalination is a proven, effective mechanism for providing a new source of water. A variety of desalination technologies have been applied in many locations throughout the world.*
- *Economically and environmentally acceptable desalination should be considered as part of a balanced water portfolio to help meet California's existing and future water supply and environmental needs.*
- *While they vary on a site-specific level, potential impediments to seawater desalination include the environmental impacts associated with the feedwater intake and brine/concentrate disposal. As is the case with many other water management strategies, other potential issues include cost, siting and growth-inducement.*
- *With proper design and location of outfalls, brine/concentrate disposal may not be a major impediment to desalination.*
- *Seawater desalination is more energy intensive, per acre-foot, than brackish water desalination or water recycling. For energy comparison purposes, current desalination systems using reverse osmosis technology require about 30 percent more energy than existing interbasin supply systems currently delivering water to parts of Southern California. Efforts including those supported by the Bureau of Reclamation, U.S Desalination Coalition, and the National Water Research Institute are underway to increase the energy efficiency of desalination through improved membranes, dual pass processes, and additional energy recovery systems.*
- *Advantages to co-locating desalination facilities with coastal power plants using once-through cooling may include: compatible land use, use of the existing infrastructure for feedwater intake and brine discharge, location security, use of the warmed power plant cooling water as the feedwater for the desalination facility, reduction of the power plant discharge thermal plume and the potential to purchase power from the host power plant at prices below retail rates.*
- *Co-locating a desalination facility with a coastal power plant may provide a justification for the continued use of once-through cooling technology. Once through cooling technology has well-documented environmental impacts, including impacts on marine organisms.*
- *The appropriate State regulatory agencies have indicated that the siting of a new desalination facility, which utilizes any new or existing open water feedwater intakes, will require a current assessment of entrainment and impingement impacts as part of the environmental review and permitting process.*
- *Various technologies exist that may avoid, reduce or minimize the impacts of feedwater intake.*
  - *Drawing feedwater from beach wells is one way to avoid the ecological impacts of entrainment and impingement associated with open water intakes; however, the capacity of each well is limited and is subject to local hydrogeologic conditions.*
  - *Low velocity intake systems, marine fish screens, sub-floor intakes and appropriate intake pipe design and location are methods that may reduce or minimize impacts of entrainment and impingement associated with open water intakes.*
- *Water, including ocean and estuarine water, is a public resource, subject to the public trust doctrine, and should be protected and managed for the public good.*

- *The extent to which private companies are involved in the ownership and operation of proposed desalination plants varies widely, from completely private projects that may be regulated by the State Public Utilities Commission, to public-private partnerships, to projects that would be wholly owned, operated and controlled by public entities. The involvement of private companies in the ownership and/or operation of a desalination plant raises unique issues.*
- *There are implications associated with the range of public-private possibilities for ownership and operation of desalination facilities. Local government has the responsibility to make the details of these arrangements available to the public.*
- *Recently adopted international trade agreements and international trade agreements currently being negotiated may affect how federal, State and local agencies adopt or apply regulations concerning activities of public agencies or private entities with multinational ties.*
- *Desalination proposals are subject to existing regulatory and permitting processes to ensure environmental protection and public health.*
- *Environmental justice considerations include the siting of desalination facilities, determining who accrues the costs and benefits of desalination and who has the opportunity to use higher quality (desalinated) water, and the possible impacts of replacing low-cost with high-cost water.*
- *Growth inducing impacts of any new water supply project, including desalination, must be evaluated on a case-by-case basis through existing environmental review and regulatory processes.*
- *Each desalination project involves different environmental characteristics, other water supply alternatives, proposed plant ownership/operation arrangements, demographics, economics, community values and planning guidelines.*

- **Coastal Commission Report – Seawater Desalination and the California Coastal Act:** In 2004, Commission staff published a report describing many of the issues associated with seawater desalination along the California coast and discussing how proposed desalination facilities could conform to Coastal Act provisions.. The report provides general information about desalination, describes the status of desalination in California, identifies key Coastal Act policies most likely to apply to proposed desalination facilities, and identifies much of the information likely to be required during review of a coastal development permit application for those facilities.

  Its key conclusions recognize that each facility will require case-by-case review due to the unique operating characteristics and environmental settings, that Coastal Act policies do not suggest overall support of, or opposition to, desalination, that there may be differences in applying those policies to public or private proposals, that the most significant potential impacts to address are likely entrainment of marine organisms and growth-inducement, and that proposed co-located facilities raise unique issues regarding Coastal Act conformity.

- **Proposition 50 Grants:** As part of Proposition 50, which Californians approved in 2002 to provide funding for a number of water-related projects around the state, the state Department of Water Resources distributed about $50 million to public agencies for various types of desalination research projects. Several of the Commission's past decisions have been in support of these projects – for example, the Commission has approved projects conducted by

the City of Long Beach Water Department to conduct pilot tests and subsurface intake methods and projects by the Metropolitan Water District of Orange County for its innovative and successful research on using slant-drilled wells for subsurface desalination intakes.

There are also a number of initiatives at local or regional levels to support or research the potential for seawater desalination to provide part of an area's water supply. For example, Southern California's Metropolitan Water District (MWD), which represents most water agencies in coastal Southern California, established a program offering to its member agencies subsidies of up to $250 for each acre-foot of desalinated seawater produced. The agencies eligible for this subsidy include the San Diego County Water Authority, Long Beach Water Department, Los Angeles Department of Water and Power, West Basin Municipal Water District, and the Municipal Water District of Orange County. The MWD has also provided about $250,000 to its member agencies for desalination research

### *Association with a power plant once-through cooling water intake system*

Poseidon proposes to use the existing Encina power plant intake and discharge. Originally, Poseidon planned to reuse some of the estuary water the power plant drew in from Agua Hedionda Lagoon to cool its generating units. However, as discussed in Section 4.1 above, Cabrillo has applied to cease operations of its existing facility and to build a new power plant. In September 2007, Cabrillo applied to the California Energy Commission to build by 2010 a new, smaller, dry-cooled power plant on site that would not use water from Agua Hedionda. Cabrillo's proposal includes removing three of the existing plant's five generating units and operating the remaining two units only part time (expected to be up to a few weeks per year) for several more years until replacement power becomes available. The two remaining units would represent up to about 528 MGD of pumping capacity. As noted previously, the power plant is subject to "Reliability Must Run" contracts with Cal-ISO. At the October 2007 State Lands Commission hearing, a Cabrillo representative stated that the generating units will be available for service indefinitely and that Cal-ISO would ultimately determine when they are no longer needed for grid reliability. Once the power plant's operations cease, Poseidon would continue to use the existing power plant intake and discharge structure for its water supply. The proposed project was the subject of CEQA review conducted by the City of Carlsbad. The Final EIR, certified by the City on June 14, 2006, addressed the potential stand-alone operation of the facility and concluded that such a facility would not result in any significant adverse environmental impacts.[16] In March 2007, Poseidon provided Commission staff with results of its entrainment study showing impacts roughly equal to the loss of productivity from 37 acres of wetlands and open water in Agua Hedionda Lagoon.[17] Poseidon also provided in December 2006 and May 2007 technical papers showing the amount of Lagoon sedimentation caused by use of the intake.[18]

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[16] See Project EIR Section 4.3, Appendix E.

[17] See *Carlsbad Seawater Desalination Project Revised Flow, Entrainment, and Impingement Minimization Plan*, June 1, 2007, Attachment 4, Tenera Environmental, Inc., *Assessment of Potential Impingement and Entrainment Attributed to Desalination Plant Operations and Associated Area of Production Forgone*, May 2007, at p. 4.

[18] See *Carlsbad Seawater Desalination Project Revised Flow, Entrainment, and Impingement Minimization Plan*, June 1, 2007: Attachment 6, Scott A. Jenkins and Joseph Wasyl, *Coastal Process Effects of Reduced Intake Flows at Agua Hedionda Lagoon*, December 13, 2006, Attachment 8, Steve Le Page, *Potential Adverse Changes in Agua Hedionda Lagoon Resulting From Abandonment of the Lagoon Intake*, May 18, 2007.

As a stand-alone facility, Poseidon would operate the power plant's pumps to take in approximately 304 MGD of estuarine water. The project would use about 100 MGD of that water in the desalination process to create about 50 MGD of potable water and about 50 MGD of a high salinity discharge. The facility's NPDES permit issued to Poseidon by the Regional Board requires that Poseidon's discharge not exceed a maximum salinity level of 40.1 parts per thousand. Poseidon would use the additional 200 MGD of estuarine water it pumps in to reduce its discharge's salinity concentration to levels established in the NPDES permit.

Some other reverse osmosis desalination facilities can produce a particular amount of potable water by using about twice that amount of seawater (i.e., a 2:1 ratio), but because of the approach used in this project to dilute Poseidon's discharge and due to the Regional Board's requirements, this project would require a 6:1 ratio. This is discussed in more detail in Section 4.5.1 of these Findings.

Poseidon's preferred operating scenario, which is the basis of the analyses herein, is to use the power plant's Unit 4 pumps to provide the necessary 304 MGD.[19]

A number of regulatory, policy, and legal challenges have been raised with respect to once-through cooling. Their relevance to the project is not yet certain, in part because while the project will use the existing once-through cooling system, it will not be using that system for once-through cooling. Issues that may be relevant include:

- *Entrainment/impingement studies along California's coast*: California's coastal power plants have been studied over the past few years to determine what effects their use of seawater for cooling has on the marine environment.[20] These power plants can use from several hundred million gallons per day to over two billion gallons per day of water from the nearshore ocean, open embayments, and enclosed estuaries. Each of the studies showed these cooling water intakes cause significant adverse effects to the marine environment that in some cases extended up to dozens of miles along the coast or covered up to hundreds of acres of nearshore waters.

- *California Ocean Protection Council's Once-Through Cooling Policy*: In response to these studies and in recognition of the degraded quality of California's ocean environment, the California Ocean Protection Council last year adopted a policy to reduce the adverse effects

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[19] The power plant has five separate generating units, each with two cooling water pumps and one or two service pumps. Each unit's pumps have a different capacity, from about 73 MGD to 326 MGD. Poseidon's preferred scenario would be to operate the Unit 4 pumps, which would provide the required 304 MGD rate. The Regional Board determined that 304 MGD would be necessary to adequately dilute Poseidon's 50 MGD high salinity discharge. On June 1, 2007, Poseidon submitted to the Board a *Revised Flow, Entrainment and Impingement Minimization Plan* that the Board is currently reviewing. The draft Plan states that operating the Unit 4 pumps would result in a discharge of 304 MGD with a salinity level of 40.1 parts per thousand, which is the limit established in the facility's conditional NPDES permit. This operating scenario serves as the basis of the various analyses in these Findings related to entrainment, impingement, greenhouse gas emissions, and others.

[20] Since 1998, power plant entrainment/impingement studies done in California include South Bay (in San Diego), Huntington Beach (Orange County), Diablo Canyon and Morro Bay (San Luis Obispo County), and Moss Landing (Monterey County).

of once-through cooling systems.[21] The resolution recognizes that such systems cause significant adverse impacts to the marine ecosystem. The Council further directed its staff to complete by December 2007 a study of alternative cooling methods that would reduce impacts, urged the State Water Resources Control Board to implement the most protective controls to reduce entrainment and impingement impacts by 90-95%, and established an interagency coordinating effort to address once-through cooling issues.[22]

- *Changes in regulatory / legal status of seawater intake systems*: In January 2007, the 2nd Circuit Court of Appeals determined that U.S. EPA rules for regulating existing power plant cooling water intakes did not conform to Clean Water Act requirements (*Riverkeeper, Inc., v. United States EPA*, 475 F.3d 83, 97 (2d Cir. 2007)). In response, the U.S. EPA rescinded its proposed requirements and directed state water quality agencies to use Best Professional Judgment in determining applicable NPDES requirements for once-through cooling systems.

  In conjunction with that ruling, the State Water Resources Control Board is developing a *Statewide Policy for Once-Through Cooling*[23] that will incorporate the *Riverkeeper II* decision, which was a decision involving the federal Clean Water Act, but will also be based primarily on a state requirement that regulates more than just cooling water structures. Porter-Cologne Act Section 13142.5(b)[24] states:

  > *"For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life."*

  Although Poseidon's use of the power plant intake structure would not be for cooling purposes, it would be subject to this Porter-Cologne Act provision and would cause the same type of entrainment and impingement impacts both the Clean Water Act and the Porter-Cologne-Act require be avoided and minimized. At this time, the Regional Water Quality Control Board is processing a plan to regulate Poseidon's use of the power plant intake structure for desalination purposes. This plan is described in more detail in Section 4.5.1 of these Findings. In addition, the Commission retains full authority to ensure the project's consistency with the Coastal Act's marine resources protection policies through the imposition of **Special Condition 8**, which provides that Poseidon shall submit a Marine Life Mitigation Plan for Commission review and approval.

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[21] See *Resolution of the California Ocean Protection Council Regarding the Use of Once-through Cooling Technologies in Coastal Waters*, April 20, 2006.

[22] Coastal Commission staff is active in the interagency coordinating group.

[23] In July 2006, the Board initiated CEQA review for the proposed policy and is expected to issue a draft policy sometime in early 2008, with a final policy later in 2008.

[24] Pursuant to Coastal Act Section 30412(a), the Commission shares responsibilities with the State Board in implementing this section of the Porter-Cologne Act.

Without the mitigation measures in the **Special Conditions** contained herein, the proposed use of the existing intake and discharge facilities would be inconsistent with applicable Coastal Act policies. As mitigated and conditioned, the Commission finds the project will be consistent with the Coastal Act because all feasible mitigation measures will be adopted to reduce impacts to marine resources and **Special Condition 8** and Poseidon's mitigation package will ensure that marine resources are maintained and enhanced to the maximum extent feasible.

## *Public use of water*

Poseidon has announced purchase agreements totaling 57,900 acre-feet of water per year with the following water agencies:

- Carlsbad Municipal Water Department: 22,000 acre-feet per year, or about 20 MGD
- Olivenhain Municipal Water District: 5,000 acre-feet per year, or about 4.5 MGD
- Rainbow Municipal Water District: 7500 acre-feet per year, or about 6.5 MGD
- Rincon Del Diablo Municipal Water District: 4,000 acre-feet per year, or about 3.5 MGD
- Sante Fe Irrigation District: 2000 acre-feet per year, or about 1.8 MGD
- Sweetwater Authority: 2400 acre-feet per year, or about 2 MGD
- Vallecitos Water District: 7500 acre-feet per year, or about 6.5 MGD
- Valley Center Municipal Water District: 7,500 acre-feet per year, or about 6.5 MGD

Poseidon's stated objective is to provide water to purchasers at or below the price they would pay for imported water, and its purchase agreements with these agencies are based on that objective. These agencies, all of which are members of the San Diego County Water Authority, currently purchase imported water from the Authority at rates ranging from about $250 to $700 per acre-foot, which are below the costs anticipated for water from the Poseidon project. Cost considerations are described in more detail later in this section.

Of the purchasers above, several would not be able to receive water directly from Poseidon's facility, as they are some distance from Carlsbad – for example, the Sweetwater Authority is about twenty miles away at the southern end of San Diego Bay and both Rincon and Valley Center are several miles inland. Instead, Poseidon's intent is to allow some of the agencies to trade water it has purchased from Poseidon to agencies closer to the facility in exchange for those nearby agencies' rights to imported water.

The project as currently proposed would allow for only limited exchanges, since it does not include several elements of public infrastructure needed to distribute the water beyond adjacent communities. Poseidon's proposal includes pipelines and pumps necessary to transport its produced water to Carlsbad's Maerkle Reservoir, which serves parts of Carlsbad, and its other pipelines would serve parts of some other neighboring communities. Poseidon's proposal includes several pipeline route alternatives, for the most part outside the coastal zone, that would allow it to provide water to portions of the cities of Carlsbad, Oceanside, Vista, San Marcos, Escondido, Encinitas, and Solana Beach. The project EIR examined facilities to connect with these local water delivery systems. Getting water from this reservoir to the regional distribution system where it would be usable or tradable by other water agencies would require an additional pump station and pipeline between the reservoir and elements of the regional system located further inland and several hundred feet higher in elevation. Poseidon does not currently plan to

connect the desalination facility to the regional water distribution system. This new pump station and pipeline are included in the SDCWA's 2007 *Draft Integrated Water Resource Management Plan*, which describes the project as conveying desalinated water from Carlsbad to the regional water distribution system.

Further, Maerkle Reservoir is currently designated by Carlsbad as its required emergency storage reservoir – that is, water stored there is meant to provide the City with a 10-day emergency water supply during a shutdown of the regional delivery system – and, as noted in the Water Purchase Agreement between Poseidon and the Carlsbad Water Department, the City's need for water from the regional system is likely to be significantly reduced after Poseidon is able to provide water to the City at or below the cost of imported water, thereby freeing up capacity in the reservoir for operational storage of desalinated water.

## *Expected Project Costs*

The Commission does not directly regulate costs; however, the Coastal Act includes consideration of project costs in an indirect but important way. Some Coastal Act provisions require the Commission to determine whether certain adverse impacts of the proposed project are mitigated to the extent feasible or whether there are feasible and less environmentally damaging alternatives to aspects of a proposed project (see, for example, Coastal Act Sections 30212.5, 30230, 30231, 30233(a), and 30260). Coastal Act Section 30108 defines "feasible" as "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." Therefore, information about proposed project costs may sometimes be necessary to fully evaluate what project changes or mitigation measures may be economically feasible. The Commission includes the following discussion of the project's estimated costs to assist in determining feasible mitigation measures and alternatives for the project.

One of Poseidon's objectives and the basis of its purchase agreements is to provide water to water districts at or below the costs of imported water.[25] Those costs now range from about $250 to $700 per acre-foot for water districts in the San Diego area.[26] Poseidon provided the Commission with a description of its expected costs,[27] which are currently higher than what local

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[25] More precisely, Poseidon's Water Purchase Agreements describe the price as: "The lower of (i) the sum of (A) $861/acre-foot [$0.70/m$^3$] (the "Base Price" in 2004 dollars) and (B) a delivery charge for transportation of the desalinated water to the Exchange Partner; and (ii) the sum (the "Avoided Cost") of (A) Buyer's cost of water supplied by the SDCWA and (B) any subsidy received by Buyer from MWD or any other third party for the purchase of water from the Project. To the extent the Base Price plus the delivery charge is less than the Avoided Cost, the savings shall be shared equally between the Parties."

The "Avoided Cost" method is equal to the sum of costs charged by the San Diego County Water Authority. The "Base Price" method is tied to the Consumer Price Index and is based on the following formula:

$$\text{Current Base Price} = (\text{Base Price}_{initial})(70\%(CPI_i / CPI_{initial}) + (30\%(EC_i / Ec_{initial})))$$

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[26] The MWD, from whom SDCWA purchases most of its imported water, expects its imported water price to go up from 4-6% per year for the next ten years. In the shorter term, SDCWA expects its costs to increase next year by about 10%.

[27] Poseidon has provided the Commission with the following documents supporting its projections of expected costs: Poseidon Resources Corporation, *Response to California Coastal Commission's September 28 Request for Additional Information*, November 30, 2006 pp. 46-51; Poseidon Resources Corporation, *Response to California*

water districts are paying for imported water. However, Poseidon stated at the Commission's November 15, 2007 hearing that it intends to operate at a loss for some unknown number of years until the costs of imported water increase to match Poseidon's costs for constructing and operating the desalination facility.

In July 2007, Poseidon provided the following figures for its expected project costs:

| | | |
|---|---|---|
| **Total capital costs:** | $300 million | |
| **Annual gross revenues:** (based on 56,000 acre-feet per year X ~$950 per acre-foot) | $53 million | |
| **Annual operations and maintenance costs:** | $30 million | $535 per acre-foot |
| **Debt service and taxes:** | $21 million | $375 per acre-foot |
| **Anticipated net annual revenues:** | $2 million | $ 36 per acre-foot |
| **Total:** | | $946 per acre-foot |

Commission staff believe, based on the analysis below, however, that the overall cost would likely be somewhat higher and, in fact, for some components of the proposed project could only verify higher costs. These higher costs, which would make Poseidon's water cost more than the expected $950 per acre-foot, include those listed below. Poseidon states, however, that it has taken all these potential costs into consideration in assessing the feasibility of its project.[28]

- *Overall trend of desalination costs*: Over the past couple of decades, desalination costs have declined significantly, due largely to advances in technology such as increased energy efficiency, extended membrane and filter operating life, and other improvements. More recently, however, the trend appears to have reversed, due in part to increased cost for energy and materials. Of all significant sources of water, seawater desalination is the most energy intensive and the most cost-sensitive to energy prices. In 2004, Poseidon estimated its water would cost $800 per acre-foot; its most recent estimate is $950 per acre-foot. Its overall capital costs have increased from $270 million to about $300 million during the same period.

- *Additional mitigation costs*: As noted later in these Findings, several mitigation measures are needed for the proposed project to conform to various Coastal Act provisions. For example, Poseidon stated it is considering purchasing "carbon offset" credits for its greenhouse gas

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*Coastal Commission's July 3 Request for Additional Information*, July 16 2007, at pp. 11-13; Poseidon Resources Corporation, *Transmittal of Intake Cost Estimates*, October 17, 2007.

[28] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Ex. B, at p. 7; Poseidon Resources Corporation, *Response to California Coastal Commission's July 3, 2007 Request for Additional Information*, July 16, 2007; and Poseidon Resources Corporation, *Response to California Coastal Commission's September 28, 2006 Request for Additional Information*, November 30 2006: (Attachment 3) Water Purchase Agreement by and between The Carlsbad Municipal Water District and Poseidon Resources (Channelside) LLC, September 28, 2004, at § 3.1.2; (Attachment 4) Water Purchase Agreement by and between Rincon del Diablo Municipal Water District and Poseidon Resources (Channelside) LLC, March 14, 2006, at § 3.1.2; (Attachment 5) Water Purchase Agreement by and between Valley Center Municipal Water District and Poseidon Resources (Channelside) LLC, December 20, 2005, at § 3.1.2.

emissions. At a current average cost of $20 per megawatt-hour, these credits would cost Poseidon over $5 million per year to fully offset its emissions, which would add about $95 to the cost of each acre-foot produced. Poseidon indicated that it has taken all of these costs into consideration in assessing the feasibility of the project and addressed these costs in its Climate Action Plan.

- *Poseidon's reliance on a MWD subsidy*: Poseidon's anticipated costs are also based in part on it being eligible to benefit from the $250 per acre-foot subsidy available from the MWD described previously in these Findings. Without this subsidy, Poseidon's stated costs would be $250 per acre-foot higher.

- *Present and future costs for electricity*: Poseidon estimates its average cost for electricity will be $0.0749 per kWh. It bases this estimate on the rates available from the San Diego Gas & Electric Company (SDG&E) for large industrial customers (SDG&E Tariff Sheet #AL-TOU), which provides a range of energy prices based on the time-of-use (e.g., higher costs at peak afternoon hours, lower costs at night; generally higher costs in summer than in winter) and its eligibility for a discount due to its participation in SDG&E's emergency response program.

  However, to Commission staff, it appears that applying the rates from that Tariff Sheet would result in an actual annual average rate of no less than $0.10 per kWh which, if applicable, would increase Poseidon's expected costs per acre-foot by about $125.[29] Poseidon responds that the applicable SDG&E tariff is subject to a discount due to the project's ability to reduce demand during peak periods and to shed up to 95 percent of the project's energy load during local utility emergencies.[30] Additionally, to Commission staff, it appears that Poseidon's anticipated costs do not recognize likely future rate increases for electricity, which it expects would add about $25 per acre-foot if applied next year to Poseidon's costs.[31]

- *Additional costs to pump water into SDCWA distribution system*: As noted above, Poseidon's current proposal includes installing the pipelines and pumps needed to deliver water only to Carlsbad's Maerkle Reservoir and parts of Vista and Oceanside. Transporting water to other entities would require an additional pipeline from the reservoir to the regional distribution system along with an additional pumping station and additional electricity costs. SDG&E's most recent cost estimates for these components are $80 million in capital costs and $2.5 million per year in operations and maintenance costs.

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[29] Poseidon stated that it could take advantage of lower off-peak electricity rates by reducing its production during peak hours and increasing it during non-peak hours – it proposed, for example, that it could operate at 80% capacity (40 MGD) during the highest rate periods and at 108% capacity (54 MGD) during lower rate periods. However, it appears this scenario would have little effect on average electrical costs, since Poseidon would use even more electricity during the longer low-rate periods and less during the much shorter high-rate periods. Further, this "start/stop" operating scenario would likely increase Poseidon's operations and maintenance costs due to shortening the operating life of the various membranes, filters, and other facility components.

[30] See Poseidon Resources Corporation. Updated Response to Coastal Commission's September 28, 2006 Request for Additional Information, Section 13, CDP Energy Use, GHG Production & Mitigation, October 21, 2007, at p. 3.

[31] For 2008, SDG&E has already proposed an increase of about 5% increase for its industrial users, which would add about $25 per acre-foot to Poseidon's current estimated costs.

- *Additional costs for dredging Aqua Hedionda Lagoon*: The power plant owner is currently responsible for dredging the Lagoon and is expected to maintain that responsibility as long as the power plant plans to use its once-through cooling system. When the power plant ends its use of that system, it might allow Poseidon to take on responsibilities for dredging the Lagoon, which based on the power plant's current costs, could add about $1 million per year to Poseidon's costs.

In sum, Commission staff estimates that the additional costs described above could add up to about $450 to Poseidon's stated $950 per acre-foot costs, which is more in line with cost estimates available from other seawater desalination facilities operating or being developed in California.

Regardless of which cost estimates are more accurate – those provided by Poseidon or those of Commission staff – the Commission has found that the project, as conditioned herein, will incorporate all feasible mitigation measures needed for the project to conform to applicable Coastal Act provisions, and Poseidon has stated it has taken all these costs into consideration in assessing the project's feasibility. There are no feasible and less environmentally damaging alternative locations to draw in the needed seawater (e.g., subsurface or offshore). The Commission finds that slant wells are infeasible because the water quality available from such intakes would make it difficult, if not impossible, to treat for desalination purposes, and that the construction impacts associated with this alternative render it environmentally inferior to the proposed project.[32] The Commission also finds that an infiltration gallery is environmentally inferior to the proposed project because this alternative would disrupt public access to marine resources, require frequent dredging and require the destruction of 150 acres of coastal habitat, and that the alternative is economically infeasible.[33] The Commission further finds that an offshore intake system would result in greater environmental impacts than the proposed project's use of the existing power plant intake, and that construction of an offshore intake would render the project infeasible.[34]

Moreover, should Poseidon's costs or other concerns make the project unsuccessful, measures exist to protect coastal resources. First, under the water purchase agreements between Poseidon and the Carlsbad Municipal Water District, the Water District at its option can assume operation or ownership of the facility. Second, if the Water District chooses not to assume either of those options, or if operations ceased for some reason, Poseidon is required to remediate the site and remove the facility. To accomplish this, and as described in the Water Purchase Agreement

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[32] See Poseidon Resources Corporation *Response to California Coastal Commission's Letter of September 28, 2006*, November 30, 2006, at pp. 24-51; Poseidon Resources Corporation, Response to Staff Report, November 9, 2007, Exh. A at pp. 16-17.

[33] See Poseidon Resources Corporation, *Additional Analysis of Submerged Seabed Intake Gallery*, October 8, 2007; Poseidon Resources Corporation, Response to Staff Report, November 9, 2007, Exh. A at pp. 17-18.

[34] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at pp. 19-20; Issues Related to the Use of the Agua Hedionda Inlet Jetty Extension EIR to Recommend An Alternative Seawater Intake for the Carlsbad Desalination Project, Graham, Le Page and Mayer, October 8, 2007.

between the Water District and Poseidon, Poseidon is required to post a security in the form of either a letter of credit or an irrevocable bond with the property owner.[35]

## 4.3 COASTAL COMMISSION JURISDICTION AND STANDARD OF REVIEW

The proposed desalination facility and portions of its associated pipelines would be located in the coastal zone within the City of Carlsbad. Carlsbad has a certified Local Coastal Program (LCP), and the Agua Hedionda area is one of six segments of that LCP. Although most of the city's coastal zone is fully certified, the Agua Hedionda segment has only a certified Land Use Program (LUP), not a certified implementation program. Therefore, review and permitting authority within this segment remain with the Commission, with the standard of review being Chapter 3 of the Coastal Act. The Commission may also use provisions of the certified LUP as guidance.

## 4.4 OTHER PERMITS AND APPROVALS

**City of Carlsbad:**

- **Precise Development Plan:** As part of its project review and approval, the City of Carlsbad approved a Precise Development Plan for the project site, which modified the allowable uses on the site to include the proposed desalination facility.

- **Environmental Impact Report:** On June 14, 2006, the City of Carlsbad certified a Final EIR for the project. At the request of the Coastal Commission staff, the City added a discussion to the Final EIR to address stand-alone operations of the project. In addition, the potential for stand-alone operations was evaluated in the City's staff reports to the City Planning Department and City Council. The City concluded that the project, operating as either a co-located or a stand-alone facility, would not result in any significant adverse impacts.[36]

**State:**

- **Lease of state tidelands from the State Lands Commission:** The proposed project would require a lease from the State Lands Commission due to its use of two sets of structures built on state tidelands – the jetties at the mouth of Agua Hedionda and the discharge structure built across a state beach about 3000 feet south of the Lagoon mouth.

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[35] See Water Purchase Agreement by and between The Carlsbad Municipal Water District and Poseidon Resources (Channelside) LLC, September 28, 2004, at § 14.2.

[36] Note: The EIR found that all but one of the project-related impacts would be nonsignificant or through mitigation would be less than significant. The EIR found that the project would indirectly contribute to a significant cumulative impact to air quality because it is likely that at least part of the mix of electricity that the desalination plant uses will come from pollutant-emitting sources in the San Diego air basin. However, the EIR also found that there were no feasible mitigation measures to reduce this impact. (See Project EIR, Chapter 5, p. 5-9.)

The power plant currently has a lease from the State Lands Commission allowing it to use those structures until 2026; however, that lease allows use of those structures only for power plant cooling operations and for minor use by Poseidon's test desalination facility (up to 200 gallons per minute) only when the power plant is operating. The power plant's lease also states that the "Commission has expressed concerns regarding Once-Through Cooling (OTC) of power plants and the environmental impacts to the waters of California that may be caused by OTC systems", and further states that the lease includes provisions that authorize the State Lands Commission to amend the lease if the State or Regional Water Boards modify Cabrillo's NPDES permit. This lease requires additional written approval from the State Lands Commission for use of the intake or discharge by a future desalination project. Poseidon submitted its lease application in February 2007. As Commissioner Thayer explained at the hearing, the State Lands Commission held a hearing on Poseidon's lease application on October 30, 2007. Staff recommended approval of the lease but the Commission took no action and continued the hearing at the request of the public because the hearing was held just days after the San Diego region fires and at least one individual who wanted to participate in that hearing had been evacuated. Commissioner Thayer said a second hearing would be scheduled in December 2007 or at a later date.

Coastal Act Section 30601.5[37] requires in part that an applicant demonstrate its ability to comply with all conditions of a coastal development permit prior to issuance of that permit. This demonstration includes landowner approval, which in this case would take the form of Poseidon obtaining the necessary State Lands Commission leases. To ensure Poseidon complies with this requirement, **Special Condition 2** requires Poseidon, prior to the Commission's issuance of the coastal development permit, to submit for Executive Director review and approval all necessary leases from the State Lands Commission, local governments, and the power plant owner showing that it has the necessary legal interest in all property within the coastal zone necessary to construct and operate the project. **Special Condition 3** further requires Poseidon to execute and record against its leasehold interests restrictions that bind both Poseidon and any future holders of those interests to the terms and conditions of the Commission's approval. This, too, requires review and approval by the Executive Director before issuance of the coastal development permit.

- **National Pollutant Discharge Elimination System (NPDES) permit from the Regional Water Quality Control Board:** Poseidon's proposed project is subject to a NPDES permit issued by the San Diego Regional Water Quality Control Board in August 2006 pursuant to the Clean Water Act (33 U.S.C. § 1251 et seq.) and the Porter-Cologne Water Quality Control Act (Cal. Water Code § 13000 et seq.). The NPDES permit, issued after the Regional Board reviewed several studies and analyses of the project, covers discharges from the project to the Pacific Ocean. The NPDES permit addresses marine impacts of the project by requiring compliance with applicable water quality control plans, water quality objectives,

[37] Coastal Act Section 30601.5 states: "Where the applicant for a coastal development permit is not the owner of a fee interest in the property on which a proposed development is to be located, but can demonstrate a legal right, interest, or other entitlement to use the property for the proposed development, the commission shall not require the holder or owner of any superior interest in the property to join the applicant as coapplicant. All holders or owners of any other interests of record in the affected property shall be notified in writing of the permit application and invited to join as coapplicant. In addition, prior to the issuance of a coastal development permit, the applicant shall demonstrate the authority to comply with all conditions of approval."

performance goals, effluent limitations, and other receiving water and discharge limitations. In September 2006, Surfrider Foundation and Orange County CoastKeeper filed a petition with the State Board challenging the permit on several grounds. In June 2007, the State Board dismissed the petition because it failed "to raise substantial issues that are appropriate for review" by the State Board.[38] The permit requires Poseidon to submit additional documentation for Board approval before starting operations and is based on Poseidon operating with or without concurrent power plant operations, as long as either entity ensures a discharge of at least 304 MGD to provide adequate dilution of the desalination facility's high salinity discharge.

One of the required documents is a *Flow, Entrainment and Impingement Minimization Plan*, which Poseidon submitted in February 2007 and revised in June 2007 and which the Board is still reviewing. This plan is described in more detail in Section 4.5.1 of these Findings. The NPDES Permit states that the Board will determine through its review of this Plan whether the proposed project conforms to Porter-Cologne Act Section 13142.5.

Additionally, Poseidon's operations would cause sedimentation in Agua Hedionda, which is listed by the State and Regional Boards as an impaired water body due in part to high rates of sedimentation. Poseidon states, citing documentation by the Regional Board, that the 303(d) listing of Agua Hedionda Lagoon as an impaired body is based on fine-grained sedimentation discharged by urban run-off into the Lagoon from the neighboring watersheds (predominantly Agua Hedionda Creek), impacting 6.8 acres primarily located in the east basin of the Lagoon.[39] As noted in the *Carlsbad Watershed Plan*, developed pursuant to an NPDES Permit issued in 2001 to a number of local jurisdictions by the State Water Quality Control Board, continued use of the power plant intake by either Poseidon or Cabrillo would contribute to the high sedimentation rate in the Lagoon. As described later in these Findings, Poseidon's studies show that sedimentation at the mouth of the Lagoon caused by use of the intake results in increased sedimentation within the area of the Inner Basin identified as impaired. For example, in describing sedimentation caused by the intake, Poseidon states that the build-up of sediment near the Lagoon mouth restricts the tidal prism so that outflows from the Inner Basin are both reduced and slowed, resulting in the Lagoon having insufficient transport capacity to reduce the sediment load in the Inner Basin. Poseidon contends that the intake is only partially responsible for this sedimentation, and that the fine-grained sedimentation in the Inner Basin is primarily the result of urban run-off discharge. This issue will likely require further consideration by the Regional Board as part of its ongoing review of Poseidon's provisional NPDES permit, which was issued in June 2006 before these studies were provided. The Commission expects that action by the Regional Board will result in conformity to these applicable NPDES requirements.

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[38] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, at Exh. B p. 6; see also SWRCB/OCC File A-1773, June 5, 2007.

[39] 2006 Clean Water Act 303(d) List of Water Quality Limited Segments Requiring TMDLs, San Diego Regional Water Quality Control Board, June 28, 2007.

**Federal:**

- **Federal "incidental take" permits:** Poseidon's proposed project may result in the "take" of species protected under the Marine Mammal Protection Act through entrapment of seals or other marine mammals in the power plant intake. In a June 4, 2007 letter to Commission staff, Poseidon indicated it would apply for an independent "Incidental Harassment Authorization" ("incidental take" permit) under the Marine Mammal Protection Act for any impacts to sea lions, seals, or any other protected marine mammals resulting from construction or operation of the project. During review of Poseidon's application, the National Marine Fisheries Service would engage in consultation under Section 7 of the federal Endangered Species Act to ensure that the project will not jeopardize the continued existence of any species listed as threatened or endangered under the Act. Past power plant operations have caused documented entrapment of species protected under the federal Endangered Species Act, including two endangered East Pacific green turtles *(Chelonia mydas)* over the past several decades. Poseidon's operations of the intake system at velocities of less than 0.5 feet per second are expected to decrease the likelihood of future sea turtle impingement.

  Agua Hedionda historically provided habitat for the tidewater goby (*Eucyclogobius newberryi*) a species listed as endangered by the U.S. Fish and Wildlife Service in 1999. The goby is also listed as a Special Status Species by the California Department of Fish and Game. The Service was developing a critical habitat designation for the species about the same time as publication of Commission staff's recommended Findings to the Commission.[40] In November 2006, the USFWS issued a proposed designation that did not include Agua Hedionda as critical habitat, stating that the goby has not been detected in the Lagoon for many years; the last goby specimen from Agua Hedionda was collected in 1940.[41]

To ensure Poseidon conforms to these other coastal resource protection requirements, **Special Condition 4** requires Poseidon, prior to starting construction, to submit documentation of other permits and approvals needed for project construction and operation, including those from the City of Carlsbad, the Regional Water Quality Control Board, the California Department of Health Services, the National Marine Fisheries Service, and the U.S. Fish and Wildlife Service, or documentation showing that these approvals are not needed.

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[40] In 1994, the U.S. Fish and Wildlife Service listed the goby as endangered. In 1999, the Service published in the Federal Register a proposed rule to retain the goby as a listed endangered species in Orange and San Diego County coastal waters and to establish Agua Hedionda as part of the critical habitat for the goby. The goby had been listed as endangered in February 1994. In November 2000, the Service published its final rule, which designated Agua Hedionda as critical habitat for the goby. In August 2001, Cabrillo Power L.L.C., owner of the Encina power plant, filed a lawsuit challenging that designation. The Service later filed a consent decree with U.S. District Court in which it agreed to vacate that designation and reconsider the entire critical habitat designation in the rule. That consent decree also established that the Service would publish a revised proposal for critical habitat by November 15, 2006 and a new final rule by November 1, 2007. The USFWS had not issued its final habitat designation as of the date of the Commission's decision.

[41] See Poseidon Resources, Response to Staff Report, November 9, 2007, Exh. B, at p. 9.

## 4.5 CONFORMITY TO APPLICABLE COASTAL ACT POLICIES

### 4.5.1 Protection of Marine Life (Coastal Act Sections 30230 & 30231)

Coastal Act Section 30230 states:

> *Marine resources shall be maintained, enhanced, and, where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Coastal Act Section 30231 states:

> *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface waterflow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

These Coastal Act provisions require generally that marine resources be maintained, enhanced, and where feasible, restored. They also require that the marine environment be used in a manner that sustains biological productivity and maintains healthy populations of all marine species. Coastal Act Section 30231 requires that biological productivity be maintained, and where feasible, restored, including by minimizing the adverse effects of entrainment.[42]

#### *Other policies as guidance*

In applying the above-quoted Chapter 3 policies, the Commission may be guided by Porter-Cologne Act Section 13142.5, pursuant to Coastal Act Section 30412(a).[43] Subsection (b) of Section 13142.5 states:

> *For each new or expanded coastal powerplant or other industrial installation using seawater for cooling, heating, or industrial processing, the best available site, design, technology, and mitigation measures feasible shall be used to minimize the intake and mortality of all forms of marine life.*

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[42] "Minimize", as used in these Findings, means "to reduce to the smallest possible amount, extent, size, or degree" as defined in the American Heritage® Dictionary of the English Language: Fourth Edition (2000).

[43] Coastal Act Section 30412(a) states: "In addition to Section 13142.5 of the Water Code, this section shall apply to the commission and the State Water Resources Control Board and the California regional water quality control boards."

State, regional and local water plans all have confirmed that water needs in the San Diego region will rely in part on seawater desalination.[44] To that end: (1) the proposed project will provide 56,000 AFY of new water supply for the San Diego region; (2) the California Department of Water Resources' 2006 Water Plan Update identifies the need for 500,000 AF of desalinated water by 2030; (3) the Metropolitan Water District of Southern California's Integrated Water Resources Plan identified a need for 250,000 AFY of seawater desalination (including 56,000 AFY from the Carlsbad project) to ensure regional water supply reliability; (4) the San Diego County Water Authority (SDCWA) updated its 2005 Urban Water Management Plan in April 2007 specifically to reaffirm the need for 56,000 AFY of seawater desalination from the Carlsbad project by 2011; and (5) Carlsbad Municipal Water District, Valley Center Municipal Water District, Rincon del Diablo Municipal Water District, Sweetwater Authority, Rainbow Municipal Water District, Santa Fe Irrigation District, Vallecitos Water District, and Olivenhain Municipal Water District have entered into long-term water purchase agreements with the Carlsbad Desalination Project.[45] Collectively, these water districts will use 100% of Poseidon's capacity.[46] These agencies that have or are planning to acquire water from the Carlsbad Desalination Project have organized the "San Diego Desal Partners" and meet on a regular basis to coordinate efforts to advance the project. In a communication to Commission Chairman Kruer, the San Diego Desal Partners described the Carlsbad Desalination Project as "one of the most important water infrastructure projects currently being planned for the State of California."[47]

The SDCWA's April 18 Update of 2007 Metropolitan Water District supply assessment projected 2007 to be a critically dry year in both the State Water Project and Colorado River watersheds.[48] In light of this concern, the public support for the project continues to grow. For example, among key findings of the SDCWA 2006 Public Opinion Survey, the top response by respondents when asked what the most critical things the SDCWA could do to ensure a safe and reliable water supply was to develop seawater desalination.[49]

*Certified Agua Hedionda Land Use Plan*: Because the proposed project is within the Commission's retained jurisdiction, the standard of review is Chapter 3 of the Coastal Act. However, in such instances, the Commission may use as guidance adjacent certified Local Coastal Programs (LCPs). The proposed project would be in the coastal zone within the City of Carlsbad. Although the City has a certified LCP, the Commission has not yet certified the LCP for the portion of the City, known as the Agua Hedionda segment, where the project would be.

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[44] See Poseidon Resources Corporation, *Response to California Coastal Commission's February 20 Request for Additional Information*, June 1, 2007, at pp. 7-9.

[45] See *id.*

[46] See *id.*

[47] See *id.*

[48] See *id.*.

[49] See *id.*

The Commission, however, has certified the Land Use Plan (LUP) for the Agua Hedionda segment. The certified Land Use Plan recognizes the Lagoon's unique environmental status and designates the entire Lagoon as a "special treatment area". The Plan's goals for the Lagoon include the following:

- *Protect and conserve natural resources, fragile ecological areas, unique natural assets, and historically significant features of the community.*

- *Preserve natural resources by protecting fish, wildlife, and vegetation habitats; retain the natural character of waterways, shoreline features, hillsides, and scenic areas; safeguard areas for scientific and educational research; respect the limitations of our air and water resources to absorb pollution; and encourage legislation that will assist in preserving these resources.*

Agua Hedionda is also one of 19 coastal wetlands identified in the California Department of Fish and Game report, *Acquisition Priorities for the Coastal Wetlands of California*. This report identifies high priority wetlands for acquisition, based primarily on their values for fish and wildlife habitat and threats to their continued existence as a natural resource.[50] Coastal wetlands identified in this report are subject to the additional protections of Coastal Act Section 30233(c), which are described in Section 4.5.2 of these Findings.

### *Other policies and requirements applicable to the proposed project*

*Marine Reserve Designation*: Additionally, part of Agua Hedionda has been designated by the California Department of Fish and Game as the Agua Hedionda Lagoon State Marine Reserve. Pursuant to Section 1580 of the state Fish and Game Code, the Reserve is to be managed to:

> *"...protect threatened or endangered native plants, wildlife, or aquatic organisms or specialized habitat types, both terrestrial and nonmarine aquatic, or large heterogeneous natural gene pools for the future use of mankind through the establishment of ecological reserves."*

*NPDES permit*: Activities within the City of Carlsbad affecting Agua Hedionda Lagoon are in part subject to an NPDES permit issued in 2001 by the State Water Resources Control Board to several San Diego County cities to address significant water quality impacts in several coastal watersheds. The permit in part requires the cities to develop a comprehensive plan to manage the region's watersheds and to avoid and solve surface water quality problems. The *Carlsbad Watershed Management Plan*, published in 2002 pursuant to these NPDES requirements, includes a number of goals and objectives to implement the NPDES permit requirements. Its goals include, for example:

> *Protect Beneficial Water Uses: To be considered supportable by this plan, all "Action Items" must protect, restore, or enhance beneficial water uses within the watershed. The action should focus on the protection of human public health first and then on the health of wildlife and natural ecosystems. The action item should recognize that public health*

[50] See also the California Coastal Plan, December 1975.

*includes flood protection and should strive to balance natural restoration with water quality improvements and flood control.*

*Protect Coastal and Wetland Resources: Extra credit should be given to "Action Items" that serve to protect the wetland resources, sensitive species and fragile ecosystems associated with coastal lagoons and riverine resources. These resources are not only sensitive and highly valued, but they support a great diversity of species and tend to be "sink holes" where water quality problems become much greater.*

*Multiple Habitat Conservation Program*: The Multiple Habitat Conservation Program (MHCP) is a comprehensive habitat conservation planning process that addresses multiple species needs and the preservation of native vegetation communities for the cities of Carlsbad, Encinitas, Escondido, Oceanside, San Marcos, Solana Beach, and Vista, California. The MHCP is established in part to develop coordinated habitat preserve system. In Carlsbad, the MHCP is focused on preserving eight vegetation types, including marsh and estuarine wetlands. The covered species for this plan include invertebrates, birds, and plants found in and near Agua Hedionda and use the Lagoon as habitat.

*Marine Life Management Act*: The California Marine Life Management Act (MLMA) was established to ensure the conservation, sustainable use, and restoration of California's marine life. This includes the conservation of healthy and diverse marine ecosystems and marine living resources. To achieve this goal, the MLMA calls for allowing and encouraging only those activities and uses that are sustainable. Although most of the MLMA is devoted to fisheries management, it also recognizes that non-consumptive values such as aesthetic, educational, and recreational are equally important. Unlike previous law, which focused on individual species, the MLMA recognizes that maintaining the health of marine ecosystems is important in and of itself. The MLMA also holds that maintaining the health of marine ecosystems is key to productive fisheries and non-consumptive uses of marine living resources.

One of the MLMA's primary goals is to provide for sustainable fisheries. A sustainable fishery is defined in the MLMA as one in which fish populations are able to replace themselves. The MLMA recognizes that populations of marine wildlife may fluctuate from year to year in response to external environmental factors, such as climate and oceanic conditions. Unlike traditional definitions of sustainability in fisheries, a key feature of the MLMA definition calls for maintaining biological diversity.

"*Essential Fish Habitat*": Agua Hedionda Lagoon is also considered "Essential Fish Habitat" (EFH), pursuant to provisions of the federal Magnuson-Stevens Fishery Conservation and Management Act. The Act defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and establishes that activities that would affect this habitat require consultation with the National Marine Fisheries Service pursuant to Section 305(b) of the Act.

## *Proposed Project Location and Site Conditions*

Poseidon's proposed facility would be located on the site of the Encina power plant adjacent to Agua Hedionda. The facility would pump approximately 304 million gallons per day (MGD) of estuarine water from the Lagoon.[51] Although Poseidon's proposal is to use 100 MGD of seawater to produce 50 MGD of potable water, the Regional Water Quality Control Board has required through its issuance of an NPDES permit that Poseidon discharge no less than 254 MGD to dilute its high salinity discharge.[52] These proposed project characteristics and issues associated with this discharge are discussed later in these Findings.

**Characteristics of Agua Hedionda Lagoon:** Agua Hedionda Lagoon is located within the City of Carlsbad and is used for a wide variety of activities. It is used recreationally, it includes extensive aquaculture operations, and it has served as the location for the power plant's cooling water intake structure since the mid-1950s.

The vast majority of the water in the estuary is from tidal sources. Each semi-diurnal tide brings in or discharges about 500 million gallons of seawater, so Poseidon's water withdrawals would represent about 30% of the estuary's daily water influx.[53] The Lagoon receives a relatively small amount of freshwater from Agua Hedionda Creek, from twenty-three storm drains, and from urban and agricultural runoff. The Lagoon's three basins have very different habitat characteristics, based largely on the hydrodynamics of the tidal flow and the resulting different substrates – finer materials in the Inner Basin grading to coarser materials in the Outer Basin.

Agua Hedionda Lagoon is listed by the Regional Board as having impaired water quality due to the presence of indicator bacteria and because of siltation and sedimentation.[54] As noted in the *Carlsbad Watershed Plan*, the impairment is due largely to fine-grained sediments being discharged into the Lagoon from urban runoff coming from the neighboring watersheds (predominantly Agua Hedionda Creek)[55], although part of the excess sedimentation within the estuary has been due to the power plant's water intake causing an imbalance between sediment

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[51] To provide a sense of scale, the 304 million gallons of estuarine water Poseidon would use each day equals about 932 acre-feet, or the amount of water that would cover 932 acres (about 1.5 square miles) with a foot of water. Over the course of a year, Poseidon would use more than 100 billion gallons of water from the estuary, or about 340,000 acre-feet, which would cover over 500 square miles up to a foot deep.

[52] 304 MGD is an average volume. Poseidon's NPDES Permit limits the facility's salinity discharge to no more than about 40 parts per thousand, which requires Poseidon to pump from up to about 320 MGD at various times.

[53] Poseidon's Flow Plan states that the tidal cycle brings in about 475 million gallons. The San Diego County Water Authority estimated in its recent Draft EIR for a similar proposed desalination facility that tidal inputs were about 528 million gallons. The average of these two estimates would result in a twice-per-day influx of about 1003 MGD, so Poseidon's 304 MGD withdrawal would represent about 30% of the average tidal inputs.

[54] As noted in Section 4.4 of these Findings, pursuant to provisions of the federal Clean Water Act, states are required to identify polluted surface water bodies that do not meet water quality standards. States are to then prioritize those waterbodies for cleanup activities through developing a "Total Maximum Daily Load" (TMDL) for those waterbodies that identifies the cleanup steps needed to allow the waterbodies to meet the standards. California has not yet developed a TMDL for Agua Hedionda Lagoon.

[55] 2006 Clean Water Act 303(d) List of Water Quality Limited Segments Requiring TDMLs, San Diego Regional Water Quality Control Board, June 28, 2007.

inflow and outflow, and Poseidon's proposed project would cause similar sedimentation problems. Poseidon has also submitted a study indicating that due to sedimentation and in the absence of the power plant, if the Lagoon is not regularly dredged, it would close in from about five to seven years and slowly revert to its natural state of marshy channels with hyper-saline waters.

Despite these water quality concerns, Agua Hedionda provides extensive habitat values for a wide variety of marine biological resources and other wildlife. Surveys from 1994-95 found that the Lagoon and nearby wetlands supported 29 fish species and 143 species of benthic invertebrates.[56] Agua Hedionda provides habitat for important commercial and recreational fish species, special listed species, and forage fish used by these other species. Fish in the Lagoon include California halibut, which use the Lagoon as an important nursery area, garibaldi, Northern anchovy, and various gobies, blennies, and others. The Lagoon formerly provided habitat for the endangered tidewater goby (*Eucyclogobius newberryi*). The U.S. Fish and Wildlife Service determined in 2006 that the goby's absence from the Lagoon is due to habitat loss and other anthropogenic factors.[57] The Lagoon is also identified as Essential Fish Habitat (EFH), pursuant to the Magnuson-Stevens Act described above.

The surveys also identified 81 different bird species in these areas, including 12 listed as sensitive: Belding's Savanna sparrow, California least tern, Western snowy plover, Brown pelican, White-faced ibis, California gull, Osprey, Cooper's hawk, Long-billed curlew, Loggerhead shrike, Northern harrier, and Black skimmer. In the coastal scrub sage habitat adjacent to many of its wetlands, the surveys found additional sensitive bird species, including the California gnatcatcher, the least Bell's vireo, and the light-footed Clapper rail. Many of these species rely on marine life within the Lagoon and adjoining wetlands.

## *Anticipated Project Impacts and Coastal Act Conformity – Intake-Related*

Findings in this section evaluate the proposed project's impacts on marine biological resources associated with its intake of estuarine water. Findings in subsequent sections describe discharge-related impacts caused by the proposed facility's discharge of highly saline wastewater into nearshore ocean waters and its cumulative impacts. All analyses are based on Poseidon's proposed use and discharge of an average of 304 MGD of estuarine water, and on Poseidon's use of the existing power plant pumps as a stand-alone desalination facility.

**Adverse Impacts Caused by Poseidon's Intake:** The project's proposed withdrawal of 304 MGD of estuarine water through the power plant intake structure would cause several types of impacts to marine biological resources, including impingement, entrainment, and potential "take" of protected species. However, with implementation of the mitigation measures and **Special Conditions** described in these Findings, these impacts can be mitigated to an insignificant level such that the project conforms to Coastal Act Sections 30230 and 30231.

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[56] From California Wetlands Information System database at: http://ceres.ca.gov/wetlands/geo_info/so_cal/agua_hedionda.html.

[57] From *Federal Register*, November 28, 2006, proposed rule pursuant to 50 CFR 17 (see: http://www.epa.gov/fedrgstr/EPA-SPECIES/2006/November/Day-28/e9291.htm). Additionally, as noted in Section 4.4 of these findings, Agua Hedionda Lagoon is not listed as critical habitat for the species.

- **Impingement:** Impingement occurs when fish or other organisms are caught on an intake's screening system and are either killed or injured. The impingement rate for an intake is primarily a function of water velocity. The current Clean Water Act regulations (at 40 CFR 125) applicable to cooling water systems establish a maximum velocity of 0.5 feet per second as the required Best Available Technology. When velocities are below that level, fish are usually able to swim away from the pull of the intake. Impingement rates may also vary seasonally or when schools of fish get close to the intake.

  Regarding Poseidon's expected impingement impacts, the project EIR at Section 4.3 and Poseidon's 2004-05 study described below showed that it would not cause impingement at levels beyond those caused by the power plant and that its use of the power plant intake would impinge about 20,000 fish per year (or about 55 per day) weighing a total of about 4500 pounds (or about 12 pounds per day). During the study period, however, most of this impingement – about 80% – was caused by power plant heat treatments, which Poseidon would not have to do as a stand-alone desalination facility. Therefore, Poseidon's impingement rate would be much less, averaging less than 2.5 pounds per day. The City of Carlsbad's EIR determined that under the stand-alone "No Power Plant Operation" scenario, the project would have an intake flow velocity that would not exceed 0.5 feet per second, which is consistent with the U.S. EPA guidance for "best available technology" for cooling water intakes, and that under these operating conditions the project "would not result in significant impingement effects." See project EIR Section 4.3. Poseidon has prepared a *Flow, Entrainment and Impingement Minimization Plan* in accordance with its Regional Board issued NPDES Permit (Regional Board Order No. 2006-0065). The *Flow, Entrainment and Impingement Minimization Plan* provides that the project, when operating stand-alone, is expected to impinge approximately 2.12 pounds of fish per day, which Poseidon provides is less than the average daily consumption of an adult pelican (more than 2.5 pounds per day), which for this project the Commission considers *de minimis* and insignificant.[58]

  Moreover, **Special Condition 8** requires Poseidon to submit a Marine Life Mitigation Plan for Commission approval, and implementation of that Plan will mitigate any expected impingement impacts. Past impingement at the power plant has included entrapment and "take" of the endangered Eastern Pacific green turtle a protected species. During the past several decades, one green sea turtle has been entrained and released unharmed and a second one was found dead at the intake structure. Sea turtles are rarely seen in the Lagoon area, or in the intake or outflow bays of the power plant. The flow rate of the water in the intake bays is expected to be at or below 0.5 fps; therefore, death of healthy sea turtles after entering these areas is highly unlikely. Because there will be either no change to the existing conditions, or in the case of the project operating by itself a substantial reduction in the seawater pumping rate, it is not anticipated that continued operation of the power plant or the needs of the project will have significant adverse impacts on sea turtle species. The current design of the power plant minimizes the possibility of entrainment of sea turtles in the power plant structures. The intake structure is outfitted with metal guard rails (trash racks) that prevent animals from entering the forebay area on the plant side. The slow moving water in the Lagoon and through the intake trash racks allow the sea turtles to get out of the area if

[58] See also Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at pp. 9-10.

they enter.[59] Because the turtles do not breed in this area, only adults would be susceptible to potential "take", and adult turtles are too large to fit through the bar racks at the intake entrance. Poseidon has documented that stand-alone operation of the facility would result in intake water velocities at or below 0.5 feet per second, which is consistent with the U.S. EPA guidance for "best available technology" for cooling water intakes. As noted above, Poseidon will also apply for an incidental take permit from NMFS to mitigate any such impacts. Based on the above, and with **Special Condition 8**, the Commission finds the impingement impacts and the potential for an incidental take associated with stand-alone operations will be consistent with the Coastal Act and fully mitigated.

- **Entrainment:** Entrainment occurs when small organisms, such as plankton, fish eggs, larvae, etc., are pulled into an open-water intake. Once-through cooling systems like the one at the Encina power plant are considered to cause essentially 100% mortality due to the organisms being subjected to high temperatures or high pressures within the system. Entrainment causes direct impacts by killing the small organisms that are pulled through the cooling system and causes indirect impacts to the larger marine community by altering the food web and removing part of the community's productivity. Seawater is not just water, but is habitat, and along the California coast an acre-foot of seawater (about 326,000 gallons) can contain an average of about 500 different species of fish, invertebrates, plankton, and other marine life. Large intake systems such as the one Poseidon proposes to use can kill millions of organisms each day and cause a loss or change in ecosystem resources and alterations in community structure. While impingement rates are largely a function of water velocity and can be reduced when velocities are reduced, the amount of entrainment is primarily associated with the amount of water used, so the main way to reduce entrainment impacts is to reduce water volumes pulled into an intake system.

  *Background – How to Determine Entrainment Effects*: Determining the scale and the extent of entrainment impacts generally requires a study that includes obtaining at least one year's worth of regular sampling data and application of any of several modeling approaches. The samples are taken from waters near the intake and from nearby source waters. Organisms captured are identified to the lowest possible taxon. In most cases, all organisms cannot be identified, so the known taxa serve as indicators or surrogates for the full set of affected species. Of the various models available, the most acceptable is known as the Empirical Transport Model (ETM). It is used to provide an estimate of the proportion of organisms lost due to entrainment compared to the overall number of organisms in a source water body. The ETM approach allows estimates of loss for each identified species, in part by recognizing that each species is subject to entrainment during particular life stages. Once the species subject to entrainment are identified, the ETM approach then determines what period of time each of the species are subject to entrainment – that is, based on local currents, it determines how many days an egg stage or larval stage of a particular species is subject to being pulled into the cooling system rather than be able to move away and escape from it. This period varies by species, ranging from just a few days to several weeks. It will also vary by whether it is calculated using the maximum or mean duration of larvae in the source water. As a very simple example, if individuals of a species are "entrainable" for the first five days of their lives and the average currents in the area move past the cooling system intake at half a mile per hour, that species has a source water area of sixty miles (5 days x 24

[59] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. B at p. 14.

hours x 0.5 mph = 60 miles). Determining source water areas may be complicated by seasonal changes in current speed or direction and whether the species are from nearshore or offshore areas, and for intakes proposed in enclosed estuaries, the calculations must incorporate the hydrologic pattern of the estuary.

The proportion of larvae lost to larvae in the source water (known as "proportional mortality") is then multiplied by the source water area to provide an estimate of how much overall production of the species in this area is lost due to entrainment. This result of this calculation, known as "habitat production foregone" (HPF) can be expressed in acres or in miles of shoreline. Even a low "proportional mortality" figure can result in a large impact if the loss occurs over a large stretch of shoreline. Using the example above, if 5% of the larval stage of that species is lost due to entrainment, that represents that species' production along about three miles of shoreline (0.05 x 60 miles = 3 miles). The HPF for the various species can be kept separate or can be combined as an overall average figure.

Results of entrainment studies such as this do not reflect all the variables that may affect populations within a given area – for example, populations may decrease or increase due to seasonal or long-term changes, the habitat within the source water areas is likely to include characteristics that affect particular species and may be of variable quality within the same source water area, etc. These methods do, however, provide a good sense of scale of the overall impacts of a given intake system during the period sampled.

*Poseidon's anticipated entrainment effects*: The project is expected to cause adverse effects to marine life due to its use of 304 MGD of estuarine water. The City of Carlsbad determined, in Section 4.3 of the project EIR, that under standalone operations, the facility would have no significant effects "on the source water populations [ability] to sustain themselves".[60] However, in 2004-05, Poseidon conducted a study as part of the documentation for its Flow, Entrainment, and Impingement Minimization Plan to determine the entrainment impacts that would be caused by continuous 304 MGD water use. In May 2007, Poseidon provided a technical memorandum to Commission staff summarizing the results of that study and its Flow, Entrainment, and Impingement Minimization Plan and stated that the study used Regional Board approved protocols for sampling and analysis. Poseidon stated its study showed that the desalination facility's water withdrawals would entrain an average of about 12% of three types of fish larvae in Agua Hedionda subject to entrainment – gobies, blennies, and garibaldi – in addition to smaller percentages of other species, including white croaker, Northern anchovy, California halibut, and queenfish, none of which are listed as endangered or threatened. Poseidon identified these species as coming from about 302 acres of Agua Hedionda's open water habitat (253 acres) and its mudflat/tidal channel habitat (49 acres). Applying the ETM and HPF methods described above suggests that Poseidon's entrainment would cause a loss of productivity about equal to that created by 36 acres of Agua Hedionda's open water and mudflat/tidal channel habitat (i.e., 12% of 302 acres = ~36 acres).

To ensure Poseidon's study accurately assesses the project's entrainment impacts, **Special Condition 8** requires that Poseidon provide a full copy of its study for further Commission review and approval.

[60] See Project EIR, Section 4.3.

Poseidon has argued, for a number of reasons, that this expected entrainment impact does not constitute a significant adverse impact, and that several features of its project will reduce entrainment impacts:

- *Ongoing use of the intake by the power plant*: Poseidon states that its entrainment impacts will be reduced as long as the power plant continues to use its cooling water intake. Poseidon states that the power plant expects to continue its use of the once-through cooling system indefinitely. The magnitude of the entrainment losses identified in Chapter 3 of Poseidon's *Revised Flow, Entrainment and Impingement Minimization Plan*, dated June 1, 2007, is estimated for continuous operation of the desalination plant on a stand-alone basis notwithstanding the fact that the power plant generating units will be available for service indefinitely. The power plant owner has proposed removing three of the existing plant's five generating units and operating the remaining two units only part time for several more years until replacement power becomes available. The two remaining generating units represent 528 MGD of pumping capacity. Cal-ISO would ultimately determine when the remaining units are no longer needed for grid reliability. Poseidon states that in the meantime, seawater pumping by the power plant would likely meet a substantial portion of the desalination facility's flow requirements, resulting in a comparable reduction of entrainment and impingement impacts attributable to the facility.[61]

- *Modifications to the intake system for desalination facility use*: Poseidon states that entrainment mortality that occurs within the existing power plant screens, pumps, and condensers upstream of the desalination facility intake would be substantially reduced during the desalination facility's standalone operations due to lower water temperatures, volumes, velocities, and turbulence resulting from desalination operations compared to those of the power plant.[62]

- *Use of water for dilution*: Of Poseidon's 304 MGD use of estuarine water, about two-thirds, or 200 MGD, would be pulled in to the intake system and used, without further processing, to dilute the high salinity discharge from the desalination facility. Poseidon states that only 104 MGD would be subjected to additional processing that would cause entrainment mortality, as 200 MGD bypasses the desalination facility and is discharged to the ocean.[63]

- *"Cropping" and population size*: Poseidon states, for example, that because there are large numbers of planktonic organisms in estuarine water and because they experience a very high natural mortality rate, the effects of entrainment are generally similar to what these organisms already experience. Poseidon further states that the "cropping" of these

[61] See Poseidon Resources Corporation *Response to California Coastal Commission's Letter of February 20, 2007*, June 1, 2007, at Attachment 25.

[62] See *Carlsbad Seawater Desalination Project Revised Flow, Entrainment, and Impingement Minimization Plan*, June 1, 2007, at p. 26.

[63] See *Carlsbad Seawater Desalination Project Revised Flow, Entrainment, and Impingement Minimization Plan*, June 1, 2007, at pp. 1-19.

organisms via entrainment is beneficial in that it allows remaining individuals to have less competition. It states that entrainment samples collected during the study were consistently dominated by larvae of three lagoon-dwelling species and contained relatively few numbers of ocean-dwelling species. It states that study samples were dominated by gobies, a mud-dwelling group of fish ubiquitous to all California lagoons and bays, blennies, fish that are crevice dwellers; and garibaldi, a typical rocky reef dweller in open ocean habitat, but in this case occupying the rocky reef of rock rip-rap armoring the Lagoon side of the Carlsbad Boulevard jetty. None of the species entrained is listed as threatened or endangered. In addition, Poseidon states its samples showed entrainment would affect about 0.2% of other species, including white croaker, Northern anchovy, California halibut, and queenfish. Poseidon further states that because the affected species are primarily gobies, which are ubiquitous in California lagoons and bays, blennies, which are also common, and garibaldi, which are more often found in rocky habitats in the open ocean, the 12% average loss is not significant. Poseidon states that most of the organisms that would be entrained are species that are not commercially or recreationally fished, and since they are not harvested, the entrainment mortality is being imposed on populations that are at a level close to the natural carrying capacity of the coastal environment. Therefore, Poseidon contends, mortality due to entrainment would not affect such populations, and any impingement or entrainment impacts of the project, if it should operate stand-alone in the future, would have no significant adverse effects on marine biology. Poseidon also applies measures from the California Department of Fish and Game's *Nearshore Fisheries Management Plan* to conclude that because the 12% loss is below the levels identified in that Plan (i.e., 30% or 60% loss of a fish stock's biomass) that require a fisheries management response, the entrainment loss is not significant. Poseidon states that because the fish are not harvested, the mortality levels caused by entrainment would not affect the populations.

However, Commission staff's analysis shows that Poseidon's arguments are not supported by available science or the findings from the past several years of entrainment studies conducted at power plants along the California coast and elsewhere in the U.S.

Regarding ongoing use by the power plant of its once-through cooling system, Commission staff concur that in that situation, the entrainment caused would be shared by both Poseidon and Cabrillo; however, it is not able to determine what proportion of the adverse effects could be assigned to either entity. Staff's analysis was based on Poseidon's stand-alone operations pulling in about 304 MGD. Cabrillo has stated that while it would continue to make available two of its generating units as needed, that it expects them to operate for no more than a few weeks per year once its new dry-cooled facility is operating, and it is not possible to predict how often or for how long these units might run in the future. Therefore, the Commission is unable to determine whether continued, part-time co-located operations would affect Poseidon's entrainment impacts. If the power plant operates at times when Poseidon is operating and draws in additional water, Poseidon's impacts may be a "share" of the overall total; however, as noted previously, the adverse effects to marine biology evaluated in these Findings and the necessary mitigation are based on Poseidon operating as a stand-alone facility and drawing in about 304 MGD.

Regarding the modifications and different processes Poseidon states may occur within the intake and discharge system, including use of estuarine water for dilution, staff notes that the standard protocols used for conducting entrainment studies and determining the levels of adverse effects do not allow a lower mortality rate to be applied to the different processes organisms may experience in the various types of these systems. There are no peer-reviewed scientific studies that support a lower mortality level – therefore, the protocols' assumption of 100% mortality applies to each study regardless of the variable temperatures, water volumes, velocity, and turbulence caused by any particular intake system. Further, the project EIR stated that it did not evaluate how larvae may be affected differently by different levels of turbulence and temperature, and also noted that entrained organisms would be subject to the same level of turbulence from the desalination facility whether the power plant is operating or not.

In all entrainment studies done at California's coastal power plants, and per guidance and findings from the U.S. EPA, the California Regional Water Quality Control Boards, the California Energy Commission, and previous Coastal Commission decisions, entrainment mortality is assumed to be 100% regardless of the various processes and stressors the entrained organisms may experience in different intake systems. Even if some organisms may survive the initial heat, turbulence, or pressure-induced stresses experienced when passing through these systems, they are expected to be injured and suffer mortality shortly after being discharged due to injury, increased rates of predation, or other related causes. A stand-alone desalination facility using the same type of water intake structure is assumed to cause the same level of mortality, due to its use of filters and high pressures to remove most particles from seawater and due to its high salinity discharge. Those organisms drawn into the intake in water used just to dilute the desalination discharge may experience somewhat less than 100% immediate mortality; however, there are insufficient data or peer-reviewed scientific studies to conclude that the overall mortality from desalination processes and discharges would be anything less than the 100% mortality the protocols apply to organisms going through the power plant processes and discharges. Further, for this particular intake and discharge system, organisms that may survive being pulled from the estuary and through the desalination processes would be discharged into the very different habitat conditions of the nearshore ocean shoreline, which in itself is likely to cause substantial mortality.

Regarding "cropping" and population size, staff notes that Poseidon's proposed use of the CDFG's fisheries management definitions do not apply to the species Poseidon states are most subject to its entrainment impacts – that is, gobies, blennies, and garibaldi, none of which are managed as part of a fishery. Further, Poseidon's contentions regarding the ubiquity and population sizes of these species do not incorporate standard ecological concepts that recognize the importance of forage fish, such as gobies and blennies in supporting other species and ecosystem functions.

Each of the entrainment studies done in California since 1998 concluded that the power plant intakes caused significant adverse impacts to local or regional marine biota.[64] Additionally,

[64] Since 1998, entrainment studies completed at California coastal power plants include those done at Moss Landing, Morro Bay, Diablo Canyon, Huntington Beach, and South Bay (e.g., *Morro Bay Power Plant 316(b) Resource Assessment*, 2001; *AES Huntington Beach Generating Station Entrainment and Impingement Study*, 2005 and *California Energy Commission Entrainment and Impingement Final Staff Analysis*, August, 2006, etc.).

for the most part, the main adverse entrainment effects these studies identified were to species of forage fish (e.g., gobies, queenfish, etc.) similar to those identified in Poseidon's study, and each study resulted in a requirement of substantial mitigation for the identified losses. Some studies evaluated intake volumes in the same range as those proposed by Poseidon – for example, the entrainment study for the Huntington Beach power plant determined that its use of 253 MGD of ocean water resulted in Habitat Production Foregone of over 100 acres. Each of the three recent studies done for intakes within estuarine environments identified adverse entrainment impacts and substantial mitigation needs. For example, the Moss Landing study showed that its 1224 MGD estuarine intake resulted in Habitat Production Foregone of 1135 acres. If applied proportionally to Poseidon's 304 MGD intake, the HPF would be about 281 acres. Similarly, the study of Morro Bay's 668 MGD intake showed an HPF of from 230 to 759 acres, which is applied proportionally to Poseidon's expected flow would result in an HPF of from 104 to 345 acres. In each of these power plant siting cases, the Commission found that mitigation was necessary to allow Coastal Act conformity. Finally, the South Bay power plant study of a 601 MGD intake resulted in an HPF of 1003 acres, which if applied to Poseidon's flow would require 507 acres of mitigation. Poseidon's contentions that its entrainment effects would be minimal or even beneficial are further refuted by both Coastal Act and Porter-Cologne Act requirements that call for entrainment to be minimized to protect marine biology and water quality.

Having seen only the summary Poseidon provided, rather than the full study, the Commission is requiring through **Special Condition 8** that Poseidon provide the full study to confirm these contentions, especially in comparison to these other recent entrainment studies, all of which found significant adverse impacts and resulted in HPF and mitigation needs well above Poseidon's proposal. The previous entrainment study done at the Encina power plant in 1979 found that there was an average of more than 1400 individuals of just the ten most abundant fish species in each 100 cubic meters of estuarine water.[65] The results Poseidon provided of its more recent study did not include this information, but if the current densities are similar, Poseidon's 304 MGD intake would cause entrainment to at least 16 million fish larvae per day (i.e., 304 MGD / 100 cubic meters (or 26,400 gallons) = 11,515 x 1400 = 16,121,000). That 1979 study also found that the power plant's 795 MGD intake would cause annual entrainment losses of identified zooplankton (including Crustacea, copepods, Mysidacea, Decapoda, etc.) of $30.9 \times 10^9$, or more than 30 billion organisms per year. When applied to Poseidon's 304 MGD flow volume, this would be about 11 billion of these identified organisms per year.

Along with the lost productivity that would result from Poseidon's estuarine water use, the water use would also cause significant adverse effects to specific species. The species identified in the study as subject to entrainment include several subject to "take" prohibition or fishing limits and others that provide important functions in the estuarine food web. Of the species that would be entrained, most have a role in the estuary's food web as prey species for higher trophic level species, including many that are important for commercial or recreational fishing.[66]

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[65] See Cabrillo Power I LLC, *Proposal for Information Collection Clean Water Act Section 316(b) Encina Power Station*, April 1, 2006.

[66] The recently published report by the Environment California Research and Policy Center, *Net Loss: Overfishing Off the Pacific Coast* (October 2007) identifies significant overfishing along the coast of California and other states.

Three species – the garibaldi, California halibut, and Northern anchovy – make up about 6% of the identified organisms collected during entrainment sampling. They would constitute a similar percentage of the millions of organisms that Poseidon's project would entrain, and therefore represent an adverse impact to marine biological resources protected under the Coastal Act.

Overall, Poseidon's entrainment study results show that its proposed use of an estuarine intake would causes a substantial reduction of important individual species and of production within Agua Hedionda. It may also cause losses in nearby nearshore waters due to the intake entraining organisms that would otherwise enter nearshore areas due to tidal discharges; however, the study results did not identify whether that hydrodynamic-related effect was included.

Therefore, although the Final EIR found the project would cause no significant entrainment impacts pursuant to CEQA, the Commission finds that the project's entrainment impacts will require mitigation to ensure conformity to Coastal Act Sections 30230 and 30231.

**Mitigating the Impacts Caused by the Poseidon's Use of an Estuarine Open Water Intake:**

*Mitigation Background*: The standard approach for identifying, selecting, and implementing appropriate mitigation for project impacts is to first *avoid* the impacts, to then *minimize* the impacts, and to finally *compensate* for the impacts that remain.[67] Mitigation sequencing, as it is known, requires that mitigation measures to achieve the first step be considered and selected (or be determined infeasible) before moving to the next step. If the third step, compensatory mitigation, is necessary to address remaining impacts, it also includes a preferred sequence – to first create environmental conditions similar to those being lost; to next restore or enhance conditions similar to those being lost; and to finally preserve or protect an area that provides habitat value. It is generally preferable to select "in-kind" mitigation; that is, to develop mitigation sites with habitat similar to that being adversely affected, rather than to develop "out-of-kind" mitigation. Similarly, it is generally considered better to develop mitigation on-site rather than off-site.

*Avoiding and Minimizing Impingement Impacts*: As noted above, Poseidon's study showed that its use of the power plant intake would impinge less than 2.5 pounds of fish per day, which the Commission considers a *de minimis* impact.

The primary method of avoiding and minimizing impingement is to maintain intake water velocities below 0.5 feet per second (fps), a rate that the U.S. EPA considers to be "best available technology" for cooling water intakes. This velocity represents the rate from which most fish species are able to swim away from intake screens and avoid being impinged. Poseidon showed in its draft *Revised Flow, Entrainment, and Impingement Minimization Plan* that its use of the power plant pumps would create intake velocities higher than 0.5 fps and that its preferred operating scenario – using the power plant's Unit 4 pumps—would result in rates between 1.8

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Among the populations identified as overfished (i.e., reduced to below 20-25% of its original population) are several that rely on fish that would be entrained by Poseidon's project.

[67] See, for example, the CEQA Guidelines at Section 15370.

and 2.8 fps, or from more than three to five times the acceptable rate. However, in Exhibit B of its November 9, 2007 letter to Commission staff, Poseidon states that water velocities at the intake bar racks during stand-alone operations would be less than 0.5 fps, which would conform to the U.S. EPA's "Best Technology Available" standard for minimizing impingement impacts. Additionally, as noted previously, Poseidon has stated it intends to apply for an "incidental take permit" from NMFS. With these measures, the project is not likely to cause substantial adverse impingement effects. Furthermore, Poseidon's Exhibit B and its Revised Flow, Entrainment, and Impingement Minimization Plan state that it will install variable frequency drives to further decrease water flow intake velocities. With these low velocities, the already *de minimis* impingement impacts that Poseidon's project may cause are expected to be further reduced and thus mitigated to an insignificant level and consistent with Coastal Act Sections 30230 and 30231.

*Avoiding Entrainment Impacts*: The most direct way to avoid Poseidon's expected adverse entrainment effects would be, if feasible, to use an alternative intake structure that avoids those effects. Certain types of subsurface intakes may avoid these effects by drawing in water through an overlying layer of sand. As discussed below, however, the Commission finds that these alternatives are infeasible.

The four main types of intakes are vertical beach wells, Raney-type wells, slant-drilled wells, and infiltration galleries (see Exhibit 4). Vertical beach wells are essentially the same as wells located at inland locations, drilled to a depth where they intercept an underlying aquifer, or for beach wells, where they intercept the seawater "wedge" underlying the beach. Raney-type wells are vertical wells with an additional series of horizontal collector wells extending out from the bottom of the vertical well shaft. This type of well can significantly add to the yield obtained from a vertical well shaft. Slant-drilled wells are drilled at an angle from the beach or from further inland, with a perforated well casing that extends below the seafloor to intercept water from below the substrate. An infiltration gallery consists of a series of perforated pipes that are placed in a trench dug on the seafloor, which is then backfilled with sand. As explained below, the most common adverse effects of wells would be caused by construction or would be related to groundwater quality or quantity. For example, an improperly located subsurface intake could draw down aquifers or could intercept areas of contaminated groundwater or water with naturally high mineral content, high salinity concentrations, or high levels of suspended solids that are difficult to treat and which may make a project practically or economically infeasible. Adverse effects of galleries for this project would include significant environmental impacts related to constructing structures that would affect up to more than 150 acres of coastal habitat. Although subsurface intakes can, like open water intakes, cause adverse environmental effects, they may be less severe and temporary, and a properly designed subsurface system can be environmentally benign. At least four desalination facilities along the California coast use beach wells as their feedwater system, and the Commission recently approved two pilot studies to determine the applicability of both a slant-drilled intake and an infiltration gallery for desalination.

The amount of water subsurface intakes can take in depends on the permeability of the overlying substrate and other geotechnical characteristics. With an infiltration gallery, the substrate can be engineered to allow much higher permeability than would occur with the natural substrate. Subsurface intakes also offer additional operational advantages, such as reduced chemical use and reduced operating costs. Water from subsurface intakes generally has lower concentrations of solids, organic material, oil and grease, and other constituents that would have to be removed

before the water contacts a desalination facility's reverse osmosis membranes. The natural filtering effect of the overlying substrate can buffer changes in the open water column caused by storms, runoff, or spills, and they may be able to operate during times when facilities with open water intakes would have to shut down. Subsurface intakes also provide some of the pre-treatment needed before seawater goes through desalination filters or membranes, thus eliminating part of the chemical or physical treatment that would otherwise be required at the desalination facility. While subsurface intakes may have higher initial construction costs, they can result in long-term operational savings due to their lower pre-treatment and chemical costs, and because water quality from those intakes is generally less variable, which allows for more efficient desalination operations. These characteristics are likely more evident from intakes that extend under the nearshore ocean water column than those that intercept aquifers that may be affected by surface infiltration from inland areas or have high mineral content.

Carlsbad EIR analyzed the feasibility and environmental impact of several types of alternative intake systems pursuant to the Modified Intake Design Alternative. The EIR concluded that the use of horizontal wells, vertical beach wells and infiltration galleries in lieu of the project's proposed use of the power plant intake system was either infeasible and/or had greater environmental impacts than the proposed project.[68] Poseidon also provided evidence that subsurface intakes would cause more significant impacts than those caused by the existing power plant intake and that they would be economically infeasible. In support of this position, Poseidon has submitted extensive analysis and cost estimates it prepared at the request of Commission staff. This information provides further confirmation that alternative intake systems were infeasible and not the environmentally preferred alternative.[69] Regarding economic infeasibility, Poseidon believes that subsurface intake options would be infeasible in part because they would raise the anticipated cost of desalinated water from Poseidon's current estimate of $950 per acre-foot to about $1300 per acre-foot.

Regarding slant-drilled wells, a recent study conducted by the Municipal Water District of Orange County (MWDOC) showed that that type of intake could be used to draw in 30 MGD of seawater for its proposed desalination facility near Dana Point.[70] The facility would draw 30 MGD from nine 500-foot long wells extending under the seafloor at about a 20° angle.

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[68] See Project EIR at Section 6.3.

[69] See Poseidon Resources Corporation, *Response to California Coastal Commission's Letter of September 28, 2006*, November 30, 2006, at pp. 24-51; See Poseidon Resources Corporation, *Response to California Coastal Commission's December 28 Request for Additional Information*, February 2, 2007, at pp. 2-4; See Poseidon Resources Corporation, *Response to California Coastal Commission's February 20 Request for Additional Information*, June 1, 2007, at pp. 2-7, 10-11; See Poseidon Resources Corporation, *Response to California Coastal Commission's July 3 Request for Additional Information*, July 16, 2007, at pp. 4-8, 11-14; Poseidon Resources Corporation, *Additional Analysis of Submerged Seabed Intake Gallery*, October 7, 2007; Poseidon Resources Corporation, *Issues Related to the Use of the Agua Hedionda Inlet Jetty Extension EIR to Recommend an Alternative Seawater Intake for the Carlsbad Desalination Project*, October 8, 2007; Poseidon Resources Corporation, *Intake Cost Estimates*, October 2007.

[70] See Boyle Engineering's *Dana Point Ocean Desalination Project – Engineering Feasibility Report* (March 2007), prepared for the Municipal Water District of Orange County.

Poseidon submitted evidence stating slant wells are infeasible because pilot testing indicates that the quality of the water available from them would be so low as to be difficult, if not impossible, to treat due to salinity concentrations twice that of seawater, excessive iron, and high suspended solids.[71] Poseidon's studies also confirmed that, at best, one slant well could provide only 5% of the water required by the project. Thus, numerous slant wells would be needed to meet project objectives and address the well-documented water needs in Southern California. As a result of the necessity for multiple slant wells in public areas, this option is infeasible due to their noticeable presence on the beach and disruption of public access and recreation. The EIR prepared by the City of Carlsbad concluded that the construction and use of subsurface intakes for the project would cause adverse environmental impacts to coastal resources at Carlsbad beach, including but not limited to the creation of negative traffic, noise, and air pollution impacts for a period of two years during construction, and disturbance of and, loss of public access to, the beach area occupied by the wells both during and after construction.[72] The EIR also concluded that the slant wells would require the construction of permanent access ramps from the Pacific Coast Highway to the beach to transport equipment during construction and to permit well inspection during the life of the wells. Because the project would require multiple smaller well facilities to meet its water needs, these wells would result in far greater environmental impacts and costs than the project, and they would be neither feasible to address water needs nor consistent with Coastal Act policies.[73]

An infiltration gallery is another potential alternative. These systems are in place at a number of locations around the world, including one that provides water for a 45 MGD desalination facility, with plans for other galleries that would provide up to several hundred million gallons per day for power plant cooling water use. While these systems would result in seafloor disturbance during construction, they would cause few, if any, impacts to marine life once in operation. When installed in an area of open sandy seafloor, the post-construction benthic habitat conditions would be essentially the same as pre-construction conditions. The initial construction impacts to the offshore sandy bottom habitat would be similar to the continual offshore sand deposition and movement already experienced by that type of habitat.

As noted above, once a gallery is installed, it is essentially invisible from the surface of the seafloor, both in terms of its structure and any effects on marine life. The systems are designed so that the pull of the pumps are undetectable at the seafloor, thus making it highly unlikely that organisms would be "trapped". While Poseidon's initial geophysical surveys of an area offshore of Agua Hedionda showed an area of over 200 acres of featureless bottom with fine-grained sand, which may be suitable for such a system, recent surveys of the area indicated that 70% of the inspected area would contain sensitive basement and high relief reefs.[74] During construction, not all the seafloor material within the gallery area would need to be removed, and it certainly

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[71] See Poseidon Resources, *Transmittal of Analysis of Alternative Subsurface Seawater Intake Structures, Proposed Desalination Plant*, Carlsbad, CA, Wiedlin & Associates (January 30, 2007), sent February 2, 2007; Poseidon Resources Corporation, *Response to California Coastal Commission's September 28, 2006 Request for Additional Information*, November 30, 2006, at pp. 31-41.

[72] See Project EIR Section 6.3.

[73] See Poseidon Resources Corporation, *Response to Staff Report, November 9, 2007*, Exh. A at pp. 16-18.

[74] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Ex. B, p. 18.

would not require being transported to a landfill. Most material would likely be suitable for the ongoing longshore sand movement in this area of the coast. The largest infiltration gallery used for desalination, at San Pedro del Pinatar in Spain, was selected in recognition of its location next to the highly sensitive marine environment of a regional nature reserve. That installation was also able to use horizontal directional drilling, which significantly reduced its installation impacts. However, based on testimony provided at the Commission's November 15, 2007 hearing, the facility in Spain is now having significant fouling problems with the intake; the plant and a future expansion will rely on an open ocean intake for its primary source of seawater.

For this project, infiltration galleries would cause even greater environmental impacts than slant wells and would be economically infeasible. In Exhibit B of its November 9, 2007 letter to Commission staff, Poseidon confirmed that over 70% of this area offshore of Carlsbad actually consists of more sensitive basement and high relief reefs. Poseidon also provided evidence that an adequately-sized subsurface system would require about 150 acres of seafloor, which would be adversely affected by gallery installation. Based on this information, environmental impacts to 150 acres of offshore habitat would be greater adverse impacts than caused by the proposed existing intake for the following reasons:

First, construction of an infiltration gallery would result in a physical removal and alteration of 150 acres of coastal habitat, such that a 15-foot thick layer of ocean bottom shelf with all living organisms in it would be removed, as compared to the annual productivity loss of 36.8 acres identified in Poseidon's entrainment study results.[75]

Second, it would be necessary to excavate and construct 76 intake water collection wells and trenches for collector piping along a three-mile beach strip of the City of Carlsbad shore, which would limit public access to the beach for a period of 2 to 4 years, result in significant loss of recreational activities for the City of Carlsbad, and result in a permanent loss in public access and visual resources impacts where the collection wells are located.[76]

Third, excavation of three-mile long by 400 feet wide strip of seafloor will make this area of the ocean unavailable for recreational activities such as fishing and diving and will result in additional NOx and carbon dioxide gas emissions associated with operation of barges and platforms and equipment needed to excavate and remove the ocean shelf material over this vast area.[77]

Fourth, in order to secure consistent operation of the filter bed at this location, the bed may require dredging every one to three years to remove the sediment and entrained marine life that would accumulate in the intake filter bed and which, over time would plug the bed. The dredged material would require disposal away from the one-mile strip of the intake filter bed to prevent the removed solids from returning to the area of the bed. This would not only result in frequent adverse impacts to the marine flora and fauna in the area but would also render the area

[75] See Poseidon Resources Corporation, *Additional Analysis of Submerged Seabed Intake Gallery*, October 8, 2007.

[76] Id.

[77] Id.

unavailable for recreational activities during maintenance activities.[78] Based on the foregoing, a 150-acre gallery in this area would be physically and environmentally infeasible. Poseidon also submitted evidence demonstrating that such a system would be economically infeasible. Its October 2007 cost estimates show that an infiltration gallery for its Carlsbad facility would cost $646 million.

In reviewing the EIR, Commission staff's presentation, and Poseidon's submissions about alternative intake systems, including the potential environmental impacts, site-specific constraints, and costs of subsurface intakes, the Commission finds that the substantial weight of the evidence is that subsurface intakes are an infeasible alternative for two reasons. First, the proposed alternatives would result in greater environmental impacts than the proposed project due to destruction of coastal habitat from construction of the intake systems, the loss of public use of coastal land due to numerous intake collector wells that would be located on the beach, and the adverse environmental impacts to coastal resources during construction, including but not limited to the creation of negative traffic, noise, and air pollution impacts. Second, the alternative intake systems are infeasible at the project site due to site-specific geologic and/or water quality conditions, which render the water untreatable, and the increased and prohibitive costs of such intake systems.

*Minimize or reduce entrainment impacts*: Another alternative that was considered to reduce but not eliminate adverse entrainment and impingement impacts would be to move the intake offshore into open coastal waters.

In Exhibit B of its November 9, 2007 letter to Commission staff, Poseidon states that using an offshore intake would likely require installation of a large diameter pipe over one thousand feet long which, depending on placement, might cross areas of rocky reef habitat, and terminate in an area near some kelp beds. It also states that the effects of this pipe's placement and operations on habitat, sand flow, and sedimentation are not known. Poseidon's experts concluded that entrainment and impingement caused by this intake could potentially affect a greater diversity of organisms than those affected by the existing intake in Agua Hedionda and that organisms colonizing the inside of the pipe would consume much of the entrained plankton.[79]

Poseidon also provided evidence that such an intake would also be economically infeasible. On October 18, 2007, Poseidon provided cost estimates showing that a 1000-foot long offshore intake would cost about $150 million.

One measure Poseidon offered to include in its facility to reduce entrainment would be to install variable speed pumps (see Poseidon's June 2007 *Flow, Entrainment and Impingement Minimization Plan*); however, since the entrainment rate is primarily a function of the amount of water used, this measure would not likely reduce entrainment as long as Poseidon continued to pump the anticipated 304 MGD into the desalination facility.

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[78] Id.

[79] See *Issues Related to the Use of the Agua Hedionda Inlet Jetty Extension EIR to Recommend An Alternative Seawater Intake for the Carlsbad Desalination Project*, Graham, Le Page and Mayer, October 8, 2007.

Other available mitigation options that would avoid or reduce entrainment impacts include the use of a zero-discharge system or routing more of Poseidon's discharge to the sanitary sewer system, as either of these options would reduce the amount of estuarine water needed for dilution. A zero-discharge system uses either mechanical means or evaporation to re-use and reduce discharge volumes. Some of these systems may also allow some cost savings through their recovery of salts or minerals from the seawater. Although the scale of the proposed project may prevent use of a zero-discharge system for the entire amount, it could possibly used for some of the discharge, perhaps in conjunction with routing additional volumes to the sanitary sewer system at the nearby Encina Wastewater Pollution Control Facilities. However, the sewer system has limited capacity, and this option would be feasible only if additional capacity were to be made available. Further, Poseidon has noted that the system is not currently designed to handle what would be a highly corrosive discharge of concentrated seawater, thereby making this option infeasible.

As noted in Exhibit B of its November 9, 2007 letter, Poseidon has submitted to the Regional Board a *Flow, Entrainment and Impingement Minimization Plan* meant to identify feasible methods to minimize the remaining entrainment impacts. The Board's approval of that Plan is to be based on Poseidon identifying the best available and feasible operational, technological, and mitigation measures to meet that standard. Poseidon further notes that a proposed condition of the draft State Lands Commission lease would require, ten years after the lease is issued, that Poseidon be subject to further environmental review to ensure its operations at that time are using technologies that may reduce any impacts. Regarding the potential to route all or part of its discharge to the nearby sewer treatment system, Poseidon notes that the system is not designed to handle highly corrosive concentrated seawater.

Therefore, based on the above, and along with the Regional Board's approval of Poseidon's *Flow, Entrainment and Impingement Minimization Plan* to ensure that Poseidon implements all feasible methods to minimize the project's entrainment impacts, the Commission finds that Poseidon's proposal is using all feasible methods to minimize or reduce its entrainment impacts. Even so, project operations will result in ongoing substantial entrainment impacts that require compensatory mitigation, as described below.

*Compensatory mitigation*: The third main step in mitigation sequencing is to provide compensatory mitigation – that is, creating, restoring, or enhancing the same or similar types of habitats as those a project would adversely affect. This mitigation step has its own sequence – it should first be "in-kind", if possible – that is, it should result in the same type of habitat as that being lost; it should be "on-site" – that is, it should be at or near the site of the affected habitat; and it should be "in time" – that is, the mitigation site should provide habitat functions at the same time the affected habitat is losing its habitat value. As mitigation options move away from any of these three characteristics, the amount of mitigation needs to increase to reflect that the mitigation is not fully providing the habitat functions and values being lost. For example, if a mitigation site is not expected to provide its expected habitat functions for several years – due to the need to construct it, plant the necessary vegetation, let the vegetation take hold, etc. – that time lag is addressed by requiring mitigation at greater than a 1:1 ratio to make up for the time period between when the habitat impact starts and when the mitigation site begins providing the anticipated habitat function. Similarly, when mitigation is intended to replace lost high-quality habitat, a restoration or enhancement mitigation site will often be larger than the project site to reflect the overall lower quality of the habitat that comes about through mitigation. Mitigation

ratios can range from as low as 1:1 when mitigation is certain, immediate, and of equivalent value as the lost habitat, to 30:1 or higher for lower quality or delayed mitigation to make up for the loss of high-quality habitat.

On October 10, 2007, Poseidon provided to Commission staff its updated proposed *Coastal Habitat Restoration and Enhancement Plan* that it intends to submit to the Regional Board. This Plan described seven possible mitigation options at various locations in Agua Hedionda or elsewhere in northern San Diego County. Commission staff evaluated it to determine whether it would provide adequate mitigation for Poseidon's anticipated entrainment and impingement impacts. As discussed below, the Plan does not yet include the level of information or certainty to determine that any of the possible measures would be implemented, would provide adequate mitigation, or would conform to Coastal Act provisions. However, with the Commission's imposition of **Special Condition 8**, requiring that Poseidon submit for further Commission approval a revised Plan that fully documents Poseidon's entrainment study, identifies specific mitigation measures, implementation criteria, monitoring measures, and other standard mitigation plan elements, the Commission ensures that the Plan will provide adequate mitigation for Coastal Act conformity.

The Commission has authority to require mitigation for the anticipated entrainment impact even though the Regional Board is expected to also address any mitigation needs. Coastal Act Sections 30230 and 30231 confer on the Commission authority to regulate impingement and entrainment impacts of processes that involve the intake of seawater. This authority is not affected by the limitation of Section 30412(b) that prohibits the Commission from taking any action that is "in conflict with" any determination by the State Water Quality Control Board or a Regional Board "in matters relating to water quality...." The Commission's position is that adverse entrainment and impingement effects on marine organisms are not matters of "water quality." This interpretation of the "no conflict" language of Section 30412(b) is supported by the second paragraph of that provision which provides that nothing in Section 30412(b) "shall be interpreted *in any way*...as...limiting the Commission...from exercising" its authority under the Coastal Act "except as provided in this section." (Emphasis added.)

Past Commission decisions have included findings and conditions based in part on entrainment and impingement impacts to marine resources. Recently, for example, the Commission denied the proposed BHP Billiton Liquefied Natural Gas terminal (CC # 079-06) due in part to its inadequate entrainment mitigation. In several power plant siting cases during the past seven years, the Commission found that the predicted adverse entrainment effects would be significant and would require mitigation to conform to Coastal Act policies. As noted previously, these include Moss Landing, Morro Bay, and South Bay, which have intakes in estuaries.

Poseidon stated in the Plan that it would provide up to $2.79 million for various potential mitigation projects in northern San Diego County. The Plan identified those potential projects based on responses to Poseidon's distribution in August 2007 of a "Request For Expressions of Interest" (REI). The REI asked interested parties to submit mitigation proposals that would "preserve, restore or enhance existing wetlands, lagoons, or other high-productivity near-shore coastal areas" in San Diego County. The proposals were also to be consistent with requirements of the Coastal Commission, Regional Board, National Marine Fisheries Service, and other federal, state, and local agencies. Poseidon asked that the proposals cover areas of from five to 37 acres, that they hold promise for long-term benefits, and that they be technically feasible.

Poseidon then presented Commission staff with seven proposals from the responses received. On November 9, 2007, Poseidon presented to Commission staff a modified plan focused on just one of the seven mitigation options (i.e., the San Dieguito Coastal Habitat Restoration, shown below) described in its previous plan. The seven proposals are described below:

- *San Dieguito Coastal Habitat Restoration*: This proposal describes possible mitigation measures at San Dieguito Lagoon, about 12 miles south of Agua Hedionda. This mitigation site would be adjacent to a 115-acre mitigation site being developed by Southern California Edison pursuant to Coastal Development Permit #6-81-330. The proposal describes two options, each of which would create about 37 acres of various wetland and upland habitat types – e.g., high salt marsh, seasonal salt marsh, native grasslands, etc. – for about $2.4 million to $2.79 million. Both options would rely in part on water quality treatment ponds that have been funded but not yet constructed. It is unclear from the description how either option would be selected or implemented.

- *Loma Alta Lagoon Restoration*: This proposal describes acquiring two privately-owned parcels that total 0.89 acres and restoring those and three other publicly-owned adjacent parcels to add 3.01 acres of wetlands to an already restored 2.0 acre lagoon in Oceanside. The overall project, proposed by the City of Oceanside, would cost about $5.6 million. It is not clear from the proposal whether other funds have been provided or what amount is being requested from Poseidon. The proposal does not provide specific descriptions of the expected habitat types.

- *Agua Hedionda Lagoon Ecological Reserve Expansion*: This proposal describes acquiring and preserving a parcel of land near the existing Ecological Reserve on the north shore of Agua Hedionda's Inner Basin. The subject parcel is apparently being considered for a housing development, but provides wildlife habitat adjacent to the Lagoon's wetlands. However, the proposal does not identify details about expected mitigation benefits or project costs. Additionally, it is apparently contingent on first determining whether the current owner is interested in selling and then raising other needed funds for the purchase. It describes Poseidon's potential contributions as helping with a down payment or helping to secure a loan for the property.

- *Agua Hedionda Lagoon Invasive Plant Eradication and Native Plant Restoration*: This proposal would involve removing invasive, exotic species from the Agua Hedionda watershed and planting native species. It proposes a one-year, $1 million project that would locate and map non-native, invasive plants, removal some number of those plants, revegetate those areas with native plants, measure water quality and habitat parameters before and after site treatments to determine ecosystem improvements, and provide public education and outreach. However, the proposal does not specify how many acres of invasive plants would be removed or how many acres of native plants would be planted, and does not include any monitoring or contingency plans to ensure the areas are maintained.

- *Agua Hedionda Lagoon Abalone Stock Enhancement*: This proposal by the Carlsbad Aquafarm would involve growing and planting about 100,000 abalone at unspecified sites in Agua Hedionda and other nearby waters. It would require $910,000 and is expected to take from three to five years.

- *Buena Vista Lagoon Environmental Analysis*: This proposal consists of a request that Poseidon fund the completion of a Restoration Plan and Environmental Impact Report for the Buena Vista Lagoon Foundation.

- *Frazee State Beach Coastal Bluff Habitat Restoration*: This proposal, from the California Department of Parks and Recreation, would restore about 5.8 acres of coastal bluff habitat near Agua Hedionda. The project would cost $508,330 and would involve removing non-native vegetation, performing unspecified habitat restoration, and providing public interpretation.

Poseidon states that it believes the *San Dieguito Coastal Habitat Restoration* is best fit to preserve, restore and enhance existing wetlands, lagoons or other high-productivity near-shore coastal areas located in the vicinity of Agua Hedionda Lagoon and/or elsewhere in San Diego County.[80] Poseidon's proposal is to create 40.71 acres of coastal wetlands habitat which it states will be comparable to that found in and around Agua Hedionda Lagoon and will provide sustainable, comprehensive environmental benefits for water quality, habitat diversity for species abundance and for sensitive and endangered species.[81]

Overall, although Poseidon contends this proposal will more than mitigate for Poseidon's anticipated entrainment impacts, Commission staff's evaluation shows that the Plan does not currently provide enough information or certainty to determine what mitigation would actually occur. Staff notes that the Plan's shortcomings include the following:

- The Plan provides no certainty that the potential project would occur, as Poseidon states the mitigation is contingent upon possible Regional Board approval.

  The proposal does not include the type or level of information needed to determine what mitigation benefits would accrue, what performance standards or contingency measures would be used to ensure mitigation success, or other similar descriptions generally required for determining the adequacy of a mitigation proposal. The proposal has the potential to mitigate for entrainment impacts, but the Commission would need a substantially more detailed proposal to determine whether it would meet Coastal Act mitigation standards.

  The Commission notes, for example, that Poseidon's proposed mitigation area would be adjacent to a wetland mitigation site the Commission required as part of its approval of the San Onofre Nuclear Generating Station (SONGS). To ensure the Commission's approval of the SONGS mitigation plan conformed to Coastal Act policies, it required extensive scientific study, substantial amounts of data collection, and detailed impact analyses to

[80] Poseidon Resources, *Carsbad Desalination Project, Coastal Habitate Restoration and Enhancement Plan*, November 2007, at p. 3.

[81] Id. at p. 7.

determine the appropriate types and amount of mitigation needed to compensate for the identified adverse effects of the SONGS once-through cooling system – for example, the mitigation required included creation of new kelp beds to address the SONGS' impacts to nearby kelp beds. The Commission's approval also required Southern California Edison to meet specific performance standards and to provide ongoing monitoring efforts to ensure the mitigation area functions as intended. Mitigation necessary to address Poseidon's impacts will need to include a similar approach and level of detailed information to ensure Coastal Act conformity.

- Commission staff further notes that the Plan does not include habitat restoration projects in Agua Hedionda Lagoon, which is already the subject of extensive study on restoration needs and mitigation work. There are a number of initiatives already occurring or planned that involve enhancing or restoring water quality or habitat in Agua Hedionda, many being implemented with substantial amounts of public funding. Poseidon's planned use of the estuarine intake and its proposed compensatory mitigation approach away from Agua Hedionda would diminish many of the water quality benefits and habitat values that these other mitigation efforts are expected to provide.

  As noted previously, for example, Carlsbad and other nearby cities are subject to requirements of an NPDES permit issued by the Regional Board to improve stormwater management practices affecting Agua Hedionda. Also, the State Water Resources Control Board is funding development of an Agua Hedionda Watershed Management Plan by the Carlsbad Watershed Network. That plan calls for coordinated and integrated planning for watershed management initiatives. As part of this plan, the Network is establishing a comprehensive and prioritized list of mitigation opportunities in the watershed, which it expects to complete in August 2008. The Network recently completed research identifying shortcomings in the mitigation approach used thus far in the Lagoon that has resulted in low success rates and recommending steps to improve mitigation success. The Network requested that any mitigation the Commission may require of Poseidon be integrated with this existing state-funded effort. Thus far, however, Poseidon's possible mitigation projects do not show the necessary level of coordination with these other ongoing efforts.

- Poseidon states that the Plan is based on providing 1:1 mitigation for the loss of about 37 acres of habitat within Agua Hedionda. Staff believes, however, that the potential projects offered do not provide "in-kind", on-site mitigation – that is, none would replace the habitat or organisms lost in Agua Hedionda due to entrainment – and so the individual projects or any combination of projects would have to provide mitigation at more than a 1:1 ratio.

- Commission staff further notes that the Plan appears to be based more on cost than mitigation needs. Poseidon has established an upper limit of $2.79 million for mitigation costs, but that does not appear to reflect the cost to provide adequate mitigation for its expected impacts. For example, the October 10, 2007 Plan assumes wetland restoration in Southern California would cost about $75,000 per acre, but it includes several proposals where the costs are unspecified or are well above that figure. The San Dieguito proposal comes closest to Poseidon's assumed cost figure, but about a quarter of the mitigation at that site would be uplands. The Oceanside proposal, to restore about three wetland acres for about $2.5 million is well beyond Poseidon's expected costs. Even the completely out-of-kind mitigation that

could result from the Frazee coastal bluff restoration would cost about $100,000 per acre. Regarding Commission staff's concerns about the Plan's relationship to costs rather than mitigation needs, at the November 15, 2007 hearing Poseidon confirmed that it commits to providing 37 acres of tidally-exchanged marine wetlands. Poseidon has also proposed additional marine resources restoration and enhancement beyond that described in the Plan.

Poseidon contends, however, that the Plan adequately resolves the concerns raised by Commission staff, will more than fully mitigate any project-related entrainment impacts, and ensures that the productivity of coastal waters, wetlands and estuaries will be enhanced and restored in compliance with Coastal Act Sections 30230 and 30231, based on the following:

- Regarding the concerns about Regional Board approval of the Plan, Poseidon's position is that Carlsbad and other nearby cities are subject to requirements of an NPDES permit issued by the Regional Board to improve stormwater management practices affecting Agua Hedionda. Also, the State Water Resources Control Board is funding development of an Agua Hedionda Watershed Management Plan by the Carlsbad Watershed Network. That plan calls for coordinated and integrated planning for watershed managements initiatives.[82] As part of this plan, the Network is establishing a comprehensive and prioritized list of mitigation opportunities in the watershed, which it expects to complete in August 2008. The Network recently completed research identifying shortcomings in the mitigation approach used thus far in the Lagoon that has resulted in low success rates and recommending steps to improve mitigation success.[83] The Network requested that any mitigation the Commission may require of Poseidon be integrated with this existing state-funded effort.[84] In addition, the Commission retains full authority to ensure the project's consistency with the Coastal Act's marine resource protection policies through the imposition of **Special Condition 8**, which provides that Poseidon submit a Marine Life Mitigation Plan for Commission review and approval.

- Poseidon has stated that it would be very interested in collaborating on a habitat restoration project for Agua Hedionda Lagoon, but that it has not yet received proposals from entities interested in doing marine wetlands mitigation in the Lagoon. On-site mitigation has not yet been identified as a feasible mitigation option for the project, but the revised Plan provides for further research into on-site mitigation opportunities. The revised Plan contains a detailed description of Poseidon's efforts to identify feasible restoration projects on-site in

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[82] For example, the Carlsbad Watershed Management Plan includes the following objectives:

- "*Coordinate watershed efforts*: "Action Items" should facilitate coordinated efforts between municipalities, regulatory agencies, and environmental organizations to implement watershed management policies and physical improvements at the most functional locations and in the most effective manner, without the restriction of political boundaries.

- *Integrate various planning efforts*: Planning for land use, transportation, watershed protection and habitat conservation need to be integrated and coordinated. "Action Items" related to planning must look for as many overlapping benefits between these planning topic areas as possible."

[83] *Case Study: Systemic Evaluation of Compensatory Mitigation Sites Within the Carlsbad Hydrologic Unit*, by Nicholas R. Magliocca, UCSD.

[84] See September 24, 2007 letter from Carlsbad Watershed Network to Commission staff.

Agua Hedionda Lagoon. In August 2007, Poseidon sent "Requests for Expressions of Interest" to 77 public and private entities and individuals that are involved in, have jurisdiction over, or interest in wetlands restoration in the San Diego region, including the Carlsbad Watershed Network. Through this effort, Poseidon received a total of eight mitigation proposals. Three proposals involved proposed mitigation projects in the Agua Hedionda Lagoon watershed; however, none of these proposals addressed the primary purpose of the mitigation project – restoration of marine wetlands. Because these proposals did not meet the mitigation project objective, they were not considered further.

Because investigations to date have not resulted in the identification of any mitigation opportunities within Agua Hedionda Lagoon that meet the basic marine wetlands restoration objectives of the Plan, Poseidon's proposed mitigation includes a core off-site project that meets the Plan goals and objectives. This mitigation project, located in the San Dieguito River Valley adjacent to the marine wetlands restoration project implemented by Southern California Edison as mitigation for the entrainment and impingement impacts from its San Onofre Power Plan, is being developed in parallel with continued efforts to identify feasible mitigation opportunities in Agua Hedionda Lagoon.

In addition to the core off-site mitigation project, Poseidon's Flow, *Entrainment and Impingement Minimization Plan* sets forth a mitigation plan that includes additional coordination activities either (1) to identify if new mitigation options within Agua Hedionda Lagoon have arisen since Poseidon's last Requests for Expressions of Interest or (2) to confirm the lack of on-site mitigation opportunities. If mitigation opportunities within Agua Hedionda Lagoon have arisen, and such mitigation is determined to be feasible, Poseidon will coordinate with regulatory agencies – including the Commission – to implement such mitigation.[85] If Agua Hedionda Lagoon mitigation that meets the objectives is confirmed to be unavailable and infeasible, Poseidon will implement the proposed off-site mitigation project.[86] In the meantime, however, on-site mitigation remains as an option to be further explored after approval of the Plan.

- Poseidon also contends that the Plan provides more than 1:1 mitigation for reduced productivity in about 37 acres of habitat within Agua Hedionda. However, in Commission staff's view, none of the potential projects offered would provide "in-kind", on-site mitigation – that is, none would replace the habitat or organisms lost in Agua Hedionda due to entrainment – and so the individual projects or any combination of projects may have to provide mitigation at more than 1:1 ratio. In contrast to staff's view, Poseidon contends that the wetlands in the Plan's proposed off-site San Dieguito mitigation are of the same type of habitat that would be impacted by desalination plant operations (i.e., gobies, blennies, anchovy, topsmelt, white croaker, etc.), based on the biological survey of the existing tidal wetlands of the San Dieguito Lagoon completed as a part of the Southern California Edison Restoration Project.[87] Poseidon therefore states that implementation of the proposed restoration project at San Dieguito will create in-kind replacement habitat, which has 1:1 restoration value. Poseidon notes that the Coastal Commission found the San Dieguito

[85] *Id.*

[86] *Id.*

[87] SCE, *San Dieguito Wetlands Restoration Project, Final Restoration Plan*, November 2005.

Lagoon to be acceptable for mitigation of the entrainment and impingement impacts of the San Onofre Nuclear Generating Station, which is 45 miles away from the San Dieguito Lagoon and which is impacting open water fish species that do not necessarily reside in a lagoon environment. The proposed desalination facility is much closer to the proposed mitigation site (12 miles) and Poseidon is proposing to replace tidally exchanged coastal lagoon habitat with in-kind mitigation.

- Regarding Commission staff's concerns about the Plan's relationship to costs rather than mitigation needs, at the November 15, 2007 hearing Poseidon did confirm that it commits to providing at least 37 acres of tidally exchanged marine wetlands.

In sum, Poseidon has described several mitigation options, but has not yet confirmed which mitigation option(s) it would implement to address impacts caused by its use of the estuarine intake. Poseidon has currently identified the need to restore no less than about 37 acres of marine wetlands. However, as described in these Findings and through imposition of **Special Condition 8**, which requires Poseidon to submit for Commission review and approval a Marine Life Mitigation Plan that includes a full entrainment study that documents its expected impacts and identifies the specific mitigation measures, implementation plans, and compliance monitoring needed to mitigate the impacts identified in that study, the Commission is ensuring that Poseidon will provide the mitigation necessary to address those impacts in a manner consistent with applicable Coastal Act provisions. **Special Condition 8** ensures that all project-related entrainment impacts will be fully mitigated and that marine resources and the biological productivity of coastal waters, wetlands, and estuaries will be enhanced and restored in compliance with Coastal Act Sections 30230 and 30231.

## *Anticipated Project Impacts and Coastal Act Conformity – Discharge-Related*

**Description of Impacts:** The proposed project would result in a discharge of about 250 MGD from the desalination facility to the outfall currently used by the power plant, which is located on state tidelands and on Carlsbad State Beach. The discharge would contain at least 50 MGD of high salinity water from the facility along with at least about 200 MGD of estuarine water pumped into the intake system to provide dilution for the high salinity discharge. The expected "end of pipe" salinity of the blended discharges is expected to be about 40 parts per thousand (ppt) of salinity. This would be about twenty percent higher than the naturally occurring average salinity of about 33.5 ppt in these nearshore waters. Because the discharge would be immediately adjacent to the shoreline, the plume of higher salinity water would extend along the beach and nearshore waters. Poseidon's discharge would be subject to conditions of an NPDES permit that allows discharges at an average daily concentration of up to 40 ppt and an average hourly concentration of up to 44 ppt. The NPDES permit additionally requires Poseidon to conduct monitoring, identify additional methods to minimize its discharge-related impacts, and to implement many of those methods.

Poseidon's desalination process would also include adding a number of chemicals to the water during desalination. The chemicals used would be those commonly used in water treatment plants, such as coagulants, alkalinity adjusters, and various membrane cleaning chemicals such as hydrochloric acid, detergents, or caustic soda. Poseidon stated in Exhibit B of its November 9, 2007 *Response to Staff Report* that chemicals used would be neutralized or sent to the sanitary

sewer system instead of the seawater discharge. The discharge would also include biological matter – i.e., the entrained organisms from the intake.

Poseidon's project as originally proposed – that is, co-located with an operating power plant cooling water system – would have withdrawn 100 MGD of the several hundred million gallons used by the power plant, processed that water to produce 50 MGD of potable water, and discharged about 50 MGD of its high salinity waste stream back into the up to eight hundred million gallons of seawater being discharged by the power plant. Blending the desalination discharge with the much larger power plant discharge would have resulted in an overall discharge with salinity levels very close to the natural background levels in the nearshore ocean waters. Without the power plant discharge, however, a 50 MGD high salinity discharge would cause salinity levels twice that of seawater and cause significant adverse impacts to marine life in the nearshore waters and on the seafloor.

**Mitigation measures:** To address this issue, Poseidon proposes to maintain a discharge of at least 254 MGD when the power plant is not operating or is discharging less than that amount. Poseidon determined that an overall 254 MGD discharge would dilute its 50 MGD desalination discharge so that salinity levels near the outfall would be about 40 ppt instead of 67 ppt. This 40 ppt level is about 20 percent higher than the average receiving water salinity and about 15 percent higher than the level of natural variation in local seawater salinity. Local seawater averages about 33.5 ppt and varies naturally up to about 34.4 ppt, due to phenomena such as upwellings, changes in freshwater inputs, and others. The project EIR determined that a discharge of 40 ppt salinity would not cause significant adverse impacts to marine life.[88] Guidance from the U.S. EPA recommends that salinity levels from a discharge should not vary more than 4 ppt from the range of natural variation in areas permanently occupied by food and habitat forming plants (e.g., hard bottom habitat, kelp beds, etc.). Using the EPA guidance would result in a maximum allowable discharge level of about 38.4 ppt in the kelp beds 2000 feet offshore. Poseidon's NPDES permit allows an average daily concentration of 40 ppt and an average hourly concentration of up to 44 ppt. Poseidon's hydrodynamic modeling indicated that as long as the discharge remains at or below these concentrations, the salinity in the kelp bed would be below 36.8 ppt.

Poseidon also submitted modeling results showing the expected extent of the salinity plume based on local historical data for characteristics such as ocean temperatures, currents, and salinity levels. The extent of the high salinity in the discharge would vary based on how these characteristics interact at any given time. Poseidon's models show that salinity concentrations above the level of natural variation would cover about 8.3 acres of the nearshore seafloor during average conditions (i.e., a frequency of 50%) and would cover up to about 44 acres during extreme conditions (i.e., a frequency of less than 0.1%).

Under either condition, the salinity range of the discharge would not exceed 40 ppt (or 44 ppt maximum hourly concentration) at the point of discharge, and the discharge would be diluted to near 36.5 ppt within the zone of initial dilution, which extends 1000 feet from the discharge channel. While the discharge would create conditions beyond the range experienced by the local

[88] The EIR stated that elevated salinity levels would cause significant impacts if they had a substantial adverse effect on marine biota, included extended exposure to salinity levels above 40 ppt or permanent elevation of salinity levels above 38.4 ppt on hard bottom habitat.

biota, Poseidon has provided test results showing that a 40 ppt salinity level would cause no acute or chronic effects to several test organisms. The site-specific Comprehensive Salinity Tolerance Study completed for Poseidon by Dr. Steven Le Page and Dr. Jeffrey Graham indicates that the proposed discharge will not result in acute or chronic toxicity. The Study included long term (5.5 months) exposure of 18 marine species inhabiting the discharge area to a typical discharge salinity of 36 ppt. According to the project's EIR, all of the test species were chosen due to their known existence in the subject area, and several of the species (abalone, sand dollar and red sea urchin) where chosen for their susceptibility to environmental stress. (See project EIR, at Appendix E.) Poseidon provides that the results of the 5.5 month test of exposure of the 18 species to typical discharge salinity of 36 ppt indicate that all organisms remained healthy throughout the test period. No mortality was encountered and all species showed normal activity and feeding behavior. Poseidon further provides that additional acute and chronic toxicity studies completed subsequently for the project using the United States Environmental Protection Agency's standard whole effluent toxicity (WET) test have confirmed the validity and results of the Salinity Tolerance Study.

However, Commission staff's view is that the organisms studied in the Salinity Tolerance Study are not representative of the full suite of marine life living in these nearshore waters and benthic habitat that would experience this level of salinity. Further, several species used in these tests are generally considered more salinity tolerant than others, so the test results likely do not reflect actual effects that would occur to species exposed to these high salinity levels in the natural environment. For example, a State Board proposal to establish a salinity limit in the state's Ocean Plan includes a proposed limit of 36.5 ppt based on study results showing that level caused adverse effects to sea urchin embryos, which is one of standard test species more sensitive to salinity differences.[89] Other studies show that slight differences in salinity levels can affect the population density of various species, their ability to tolerate various environmental stressors, reproductive rates, and other effects.[90]

In addition to higher than natural levels of salinity, Poseidon's discharge would include some as-of-yet unknown amounts of other constituents that would enter the discharge from various materials or methods used in the proposed facility. As noted above, these include various chemicals and the dead organic matter from organisms entrained in the intake.

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[89] The State Board is considering an amendment to the state's Ocean Plan that would establish an upper salinity limit for discharges into California's coastal waters. The Ocean Plan at this time does not have a specific salinity limit, but requires in general protection of beneficial uses and water quality objectives for other contaminants and physical water quality characteristics. In June 2007, the State Board issued a Scoping Document for its proposed policy that included three proposed alternatives: "No Action" – that is, do not add a salinity limit to the Plan; "No discharges above natural variation" – that is, limit salinity in discharges to the range of natural variation which is about 10% above average; or, "Numeric water quality objective of 36.5 ppt", based on study results showing that salinity levels above than 36.5 ppt caused adverse effects to sea urchin embryos.

[90] See, for example, *Technical Report 39: San Francisco Estuary Regional Monitoring Program for Trace Substances, Result of the Benthic Pilot Study*, August 2000; and Voyer, R.A., and Glen Modica, *Influence of salinity and temperature on acute toxicity of cadmium on Mysidopsis bahia*, in *Environmental Contamination and Toxicology*, Vol. 19:1, January 1990.

Based on the above, Poseidon's proposed discharge would likely result in salinity levels higher than the natural range in from about eight to 44 acres of nearshore benthic habitat. Although the extent of the areas would vary continually based on environmental conditions, some areas would be subject to nearly continual salinity concentrations higher than natural salinity variations.

The Regional Board studied the project's discharge before issuing the project's NPDES Permit (Regional Board Order No. 2006-0065). The Regional Board considered the discharge impacts of the project and conditioned all potential discharge-related impacts to ensure compliance with Clean Water Act and California Ocean Plan requirements. The Ocean Plan contains water quality objectives and beneficial uses for ocean waters of California. The beneficial uses of ocean waters include industrial water supply; water contact and non-contact recreation, including aesthetic enjoyment; navigation; commercial and sport fishing; mariculture; preservation and enhancement of designated areas of special biological significance; rare and endangered species; marine habitat; fish migration; and fish spawning and shellfish harvesting. The Regional Board determined that an average daily effluent limitation of 40 parts per thousand for salinity would protect beneficial uses of the Ocean (including protection of fish habitat) and ensure that no salinity-related toxicity effects would occur in receiving waters. The NDPES Permit establishes extensive monitoring and reporting requirements to ensure compliance with this effluent limitation.[91]

As noted previously, Poseidon states in its November 9, 2007 letter that the project's NPDES permit and the Regional Board's eventual approval of Poseidon's *Flow, Entrainment and Impingement Minimization Plan* will ensure that the proposed facility uses all feasible measures to avoid and reduce any discharge-related impacts. Further, the Board's approval is necessary before the facility can operate. Because the Board's final approval would include such findings and would ensure that the project's discharges conform to relevant requirements of the federal Clean Water Act and the water quality objectives of the state's Ocean Plan, the Commission therefore finds that project-related discharges result in minimal adverse effects to water quality and marine life.

## *Anticipated Project Impacts and Coastal Act Conformity – Cumulative Impacts*

In addition to the adverse marine biological effects the proposed project would cause to Agua Hedionda Lagoon and the nearshore waters off of Carlsbad, the project would contribute to cumulative impacts already occurring in those waters. As noted above, Agua Hedionda Lagoon is listed as an impaired waterbody due in part to excess sedimentation. The impairment affects a number of beneficial uses of the waterbody and requires the ongoing dredging described in the next section of these Findings. As documented by the Regional Board's 303(d) listing of Agua Hedionda Lagoon as an impaired water body[92] and by Poseidon's sediment studies, the

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[91] See Poseidon Resources Corporation, *Response to Staff Report, November 9, 2007*, Exh. A, at p. 12; NPDES Permit, Regional Board Order R9-2006-0065 at 12, F-18, F-37 (Attachment 1 to Poseidon Resources Corporation, *Response to California Coastal Commission's September 28, 2006 Request for Additional Information*, November 30, 2006).

[92] 2006 Clean Water Act 303(d) List of Water Quality Limited Segments Requiring TMDLs, San Diego Regional Water Quality Control Board, June 28, 2007.

sedimentation is due both to fine-grained material from urban runoff being deposited in the Lagoon's Inner Basin and to the intake drawing in water from the Lagoon that would otherwise exit through the Lagoon mouth and take much of the sediment with it. The source of this sediment is the longshore sand movement off the coast of Carlsbad, and as a result of the jetties and the intake, sediment pulled into the Lagoon is removed from that longshore process, resulting in the need for beach nourishment that causes effects to coastal resources in the form of ongoing dredging every few years and the accompanying disruption of public access to areas of the nearby beaches. As noted previously in Section 4.4 of these Findings, sedimentation concerns will be addressed through the Regional Board's NPDES review and through ongoing Coastal Commission permit review of future dredging proposals.

### *Conclusion*

Regarding entrainment and impingement, Poseidon's proposed project would use 304 MGD of estuarine waters (equal to about 932 acre-feet of water per day, which over a year would cover more than 500 square miles up to one foot deep in water). This water use is assumed to kill all the larval and planktonic organisms in that water, which Poseidon estimates represent about 37 acres worth of wetland and open water productivity in Agua Hedionda. Poseidon has proposed a compensatory mitigation approach to mitigate these impacts.

Poseidon contends that the assumption that the project will cause 100 percent mortality to the marine organisms in the seawater diverted from Agua Hedionda Lagoon is overly conservative because it ignores the design and technology features that have been incorporated in the proposed project. Poseidon contends the project has incorporated several technology features that will substantially lessen the impacts to marine life, including: mortality will be reduced due to the lower temperature, volume, velocity and turbulence of the desalination facility's operations compared to the power plant; and only 35 percent of the seawater in the desalination plant's intake will actually enter the desalination facility and be subject to processing that could result in entrainment mortality, while the rest of the water will be returned to the ocean. However, as noted above, both the project EIR and the entrainment study protocols used to assess this type of impact do not recognize a lower mortality rate for these types of factors, and the 100 percent mortality is a reasonable assumption.

As noted above, the Commission has determined that alternative intakes that might avoid or minimize environmental impacts are infeasible or would cause greater environmental damage. Therefore, to ensure Poseidon provides adequate compensatory mitigation for the proposed project's marine life impacts and to conform to Coastal Act Sections 30230 and 30231, **Special Condition 8** requires Poseidon to submit to the Commission for review and approval a marine life mitigation plan. This plan must document the project's expected impacts to marine life caused by entrainment and impingement and identify the types and amounts of mitigation best suited to address those impacts. It must also provide mitigation to the maximum extent feasible in the form of creation, enhancement, or restoration of aquatic and wetland habitat and must include standard mitigation measures, including acceptable performance standards, monitoring, contingency measures, and legal mechanisms to ensure permanent protection of the proposed mitigation site(s). The coastal development permit will not be issued until the Commission approves a mitigation plan meeting these requirements. Further, to ensure the identified marine life impacts do not exceed those identified through development of this mitigation plan, **Special**

**Condition 9** requires Poseidon to obtain an amendment of its coastal development permit before any increase in its average seawater flows of 304 MGD.

Therefore, based on the studies cited and the information provided above, the Commission finds that the project as conditioned, conform to Coastal Act Sections 30230 and 30231.

## 4.5.2 Use of Wetlands and Coastal Waters (Coastal Act Section 30233)

Coastal Act Section 30233(a) states, in relevant part:

> *The diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects...*

Coastal Act Section 30233(b) states:

> *Dredging and spoils disposal shall be planned and carried out to avoid significant disruption to marine and wildlife habitats and water circulation. Dredge spoils suitable for beach replenishment should be transported for these purposes to appropriate beaches or into suitable longshore current systems.*

Coastal Act Section 30233(c) states:

> *"In addition to the other provisions of this section, diking, filling, or dredging in existing estuaries and wetlands shall maintain or enhance the functional capacity of the wetland or estuary. Any alteration of coastal wetlands identified by the Department of Fish and Game, including, but not limited to, the 19 coastal wetlands identified in its report entitled, "Acquisition Priorities for the Coastal Wetlands of California", shall be limited to very minor incidental public facilities, restorative measures, nature study, commercial fishing facilities in Bodega Bay, and development in already developed parts of south San Diego Bay, if otherwise in accordance with this division...*

Coastal Act Section 30233 requires in general that dredging in coastal wetlands and estuaries be limited to certain types of uses, that it be allowed only where there are no feasible less environmentally harmful alternatives, and that it be mitigated to the extent feasible. It also requires that dredging be implemented in a manner that avoids significant disruption to marine and wildlife habitats and to water circulation. Section 30233(c) further imposes a more limited set of allowable uses in some wetlands, including Agua Hedionda Lagoon. Because Agua Hedionda Lagoon is one of the coastal wetlands subject to the use limitations in Coastal Act Section 30233(c), that subsection serves for this proposed project as the standard of review for allowable uses.

### *Description of the project's alteration of, and its effects on, Agua Hedionda Lagoon*

Agua Hedionda Lagoon is one of 19 coastal wetlands identified in the California Department of Fish and Game report, *Acquisition Priorities for the Coastal Wetlands of California*. This report identifies high priority wetlands for acquisition, based primarily on their values for fish and wildlife habitat and threats to their continued existence as a natural resource. Areas of the Lagoon where the plant and animal life is especially valuable due to its special nature in the ecosystem include the Agua Hedionda Lagoon State Marine Reserve and Ecological Reserve,

which cover about 180 acres extending along about a half-mile of the Lagoon's Inner Basin. The Lagoon includes extensive areas of open water habitat, eelgrass beds, and various types of wetlands, and provides significant habitat benefits to a number of species, as described previously in these Findings. These Findings also show that Poseidon expects its use of estuary water would create adverse entrainment effects equal to the loss of about 37 acres of Agua Hedionda's wetland and open water areas. As explained below, Poseidon's proposed water use and the resulting adverse effects would be an alteration of Agua Hedionda subject to review under Coastal Act Section 30233(c).

Agua Hedionda Lagoon as it currently exists is a highly engineered coastal lagoon. During the past half-century of power plant operations, the power plant's cooling water intake created an imbalance between tidal inflow and outflow, resulting in more sediment entering the estuary than leaving. Agua Hedionda Lagoon is on the state's list of impaired waterbodies due to high rates of sedimentation, which are caused primarily by fine-grained sedimentation discharged by urban runoff into the Lagoon and in part by the power plant's intake and would continue due to Poseidon's proposed use of the intake. As an existing coastal-dependent industrial facility operating in the Lagoon since the mid 1950s, the power plant has dredged its cooling water intake channel at least 25 times over the last half-century.[93] Since 1954, dredging is estimated to have removed about eleven million cubic yards of material from the Lagoon.

Starting in 1977, the Commission issued a number of coastal development permits to allow various amounts of dredging for one-year or multiple-year periods. During Commission review of the last several permits, there was considerable debate about where to deposit the dredged spoils. Much of the material was sand suitable for being placed on beaches and used for recreation; however, it was believed that material placed on some of the nearby beaches, particularly those to the north of the Lagoon mouth where recreational benefits were higher, would be quickly transported by tide and currents back into the Lagoon where it would need to be dredged again.

The Commission required that some material be placed at various beaches in and near the Lagoon where it would serve a recreational purpose; however, the Commission also required the power plant owner to pay for an independent study to assess sediment transport conditions along the ocean shoreline in and near Agua Hedionda.[94] That 1999 study found that, on average, about 80% of the sand trapped within the Lagoon comes from longshore transport from north and the rest comes from the south. It recommended that most of the dredged spoils be placed to the south of the lagoon to reduce the need for "re-dredging" the same material. At about the same time, the San Diego Association of Governments (SANDAG) was implementing another program to increase the amount of sand on nearby beaches with a focus on providing sand to enhance recreational uses of beaches to the north (See CDP 6-06-061).

While it is clear that continued use of the intake will require some level of dredging, it is unclear at this time how much dredging will be needed and whether dredging would be done just to ensure the intake channel remains open or would also be done to protect or enhance other lagoon

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[93] Poseidon's proposed project would be a new, rather than an existing, facility, and with the pending power plant shutdown, would result in new dredging-related impacts not necessary to maintain operations of an existing facility.

[94] Elwany, Dr. Hany. Study *of Sediment Transport Conditions in the Vicinity of the Agua Hedionda Lagoon*, 1999.

functions. Further, the power plant owner has stated it anticipates dredging and maintaining the lagoon as long as it plans to use the existing once-through cooling system. To address these uncertainties, **Special Condition 12** clarifies that the Commission's approval at this time does not authorize Poseidon to conduct any dredging and that future proposed dredging activities will require submittal of new coastal development permit applications for the Commission's further review and approval. However, Poseidon's proposed withdrawal of approximately 304 MGD of estuarine water and the resulting loss of marine life and estuarine productivity caused by entrainment represent an alteration to Agua Hedionda subject to review pursuant to Coastal Act Section 30233(c).

### *Analysis of Conformity to Coastal Act Section 30233(c)*

Coastal Act Section 30233(c) establishes that alterations to certain wetlands included in the report, *Acquisition Priorities for the Coastal Wetlands of California*, must be limited to "…very minor incidental public facilities, restorative measures, nature study, commercial fishing facilities in Bodega Bay, and development in already developed parts of south San Diego Bay…". The report lists 19 of California's most productive coastal wetlands, which include Agua Hedionda.

The proposed project would alter these wetlands in a manner not allowed by Section 30233(c). As stated in Section 30233(c), the allowable activities in Agua Hedionda are "very minor incidental public facilities, restorative measures, [and] nature study…". The project's proposed development activity – i.e., alteration in the form of removal and use of about 304 MGD of estuarine water for desalination that results in a loss of estuarine productivity equal to about 37 acres of the lagoon, along with other lost biological functions and associated adverse impacts – is not for a "very minor incidental public facility," and is not a restorative measure or nature study. Further, although not currently proposed, dredging is expected to be necessary in the future to allow the facility to use water from the lagoon, and this alteration would also be subject to review under Section 30233(c) (see below). Therefore, the project's proposed use of these wetlands does not conform to this section of the Coastal Act.[95] The Commission further notes

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[95] Past Commission decisions have interpreted "minor" and "incidental" activities as those that are temporary in nature and for which no alternatives exist. For example, in a recent decision approving the placement of pilings within Agua Hedionda Lagoon to support an existing rail line (Consistency Certification #CC-52-05), the Commission found that determining whether to allow an "incidental" public use under Section 30233(c) should also consider whether there are feasible alternatives to the proposed wetland use. The Commission approved the project in part because there were no alternatives, because the project would not affect the functional capacity of the lagoon, and because it did not increase the capacity of the rail line.

In another example, the Court of Appeal recognized the Commission's approach as a permissible interpretation of the Coastal Act and supported the Commission's interpretation of "incidental" public service. In the case of *Bolsa Chica Land Trust et al., v. The Superior Court of San Diego County* (1999) 71 Cal.App.4th 493, 517, the court found that:

> *… we accept Commission's interpretation of sections 30233 and 30240… In particular we note that under Commission's interpretation, incidental public services are limited to temporary disruptions and do not usually include permanent roadway expansions. Roadway expansions are permitted only when no other alternative exists and the expansion is necessary to maintain existing traffic capacity.*

As noted above, Poseidon's proposed dredging would not be temporary, as it would occur every three or four years for 30 to 90 years. Also as noted above, there are alternatives available to this proposed dredging.

that Section 30233(c) does not allow other uses in exchange for offsetting mitigation; therefore, the mitigation Poseidon has offered for its entrainment impacts does not provide the needed conformity to this section.

However, because the proposed project is considered a "coastal-dependent" industrial facility, the Commission may evaluate it under Coastal Act Section 30260, which allows such projects to be approved in some instances even when they are found to be inconsistent with other Coastal Act provisions. The analysis and findings related to Section 30260 are in Section 4.5.7 of these Findings.

### *Additional evaluation of the proposed project's dredging component*

Coastal Act Section 30233 also includes other provisions that are applicable to projects involving fill or dredging. These include Section 30233(a), which imposes a three-part test to determine whether proposed dredging is for an acceptable use, whether there are feasible and less damaging alternatives, and if feasible mitigation measures are included to minimize adverse environmental effects. Additionally, Coastal Act Section 30233(b) requires dredging and spoils disposal be implemented in a manner that avoids significant disruption to habitat and water circulation. Further, Coastal Act Section 30233(c), in addition to the use limitations noted above, includes a provision that dredging maintain or enhance the functional capacity of wetlands or estuaries. However, with the Commission's imposition of **Special Condition 12** requiring Poseidon to submit separate coastal development permit applications for any proposed future dredging, the project as currently reviewed does not include dredging activities that would be subject to these provisions. Further, as noted above, there is substantial uncertainty about how much dredging Poseidon would be required to perform, where the dredging would occur, its effects, and the mitigation needed to address those effects. Additionally, the currently available information shows that the power plant owner plans to dredge and maintain the lagoon for the foreseeable future. It is therefore appropriate to conduct the necessary review for Coastal Act conformity when these aspects of any needed dredging are better known. At that time, proposed dredging activities would be reviewed to determine their conformity to applicable Coastal Act provisions.

Poseidon contends that its proposed dredging of the lagoon would be a permitted use under Coastal Act Section 30233. It states that its dredging would benefit the lagoon and the marine resources, scientific research, fishing, public access and recreational activities that rely on the lagoon.[96] Poseidon further contends that there is no feasible alternative to its proposed dredging and that dredging is a project benefit that is fully consistent with the Coastal Act. It states that the Commission has approved dredging of the Lagoon on at least 17 separate occasions since 1977, most recently in November 2006 (see CDP 6-06-061). Poseidon further contends that, because Cabrillo Power, the owner of the power plant, currently dredges the Lagoon on a routine basis and has done so for the past fifty years, the existing environmental baseline from which the Commission must review the project is an environment in which dredging occurs routinely.[97] Poseidon states that it would voluntarily take over this responsibility if, at some point in the future, the power plant were to shut down and Poseidon would do nothing to change this existing

[96] See Poseidon Resources Corporation, Response to Staff Report, November 9, 2007, Exh. A at p. 25.

[97] See, e.g., *Fat v. County of Sacramento*, 97 Cal. App. 4th 1270 (2002) (environmental baseline consists of environmental conditions as they exist prior to the commencement of environmental review of the project).

dredging activity other than reduce the frequency of the dredge cycle as described in Dr. Scott Jenkin's report, *Comparative Analysis of Intake Flow Rate on Sand Influx Rates at Agua Hedionda Lagoon: Low-Flow vs. No-Flow Alternatives*, September 28, 2007.

Poseidon further contends that routine dredging is required to maintain the Lagoon in its current state and prevent it from reverting to its original state – a slough comprised of shallow marsh channels filled with anaerobic hyper-saline water – and that the recreational, fishing, and aquaculture activities would halt if the power plant shut down and Poseidon did not volunteer to continue maintenance dredging of the Lagoon. Poseidon also contends that, while dredging may have minimal short-term environmental impacts, the long-term environmental benefits that dredging provides, including protecting the valuable Lagoon in its current state, far outweigh the minimal short term impacts.[98] Poseidon relies on *Comparative Analysis of Intake Flow Rate on Sand Influx Rates at Agua Hedionda Lagoon: Low-Flow vs. No-Flow Alternatives*, Jenkins and Wasyl, September 28, 2007, to demonstrate that there is no alternative to dredging to protect the Lagoon from returning to "stinky water." In the absence of Poseidon's operations and its assumption of the responsibility for maintenance dredging and stewardship of the Lagoon after the Encina power station is decommissioned, Lagoon sedimentation from urban run-off will result in closure of the Lagoon in five to seven years, and nearly complete loss of existing beneficial uses thereafter.[99] Poseidon believes its project will therefore enhance marine habitat because it will preserve the Lagoon for both existing organisms and current recreational, fishing and aquaculture activities.

For several reasons, however, the Commission does not concur. Poseidon does not own or control lagoon areas subject to dredging or the various activities described above. Cabrillo, the power plant owner, owns the lagoon, including the underlying aquatic lands, and has stated it intends to continue its dredging and maintenance activities for the foreseeable future, both to ensure a water supply for any of its generating units that may be needed as a regional back-up power supply and to maintain the lagoon's amenities to preserve the value of its adjacent upland properties. It is therefore not apparent that Poseidon will be conducting dredging, or that it would be able to conduct dredging without permission from Cabrillo and approval from the State Lands Commission, and the Commission is not aware of such any agreements or approvals that could be incorporated into these Findings or **Special Conditions**.[100] The Commission also notes that the original power plant owner dredged the lagoon and started operating in the 1950s, well before adoption of the Coastal Act, and that Poseidon's proposal would represent a new use of the lagoon. The Commission notes, too, that it approved previous power plant-related dredging activities on a case-by-case basis by reviewing detailed dredging proposals provided by the power plant owners and making findings on those specific proposals. Poseidon has not yet proposed or submitted a detailed dredging plan that describes how it would conduct dredging or how it would maintain these lagoon functions and activities. Such a plan would not only require

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[98] See *Sierra Club v. California Coastal Commission*, 19 Cal. App. 4th 547, 562 (4th Dist. 1994) (finding that "the Commission has the power in particular cases to permit significant short-term disruption [from dredging] in order to provide long-term benefits [to coastal resources]" under Coastal Act Section 30233.)

[99] Comparative Analysis of Intake Flow Rate on Sand Influx Rates at Agua Hedionda Lagoon: Low Flow vs. No-Flow Alternatives, Dr. Scott Jenkins, September 28, 2007.

[100] As described previously, Coastal Act Section 30601.5 requires in part that an applicant demonstrate, prior to issuance of a coastal development permit, its ability to comply with all conditions of approval.

landowner approval and other regulatory approvals, but would require detailed analyses of the amounts and locations of dredging needed to maintain the water intake channel, additional dredging that may be needed to maintain these various functions and activities, and further analyses to determine whether there are feasible and less environmentally damaging alternatives to dredging for both the intake and the other functions. Additionally, Cabrillo's existing State Lands Commission lease for the lagoon inlet structure on state tidelands is limited to use for power plant operations only and would require modification to allow Poseidon's proposed use or subsequent dredging in areas subject to State Lands Commission jurisdiction. It would therefore be speculative for the Commission at this time to concur with Poseidon's contentions, and the Commission is therefore requiring these issues be appropriately addressed through **Special Condition 12**, which will ensure the Commission has the opportunity in the future to determine whether proposed dredging activities conform to applicable Coastal Act provisions.

### *Conclusion*

The proposed project would represent a use and alteration of the Agua Hedionda wetlands not permitted by Coastal Act Section 30233(c); therefore, based on the studies cited and the information provided above, the Commission finds that the project as proposed does not conform to this Coastal Act provision. However, because the proposed project is considered a "coastal-dependent" industrial facility, the Commission may therefore evaluate it under Coastal Act Section 30260, which allows such projects to be approved in some instances even when they are found to be inconsistent with other Coastal Act provisions. The analysis and findings related to Section 30260 are in Section 4.5.7 of these Findings. The Commission further finds that the project as currently proposed does not include dredging but that imposition of **Special Condition 12** ensures that Poseidon will apply for new, separate coastal development permits for any future dredging projects it may propose. Commission review at that time will determine whether a particular proposed dredging project will conform to applicable Coastal Act provisions.

### 4.5.3 Public Access

Coastal Act Section 30210 states:

> *In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse.*

Coastal Act Section 30211 states:

> *Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.*

Coastal Act Section 30212(a) states:

> *Public access from the nearest public roadway to the shoreline and along the coast shall be provided in new development projects except where (1) it is inconsistent with public safety, military security needs, or the protection of fragile coastal resources, (2) adequate access exists nearby, or (3) agriculture would be adversely affected. Dedicated accessway shall not be required to be opened to public use until a public agency or private association agrees to accept responsibility for maintenance and liability of the accessway.*

Coastal Act Section 30212.5 states:

> *Wherever appropriate and feasible, public facilities, including parking areas or facilities, shall be distributed throughout an area so as to mitigate against the impacts, social and otherwise, of overcrowding or overuse by the public of any single area.*

Coastal Act Section 30213 states, in relevant part:

**014111**

> *Lower cost visitor and recreational facilities shall be protected, encouraged, and, where feasible, provided. Developments providing public recreational opportunities are preferred...*

The proposed project would be built largely on a site already occupied by industrial uses and would not affect public access to the shoreline at that location. The project also includes constructing pipelines under roads within the coastal zone, although the pipeline construction would be similar to other road construction projects and its temporary impacts would likely not result in adverse effects on public access to the shoreline.

The project's proposed use of estuarine water from Agua Hedionda Lagoon, and its reliance on intake jetties and a discharge structure on State tidelands would affect public access by limiting accessibility to those areas. However, as noted previously in these Findings, no feasible

alternatives exist that would allow cessation of use of these structures. Further, the project would require ongoing dredging within the Lagoon and deposition of the dredged spoils (which would be subject to Cabrillo, Poseidon, or another dredging proponent obtaining a new, separate coastal development permit), which could allow for beach nourishment along nearby beaches. While these activities would cause temporary disruptions to public access, they would have a long-term public benefit by adding sand to the beach. The alternatives determined by the Commission to be infeasible would cause impacts to public access during construction and possibly during operations.

To address the public access impacts of its project as proposed, Poseidon has offered to dedicate to the City of Carlsbad the following sites to be used for public access:

- A site of about two acres, known as the Hubbs Site, on the north side of the Lagoon's Outer Basin that would include a trail system and expansion of the existing fish hatchery and aquatic research uses;
- A site of about 2.4 acres on the west shore of the Lagoon's Outer Basin to be used as a fishing beach;
- A site of about 10.2 acres of bluffs west of the power plant site and adjacent to the shoreline to be used for recreation and coastal access; and,
- A parking area covering about 0.3 acres at the south end of the power plant for public parking.

These sites total about 15 acres, and are described in more detail in the City's precise development permit for the project, and Poseidon's coastal development permit application submittals. To ensure these sites are made available for public use, **Special Condition 11** requires that, prior to starting operations of the desalination facility, Poseidon ensure these parcels are dedicated for public access and recreation as described in the City's Precise Development Plan #PDP 00-02. These public access dedications provide adequate conformity to the Coastal Act's public access provisions.

### *Conclusion*

Based on the above, the Commission finds that the project as conditioned conforms to the Coastal Act's public access provisions.

### 4.5.4 Scenic and Visual Resources

Coastal Act Section 30251 states:

> *The scenic and visual qualities of coastal areas shall be considered and protected as a resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinate to the character of its setting.*

The proposed project would be built largely within the existing developed area of the Encina power plant. The desalination facility site is currently occupied by large oil tanks that are no longer in use and that have been proposed for demolition. The desalination facility would create less of a visual impact than the currently existing tanks.

Poseidon's project plans include a number of measures to minimize any adverse visual effects of the proposed facility. The facility would be a relatively low profile building of about 44,000 square feet and reaching about 35 feet above the existing grade. Its appearance would be similar to a large warehouse. As part of the facility design, Poseidon has added both vegetative and architectural screening to ensure that exposed pipelines, tanks, and other industrial-type equipment are screened from public view.

The Commission considered several intake alternatives, including slant wells and an intake gallery, and concluded that they are environmentally inferior to the proposed project. With respect to visual and scenic resources, each of the alternatives would require development of permanent structures on the beach that could result in a permanent impact to visual resources. The slant well alternative would require between 20 and 200 beach wells along a two mile stretch of coast, and associated access roads, parking, pipelines and electrical supply.[101] The intake gallery alternative would require 78 beach wells, each of which would require approximately 2,800 square feet of beachfront property, for a combined loss of seven acres of beachfront property.[102] Construction of the intake gallery alternative would also require trenches for collection piping and could limit access to the beach for a period of 2 to 4 years, and would require the creation of permanent access ramps from the Pacific Coast Highway to the beach to transport equipment during construction and to permit well inspection during the life of the wells.[103] Therefore, the proposed project is the environmentally superior alternative.

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[101] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. B at p. 16.

[102] Id. at 17-19.

[103] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at pp. 17-18.

To ensure the facility conforms to the Coastal Act's scenic and visual resource policies, **Special Conditions 13 and 14** require Poseidon to submit, prior to starting construction, a Screening Plan and a Lighting Plan showing the planned appearance of the facility. The plans must describe how Poseidon will screen the facility's industrial and mechanical equipment and how the facility and surrounding area will be lighted to provide the necessary level of safety and security while minimizing offsite glare and other adverse affects. Both plans must be submitted to the Executive Director for review and approval before construction can begin.

## *Conclusion*

Based on the above, the Commission finds that the project, as conditioned, will conform to the Coastal Act's scenic and visual resource provisions.

## 4.5.5 Energy Use and Greenhouse Gas Emissions (Coastal Act Section 30253(4))

Coastal Act Section 30253(4) states:

> *New development shall: ... (4) Minimize energy consumption and vehicle miles traveled.*

Section 30253(4)'s requirement to minimize energy consumption reduces impacts to coastal resources caused by greenhouse gas emissions. Most of the electricity Poseidon would use would be produced by natural gas-fired power plants, with some produced by coal, hydroelectric, or renewable sources. According to methods developed by the California Climate Action Registry (CCAR), Poseidon's proposed electrical use would result in from about 134,400,000 pounds (or about 61,000 metric tonnes) to 200,000,000 pounds (about 90,000 metric tonnes) of carbon dioxide emissions per year.[104] The difference between the Commission's conclusion and Poseidon's estimates is further described below.

> **Note:** The anticipated emissions described herein, in Commission staff's view, likely represent the very low end of the range of actual greenhouse gas contributions Poseidon would generate. These analyses evaluate only those carbon emissions that would be generated by Poseidon's electrical use for pumping and desalinating water and transporting it to Maerkle Reservoir. It does not include emissions that would result from project construction, manufacture of reverse osmosis membranes, dredging needed to maintain the intake channel, etc. Also, it includes only carbon dioxide emissions, not emissions of other greenhouse gases generated by power plants. Commission staff's analyses also credit Poseidon with emission reductions that may occur through its potential use of a high-efficiency energy recovery device that is still being tested and that Poseidon has not yet committed to use.

Emissions from this facility's electrical use would be greater than those created by other water sources and would contribute to California's greenhouse gas emissions. They would also cause significant adverse effects to many coastal resources the Coastal Act is meant to protect. The global heating, sea level rise, and ocean acidification resulting from greenhouse gas emissions affects public access (Coastal Act Sections 30210-30214), recreation (Sections 30212.5, 30213, 30220-30222), marine resources (Sections 30230-30231), wetlands (Sections 30231, 30233), ESHA (Section 30240), agriculture (Sections 30241-30242), natural land forms (30251), and existing development (Sections 30235, 30253).

Poseidon's position is that it shares the Governor's commitment to address climate change, but disagrees with Commission staff that the project will be a contributing factor to climate change for several reasons: the project is consistent with its proposed Climate Action Plan, which Poseidon

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[104] Protocols developed by the California Climate Action Registry estimate carbon dioxide emissions from California's electricity sources total 804.54 pounds per megawatt-hour. Poseidon's expected electrical use of about 250,000 megawatt-hours per year would therefore total just over 200,000,000 pounds of carbon dioxide. These calculations are described in more detail below.

For comparison, 200,000,000 pounds of carbon dioxide is about the same amount produced during 235 million vehicle miles traveled or is the amount of carbon stored each year in 75,000 acres of growing forest (see the U.S. EPA and U.S. Agency for International Development *Climate Technology Gateway* at www.usctcgateway.net).

believes will result in a reduction in regional greenhouse gas emissions, and the project includes numerous components to ensure that it will use only the minimum energy necessary.[105] Moreover, Poseidon maintains that the Commission's authority to impose greenhouse gas emission standards or emissions-related mitigation is limited.[106] Poseidon states that due to the importance of the project and Poseidon's environmental stewardship, it has proposed a Climate Action Plan pursuant to which Poseidon commits to measures that will offset the project's net carbon emissions so that the project is net carbon neutral.[107]

As described below, Poseidon will demonstrate that its proposed project will conform to the Section 30253(4) requirement to minimize energy consumption to avoid or mitigate adverse effects to coastal resources caused by energy-related greenhouse gas emissions through its conformity to **Special Condition 10**, as described below.

## *Issue Background*

One of California's biggest overall energy uses, and one of its most intensive energy uses, is moving water around the state. With most of its water in the north and most of its population in the south, California has established conveyance systems to move water hundreds of miles and over hundreds of feet of elevation gain. Because water is relatively heavy, it requires significant amounts of electricity to transport – for example, the State Water Project uses up to about 5 billion kilowatt-hours each year to move millions of acre-feet of water from Northern to Southern California. Its average demand per acre-foot is about 3,400 kilowatt-hours, which is about the same as the annual residential use for each person in the U.S.

Compared to California's existing water supply systems, seawater desalination is an even more energy intensive source of water. Although desalination's energy needs have decreased significantly in the past several years, reverse osmosis facilities such as Poseidon's proposed project still require much more electricity than is needed for other water sources. For example, Poseidon's proposal is expected to require no less than about 4,400 kilowatt-hours per acre-foot, about 30% more than the State Water Project, which provides a part of the water imported to the San Diego area, and about 120% more kilowatt-hours per acre-foot than water imported to the area from the Colorado River, which requires about 2000 kilowatt-hours per acre-foot.

In many parts of the state, the electrical grid needed to provide water is under a great deal of strain. Southern California, in particular, will be challenged to meet its energy needs due to its need to reduce its reliance on aging power plants and to develop new energy sources, developing updated transmission infrastructure, and other similar difficulties.[108] Poseidon's proposal would rely on the local and regional electrical grid, which generates most of its electricity from fossil fuel-fired power plants. The proposed facility's electrical use would therefore result in substantial greenhouse gas emissions due to its use of this type of electricity. In response, Poseidon has proposed a Climate Action Plan, which is discussed in greater detail later in these Findings.

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[105] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exb. A at pp. 20-21.

[106] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at pp. 20-21.

[107] See *id.*

[108] See, for example, the California Energy Commission's 2007 *Draft Integrated Energy Policy Report.*

**Background of Greenhouse Gas-related Issues and Impacts:** The Fourth Assessment Report of Working Group I of the Intergovernmental Panel on Climate Change (IPCC) (2007) represents the consensus of fifty top international scientists working in fields related to climate change. More than one hundred national governments, including the United States, have approved the report. The report concludes that the evidence of global climate system warming is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level (IPCC, 2007). Further, the report concludes that "most of the observed increase in globally averaged temperatures since the mid-20th century is very likely [greater than 90% probable] due to the observed increase in anthropogenic greenhouse gas concentrations." The report cites numerous long-term changes in climate, including changes in Arctic air temperatures, decreases in the amount of Arctic sea ice, widespread changes in precipitation amounts, increase in ocean salinity, changes in wind patterns and increased incidences of extreme weather including droughts, heavy precipitation, heat waves and tropical storms.

Many studies consider a climate heating of more than 2 degrees Celsius above pre-industrial temperatures as representing "dangerous" level of climate disruptions. Based on six emissions scenarios ranging from "business as usual" to aggressive shifts to cleaner technologies, the best estimates of global average temperature increase are between 1.8 and 4.0 degrees Celsius by 2099. A more recent study has found that comparing actual "on the ground" data compiled during the last ten years shows that the model used to develop these scenarios has vastly underestimated the rate and degree of global warming effects. It suggests that limiting global heating to no more than 2 degrees Celsius will require measures that result in the equivalent of complete elimination of industrial emissions (see Weaver et. al. *Long term climate implications of 2050 emission reduction targets*, in Geophysical Research Letters, October 6, 2007).

These six emission scenarios also estimate that sea level will rise between 0.18 and 0.59 m. This amount of sea level rise does not include contributions from rapid melting of either the Greenland or Antarctic ice caps. (Bindschadler, 2006; Ekström et al., 2006; Joughin, 2006; Kerr, 2006). In addition, the ocean's absorption of carbon dioxide leads to a reduction in ocean pH with concomitant consumption of dissolved carbonate ions, which adversely affects calcite-secreting marine organisms, marine water quality and the abundance and distribution of marine species (The Royal Society, 2005).

**Impacts to the California Coastal Zone**: In July 2006, the California Climate Change Center released a series of reports describing ongoing and future effects of global warming on the California environment (Baldocchi and Wong, 2006; Battles et al., 2006; Cavagnaro et al., 2006; Cayan et al., 2006a; Cayan et al., 2006b; Cayan et al., 2006c; Drechsler et al., 2006; Franco and Sanstad, 2006; Fried et al., 2006; Gutierrez et al., 2006; Joyce et al., 2006; Lenihan et al., 2006; Luers et al., 2006; Luers and Moser, 2006; Medellin et al., 2006; Miller and Schlegel, 2006; Moritz and Stephens, 2006; Vicuña, 2006; Vicuña et al., 2006; Westerling and Bryant, 2006). Drawing on three projected warming scenarios (low, medium, and high), the reports projected severe impacts by the end of the century in the areas of public health, water resources, agriculture, forests and landscapes, and sea level. Many of these effects will adversely impact resources of the coastal zone. The adverse effects include worsened air quality, changes in species distribution, significant reductions in plant and animal diversity, loss of various kinds of agriculture (such as fruit trees), expansion of invasive plant and animal species, increase in plant pathogens, increase in number and severity of wildfires, rising sea level, coastal flooding, and increased coastal erosion. In addition, absorption of carbon dioxide by the ocean is causing a reduction in ocean pH with concomitant consumption of dissolved carbonate ions, which is

adversely impacting calcite-secreting marine organisms. The warming of ocean waters is also adversely affecting marine resources.

As identified in the 2006 Climate Change Center reports, air quality will be compromised by soot from wildfires, which the report predicts will increase. Coastal agriculture, already threatened by land development and habitat fragmentation, will be subject to further impacts from climate change. Impacts to coastal agricultural will include impacts to wine grapes, which will be subject to premature ripening and decreased fruit quality; adverse impacts to fruit and nut trees, many of which will no longer be able to produce once the number of "chill hours" per day drops below that necessary for proper ripening; and adverse impacts to milk production. Other threats to coastal agriculture identified by the Climate Change Center reports include the expansion of the ranges of agricultural weeds and an increase in plant pests and pathogens. Coastal forests and scrublands will be increasingly susceptible to wildfires due to longer and warmer periods of summer drying. This, together with the warmer climate itself, will lead to shifts in vegetation type, probably resulting in the loss of coastal scrub as it is converted to grasslands. Inasmuch as suitable habitat exists, species requiring cooler climates can migrate northward or to higher elevations. Their ability to do this, however, will be limited by the speed with which they are able to disperse, the suitability and interconnectivity of available habitat, and their ability to compete with non-native invasive species which, by definition, are able to disperse and exploit habitat efficiently. All of these effects will lead to a decline in forest productivity, with a concomitant loss in habitat.

The most direct impacts of global warming focused on the coastal zone are sea level rise and its associated impacts, ocean warming, and ocean acidification:

- **Sea Level Rise:** According to tide gage data, global mean sea level has been rising at the rate of approximately 1.8 mm/yr for the past century (IPCC, 2001). Although no acceleration of this rate is apparent from the tide gage data (IPCC, 2001), satellite measurements starting in the early 1990s indicate an annual rate of approximately 2.8 mm/yr (Church and White, 2006). Sea level is clearly rising, and the rate of increase may in fact be accelerating. Since land can also change elevation due to either uplift or subsidence, global sea level change affects various coastal areas differently. Much of the California coast is rising; however the rate of uplift is, everywhere except northernmost California, lower than the rate of sea level rise. The *relative* historic rate of sea level rise (relative sea level rise is global sea level minus local land uplift or plus local land subsidence) has been calculated by Commission staff to range from a high of 2.16 ± 0.11 mm/yr in San Diego to a low of 0.92 ± 0.17 mm/yr in Los Angeles. Relative sea level is actually falling at Crescent City due to the high rates of tectonic uplift at that locality. (California Coastal Commission, 2001).

  Even the 0.18 to 0.59 meter rise in sea level by 2100 predicted by the IPCC will have a large impact on the California coast. The effects of a much larger increase in sea level due to large contributions from the Greenland and/or Antarctic ice sheet would be truly catastrophic. The 2001 Coastal Commission report concluded:

  > *The most obvious consequence of a large rise in sea level will be changes in areas that are submerged. Lands that now are only wet at high tide could be wet most of the day. Structures that are built above the water, like docks and piers, will be closer to the water, or eventually submerged. A second consequence will be an increase in wave energy. Wave energy is a factor*

*of wave height. Wave heights along the California coast are influenced greatly by bottom depths and for most locations along the coast, the heights of nearshore waves are "depth limited". When the water depth increases, the wave height can be higher. Thus, higher waves impact the coast during high tide than during low tide. Wave energy increases with the square of the wave height. Thus, a 2-foot (0.6-meter) wave would have 4 times the energy of a 1-foot (0.3-meter) wave. Small changes in water level can cause significant changes in wave energy and the potential for shoreline damage from wave forces. A 1-foot to 3-foot (0.3 to 0.9 meter) rise in sea level, such as projected to occur over the next 100 years, would cause enormous changes in nearshore wave energy. The consequences of a 1-foot to 3-foot (0.3 to 0.9 meter) rise in sea level are far reaching. Along the California coast, the best analogy for sea level rise is thought to be El Niño, where a significant rise in sea level will be like El Niño on steroids. One of the factors that contributed to the amount of damage caused by the 1982/83 El Niño was that several storms coincided with high tide events and the elevated water levels (from tides and low pressure system combined) brought waves further inland than would have occurred otherwise...*

*Beaches and Coastal Bluffs: Open coastal landforms like beaches and bluffs will be exposed to greater and more frequent wave attack. There will more potential for erosion and shoreline retreat. For gently sloping beaches, the general rule of thumb is that 50 to 100 feet of beach width will be lost from use for every foot of sea level rise... Some global circulation models predict significant increases in run-off from coastal watersheds in California (Wolock and McCabe, 1999) ...*

In general, erosion of the landward edge of a beach, dune, or coastal bluff creates additional beach area, and so even in a period of sea level rise such as the present, in which the seaward extent of the beach is reduced by flooding and erosion, new beach creation can result in a relatively constant beach width. However, when threats to existing development from erosion lead to the construction of shoreline protective devices that halt the landward migration of the back beach, continued flooding of the seaward beach results in a reduction in beach width. Thus, on beaches experiencing erosion due to rising sea level, the protection of threatened structures will result in the loss of beaches wherever property owners choose to harden the coast to prevent coastal erosion. This loss of beach has immense negative impacts, including loss of recreational value, tourism, marine mammal haul-out area, sandy beach habitat, and buffering capacity against future bluff erosion.

The 2001 Coastal Commission report goes on to indicate other potential impacts of sea level rise on the California coast:

*Wetland changes also will be affected by inland development. Historically, wetland areas migrated both upward and landward as they were inundated. If the inland area has a slope and soil composition that can support a wetland and is not already developed, then inland migration may be possible. If there is a steep bluff or some type of fixed development, such as a highway or bulkhead, inland of a wetland, inland migration will not be possible and the wetland area will diminish over time.*

*Another physical change to wetland in response to a rise in sea level is an increase in the tidal currents, with the potential for increased scour. Also, for estuarine systems there will be a shift in the location of the salt water-freshwater interface, and an inland movement of the zone of brackish water...*

*Ports, Harbors and Marine Facilities: Much of the infrastructure of a port or harbor will be affected by a change in sea level. So too will marine terminals and offshore structures. All of the horizontal elements, such as the decking of wharves and piers, will be exposed more frequently to uplift forces larger than those occurring now. Compared to current conditions, ships will ride higher at the dock and cargo-handling facilities will have less access to all parts of the ship. Loading and unloading may have to be scheduled for low tide periods to allow greatest access into the ship, or else mooring and cargo handling facilities will need to be elevated.*

*If breakwaters or jetties protect the harbor, these structures will become less efficient as water levels increase. The breakwaters and jetties will need to be enlarged and heightened to keep up with the rise in sea level, or the harbor will have to accept a higher level of overtopping and storm surge, and a higher probability of storm damage. The increase in water level could also increase the tidal prism of the harbor, resulting in increased scour at the foundations of any structures in the harbor. So, it may also be necessary to reinforce the base of the breakwater or jetty to insure stability. Benefits that could occur from a rise in sea level would be the opportunity for harbors to accommodate deeper draught ships and a decrease in dredging to maintain necessary channel depths.*

*Seawalls and other engineered shoreline protection: [Seawall] foundations would be exposed to greater scour and the main structure would be exposed to greater and more frequent wave forces. As with breakwaters and jetties, these structures will need to be reinforced to withstand these greater forces, or a lower level of protection will have to be accepted for the backshore property.*

- **Ocean Warming:** In December 2006, the Commission held the first in a series of workshops on global warming. One of the well-recognized connections between the atmosphere and the ocean is heat exchange. Global warming of the atmosphere is expected to cause an increase in ocean warming as the ocean absorbs greater amounts of thermal energy from the atmosphere. At the workshop, Dr. James Barry (Associate Scientist, Monterey Bay Aquarium Research Institute) presented a summary of observed and predicted effects of ocean warming on California coastal ecosystems. Dr. Barry inventoried intertidal animals along the Monterey coast, and compared his results to a 1932 baseline inventory. He found that species that increased in abundance in southern California had increased markedly since the baseline study. Over the same time, there was a dramatic decline in species more associated with northern California. This demonstrates that the observed warming of the ocean over the past 60 years has resulted in a shift in the geographic ranges of species. With continued warming, species can be expected to continue to migrate northward as long as suitable habitat is available.

Some instances of remarkable biodiversity are due to the fortuitous combination of suitable ocean temperature and suitable geomorphic conditions. For example, one of the most diverse shallow water habitats in California is found in the rocky-bottom waters around the northern Channel Islands. This is a zone of mixing of species characteristic of a "southern California realm" and a "northern California realm." The abundant rocky bottom habitat in the shallow waters ringing the islands provides a niche in which this diversity is expressed. If, because of global warming, the suitable temperature zone migrates northward, it will be moved off of the abundant rocky bottom habitat and the diversity and ocean productivity might decrease significantly.

Declines in ocean productivity due to habitat shifts are an indirect consequence of ocean warming. Ocean warming can cause a direct loss of primary productivity as well. Warming of the surface of the ocean results in increased ocean stratification, limiting the upwelling of deep, nutrient-rich waters that are responsible for California's rich coastal productivity. Roemmich and McGowan (1995) report a 1.2 to 1.4 degree centigrade increase in ocean temperature between 1950 and 1994. This was accompanied by a 75% reduction in zooplankton biomass. Reductions in phytoplankton and zooplankton biomass have profound cascading effects throughout the food chain. Short term warming events, such as El Niño events, have resulted in abrupt decline in commercial fish species, marine mammals, and birds (Laws, 1997; Nezlin et al., 2005). Similar effects might accompany global warming on a longer time scale, vastly affecting California's coastal resources.

Ocean warming could also create a disconnect between historic feeding and breeding grounds for many species. Welch and others (1998) reported on potential changes in sockeye salmon distribution due to future global warming. Sockeye salmon, which spend 2-3 years in waters of the northern Pacific, migrate northwards to areas of high productivity, such as the Bering Sea, in the summer. Productivity decreases with temperature increase, however, and as the Bering Sea warms, migration routes would have to be longer. Eventually, the metabolic cost of migrating further northwards to feeding grounds could make the migration infeasible. When summer feeding grounds are disconnected from winter breeding grounds, a population crash may be anticipated. A population crash in such species would not only impact commercial fishing in California, but would ripple up through the food chain, impacting protected coastal resources such as marine mammals and birds.

- **Ocean Acidification:** Just as there is an exchange of thermal energy between the atmosphere and the oceans, there is an ongoing exchange of gases between the atmosphere and the ocean. Each year some 92 billion metric tonnes of CO2 annually are directly absorbed by the ocean from the atmosphere. At the same time, approximately 90 billion metric tonnes are released back to the atmosphere (Schlesinger, 1997). The net increase in dissolved CO2 in the ocean is a direct result of increases in the atmosphere related to changes humans are making to the carbon cycle—most notably fossil fuel burning and land use changes (deforestation, mostly in the tropics). The ocean is an enormous reservoir that can absorb a vast amount of $CO_2$, although the rate of ocean mixing is too slow to prevent the current buildup in the atmosphere. Without this net absorption of $CO_2$ by the oceans, the atmospheric buildup—and global warming—would be far greater than it is now.

Over the past 200 years, the oceans have taken up approximately half of the industrial age $CO_2$ emissions, substantially reducing the net atmospheric concentrations of $CO_2$. This effect does not come without a cost, however. When $CO_2$ is absorbed by the ocean, some of it combines with water to form carbonic acid ($H_2CO_3$). This results in only a modest decrease in ocean pH, however, because most of the carbolic acid recombines to form bicarbonate ions ($HCO_3$). In the process, carbonate ions ($CO_3^{-2}$) are consumed, with the net result being that absorption of $CO_2$ by the ocean consumes carbonate ions and reduces the pH of the ocean. The decrease in pH is minor because of the "buffering capacity" of these carbonate reactions, but appears to have decreased mean average surface water pH by 0.1 pH units over the past 200 years (Caldeira and Wickett, 2003). Because the pH scale is logarithmic, this decrease in ocean pH (commonly called "ocean acidification," but more properly referred to as a decrease in alkalinity) means that hydrogen ion activity (which defines acidity) has increased by some 30% in this time frame (The Royal Society, 2005).

The effects of decreasing ocean alkalinity and carbonate ion concentration are twofold. First, many species are directly affected by the reduction in pH. In his presentation before the Commission in December 2006, Dr. Barry identified several physiologic stresses to which some species are susceptible. These stresses include respiratory stress (reduced pH limits oxygen binding and transport by respiratory proteins, such as hemoglobin, leading to reduced aerobic capacity), acidosis (disruption of acid/base balance which impairs function and requires energy to restore or maintain optimal pH balance), and metabolic depression (reduced pH associated with increased environmental $CO_2$ can cause some animals to enter a state of torpor or semi-hibernation). In addition to these physiologic effects, calcite-secreting organisms (including many phytoplankton, zooplankton, clams, snails, sea stars, sea urchins, crabs, shrimp, and many others) have more difficulty secreting their shells or tests under reduced carbonate ion concentrations. Deep-sea species will be particularly affected because increasing $CO_2$ levels in seawater decreases the saturation state of seawater with respect to calcium carbonate ($CaCO_3$) and raises the saturation horizon closer to the surface. The $CaCO_3$ saturation horizon is a depth in the ocean above which $CaCO_3$ can form, but below which $CaCO_3$ dissolves. Increasing surface $CO_2$ levels could have serious consequences for organisms that make external $CaCO_3$ shells and plates (The Royal Society, 2005). The consequences of reduced calcification are not fully known, but are likely to include changes to plankton communities, higher metabolic costs for water-breathing species, resulting in lower growth, survival and reproduction, and higher metabolic costs for calcite secreting organisms. The effect on food webs is unclear, but it is very likely that these effects will result in a loss of biodiversity and complexity in California's coastal marine ecosystems.

### *Analysis of Poseidon's Anticipated Greenhouse Gas Emissions and Poseidon's Response*

As noted above, Commission staff estimates that Poseidon's electricity use would generate no less than 200,000,000 pounds (about 90,000 metric tonnes) of carbon dioxide emissions each year, based on Poseidon's use of approximately 250,000 megawatt-hours per year from the San Diego Gas & Electric Company (SDG&E) energy portfolio. Conversely, Poseidon, relying on California Climate Action Registry (CCAR) Protocol, estimates that its electricity use would generate approximately 61,004 metric tonnes of carbon dioxide emissions each year, based upon its use of 246,156 megawatt-hours per year from SDG&E, which has a CCAR certified

emissions factor of 546.46 lbs of CO2/MWH. Since Poseidon intends to buy all of its energy from SDG&E system power, Poseidon states that the appropriate emission factor to use for the project's indirect carbon emissions from its electricity purchases is SDG&E's annual emission factor for delivered electricity as stated in their CCAR Annual Emissions Report.[109] SDG&E last filed an Annual Emissions Report with the CCAR on March 7. 2007, and it provides an emission rate of 546 lbs of CO2/MWH.

In October 2007, Poseidon submitted several letters and memoranda to Commission staff describing the proposed facility's expected electricity use, some possible measures that would reduce its expected use, and measures that Poseidon may use to address its greenhouse gas emissions. These are described in more detail below.

Poseidon's most recent estimates show that it expects the project would use 4,833 kilowatt-hours to produce each acre-foot of potable water, but that this figure would be lowered to about 4,400 kilowatt-hours by implementing measures described below. This includes using the power plant's pumps to bring water into the intake channel, pumping that water into the proposed facility, pretreating the water, producing desalinated water using reverse osmosis membranes, and pumping the water from the water from the facility to delivery points in Carlsbad and nearby communities. At 4,833 kilowatt-hours per acre-foot, Poseidon's electrical use would total 270,648 megawatt-hours per year.[110] Poseidon's estimates also show that its expected continual electrical demand would be between 28.1 and 33.8 megawatts, with an average demand of about 30 megawatts. Using these figures, Poseidon's electrical use would range from 246,156 to 296,088 megawatt-hours per year, with an average annual use of 262,800 megawatt-hours.[111]

Poseidon's proposed Climate Action Plan describes several measures that it may use to reduce its electrical use. Those measures include a high-efficiency energy recovery device that Poseidon is still testing, but which could reduce its electrical use by about 10%, to about 4400 megawatt-hours per acre-foot of production. Although Poseidon has not yet committed to using this device, the emissions analysis in these Findings credits Poseidon with the emission reductions that would occur due to its use. Using the 4400 megawatt-hour per acre-foot figure would result in Poseidon's electrical use being 246,400 megawatt-hours per year, or approximately 250,000 megawatt-hours per year, which is used as the basis for the analyses in these findings. Using Commission staff's calculations, this would result in carbon dioxide emissions of about 200,000,000 pounds (about 90,000 metric tonnes) per year.[112]

As noted above, the analyses in these Findings do not include several emission sources that could add significantly to Poseidon's total. The analyses do not include emissions resulting from project construction and manufacture of materials used.

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[109] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at pp. 23-24.

[110] 4,833 X 56,000 acre-feet per year / 1,000 kilowatts per megawatt = 270,648 megawatt-hours.

[111] At a steady rate of elecrical use, 30 megawatts X 24 hours per day X 365 days per year = 262,800 megawatt-hours.

[112] Based on the CCAR average rate of 804.54 pounds per megawatt-hour of carbon dioxide emissions from California's electrical sources.

Recent letters and memoranda from Poseidon (see October 21 and 22, 2007) provide a much lower estimate of its anticipated greenhouse gas emissions. Poseidon, citing the most recent CCAR protocol and certified SDG&E emission rate, contends that its emission rate should be based on 546 pounds of carbon dioxide emissions per megawatt-hour, based on emissions expected from the energy sources in SDG&E's energy supply portfolio. This would result in about 134,400,000 pounds (about 61,000 metric tonnes) of carbon dioxide per year instead of 200,000,000 pounds (90,000 metric tonnes). However, Commission staff's analysis shows that in comparing the SDG&E portfolio with the CCAR's average California portfolio, the SDG&E portfolio appears to result in an even higher emission figure than the California average.[113] For example, coal and natural gas, which have average emission rates much higher than 804.54 pounds per megawatt-hour,[114] make up a larger proportion of San Diego's portfolio than the state portfolio. Additionally, SDG&E testimony before the California Public Utilities Commission suggests its carbon dioxide emissions are in the range of 1100 pounds per megawatt-hour, based on an average of a range of natural gas technologies and heat rates.[115] Elsewhere, SDG&E's emissions are cited as 915 pounds per megawatt-hour for electricity it purchases.[116] Commission staff, therefore, contend that Poseidon's reliance on the latest published CCAR rate calculations for SDG&E may be in error. The CCAR-certified figure is derived from SDG&E's 2005 self-reported Annual Entity Emissions report, which states that SDG&E expects emissions of 546 pounds per megawatt-hour from owned and purchased generation sources; however, that figure is not supported by other SDG&E sources or by other agencies, including the California Energy Commission and State Lands Commission, in their determations related to emissions from different types of electricity sources. For example, the State Lands Commission in its October 30, 2007 hearing used 815 pounds per megawatt-hour as the basis of its review, with a "best-case" low emission rate of 690 pounds and a high rate of 1100 pounds. Poseidon, however, states that the CCAR-certified figure is not erroneous, since CCAR is the only certifying entity currently authorized by California and because CCAR used SDG&E's credible self-reported Annual Entity Emissions report.[117]

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[113] Poseidon provided the following percentages of SDG&E's electricity sources, and the California averages are from the California Energy Commission's *2006 Gross System Power Report*:

| Resource Type: | SDG&E Percent: | State Percent: |
|---|---|---|
| Coal | 18.0 | 15.7 |
| Natural Gas | 50.0 | 41.5 |
| Large Hydro | 10.0 | 19.0 |
| Nuclear | 15.0 | 12.9 |
| Biomass | 3.0 | 2.1 |
| Geothermal | 2.0 | 4.7 |
| Small Hydro | <1 | 2.1 |
| Solar | <1 | 0.2 |
| Wind | 3.0 | 1.8 |

[114] Natural gas emissions range from about 800-1200 lbs/megawatt-hour, and coal emissions are more than 2000 lbs/megawatt-hour.

[115] See page 12 of the *Prepared Rebuttal Testimony of San Diego Gas & Electric Company – J. Strack*, in the CPUC's Application No. 06-08-010 for the Sunrise Powerlink Transmission project, June 25, 2007.

[116] See Powers, Bill, *Assessment of Energy Intensity and CO2 Emissions Associated with Water Supply Options for San Diego County*, October 12, 2007.

[117] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at pp. 23-24.

In selecting an appropriate rate to use for these analyses, Commission staff used CCAR's standard figure for California to establish Poseidon's 200 million pound contribution to greenhouse gas emissions.[118] Poseidon disagrees, stating that because Commission staff did not follow the CCAR protocol or rely on the CCAR certified SDG&E emissions factor, staff's analysis was in error.[119] Regardless, because SDG&E reports its overall emission rate on an annual basis and that rate changes based on the particular mix of electricity sources SDG&E uses each year, the rate used to determine Poseidon's greenhouse gas contributions each year is at this point unknown but will be determined through Commission review and approval of Poseidon's Energy Minimization and Greenhouse Gas Reduction Plan as described later in these Findings.

In its October 21, 2007 memorandum, Exhibit D to its November 9, 2007 letter to the Commission, and in its presentation to the Commission at the November 15, 2007 hearing, Poseidon presented its proposal to offset or reduce the proposed project's energy use and greenhouse gas production so that the facility's operations would be net carbon neutral. Poseidon states that it will develop a Climate Action Plan that (1) would ensure the project minimizes energy consumption in compliance with Coastal Act Section 30253(4), and (2) would render the project net carbon neutral. Poseidon stated its Climate Action Plan may include the following, which are described in more detail below:

**Energy Minimization Measures:**

- Installing a state-of-the-art high efficiency energy recovery system that will decrease the amount of electricity required by the facility by 10% or about 433 kWh/AF.
- Evaluating the proposed project through a LEED-type process, and implementing as many of the LEED Checklist items as feasible ("LEED" is the "Leadership in Energy and Environmental Design" program).
- Installing variable-frequency drives on the intake water pumps of the desalination facility to improve the energy-efficiency of these pumps.
- Installing low-friction piping materials (e.g., FRP and HDPE) wherever possible to reduce head losses and related energy consumption through the piping.

**Carbon Neutrality Measures:**

- Acquiring renewable power through installation of photovoltaic array and other renewable energy sources.
- Acquiring Renewable Energy Credits (RECs) or purchasing carbon offset projects.
- Restoring and preserving coastal wetlands for carbon sequestration.
- Providing $1 million worth of trees for reforestation in the San Diego area.

As noted previously, Poseidon initially estimated that its facility would require 4,833 kilowatt-hours of electricity to produce each acre-foot of potable water (kWh/AF) and transport that water to delivery points in and near Carlsbad. This figure would otherwise be somewhat higher – about 5,990 kWh/AF

[118] Using the next higher credible estimate (1100 pounds per megawatt-hour) would result in Poseidon's emissions being closer to 300,000,000 pounds per year.

[119] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at pp. 23-24.

– however, Poseidon plans to use an energy recovery turbine to reduce electricity demand by about 1,103 kWh/AF. Poseidon is also exploring the use of a relatively new energy recovery device known as a pressure exchanger, which it expects could reduce electrical use by an additional 10%. This would result in electrical usage of about 4,400 kWh/AF and would reduce Poseidon's expected carbon dioxide emissions to about 200 million pounds (90,000 metric tonnes) per year according to Commission staff's calculations, or about 134 million pounds (61,000 metric tonnes) per year using Poseidon's calculations. It would clearly be to Poseidon's advantage to use any cost-effective energy efficiency devices available to reduce its operating costs, and Poseidon has committed to use this device, so the emission estimates in these Findings already credit Poseidon with the emission reductions that would result from its use.

Poseidon is also exploring a number of other energy efficiency measures, including installing variable speed pumps, installing high efficiency lighting and motors throughout the facility, and using low-friction piping material and installing larger diameter piping where possible. It is proposing to implement as many LEED items as feasible, including providing bicycle storage, using water efficient landscaping, providing recycling capability, using low-emission adhesives and sealants, etc. It is also considering installing a rooftop solar energy system. The Commission supports Poseidon's proposed use of the LEED guidelines, as implementing LEED-related measures would likely provide numerous benefits; however, those guidelines would not result in significantly lower emissions from Poseidon's anticipated electrical use. Further, Poseidon has not yet committed to these measures.

Poseidon also states that it could further reduce its energy use by operating at 80% capacity during the eight hours per day of peak electricity demand and then operate at 108% of its average capacity during the remaining hours each day.[120] This proposed operating scenario, however, would not necessarily reduce energy use or emissions; it would instead shift energy use from one time of day to another. This would be beneficial in that it would lower Poseidon's electricity costs and reduce demand on the electricity grid during those peak hours, but Poseidon would still produce about the same amount of water each day requiring the same amount of electricity for each acre-foot.

Poseidon further contends it should be credited with emission reductions because its project would result in less water being transported to the San Diego region from the State Water Project. Although the State Water Project emits fewer emissions per acre-foot than Poseidon's project would, applying a credit for any foregone use would lower Poseidon's overall greenhouse gas contributions by about 77% (i.e., the difference between Poseidon's 4400 kilowatt-hour per acre-foot energy use and the State Water Project's 3400 kilowatt-hour per acre-foot).[121] Poseidon states that the Carlsbad facility will supply 56,000 acre-feet of water per year to the San Diego region, water that would otherwise have to be pumped into the region through either the State Water Project or the Colorado River Aqueduct. Poseidon further contends, as stated by all Carlsbad desalination project water agency partners in letters to the State Lands Commission dated November 6 and November 7, 2007, which were also provided to the Coastal Commission, that water from the desalination plant will provide direct, one-

[120] An annual daily average of 50 MGD equals 2,083,333 million gallons per hour. Operating at 80% capacity for eight hours would produce about 16.6 million gallons, and operating at 108% capacity for sixteen hours would produce about 33.3 million gallons, for an overall total of about 49.9 MGD. Since the energy required to produce each acre-foot is about 4400 kilowatt-hours, the overall energy difference between continual production of 50 MGD (153.4 AF) and variable production of 49.9 MGD (153.1 AF) would be minimal.

[121] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. D (Climate Action Plan).

for-one replacement of imported water to meet the requirements of their Urban Water Management Plans, thus eliminating the need to pump 56,000 acre feet of water into the region.[122] Conversely, Poseidon contends that if the project is not approved the demand for imported water by the eight public water agencies will increase by 56,000 AF/Y starting in 2010. Additionally, Metropolitan Water District of Southern California (MWD) has committed to pay Poseidon's customers $250/AF for each acre-foot of water purchased from the project that offsets a demand on MWD. The availability of MWD funding is subject to annual audit demonstrating that the desalinated water was used to offset a demand for imported water that would otherwise have to be delivered by MWD. Poseidon concludes that, if the replaced water is pumped into the region for other uses, then the associated carbon emissions from such pumping should be and is the responsibility of the proponents of those other uses. Poseidon believes that any other result would be an unfair and unwarranted "double counting" of carbon emissions, requiring Poseidon to offset emissions caused by other activities not associated with its own operations.[123]

For several reasons, however, the Commission staff believe this "crediting" approach is not warranted. First, Poseidon's proposed project does not ensure a decrease in imported water supplies to the San Diego Region.[124] Other factors may contribute to such a decrease – e.g., supply cutbacks imposed by court order, a shift in water prices, etc. – but Poseidon's project itself does not include measures that would implement such a decrease, such as retiring distant water rights or assigning water rights to instream uses.

Poseidon acknowledges that the State Water Project would continue to pump available water to Southern California users, but then argues that it should still be credited for what would then be a non-existent reduction in emissions. Additionally, because Poseidon's water would be more expensive than imported sources, available imported water would likely remain the water of choice for most users, and so Poseidon's project would not likely affect the cost preference for imported water (e.g., the San Diego County Water Authority has contracted with the Imperial Irrigation District for up to 200,000 acre-feet per year – about 175 MGD – at less than $300 per acre-foot). Further, much of the water imported to San Diego comes from the Colorado River, which requires about a third less electricity than water imported from the State Water Project (approximately 2,000 kilowatt-hours per acre-foot versus 3,400 kilowatt-hours per acre-foot), so even if "crediting" was appropriate, it would be at a much lower level than Poseidon proposes.

Poseidon further contends that its project should be seen as part of a proposed regional water supply portfolio that would result in an overall reduction of electrical use and greenhouse gas emissions from the area's water use. Poseidon states that the planned shift in the San Diego region's water portfolio – using less imported water, gaining water through conservation, recycling, and canal lining projects, using seawater desalination, etc. – will result in an overall 19% reduction in the energy use per acre-foot now used for the region's water supply. While such a shift would likely reduce overall electrical use and emissions, those measures are not a part of Poseidon's proposal and those components of the proposed future portfolio would not reduce Poseidon's carbon dioxide emissions.

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[122] See Poseidon Resources Corporation. *Letter to Paul Thayer Re: Desalination Project's Impact on Imported Water Use*, November 8, 2007, including attachments from eight water agencies.

[123] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at p. 24.

[124] We note that the San Diego County Water Authority continues to seek out additional imported water sources that would be used regardless of Poseidon's project.

In sum, Commission staff's analysis shows the electrical demand of Poseidon's proposed project would contribute approximately 200 million pounds (90,000 metric tonnes) of carbon dioxide annually, and Poseidon's calculations, using the most recent CCAR-certified emission factor estimate about 134 million pounds (61,000 metric tonnes) of carbon dioxide emissions annually.

Poseidon and the Commission staff will consult with CCAR and CARB and other agencies to ensure that the carbon emissions will be neutralized regardless of the actual output, and **Special Condition 10** will assure that all net greenhouse gas emissions will be offset. Additionally, as noted above, because the SDG&E emission factor will change each year based on its electricity portfolio, the method used to determine Poseidon's needed emission reductions each year would need to be identified in the plan reviewed and approved by the Commission.

As described above, Poseidon's proposed Climate Action Plan presents a variety of measures it is exploring to reduce the plant's electricity consumption and resulting emissions and to offset the remaining emissions. The Plan does not currently commit to specific electricity minimization measures beyond those identified above; however, Poseidon is still exploring its options in regard to further electricity minimization and the Plan commits to specific electricity reductions.

To ensure Poseidon's proposal will conform to Coastal Act Section 30253(4) and other applicable Coastal Act provisions by minimizing energy consumption and reducing effects of greenhouse gas emissions on coastal resources, **Special Condition 10** requires Poseidon, prior to issuance of its coastal development permit, to submit to the Commission for review and approval a revised Energy Minimization and Greenhouse Gas Reduction Plan. That Plan is to be developed in conjunction with Coastal Commission staff and staff of other interested agencies and is to describe the procedures and mitigation measures that will be implemented to minimize electricity consumption of the desalination facility and to reduce or offset emissions resulting from the facility's remaining electrical use.

As noted above, Poseidon contends that its Climate Action Plan further provides a commitment that Poseidon will render the project "net carbon neutral" through measures including:

- Acquiring Renewable Energy Credits (RECs)
- Purchasing carbon offset projects
- Restoring and preserving coastal wetlands for carbon sequestration
- Providing $1 million worth of trees for reforestation in the San Diego area.

Poseidon states that it would consider purchasing RECs, which are credits bought and sold in an open market and used to fund renewable energy sources. For example, a renewable energy provider can be credited with one REC for every megawatt it produces, and can sell its RECs to make up some of the difference between the generally higher-cost energy produced from the renewable source and the generally lower-cost energy produced by a conventional fossil fuel source.[125] Carbon offsets are

[125] Recent REC prices have ranged from about $5 to $90 per megawatt-hour, with an average cost in 2006 of about $20 (see U.S. Department of Energy, Energy Efficiency and Renewable Energy website at: http://www.eere.energy.gov/greenpower/markets/certificates.shtml?page=1). Based on the average 2006 cost, offsetting Poseidon's anticipated use of 250,000 megawatt-hours per year would require it to purchase $5 million worth of RECs, equal to about $90 for each acre-foot of water it produced.

similar, in that they can be purchased through various market systems – non-profit or for-profit organizations, formal trading systems, etc. – and used for projects that reduce atmospheric carbon, such as energy conservation projects, methane capture, reforestation, etc. One method of offsetting carbon emissions involves sequestering carbon in growing plants, either through reforestation, or as Poseidon describes, through restoring and preserving coastal wetlands.[126] As part of its proposal, Poseidon has committed to purchase one million dollars worth of native and non-invasive trees to be planted in areas of San Diego County that were burned during the October 2007 wildfires. The Commission requested that Poseidon work with the San Diego Air Quality Management District to determine what kinds of trees would be appropriate to use. However, Poseidon has not provided further details about the type or amount of emission credits it would purchase or what kinds of emission reduction projects it would undertake. An additional concern is that there are only limited methods currently available for offsetting emissions, and it may be necessary to commit those offsetting measures to existing and critically needed facilities rather than a proposed and highly energy-intensive use such as this desalination facility. Further, rather than use offsets, Poseidon would be better able to conform to the Coastal Act Section 30253(4) requirement by including with its proposed project an energy conservation plan that commits to specific measures it will take to minimize energy use and its associated greenhouse gas emissions. A plan focusing on onsite and offsite energy conservation measures that result in an annual 200 million pound decrease in carbon dioxide emissions would be most closely related to Section 30253(4)'s mandate to minimize energy use. If those measures are inadequate, the plan could then provide offsets for the remaining emissions.

To ensure Poseidon's proposal will avoid and offset the adverse coastal resource impacts noted above and will conform to applicable Coastal Act provisions, **Special Condition 10** requires Poseidon, prior to issuance of its coastal development permit, to submit to the Commission for review and approval a revised Energy Minimization and Greenhouse Gas Reduction Plan. That Plan is to be developed in conjunction with Coastal Commission staff and staff of other interested agencies and is to describe the procedures and mitigation measures that will be implemented to determine the amount of carbon dioxide emitted due to Poseidon's electrical use and to ensure that project operations are "net carbon neutral". These may include measures described above and others, such as confirmed use of renewable energy sources like solar or wind power that would reduce the project's carbon footprint.

## *Conclusion*

**Special Condition 10** requires Poseidon to submit to the Commission for review and approval a Revised Energy Minimization and Greenhouse Gas Reduction Plan that addresses comments submitted by the staffs of the Commission, State Lands Commission and the Air Resources Board prior to issuance of the permit. The Commission finds that imposition of **Special Condition 10** will ensure that Poseidon minimizes electricity consumption of the project and mitigate any effects of the project's emissions on coastal resources, and that, as mitigated and conditioned, the project is consistent with the requirements of Section 30253(4) and other relevant Coastal Act provisions. The proposed project is meant in part to respond to the threat of drought and dwindling water supplies, and with adequate minimization and compensatory mitigation measures, the project will help achieve those goals. Poseidon's revised plan shall establish that the project will avoid, minimize, or mitigate adverse

[126] To provide a comparison, the U.S. EPA and U.S. Agency for International Development Climate Technology website calculates that sequestering 200,000,000 pounds of annual carbon emissions each year requires about 75,000 acres of growing forest (see www.usctcgateway.net).

impacts to a wide range of coastal resources, including public access, recreation, marine resources, wetlands, ESHA, agriculture, natural land forms, and existing development associated with its minimized and mitigated energy consumption. Based on the above, the Commission finds that the project, as conditioned, will conform to Coastal Act provisions related to minimizing energy use and mitigating any adverse effects on coastal resources from greenhouse gas emissions.

### 4.5.6 Development and Public Services (Coastal Act Sections 30250 & 30254)

Coastal Act Section 30250(a) states:

> *New residential, commercial, or industrial development, except as otherwise provided in this division, shall be located within, contiguous with, or in close proximity to, existing developed areas able to accommodate it or, where such areas are not able to accommodate it, in other areas with adequate public services and where it will not have significant adverse effects, either individually or cumulatively, on coastal resources. In addition, land divisions, other than leases for agricultural uses, outside existing developed areas shall be permitted only where 50 percent of the usable parcels in the area have been developed and the created parcels would be no smaller than the average size of surrounding parcels.*

Coastal Act Section 30254 states:

> *New or expanded public works facilities shall be designed and limited to accommodate needs generated by development or uses permitted consistent with the provisions of this division; provided, however, that it is the intent of the Legislature that State Highway Route 1 in rural areas of the coastal zone remain a scenic two-lane road. Special districts shall not be formed or expanded except where assessment for, and provision of, the service would not induce new development inconsistent with this division. Where existing or planned public works facilities can accommodate only a limited amount of new development, services to coastal-dependent land use, essential public services and basic industries vital to the economic health of the region, state, or nation, public recreation, commercial recreation, and visitor-serving land uses shall not be precluded by other development.*

Coastal Act Section 30250(a) generally requires that new industrial development, such as the proposed project, be sited in developed areas able to accommodate it or in areas with adequate public services and where it will not result in significant adverse effects to coastal resources. The facility would be located on an existing industrial site in an area with public services provided. Coastal Act Section 30254 requires in part that development not preclude public works facilities able to accommodate only limited new development from providing essential public services. Taken together, these policies are meant to ensure, in part, that new development not outpace the ability of communities to provide necessary public services and that development be supportive of other coastal resources.

The project's capacity of 56,000 AFY of new water supply for the San Diego region is about ten percent of 500,000 AFY of desalinated water identified by the California Department of Water Resources as needed by 2030, as stated in its 2006 Water Plan Update. This Update lists the project as a potential source of desalinated water. The Metropolitan Water District of Southern California's Integrated Water Resources Plan identified a need for 250,000 AFY of seawater desalination (including 56,000 AFY from the Carlsbad project) to ensure regional water supply reliability. In addition, the San Diego County Water Authority updated its 2005 Urban Water Management Plan in April 2007 specifically to reaffirm the need for 56,000 AFY of seawater desalination from the project by 2011. The project is a central component of state, regional and local water supply planning to meet already-identified demand.

The proposed project conforms to Sections 30250(a) and 30254 because any adverse effects to coastal resources will be mitigated as described in other sections of these Findings. Regarding growth implications, the Commission finds that the project will not induce growth since Poseidon will be selling its produced water to various public water districts. In this instance, use of that water by those districts will be subject to the applicable current and future growth plans, allowable levels of build-out, and conservation plans adopted by those districts or by the local jurisdictions they serve. The project provides part of the water supply that the California Department of Water Resources has identified as being needed in the area. The project does not induce growth, but rather, concentrates on providing a secure water supply for a region importing about 85% of its water and whose sources of imported water may not be secure. Accordingly, the project is a needed component of, and is consistent with, state, regional, and local water supply planning to meet an identified demand.

### *Conclusion*

Based on the above, the Commission finds that the project will not result in growth-inducing impacts and, as proposed and conditioned conforms to Coastal Act Sections 30250 and 30254.

## 4.5.7 Coastal-Dependent "Override" (Coastal Act Section 30260)

Coastal Act Section 30101 states:

> *"Coastal-dependent development or use" means any development or use which requires a site on, or adjacent to, the sea to be able to function at all.*

Coastal Act Section 30260 states:

> *Coastal-dependent industrial facilities shall be encouraged to locate or expand within existing sites and shall be permitted reasonable long-term growth where consistent with this division. However, where new or expanded coastal-dependent industrial facilities cannot feasibly be accommodated consistent with other policies of this division, they may nonetheless be permitted in accordance with this section and Sections 30261 and 30262 if (1) alternative locations are infeasible or more environmentally damaging; (2) to do otherwise would adversely affect the public welfare; and (3) adverse environmental effects are mitigated to the maximum extent feasible.*

Coastal Act Section 30260 provides for special consideration of coastal-dependent industrial facilities that may otherwise be found inconsistent with the Coastal Act's Chapter 3 policies. Such coastal-dependent proposals must first be evaluated for consistency to all other applicable policies and standards contained in Chapter 3. If a proposal is found to be inconsistent with any Chapter 3 policy, Section 30260 provides that it may be approved, notwithstanding its inconsistencies with those other policies, but only upon application of a three-part test – (1) that alternative locations are infeasible or more environmentally damaging; (2) that adverse environmental effects are mitigated to the maximum extent feasible; and (3) that to do otherwise (i.e., to deny the project) would adversely affect the public welfare.

Poseidon's proposed seawater desalination facility would be a coastal-dependent industrial facility, as it would need to be sited on or adjacent to the sea in order to function at all. Additionally, as determined previously in these findings, the Commission has found that the proposed project, as conditioned, would conform to applicable Coastal Act policies except Section 30233(c). Therefore, the Commission's approval of the project requires use of the Section 30260 "override". As shown in the discussion below, the Commission has determined that the project, as conditioned, meets the three tests of Section 30260 and thereby conforms to this Coastal Act policy. Each of the three tests is applied below.

### *Test 1 – Alternative Locations are Infeasible or More Environmentally Damaging*

Under Section 30260, the project can be approved if the Commission finds there are no alternative locations that would lessen the project's environmental impacts. Previously in Section 4.5.1 of these Findings, the Commission found that there are no feasible alternative locations that would significantly reduce any impacts of the proposed intake and the outfall.

Based on the analysis provided previously in these Findings, the Commission finds that there are no feasible and less environmentally damaging alternative locations available for the project's seawater intake and discharge components and that the proposed project meets the first test of Section 30260.

### *Test 2 – Adverse environmental effects are minimized to the maximum extent feasible*

Section 30260's second test requires that a proposed project include maximum feasible mitigation measures. Poseidon's proposal meets this test of Section 30260 through imposition of **Special Conditions 4** (Other Agency Approvals), **8** (Marine Life Mitigation Plan), **9** (Seawater Withdrawal), **10** (Energy Minimization and Greenhouse Gas Reduction Plan); **11** (Public Access), **12** (Dredging), **13** (Visual Resources), **15** (Construction Plan), **16** (Storm Water Pollution Prevention Plan) and **17** (Water Quality), which, among other protections, impose requirements that Poseidon implement mitigation measures that will minimize potential adverse environmental effects to the maximum extent feasible. These conditions will, among other things require Poseidon to (1) submit to and obtain from the Commission approval of a revised Marine Life Mitigation Plan in the form of an amendment to the CDP that will mitigate to the extent feasible project-related impacts to marine life; (2) submit to and obtain from the Commission approval of a revised Energy Minimization and Greenhouse Gas Reduction Plan that results in reduction in electrical use and reduction or offset of greenhouse gas emissions associated with the project's operations to the maximum extent feasible through Poseidon's agreement that the project will be net carbon neutral; and (3) submit separate coastal development permit applications to the Commission for future dredging of the Lagoon so the Commission can ensure that future dredging is consistent with the Coastal Act. Together, these and the other **Special Conditions** ensure the project will mitigate to the maximum extent feasible the project's adverse effects on coastal resources.

Based on the above and on the previous Findings herein, the Commission finds that the proposed project as conditioned mitigates its impacts to the maximum extent feasible and that it meets the second test of Section 30260.

### *Test 3 – To not permit the development would adversely affect public welfare*

Section 30260's final test provides that coastal-dependent industrial development may be permitted if to do otherwise would adversely affect the public welfare. This test requires more than a finding that, on balance, a project as proposed is in the interest of the public. It requires that the Commission find that there would be a detriment to the public welfare were the Commission to deny the project. The Commission recognizes that it is clearly in the interest of the San Diego region to develop local and reliable water sources and that seawater desalination is a part of this portfolio. For the reasons below, the Commission finds that denial of the proposed project is not in the public interest.

- **Effects of environmental impacts on public welfare:** Through imposition of **Special Conditions 8 and 10**, the Commission finds that the project as mitigated will address the need to improve marine life productivity and will therefore be consistent with the goals of Sections 30230 and 30231. The Lagoon also provides many beneficial uses to the public that this project will support through continued and increased opportunities for public access, ongoing use for marine life science and research, and others. Additionally, **Special Condition 12** requires

Poseidon to obtain separate coastal development permits for any proposed future dredging activities in the Lagoon, which will ensure those activities conform to applicable Coastal Act provisions.

- **Public welfare as applied to public or private water supplies:** As noted in the Commission's 2004 report, Seawater Desalination and the California Coastal Act:

> *A fundamental Coastal Act principle is that many coastal resources are imbued with a public interest and value that must be vigorously protected for the benefit of current and future generations. Unlike many coastal resources that are privately owned, ocean water, and the uses and values it embodies, constitute a public trust resource held in common for public use and enjoyment. This principle is codified in numerous federal and state laws and regulations, including the Coastal Act... Notwithstanding the public nature of coastal ocean waters, use of such waters and of living and non-living resources in and under them have historically been allowed for non-public purposes.*
>
> *Ocean water serves a number of beneficial uses and vital environmental, social, and economic functions. It is part of the shared public "commons", it serves as habitat for a multitude of species, it is a source of food and livelihood for society, and it is used to support transportation, commerce, recreation, and other important societal uses. For the most part, these uses are non-consumptive and sustainable, in that using ocean water for one of these purposes does not necessarily impair its ability to be used for others.*

Privatization of water supplies, in and of itself, may not cause effects on coastal resources different than those caused by a public agency. Most differences would be due to how each type of entity implements its water use. Both public and private projects may include particular characteristics that change how they affect resources and how they meet the public interest. Further, California has recognized there is a role for private water purveyors and for providers of other basic utilities such as gas and electricity. The state has a system to regulate public and private utilities to ensure that public interests are being met.

Private entities can clearly bring benefits to public agencies. One of the benefits stated by the public agencies involved with Poseidon's proposed project is that Poseidon is willing to provide the initial capital investment and obtain the approvals needed to build and operate the facility, which can represent a significant savings to public agencies. However, this benefit comes with risks and costs, as noted by the Commission in previous decisions.

The Commission in the past has both approved and denied proposed private desalination facilities. For example, it approved a privately-owned facility on Catalina Island in part because there were no feasible alternatives for the proposal. In 1994, the Commission denied construction of a private desalination facility (A-3-SNC-94-008-E2, Sterling Center in the City of Sand City) based in part that it would result in fragmentation of public works facilities. In 1995, the Commission's Findings for an adopted LCP amendment to the Santa Barbara Coastal Program stated: "Private desalination facilities also raise the basic policy question of the effect of allowing the proliferation of privately owned and operated water supply facilities on the ability to comprehensively plan for the provision of essential public services". Those Findings go on to express concerns about the abilities of private owners to operate and be accountable for desalination operations, to mitigate associated impacts, to maintain the facility in a manner

necessary for public health and environmental safety, and other issues. The Findings also state that proliferation of private desalination facilities could fragment public utility services.[127] They conclude by stating that proliferation of such facilities where consolidation is feasible is inconsistent with the Coastal Act. In 1997, the Commission found in its consideration of a LUP update in San Luis Obispo County that a proposed desalination facility would be inconsistent with Coastal Act policies because it would provide for continued urban development that could not be supported by existing water supplies.

The recent history of privatizing water services has identified some of these risks and has resulted in some key questions about such proposals: Will there be adequate public oversight and monitoring, and transparency in decision-making and financial issues?; What measures will ensure that ecosystem values are protected?; How will privatization affect initiatives related to water-use efficiency and conservation?; and, What happens if it doesn't work?[128]

Regarding transparency in decision-making and financial issues, both the State Desalination Task Force and the California Resources Agency have recognized that private desalination proponents should disclose the same information as that disclosed by public entities.[129] Public water districts are required by law to publish financial statements that disclose the basis of a district's revenues, costs, cash flow, and other basic economic data that describe the financial health of the district. These statements are public documents and serve to inform the public about the basis for a district's rates, the need for additional funding for various projects, etc. Many districts provide this information on their websites, along with meeting agendas, meeting minutes, information about health and safety-related characteristics of their water supplies, and other information useful to the public to find out about its water and about the important decisions to be made about its water supply. Poseidon's water purchase agreements with the eight municipal water agencies that will be purchasing water from the project are public documents, which provide the public with transparency regarding the project's financial relationship with the agencies.[130]

Additionally, as noted previously in Section 4.2 of these Findings, Poseidon's contracts with the Carlsbad Municipal Water District provide that the Water District could assume operation or ownership of the facility if necessary, and Poseidon is required to post securities to ensure site remediation or removal of the facility, if warranted. Additionally, Poseidon's water purchase agreements with the various public water districts primarily obligate the purchasers to buy up to a certain amount of water at a specified price. Decisions about use and distribution of that water will remain the purview of these public water districts.

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[127] However, the San Diego County Water Authority supports the desalination facility and passed a resolution on June 28, 2007 in support of the Project finding that "the Carlsbad Desalination Project is essential to the Water Authority's ability to achieve the supply diversification goals contained in the 2005 UWMP [Urban Water Management Plan]."

[128] See the Pacific Institute's report, *The New Economy of Water: The Risks and Benefits of Globalization and Privatization of Fresh Water*, February 2002.

[129] See State Desalination Task Force recommendations and March 15, 2004 letter from Resources Secretary Mike Chrisman to Coastal Commission.

[130] See Reporter's Transcript of Proceedings, Application No. E-06-013, November 15, 2007, Agenda Item No. 7.a., at p. 275-276.

Overall, however, the Commission recognizes the importance and the urgency in providing a reliable water supply in the San Diego region during a time of declining availability of imported water and a time of significant fiscal constraints on public water agencies. Even with regional initiatives to emphasize water conservation and to reuse existing supplies, the population and economy of the San Diego area is heavily reliant on maintaining and creating an adequate water supply such as the supply created by this facility. Further, this facility's initial development and construction costs, which are expected to exceed $300 million, will be borne directly by a willing private entity rather than by the water districts that have agreed to purchase the water produced at the facility. Further, as noted above, the San Diego County Water Authority withdrew its proposal to construct a desalination facility at this site, leaving Poseidon as the only entity willing to undertake construction and operation. The Commission therefore finds in this case that it is in the public interest to allow private development of a portion of the region's water supply.

- **The combination of this facility and other alternatives provide for the public welfare:** The Commission also believes that in combination with a well-designed desalination facility that conforms to Coastal Act provisions, other water sources are available to provide a local and reliable water supply. These other sources, including conservation, recycling, and others, are feasible, less environmentally damaging, and are already being done to some degree in the San Diego area and elsewhere.

  Regarding conservation, it is considered the least expensive and often the least environmentally damaging type of local water supply. Water users and providers in the San Diego region have already implemented a number of effective conservation measures to increase the local water supply and have recognized it as a necessary part of the regional water portfolio. For example, the San Diego County Water Authority's May 2007 draft *Blueprint for Water Conservation* states that conservation is the cheapest form of new water supplies and shows that it expects conservation to go from providing about seven percent of the region's supply (about 51,000 acre-feet per year) to about twelve percent (100,000 acre-feet per year) by 2030. As noted previously in these Findings, the Blueprint also shows that seawater desalination is expected to provide about ten percent (89,000 acre-feet per year) of the regional supply by 2030. Similarly, in March 2002, the San Diego County Board of Supervisors adopted Policy No. A-106, which emphasizes the need for water conservation as a significant part of the County's water portfolio.

  The region could develop even more new water through conservation, similar to other coastal areas in California with limited local water supplies but with ongoing growth. For example, in Long Beach, conservation is expected to provide 15 percent of the water supply by 2015, and in the Monterey County area, conservation accounts for about twenty percent of the supply. Applying those percentages to San Diego's total expected water use in 2030 would result in conservation supplies of about 125,000 to 160,000 acre-feet per year.

  Although many of the region's water districts have developed effective conservation programs, there are still a substantial number of conservation measures and initiatives that could provide significant amounts of water. For example, many of the agencies that have agreed to purchase water from Poseidon are members of the California Urban Water Conservation Council, which has developed a menu of cost-effective Best Management Practices (BMPs) to reduce urban water use. These member agencies are implementing some, but not all, of the Council's fourteen adopted BMPs, suggesting that there is an as-of-yet untapped source of conservation water

available. Other sources include recycling and even indirect potable reuse. Carlsbad recently reported that it is using less than half the recycled water it has available to it, which suggests it has an underused local and reliable option.[131] We note, too, for example, that the same treatment system Poseidon proposes for its facility is used in indirect potable reuse applications. The Commission expects that the use of these and other conservation measures will continue and will increase, with or without the proposed project.

Even with these conservation measures in place and with other conservation measures still available, the Commission finds that it is in the public interest for this desalination facility to provide water that augments these other sources. The project would provide an important and much-needed source of potable water for Southern California. Since Poseidon filed its CDP application, the water supply situation in the State of California – already bad – has substantially deteriorated. Poseidon has previously provided the Commission with newspaper reports that recognize a looming water crisis and clearly identify the need for California, and more specifically San Diego County, to lessen its demand on the State Water Project and Colorado River watersheds, which were critically dry in 2007.[132]

State, regional, and local water plans all have confirmed that the immediate and pressing water needs are so great, that they cannot be met by conservation and recycled water alone and that a substantial investment in seawater desalination, including the project, is required. The project's capacity of 56,000 AFY of new water supply for the San Diego region is about ten percent of 500,000 AFY of desalinated water identified by the California Department of Water Resources as needed by 2030, as stated in its 2006 Water Plan Update. This Update lists the project as a potential source of desalinated water. The Metropolitan Water District of Southern California's Integrated Water Resources Plan identified a need for 150,000 AFY of seawater desalination (including 56,000 AFY from the Carlsbad project) to ensure regional water supply reliability. In addition, the San Diego County Water Authority updated its 2005 Urban Water Management Plan in April 2007 specifically to reaffirm the need for 56,000 AFY of seawater desalination from the project by 2011. The project is a central component of state, regional and local water supply planning to meet already-identified demand.[133]

Eight public water agencies have already entered into long-term agreements with Poseidon to receive 100% of the supply of desalinated water from the project. These agencies have some of the most aggressive water recycling programs in the region, but they have stressed the need for desalinated water to ensure regional water supply reliability and to meet existing demands and planned-for future growth, and they have identified the project's water supply as a component of their water plans.[134] The entire plant's output will be put to public use by these public agency partners, ensuring that the water will remain in the public domain.

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[131] See Carlsbad's 2007 *State of Effectiveness Report.*

[132] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at p. 5.

[133] See id. at p. 6.

[134] See Poseidon Resources Corporation, *Letter to State Lands Commission Executive Director re: Desalination Project's Impact on Imported Water Use*, November 8, 2007 (including attachments from water districts); Poseidon Resources Corporation, *Carlsbad Desalination Project Briefing Package*, CDP Application No. E-06-013, November 2007.

Public agencies will continue to control the allocation and use of the water, so local government oversight will be preserved. Under Poseidon's contracts with each public water agency, the customers' price of water will not exceed the price that the customer would have paid for the imported water supply from the San Diego County Water Authority.

The region expects further restrictions in the amount of water being imported to the area. If the restrictions are as severe as expected – i.e., reductions of up to about 30% -- it will need to rely on conservation, desalination, and other means to make up the water deficit. This facility is therefore a necessary and integral part of the region's water portfolio.

- **Public benefits resulting from increased shoreline access opportunities:** In addition to the above public welfare benefits, the project will result in increased access to the shoreline of both Agua Hedionda Lagoon and the Pacific Ocean. As part of its project, Poseidon has offered to dedicate for public use four sites totaling about 15 acres on or near the shore of both the Lagoon and the ocean. The dedicated area will not only provide greater public access to formerly private ocean and Lagoon front property, but it will provide additional opportunities for recreation, fishing and marine research and restoration.[135] Specifically, the dedicated area would be used for expansion of the existing fish hatchery and aquatic research uses, a fishing beach, recreation and coastal access, and public parking. To ensure the sites are made available for public use, **Special Condition 11** requires that, prior to starting operations of the desalination facility, Poseidon ensure these parcels are dedicated for public access and recreation as described in the City's Precise Development Plan #PDP 00-02. These public access dedications provide adequate conformity to the Coastal Act's public access provisions. One of the Coastal Act's primary goals is to maximize public access and recreational opportunities along the coast[136], and the project's public access aspects support that goal.

Based on the above, the Commission finds that the proposed project meets the final test of Section 30260.

## *Conclusion*

The Commission recognizes that the San Diego region is clearly in need of reliable and local water sources. As noted above, the Commission has found that this coastal-dependent industrial facility, as conditioned, conforms to all applicable Coastal Act policies except Section 30233(c). However, the Commission has determined through applying the three tests above that the project conforms to the "override" provisions of Coastal Act 30260 provided for such facilities. The Commission therefore finds that by meeting the requirements of these three tests and with imposition of the **Special Conditions** described previously in these Findings, the project conforms to Coastal Act Section 30260. The Commission may therefore approve the project pursuant to that Coastal Act policy.

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[135] See Poseidon Resources Corporation, *Response to Staff Report*, November 9, 2007, Exh. A at p. 4, 26.

[136] See, for example, Coastal Act Section 30001.5, which states in relevant part: "The Legislature further finds and declares that the basic goals of the state for the coastal zone are to... (c) Maximize public access to and along the coast and maximize public recreational opportunities in the coastal zone consistent with sound resources conservation principles and constitutionally protected rights of property owners."

## 5.0 CALIFORNIA ENVIRONMENTAL QUALITY ACT

On June 13, 2006, the City of Carlsbad certified an Environmental Impact Report for the proposed project. In addition, Section 13096 of the Commission's administrative regulations requires Commission approval of CDP applications to be supported by a finding showing the application, as modified by any conditions of approval, to be consistent with any applicable requirements of the California Environmental Quality Act (CEQA). Public Resources Code Section 21080.5(d)(2)(A) prohibits approval of a proposed development if there are feasible alternatives or feasible mitigation measures available that would substantially lessen any significant impacts that the activity may have on the environment.

As discussed above, although the project is not an allowable use pursuant to Section 30233(c), it is a coastal-dependent industrial facility and the Commission has therefore approved the project pursuant to the policies of Coastal Act Section 30260, which allows such projects to be approved if the Commission finds there are no feasible less environmentally damaging alternative locations, that all adverse environmental impacts are mitigated to the maximum extent feasible, and that to not approve the project would not be in the public welfare. Pursuant to these Findings and the review conducted in the City of Carlsbad's EIR, the project includes all available and feasible measures to avoid or minimize significant adverse environmental impacts. There are no feasible alternatives or feasible mitigation measures available that would substantially lessen any significant adverse impact that the activity would have on the environment. Therefore, the Commission finds that the proposed project, as conditioned, is consistent with the requirements of CEQA.

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- Planning Commission Resolution No. 6093 - SUP 05-04
- Planning Commission Resolution No. 6092 - CDP 04-41
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- Poseidon Resources Corporation. Appeal of California Coastal Commission's July 3, 2007 Notice of Incomplete, July 6, 2007.
- Poseidon Resources Corporation. Response to California Coastal Commission's July 3, 2007 Request for Additional Information (including attachments), July 16, 2007.
- Poseidon Resources Corporation. Additional Analysis of Submerged Seabed Intake Gallery (including attachments), October 8, 2007.
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- Poseidon Resources Corporation. Letter to Chairman Kruer and Honorable Commissioners Attaching Draft Proposed Conditions of Approval, November 7, 2007.
- Poseidon Resources Corporation. Letter to State Lands Commission Executive Director Re: Desalination Project's Impact on Imported Water Use, November 8, 2007, including the following attachments:
    - Carlsbad Municipal Water District. Letter to State Lands Commission Executive Director Re: Desalination Project's Impact on Imported Water Use (including attachments), November 7, 2007.
    - Valley Center Municipal Water District. Letter to State Lands Commission Executive Director Re: Desalination Project's Impact on Imported Water Use (including attachments), November 6, 2007.
    - Rincon del Diablo Municipal Water District. Letter to State Lands Commission Executive Director Re: Desalination Project's Impact on Imported Water Use (including attachments), November 6, 2007.
    - Rainbow Municipal Water District. Letter to State Lands Commission Executive Director Re: Desalination Project's Impact on Imported Water Use (including attachments), November 6, 2007.
    - Sweetwater Authority. Letter to State Lands Commission Executive Director Re: Desalination Project's Impact on Imported Water Use (including attachments), November 6, 2007.
    - Vallecitos Water District. Letter to State Lands Commission Executive Director Re: Desalination Project's Impact on Imported Water Use (including attachments), November 6, 2007.
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- Exhibit A: Response to Staff Report
- Exhibit B: Correction of Staff Report Misstatements, Inaccuracies and Omissions
- Exhibit C: Draft Proposed Conditions of Approval
- Exhibit D: Climate Action Plan, November 2007
- Exhibit E: Requested Additions to Substantive File Documents

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REPORTER'S TRANSCRIPT OF PROCEEDINGS

Wednesday
August 6, 2008
Agenda Items Nos. 4.a., 5.a., 5.b.

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Council Chambers
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With that -- oh, go ahead, sir.

**MR. KORTHOF:** Doug Korthof, and I am a member of the general public, and I come from Seal Beach, and I have good news, and bad news, but it is the same. The good news and the bad news there will never by a geyser of water coming from desalination. You know, we have to rely upon other methods, such as conservation, and reclamation. That is the facts.

The outrageous thing here, we are talking about, Poseidon says there are no impacts to their air pollution. The idea that this is all new water, all old water, is very difficult to swallow. In reality, what will happen is it will go into new construction, and you know, we have 200 gallons a day goes in, and 100 gallon a day goes out in sewage, and the more people the more usage.

Some of this water will probably all go to new construction, because you have to have new water before you can justify new construction.

Now, this is an enormous use of energy. It is about $500 in current prices per acre foot in electrical costs alone, that is the electrical costs. And, it is extremely energy intensive.

Now, MWD says they will pay $250 in subsidies, but what the reality is, is that we will pay, all over California, we will be chipping in for San Diego's water, and

$250 will be the start of it -- if it ever happens -- and there will be much more. It will by a geyser of money from everybody in California, as MWD is nothing but us.

What I suggest, if Poseidon has a problem finding offsets, and I think that you have to worry about things like credits. The California Air Resources Board hands out credits like candy. They give extra credits, partial credits, and credits all over the place. The only real credits that count are the benefits to the communities.

I suggest that it would be a lot easier for Poseidon, so long as it exists in this incarnation -- we know it is not going anyway -- why don't they do something like finance solar power? We installed solar power systems all throughout California, and Poseidon could do something like, you know, the amortized costs for solar power on your roof is less than the cost of the utility electric that it replaces.

So, if Poseidon puts in solar power on the roofs of houses in Carlsbad, you know, it wouldn't have to cost them any money at all. All they would have to do is float the bonds, could be public service bonds, tax free bonds, put in solar power, and the vast majority of the money comes from the citizens. They could, maybe, give a little bit extra, and finance it, and the majority of the money and the private property -- the roofs come from the citizens, and this would be a real benefit for the local communities. It wouldn't

involve arcane credits, and replanting trees that are just going to be burned down again as the climate is changing, and would actually have a benefit for the people of Carlsbad, and Oceanside, and all of San Diego.

So, I think that that would be the best way, if you are going to do offset credits, you know, so long as Poseidon exists, which will be for long.

**CHAIR KRUER:** Thank you, sir.

And, with that, that was the last speaker slip, and now we are going to have rebuttal. We will go back to Mr. Zbur, and you have five minutes for Poseidon.

**MR. ZBUR:** Good afternoon, Chairman and members of the Commission. I just wanted to make a couple of responses, and then Mr. MacLaggan, I think, will finish, if I have any additional time.

First point I wanted to address was Mr. Mitton's assertion that we have asserted that water will not be used in other places. That is actually not accurate. What we have said is that Poseidon's customers, the water districts, have agreed to replace the water, and therefore that the water that is replaced, where that goes is speculative, but wherever it goes, CEQA will apply to require those people to mitigate it.

So, our view is that the new users of the water should be responsible for the environmental mitigation of

that. That is consistent with CEQA methodology. That is consistent with -- we have assurances that the attorney general will enforce that.

In addition, this Commission determined that the project was not growth inducing. That was part of your findings. The requirement that Poseidon be assigned the mitigation for the replaced water is just not consistent with the determination that you have already made that the project is not growth inducing.

Another point that we wanted to address is the request by Mr. Massara that the AB32 criteria should apply to the energy reduction from replaced water. This is really the key issue related to the growth versus net issue, and is the crux of what is before the Commission. Essentially, what the staff does is they apply these vague principles to the replaced water, which, in effect, would impose the growth requirements, because the principles would require that the replaced water would have contractual agreements that the replaced water would be retired and not used by anyone. That effectively would not allow -- it effectually imposes the growth requirement.

Your staff has indicated that it does not have the expertise in this area to evaluate this. Each of the agencies that are responsible for the implementation of AB32, have supported Poseidon's ability to take credit for the

replaced water, and in the packets are the letters from the California Air Resources Board, the California Energy Commission, the Resources Agencies are in the blue packet we distributed. They have supported the net approach, and supported Poseidon's calculation of the net approach.

Finally, the last point I would like to raise is with respects to the references to the committee to verify the offsets that was originally in the Poseidon's proposal. I am a little bit frustrated, in that what we are asking you to adopt today is the proposal that is attached to your green sheet. We made a number of changes to respond to the staff's concerns when we got the staff report a week ago Friday. We got those into the staff, and the staff has not responded to the changes that we made to address their concerns.

One of those was that they said that they had a concern about the committee verifying the offsets. The committee that we had originally proposed, included Poseidon, it included CCSE, the California Center for Sustainable Energy, and the San Diego APCD, a three-member committee.

The APCD had concerns about their ability to do this, because of their authority, so that was an issue that I think was valid upon the staff's part. They recommended, instead, that we buy all of our offsets through CCAR. We have not problems buying our offsets through CCAR. We think they are a high quality verifier. Our concern is that CCAR

is in very early stages of the implementation.

As you heard, they have three forestation protocols, one for land fills and one for dairies. That really limits the offsets we can buy in the early year, and while we are hopeful that they will progress fast with these other protocols out there, we want to be able to buy offsets in the broadest market to keep the costs reasonable.

So, what we have done is, the proposal you have takes out the committee that the staff had concerns about, and it says we will buy credits through CCAR, or three of the other entities that are all part of the offset quality initiative, which are listed in your program, that we think that they are equivalently high quality entities. CCAR is one of the four entities that is a member of that quality initiative, and includes some other think tanks that don't sell credits, but that is what we are proposing. So, we do think that these are CCAR equivalents. It would broaden out the market, and that is really our proposal.

There are some other things that are in there, that we tried to respond to the staff's concerns, which I don't think I am going to have time to go through, but we would be happy to walk you through that if you have any questions related to the proposals.

So, the main things that are in that are the differences on gross and nets, and in order to apply the net

approach, you need to not apply these AB32 principles to the offsets to the replaced water. The application, by definition, means that Poseidon cannot take credit for it. The other main differences are the CCAR issue, with the three other entities, and the two contingency plans.

If I have any more time, I would like to --

**CHAIR KRUER:** You don't.

**MR. ZBUR:** No, so.

**CHAIR KRUER:** Thank you.

**MR. ZBUR:** We will close.

**CHAIR KRUER:** Appreciate it.

With that, I will close the public hearing and go back to staff for staff response.

Mr. Luster.

**ENVIRONMENTAL SPECIALIST LUSTER:** Thank you, Chair Kruer. I'll start with a number of comments.

First, in response to the last comment by Mr. Zbur, staff did respond to Poseidon's latest changes last week. We concurred with Poseidon's proposal to allow the use of CARB, CCAR and additionally any programs adopted by state air districts for any of their emission reduction programs.

We did not concur with Poseidon's proposal allowing use of programs developed by any government entity. We weren't sure how widespread that would be, that could include all sorts of things, water districts, very small

government entities that may not have the expertise, but we did concur with their proposal to use air districts, along with CCAR and CARB for approved programs. We didn't concur with their proposal to allow them to use SDG&E programs.

And, regarding the proposal to change their committee structure for reporting, we asked for more information about that. We didn't have enough information to go on. They just said that they were going to do away with that, and we had some more questions about it, and we haven't heard what those changes are. They may be reflected in this latest document, but we haven't had a chance to review that, yet.

Going on, just covering on AB32, Poseidon is subject to the *Coastal Act* and the only methods to address greenhouse gas emissions that are approved by the state are those established in AB32, so through your findings and Special Condition, staff is recommending that Poseidon's Greenhouse Gas Emission Reduction Program be implemented using the guidelines provided by AB32. The *Coastal Act* doesn't have independent guidance on how to deal with those issues, so staff believes the best and only real protocols and mechanisms approved at the state level are those that are being developed and are developed through AB32.

Poseidon has also asked to use some emission reduction methods not established through the state system.

For example, they reference the offset quality initiative, which includes three entities, the Climate Trust, the Environmental Resources Trust, and the Climate Group.

Staff researched what was available through these entities, and found that they do not have consistent standards or protocols, so staff believes Poseidon's proposal would be confusing and onerous to implement, and would not provide the level of independent verification the state has identified as a necessary part of its greenhouse gas reduction approach.

Additionally, AB32 does have mechanisms for developing these guidelines and protocols for voluntary efforts for regulated entities, pretty much any sort of emission reduction measure that is meant to be part of the state's program, regulated community, voluntary, market based incentives are covered by AB32, and we believe that is the appropriate method to use.

That has also been supported by the agencies we've worked with. You heard from CARB. They still support the use of AB32. The air district supports staff's recommend-ations, so we believe our coordination efforts with the involved agencies supports staff's recommendations, as well.

Regarding comments about the Commission's authority being limited by *Coastal Act* provisions. Staff is not suggesting imposing an emission control program,

therefore we don't believe our proposal is inconsistent with Section 30414. It is not inconsistent with what CARB is doing, and in fact CARB and the air district supports the use of AB32.

Additional authority the Commission has for implementing this program, is through the use of Section 30260, the override as determined in your findings. The findings state that the project's adverse effects will be mitigated to the maximum extent feasible, and staff's recommendation would help carry out that aspect of the Commission's findings.

Regarding gross versus net, that whole question, again staff is not asking that Poseidon mitigate its gross emissions, just the net. Much of the difference in the two proposals is that staff is addressing the expected net emissions from the facility's electrical use, and Poseidon is relying on speculative changes in water deliveries to somehow reduce emissions. As you have heard several times today, the state water project will not necessarily reduce its electrical use or its emissions, due to Poseidon's project.

The state water project is affected by any number of issues that may increase or decrease its pumping rates, and regardless of how those issues play out, Poseidon's project is expected to continually use about 30 megawatts of electricity to produce its water, and the emissions would

result from that use of that electricity.

Also, regarding the state water project, you received a letter from the Metropolitan Water District. The letter, however, is not consistent with the Met's program that establishes its desal incentives, or Met's water management plans. Met describes its desal program as allowing Metropolitan to redirect imports, not necessarily reduce them. For example, Met's recent integrated water resources plan from 2004 -- which staff is adding to the record -- states that desal is expected to offset water use in one area of its service area, and allow it to send additional imported water to other parts of its service area.

Moreover, Metropolitan doesn't say anything about reducing its electricity use in its emissions, which is the impact that the Commission is addressing today. Even at the local level, some of the planning documents from as recently as earlier this year, from the water districts Poseidon has contracted with, show expected increase in imports over the next 25 years, in addition to their desalination supplies.

For example, the January 2008 update of the Oliveheim Water District urban water management plan -- which staff is adding to the record -- shows that it and three other associated districts will increase their imports.

Further, the state water project has a lower emission factor than Poseidon's electricity supplies, so if

there is an offset, it would be a much lower level than Poseidon proposes. Similarly, in the San Diego region, much of the imported water comes from the Colorado River, and pumping that supply has its own emission factor adding more complexity to the issue.

Again, however, staff is not asking that you decide this question today, but to allow the agencies with expertise to make the determination to work through these issues and to figure out what offset, if any, is appropriate.

You also heard a comment earlier about staff treating an Edison project differently than this project. We are not recommending emission reduction requirements for that project, because its net emissions are so low. You will hear the details of that project a little later, today, but if you would like, Ms. Dettmer is available now to answer any questions you may have about the difference between the Edison project and Poseidon's.

I believe the Edison project is in the range of something like 750 tons of emissions over its 30-year life. With Poseidon, their gross emission are expected to be about 90,000 tons per year, so there is a significant range between the two projects, and staff believe that the Edison project is small enough whereas Poseidon's was significant enough for the Commission to handle.

Regarding CEQA, we should note that the project's

environmental impact report did not address greenhouse gas emissions at all, and so the Commission establishes the baseline, just Poseidon's project, what emissions would result from it.

I also want to note that the California Air Pollution Control Officers Association, in January published its report called CEQA and climate change -- which staff is adding to the record -- and it provides guidance on how it intends to address climate change issues through CEQA, including those associated with meeting AB32's emission reduction targets.

Staff believes this provides further support for staff's recommendation that the Commission allow the air districts, along with CARB and CCAR to address the issues involved with vrifying Poseidon's proposed plan.

A couple of points on the cost of the mitigation, based on your findings, staff's recommendations will not prevent the project from being built, or render the project economically infeasible. Your findings identify costs of up to several hundred dollars per acre foot, above Poseidon's stated costs, and Poseidon has stated that had it included those cost then its assessment of project feasibility -- Poseidon's proposed $6 million program over 30 years -- would increase the costs of its water by about $3.50 per acre foot, and its estimates of $32 million would add about $19 per acre

foot, and that is well below the range of the costs that staff identified in the report, and that Poseidon said it had already assessed as part of its feasibility.

We note, too, that an even larger desal facility being built in Australia has committed to use entirely renewable energy for its operations, and will purchase that energy using a government regulated offset program, which is similar to what staff is proposing in having Poseidon use CARB CCAR or air district approved measures.

And, I think that is all that I have for now. I believe Ms. Schmeltzer and Director Douglas have something.

**EXECUTIVE DIRECTOR DOUGLAS:** I just have a couple of comments, and then ask Ms. Schmeltzer to address some of the legal issues Mr. Zbur raised.

But, I just want to underscore, again, the assertion that somehow we are using Coastal Commission authority to subject Poseidon to AB32 is simply wrong. We recognize that this project is not subject to AB32 controls at this time, but what we are saying is we are using the *Coastal Act* the policies and authorities that you have under the *Coastal Act*, and the responsibility that this Commission has to protect coastal resources consistent with the policies in the *Coastal Act* leads to a requirement for greenhouse gas mitigation, and offsets and reductions of emissions. And, that the best way to deal with that is to use the protocols

and the approaches set forth in AB32, that that makes sense, because that is where the expertise lies.

And, if in fact, Poseidon is going to keep its promise of being carbon neutral, I don't understand why they object to a review by an entity that will, in fact, verify whether or not that is the case, and that is exactly what we have recommended.

In terms of the state water project, or the reductions and the offsets there, that just doesn't make sense to us. We are not talking about water here. We are not talking about displacing or placing water, and where that is going to go. We are talking about the energy that it takes to provide the desalinated water by Poseidon.

And, if they are looking to get credit because there is going to be a reduction in energy generation, or energy use in the state water project, as a result of the Poseidon project, we just don't see how that happens. All of what we have heard is speculative -- that may or may not happen. We have no reason to believe that there is going to be any reduction whatsoever in energy usage for bringing state water from the north to the south, as a result of this, or any other project that we know about at this point. So, that just doesn't match.

But, in any event, we are not saying that it can't work that way, if in fact there is a reduction in energy

usage. We are just saying that that needs to be verified by somebody who has got the expertise, who could look at it, and say, "Yes, indeed, as the result of this project, or but for this project, there would be this level of energy production for the state water project, but because of this project there is going to be a reduction, which means less air emissions, and they get credit for it," they would get it, under our recommendation.

The final point is, we have not said this project is not growth inducing. We have said this project is not growth inducing in the coastal zone. What happens outside of the coastal zone, as a result of this water being freed up for the Met, that they could use elsewhere for projects that are waiting for water, that don't have water now, that is beyond the purview of this Commission, and we have never expressed an opinion on that.

So, I think it is misleading to say that we have concluded this is not growth inducing. It is not growth inducing in the coastal zone.

With that, let me ask Ms. Schmeltzer to make some comments on legal issues.

**CHIEF COUNSEL SCHMELTZER:** Thank you.

Poseidon's attorney, Mr. Zbur, stated that the Commission only had three statutory provisions under which it could assert authority. He specifically mentioned 30253(4)

30253(3) and 30414(a).

The first is the Commission's ability to minimize energy use, which he asserted that Poseidon was doing.

For the second, he paraphrased what that statutory language said, and he said that it said that the Commission may only impose conditions requirements that have been imposed by CARB. That is actually a misstatement of that statutory provision. That provision that says that "For the minimization of adverse impacts new development shall be consistent with the requirements imposed by an air pollution control district, or CARB," which the Commission's staff proposal in having this follow AB32 and CCAR, we believe is consistent, and that it does comply with that, and it is not contrary to it, as described.

In addition, as Mr. Luster described, 30414(a) only talks about not creating a new air program, which again staff is not proposing.

What he left out was 30260, which is the override provision, that the Commission made in its findings that it adopted this morning. Under the override provision of the findings, which begins -- the discussion begins on page 115 of your findings.

There is extensive discussion of adverse impacts, the impacts to coastal resources that can occur from green-house gas emissions, and global warming, and the Commission

does have the authority, and does exert that authority under Special Condition 10, in this case, and so the authority for Special Condition 10 also flows from 30260.

**CHAIR KRUER:** Okay, thank you, is that it from staff.

**EXECUTIVE DIRECTOR DOUGLAS:** Yes.

**CHAIR KRUER:** Thank you for your presentation, and your comments.

Now, I will go to the Commission, and Commissioner Hueso, first, and then Commissioner Reilly.

[ **MOTION** ]

**COMMISSIONER HUESO:** Yes, I move that the Commission approve the Energy Minimization and Greenhouse Gas Reduction Plan as attached to the letter submitted by the permittee, Poseidon Resources LLC, dated August 6, 2008, as compliant with Special Condition 10 of the Coastal Development Permit E-06-013.

**CHAIR KRUER:** I have a motion, is there a "second"?

**COMMISSIONER POTTER:** Second.

**CHAIR KRUER:** Seconded by Commissioner Potter --

**EXECUTIVE DIRECTOR DOUGLAS:** Mr. Chairman.

**CHAIR KRUER:** What?

**EXECUTIVE DIRECTOR DOUGLAS:** I just wanted to check with counsel.

The motion that staff has recommended, I am just wondering whether that is the motion that needs to be made, and then that motion needs to be amended, or whether or not the motion proposed by Commissioner Hueso is the correct way to go? I thought it needed to be --

**CHAIR KRUER:** I don't think so, but, we will see what the attorney says, but I think -- I am not a lawyer, but it sounds like he can do it.

**CHIEF COUNSEL SCHMELTZER:** It would be helpful if the entire motion was read. I think you just referred to the motion as it was stated here, but if you could read the whole motion into the record, that would be helpful.

**COMMISSIONER HUESO:** I actually did, but you want me to also state the resolution to the proof.

**CHIEF COUNSEL SCHMELTZER:** I have that, so I --

**COMMISSIONER HUESO:** I did.

**CHAIR KRUER:** He did read the whole motion.

**CHIEF COUNSEL SCHMELTZER:** Okay.

**CHAIR KRUER:** And, the question was, can he do it that way? to the general counsel, from Director Douglas. And, I think he can.

**CHIEF COUNSEL SCHMELTZER:** Yes.

**CHAIR KRUER:** So, with that, and there has been a "second" by Commissioner Potter.

Commissioner Hueso, would you like to speak to

your motion?

**COMMISSIONER HUESO:** Yes, and I have some questions of staff.

**CHAIR KRUER:** That's fine.

**COMMISSIONER HUESO:** This came back to the air quality issues, specifically to this project.

What disturbed me a little bit -- and I will just give you some general feedback concerning the Oxnard facility -- you said that facility doesn't generate a lot of energy, so you don't really see fit to apply the state's AB32 regulations to that project, because it was not a big generator.

What are we talking about, in terms of the amount of wattage that that facility is going to be generating? just to compare it to this project? do we know what the amounts are, in terms of this project is going to be using 50 megawatts, per year, or is it -- what is the usage of this desal project?

**EXECUTIVE DIRECTOR DOUGLAS:** Okay.

**COMMISSIONER HUESO:** And, if we can get that as a comparison to the Oxnard one?

**EXECUTIVE DIRECTOR DOUGLAS:** Well, Allison is going to come back and address this, she has been working on it.

But, just so that you know, we have been looking

at projects coming before the Commission, and as we have indicated to you before, we are only suggesting the application of greenhouse gas reduction conditions on major projects, that have major emissions per year of carbons. We are not applying them to every project that comes along.

So, we have identified new subdivisions; we have identified new Caltrans projects, major energy projects, but when we looked at this particular project -- and Allison can explain to you why -- we just felt it was not an area where we wanted to enter into this particular issue.

**COMMISSIONER HUESO:** I understand that, and just to get an idea of what criteria you are using, what are we talking about here? in differences?

**COASTAL PROGRAM MANAGER DETTMER:** Sure, for the Edison project, on your agenda later today, we did ask Edison to do a greenhouse gas analysis, which they did do. They submitted their calculations to us, as well as their analysis of what their net emissions would be over the 30-year life of the project.

We had that analysis peer reviewed, independently reviewed by Steve Radus with Marine Research Specialists. At the end of the day, Mr. Radus agreed with Edison's analysis. And, what the conclusion was, was that over the 30-year life of the project, there would be about 726 metric tons of CO2 emitted, and that is over a 30-year period, which is a

relatively small number. In the staff report, we go through that, and we give an example that that equates to driving 8 Prius for 15,000 miles over that 30-year period.

And, just to back up a little bit, Edison's project is a direct emitter, and so they will come under AB32 requirements, probably in the next 3 or 4 years. I understand that may be 2011 or 2012, and they will be regulated system wide.

So, what we were looking at for the Coastal Commission is to actually look at that gap, if Edison had their project approved, and that they were going to be in operational phase later in 2008, that this Commission would consider, possibly, requiring mitigation or offsets for that gap period, so maybe for the next 4 or 5 years. So, we are really talking about a very small number.

So, in staff's judgment, we did not think that this Commission needed to require mitigation or offsets.

**COMMISSIONER HUESO:** But, you didn't answer the question about what the desal facility --

**ENVIRONMENTAL SPECIALIST LUSTER:** Yes.

**COMMISSIONER HUESO:** Okay.

**ENVIRONMENTAL SPECIALIST LUSTER:** The Edison project, as Allison said, is just over 700 tons, over a 30-year life. Poseidon's project looks like about 2.7 million tons over the 30-life of this project, so

substantially greater, and that is why Commission staff worked so hard on this emission reduction program for the Poseidon project.

**COMMISSIONER HUESO:** In and around the facility, itself, in and around the plant, will the air quality be effected in the area around the plant? will the facility be discharging pollutants in the area in which the construction for this project is proposed?

**ENVIRONMENTAL SPECIALIST LUSTER:** Our understanding of --

**COMMISSIONER HUESO:** And, the specific number of the 2.7 million, will that discharge be in and around the facility --

**EXECUTIVE DIRECTOR DOUGLAS:** No.

**COMMISSIONER HUESO:** -- of the plant?

**ENVIRONMENTAL SPECIALIST LUSTER:** That discharge is just from the electrical generation needed to run the plant, so the air quality impacts would be based on where the energy production facilities are. If they use some of the power from the Encino Power Plant, there could be some nearby emission effects.

**COMMISSIONER HUESO:** So, we don't necessarily know where this project is going to effect the air quality?

**ENVIRONMENTAL SPECIALIST LUSTER:** Because we are only looking at greenhouse gas emissions, that is not really

considered a local problem, as much as a world wide problem and so, generally, any emission reduction anywhere in the world affects the greenhouse gas problem.

**EXECUTIVE DIRECTOR DOUGLAS:** Well, it is also a difference. It is not an air pollutant. We are not talking about that. We are talking about emissions of a gas that goes into the atmosphere, and that effects the climate, and the temperature on the planet, not the kind of air pollutants that are discharged and regulated by air pollution control limits. So, it does not affect the air quality around the facility.

**COMMISSIONER HUESO:** Because every project we've looked at -- you have cited some projects, like the LNG where we looked at air quality, where air quality in the area of the coastal resources were directly affected, and because you use those as examples, I thought it was slightly misleading because we were talking about air quality in the coastal zone, and here we are talking about air quality regionally, statewide or --

**EXECUTIVE DIRECTOR DOUGLAS:** In the LNG case, for example, one of the big issues was air quality, separate from greenhouse gases, they are distinct.

And, one --

**COMMISSIONER HUESO:** The number had to do with the shifting and the exchange of the material, so it had a more

direct -- from my recollection, in the testimony and the arguments, it had to do more with an immediate impact of the air quality in the area.

**EXECUTIVE DIRECTOR DOUGLAS:** That was a separate issue, and that was one on what rule would be applied, would the onshore rules for air quality, air pollutants, air emissions, be applicable, or would the rules that apply to the islands be applicable? That is for air quality.

For greenhouse gases, that was totally different. That was the question of how much, in terms of greenhouse gases, were going to be emitted, and that was a different issue. Both of those were issues that formed the basis for our recommendation of denial, but they were distinct.

**COMMISSIONER HUESO:** Would you agree that in future years, the power sources that are going to electrify the grid, are going to be more diverse. We might see more wind power come on line? more solar power come on line? more hydro-thermal power? is that something that we contemplate in this action?

**EXECUTIVE DIRECTOR DOUGLAS:** I think it is inevitable, and it is already occurring, and we understand that part of the source here needs to be renewable. We just don't know what that is going to be, unless Tom you have something?

**COMMISSIONER HUESO:** But, it is possible in the

future, that a greater source of our grid is going to come from renewable sources, and sources that are friendly to the environment?

**EXECUTIVE DIRECTOR DOUGLAS:** We hope so.

**COMMISSIONER HUESO:** So, it is possible that this project will have a smaller carbon footprint in future years, if that improves?

**ENVIRONMENTAL SPECIALIST LUSTER:** That is correct, both Poseidon's proposal and staff's are based on an annual reporting and recognition that the emission factor for the San Diego Gas and Electric will change every year, as they put more renewable energy sources on line, their emission factor will go down, and Poseidon would have to, presumably, do fewer mitigation measures, because of that.

**COMMISSIONER HUESO:** But, are you taking that into consideration in our policy, in staff's policy towards this project?

**ENVIRONMENTAL SPECIALIST LUSTER:** Yes.

**CHIEF COUNSEL SCHMELTZER:** Yes, and also, to answer your question, relatively anticipated that that will happen over time, and we can't base mitigation on speculative increases in renewable power in the future. We don't know when those will occur, and how much they will occur, so we can't do something now that relies on something unknown in the future.

But, what we have built into the review process is an annual report that will look at what is happening on the ground as it happens, and then in that way be able to take account of actual improvements to the power grid, as far as renewable resources, as they occur.

**COMMISSIONER HUESO:** Okay, and I think that that is the principal issue that I am looking at here. I think this power plant is definitely a consumer of electricity, thereby having an impact on air quality regionally, and I think we are using, in this instance, the Commission to kind of effect air quality regionally, which I think is a good goal, but I think, from my perspective, we are looking at the *Coastal Act* and it endeavors to specifically concentrate in the coastal zone.

I remember having a project, the Pebble Beach Project, that sought to replace trees in the Del Monte Forest at a rate of 10:1 -- I forget what it was -- and I remember us being told specifically that we cannot mitigate for impacts, you know, outside of the coastal zone in an area that wasn't in the coastal zone, because it wasn't, it wasn't identical, and here we are trying to apply that policy towards air quality, which I think kind of exceeds the scope of coastal area.

But, I understand that this is a very, very sensitive issue, and I am very concerned about air quality,

but there is always, you know, there is always some contradiction in terms of we heard some person speak earlier, during non-agenda public comment, about San Diego's waiver for water treatment, and that we are the only city that obtains a waiver. Well, one of the arguments our city has been making is because we don't go through tertiary treatment, we have been able to show that we haven't negatively affected the coastal resources and the water, due to the depth of our outfall.

But, because of that, we haven't been negatively affecting air quality, because tertiary treatment is a very, very intense industrial use that has an impact on air quality. So, on the one hand, we've been contributing to better air quality to try to find a balance between good water quality, and good air quality, and this is one of those projects that falls into the balance, where we need water, but it is going to affect air quality.

And, from my perspective, in terms of what we are doing in our city, in terms of trying to reduce our dependence on the river delta in Sacramento, this is one those efforts that would really have a real effect on reducing our dependence on the river delta. In addition to conservation, in addition to other methods of retreating water, we are really trying to reduce our dependence on foreign water, and that does have a direct impact on air

quality.

And, I do think that this project will reduce our dependence on outside water, thereby reducing our impacts for air quality, so I do think there is a direct relationship there between this project and our intent to make our city self sufficient, and create a well balanced portfolio of predictable and affordable water.

**CHAIR KRUER:** So, you recommend a "Yes" vote?

**COMMISSIONER HUESO:** So, I recommend a "Yes" vote.

**CHAIR KRUER:** Thank you, sir.

**COMMISSIONER POTTER:** Thank you, Mr. Castro.

**CHAIR KRUER:** Commissioner Potter, as the "seconder", would you like to speak to the motion?

**COMMISSIONER POTTER:** Sure, I'll try to speak to the condition, itself.

I want to talk, just for a second, about my level of comfort with being the "seconder" of this motion, and I will talk specifically to what Director Douglas talked about for a moment, which was what is the level of reduction in gases that are going to go into the atmosphere, as a result of this project? And, I am comfortable that what is before us today, in this GHG plan, does comply with Special Condition 10, that the measures that are provided through this will provide enough reductions that are certain and verifiable, and would reduce to zero the impacts of this

project.

And, you know, there is one element that I am not overly compelled by, but I do think that there is significant investment into energy reducing portions of this project that make a difference. The commitment to the use of solar seems kind of weak to me. What it says is if it is economically feasible over the life of the project, then we will do it. I would prefer to see it done, period, because I do think it is a viable source of energy that would be appropriate for this project.

The reforestation plan, I think that is a good idea. There is, certainly, quantifiable return on that investment, and if there is another fire, there is another fire, but that is not an issue before us today.

And, in the purchase of offsets, I think makes a difference. There is a proposal as part of this, that there be, at least, third party providers who would be verifying, quantifying, through annual reports to this Commission, the viability and successes of those purchases, and I think that is an appropriate way to verify the success of that intent.

And, then, finally, it does seem to me that the carb process is going to require, you know, public review and the associated findings, and I think it is feasibility, equitability, and cost effectiveness, something like that, but I think those are reasons why, specific to the GHG

portion of this -- which is Special Condition 10 -- that is why I have a level of comfort with what is before us, as proposed, and the motion, itself.

**CHAIR KRUER:** Thank you, Commissioner Potter.

Commissioner Reilly.

**COMMISSIONER REILLY:** Thank you, Mr. Chair.

I was going to ask for some additional comments by one of the folks who testified, and then offer -- I have a couple of questions about the motion, itself.

**CHAIR KRUER:** Sure.

**COMMISSIONER REILLY:** The gentleman from CCAR, the registry, I think you weren't quite able to complete your comments within the three minutes that we gave you, and assuming that you don't have too many more minutes, I think your testimony was certainly pertinent to the issues before us, and I would like to hear your concluding comments.

**MR. LEVIN:** Okay, sure, and I was pretty close to done. I just wanted to talk a little bit about supply. I know that has been an issue that people talked about, whether there would be --

**CHAIR KRUER:** Your name, for the record, please.

**MR. LEVIN:** Sorry, Joel Levin, with the California Climate Action Registry.

So, what I was summing up to say is that we currently, the reserve program that we track and register

greenhouse gas reduction projects has been operational for just a couple of months. We currently have two project registered, with about 200,000 tons of credits issued. We have about another 5 in hand that we are reviewing, and about another 25 that I have been actually talking with developers and expect to be delivered over the next 6 to 12 months, or so.

So, just in terms of projects that I am aware of, conservatively, we are expecting to have about 1.5 million tons, or so, by next year, and about 5 million tons registered by the end of 2012. So, the kind of volumes that you are talking here with this project are, actually, fairly minor, in the scope of our program. Unless our program is, you know, a complete failure, the volumes we are looking at are much greater than what you would need for this.

But, I wanted to say that I don't think supply would really be an issue.

**COMMISSIONER REILLY:** So, just to be clear, what is CCAR seeing as their preferred relationship relative to Poseidon project before us?

**MR. LEVIN:** A preferred relationship? Well, what we understood was the staff proposal was to, essentially, say that they would buy -- to have an account on the reserve, and then they could negotiate purchases with project developers, and those would be tracked through the reserve, and then they

would buy them and retire them, and that would be publicly visible.

So, that is sort of how we operate. It is, essentially, it is a banking system where people can register projects, and then we track trades of those credits and verify them.

**COMMISSIONER REILLY:** So, it is both sale and verification?

**MR. LEVIN:** Yes, we don't get involved in the financial transactions --

**COMMISSIONER REILLY:** No, that's right.

**MR. LEVIN:** -- but, we track ownership of the --

**COMMISSIONER REILLY:** Fine, thank you.

**MR. LEVIN:** -- and it is all very public visible.

**COMMISSIONER REILLY:** Thank you.

**MR. LEVIN:** Yes.

**COMMISSIONER REILLY:** Staff had mentioned that the air quality board and CCAR and CARB had all indicated support for having the verification be part of their process, as opposed to some other process. It seems like a lot of the same agencies, along with State Lands.

And, I would also say Lieutenant Governor Garamendi, who I have tremendous respect for, is also sort of saying that they see the argument that Poseidon should, in fact, get credit for the energy saved in the MWD imports.

So, it seems like they are agreeing with you on one point, and they are agreeing with them on the other point.

I am sympathetic on allowing these credits, but what I am not clear about, in terms of the motion before us, as opposed to CCAR or CARB verification, is under the motion before us, who actually does the verification on -- who does the verification, you know, in a publicly transparent way, under the current motion before us --

**EXECUTIVE DIRECTOR DOUGLAS:** We have --

**COMMISSIONER REILLY:** -- and I --

**EXECUTIVE DIRECTOR DOUGLAS:** -- no idea.

**COMMISSIONER REILLY:** Okay.

**EXECUTIVE DIRECTOR DOUGLAS:** And, that is one of the problems, that we don't know what it is that you are going to be adopting here, if you adopt this --

**COMMISSIONER REILLY:** Yes, why don't you take a shot at that.

**EXECUTIVE DIRECTOR DOUGLAS:** -- unless it was changed.

**MR. ZBUR:** There are two separate provisions that are part of the motion, and they are sort of getting muddled a but, so if I could sort of take one at a time.

One provision in the Poseidon proposal, basically, allows for Poseidon to opt in to offset programs that may be developed by government agencies, like the AQMD, you know,

the air districts, and we did have SDG&E on that. We don't have any problems taking SDG&E, and just limiting it to the air districts on that piece of it.

**COMMISSIONER REILLY:** I think staff's problem was the court of all of the governments, because they didn't know what that meant.

**MR. ZBUR:** All of the governments, I mean we, basically, want to make sure that, you know, that basically government supervise their programs, but if you wanted to limit it to the -- you know, we think the most likely folks that will do it will be CARB, probably the South Coast District air districts, will probably be the most likely ones that will develop them, if they do, soon.

So, that piece crossed, is really just something we thought that if it is a government supervised program, we should be able to opt in. That is probably better verification than anything else. So, that is one piece. We don't have any limits. We don't have any concerns, and could take out the small governments, the SDG&E, if you would like.

The other piece, which is a separate provision, is that the staff's proposal would require that all of our purchase of credits be run through, or purchased through CCAR. We have no problem doing that. We think CCAR is a high quality entity. Our concern is, as you have heard, is that it is simply that we are going to be subject to this for

the next 30 years, and then next 3 or 4 years, we don't know how fast things are going to be moving, and we need to be able to buy the credits that we need, and in fact we are going to be buying some credits up front.

So, we are just concerned that there may not be enough credits from CCAR, and what we have asked is that, just like CCAR, we would be able to buy credits that are run through other entities that are doing the same thing as CCAR, and those three other entities are all entities that are part of offset quality initiative, and we can provide more information about that, if you would like.

**COMMISSIONER REILLY:** My interest is, not only in the acquisition of credits, it is also the verification of reductions --

**MR. ZBUR:** The way our proposal works is that basically, all of them would have to be run through one of those four entities, and we are happy to have CCAR to be the main one, so long as we can get credits that are sort of at the market price through CCAR.

But, it would be run through those entities, and we would, at the end of each year -- I mean, there are time periods in our plan, but that basically, there are two things that have to happen. One, we have to sort of have CCAR emission factors to measure the emissions from our -- that are going to be offset, and once the emission factors are

available, we have to, within a certain amount of time, submit a report that says what needs to be offset, and at that point demonstrate that we have provided offsets.

We can do the annual report that would, basically, show what our emissions are, what our offsets are. We would have to show that it was run through one of those four programs, and we have to provide documentation that they were verified through one of those four programs.

**COMMISSIONER REILLY:** All right, and don't go away.

Is that any clearer for staff, then it has been in the past? does staff want to comment on that?

**ENVIRONMENTAL SPECIALIST LUSTER:** Well, we still have to call this a verification issue.

CCAR has a very clear transparent verification mechanism in place. We have looked into --

**COMMISSIONER REILLY:** What are these other three entities that are listed there on the quality program?

**ENVIRONMENTAL SPECIALIST LUSTER:** The Climate Trust, the Environmental Reserve Trust, and I don't recall the other name, right off hand. They each have their own different protocols, and don't appear to have independent third party verification built into their processes.

We have just found a little bit out about them through their web sites, which don't provide a whole lot of

detail, but there is not enough for staff to assume that those entities would provide the same level of verification that CCAR would, and that is established in AB32 as being necessary for state programs.

**COMMISSIONER REILLY:** Well, let me ask this of the applicant, then, would Poseidon be will to accept the requirement of going through CCAR unless you can come back and demonstrate to the executive director that that is infeasible because they just don't have the credits, or they are not available to you?

**MR. ZBUR:** Yes, I mean, really the key issue for us we are worried that we are not going to have enough credits, and we would actually like that the infeasibility issue be focused in part on whether the credits are available at a generally domestic market price, and if is -- you know, if we can show that it significantly exceeding that of going through CCAR, we would like to have the ability to evaluate --

**COMMISSIONER REILLY:** Through CCAR unless you come back and get an "Okay" then? can you live with that?

**MR. ZBUR:** Say that again?

**COMMISSIONER REILLY:** It is CCAR unless you come back and get an "Okay" for mediation.

**MR. ZBUR:** Yes, we are fine with that, and we would just like the criteria to take the cost into account.

**COMMISSIONER REILLY:** All right.

And, what I am also hearing is that we modified your other language about local governments, and stuff, you are staying with?

**MR. ZBUR:** That is acceptable, as well. We would like to have the major air districts and CARB included in that.

**COMMISSIONER REILLY:** Mr. Chair, that clears up a couple of things for me, thank you.

**CHAIR KRUER:** Thank you, very much, Commissioner Reilly, for those questions.

Commissioner Burke.

**COMMISSIONER BURKE:** First of all, let me try and help out the discussion between Commissioner Hueso and Mr. Douglas.

What one was talking about was particulate matter, 2.5, which is a particle in the air which is small enough to transfer to your blood vessels, through your lungs, when you are breathing, and go into your blood stream. The other was a gas which goes into the air, and causes diminishing of the air quality, in that manner, so they are totally two different things. And, one is a regional -- one is a very localized, and one is a regional, regional problem.

And, I don't think that this project should be penalized because they are facing a problem that is an

international problem. First of all, we are asking them to go out and buy credits, at the best known institution that we can find. Well, there is no place the world -- forget the United States of America -- in the world, because after this project came along, I asked them to go to the South Coast Air Quality District, and they did that. They met with the people out there. The guys went through their whole plan, and found it to be acceptable. So, when they made the briefing to me, my question was if these people who are verifying these credits, are not government organizations, or government licensed, how do you know that this credit is not from some guy in the small village burning a fire in front of his hut, and selling air credits by putting the fire out?

So, he looked at me and said, "There is no way that you can know that."

So, but that is not our job, and that is not what is before us today, but that definitely has an impact on any project that we are going to consider, which has, as part of its mitigation, the purchase of air credits, pollution credits.

So, I think that what staff is trying to do is admirable, but I don't think it is doable. So, I am going to support yours and Commissioner Hueso's motion, to go ahead and get this done in this manner.

**CHAIR KRUER:** Thank you, Commissioner Burke.

Commissioner Wan.

**COMMISSIONER WAN:** Yeah, I just want to deal with, maybe just three or four issues, very quickly.

The first one deals with the issue of what the amount of credits we should be dealing with, and that is the replacement water issue. Poseidon says that this will directly replace water, and therefore they only need to offset the net energy -- and we are talking about the energy offsets here for that replacement water.

From my perspective, if there were conditions that actually required that water be replacement water, and not new water, I would agree with that, okay. But, there aren't any such conditions. There are promises, but there aren't any contractual agreements, and therefore there is no certainty that they will really offset this water from the state water project. And, as we have heard, in fact, it will probably be diverted to other uses, and that is not really, therefore an offset.

And, therefore, they may not be reducing the overall energy use for the state water project, and that is a very serious issue, in terms of the amount of credits that they need to have.

Therefore, from my perspective, this needs to be dealt with by either providing the proof. If you can provide the proof to us that is fine, but if you don't then we need

to deal with this the way the staff is recommending.

There is a second issue, major issue, for me, and that is this, quote, opt out -- what I can an opt out provision, where they are allowed to pay just $10 per ton -- rather than doing what we have all been talking about. If they are allowed to retain that opt out provision, that is the cheapest way to go, and they are going to do that, and you are going to see a token replacement here. You are not going to see real replacements. And, I am not sure I understand why that opt out provision is in there, given all of the other ways, particularly after this discussion with Commissioner Reilly, for them to make sure -- and that we make sure that they can actually buy these credits, why the opt out provision?

But, there is one thing that is most important here, okay. Poseidon maintains that this is voluntary, because they don't directly emit anything, and it is through their use of electricity that we are dealing with it, and that we don't have the authority to require this of them. That is a very dangerous path for this Commission to go down.

Section 30253(4) requires that new development minimizes energy consumption. That is directly on point to what is happening here. We are talking about energy usage. It is not talking about direct emission, it is talking about energy consumption, and 30260 requires that all impacts be

fully mitigated. It does not exempt energy consumption impacts from that.

The two sections together give this Commission its regulatory authority. To decide that this is voluntary will set an unacceptable precedent for all future projects that need greenhouse gas emission reductions. If you find that the *Coastal Act* does not allow us to require greenhouse gas mitigations, regardless of what plan you adopt, whether you go with the applicant's plan, or not, please don't undermine our long term regulatory authority by saying that this is voluntary. Because, if you say it is voluntary here, and that we don't have that authority, then it is voluntary with everything else, as well.

And, you don't need to do that, to even agree with the applicant's plan, and I think that is a very, very important thing for everyone here to remember, relative to this Commission's regulatory authority.

**COMMISSIONER REILLY:** Well, Mr. Chair, just quickly, is there anything in the motion before us that would restrict or effect the Commission's jurisdiction? And, I ask counsel to respond to that.

**COMMISSIONER WAN:** Can I answer that question, in fact, there is, because in this --

**COMMISSIONER REILLY:** Either attorney can answer it, so that is fine.

**COMMISSIONER WAN:** Let me answer, and then the attorneys can answer, because this was my question, my issue.

Let me tell you that in here, which we have asked, according to Commissioner Hueso's motion, we adopt this in its entirety, there are statements in here about it being voluntary.

**COMMISSIONER REILLY:** Where?

**COMMISSIONER WAN:** First page.

If you remove just the word "voluntary" that would change it.

**CHAIR KRUER:** Okay, well, we will hear from our other counsel, now.

**EXECUTIVE DIRECTOR DOUGLAS:** Well, one of the problems we have got -- as they are looking -- is that we have not had time to review everything that, apparently, will be adopted if this motion passes.

I was under the impression that there was nothing in the motion that would say this is a voluntary plan, but rather that this complies with the requirements of the Commission's condition for a Greenhouse Gas Reduction Mitigation Plan. If I am wrong, on that, please let me know.

**COMMISSIONER HUESO:** I agree with that.

This entire motion is designed to comply with Special Condition No. 10 --

**EXECUTIVE DIRECTOR DOUGLAS:** Right.

**COMMISSIONER HUESO:** -- which is condition of approval of the project.

So, none of this is being stated as voluntary, but rather -- and if there is any language that implies that this is a voluntary requirement, it conflicts with Special Condition No. 10, so, if there are some comments regarding -- because I know there were some comments here with voluntary offsets, but I think that doesn't get to the point of this being a voluntary matter. This entire plan is specifically designed to get to Special Condition No. 10 --

**EXECUTIVE DIRECTOR DOUGLAS:** Right.

**COMMISSIONER HUESO:** -- and I think in its spirit and intent, it does that.

**CHAIR KRUER:** Commissioner Potter.

**EXECUTIVE DIRECTOR DOUGLAS:** And, as far as we are concerned, Mr. Chairman, the maker of the motion having clarified that, if that is agreeable with the "seconder" then that is the way the motion, if it is approved, will be passed, and we will make whatever adjustments have to be made to, in fact, reflect that.

**CHAIR KRUER:** I see both Commissioner Potter nodding his head, that he is fine with that, and Commissioner Hueso.

**COMMISSIONER REILLY:** Well, just to try to complicate it a little bit further.

I don't think it matters if it is a voluntary plan, or not. They offered a voluntary plan, we codified it under Condition 10, and made it a requirement, and so it doesn't matter whether you call it a voluntary plan, or not.

The issue is that there is nothing -- we don't want to have anything in the motion before us, to indicate that the Commission does not have the authority to require measures above and beyond what they submitted.

**COMMISSIONER HUESO:** That is precisely correct.

**CHAIR KRUER:** I think you are right, Commissioner Reilly.

Commissioner Potter, you have no problem with that, either, right?

**COMMISSIONER POTTER:** No, in fact, I concur exactly with what Commissioner Reilly just stated. I was about to do the same.

**CHAIR KRUER:** Thank you.

Okay, Commissioner Burke, or Commmissioner --

**COMMISSIONER SCARBOROUGH:** We've taken care of it.

**CHAIR KRUER:** It is taken care of.

**COMMISSIONER BURKE:** Yes, we are doing a tag team over here.

I just wanted to report that I had an exparte, just a few seconds ago, with Rick Zbur, because what I wanted to do was clarify the fact that if, in fact, a government

institution like South Coast Air Quality Management District, did organize a qualification unit, and license some one of these companies to sell credits that had been verified by a government agency, that they would be willing to do that. He said it was already in the proposal.

So, that is what my ex parte is.

**CHAIR KRUER:** Okay.

Commissioner Thayer.

**EXECUTIVE DIRECTOR DOUGLAS:** Mr. Chairman?

**CHAIR KRUER:** Yes.

**EXECUTIVE DIRECTOR DOUGLAS:** Can I just clarify --

**CHAIR KRUER:** Are you Commissioner Thayer?

**EXECUTIVE DIRECTOR DOUGLAS:** Pardon me?

**CHAIR KRUER:** Commissioner Thayer was going to speak.

**EXECUTIVE DIRECTOR DOUGLAS:** Well, he was a little slow.

**CHAIR KRUER:** He said that about you.

**EXECUTIVE DIRECTOR DOUGLAS:** He's been saying that for 30 years.

**CHAIR KRUER:** Commissioner Thayer, do you want to yield to Director Douglas?

**COMMISSIONER THAYER:** No.

**CHAIR KRUER:** No, so go ahead, Commissioner Thayer, and then Director Douglas.

**COMMISSIONER THAYER:** Now?

**CHAIR KRUER:** Yes.

**COMMISSIONER THAYER:** Okay, sorry, I just wanted to clarify one small point, and that is Commission Reilly, earlier on made the discussion of some of the agencies that had weighed in, and had worked on the air issues, and the offset issues, and as he pointed out, the Lieutenant Governor did write a letter on that issue, as Ann Sheehan, another one of our Commissioners, but the State Lands Commission hasn't yet weighed in on that issue.

And, of course, as you know, the Lands Commission heard this last fall, about the same time as the Coastal Commission, and had almost the exact same concerns, and directed that staff return with additional information on, in essence, both Conditions 8 and 10. We have worked closely with your staff, in that regard.

Our staffs have a lot of the same concerns and the same analyses of these issues, and we will be reporting to our own Commission on August 22, and so at that point, the State Lands Commission will be evaluating the same thing, and the people with whom I almost have a first name basis, at this point, in the crowd, will be there, as well, I am sure, and we will hear all of the same issues, again, and the State Lands Commission will figure out what it will do then.

But, I wasn't sure whether Commission Reilly was

inferring that the State Lands Commission had already weighed in on this, and it hasn't, really.

**CHAIR KRUER:** Okay, anything else, Commissioner Thayer, okay.

Director Douglas, what were you going to say?

**EXECUTIVE DIRECTOR DOUGLAS:** I just wanted to clarify.

There was some conversation in which Mr. Zbur indicated -- in an exchange with Commissioner Reilly, I believe it was -- that they were prepared to just use only purchase from CCAR, unless the executive director approves others, in case there aren't enough available. Is that incorporated into the motion?

**CHAIR KRUER:** Yes.

**COMMISSIONER HUESO:** From my reading of the motion, there is a Special Exhibit A where it talks about priority acquisition and verification, and it talks about CCAR or CARB, and I am fine with CCAR being the first choice, and then having any other options available pursuant to approval of the executive director, just so long as they have the opportunity to look at other cost effective savings, because, from my perspective, as long as we make sure that the credits are purchased through a program that accomplishes what --

**EXECUTIVE DIRECTOR DOUGLAS:** Okay, there are a

couple of issues, just to make clear, because we don't want to come back and have an argument over this.

Poseidon would only purchase from CCAR, unless the executive director approves other sources for acquisition because they don't have enough credits available. That is what I understood on that part of it.

**CHAIR KRUER:** And, reasonably priced. Price was one of the issues, too. In other words, if they go to CCAR -- I am just telling you what they said, and we agree or disagree, but I am just saying they added a caveat on that.

**EXECUTIVE DIRECTOR DOUGLAS:** Okay, but they would have to come back --

**CHAIR KRUER:** Right, they would --

**EXECUTIVE DIRECTOR DOUGLAS:** -- if they are going to go to somewhere else, they would have to come back and say, "We can't buy the credits we need here, because of this reason" --

**CHAIR KRUER:** Right.

**EXECUTIVE DIRECTOR DOUGLAS:** --"therefore can we go somewhere else."

**CHAIR KRUER:** Yes.

**EXECUTIVE DIRECTOR DOUGLAS:** And, if we have a dispute, it comes back to you.

**CHAIR KRUER:** Right.

**EXECUTIVE DIRECTOR DOUGLAS:** And, then, the second

question was, they would use any programs adopted by any air districts, by CARR, or CCARB and eliminate all of the other governmental entities, local. I heard them say that, but I wanted to make sure that that was included in the motion.

**COMMISSIONER HUESO:** That is fine. That is acceptable.

**EXECUTIVE DIRECTOR DOUGLAS:** Okay.

**COMMISSIONER BURKE:** [ remarks off microphone ]

**COURT REPORTER:** Please use your microphone.

**CHAIR KRUER:** On your mike, please.

**EXECUTIVE DIRECTOR DOUGLAS:** Well, I thought they said any --

**COMMISSIONER BURKE:** Well, let's call them up and ask that, because I want to get that clarified.

**CHAIR KRUER:** Fine, Commissioner Burke, that is a good idea.

Mr. Zbur, you heard what Director Douglas said.

**MR. ZBUR:** We are happy and it is acceptable to have any major air district, or CARB and the South Coast, either one of those is acceptable to us.

**CHAIR KRUER:** Okay.

**EXECUTIVE DIRECTOR DOUGLAS:** That is included, okay.

**CHAIR KRUER:** And, the "seconder" they can adopt that?

**COMMISSIONER POTTER:** Yes.

**CHAIR KRUER:** Is there anyone else?

Director Douglas.

**EXECUTIVE DIRECTOR DOUGLAS:** Yes, this is not relative to what is in the motion. This is for clarification because we are going to have to implement this.

One of the opt out provisions does indicate that they can opt out if the market is unstable for credits. And, I don't understand any criteria for what is unstable, and what that means? If we could get some guidance, so that we don't end up being in an argument over that, because that is still part of the motion.

**COMMISSIONER POTTER:** Mr. Douglas, as the "seconder" I would be in support of knocking out the opt out piece. I think to keep buying your way into this does nothing for the environment. It is just paying for a sin.

So, I would support, or offer as the "seconder" if the maker agrees, that the condition is that the opt out piece is eliminated.

**COMMISSIONER HUESO:** I am okay with eliminating it, but I would ask that we include at least some provision for review --

**COMMISSIONER POTTER:** Bring it back here.

**COMMISSIONER HUESO:** -- given extenuating circumstances that are beyond anyone's control, if we can

have, at the executive director's discretion, working with the applicant to determine a condition which fits that, where we can either have the executive director make a recommendation back to the Commission that we can act on.

I am just --

**COMMISSIONER REILLY:** Mr. Chair --

**COMMISSIONER HUESO:** -- from my perspective, I am not interested in having them opt out of a requirement. I don't want that, at all, but given certain circumstances, it may be prudent to wait out a certain period, to purchase credits that either are at a more favorable rate, or I don't know, if the program ends, and if there is no substitute program, if they were in transition in programming. I mean, there may be a situation in which it may render the applicant in default, and we don't want to put this project in that situation.

**MR. ZBUR:** Mr. Chair, would it be in order for me to explain what the proposal does, because I think a lot of the concerns would be addressed, although I do believe that Mr. Douglas is right, that the opt out has a subjective standard.

So, essentially, what it says is if there are market disruptions, or the price of offsets make the compliance infeasible, we would have to come back to the executive director, first, and he would have to make a

determination that those factors occurred, and if that is the case we would be able to go into the opt in program. It may be for a temporary period of time. It may be for a longer period of time. It is up to the executive director to make that determination.

We are just worried about the fact if there are not offsets on the market, as there have been many cases with other offset markets. But, anyway, if there is a disagreement, then it would come to the Commission.

**EXECUTIVE DIRECTOR DOUGLAS:** That's right.

**COMMISSIONER POTTER:** Exactly, this placing the money into an escrow account, and then letting that account sit there is perpetuity, does nothing as far as zero reductions.

**MR. ZBUR:** I think the term of the escrow period is subject to the Executive Director's determination, and if there is a disagreement we would bring it to the Commission.

So, this isn't something that is permanent, it also has contingencies.

**COMMISSIONER HUESO:** I'm fine with that.

**COMMISSIONER POTTER:** I am absolutely fine with it.

**CHAIR KRUER:** Okay, we are fine.

Commissioner Shallenberger.

**COMMISSIONER SHALLENBERGER:** Yes, I would like to

ask Joel Levin of the California Registry to come up for just a question, and that is that I am talking now about the baseline reason, which seems to be the other major issue before us, the disagreement between the project proponent and the staff recommendation.

If the Commissioner were to request the project's baseline be determined through the California Registry, how would you calculate that? how would it be calculated?

**MR. LEVIN:** Okay, well, if you can bear with for a second, as I need to talk a little bit about greenhouse gas accounting rules.

There is, in international practice, all greenhouse gas emissions are divided into Scope 1, Scope 2, and Scope 3 emissions. Scope 1 emissions are direct emissions, which in this project are very small, and hasn't really been any discussion.

Scope 2, is indirect emissions from purchases and sales of electricity, and schemes -- there is no scheme here -- so, Scope 2 emission would, basically be -- and this an international standard -- essentially, your purchases of electricity, minus your sales of electricity, so that is your net purchases of electricity.

Scope 3 is all other kinds of indirect emissions that go up and down the supply chain, and so, for example what you are talking about with the State Water Project, the

way I understand that, that would, essentially, be a Scope 3 emission.

In international accounting standards, you keep all three of those separately. They are all significant, each one of them is real, but they are different. They are apples and oranges, so you can't add Scope 1 and Scope 2 together, or Scope 2 and Scope 3.

Under our program, we require people to report Scope 1 and Scope 2. Scope 3 is voluntary. Some people report certain aspects of their Scope 3, some don't.

So, if we were to calculate this, it depends a little bit on what you ask for. If you said you would like the California Registry just to calculate the base line, and we'd like it to be their Scope 2 emissions, then, it would be just that, it would be their net electricity purchases, which is not to say that the emission reductions associated with the State Water Project are nothing, but it is a different type of emission. It is not something that we have a calculation methodology for right now.

So, that would be sort of a policy decision for you, if you wanted to, to put those together, and math them out, but in terms of the way we calculate, Scope 2 would be just straight electricity purchases.

**COMMISSIONER SHALLENBERGER:** May I ask you one more question.

**MR. LEVIN:** Sure.

**COMMISSIONER SHALLENBERGER:** If I were to tell you -- and we can talk later about whether it is true -- but, if I were to assert that this project coming online will make no difference in the exports through the State Water Project into the Metropolitan Water District, how would you then calculate that, in this project?

**MR. LEVIN:** Well, again, we don't have a protocol for that. It is not something -- the way that we operate is we develop accounting standards through a big public process, with a working group, and we will establish rules for how you measure a specific source. To look at what are the emissions associated with water from the State Water Project, we just have never tackled that, so I am not even sure I could answer that.

**COMMISSIONER SHALLENBERGER:** Okay, thank you, I did want to address that.

As my fellow Commissioners know, I worked in water policy for 15 years, began with the Peripheral Canal Bill passing the legislature, and ditch ditch, and many bonds, right up and including the current proposal about alternatives to the delta, and there has been a lot of talk about the use of the words gross versus net, which I think is a bit of a smokescreen as opposed to what is really going to happen here.

The State Water Project is over contracted, and when Metropolitan Water District says it is not fully built out, that is absolutely true, and nobody would disagree with that, nor will it ever be fully built out. It was a grand concept, and it didn't -- there was no understanding at the time of what the impact of the State Water Project and the Central Valley Project would have on the delta. The delta is now in a state of -- and I don't think anybody would disagree that it is in a complete state of deterioration, and we are not sure -- nobody is actually sure that it can be saved.

There are actually three different alternatives being floated now for ways to save it, but none of those alternatives include fully building out the State Water Project.

So, the Metropolitan Water District -- and these are round numbers, so if somebody ends up going to court, you are going to have to look it up on your own -- but, the Metropolitan Water District, I believe, has contracted for, approximately, 2 million acre feet of water a year. I don't believe they have ever gotten more than 1.7 million acre feet, and it has gone down way below that in times of drought.

We have heard a lot of statements about being in a time of drought, and we are. I absolutely agree that we need to have a broad portfolio of new water sources, and

desalination is one of them, and this project, absolutely, should be one of the pieces in the portfolio for increasing reliability of water, but if it were to go online tomorrow, and have maximum productions, it would not reduce the amount of water being pumped through the State Water Project into the Metropolitan Water District, and yes, that is over the Tehachapis, and no it would not have to go through an EIR review, because that is contracted water.

The Metropolitan Water District has a contract for that water, and every year they go through how they are going to distribute that water within their jurisdiction, which includes selling it to San Diego.

So, I have to commend staff, our staff, for what I understand working very constructively with both the Energy Commission staff and the Air Resources staff. The first letter we got from the Energy Commission, dated July 18, was very clear and constructive and told us where it needed to be strengthened.

Eleven days later we get a letter which is about as mealymouth as a state agency can be. This is a Governor, an administration who has claimed AB32 as the most strongest legislation in the country. He has gone abroad, he has gone to Germany, he has gone to many places, and California is leading on what we are doing about climate change.

And, then, the first big project to come before

us, happens to be before the Coastal Commission, it is going to have a huge impact on climate change, and we get letters like this from the Air Resources Board, who we know staff has been working constructively on real substance with our staff.

But, as I read these, none of them, including the Deputy Director of the Department of Science, who admits the State Lands has not had a hearing on this yet, but apparently, already has an opinion on it, none of them -- actually, they are very careful about how they word this. They talk about it should only be the net greenhouse gases that are taken into account. None of them say that there is going to be a reduction of State Water Project energy use to pump it over the Tehachpis.

Metropolitan Water District is going to, and needs to, and has a right to take all of the water that is available to them out of the delta.

This project is going to increase reliability. It is going to increase, kind of stop the ebs and flows of drought, and time of plenty.

So, I really, on the baseline, and here is -- now I am getting to the problem, is that we have a 32-page redlined proposal that comes from the project proponent, which I got this morning, I admit I have not read, and therefore the motion that is before me, I don't know what it

does with this baseline.

So, now I am going to turn to staff and say with the motion that is before us, and with your understanding of the amendments that have been made to it, with having to do with the Registry, what else is different between your proposal for a motion, and the one that is before us, because I am going to need to vote on this without having actually read the proposal that is before us.

**ENVIRONMENTAL SPECIALIST LUSTER:** Staff's understanding, addressing your concerns as I understand it, one of the main differences, is that Poseidon refers to the state water offset as a project related measure that is, essentially, automatically included in calculating where it starts for its net emissions.

And, so, although CCAR would -- it would work with CCAR to get agreed emission credits in place, the issue of the State Water Project would not be included in that review. That is staff's understanding, just having briefly read through the plan we received this morning.

**COMMISSIONER SHALLENBERGER:** Well, it is funny, because our critics say, you know, you are specialists in greenhouse gases, and you are not specialists in climate change, and the Air Resources Board is the specialist, and Assembly Bill 32 put them in charge for determining things like this, and yet we are about to, perhaps, pass something

which says that we are, in fact, in a position to know what the baseline is.

So, I would like to urge my fellow Commissioners not to approve the resolution, as it sits before you, because of the baseline calculation, which we are not in a position to foreclose the Air Resources Board making their own determination.

**CHAIR KRUER:** Commissioner Scarborough.

**COMMISSIONER SCARBOROUGH:** Yes, thank you.

Talking overarching, I agree with Commissioner Shallenberger about the importance of adding desal to the portfolio of the water supply. Getting to the elements of baseline, yes AB32 staff have worked together at many different levels.

What the new letter from the Energy Commission describes is a further understanding with further meetings -- and the executive director was here this morning, I am sorry you weren't able to ask her further questions, Ms. Shallenberger, when she was here, but she tried to describe in her letter the better understanding of, perhaps, is the glass half full, or is it half empty?

The concept of net or gross has been wrestled around through CARB, through the CEC, through the Resources Agency, through many, in fact, as I know in here with many of our staff.

In essence, what I understand from a Resources perspective -- indeed, we are arguing within our family as well -- is that, yes, Met will continue to receive that water. They are not going to turn the state tap off. Other projects that will then need to use that water will have to go through a process by which they get the okay to use that water. And, it is that new project that will then have to be in compliance with CARB and APCD, or whatever local district, on their greenhouse gas emission reductions for that project.

So, therein lies the neutrality of the 100, with the charts of 100 and the 25. So, net versus gross is pretty clear that the impacts on the increase of the 56,000-feet that they are providing, that is what they are reducing.

So, from a Resources Agency perspective, from CARB, naturally, it still astonishes me how people refer to AB32. Yes, it was a bill, you understand that, Commissioner Shallenberger, and it got signed. The implementation of that bill is still being done.

It was noted by several local speakers that just last week some of the documents had hit the street. It is not final. It is not approved. A scoping plan is out for public comment. You can't refer to AB32 as having guidelines by which a project will have to mitigate, yet, it will, and that is why, therefore, a sister agency, as CARB, should be adjoined to this, which it is. CCAR, CARB, they are all a

collected family, of which you are joining by approving this mitigation plan that has CARB connected to it.

So, Resources Agency, for one, agrees that the project mitigation plan as an overall water supply portfolio expansion, completely supports the concept of it going net, as justified in the letter attached from the Energy Commission, and the ARB.

**CHAIR KRUER:** Thank you, Commissioner Scarborough.

And is that it, before I call for the motion?

I'm sorry, Commissioner, do you want to go again. No. I am going to wait until last, just so we don't get into a debate here.

**COMMISSIONER SHALLENBERGER:** Yes, I just wanted to respond that either this is water being freed up for new development, or it is not.

It is my understanding, given the condition of the Metropolitan Water District's water supply, that this isn't for new development, and I agreed with people who said that it was not growth inducing. They don't have enough water for reliable water source, given what is already on the ground.

So, when I hear the Resources Agency saying that it will have to go through, get a permit for new development, now I am hearing that it is new development. So, I don't believe that is true. I don't think it is, and if it is not due to new development, there will be no environmental

review, because it is already contracted for.

My question to staff is, given that we are not working off your motion, is there a way to have this baseline issue addressed by the agencies, state agencies, who in fact are recognized as that is their expertise, not ours, rather than us foreclosing that now?

**ENVIRONMENTAL SPECIALIST LUSTER:** My initial suggestion, as you heard earlier from the CCAR representative, of the different, three different forms of emissions, if the Commission required CCAR to evaluate all Scope 2 and Scope 3 forms of emissions from the project, that would allow CCAR to review the state water project offsets, and to see whether they meet various criteria.

**EXECUTIVE DIRECTOR DOUGLAS:** I think that the most important element of that is since we have a real difference of opinion here, on what the baseline is, and we agree with your analysis of this, to have a credible independent review of what the baseline is, if you could ask CCAR to look at the category 3 -- I know they don't have any protocols yet for that, but at least they have got the expertise to be able to look at that and determine, in their best judgment, what they think the baseline might be. You could look at that as an alternative.

**COMMISSIONER SHALLENBERGER:** And, if there is an amending motion to do that, would the project proponent

probably come forward and say this is going to cost time, and delay?

**EXECUTIVE DIRECTOR DOUGLAS:** Well, you could approve the plan today, which would get you passed that issue of prior to issuance, with a provision, a proviso, that you have the baseline determined by CCAR, and that if they have a dispute with what that means, in terms of feasibility or costs, again they could come back, and you could authorize them to come back for an amendment, if they wish.

**CHAIR KRUER:** Okay, I am going to go to Commissioner Lowenthal, and then I will address this last idea of yours, Director Douglas.

Commissioner Lowenthal.

**COMMISSIONER LOWENTHAL:** Actually, was wondering if the applicant -- looked like the applicant had a response to that. Would that be appropriate, on the baseline being described by CCAR, would that be appropriate, just to hear what his response would have been? from Mr. Zbur?

**CHAIR KRUER:** You can do that.

**COMMISSIONER LOWENTHAL:** May I ask Mr. Zbur to do that?

**MR. ZBUR:** We would not like that. We would want it to be clear, as I think the ARB letter said, that it be the net approach, which allows us to automatically reduce the water that is foregone from the State Water Project, so we

would actually prefer that the plan be adopted, as the motion would do.

**COMMISSIONER LOWENTHAL:** Okay, and I also wanted to just make a couple of comments regarding the imported water from the State Water Project.

I think we all understand that Metropolitan has a contract for the amount that it does take annually, and I don't look to creating additional facets to water portfolios necessarily as a 1:1 trade. I think, in the reality of a lot of what is going on with water in our state, drought being one of them, it is difficult to make that 1:1 assumption if there are 100 units of water produced by the desal project, that 100 units would be reduced in terms of imported supplies.

I think what we are seeing in communities across California, we have been seeing this for many, many years, separate from various contamination issues, so where they may have had ground water resources in the past, they actually take greater imported supplies, and so that ends up upsetting this 1:1 offset that we may expect when we add new facets to the portfolio.

So, I understand the difference in the total landscape and what has changed, and why. For instance, water imported into San Diego may continue at the same level, or into other areas, one accounting for increase in population,

not necessarily inducing the growth, and two, accounting for any changes in local portfolio that need to take place because of their need to address any contamination issues.

And, so, I just wanted to make that remark, and also mention that I am a board member of the MWD and am very familiar with their operations, and do understand the challenges that members of the audience and communities may experience when it comes to looking at why we continue to take the same amount of contractual water annually.

But, I think it is a little bit more complex, than the 1:1 offset we would expect from every project.

**CHAIR KRUER:** Thank you, Commissioner Lowenthal.

I'll go to Commissioner Thayer, then myself, and then I am going to call the question.

**COMMISSIONER THAYER:** I'll be brief.

I wanted to respond, in connection to the question about Ms. Sheehan, one of my Commissioner's letters. I think she does a good job of speaking two different voices here.

One of them, she speaking as a representative of the administration, and advocating that the approach taken on the replacement versus additive questions for the water offsets is something that the Commission, this Commission, the Coastal Commission, should feel satisfied with the permit conditions -- not a State Lands Commission issue. In the next sentence, she gets onto the State Lands Commission role

that she has, a separate one, indicates she will be considering this matter further, before she acts as a Commissioner.

So, I think, her letter reflects knowing a lot about the project for her work as a State Lands Commissioner, but she is speaking as a official who is not a State Lands Commissioner, in this letter.

**CHAIR KRUER:** Okay?

**COMMISSIONER THAYER:** Yes, thank you.

**CHAIR KRUER:** Thank you.

Yes, I would like to just say that at this point in time, this project has been before us quite some time ago, and before that, and I think it is time to move forward today with this motion. I have heard a lot of testimony, some things got cleared up, like voluntary, that I had issue with, those words. But, I am concerned that we move forward today, and take a decisive action on this.

In listening to the testimony of all of the people, today, it was excellent, but listening to the regulatory agencies, that are going to be responsible for AB32, at this juncture, on an approved project like this, I have no problem understanding, from my own perspective, that there is the net versus the growth.

If somebody is going to spend $300 million on a project, and it goes under the old "no good deed goes

unpunished," they should get some credits. And, what happens is AB32 comes along, which is fine, et cetera, but if you add -- I don't want to have happen -- the support, in this case, of the staff recommendation because if you did that, and added -- the testimony was given that the mitigation plan went from $55 million to $121 million -- and it isn't just $19 a ton, or some of the numbers you had.

The infrastructure costs of putting all of that money up front, and putting all of that money that you have to amortize over a period of time, those are the things that create very big difficulties, that delay projects, and that makes them, sometimes, infeasible. You just can't add $50 or $60 or $70 million to a project like that. The capital markets won't allow it.

And, in this case, there is a good participation between the private sector and the public sector, and I think there has been a lot of testimony that now is the time. I think I have heard enough about that the plan is flexible, good, fair, and equitable.

And, it is always good to hear from Mr. Simmons. I think he is one of the most astute men in law today, that has for so many years been in water, et cetera, and his testimony was very important to hear that today, along with Dr. Cook, and others.

So, with that we will move on.

The maker and seconder are asking for a "Yes" vote, and Clerk, would you call the roll, please.

**SECRETARY MILLER:** Commissioner Achadjian?

**COMMISSIONER ACHADJIAN:** Yes.

**SECRETARY MILLER:** Commissioner Blank?

**COMMISSIONER BLANK:** Yes.

**SECRETARY MILLER:** Commissioner Burke?

**COMMISSIONER BURKE:** Yes.

**SECRETARY MILLER:** Commissioner Lowenthal?

**COMMISSIONER LOWENTHAL:** Yes.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.

**SECRETARY MILLER:** Commissioner Kram?

**COMMISSIONER KRAM:** Yes.

**SECRETARY MILLER:** Commissioner Neely?

**VICE CHAIR NEELY:** Yes.

**SECRETARY MILLER:** Commissioner Potter?

**COMMISSIONER POTTER:** Aye.

**SECRETARY MILLER:** Commissioner Reilly?

**COMMISSIONER REILLY:** Yes.

**SECRETARY MILLER:** Commissioner Shallenberger?

**COMMISSIONER SHALLENBERGER:** No.

**SECRETARY MILLER:** Commissioner Wan?

**COMMISSIONER WAN:** No.

**SECRETARY MILLER:** Chairman Kruer?

**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Ten, two.

**CHAIR KRUER:** Ten, two, the motion passes, and the Commission hereby finds that the Compliance Plan entitled Carlsbad Seawater Desal Plant Energy Minimization and Greenhouse Gas Reduction Plan, prepared and submitted by the permittee, Poseidon Resources, Channelside, LLC, dated August 6, 2008, is adequate and fully implemented to comply with the Special Condition 10 of the Coastal Development Permit E-06-013.

We are going to take a break now, a 10-minute break.

[ Recess &

Item No. 5.b. Condition Compliance

Marine Life Mitigation Plan ]

**CHAIR KRUER:** Is everybody ready to go? Director Douglas, are you all set? Okay.

**EXECUTIVE DIRECTOR DOUGLAS:** We are ready to proceed, Mr. Chairman, if you are.

**CHAIR KRUER:** And, that is what we are going to do, Director Douglas, go to 5.b.

**EXECUTIVE DIRECTOR DOUGLAS:** Tom.

**ENVIRONMENTAL SPECIALIST LUSTER:** Okay, thank you, Chair Kruer and Commissioners. This next item is Condition Compliance report for Poseidon Resources proposed Marine Life

Mitigation Plan.

Staff has been working since November with Poseidon, several agencies, and the Commission's scientific experts to develop an acceptable plan.

Poseidon's most recent plan is attached as Exhibit 1 to your staff report, and staff is recommending you approved the plan as modified in the staff report, and in the addendum, which you received from staff last night, or this morning. The addendum also includes correspondence received regarding the plan.

I'll first briefly describe some key elements of Poseidon's proposed plan, then staff's recommendations and reasons for those recommendations, and then address some of Poseidon's concerns.

Again, staff believes, with our recommended modifications, Poseidon's plan would conform to Special Condition 8, and would be consistent with the Commission's findings.

The Special Condition requires Poseidon to develop a plan that would emphasize creation, enhancement, or restoration of marine habitat. The plan was to be based on results of an entrainment study Poseidon conducted in 2004 and 2005, in which Poseidon provided the staff in March of this year. It was also to identify specific goals, criteria, performance standards, and other measures at proposed

mitigation sites.

Until recently, Poseidon was proposing to do most of its mitigations at the San Dieguito Lagoon here in San Diego County, at a site adjacent to the restoration site Southern California Edison is implementing pursuant to its Coastal Development Permit for the San Onofre Nuclear Generating Station.

You may recall the discussion at the November hearing about the standards that the Commission had established for that project, and the staff has recommended to Poseidon that it include those standards in its proposed. Those standards, which staff modified to match Poseidon's situation are in Exhibit 2 of the staff report.

Recently, however, Poseidon has proposed more of a process to develop mitigation. Its plan now proposes to provide esturane restoration at one or two sites somewhere in the Southern California bite. Poseidon would select these sites and conduct the necessary CEQA review over the next couple of years, and would return to the Commission with a new Coastal Development Permit application to implement the proposed project.

Poseidon is also proposing a phased mitigation approach, in which it would provide some mitigation through the process just described, and would then consider additional mitigation at some future date, depending on

potential changes in policy that might reduce the desalination facility's entrainment impacts, or based on changes in how the co-located power plan operates.

Poseidon wishes to also seek credit for taking on the dredging activities now conducted by the power plant owner that are needed to maintain the water intake channel for both facilities.

As noted earlier, staff has consulted with other agencies to evaluate Poseidon's proposal, and has worked with the Commission's scientific experts to better identify the impacts resulting from the project, and the type and amount of mitigation needed to address these impacts.

We worked with the Commission's science advisory panel, which the Commission charged with overseeing implementation of the SONGS restoration project at San Dieguito. Dr. Pete Raimondi of that panel is here today, and will provide a brief presentation on his findings regarding impacts and mitigations.

Even with this coordination, there are some key differences between Poseidon's proposed plan, and the elements staff recommends the Commission include as part of the plan. They include the amount of the mitigation needed to adequately address outside impacts and concerns about the proposed phased approach.

Regarding the amount of mitigation Poseidon has

proposed to initially create 37 acres of wetland restoration, with possible future mitigation to follow, based on staff's consultation with the Commission's scientists, and through concurrence with staff in other agencies, including State Lands Commission, California Department of Fish and Game, U.S. Fish and Wildlife Service, the National Marine Fisheries Service, we are recommending Poseidon restore between about 55 and 68 acres of esturane habitat.

This acreage range is based on what Poseidon's entrainment study identified as impacts that would be caused by the desalination facility's use of 304 million gallons per day of water from Aqua Hedionda. This impact also served as the basis for the Commission's conclusions in its findings.

These acreage figures represent a departure from how the Commission has determined needed mitigation in the past, and we have asked Dr. Raimondi, as part of his presentation, to describe how these various acreage levels were derived.

Generally, the Commission requires mitigation at various ratios to the identified impact, for example 2:1, or 3:1. However, staff's recommendation today, essentially trades the need for higher ratio for more certainty about the success of the mitigation; that is, if combined with the appropriate design and construction methods adequate performance standards, and thorough monitoring less

mitigation acreage may be able to provide the necessary level of mitigation to address the impacts.

We note that the addendum includes a change to the staff report that clarifies part of Dr. Raimondi's review, and in which it shows Poseidon's study resulted in an even higher acreage level than those Dr. Raimondi calculated. We Should also note that you received another analysis in your packet yesterday, or this morning, which describes a method Surfrider identifies as resulting in a 138-acre mitigation level. Staff believes you will hear from both Poseidon and Surfrider a little later today, about their proposed ranges.

And, I do have one slide, just as an illustration of the acreage ranges that staff is presenting today.

This should just give you an idea of the different positions by Poseidon, staff, Surfrider, and also illustrates the acreage that would be required if the Commission were to require 2:1 or 3:1 mitigation.

[ Poor Quality Slide ]

But, perhaps we will skip that.

**EXECUTIVE DIRECTOR DOUGLAS:** Actually, our explanation is much clearer than that slide.

[ Slide ]

**ENVIRONMENTAL SPECIALIST LUSTER:** Okay, there we go, that was it. That just gives an idea of what you will be hearing about this evening.

Poseidon's lesser mitigation amount also relies upon a phased approach, which staff believes would not provide the Commission assurance of the facility's impacts are adequately mitigated in conformity to *Coastal Act* policies. Poseidon suggests that the Commission not require full mitigation at this time, based on speculative future operations of the co-located power plant, which is expected to operate sporadically over the next few years, until its expected retirement in 2017.

As noted a moment ago, the Commission's review is based on the impacts caused by Poseidon's use of just over 300,000 million gallon per day of esturane water, which is expected to continue for up to 90 years; therefore, even if the power plant does operate at times during the next few years, it would use only a small percentage of the water, and cause a small percent of the impacts that are expected from the desalination facility, as illustrated by Poseidon's entrainment study.

Poseidon also bases its phased mitigation proposal on the possibility of future technological changes that would reduce its entrainment impacts. Again, staff regards this as speculative and not adequate reason to reduce the necessary mitigation level. We note that all of the technologies considered over the past several decades, such as screens, flow diverters, and others, none have been effective for

reducing entrainment in the marine environment.

Further, Poseidon has already required through its NPDES permit to use all feasible technologies to reduce its entrainment impacts, both now and in the future. If there is a need for such a device, Poseidon would need to submit either a new Coastal Development Permit application, or an application for an amendment, and any mitigation changes could be properly addressed at that time.

I'll now ask Dr. Raimondi to provide his presentation on this entrainment study and mitigation, and his review of those issues.

**MR. RAIMONDI:** Could I get my slides up, please.

[ Slide Presentation ]

I am here today to talk about numbers, really. And, what I have done for the Coastal Commission as part of the Scientific Advisory Team for the Coastal Commission is I did a review of the Marine Life Mitigation Plan, and in particular I looked at their assessment of impacts, using the approach that they used.

So, I want to make a few general comments, first. The first was that the review was of the proposal submitted by Poseidon. We didn't do anything new here. What we did is we evaluated the proposal and the numbers that Poseidon submitted, so it is based upon their studies. There are other types of work that could be done, we didn't explore any

of those issues.

Secondly, this study is designed for entrainment sampling, including historic water sampling, as consistent with the recent entrainment studies under the 316B Rule, which is the NEPA standards that apply here. In fact, it was a very well done study. This is characteristic of Tenera International, which did the work, and that work was done very well.

Calculations of these terms, which I am going to explain later on, but these are proportional: mortality, source water body, and area of production forgone -- which is a term which is going to be of importance later on -- are generally consistent with recent studies; however, I made additional calculations to incorporate the uncertainty associated with the calculation of acreage required to compensate for entrainment. These are completely consistent with the standard statistical approaches. There is nothing new there. I am not making anything up here. These are standard statistical approaches.

And, finally, in the report there was no mitigation that was proposed for losses of larvae to open water habitat. Those are species that are open water species and in there the areas of production foregone is small, but not at zero, but I also included those species into the model that does add to the acreage.

So, here are the major issues, and I am going to go over them pretty briefly. The use of uncertainty in the estimation of the area of production foregone, that is the key issue in front of us here. So, I want to go over three things. I want to go over what is the area of production foregone, what does it mean? It is a pretty simply premise, really, once you understand the terms in it.

Secondly, how do you use that to calculate the appropriate mitigation? and third, how does uncertainty provide a context for the likelihood that you will actually get full compensation for the impacts? because that is what we want. We want full compensation for the impacts.

And, so first I always do this. I want to explain what is entrainment, because you have got to understand entrainment before you can get to any of these impact assessments.

So, this is entrainment, and I usually do this in the context of power plants, so I have changed it for desal plants, and the idea here is that fish and other organisms are entrained -- which means they are brought in from, in this case an estuary, and they are brought into the plant, and usually there is going to be a screen that sort of screens out all of the big things. Those big things that are impinged on that screen and then deposited -- usually, they are killed -- are called impinged. We are not talking about

this today. We are talking about the things that make it through that first set of screens, and these are typically larvae or other papery gills, could be eggs, larvae, and they go through these screens, and they go into -- in this case -- the desal operation, and they are considered to be killed as a result of the operation, so there are many reasons why they are considered to be killed.

And, then they go out with either the mixed water in a co-located plant, which is a plant that is co-located with a power generating facility, or if it is by itself they go out in brine, which would be water that is elevated above the receiving water.

Well, once the area of production is foregone -- this is a key slide here, so we are going to walk through this. The area of production foregone is the product of two terms. The first term is proportional mortality, and that term just refers to the proportion of vulnerable larvae that is lost to entrainment. So, as an example, 20 percent -- that is could be a number that could be confused -- 20 percent of vulnerable larvae are lost due to entrainment.

The second one is the source water body, and that is the area from which the larvae could have originated. Most of the time today, we are going to be talking about Aqua Hedionda Lagoon, in there there is about 302 acres from which these larvae could have arisen. So, in this example, for

gobies, these are real numbers, the source water body is 302 acres, that is the area of Aqua Hedionda, and the proportional mortality of .216, which is 21.6 percent, and that means, very simply, that 21 percent, or 21.6 percent of the larvae in Aqua Hedionda Lagoon, that were gobies, are lost due to entrainment, that is what it means.

All right, now, how do you use this? Well, we usually multiply it. We say there are 300 acres. We multiply it by .216 and we come up with this acreage, which is about 65 acres, and this says that 65 new acres, if you restored 65 new acres, and they had the same habitat mix in the source water body, Aqua Hedionda, you would then produce larvae sufficient to make up for those lost gobies, that particular species -- pretty straight forward.

The problem is we can't make this assessment for all of the species that are lost; therefore, we must estimate the acreage that would compensate for the impacts to the threatened species, and the by products of such estimation is uncertain, because you can't do it for all of them. That is the nature of the impact assessment, that you can't do it for all of them.

So, this is the problem. This is the inverse triangle in entrainment assessments. You have got this light blue, which is the species that are entrained. You have got the dark blue, which are the species that are actually

sampled in the entrainment sampling. It is a much smaller triangle. And, then, you have got this red, which is the species for which impacts are actually assessed.

So, if you go up from here, these are the species for which you do the assessment, the impact assessment, these are the ones you actually sample, and these are the ones that are left unsampled and unassessed. And, we have to go from this red to the blue in estimating the impacts to the whole system. That is the key thing. We want the impact the assessments, the impacts for the whole system.

And, so the goal is to use information from the species for which impacts were assessed -- the red guys -- to estimate the overall impacts of entrainment, and to estimate the mitigation that would be compensatory for the whole triangle, the whole thing, light blue, dark blue, red.

All right, here at Aqua Hedionda, I said that I think they did a really nice job, completely consistent with other entrainment studies in there., We don't know the number of species that were entrained, because you don't sample them all. There were at least 40 types fish that were entrained and sampled. Three base species of fish were assessed for impacts, five coastal species of fish were assessed for impacts, so in this case 8 out of the 40 fish species, and only one species of an invertebrate, cancer crabs, were sampled for entrainment, and we didn't use that

for an estimation of impacts. So, this is a list.

Let's go back to this inverse triangle. So, we go over here, and I have a new part over here: numbers entrained. So, how many -- there were 3.4 to 4.5 billion larvae per year that are lost due to entrainment, 4 of the species that were sampled -- that is our clue part. We don't know. I mean, we want to use this information, especially the information in the red, to estimate the impacts to all of the other stock that hasn't been sampled.

This is not new stuff. This is exactly what you do with samplings here, and this is why you do samples in the field, is you take a few samples, and you extrapolate it into the population at large, so when you do that there will be uncertainty in your estimation. That is what we want to incorporate here. That is all that we want to do, is to incorporate that level uncertainty.

So, this is the key question here, what is the size of the impact? we can use estimation to get to that. What acreage would be compensatory for that impact? how confident do you want to be in that assessment? Those are the three questions I want to address here.

So, there were 3 species that were sampled, and one of them were blennies, the proportional mortality there was 8.6 percent of blennies in the lagoon were lost, and that would lead to a restoration of 26 acres. Gobies, 65 acres of

compensation: garibaldis, 20 acres of compensation.

Now, here are some scenarios. The first scenario is that you can be completely precautionary, you choose the maximum, 55.23 acres, and if you do that you know everything is going to be covered, because that is the maximum value you have got there. You might think that is overdoing it, because that is the maximum value, not the average, not some sort of estimate of it.

Second, you could weigh the risk of over estimation, which is providing excess habitat, and under estimation, providing too little habitat, equally. Many choose the average. That is what Poseidon did, they chose the average. That is about 37 acres.

The third thing you could do -- and this is what I am going to talk about now -- you could use what we call confidence intervals, which is just a statistical tool to guide the assessment. And, this is a policy decision. You select the acreage that reflects the desired degree of certainty that the mitigation requirements will completely compensate for the impact. So, this graph here is an example of that.

I am going to walk you through it. This is mitigation acres on the x-axis here. This is the likelihood that you are going to get complete compensation, all right. So, if you want to have a 50 percent likelihood that you are

going to get complete compensation, choose the average. If you wanted 80 percent likelihood that you are going to get complete compensation, go 49 acres. If you want a 95 percent likelihood that you are going to get complete compensation, go 61 acres. The 95 percent confidence intervals is typical what is used in non-mitigation type work, in traditional science, and I wanted to give you the range.

The key thing is, what do you guys want? what is wanted by the public, and by the Commission? in terms of the confidence that you are going to get complete compensation for the impacts?

So, here are the results for the bay esturane species, and ours is not the only model that you can use to calculate confidence intervals. The CCC staff, the model that I am presenting, ends up with this level of acreage for these different confidence intervals: 37, 49 and 61.

There are also error rates that are associated with the Poseidon report, itself. They calculate error rates, themselves. And, if we use the error rates that were in the Poseidon document, they do the same thing, they calculate the 50 percent confidence interval, the 80 percent confidence interval, the 95 percent confidence interval, then when we get a 37 to say -- if you only want a 50 percent likely you are going to get full compensation, 87 acres would be required using these data, allowing for 80 percent

confidence, and 133 acres would be required if you wanted to get the 95 percent confidence interval.

I have to say I have reviewed this with the Tenera scientists. I don't think that these are the correct error rates. I am presenting them just as the documents, that there are error rates in that document, in the Poseidon documents, and if you use them these are the numbers you can come up with. I think they overestimate the acreage.

There is a separate model. It is completely different from the approach we took, that was done by Stratus Consulting, and I think they are going to talk about it later on about single species gobis, and that yielded an estimate of 138 acres.

So, what are the assumptions here? the assumption is that the restored acres, if you did the restoration, and you did it correctly, it would have to have a similar habit mix as at Aqua Hedionda, because that is where the impact occurs. This would produce larvae sufficient to make up for those lost to entrainment, and the key thing here is it works. The restoration works. Just getting the estimation right doesn't mean it is going to work. You are going to do the test, the construction, all sorts of things go on there, and then the mitigations and restorations don't always work. And, this could be insured by monitoring, or the possibility of remediation, which is exactly what it has been held to in

the SONGS requirements.

So, as I said earlier, there are these other species, coastal species -- you remember coastal species -- using the same approach, I am just going to cut to the chase. This is what we end up with. Based upon the CCC model is the only one that has a 60 percent likelihood of getting full compensation so you choose 42 acres. If you want 80 percent likelihood of getting full compensation, you would choose 55 acres, and if you want 95 percent you would use 68 acres, and again, using the error rates presented in the Poseidon document, it would be 42, 100, 156.

So, I hope that helps you understand how these calculations arose, and what is meant by using uncertainty as a guide to acreage that might be necessary.

**CHAIR KRUER:** Thank you.

Staff.

**ENVIRONMENTAL SPECIALIST LUSTER:** Thank you, Mr. Raimondi.

One other point staff should address is Poseidon's statement that its 37-acre mitigation acreage is consistent with the methodology used by the California Energy Commission to determine mitigation requirements at various power plants that use intakes similar to Poseidon's.

These power plants use the same sort of study that Dr. Raimondi just referred to, the entrainment studies, and

although the Energy Commission, and other agencies, including the Regional Board, the Coastal Commission, Fish and Game, USEPA, all agree on the types of protocols used for those studies, there is no consistent methodology for determining how much mitigation has been needed at the various power plants.

So, the studies are all done very similarly, determining the mitigation has varied case by case and site specific, and it has ranged from requiring creation of estuarine habitat to providing upland protection, to enhance certain water quality improvements, and it has been different for each power plant. So, there is really no single methodology that we can look to, as Poseidon states.

Further, in each case, during the past decade the Commission, in reviewing the consistency of the various power plant projects with the *Coastal Act* has identified the need for more mitigations than the Energy Commission identified as necessary under the *Warren Alquist Act*.

So, I will close now by stating that staff's recommendation of 55 to 68 acres of wetland mitigation is based on the impacts identified in Poseidon's study, and does not rely on future speculative developments. Staff believes this level of mitigation, combined with conditions based on those the Commission required of Edison for its San Dieguito Restoration Project, is both necessary and appropriate to

insure conformity with the special condition, and to be consistent with the Commission's findings and relevant *Coastal Act* policies.

With that, I'll close, and be available for your questions.

**CHAIR KRUER:** Thank you, sir, thank you for your presentation.

Ex partes, and again, Commissioners, if they are on file, or just use what was previously stated.

**COMMISSIONER HUESO:** Mine are the same as before.

**CHAIR KRUER:** Thank you.

Commissioner Lowenthal.

**COMMISSIONER LOWENTHAL:** Same.

**CHAIR KRUER:** Okay.

Vice Chair Neely.

**VICE CHAIR NEELY:** Mine are on file.

**CHAIR KRUER:** Mine are on file, plus the one I stated on August 1st in the previous 5.a.

Commissioner Wan, anything?

**COMMISSIONER WAN:** No.

**COMMISSIONER REILLY:** Mine are on file, Mr. Chairman.

**COMMISSIONER POTTER:** Same as previously.

**CHAIR KRUER:** Commissioner Achadjian.

**COMMISSIONER ACHADJIAN:** Same as this morning.

**CHAIR KRUER:** Thank you, Commissioner Achadjian.

Commissioner Blank.

**COMMISSIONER BLANK:** Same.

**COMMISSIONER KRAM:** Same as this morning.

**CHAIR KRUER:** Thank you, Commissioner Kram.

Commissioner Burke.

**COMMISSIONER BURKE:** Last night I had a brief ex parte with Susan McCabe and the applicant, and they discussed the issues of mitigation with me.

**CHAIR KRUER:** Okay, thank you.

Commissioner Scarborough.

**COMMISSIONER SCARBOROUGH:** Gave it this morning.

**CHAIR KRUER:** Okay, thank you.

And with that we will open the public hearing, and we will go to Mr. Zbur, or Peter MacLaggan, which one wants to come up, and how much time, sir, are you requesting on this item?

**MR. MAC LAGGAN:** Ten minutes, please, Mr. Chairman.

**CHAIR KRUER:** And, how much for rebuttal.

**MR. MAC LAGGAN:** Five minutes, please.

**CHAIR KRUER:** Okay, 10 and 5 it is.

**MR. MAC LAGGAN:** We have a presentation, if you would bring that up.

Thank you, Mr. Chairman, Commissioners. My notes

here say good morning, so I guess I owe you a debt of gratitude and thanks for your time today.

We are here to speak to you about Poseidon's proposed Marine Life Mitigation Plan that was submitted to satisfy Special Condition 8. We submitted the letter to the Commissioner that includes -- on the pink form this time -- includes the form of a motion, which would allow you to adopt Poseidon's plan. Attached to that letter is the version of the plan Poseidon seeks approval of today, copied on that pink copy.

The plan was developed in conjunction with and incorporates input from multiple state and regional agencies since the submission of the plan last fall. Poseidon has worked closely with your staff to address a number of staff's concerns, and these discussions lead to a number of agreed upon modifications to the plan, which are listed in the attachment to our August 2 response to the staff report; however, there are 4 areas of disagreement that remain between Poseidon and the proposed staff recommendations and modifications to the plan, thus Poseidon is recommending that the Commission adopt the plan, but not adopt staff's recommended modifications.

Moving into the presentation, let me start by reminding you of how we got here. We certified -- or the City of Carlsbad, I should say, certified an Environmental

Impact Report for the entrainment and impingement impacts. Unlike our existing water supply, we found that there were no threatened and endangered species, and commercial or sports fishing impacted by the project represented less than 1 percent of the total.

Aqua Hedionda Lagoon, today, is thriving, and it is thriving under extraction conditions that are roughly double that that would exist under the stand alone desal plant, so our expectations are that conditions would only get better as we move from co-located operations to a joint operation with the power plant.

The proposed Marine Life Mitigation Plan, therefore, is not to mitigate for impacts that were found significant under CEQA, but to comply with the *Coastal Act* goal to maintain, restore, and enhance coastal resources.

This next slide gives you a perspective of the difference between the two plans, that proposed by your staff, and that proposed by Poseidon. Poseidon is proposing to restore 42.5 acres of marine wetlands. We are seeking phased implementation, phased implementation that would provide 37 acres up front, and 5.5 after the power plant is retired. We think the phased implementation will encourage the use of new technology to avoid impacts, and therefore it is good public policy.

We are also requesting the opportunity to have

considered at a future date, when we go to phase 2, the restoration and environmental benefits associated with Poseidon taking on the stewardship of the Aqua Hedionda Lagoon. That, of course, would be at the Commission's discretion. The staff recommendation, as you just heard, is for 55.4 to 68.2 acres, no accommodation for phasing, no encouragement of new technology, no dredging credits, recommended from staff.

The restoration area of 42.5 acres, as you just heard from Mr. Raimondi, the very conservative estimate of the area needed to address the impacts associated with the project, and I just wanted to bring out one key point that has been lost in this whole discussion, and that is the fact that two-thirds of the water that will be used at the desalination plant will never go through the facility. It is dissolution water for the concentrated seawater leaving the plant, and once we dis-locate from the power plant, that is the power plant shuts down, we are then simply lifting out water from where I am standing to where you are standing, and the assumption is that the vast majority of the organisms in that water will survive.

The assumption that got us to staff's recommendation before you today is that there is 100 mortality. We can't prove that there is survival until the plant is operating, and they can't prove there isn't, so the default

is to assume the worst case scenario, 100 percent mortality, and that is how you get to 50, and we think that is how you get to 42.5 acres. That is how staff also got to their recommended acreage.

Dr. Raimondi confirmed that Poseidon's methodology is consistent with that used by the CEC. Staff just told you that there has been a wide array of outcomes to that process. We were directed by staff to follow that process over a year ago, and we did so, to the letter of what has been done in the past, and low and behold when we got it done, there was the request for more acreage.

The analogous, the Coastal Commission decisions that follow right down the line that we are recommending before you today are the Moss Landing Power Plant, and the Morro Bay Power Plant projects. Staff's proposal for 55.4 to 68.2 acres is unprecedented, and it is inconsistent with any previous CEC mitigation plans, in terms of the approach that was just described.

Dr. Raimondi talked about the glass that is half full situation, where you have a 50 percent chance of under-mitigating using the mean as your choice of where you place yourself on the curve. He described you also have a 50 percent of over-mitigating, and that is precisely why they picked that point on the curve, because it is more likely than not you are going to be right. If you go higher on the

curve, you are more likely than not that you going to be right, but you are also more rightly than not to over estimate, so this is why 50 percent has been the standard used by CEC in the past.

Poseidon is proposing phased mitigation, and we are doing so because we think it provides us an opportunity to confirm that the actual impacts are less than demonstrated in the projection that is before you in the entrainment study. We will have an operating system, and we will fully mitigate that operating system while we operate together with the power plant, but it will also be incentivised to everything we can once that power plant shuts down, to minimize those impacts, and protect those marine organisms.

Therefore, we are proposing 37 acres going to the ground right up front, when the project starts construction, and that will fully mitigate the impacts while the power plant continues to operate. In fact, if we were operating during the past 6 months, we would have found that we are more than 2.5 times over mitigated with that 37 acres, while the power plant continued to operate, because in the last 6 months, the power plant would have provided 75 percent of our water.

The project will continue to be fully mitigated until the power plant no long provides at least 13 percent of the water we need. Staff just suggested, that if Poseidon

wants to get some relaxation to the mitigation requirement, we can come back and prove it to them, and seek a permit amendment, but by the time we prove it to you, the plant will have been built, the mitigation restoration will have been built, there is nothing for us to avoid, and nothing to incentivise us to conduct a study and look at the technologies to avoid the impacts. We have already spent the money, the restoration is in the ground, because they are asking that it all go in up front. We think phasing is a tremendous public policy benefit, and would incentivise Poseidon to look at every opportunity to save fish, rather than mitigate after the fact.

Moving onto Phase 2 Mitigation. Phase 2 is triggered when the power plant is decommissioned, or provides less that 15 percent of the project's water. Under Phase 2, Poseidon would provide 5.5 acres of additional mitigation, unless those new studies that I was referring to can demonstrate to the satisfaction of the Commission, that the impacts are lower than expected, or that we can deploy state-of-the-art technology that is implemented to reduce the impacts, such as the low impacts pumps I talked about, when the power plant will no longer be operating, and we will no longer have to go through their mechanical equipment to get our water, so we can just lift the pump from where I stand to where you sit, and we think we can do so in a very sensitive

manner, and protect a lot of species, and save some money on mitigation because we are incentivised to do so.

The phased implementation, from our perspective is a good public policy, it will incentivise Poseidon to maximize opportunity to avoid impacts.

Now, how is it enforced? not only does the Commission have enforcement authority through your permit condition, so it is speculative of whether or not we are going to do Phase 2 mitigation, it will be a condition of our permit, and if we don't do it, you have the ability to require us to discontinue operations of the desal plant.

Additionally, the State Lands Commission, in its proposed lease, as was last presented to us, had a requirement that there will be a new environmental assessment, essentially, new entrainment studies, upon the decommissioning of the power plant, or within 10 years of startup of our operation, it will reassess all of the actual ongoing impacts and assess opportunities for new technology to minimize those impacts, and the Lands Commission has reserved the right to order us to implement that technology.

Similarly, the Regional Board permit, our discharge permit, has a provision within that permit that says when the power plant ceases to operate our permit is reopened and they can require implementation of best technology at that time.

Last point I wanted to make, with respect to the dredging credit. We find that this is consistent with past Commission decisions. You have allowed this in the case of the SONGS project. The Commission may decide at a later date, we are not asking you to decide today, but to leave the door open to decide at a later date whether dredging should entitle Poseidon to a restoration credit. That credit would recognize environmental benefits to Aqua Hedionda Lagoon; specifically, we would be preventing the closure of the lagoon, that would surely result in the absence of somebody dredging that lagoon, and result to significant impacts to over 300 acres of coastal resources.

Secondly, sand dredged from the lagoon will be used to maintain, restore, and enhance habitat for grunions spawning, and public access to the beaches in Carlsbad.

In closing, Mr. Chairman, we request the Commission approve Poseidon's version of the Marine Life Mitigation Plan.

Thank you, very much.

**CHAIR KRUER:** Thank you.

With that, and then we will move to Marco Gonzalez, for the organized opposition. Mr. Gonzalez, how much time are you requesting, sir.

**MR. GONZALEZ:** Since we will not have rebuttal time, we are asking for 20 minutes. We believe we will be

able to get it within the 15 that the applicant is requesting, but given the gravity of this, and given that we have brought out an expert, we would like the full 20.

**CHAIR KRUER:** That's fine, sir, we will give it to you.

**MR. GONZALEZ:** Thank you, Mr. Chair, Marco Gonzalez, Coast Law Group, on behalf of the Surfrider Foundation, and San Diego Coast Keeper.

Folks we have had a rain check on reality today, and throughout this entire process. That's right, a rain check on reality. We have been pushing this project forward based on what we believe to be our need for water, not based on what should be controlling your consideration under the *Coastal Act*, and that is science.

Three times you have had your staff recommend to you that you do something three times, and you have decided to do something entirely different. It is time that we put aside the simply policy debate over whether we have a drought, because your charge as the California Coastal Commission is to consider the impacts of projects just like this to natural resources. It is about science at this time, folks. It is not about the public subsidy that we need to give to somebody to get them water. It is about science.

Now, we have brought up an expert to discuss the very issues that Dr. Raimondi presented to you. Her name is

Dr. Liz Strange. Her resume has been attached to the letter that we delivered to staff yesterday, and made copies for you this morning. She is nationally renowned for her work on restoration scaling. She is going to touch on some specific issues, and then I will sum up with some of the bigger picture issues.

But, you have today, an opportunity that isn't usually afforded you as a Commission. You have two very well respected experts on the very issue you are deciding on, Dr. Raimondi and Dr. Strange.

I would encourage you to take advantage of their presence to ask them questions, to perhaps ask them to engage with you, together, on answering some of those questions, because they agree on a lot, and there are specific points where they diverge, but it really is a unique opportunity.

And, so, with that, I will bring up Dr. Strange.

**MS. STRANGE:** Thank you, and I welcome the opportunity to speak before you tonight. Again, my name is Liz Strange, and just to say a little bit about my background, I am an environmental scientist, working with a consulting firm that actually has worked over the last 20 years on restoration, and problems related to scaling restoration.

Scaling restoration is a concept, something that originated back at the time of Exxon Valdez, when people were

faced with the loss of habitat, damage to the services provided by that habitat, and there was the need to figure out what do you do to offset that loss. Now, scaling is very simple in concept. You have got a loss, you need a gain. You, basically want to have an equation that says the two are equal. So, in concept is very straightforward thing, but as with everything, and particularly everything in ecology, the devil is in the details.

And, what I want to talk about here today are some of those details, both in terms of the data available, and the uncertainties that Pete has talked about, in terms of some of those data, and also the methods that we are using to try and figure out what that equation is.

And, rather than talk about specific numbers, or even details of a particular method, I think it would be helpful if we kind of step back and really try and think of this in the simplest possible terms. And, in my mind the simplest way is to think in terms of buckets. Let's think of this as the ocean, and I have got a bucket, and I am going to dip into that bucket, and pull out what is in there.

You want to know what is in that bucket. You are in charge of that bucket, that is your bucket, and you require somebody to figure out what is in there. You want them to count the fish, you want them to tell you what fish they are, you want to know all of the details you can about

what is in that bucket, because I've come along, and I've said I need that bucket. I would like that bucket for something that I think is going to be very helpful, very beneficial, so I would like that bucket, and I'll give you another one in exchange.

So, your question is well, what is the bucket you are going to give me? Is it going to be exactly like the one you just showed me, and you have given me all of this information about? That is the bucket, actually, that Poseidon is talking about, and that Pete is talking about.

There has been a lot of detailed work done to figure out what is in that starting bucket. And, I agree with Pete, that it is excellent work that has been done. Not with uncertainty, because that is impossible, and I think, you know, Pete has talked about some of the ways to address the uncertainty in figuring out what is within that starting bucket.

But, the point I want to make is that bucket is just the impact. You still want to know how do you all accept that, so I am coming along with my bucket, and you want to know what is in it. Well --

[ Voice fades out of hearing range. ]

**CHAIR KRUER:** Could you come speak into the mike, please.

**MS. STRANGE:** Okay, whatever is in this bucket

over here, you know, just give me what is in there, make it the same.

And, the problem that we have in this case is that we don't know anything about that other bucket, so we are trying to infer from this bucket what it might be. Let's say -- I'll use a percentage. Let's say that what is in this bucket is 10 percent of the fish that were in this area that was sampled, and what Pete has point out is that you can think of that also, in terms of 10 percent of the habitat of those fish.

So, the idea would be let's use that 10 percent, and go over here and fill our bucket with 10 percent of whatever is over here. And, it sounds great, and it would be great if what was over here -- first all we knew what it was, and secondly it was identical to what is over here.

Now, the reality is, first of all, in this particular proposal, we don't even know what the area is that we are going to get to be able to dip our bucket in to get an offset. And, the second thing is, there is almost no cases or very few habitats exactly the same. They are going to differ. And, the question is that we are faced with is how do they differ? are the fish the same? or are they different? is the quantity of the fish the same? or are all of the details the same, or not? and, if they are different, what do we have to do to figure out how to match the bucket over

here.

Are we going to need two buckets of what's in here, or is one going to be enough? Those are the kinds of things that make scaling very complicated.

So, the first issue that I want to bring up, in terms of scaling, and how one goes about scaling, and interpreting scaling, has to do with this quality issue. Are the buckets the same, that is the first thing we have to know about. And, at this point, we don't know, because we know nothing about the other bucket.

The second thing we want to know about is are the fishes that are in that bucket? can they reproduce there? do they live there? do they reproduce there? so that we know next year we are going to have those same fish? Well, we don't know the answers to that, either.

In fact, what we do know, as Pete pointed out, is that some of those fish probably come in from the ocean, and are there only on a seasonal, or temporary basis. Do they reproduce there? what do we know about that? what do we know about their production?

Another thing that was brought out was the question of whether you use an average, or a maximum? In restoration scaling, typically, a maximum is chosen, and the reason for that is, if you can think back to Pete's numbers, gobi were the dominant loss, and it looked like they would

need 65 acres to be recovered, so what happens if you choose 44? what happens to gobis? do we get some of the gobis back? and if so, is that okay? We don't have the answers to those things.

And, I guess there is one other thing that I would bring up, in terms of kind of standard approaches to scaling, has to do with something called discounting. Discounting, I guess the easiest way for you to think about it -- for those who like me are not economists -- is you have a certain amount of money in the bank. Is that money worth more to you now, than it would be in the future? Would you rather have your hands on that money now, or is it okay with you if somebody has that money for 10 years and then gives it to you? Well, the idea of discounting is that the preference, usually, is to have the money now.

And, so discounting takes the gains into the future and puts them in terms of a present value, and that is also something that needs to be accounted for.

Another part of discounting has to do with the restoration, itself. When I snuck over here and pulled my bucket up, is that all that I need to do? is the restoration already set to go? is it already producing what I need? In most cases, no. And, in fact, in terms of the SONGS mitigation, they estimate it is going to be at least 4 years, once they start the restoration, until they start to produce

-- or actually achieve what they hope to achieve. So, discounting is another way to take account of that lag.

So, what I am trying to bring up here are the issues of the details and the science. Both in terms of the data, and the methods, that are still unresolved, and I would also like to suggest that there are other ways -- there are ways of getting at the answers to some of those questions. Also, imperfect, but they may get closer to the answer than some of the methods we are using right now.

I provided one example, which has to do with, actually thinking not just in terms of the fish that you have here now today, but what those fish produce, because what you really want to know is, are you going to have those fish in the future, an how many of them are you going to have?

So, that is the rate of production of those fish, not just the area they occupy, but the time frame over which they are producing more fish.

But, I don't really want to dwell on the different methods, so much as I want to make a point about is that there are different ways of doing this. The science continues to evolve, and for us to kind of get fixed on one way of doing this is actually to our disadvantage. At least, if we want to be certain that what we are getting back is what we think we are getting back.

One of the ways that this is addressed, of course,

is through doing monitoring, so that is another thing that is missing from this plan, is the details about what that monitoring would be. We need to do the monitoring to know what, in fact, we are getting back, because we don't know yet. We have no assurance about it, and then we have no way of knowing.

So, in addition to the point about monitoring, I think there needs to be more information addressing some of the things that I have mentioned, in terms of the assumptions that are inherent, and the method that is being used, and where there are some limitations in that methodology.

And, I guess, finally, what I would say is that right now we have got a very good assessment of impacts, we are equating that to restoration, but restoration is not the same, and in fact, experience has shown that restorations do not achieve the equivalence of what has been lost, and in almost all cases.

It also depends on what you measure, as to whether you are actually getting all of the functions of a restored habitat back. And, in terms of what the habitats are, Pete has talked in terms of a mix of habitats, and that is important to get back, because different species have different habitats that they depend on.

But, in the mitigation plan, there is reference simply to wetland habitat. Well, what does that mean? and is

that going to provide the habitat that all of these species need? We know the gobis need mud flats. How much of this mitigation plan is addressing that.

So, really, that is the purpose of what I am trying to bring up here, today, is some of these considerations, that over years of experience, people have found are important to make with their scaling restorations, and that in the particular plan that you have before you now, a lot of these issues aren't being addressed.

The standard approach for registration scaling that my company and others implement are in the peer reviewed literature. They are available for people to look at, and people to consider. They have been approved by the courts, and other cases, and in settlement cases.

So, there is precedent beyond what has happened here previously in California, which is also of importance and concern.

**MR. GONZALEZ:** Just one thing, Marco Gonzalez, for Surfrider and Coast Keeper, I just want to touch on a couple of specifics on what Poseidon is asking for here.

The Edison precedent, remember that precedent is 30 years old. They didn't have entrainment studies. They didn't have restoration scaling. They had to start from scratch.

The notion that today we go with all of the

knowledge that we have, and say, let's implement a 30-year old preliminary mitigation plan, that makes no sense. It is not based on science. It is not based on any kind of good policy.

The notion that all of a sudden, in the last month, this plan has changed from we are going to San Dieguito to we are going somewhere between Tijuana and Port Hueneme? You are telling me that today you, you, as the Commission, can say 37 acres in Aqua Hedionda is the same as 37 acres in Los Angeles? or 37 acres in San Dieguito? or 37 acres in San Diego? or 37 acres in Tijuana? That is not appropriate, it does not even pass the smell test. The buckets aren't the same.

They want to use up to 4 different sites to come up with the 37 acres. It just doesn't make sense. If they are not going to set a baseline for the place where they are going to do their restoration, then how do we know how it is going to change? how do we know it is going to get better?

They can't go into a habitat that currently exists and just protect it. They have to make it better, to the tune of 37 acres in Aqua Hedionda Lagoon, where now we all know there isn't 37 acres to restore. There is a fundamental problem here. Remember it is time to get rid of the rain check on reality. We have to face the facts and the science. We need some certainty.

Chairman Kruer made some comments earlier on the Greenhouse Gas Mitigation Plan, that really troubled me, really troubled me. His comments, quite frankly, were that we can't impose so much mitigation that it makes this project infeasible, that it makes it too expensive.

Let's go back to last November where there was really good questions about how in the world is Poseidon, who we know is going to have to spend about $1300 to $1400 maybe $1500 an acre foot to make this water, how are they offering this water to the water districts at the price they currently pay? They are rolling the dice. They are rolling the dice on their own dime, on their own investments, but you are charged with protecting the investment of the people of the State of California. That is our ecological health. It is not your job to provide an ecological subsidy to this project, just so that it pencils out.

When you look at their phasing plan, the notion that at the most they will ever have to do is 5.5 additional acres over 37. What if they go into the estuary in Tijuana, and they have to do 50, 60, or 80, or even, like we say 100 and something?

They need to write a blank check the same way that Edison did, because if you are going to do your job under the *Coastal Act* you have to insure that when they put something in the ground, it may not be enough. They have to monitor

it. They have to monitor it for a long time. They have to insure that it works, and if it doesn't they have go do more, and if that doesn't work, then they have to go do more.

And, quite frankly, at the end of the day, it makes water produced by desalination so expensive because mitigation for greenhouse gases and for marine life mitigation just costs so darned much that the water customers can't handle the costs -- well, folks, we have seen expensive water ideas in the past. Remember, bags of water from the Gualala River? remember those knuckleheads who wanted to bring icebergs down from the arctic circle? Those were expensive, therefore not feasible.

If desalination's time has not come, don't subsidize it on the backs of the public's resources, that is not your job. Let Wall Street deal with the risks, the financial risks of providing a product before its time. But, frankly, you owe us more. To date, you haven't given us that.

Mr. Hueso, you have made three motions, so far. Each time you followed it up with, quite frankly, an embarrassing representation of your knowledge of the project, and your knowledge of the science. You have hired --

**CHAIR KRUER:** Mr. Gonzalez.

**MR. GONZALEZ:** -- as your Coastal Commission staff and experts who will tell you the science needs to be --

**CHAIR KRUER:** Mr. Gonzalez, why don't you stick to the mitigation plan, and not go back on the whole project. You are scattering all of us. You are entitled to talk, but with all due respect, we are on the plan itself, and it would be much more effective if you would talk about the plan.

**MR. GONZALEZ:** Gotcha.

**CHAIR KRUER:** Okay.

**MR. GONZALEZ:** The final point that I am trying to make here, Mr. Chair, Mr. Hueso, the maker of three motions, is that you, as a Commission, as appointees of various elected officials do not have the scientific expertise to override your staff, as you have, and certainly not to override Mr. Raimondi and Ms. Strange. You don't have the expertise. It is your job to look to staff, and make policy decisions, but don't try to change the science on us.

This is one, where there is no question, they are looking for a subsidy to get this project through because they know they are rolling the dice on the price of the water. They don't deserve it.

**CHAIR KRUER:** Okay, let's see.

Jack Minan.

**MR. MINAN:** Yes, thank you, it is Jack Minin.

**CHAIR KRUER:** Thank you.

**MR. MINAN:** I would like to start with just a brief description of my credentials --

**CHAIR KRUER:** Three minutes, go ahead.

**MR. MINAN:** -- still going?

**CHAIR KRUER:** Yes.

**MR. MINAN:** I have been teaching law at the University at San Diego for some 35 years, and during this time I have been involved with the theoretical, as well as the practical applications of environmental law. Also, from 1999 through 2006, I served on the Regional Water Quality Control Board, and chaired that board for 6 consecutive years, so I bring a wealth of experience to this question that is impossible for me to capture in just 3 minutes.

I would make a couple of points, however. First, the greatest danger that you face today, I think, is contained in the idea of further delay. This has been a project that has been through an extensive 5-year review process. It has been looked at by a number of agencies, and therefore I would encourage you to take action today on the Marine Life Mitigation Plan, which I fully support.

I want to focus your attention on the staff's report, and it is really the inadequacy of the staff's report that causes me to enthusiastically support the Marine Life Mitigation Plan that has been proposed by the Poseidon Corporation.

If you will take a look at the phasing issue, which is one of the embedded issues here, you'll see that the

staff has given you two reasons why you, as a Commission, should support their view.

The first is that the power plant operator was not a co-applicant to this project. That, it seems to me, is a transparent attempt at further delay. Were you to accede to that, as a rationale, you can count on an ever-lengthening process of this permit before you.

The second reason they offer you is that it is speculative. I think Dr. Raimondi correctly indicated that there are important issues of policy that need to be decided by you, such as confidence levels, and so forth.

I would say that mitigation phasing is not a unique or new concept. It is one that is formally embedded in the law. In terms of incentivising Poseidon to do the right thing, I think they have all of the incentives in the world to make this a successful process, and to serve the public interests.

I think the staff broadly brushes away the fact that the *Clean Water Act, Porter Cologne*, as well as many other environmental laws are technology enforcing, and attempt to create real incentives for applicants like Poseidon.

I see that my time is over, and I appreciate the opportunity to address you, and I hope that you endorse Poseidon's recommendation on the mitigation plan.

**CHAIR KRUER:** Diane Nygaard.

**MS. NYGAARD:** It is almost evening now, so good evening, Mr. Chairman and Commissioners, Diane Nygaard, representing Peter Calavera.

The Aqua Hedionda Lagoon, like all of our Southern California lagoons, is in trouble. We know only fools or tourists would think of swimming in our waters off the coast after a storm because the runoff is so polluted. You certainly wouldn't call it a thriving environment.

Our stakeholder group has been working for over a year on a watershed management plan for Aqua Hedionda. A $500,000.00 project funded by the Regional Water Quality Control Board, and sponsored by the City of Vista, and that watershed management plan identifies numerous projects that would benefit this area, and some would be appropriate mitigation for the impacts of this project.

I think there are three key differences between Poseidon's proposal and what the staff has recommended. We would like to call to your attention, and that is, that first, there really should be full mitigation for all of impacts. We have looked at lots of projects over the last few years, impacting our coastal resources. The key is no net loss, and in order to achieve no net loss, it is typical that we look at mitigation requirements of 2:1 or 3:1, and not a 50/50 chance that we get to no net loss.

The staff recognizes that dredging is not mitigation. Dredging is really a cost of doing business in that lagoon. Dredging causes impacts to coastal resources, so dredging really shouldn't be counted as mitigation.

And, third, the staff report, we think, provides some flexibility so that some of the impacts of this project can really be addressed in Aqua Hedionda, the area that really is going to be impacted.

Thank you.

**CHAIR KRUER:** Thank you, very much.

Ed Kimira, then Mark Massara.

[ No Response ]

Then Rachel Davis, and Eric Munoz.

**MS. DAVIS:** Rachel Davis, the statewide desal assumptive.

First, I would like to agree with the organized opposition, we feel that Dr. Strange is an asset, and we encourage you to take advantage of her.

Open ocean intakes are not the best available technology, and will have significant impacts on the marine life. After-the-fact restoration of habitat, as proposed in the Marine Life Mitigation Plan, is not a legal or appropriate mitigation for this project. We maintain that the EIR certified by the City of Carlsbad did not accurately review marine mortality of future entrainment and impinge-

ment.

Poseidon Resources Corporation's admission that the impacts require restoration of at least 37 acres of coastal wetlands habitat, is not enough, but also contradicts the EIR. The amount of avoidable damage to marine ecosystems that would call for 37 acres of coastal wetland habitat restoration is indeed significant.

Thank you.

**CHAIR KRUER:** Thank you, Ma'am.

Mr. Massara, three minutes.

**MR. MASSARA:** Honorable Chair, Commissioners, I am Mark Massara, Sierra Club Coastal Program.

Today we would like to address the independent stand along marine ecosystem impacts associated with Poseidon's use of 304 million gallons per day of ocean seawater in perpetuity, which you could not, and did not consider in your November 2007 approval of this project.

As you know, these ocean water draws will have devastating continuing permanent impacts on ocean fisheries, including destruction of millions of Garibaldi fish, our state fish. As you know, Poseidon proposes just 37 acres of mitigation, and a total future cap and limit of just 42 acres no matter how much damage they do to our fisheries forever. Great for their bottom line profit expectations, I suppose, but entirely irrelevant to the *Coastal Act*.

At the same time, you now have the opinions and analyses of Drs. Raimondi and Strange. As Dr. Raimondi demonstrates conclusively the Poseidon's Resources Plan gets you only a 50 percent chance of success involving a very limited data base of the universe of fisheries impacts association with Poseidon's enormous ocean water draws.

It should go without saying that the desperate measures currently underway in California to save our last remnant fisheries, no take and closure zones, require that you employ the most conservative, highest confidence level of mitigation, that being a minimum of 61 acres of mitigation.

Yet, that 61 acres of mitigation is literally just the tip of the iceberg in the actual tangible species-wide impacts associated with the operation of the plant. That is the whole point behind the bucket concept, and the rationale behind the concept, and past practice, of requiring 3:1 ratio mitigation requirement. It is because, historically, we have dramatically underestimated entrainment kills. You have had entire workshop on that subject: the inadequacy of entrainment mitigation, alone.

Commissioners, think of the huge we don't know portion of Dr. Raimondi's graph. You don't know because for years Poseidon has refused to model these impacts. Despite that, you have an obligation to protect all of these fish species, and fish kill. This isn't a free fire zone. In our

view that justifies, indeed, requires a 3:1 mitigation ratio, or at least 183 acres of mitigation.

If you add to this all of the uncertainty involved in the fact that you don't even know whether you are going to get wetland or rocky reef habitat mitigation. It just underscores the high level of uncertainty.

**CHAIR KRUER:** Mr. Massara, your time is up, sir.

**MR. MASSARA:** Please deny the Poseidon Resources Plan, and impose reasonable mitigation.

**CHAIR KRUER:** Thank you, sir.

Eric Munoz, and Joey Racano, and Doug Korthof.

**MR. SANDQUIST:** Mr. Chairman, before I start, Eric Munoz had to go to a Carlsbad Planning Commission meeting, and asked me to speak on his behalf. I was also going to speak on behalf of the Batiquitos Lagoon Foundation.

**CHAIR KRUER:** You get 3 minutes, total.

**MR. SANDQUIST:** Yes, I just wanted to --

**CHAIR KRUER:** Is your name in here?

**MR. SANDQUIST:** Yes, I have a slip.

**CHAIR KRUER:** What is your name?

**MR. SANDQUIST:** Fred Sandquist.

**CHAIR KRUER:** Fred, okay, then go ahead, then.

**MR. SANDQUIST:** I am Fred Sandquist, president of the Batiquitos Lagoon Foundation, and also speaking for Aqua Hedionda Lagoon Foundation, Eric Munoz is the president

there.

I am here to address our support for the staff recommendation on the mitigation plan, and your endorsed -- hopefully your approval of the mitigation plan as proposed.

We feel that it is extremely important to look at the total picture associated with our lagoons in Carlsbad, not only do we have Aqua Hedionda, but we have Buena Vista and Batisquitos Lagoon, as well.

We feel that the opportunity for sustaining our wetlands goes beyond in looking at an investment. It includes our beaches, nearshore areas, and the watersheds that feed them. Our lagoons are one of the components of a large dynamic and complex system, and must be managed accordingly.

The desalination project mitigation requirements present an opportunity to provide sustainable stewardship and management, and we highly recommend that when considering mitigation projects, that the priority be considered of first Aqua Hedionda, and also the other two lagoons in the City of Carlsbad.

We strongly, therefore, support the staff determination that the Marine Life Mitigation Plan should be performance-based plan that identifies specific mitigation requirements and performance criteria, and provides a 24-month timeline for identification of one or more of the

mitigation projects.

I strongly, both myself and Eric Munoz, strongly supports the recommendation of the staff, and thank you for the opportunity to address you today.

**CHAIR KRUER:** Thank you, sir.

Doug.

**MR. KORTHOF:** Joey Racano, I am sorry was called off to save another area of the coast, but he sends his love.

Doug Korthof, and I stand here as the president of a growing organization called Taxpayers Against Big Oil. We are a dues paying organization, and oppose all destruction of the coast, such as the power plants on the coast using single pads.

I wanted to clarify some things that passed by before. Power is in kilowatts. We, in California, have a total capacity of 52,000 megawatts of power. Energy is in kilowatt hours. How much energy it takes to make one acre-foot of water was never clarified. It, apparently, takes 4500, which is, at current rates, about $500 worth of electricity. So, how much it takes is a big question.

You have to take the amount of acre feet you have, multiply it by kilowatt hours, and that gives you the energy that you are using. The power that is required is the total kilowatts to do that.

Now, as to pollution, the pollution that comes

from a power plant, it could be a coal plant, or a natural gas power plant, whatever it is, natural gas has ultrafine particulates, which are considered now to be a very serious problem, similar to diesel exhaust.

The greenhouse gas issue is entirely different. It is now considered, according to the State of California, and according to the EPA, a court decision, to be one of the pollutants, so CO2 and methane use are considered pollutants, and there was some big confusion about that earlier.

Now, we are for healing the entire Aqua Hedionda Lagoon. That means taking out the power plant, which is going to go out anyway. Telling us that because you are going to replace it with something slightly less destructive, and therefore it is okay, doesn't satisfy the problem.

The problem is we need to save the animals that are in this lagoon, where they are at, and not destroy them at that place. The only way this power plant -- desalination plant should be allowed to exist in this Aqua Hedionda Lagoon is if it has no impacts, at all.

As the developer said, it should have no impacts, that is, it shouldn't take any water in from the lagoon, and it shouldn't kill one single sea creature. Now, if they can do that, you should allow it. If it can't do that, any kind of mitigation you do is impossible. There are no wetlands left.

To do mitigation for the Port of Los Angeles, they had to go to Bolsa Chica. Everybody is fighting for wetlands. We used to joke about the fact that the developer who wanted 50 acres in mitigation, would go and mitigate 50 acres. The next year, another developer wanted to mitigate this same 50 acres, so you have everybody looking for stuff to mitigate, but it doesn't solve the problem that you are killing this lagoon. That is what you have to do, if it has no impact it can be allowed. And, we want to heal this lagoon, and not further destroy it.

**CHAIR KRUER:** Thank you, sir.

Joe Geever, and then Charlotte Stevenson.

**MR. GEEVER:** Thank you, Mr. Chair. My name is Joe Geever.

First, I want to read you a quote by Commissioner Thayer, from your November 2007 hearing, who was quoting the Lieutenant Governor:

> "What is the who, what, why, when and where of the mitigation of the 37 acres? where is it going to occur? when is it going to occur?"

He wasn't satisfied with the details, either, so he asked that that be nailed down before he it came back to our Commission, the State Lands Commission.

Then, as now, the plan is simply not right for approval. There is not enough substance to even characterize

the document as a plan. It is, effectively, a plan to draft a plan. None of Commissioner Thayer's questions have been answered. This type of less than satisfactory submission is what continues to stall final approval.

We think, also, that there are legitimate and important differences in the scientific community about what is the most direct approach to restoration scaling. Obviously, we think Dr. Strange's review, that is in your packet, has given the Commission substantial evidence that there is a better approach than the one the Poseidon experts and the staff's consultants have used.

We think an open discussion here, when the experts are available would be extremely valuable. I encourage you to ask clarifying questions of the experts.

Finally, Poseidon's argument that past decisions set irreversible precedent are groundless. Of course, you have the flexibility to require a different method for restoration scaling, if it is a better method than used previously. The policy of using best available science is to encourage and recognize evolving science.

Even more oddly, Poseidon rests on precedence, yet requests a phased approach that has never been considered before, and is counter to the standard of adaptive management.

We ask that you not approve the current draft,

MLMP. There is simply not enough detail to insure that the MLP will meet the goal of fully replacing marine life from the project. Make sure you get this right, so that the future projects have clear guidance, and use the best available science.

Thank you, very much.

**CHAIR KRUER:** Thank you, Mr. Geever.

Charlotte Stevenson, then Kevin Sharrar.

**MS. STEVENSON:** Hello, Chairman Kruer and Commissioners. My name is Charlotte Stevenson, and I am a staff scientist with Heal the Bay. Heal the Bay is a nonprofit organization, representing over 12,000 members, and 25,000 volunteers, dedicated to making Southern California coastal waters, and watersheds, safe, healthy, and clean.

Heal the Bay does not support the Marine Life Mitigation Plan for the Carlsbad Poseidon plant, because it relies on inadequate and after-the-fact mitigation, continuing the devastation of the marine environment through impingement and entrainments and setting a bad precedent statewide by continuing the use of a highly damaging intake technology which its colocated power station is, ironically, phasing out.

This project does not allow for implementation of the best available site design and technology to minimize the intake and mortality of marine life, as mandated by the

California water code, and *Coastal Act*.

As it has been argued by many groups since the beginning of the draft EIR on this project, this was not a prudent design, or location because it was reasonably foreseeable that the Encino Power Station would soon be discontinuing their once-through cooling process, and phasing out their intake and discharge.

Even assuming that it is legal to use restorative measures without first minimizing marine life, mortality, through better design and technology, the current marine life mitigation plan does not fully mitigate for the plans environmental impacts.

The best available science is not used to calculate the necessary mitigation, as documented in Status Consulting's recent report on this project, as you heard from Dr. Strange. Thirty-seven acres is a vast underestimate. Additionally, the lack of identification of the restoration site, and the delay in the phased timeline for restoration are unacceptable.

We understand the critical need for water in California, but approval of this project, with the current conditions would set a terrible and unnecessary precedent. This would certainly be a shame when California has been able to be a global leader in so many other marine coastal and greenhouse gas issues.

The science studies and technologies are available to do this, with substantially less environmental impact, and are already being demonstrated by other water agencies. Please hold Poseidon to its prior commitment and responsibility and demand, that at the very minimum, the Carlsbad Poseidon desalination plant fully mitigate its environmental impacts.

Thank you.

**CHAIR KRUER:** Thank you, Ma'am.

Kevin Sharrar, Steve Aceti.

[ No Response ]

Larry Porter.

[ No Response ]

**EXECUTIVE DIRECTOR DOUGLAS:** Mr. Chairman, Mr. Aceti submitted a letter for the record, which we have entered into the record.

**CHAIR KRUER:** Okay.

Joy Shih.

[ No Response ]

Bruce Reznik, Marty Benson.

**MR. REZNIK:** Good evening, Chairman Kruer and Commissioners, my name is Bruce Reznik, with San Diego Coast Keeper.

My points have been pretty much covered by others, so I will just take this opportunity to remind you that you

are -- I still believe in the coastal protection business, not in the corporate welfare and environmental degradation business. I know that the reminder may seem presumptious, it was a little confusing after the last deliberation.

Thank you.

**CHAIR KRUER:** Thank you, Mr. Reznik.

Marty Benson, Gabriel Solmer.

**MS. SOLMER:** Good evening, Mr. Chair and Commissioners, my name is Gabriel Solmer, and I am the legal director for San Diego Coast Keeper.

And, I agree with the points that have already been raised by the opposition, and I will limit my comments in two areas. One is I have to say, where is the beef? This is the problem when you approve a project and then go back and look at the required conditions, and try to fit those conditions into an approved project, and we are seeing the problems that that creates.

Don't exacerbate that problem now, by putting off specifics again, which are lacking in this current plan. As Joe Geever mentioned, this is a plan to plan, and this mitigation plan should not be nice to have, it should be a required part of the approved valid permit.

The applicant must, before its construction, if nothing else, tell you where the mitigation is going to be -- we don't know that, how large the area will be, and whether

that is going to be enough? -- you have heard a lot of scientific debate on that -- and when it is going to take place? and what criteria is going to be used to judge success? You don't have any of that before you today. Certainly, we don't believe you should give up your oversight of all of those areas today, with the approval of this plan.

Secondly, the applicant tries to address these issues, these really baseline concerns, by a new phasing requirement, which we hadn't seen until about a month ago. We would simply reject this phasing approach as patently offensive, and I'll point out two problems with it.

One, is that it gives you a 5.5-acre cap. No matter what you see in the future, you only have the ability to raise the mitigation by 5.5 acres. That just cuts across all of your authority.

The other problem is the 3-year average. You are not going to be able to look at this until a triggering point in the phasing, and that is surely a problem, because you will be taking a 3-year average when we know that there are seasonal and annual variations in the data, and you will be looking across a 3-year modeling set. That is a problem.

And, we ask that you reject at least that part of the mitigation plan, and the plan, in general.

Thank you.

This is the time now for rebuttal, five minutes, from the applicant. Who is going to represent? Mr. Zbur? or Mr. MacLaggan?

**MR. ZBUR:** I am just going to take a minute. I just wanted to take a minute to sort of take a bit of a step back.

What we are talking about is mitigation related to impacts in the Aqua Hedioda Lagoon, which is a lagoon that was created by the dredging for the power plant, and in which the marine impacts are thriving today with the power plant operating at its existing operations.

This project will, essentially, not increase the level of withdrawals that have occurred from the power plant, and so we are talking about, essentially, mitigation to a lagoon that was created for the power plant, and in which if the power plant goes away, this project would assume the dredging of the lagoon, and if they didn't assume that, the impacts are to a lagoon that wouldn't exist. So, I think we sort of need to keep that in perspective.

The second thing is, I am a little bit concerned about just the applicant's due process rights, in that we talked to the staff just day before yesterday, and asked if there were any submissions. We have never received the Dr. Strange's report. We think that we should have an opportunity, if there is going to be weight placed on it, to

at least look at it. And, as I understand Dr. Raimondi's figures, assumed figures from the Raimondi report, as of two days ago we were told that there was nothing in the file.

So, with that, I would like to turn it over to Mr. MacLaggan, who will -- oh, one other thing.

There has been some assertions that our plan doesn't have adequate monitoring. Essentially, what happened is it does. We are going to be coming back within 24 months with the CDP that your staff will review, and you will have discretionary authority over the restoration plan. The plan requires that baseline data be provided, and that the performance standards be met, after construction.

There will be annual reports to the Executive Director on the status and success on the monitoring of the plan, and every 5 years there will be workshops convened with the Commission to review the status and success to make sure that the plan is effective to mitigate impacts.

So, with that, I would like to turn it over to Mr. MacLaggan, who wanted to talk about some of the technical response.

**MR. MAC LAGGAN:** Mr. Chairman, Commissioners, Peter MacLaggan for the applicant. Three quick points.

First of all, with respect to the proposed acreage requirement, I want to point out that it is consistent with the accepted methodology used on the Morro Bay power plant,

and the Moss Landing power plant.

The phasing approach, good public policy, it incentivises Poseidon to avoid impacts. It encourages the use of new technology that will lead to greater protections for marine resources.

And, the third point, Mr. Chairman, Commissioners, the dredging credit proposed for demonstrated environmental benefits is consistent with past Coastal Commission decisions, and the Coastal Commission would have an opportunity to decide, at a later date, whether this is an appropriate amendment to our permit.

With that, I would like to ask our expert on the entrainment study, John Steinbeck, to come up. While he is coming up I will just briefly introduce his credentials. Mr. Steinbeck has been involved in virtually every entrainment study on the west coast for the last decade. He is the author of the CEC's methodology that we have been talking about today. He is on the State Water Resources Control's expert panel for once-through cooling, and you heard Dr. Raimondi's glowing remarks about his work on this project.

Thank you.

**MR. STEINBECK:** John Steinbeck, Tenera Environmental.

Just a quick point on the comments by Dr. Strange. I was recently a peer reviewer of a report she prepared on

restoration scaling, and I can go into detail, but there is no time. I will just say that the method that she promotes has been rejected by the EPA for use in scaling projects that would have occurred for 316B if mitigation was allowed.

On Dr. Raimondi's presentation, I don't really have any arguments with that. I agree that uncertainty needs to be taken into account in restoration scaling. The way the scaling was done for this project was that averaging did take into account a lot of uncertainty, by instead of using the specific habitats that occupy -- the three fishes occupy -- in the case of the garibaldi, it is the small strip of rock in the outer lagoon, and in the case of gobis it is more, but by not using those, and by using the hole again you end up with a much bigger number. This accounts for uncertainties in where those habitat are, and a number of other uncertainties associated with the process. So, that 37 acres does include a lot --

**CHAIR KRUER:** Mr. Steinbeck.

**MR. STEINBECK:** -- accounts for a lot of uncertainties, already.

Thank you.

**CHAIR KRUER:** Thank you, sir.

Okay, and with that, I will close the public hearing, and go back to staff, Mr. Luster, for your response.

**ENVIRONMENTAL SPECIALIST LUSTER:** Thank you, Chair

Kruer, a number of comments.

Regarding what you just heard about the value of Aqua Hedionda, staff wishes to notes that it is one of 19 wetlands along the coast that are specifically protected in the *Coastal Act* through the alteration prohibitions in Section 30233(c), and in recognition of the project's non-conformity to that *Coastal Act* provision that your findings implemented the override in Section 30260, which requires mitigations to the maximum extent feasible.

So, two quick points on that, first, the impacts to Aqua Hedionda are recognized by the *Coastal Act* as more significant than were characterized by the applicant.

And, second, there is nothing in the record that shows mitigations staff's recommended, its levels would be infeasible.

Regarding Poseidon's proposed plan, we have concurred with several of Poseidon's proposed changes. Those are identified in the addendum you received last night. We still have a number of differences between staff's recommend-ation, and Poseidon's plan. One of the key one is that staff does not recommend you adopt a plan that would allow the phased approach to mitigation. A number of issues are associated with that, for one thing, Poseidon proposes that its Phase 2 would occur if during any 3-year period the power plant operated at 15 percent of its full capacity.

Those numbers appear to be arbitrary. There is no basis in the record for why those were chosen. They are not associated with anything that staff recognizes, and why those are the numbers, as not another set of numbers, I don't know.

Also, there is no assurance that future phased mitigation would occur. We could possibly get 5.5 acres of restoration somewhere. There could possible be some technological changes. There could possibly be dredging occurring, which Poseidon may, or may not, be able to take on, since they don't own the lagoon, and the dredging is currently the responsibility of the power plant owner, and that dredging may, or may not result in various environmental benefits, while it also causes environmental problems.

Also, regarding the mitigation credit for dredging. Poseidon has stated that staff's recommended plan offers no possibility for restoration credit for dredging. That is not accurate, however, because, as with any Coastal Development Permit Poseidon could later request the Commission to amend its mitigation requirement.

For example, after Poseidon selects its mitigation site, it may be evident to the Commission that the site requires dredging to support the mitigation, and it could then consider providing dredging credits, as it did with the SONGS restoration project.

We note that the Commission's initial approval of

the SONGS restoration project did not include credit for dredging. It came about only after the site's characteristics were better understood. In the case of Edison's project, the restoration the Commission required was almost entirely dependent on maintaining tidal flows in over 100 acres of its mitigation area, mitigations that the Commission had required. In that case, and only after a couple of years of scientific review and deliberation did the Commission allow mitigation credit for keeping the lagoon mouth open in order to maintain the restoration site, which staff believes is the only instance where the Commission has included dredging as part of the mitigation credit for a restoration project.

Unlike Edison, Poseidon is not, at this time, conducting any restoration work in Aqua Hedionda that would rely on dredging. Also, at this point, we do not yet know where Poseidon will mitigate, and there is nothing in the record that supports putting off until a later date, the mitigation needed to address the currently identified impacts. Further, approving Poseidon's phased mitigation proposal would not insure that the project is mitigated to the extent feasible, as required by the Commission's findings.

Regarding new technology, staff's recommendation doesn't prohibit use of new technology. It just recommends

that the Commission not approve a plan that would rely on future speculative mitigation to address the impacts before it today.

Also, as staff mentioned, Poseidon is already required by the Regional Board to use all feasible technologies to reduce entrainment, and if those technologies become available Poseidon would presumably come before the Regional Board, and the Commission, to use that technology, and at that time, you would be able to better identify what effects that technology would have on entrainment.

Regarding the issue of 100 percent mortality, Poseidon argues that their project is not likely to cause that level of mortality; however, the study Poseidon used included the assumption of 100 percent mortality. That is based on how the study has been implemented by all California agencies, and by the USEPA and there are no peer reviewed studies that support using a lesser rate. Poseidon has suggested to staff some time ago that it be able to use a lower mortality rate, and staff recommended that it conduct the necessary peer review study that would support that suggestion; however, Poseidon has not provided any such studies.

Poseidon also compared its project to Moss Landing, in coming up with mitigation. Staff's understanding from Dr. Raimondi is that if the Commission use the same

criteria to require mitigation for Poseidon as was required at Moss Landing, Poseidon's mitigation would be about 3 times higher than what it is currently proposing.

Regarding the length of time Poseidon proposes to mitigate, Poseidon's plan proposes that its mitigation last 30 years from when it submits its as-built plans for its restoration site; however, Special Condition 8 required mitigation in perpetuity and the Commission's findings identified the facility and its impacts for lasting up to 90 years.

If I could get the slide back from 5.a. the single slide that showed the range of mitigation acreages. As we noted earlier, you have been presented with a range of restoration acreages needed to address the impacts identified in Poseidon's study. Staff has recommended using a different approach than you have used before.

[ Slide Presentation ]

No, it is a single line with some figure on it. While that is going up, I'll continue.

Staff is recommending using a different approach than you have used before, but only if the company who buys the condition that lead to the exemplary restoration work being done by Edison for a similar type of impact. We note that if you would prefer to use the approach you have generally used in the past, your biologist, Dr. Dixon, has

recommended a mitigation ratio of between 2:1 and 3:1 to reflect the out-of-kind nature of the mitigation, and the uncertainty as to where it would be located. This would result in a range of between 74 and 111 acres, as shown on the slide.

And, we would like Dr. Raimondi to address one point, as well.

**MR. RAIMONDI:** I just wanted to make sure that you understood what Tom just said about Moss Landing, versus here.

The point was about whether there is a consistency in the application of this approach, and the consistency is in how the data are collected, and that has been very consistent from Diablo, which is the first place that this has worked on, to Moss, to Morro, to Huntington Beach, it has all been very consistent, all very well done.

How those data have been applied and the calculation impacts have been an evolving standard, and the point that Tom made was -- and what I would like to reinforce -- is that if we use the current methodology for assessing impact, what we are doing now -- even prior to this case -- at Moss Landing, which is the first time it had been really officially used, the assessment of the impacts at Moss Landing would have been three times what was done at that time.

So, the whole point is not that Moss Landing was particularly incorrect, it is just that things evolve, that these standards have evolved. This is a new technology and new technique. It is about 8 years old within California, and we are just getting to understand how to use it.

**CHAIR KRUER:** Okay.

**EXECUTIVE DIRECTOR DOUGLAS:** Mr. Chairman, that completes the staff comments, and I am just trying to figure out how to best structure this for the Commission to deal with it, when you get to a motion, so we don't go through what we just went through before.

My suggestion is that the motion be per staff, and then you have amending motions to address the points of difference that were on a slide, and I would ask the applicant to put that back up, one by one, and then we can make conforming changes, depending on what your decide, But at least that seems to me to be a manageable way to go through it, because if you look at all of these documents, you don't really know what we are doing.

So, if that is okay with you, if I could ask Peter or Rick to put that slide back up where you had a chart, showing the differences between the applicant and the staff -- if that is okay with the Commissioners.

**CHAIR KRUER:** Well, we will have to see.

**EXECUTIVE DIRECTOR DOUGLAS:** Okay, so it is up to

whoever makes the motion.

**CHAIR KRUER:** Exactly.

**EXECUTIVE DIRECTOR DOUGLAS:** Right.

**CHAIR KRUER:** Exactly, and your process sounds rational, but then it might even take longer. I am not sure.

**EXECUTIVE DIRECTOR DOUGLAS:** Yes, those are the points of differences, right.

**CHAIR KRUER:** Okay.

You don't get to speak, Mr. Geever.

**MR. GEEVER:** Mr. Chairman, I am going to ask you for an exception.

**CHAIR KRUER:** No, I am not going to give any exceptions tonight, at this hour, no, sir, cannot do it.

**MR. GEEVER:** I wanted to take issue with --

**CHAIR KRUER:** Well, you are not entitled to rebuttal. We have closed the public hearing, first of all.

**MR. GEEVER:** Okay.

**CHAIR KRUER:** Thank you, sir.

Okay, Commissioner Hueso.

[ **MOTION** ]

**COMMISSIONER HUESO:** Thank you.

I am going to move that we approve the Marine Life Mitigation Plan attached to the staff recommendation, as Exhibit 1, if modified as shown in Section 1.1 below, and Exhibit 2 of this memorandum as compliant with Special

Condition 8 of CDP E-06-013.

And, I will have some modifications.

**CHAIR KRUER:** Okay, it has been moved by Commissioner Hueso, seconded by --

Is there a "seconded" to your motion?

Anyone want to "seconded" it.

**COMMISSIONER LOWENTHAL:** Second.

**CHAIR KRUER:** Seconded by Commissioner Lowenthal.

Would you like to speak to your motion?

**COMMISSIONER HUESO:** I would actually like to go through some of the modifications with staff, and maybe go over some of their recommendations that they have made, just to understand how they apply it.

We have gone over this in the discussion, but I would like to go over, for example, Modification No. 1, says Poseidon shall create or restore between 55 and 68 acres of coastal estuarine wetland habitat within the Southern California bite.

My question to staff about that, I mean, there were a lot of complaints about there not being a specific area, and staff also followed up that there aren't really expressed locations, in terms of where this mitigation will take place. In your recommendation, is that still the condition, in terms of we don't know where this is going to take place?

**ENVIRONMENTAL SPECIALIST LUSTER:** Staff consulted with the SONGS Scientific Advisory Panel, and our recommendation is based on input we got from the panel.

The conditions that the Commission imposed on Edison for the San Dieguito site, those were issued before Edison had selected its site, and so we feel that if Poseidon meets the same conditions that Edison was held to, and selects a site within the Southern California bite, that would provide adequate assurance that subsequent plans that come to you would be sufficient.

**COMMISSIONER HUESO:** So, we can still work out locations, in terms of optimizing the location, and there is the benefit of the improvements.

**ENVIRONMENTAL SPECIALIST LUSTER:** Right, as long as they are held to the same conditions SONGS was.

**COMMISSIONER HUESO:** And, getting to this specific acreage, you put a range of 55 to 68, that was your recommendation. Now, that is not a very, very specific number. Is that based on, again, putting the burden on the applicant to come back with a plan that mitigates the impacts of the project?

**ENVIRONMENTAL SPECIALIST LUSTER:** Staff felt that that was a decision for the Commission.

The two figures are based on the levels of confidence that derive from the study. If the Commission

wants 80 percent confidence that they would insure full mitigation for the impacts, the 55 acres, staff believes, would be sufficient. If you want 95 percent confidence in your decision, then you go with the higher number.

So, the Commission could either decide on a specific figure, this evening, or if Poseidon came back later, with a mitigation proposal, somewhere within that range, that would be the other option.

**COMMISSIONER HUESO:** So, is it so accurate, is it possible to get 95 percent with 37 acres? You are saying, is it impossible? is it improbable? is it that accurate? in terms of the possibility of getting the kind of mitigation that we want within a certain amount of acreage? Can that be achieved through a very intense mitigation monitoring of a specific acreage amount?

**ENVIRONMENTAL SPECIALIST LUSTER:** If you don't mind I will ask Dr. Raimondi to answer that.

**COMMISSIONER HUESO:** Sure.

**ENVIRONMENTAL SPECIALIST LUSTER:** He has far more expertise.

**MR. RAIMONDI:** There are really two issues here, you have addressed one of the. One of them is the amount of acreage that is required, and the other is insuring that it works, because, clearly, you could put in 50, 70, 100 acres and if it doesn't work, you get no compensation.

The key thing here is using the information that Poseidon provided, and just using what I laid out there -- and again, we are not using any data that didn't come from Poseidon -- the 80 percent really is 55 acres, and the 95 really is 68. In addition, you would still need to monitor it, to make sure that it works, because 68 acres of garbage is no compensation.

So, there are two issue, really.

**COMMISSIONER HUESO:** So, in terms of maybe hearing from Poseidon's representatives, in terms of what they can guarantee, in terms of providing the adequate mitigation for the project, you are saying you can do it with 42.5 acres is the claim that you are making?

**MR. ZBUR:** Yes, I mean I think we think that based upon the standards that were used for the Morro Bay Plant, and for the Moss Landing Plant, that the acreage amount consistent with that would be 42.5 acres.

**COMMISSIONER HUESO:** And, what level of mitigation would 42 acres provide?

**MR. ZBUR:** It would provide --

**COMMISSIONER HUESO:** In terms of a percentage?

**MR. ZBUR:** It would present 100 percent mitigation for the stand-alone operations.

**COMMISSIONER HUESO:** If monitoring showed that it didn't, would that mean that you are not let off the hook.

You would have to come back and do some work?

**MR. ZBUR:** Well, I think that one of the concerns that we have about the adoption of the staff recommendation is that it, basically, is just a very vague recommendation, if we conform it to the SONGS approach, which had a lot of details, which were related to a much, much larger restoration program, including very significant costs.

So, one of the things that we were hoping you would do is to use the -- start with the Poseidon plan, and if you wanted to make changes with respect to the acreage, and I think we want -- phasing is an important thing. Not having any phasing, really restricts the number of sites that we can do, that we can get entitled and ready to go on line, within the 24 months that the plan has required.

I mean, one of the things that is very important for us is that we are able to not delay the operation of the plant, and in order to not delay the operation of the plant, we need as broad a number of sites, as possible, and obviously, we are requiring all of that up front, so it potentially restricts the number of sites, and that makes it less likely --

**COMMISSIONER HUESO:** And, that would be required to come back to the Coastal Commission for approval, for each project?

**MR. ZBUR:** What the Poseidon proposal does is it

would require 37 acres up front. We would have to come back to the Coastal Commission within 24 months for a CDP for that project, at least 37 acres.

**COMMISSIONER HUESO:** That is 24 for the 37 acres? and, then?

**MR. ZBUR:** And, then, the Poseidon proposal was that we would have to do the additional acreage at the time that there was stand alone operations occurring, which would be that the power plant would completely shut down, or provides less than 15 percent of the water.

And, I actually wanted to dispute, there is a lot of information on the record which we can site, that provides explanation as to what the basis was of those figures.

**COMMISSIONER HUESO:** So, how did you come up with the 42.5? that is the 37 plus the 5.5 acres?

**MR. ZBUR:** Yes, the 37 plus the 5.5 acres. The 42 acres is using the CEC methodology that was used for the Morro Bay and Moss Landing. The 37 acres was, in part, picked because the San Dieguito site, which is not the site that we will, necessarily, go to -- there are still issues with respect to permitting on that site -- but, we know that we can get 37 acres out of the San Dieguito site, if we can resolve issues with the JPA and some of the other entities involved in the site.

**COMMISSIONER HUESO:** So, under of the staff's

recommended modifications, now where it says, under 1.1 on 1 we have to come up with a determination on the acres, and on No. 2 in conformity with Exhibit 2 -- and we will get to that a little bit later -- and in No. 3 it says when the 60 days of the Commission's approval of the modified plan, Poseidon shall submit for Executive Director's review an approval and review -- excuse me -- of a revised plan that includes these modifications.

So, that is not necessarily -- you are asking for 24 months, as opposed to 60 days? does that condition apply to that?

**MR. ZBUR:** I didn't think we had any disagreement with the staff on the timing of when the CDP had to come back.

**ENVIRONMENTAL SPECIALIST LUSTER:** Right, and the 60 days refers to once we decide on a plan this evening, that Poseidon returns within 60 days, and that incorporates all of the changes that are made. If we end up with some conditions, some Poseidon has proposed, and some staff has proposed, that there is one plan that encapsulates all of that.

**COMMISSIONER HUESO:** So, that would be taken care of by No. 3? there is no disagreement on timing for that?

**ENVIRONMENTAL SPECIALIST LUSTER:** I don't think there is any disagreement.

**COMMISSIONER HUESO:** Special Condition No. 2, that refers to Exhibit 2, are there any disagreements on Item No. 2?

**ENVIRONMENTAL SPECIALIST LUSTER:** Yes, staff's recommendation in Exhibit 2, those are the conditions that the Commission required of SONGS. Staff modified some of those conditions to reflect some updates, and mitigation approaches, and you know, removed references to SONGS and Edison and replaced them with Poseidon.

**COMMISSIONER HUESO:** Why are we referencing SONGS, specifically, because of their approach to the mitigation? what you are doing is recommending that exact same approach?

**ENVIRONMENTAL SPECIALIST LUSTER:** Yes, going back a ways, over the last several months we have been working with Poseidon and up until about a month ago, Poseidon's proposal was to mitigate at San Dieguito adjacent to the SONGS restoration site, and they had come up with a very detailed preliminary plan, showing the number of acres of the different types of habitat, hydraulic analyses, showing the change in tidal flows, that sort of thing. And, so we were basing our approach, up until then on consistency with the adjacent SONGS restoration site. It all changed in the last month.

We now no longer have that site as the selected mitigation area, but in consulting with the SONGS scientists,

we believe that the conditions that SONGS was held to would be applicable to Poseidon if they did estuarine restoration somewhere else in the Southern California bite.

So, that is how we ended up with proposing the SONGS conditions.

**COMMISSIONER HUESO:** Okay, and what part of those conditions can't you achieve?

**MR. ZBUR:** The SONGS conditions?

**COMMISSIONER HUESO:** Yes.

**MR. ZBUR:** I think what you have attached to the motion that we suggested that you make, included many things to respond to the staff's concerns relating to the inconsistencies within the SONGS plan. I don't think that there are very many, but I am trying to figure out what they are, frankly.

I think the only change, really, is with respect to how significant the funding and -- you know, the SONGS plan required the funding of a number of scientists, and really very frequent reports back to the Commission about the restoration plan. And, I think our plan, because it is a much smaller restoration effort, did not anticipate imposing that kind of costs, I mean, the number of scientists that would be employed full time with annual reports -- workshops, it wasn't even reports -- workshops back to the Commission.

So, I think that is the major change that remains

isn't it? plus the phasing and the number of acres.

**COMMISSIONER HUESO:** Couldn't you propose that as part of your mitigation plan? I mean, tell me here where it is that specific, where it calls out a specific number of scientists, and project management staff, and the other things you alluded to?

**MR. ZBUR:** Well, basically, it is not in our plan. It is in, basically, the old SONGS plan. There is a general recommendation, and a staff recommendation that we make this consistent with the SONGS plan.

It is in Section 1.0 Administration, and 2.0 Budget and Work Program. There are differences between the SONGS approach, which required --

**EXECUTIVE DIRECTOR DOUGLAS:** Mr. Chairman, if I may, I think this is going to be virtually impossible for us to work through tonight.

**COMMISSIONER HUESO:** I agree, I mean --

**EXECUTIVE DIRECTOR DOUGLAS:** I think, if you would just work on major issues --

**COMMISSIONER HUESO:** Exactly.

**EXECUTIVE DIRECTOR DOUGLAS:** -- and then ask us to work with Poseidon, in terms of how we implement it, I think that is what everybody is looking to at the end of the day.

You know what our recommendations are on the points of contention. If you go with our recommendation on

acreage, fine, we will work through what the nature of the plan will have to be. If you go through each one of these, at least you will be able to act on the plan tonight, and we then come back and work through some of the details of what exactly has to be in the plan, relative to whether or not it is exactly tracking with the SONGS approach, or not.

But, that is something that we can work out. You have to decide the fundamental questions here, and if we have a dispute over any of those other items, we can bring those back to you, too. But, at least, in terms of what you have got before you, and what you have asked us to bring to you, was something that you could act on today that would lead to the issuance of the permit, and we were trying to do that.

I think the best way for you to go through it is to address the issues in contention.

**MR. ZBUR:** I think we would be comfortable in working out the issues with the staff, in terms of consistent with the SONGS, as they really are not that different.

I think the one thing we would ask that the Commission consider as part of the motion is that the detail with respect to the budget is something that we could work out with the staff, and potentially that would be -- the budget, in terms of how much we have to spend could be determined at the time the CDP comes forward.

**COMMISSIONER HUESO:** And, would you like a

specific acreage amount to be decided today? or could that be done through your discussions with the applicant?

**EXECUTIVE DIRECTOR DOUGLAS:** I think that is pretty fundamental. I get the sense, from talking with them, that that is what they want you to decide, and we would like that guidance, too.

**COMMISSIONER HUESO:** Well, I am going to propose then, a --

**CHAIR KRUER:** Well, you have prefaced your --

**COMMISSIONER HUESO:** Okay.

**COMMISSIONER LOWENTHAL:** [ Inaudible ]

**COMMISSIONER POTTER:** Mr. Chair, if I might, I am prepared to move through these items in an amending form, and then we can give direction accordingly.

**CHAIR KRUER:** Well, just a --

Yes, go ahead, sir.

**COMMISSIONER LOWENTHAL:** [ Inaudible ]

**COMMISSIONER POTTER:** Unless there is the desire to belabor this kind of conversation, anyway.

**CHAIR KRUER:** Commissioner Lowenthal, you don't have a problem with Commissioner Potter going?

**COMMISSIONER LOWENTHAL:** No.

**CHAIR KRUER:** Okay, thank you.

[ **MOTION** ]

**COMMISSIONER POTTER:** Okay, I offer an amending

motion that the restoration acreage be 55.4 acres.

I need a "second" and then I will speak to it, briefly.

**COMMISSIONER HUESO:** I'll second it.

**CHAIR KRUER:** It has been moved by Commissioner Potter, seconded by Commissioner Hueso.

**COMMISSIONER POTTER:** My concern is that wetland restoration, I am compelled by the testimony by staff that the higher percentage of success is with the 55 or 68 number. That said, I also am concerned that this deal of like-kind restoration, that they not get credit for a restoration project that is not similar to this wetland.

The attachment that is here, Exhibit A, it does go through a fairly involved criteria, with minimum standards and objectives. I believe that that incorporated with the increased acreage would get us to a successful wetland mitigation project. That is my logic.

**CHAIR KRUER:** Okay, and the "seconder" Commissioner Hueso, no question, please. Do you want to speak to it?

**COMMISSIONER HUESO:** No.

**CHAIR KRUER:** Okay, any other Commissioners?

Yes, Commissioner Shallenberger.

**COMMISSIONER SHALLENBERGER:** Question to the maker of the motion. If it turns out that this doesn't adequately

-- I mean, are there any performance standards that you are proposing to put in so that we know whether or not at the end of monitoring that 55.4 has, in fact, mitigated it?

**COMMISSIONER POTTER:** I think the CDP that comes in is going to be conditioned for the project, is due in 24 months, and is going to have all of those necessary standards as part of that CDP application, that is my belief.

**COMMISSIONER SHALLENBERGER:** My question is which one rules? In other words, if we adopt the 5.4 now, and --

**COMMISSIONER POTTER:** It is 55.4.

**COMMISSIONER SHALLENBERGER:** -- 55.4, sorry, and right you are, and when we, in 24 months when we get the CDP, and the performance standard show that maybe that doesn't --

**COMMISSIONER POTTER:** It is proposed --

**EXECUTIVE DIRECTOR DOUGLAS:** No, if I may.

**CHAIR KRUER:** Yes, Director Douglas.

**EXECUTIVE DIRECTOR DOUGLAS:** The way that I understand this would work is that 55.4 acres is what they have to restore. There are performance standards that have to be met, and to the extent that those performance standards aren't met, they have to take remedial action, but that doesn't necessarily mean an increase. It means that they have to go back and make the changes that are necessary to make it function to the level that it meets the performance standards. And, that is built into the --

**COMMISSIONER POTTER:** And, specific to that, the 5.0 in here, with the wetlands monitoring management remediation, reads monitoring management remediation shall be conducted over the full operating life of Poseidon's desalination facility, which shall be 30 years.

So, there is never going to be a lapse of non-monitoring or mitigation.

**CHAIR KRUER:** Okay.

Commissioner Wan.

**COMMISSIONER WAN:** Yeah, along the lines of what Commissioner Shallenberger was talking about, you know, I don't have -- I think the problem here is that, as it has been pointed out, we don't really have the plan in front of us. We have the elements here of what will be a plan, and that makes things very difficult and very uncomfortable, because you can say, well, they will come in in 24 months, and they will be required to do 55.4 acres of restoration, and there will be some performance standards, of which I don't know what they are now.

There will be monitoring, of which I, essentially, don't know what that monitoring is, and then they will be required to meet these performance standards on these 55.4 acres, but what happens if it turns out that they can't? what happens if it turns out that after all is said and done, because at this point, we do not even know where these acres

are going to be located, so it is very difficult to really know if it is adequate. What happens then? and there is where I am really uncomfortable with what we am doing now.

I was going to talk about the total issue of uncertainty, and whether you use 50 percent uncertainty, or 80 percent in the 50 percent, plus mitigation.

But, even if you go with the 55.4 it is the uncertainty because we don't have a plan in front of us now. We are putting off the actual plan for 24 months that I don't know how you can do it.

**CHAIR KRUER:** Okay.

Commissioner Reilly.

**COMMISSIONER REILLY:** Well, the uncertainty isn't with performance standards or whether they are going to be able to do it. The uncertainty has to do with the impact of their project. And, it is not going to change.

Whatever performance standards we put on their mitigation, for success, is not going to change the analysis or the level of confidence that this Commission needs to be able to set mitigation acreage, so those are two separate issues, I believe.

And, you know, when this comes back, and you know a couple of us were here for Edison -- little grayer than we were then -- but, we were here, and when this comes back what is going to be before the Commission is adoption of an entire

restoration plan, you know, agreement on baselines, agreement on what performance standards we are going to use on this, and I am sure we are going to go back to some of the ones we have done before, and take a look at that. We are going to make decision on status reports. We are going to make decision on workshops and what period of time we do them over, and so all of those things will be before us, along with we will have an identification, hopefully, by then, of the sites that are involved, and but none of that has to do with setting the acreage. The acreage is based on the analysis, and the percentage level of confidence we have based on uncertainties.

I don't have a problem with going forward with this.

**CHAIR KRUER:** Okay, thank you, Commissioner Reilly.

**EXECUTIVE DIRECTOR DOUGLAS:** And, this is the approach that we took in San Onofre.

**CHAIR KRUER:** And, I am going to call for the question.

**COMMISSIONER HUESO:** I do want to include the concept of phasing into --

**COMMISSIONER POTTER:** I am going to move each one individually.

**CHAIR KRUER:** Phasing is in there.

Okay, with that, again the maker and seconder are asking for a "Yes" vote on the amending motion.

Would the Clerk call the roll.

**SECRETARY MILLER:** Commissioner Blank?

**COMMISSIONER BLANK:** Yes.

**SECRETARY MILLER:** Commissioner Burke?

**COMMISSIONER BURKE:** Yes.

**SECRETARY MILLER:** Commissioner Lowenthal?

**COMMISSIONER LOWENTHAL:** Yes.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.

**SECRETARY MILLER:** Commissioner Kram?

**COMMISSIONER KRAM:** [ Absent ]

**SECRETARY MILLER:** Commissioner Neely?

**VICE CHAIR NEELY:** Yes.

**SECRETARY MILLER:** Commissioner Potter?

**COMMISSIONER POTTER:** Aye.

**SECRETARY MILLER:** Commissioner Reilly?

**COMMISSIONER REILLY:** Yes.

**SECRETARY MILLER:** Commissioner Shallenberger?

**COMMISSIONER SHALLENBERGER:** No.

**SECRETARY MILLER:** Commissioner Wan?

**COMMISSIONER WAN:** No.

**SECRETARY MILLER:** Commissioner Achadjian?

**COMMISSIONER ACHADJIAN:** Aye.

**SECRETARY MILLER:** Chairman Kruer?

**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Nine, two.

**CHAIR KRUER:** Nine, two, the motion passes. Next, on this.

**COMMISSIONER POTTER:** Yes, Mr. Chair --

**CHAIR KRUER:** Yes, Commissioner Potter.

[ **MOTION** ]

**COMMISSIONER POTTER:** -- before the tech crew took away the chart of options, and decided it was better to look at us -- okay, there we go.

I believe the next issue was the phased implementation, and I am prepared to move the phased implementation approach, that is proposed in the Poseidon recommendation, and if I get a "second" I'll speak to it.

**COMMISSIONER HUESO:** Second.

**COMMISSIONER POTTER:** The original approach was to take the 37.5 and then the balance up to the 42 and phase that. I am under the impression that they can do the 37 in the 2-year period, so then it leaves, basically, the balance between the 37 and 55, so whatever that is -- and my math says it is 18.4, so that would be the second phase.

And, the details of that is to be worked out by staff. What staff wanted was direction on these items, and so for that reason I would throw that out as the approach.

**CHAIR KRUER:** Okay, Commissioner Hueso?

Commissioner Reilly.

**COMMISSIONER REILLY:** I would be willing to support that if the Phase 2 had a time certain placed on it. And, you know, we are talking about bringing it back within 2 years. They are anxious to get this project up and going, I understand, and in their concern, they may not be able to get -- well, they were concerned that they weren't going to be able to get 42.5 acres, I am assuming they are concerned they are not going to be able get 55.4 within a 2-year period.

I am willing to let them come back with 37 on a Phase 1, but from the time of that approval of Phase 1, I don't think we should let more than 5 years pass before we require the Phase 2 to come back.

**COMMISSIONER POTTER:** And, I would include that --

**CHAIR KRUER:** Is that okay with you, Commissioner Potter, as the maker of the motion?

**COMMISSIONER POTTER:** -- in my recommendation.

**CHAIR KRUER:** Commissioner Hueso, is that okay with you?

**COMMISSIONER HUESO:** Yes.

**CHAIR KRUER:** Okay, is there anyone else who wants to speak to that amending motion?

Commissioner Lowenthal.

**COMMISSIONER LOWENTHAL:** So, with the acreage

change to 55.4 what would Phase 2 acreage be?

**COMMISSIONER POTTER:** It would be 18.4.

**COMMISSIONER LOWENTHAL:** So, it will be clearly the difference as what is in the report?

**COMMISSIONER POTTER:** Yes.

**CHAIR KRUER:** Yes, and thank you, Commissioner Lowenthal.

**EXECUTIVE DIRECTOR DOUGLAS:** What I understand the motion to be is that the initial acreage is 37, that has to be done, and then according to their suggestion for phasing, which is when the power plant goes down --

**COMMISSIONER POTTER:** No, that got changed to 5 years.

**EXECUTIVE DIRECTOR DOUGLAS:** Okay, so the second phase comes in when?

**COMMISSIONER POTTER:** Within 5, that is per the Reilly idea.

**COMMISSIONER REILLY:** Five years after your approval on Phase 1.

**EXECUTIVE DIRECTOR DOUGLAS:** All right, that is more workable, thank you.

**CHAIR KRUER:** Commissioner Wan.

**COMMISSIONER WAN:** I still have a problem with the phasing, although with the time certain, it is a little bit better, because we are going to have a long period of time

where are going to have impacts, and we are not going to have any mitigations for those impacts.

And, in part, that is because I don't know when this is going to come on line, relative to these dates, and you have to remember, that if you start with 37 acres 2 years from now, it takes time to build it, and it takes even more time, quite a few years, before it is actually functioning.

So, we are now looking at 2 years before they start, to, probably, you know, 5 or 6 years down the road before we even start to get anything out of the first phase, and if you add some time on it, by the time you get, quote, full mitigation, if you ever do, you are talking about 10 years, and you have had all of those impacts you haven't accounted for.

And, so pushing this out, remember it takes time for all of this. Pushing it out this way really leaves us with a whole lot of impacts to that ocean without any mitigation.

**CHAIR KRUER:** Commissioner Reilly.

**COMMISSIONER REILLY:** I don't disagree with what Commissioner Wan said, but I would point out that SONGS operated for 20 years before we got that mitigation, so and we finally got it, and it is happening, and I think there is a balance here betweem being able to move forward on this project, for the local water needs, and our being able to

nail down the mitigation that fully mitigates what is going on, in terms of impacts.

**EXECUTIVE DIRECTOR DOUGLAS:** And, I might add that the 5-year component is 5 years from what?

**COMMISSIONER REILLY:** Adoption of Phase 1.

**EXECUTIVE DIRECTOR DOUGLAS:** The permit for Phase 1. It may be that they decide, in looking at that, that it is better to do it all at once, and they may, indeed, find an area that is big enough to accommodate the whole thing, so that would be an option open to them.

But, at least, this way, it is workable and we don't get into the ambiguity of when does it trigger, and when does it not.

**CHAIR KRUER:** Commissioner Scarborough, then Commissioner Shallenberger.

**COMMISSIONER SCARBOROUGH:** That was -- thank you, Chair, that was part of my question, was it 2 plus 5, or how did you get to the 5 plus 5, but I also wondered what would be the association, or the relationship between the 5 years, versus when the power plant does, potentially, close? I didn't understand why Poseidon had chosen the plant closing, and was wondering if I could enquire with them why that was chosen, and how it relates to 5?

**CHAIR KRUER:** Okay.

**MR. ZBUR:** The reason why we had suggested doing

the phasing at the plant closing is because, essentially, at that time we think there will be other kinds of technologies we can put in place that would reduce the potential impingement entrainment impacts that we don't have now, because we have to, basically, rely on the power plant flow, so that is why we thought that at that point we would have a technology incentive to avoid additional mitigation by doing it through avoidance and technology.

So, that is why we prefer doing it at the power plant closure.

**COMMISSIONER SCARBOROUGH:** What is the estimated time of that? time frame?

**MR. ZBUR:** It is uncertain. I mean, it could be a few years, or it could be a long time. According to the methodology, we are fully mitigated in the interim on the 37 acres, under the 50 percent compensated criteria, we would be fully mitigated, 2.5 times mitigated at the get go, until -- that is where that 15 percent number came from. We are fully mitigated until you get to the power plant only operating 15 percent of the time.

**COMMISSIONER REILLY:** That is where we got the 7 years.

**CHAIR KRUER:** Commissioner Shallenberger.

**COMMISSIONER SHALLENBERGER:** Yes, I would like to hear from staff, Dr. Raimondi, about what you think about the

phasing? and how workable that is?

**MR. RAIMONDI:** I am not going to comment about the motivation for the phasing, but the practicality of it, as we have had some experience with SONGS.

In the SONGS permit there was language that allowed there to be restoration, and up to 2 wetland areas. There was the initial phase where there was the selection of the wetlands, where restoration could be done, and in the end, Southern California Edison, and their partners, decided it was logistically more easily to do it at a single wetland for all sorts of reasons. It minimized the monitoring, it minimized the costs associated with the permitting, it minimized the construction costs, it was just cheaper to do it.

Another thing about it, and again, it is going to matter how you decide to do the monitoring, but with SONGS they are on the hook for working for what they call the full operating life of the plant.

So with phasing you are going to have two sequences. You will have the first 37 acres, which will go for a 30-year period, if you adopt that, and then the second 17 or 16 acres that will be out of phase with that, and will go longer, so that becomes problematic from a monitoring standpoint, financially, as well, because you have to carry the monitoring longer.

**COMMISSIONER SHALLENBERGER:** But, it is problematic to the project proponent, not to us, in terms, I mean, they could decide to do them all at once.

**MR. RAIMONDI:** Yes, but there is a stronger issue, and that is it is way better. It is possible, and I am sympathetic to them, at this point, about being able to find the acreage, but it is way better for the system if it is 55 rather than two pieces. You are going to have much more likelihood of it working, and it is probably going to link into other restorations, so from an ecological point of view, bigger is better.

**CHAIR KRUER:** Right, okay.

**COMMISSIONER POTTER:** Well, just as the maker, to that issue. It is a real estate issue. I mean if the opportunity is out there, and during this period of working with staff, they realize we would do better to do it in one fell swoop, fine then come back and tell us that.

I understand the logic behind what you are saying, but it is going to be more of a property acquisition problem is my suspicion.

**CHAIR KRUER:** Okay.

Commissioner Lowenthal, and then we are going to call for the question, if that is okay with everybody, unless there is somebody who hasn't spoken yet.

**COMMISSIONER LOWENTHAL:** I wanted to just be clear

on when the second -- I know we have the 5-year time frame, but just from the proponent's presentation there were different triggering mechanisms, so under our new scheme what would actually trigger Phase 2?

**EXECUTIVE DIRECTOR DOUGLAS:** It would be 5 years from the first phase, that is, the 37 acres, which has to come in for a permit within 24 months, as I understand it, right, and then once that permit is issued, that is what I understand, then the 5-year period is triggered.

But, I would suggest that the maker of the motion also incorporate in it that if they want to do the entire amount together, that that would be okay, they don't have to wait.

**COMMISSIONER POTTER:** I literally stated that 3 minutes ago, but that is my intention, and I think everybody else concurs, that if they come back and can do it great, okay.

**EXECUTIVE DIRECTOR DOUGLAS:** Okay.

**CHAIR KRUER:** Okay, and we are going --

Ms. Schmeltzer, we are going to call for the question. I thought I mentioned.

**CHIEF COUNSEL SCHMELTZER:** I am sorry, I just did want to make sure, on this timing question, I thought I heard the Executive Director say two different things.

There is the provision of coming in for a permit

within 24 months, and it being issued within the 24 months --

**COMMISSIONER POTTER:** Specific to the 37, and if they want to go ahead and try to do more at that time, for economy sake, then fine, they can go to the full 55.4, but they have an option to go ahead and do it in a phase.

**CHIEF COUNSEL SCHMELTZER:** Right, and I understand that, but if they just do the 37 within the first 24 months, that the trigger is not -- the trigger is within 24 months. It is not if the permit takes longer than that to issue.

**COMMISSIONER POTTER:** No.

**EXECUTIVE DIRECTOR DOUGLAS:** No, my understanding was, that they have to come in for a permit within 24 months, and then it depends on what the Commission does. They may have conditions about the issuance of that permit. My understanding was that the 5 years starts from the issuance of the permit.

**COMMISSIONER REILLY:** That is correct.

**COMMISSIONER POTTER:** Correct.

**CHAIR KRUER:** That is correct, Mr. Douglas, thank you.

Yes, Commissioner.

**COMMISSIONER SCARBOROUGH:** I am not sure where you are headed with your phasing in your motions, where does the dredging fit into this?

**COMMISSIONER POTTER:** I was going to that in the

next --

**CHAIR KRUER:** We will get to -- I think we are going to call the question, here, and then we will get to the other amending, if there are other amending things.

Again, the amending motion, the maker and seconder are asking for a "Yes" vote.

Would the Clerk call the roll, please.

**MR. ZBUR:** Mr. Chair, can I just so there is not a dispute on this, can I just make sure there is clarity on what the timing is on the motion. We are assuming it is 24 months --

**COMMISSIONER POTTER:** I am hoping it gets moved sometime tonight.

**MR. ZBUR:** -- 24 months -- well, only because I -- 24 months to get our application in, which is what we thought it was, and then from the date that the permit is issued, so if it takes 9 months or a year to get the permit approved, from the date the permit is issued, then the 5 years runs, and then I assume that we have to get another permit application in within that 5 years?

**COMMISSIONER POTTER:** That is correct.

**CHAIR KRUER:** Correct.

**MR. ZBUR:** Thank you for that clarification.

**CHAIR KRUER:** Okay, thank you.

Would the Clerk call the roll, please.

**SECRETARY MILLER:** Commissioner Burke?
**COMMISSIONER BURKE:** Yes.
**SECRETARY MILLER:** Commissioner Lowenthal.
**COMMISSIONER LOWENTHAL:** Yes.
**SECRETARY MILLER:** Commissioner Hueso?
**COMMISSIONER HUESO:** Yes.
**SECRETARY MILLER:** Commissioner Kram?
**COMMISSIONER KRAM:** Yes.
**SECRETARY MILLER:** Commissioner Neely?
**VICE CHAIR NEELY:** Yes.
**SECRETARY MILLER:** Commissioner Potter?
**COMMISSIONER POTTER:** Aye.
**SECRETARY MILLER:** Commissioner Reilly?
**COMMISSIONER REILLY:** Yes.
**SECRETARY MILLER:** Commissioner Shallenberger?
**COMMISSIONER SHALLENBERGER:** Yes.
**SECRETARY MILLER:** Commissioner Wan?
**COMMISSIONER WAN:** Yes.
**SECRETARY MILLER:** Commissioner Achadjian?
**COMMISSIONER ACHADJIAN:** Aye.
**SECRETARY MILLER:** Commissioner Blank?
**COMMISSIONER BLANK:** Yes.
**SECRETARY MILLER:** Chairman Kruer?
**CHAIR KRUER:** Yes.
**SECRETARY MILLER:** Unanimous.

**CHAIR KRUER:** Okay, the amending motion passes.

Commissioner Potter, do you have anymore amending motions?

**COMMISSIONER POTTER:** I am going to actually ask for staff clarification on these last two items. I think they blend together.

Staff is saying that new technologies not appropo, or in this consideration, and the applicant is saying they would like the ability to utilize new technology.

And, the other one is this dredging credits, can you explain what the conflicts are here?

**EXECUTIVE DIRECTOR DOUGLAS:** What I understand, relative to the new technology, that is that if they can come up the way that they had originally proposed it, if they come up with technology that shows that they can filter the water and avoid entrainment impacts, because of new technology, that there ought to be some adjustment in the mitigation requirement.

It seems to me that one way you could address that, and you know, we have some sympathy for that position. Obviously, if we could avoid the impacts altogether, that would be the best. But, if in that 5-year period, for the second phase, they can come up with technology that shows that they are not having impacts, you could then factor that into whether or not it necessary to add that. But, take that

into account in the permit that would be applied for in the Phase 2.

**COMMISSIONER POTTER:** Okay, with that said, I move that we amend to allow to encourage the use of new technologies --

**CHAIR KRUER:** Commissioner Potter.

**COMMISSIONER POTTER:** He spoke, I didn't preface.

**CHAIR KRUER:** Let me, just to be clear on it. I am not sure about that.

Let me just go to Vice Chair Neely for one second, and then I am coming right back to you for your motion. There is a question of you prefacing.

**COMMISSIONER POTTER:** I would like to know where in the law you can't speak anyway. I think that is something that Rusty Arias made up from his stay in the state assembly.

**VICE CHAIR NEELY:** Mr. Chairman, I don't have any questions at this time.

**CHAIR KRUER:** Okay, Commissioner Potter.

[ **MOTION** ]

**COMMISSIONER POTTER:** All right, I'll move to amend, and incorporate in the motion that we encourage the use of new technologies under the framework that was expressed by the Executive Director.

**COMMISSIONER HUESO:** I'll second it.

**COMMISSIONER POTTER:** With the intent of lessening

the impact.

**CHAIR KRUER:** Just a second.

Commissioner Potter has made the motion, and recommending a "Yes" vote, and Commissioner Hueso seconded that motion.

Commissioner Potter, would you like to speak to that motion?

**COMMISSIONER POTTER:** No, I think Mr. Douglas and I worked pretty well on that item. That was exactly what I wanted him to say, so thank you.

**COMMISSIONER REILLY:** Mr. Chairman.

**CHAIR KRUER:** That is why it was prefaced.

**COMMISSIONER REILLY:** Let me ask.

Staff is going to be incorporating the concept of the 2-year application, and the 5 years afterwards, is staff willing, in discussing that 5 years, willing to incorporate language that suggests that they look into new technology to lessen impacts, and that as part of that 5-year hearing, if they are able to do that, could be a review of mitigation requirement?

**EXECUTIVE DIRECTOR DOUGLAS:** Well, that is what I discussed, and I think that is what the motion would do, and we don't have a problem with that.

**COMMISSIONER REILLY:** Are you willing to just incorporate that into the staff?

**EXECUTIVE DIRECTOR DOUGLAS:** I would rather have the Commission do it.

**COMMISSIONER REILLY:** That's fine, okay.

**CHAIR KRUER:** Commissioner Wan.

**COMMISSIONER WAN:** I just have a question on this one, and that is, I am assuming it is always okay, if you can avoid the entrainment, that is the best, because the fact is -- I don't care what you say -- no matter what mitigation you perform, no matter how you try to compensate for it, you never get full compensation. So, the best thing is always avoidance, so I am certainly not opposed to that.

The question I want to make sure is that when they come back for the review, that we are talking about a review that requires some kind of proof, and not just a statement, "We want to use it." That there is going to be some real scientific analysis done to make sure that that is the case, because up until now there doesn't seem to be anything that has been developed that can avoid the entrainment, and we went through that in great and painful detail when we did SONGS.

So, I am not aware of it, and I just want to make sure that we know how this is going to be handled.

**EXECUTIVE DIRECTOR DOUGLAS:** Obviously, the proof would have to be that there are reductions in impacts, or elimination of impacts, in order for us to consider -- if

this motion passes -- a reduction of the Phase 2 mitigation requirement.

But, this leaves that open, and it is up to them to try to find that technology, and again, if they decide right up front, we are not going to worry about that, we are just going to do the 55.4 acres, then it becomes a moot point.

**CHAIR KRUER:** Okay.

**EXECUTIVE DIRECTOR DOUGLAS:** But, it leaves open that opportunity.

**CHAIR KRUER:** Okay, I am going to call on the amending motion.

Priscilla's got her pen up, and we'll need a brief break.

Call the roll, please, on the amending motion, on the technology.

**SECRETARY MILLER:** Commissioner Lowenthal?

**COMMISSIONER LOWENTHAL:** [ inaudible ]

**VICE CHAIR NEELY:** Speak up, she can't hear you.

**COMMISSIONER LOWENTHAL:** Yes.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.

**SECRETARY MILLER:** Commissioner Kram?

**COMMISSIONER KRAM:** Yes.

**SECRETARY MILLER:** Commissioner Neely?

**VICE CHAIR NEELY:** Yes.

**SECRETARY MILLER:** Commissioner Potter?

**COMMISSIONER POTTER:** Aye.

**SECRETARY MILLER:** Commissioner Reilly?

**COMMISSIONER REILLY:** Yes.

**SECRETARY MILLER:** Commissioner Shallenberger.

**COMMISSIONER SHALLENBERGER:** Yes.

**SECRETARY MILLER:** Commissioner Wan?

**COMMISSIONER WAN:** Yes.

**SECRETARY MILLER:** Commissioner Achadjian?

**COMMISSIONER ACHADJIAN:** Aye.

**SECRETARY MILLER:** Commissioner Blank?

**COMMISSIONER BLANK:** Yes.

**SECRETARY MILLER:** Commissioner Burke?

**COMMISSIONER BURKE:** Yes.

**SECRETARY MILLER:** Chairman Kruer?

**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Unanimous.

**CHAIR KRUER:** The amending motion passes.

Commissioner Potter, any more?

[ **MOTION** ]

**COMMISSIONER POTTER:** I am going to move that the dredging restoration credit be at the Commission's discretion, and if I get a "second" I'll speak to it.

**COMMISSIONER HUESO:** Second.

**CHAIR KRUER:** Moved by Commissioner Potter, seconded by Commissioner Hueso.

Commissioner Potter, would you like to speak to your motion?

**COMMISSIONER POTTER:** I think my concern is, and this is sort of an open ended question, that whether they can even get ownership of the dredging operations, and can incorporate that in, remains pretty much unanswered, and may remain there for awhile.

So, if there does seem to be a dredging plan that comes forward, and we can get something tangible there about how is going to be operated? who is going to do it? when it is going to occur? all of those ingredients, then it is up to the Commission to decide if that is something that we want to entertain at that time. That is my thought behind it.

**CHAIR KRUER:** Okay, Commissioner Potter or Commissioner Hueso, anything else?

Anyone else? Commissioner Wan.

**COMMISSIONER WAN:** Just very quickly, if you are going to leave this open for the discretion -- and I think I heard Commissioner Potter say this, but I just want to make sure -- there is one thing, there is a big difference between dredging connected with maintaining the project, and dredging for mitigation, because as in SONGS it is required for the mitigation, and as long as the dredging credit is understood,

it is for whatever future project they are going to be dredging for, not for the desal plant, then I would find that acceptable.

**COMMISSIONER POTTER:** That is --

**COMMISSIONER WAN:** You understand the distinction?

**CHAIR KRUER:** Commissioner Reilly.

**COMMISSIONER REILLY:** If I understood the staff correctly, earlier, your statement was if dredging becomes part of the project, and becomes a reality, as opposed to a possibility, then staff would do a full analysis of that activity, at that time, both in terms of impacts and in terms of benefits, and be prepared to make recommendations relative to whether additional conditions had to be added, or benefits would be accorded to that.

I guess, I would prefer to wait to see what happens with that issue, before we pre-judge it, that's all.

**EXECUTIVE DIRECTOR DOUGLAS:** That is the way we understand it, and this motion would just say that they could come in for credit for dredging, but they would have to prove that it warrants it, so that is fine with us.

**CHAIR KRUER:** Okay.

Call for the question.

Clerk, would you call the roll, please. They are asking for a "Yes" vote, on the amending motion.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.

**SECRETARY MILLER:** Commissioner Kram?

**COMMISSIONER KRAM:** Yes.

**SECRETARY MILLER:** Commissioner Neely?

**VICE CHAIR NEELY:** Yes.

**SECRETARY MILLER:** Commissioner Potter?

**COMMISSIONER POTTER:** Aye.

**SECRETARY MILLER:** Commissioner Reilly?

**COMMISSIONER REILLY:** No.

**SECRETARY MILLER:** Commissioner Shallenberger?

**COMMISSIONER SHALLENBERGER:** Yes.

**SECRETARY MILLER:** Commissioner Wan?

**COMMISSIONER WAN:** No.

**SECRETARY MILLER:** Commissioner Achadjian?

**COMMISSIONER ACHADJIAN:** Aye.

**SECRETARY MILLER:** Commissioner Blank?

**COMMISSIONER BLANK:** Aye.

**SECRETARY MILLER:** Commissioner Burke?

**COMMISSIONER BURKE:** No.

**SECRETARY MILLER:** No?

**COMMISSIONER BURKE:** [ Inaudible ]

**SECRETARY MILLER:** Commissioner Lowenthal?

**COMMISSIONER LOWENTHAL:** Yes.

**SECRETARY MILLER:** Chairman Kruer?

**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Nine, three.

**CHAIR KRUER:** Nine, three, the amending motion passes.

And, now we will need back to the main motion, okay. Back to the motion, and again the maker and the seconder are asking for a "Yes" vote.

Commissioner Wan has her hand up.

**COMMISSIONER WAN:** Just on the main motion, this is not an amending motion, and I just want a quick explanation as to why I am going to vote "No" and the reason I am going to vote "No" is that I don't believe, if you look at this whole thing, that we really are getting the kind of assurances we need that this is real mitigation, and the reason is -- and that this is adequate mitigation -- this is going to be doing, this facility, once it becomes a stand alone facility, essentially, what once-through cooling does, and once-through cooling has been found by the courts to be a violation of the *Porter Cologne Act*, and I don't see how -- I don't even know why you bother to phase out the power plant, if you are just going to substitute something that is going to do exactly the same thing. It is not acceptable, because it is not protective of the ocean.

Our oceans are under horrific assault, and this kind of thing is simply not appropriate, particularly, when we get a plan that is -- we deferred our decision, we passed

the power plant, deferred the decision on the mitigation, and now we are again with all of the things that we had in the amending motions, deferring the real plan for another 2 years.

We will not see a full plan, and I don't think you can approve a mitigation without the appropriate plan, and if I had a full plan in front of me, it might be different, but I don't, and without that I don't have the confidence to know just the real extent of the mitigation that is going to take place here.

And, let me, again, say mitigations here, as elsewhere, does not give you complete compensation.

**CHAIR KRUER:** Okay, would the Clerk call the roll on the main motion, please, as amended by the Commission.

**SECRETARY MILLER:** Commissioner Kram?

**COMMISSIONER KRAM:** Yes.

**SECRETARY MILLER:** Commissioner Neely?

**VICE CHAIR NEELY:** Yes.

**SECRETARY MILLER:** Commissioner Potter?

**COMMISSIONER POTTER:** Aye.

**SECRETARY MILLER:** Commissioner Reilly?

**COMMISSIONER REILLY:** Yes.

**SECRETARY MILLER:** Commissioner Shallenberger?

**COMMISSIONER SHALLENBERGER:** Yes.

**SECRETARY MILLER:** Commissioner Wan?

**COMMISSIONER WAN:** No.

**SECRETARY MILLER:** Commissioner Achadjian?

**COMMISSIONER ACHADJIAN:** Aye.

**SECRETARY MILLER:** Commissioner Blank?

**COMMISSIONER BLANK:** Yes.

**SECRETARY MILLER:** Commissioner Burke?

**COMMISSIONER BURKE:** Yes.

**SECRETARY MILLER:** Commissioner Lowenthal?

**COMMISSIONER LOWENTHAL:** Yes.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.

**SECRETARY MILLER:** Chairman Kruer?

**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Eleven, one.

**CHAIR KRUER:** Okay, the Commission hereby approves the main motion, as amended by the Commission.

We will take a break.

*

*

[ Whereupon the hearing concluded at 7:35 p.m. ]

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) SS.
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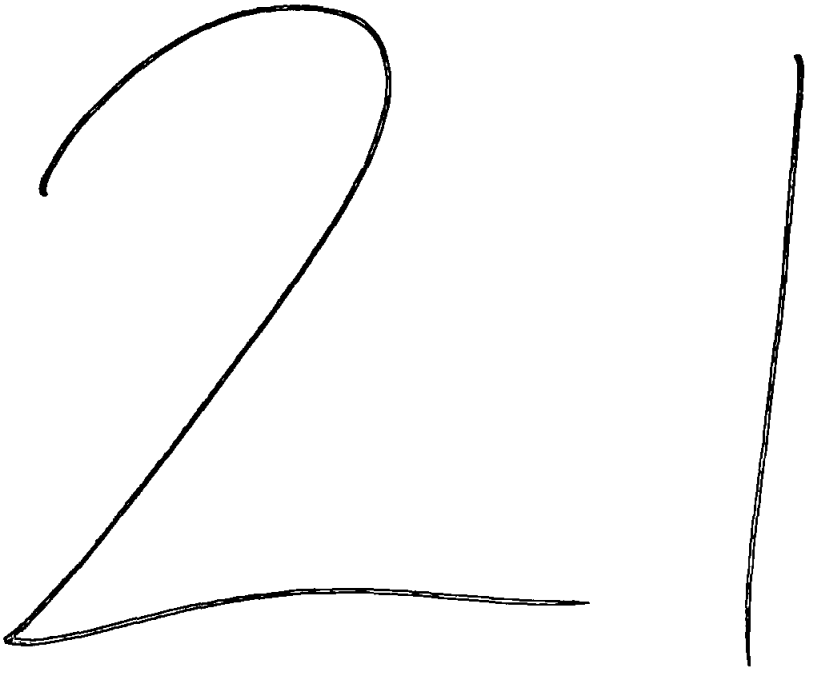
I, PRISCILLA PIKE, Hearing Reporter for the State of California, do hereby certify that the foregoing 347 pages represents a full, true, and correct transcript of the proceedings as reported by me before the California Coastal Commission on August 6, 2008.

Dated: August 25, 2008

PRISCILLA PIKE



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# STATE OF CALIFORNIA
# STATE LANDS COMMISSION

## AMENDMENT OF LEASE PRC 8727.1

**WHEREAS**, the State of California, acting through the State Lands Commission, hereinafter called Lessor, and, Cabrillo Power I LLC, hereinafter called Cabrillo, have heretofore entered into an agreement designated as Lease PRC 8727.1, authorized by the Lessor on May 10, 2007 and executed August 14, 2007, whereby the Lessor granted to said Lessee a General Lease – Industrial Use covering certain State Land situated in San Diego County, hereinafter referred to as Lease Premises ("Lease Premises"); and

**WHEREAS**, Section 4, Paragraph 15(e) provides that the Lease may be terminated and its terms, covenants and conditions amended, revised or supplemented only by mutual written agreement of the parties; and

**WHEREAS**, Cabrillo and Poseidon (Channelside) LLC, hereafter referred to as Poseidon, have entered into an Agreement dated July 11, 2003; and

**WHEREAS**, the Agreement between the Cabrillo and Poseidon provides for a use of the Lease Premises that is not allowed under current provisions contained in the Lease; and

**WHEREAS**, Poseidon has applied to the Lessor to use the Lease Premises for desalination purposes; and

**WHEREAS**, by reason of the foregoing, it is now the desire of the parties to amend the foregoing Agreement.

**NOW THEREFORE**, the parties hereto agree as follows:

**SECTION 1 – BASIC PROVISIONS and MAILING ADDRESS** is amended to include Poseidon as a Co-Lessee, whose mailing address is 501 W. Broadway, Suite 1260, San Diego, CA 92101. Any reference to "Lessee" in this lease shall refer to both Cabrillo and Poseidon as Co-Lessees.

**SECTION 1 – LAND USE OR PURPOSE** is amended to include desalination use of the existing improvements by Poseidon.

**SECTION 2 – SPECIAL PROVISIONS** shall be amended to include the following amendment to paragraph 8 (which replaces the prior paragraph 8) and to add paragraphs 10 through 23 as separate obligations of Poseidon:

8. Authorized Uses:
It is the intent of the parties to this lease that the improvements and activities authorized herein are for the exclusive use of the Co-Lessees, Cabrillo and Poseidon, in conjunction with Cabrillo's existing power plant cooling water system involving the intake of sea water and the commingling of brine water discharge from Poseidon's desalination facility. The test desalination facility shall cease operation prior to the operation of the Poseidon desalination facility.

10. Poseidon shall, at all times during the term of the Lease, comply with the Energy Minimization and Greenhouse Gas Reduction Plan (the GHG Plan), as adopted by the California Coastal Commission on August 6, 2008, except that, notwithstanding the provisions of that Plan:

a) In addition to Poseidon's offset requirements under the GHG Plan, Poseidon shall be deemed to have fully offset construction and operational impacts of the desalination facility by obtaining an additional 25,000 tons of carbon offsets/Renewable Energy Certificates (RECs), subject to the verification procedures in the GHG Plan, as a one-time obligation, to be purchased prior to operation of the desalination facility;

b) The provisions of Section III(E) of the Energy Minimization and Greenhouse Gas Reduction Plan (the GHG Plan), as adopted by the California Coastal Commission on August 6, 2008, entitled, "Contingency if No GHG Reduction Projects are Reasonably Available," shall apply to Poseidon's lease, except that if: i) offsets in an amount necessary to mitigate the Project's GHG emissions are not reasonably available; ii) the "market price" for carbon offsets or RECs is not reasonably discernable; (iii) the market for offsets or RECs is suffering from significant market disruptions or instability; or (iv) the market price has escalated to a level that renders the purchase of offsets/RECs economically infeasible to the Project, then: Poseidon may delay or postpone acquisition of carbon offsets or RECs required under this lease for a period of up to three years from the date acquisition of the offset is due, provided that: i) Poseidon shall bank the minimum purchase price of $10 per ton of carbon required to be offset per year during the market disruption as required under Section III(E) of the GHG Plan; and ii) that within three years from the date that acquisition of the annual offset would otherwise be due, Poseidon shall acquire those carbon offsets or RECs as required under this lease for that annual offset, regardless of cost per ton of carbon offsets required.

c) This sub-paragraph was intentionally left blank.

d) This sub-paragraph was intentionally left blank.

11. a) Poseidon shall, at all times during the term of the Lease, comply with the Marine Life Mitigation Plan, as adopted by the California Coastal Commission on August 6, 2008. Poseidon will provide copies of all reports that are required to be

provided to the California Coastal Commission to the Lessor's Executive Officer at the time any such reports are required to be submitted to the California Coastal Commission. The restoration project shall require up to 55.4 acres of wetlands restoration to be implemented in two Phases, with the first Phase (Phase I) comprising not less than 37 acres of wetlands restoration, and the second Phase (Phase II) comprising up to an additional 18.4 acres. Obligations for Phase II of the wetland mitigation comprise 18.4 acres, but may be proportionally reduced by the California Coastal Commission if it finds that Poseidon has reduced marine life impacts caused by entrainment and impingement.

b) The provisions of the Marine Life Mitigation Plan not withstanding, Poseidon shall request an amendment to Lease PRC 8727.1 if Poseidon desires to receive mitigation credits for direct benefits to marine life from dredging that would otherwise be required pursuant to compliance with the Marine Life Mitigation Plan.

c) Poseidon shall at all times during the term of the Lease, comply with the post restoration monitoring and remediation requirements set forth in the Marine Life Mitigation Plan Section 5.4 for ensuring the success of the wetlands restoration site(s), provided that the standards include success criteria from four existing relatively undisturbed sites and that Poseidon achieve a 95% confidence level of success for the restoration required. Should the Coastal Commission amend Section 5.4 at any time, Poseidon shall request amendment of this Lease.

12. Poseidon, without interference with, or interruption of, powerplant scheduled operations and at its sole cost and expense, shall use the best available design, technology, and mitigation measures at all times during which this Lease is in effect to minimize the intake (impingement and entrainment) and mortality of all forms of marine life associated with the operation of the desalination facility as determined by the San Diego Regional Water Quality Control Board or any other federal, state, or local entity having applicable jurisdiction.

13. As reasonably determined by the Lessor, the monitoring, maintenance, and operation of the wetland restoration site(s) and the reference site(s) may be modified to conform with equivalent or superior standards and requirements developed by the San Diego Regional Water Quality Control Board or the California Coastal Commission or any other federal, state, or local entity having applicable jurisdiction.

14. Within ten years from the effective date of this Amendment, or upon such earlier time as agreed to by the Lessor, or upon notice by Cabrillo that it will no longer require the use of the Lease Premises for the purposes of generating electrical power, Lessor will undertake an environmental review of the ongoing impacts of operation of the desalination facility to determine if additional requirements pursuant to Special Provision paragraph number 12, above, are required. Lessor, at its sole discretion, may hire a qualified independent environmental consultant, at the sole expense of Poseidon, with the intent to analyze all environmental effects of facility operations and alternative technologies that may reduce any impacts found. Lessor may require, and Poseidon shall comply with, such additional requirements as are reasonable and as are consistent with applicable state and federal laws and regulations and as Lessor determines are appropriate in light of the environmental review.

15. Poseidon shall provide copies of all regulatory monitoring and compliance reports pertaining to the operation of its desalination facility to Lessor at the time of submitting such reports with any regulatory agency.

16. a) Poseidon shall provide Lessor with

i) a non-cancelable operational performance deposit in the amount of $1,000,000, prior to commencement of construction, but not more than one year from the effective date of the Lease Amendment. At any time during the term of the Lease, Lessor may require an increase in the amount of the performance deposit to reflect economic inflation or to cover any additionally authorized improvements, alterations, or purposes or any modification of rental.

**-and-**

ii) a non-cancelable wetland performance deposit in the amount of $3,700,000 prior to commencement of operation of the desalination facility to ensure the implementation of compensatory mitigation, monitoring and maintenance as described in the approved plan. Fifty percent (50%) of the wetland performance deposit shall be released when the Lessor's Executive Officer determines that construction has been completed in conformance with the plans approved by the California Coastal Commission. The remainder of the wetland performance deposit for Phase I of the restoration project shall be proportionally and incrementally released based upon the productivity of the wetlands as determined by Lessor's Executive Officer, based upon the performance standards as outlined in the Marine Life Mitigation Plan, as adopted by the California Coastal Commission on August 6, 2008, provided that any further modification to the performance standards in Marine Life Mitigation Plan Section 5.4, shall require amendment of Lease PRC 8727.1.

b) The performance deposit may take one of the forms set out below or some other form acceptable to Lessor, and shall guarantee Poseidon's full and faithful performance of all the terms, covenants, and conditions of this Lease;

(i) Cash;

(ii) A renewable Time Certificate of Deposit from a financial institution authorized to do business in the State of California, wherein the principal sum is made payable to the State or order and both the financial institution and the form of the certificate are approved by the Lessor's Staff;

(iii) A Non-Cancelable Bond issued by a responsible surety company authorized to do business in California, as approved by the Lessor's Staff, provided:

(A) The Bond is automatically renewable and any alteration of the bond shall first require 30 days' prior written notice to Lessor, and

(B) The Bond shall guarantee payment in cash to Lessor of the performance deposit amount upon receipt of written demand from Lessor.

(iv) An irrevocable Standby Letter of Credit in a form acceptable to the Lessor's staff.

c) Regardless of the form in which Poseidon elects to make said performance deposit(s), all or any portion of the principal sum shall be available unconditionally to Lessor for correcting any default or breach of this lease by Poseidon, its successors or assigns or for payment of reasonable and actual expenses incurred by Lessor as a result of the failure of Poseidon, its successors or assigns, to perform faithfully any and all of the terms, covenants, and conditions of this Lease. The wetland performance deposit referenced in subsection (a)(ii) above shall only be available to cure defaults related to section 11 of this lease. The performance deposit referenced in subsection (a)(i) above shall be available to cure all other defaults under the lease.

d) Should Poseidon elect to assign or provide a Time Certificate of Deposit to fulfill the performance deposit requirements of this Lease, the agreement entered into by Poseidon with a financial institution to establish a deposit necessary to permit assignment or issuance of a certificate may allow the payment to Poseidon or order of interest accruing on account of said deposit.

e) Should the entire performance deposit or any portion thereof be appropriated and applied by Lessor for the payment of overdue rent or any such other sum due and payable to Lessor by Poseidon, then Poseidon, within 30 days after written demand by Lessor, restore said performance deposit to the required amount. This Paragraph D is only applicable to the performance deposit and shall not be applicable to the wetland performance deposit.

f) Poseidon shall maintain the required performance deposit throughout the Lease term. Failure to do so shall be deemed a default and shall be grounds for immediate termination of this Lease Amendment as the same relates to the additional use approved by this Lease Amendment.

g) The performance deposit shall be rebated, reassigned, released, or endorsed to Poseidon or order, as Poseidon may direct at such time as Poseidon has vacated the premises, is not in default and has no further obligation under the Lease. Interest on the performance deposit required hereunder shall accrue for the benefit of Poseidon and shall be made available to Poseidon from time to time except as the same is required to remedy or cure any default by Poseidon; provided, however, that if the performance deposit is given in the form of cash then Poseidon shall not be entitled to any interest thereon.

17. Poseidon shall, as a separate obligation, provide to Lessor, prior to commencement of construction, in the form attached to this Lease Amendment as Exhibit A, or in a form approved by Lessor's staff, an unconditional guarantee by parent company Poseidon Water LLC for full performance by Poseidon of all the obligations under the Lease.

18. Poseidon shall, prior to the use of the Lease Premises for desalination purposes, provide to Lessor a detailed report of compliance with Order No. R9-2006-0065, NPDES No. CA0109223, adopted by the San Diego Regional Water Quality Control Board, on August 16, 2006, and became effective on October 1, 2006, and any subsequent amendments thereto.

19. Poseidon shall provide a written report to the Lessor for use at a public hearing to be conducted by Lessor within five years of the effective date of this lease amendment in order to publicly review and evaluate Poseidon's compliance with the terms of the lease as provided for in Section 4, Paragraph 6 including, but not limited to, compliance with the federal Clean Water Act, and California's Porter-Cologne Water Quality Control Act.

20. In the event that Poseidon fails to comply with any or all of its separate obligations under this Lease, Lessor may terminate Poseidon's rights under this Lease Amendment. Such termination shall not affect any or all of Cabrillo's rights or obligations under this Lease. Additionally, assuming that Cabrillo is not otherwise in default of any of its separate obligations under this Lease, no default by Poseidon of any or all of its separate obligations under this Lease will give Lessor the right to terminate any of Cabrillo's rights under this Lease.

21. Poseidon shall not make any changes in use or operation of the intake channels and jetties without prior authorization by Lessor.

22. Poseidon shall be responsible for reimbursing all of Lessor's reasonable staff expenses incurred by Lessor and its Staff to monitor compliance by Poseidon of all of its reservations, terms, covenants and conditions of the Lease for the term of the Lease. Upon execution of the Lease Amendment, Poseidon shall execute a Reimbursement Agreement with the Lessor specifying the mechanism by which all actual costs by Lessor shall be reimbursed. An expense deposit of $25,000 shall be paid to and held by the Lessor as a cash surety to ensure performance of this paragraph.

23. Poseidon acknowledges that it is responsible for Section 4 General Provisions of Lease PRC 8727.1, except as otherwise noted below.

**SECTION 2 – SPECIAL PROVISIONS** shall be amended to include the following paragraph 24 as a separate obligation of Cabrillo:

24. Cabrillo shall notify Lessor in writing prior to discontinuing its use of the Lease Premises in connection with the production of electricity. Upon receipt of notification by Lessor, Cabrillo may apply to Lessor for approval of an assignment of its obligations under the lease to Poseidon. In considering Cabrillo's application for approval of an assignment, Lessor will take into account Poseidon's past performance and the likelihood that Poseidon could and would carry out all obligations under the lease as sole lessee. In the event that Lessor finds that there is a substantial probability that Poseidon would not or could not carry out all such obligations, then Lessor may disapprove the assignment, in which case, at Cabrillo's option, the lease would terminate or Cabrillo would remain as Co-Lessee.

**SECTION 2 – SPECIAL PROVISIONS** shall be amended to include the following paragraph 25:

25. Cabrillo and Poseidon shall be jointly and severally liable for all provisions of this Lease except for those provisions that specify a separate obligation of one or the other.

**SECTION 4 – GENERAL PROVISIONS** is amended as follows:

Paragraph 11, Default and Remedies, (a) Default, Paragraph (4) is hereby deleted in its entirety and is replaced with the following:

(4) Co-Lessees' failure to obtain, maintain and comply with all necessary governmental permits or other entitlements;

The effective date of this amendment to the aforesaid Agreement shall be August 22, 2008. This Amendment, consisting of seven pages together with Exhibit A, consisting of four pages, is a portion of document number PRC 8727.1, with a beginning date of December 14, 2006, consisting of four sections with a total of fourteen pages. All other terms and conditions of this lease shall remain in full force and effect. This Agreement will become binding on the Lessor only when duly executed on behalf of the State Lands Commission of the State of California.

**IN WITNESS WHEREOF**, the parties hereto have executed this Agreement as of the date hereafter affixed.

**CO-LESSEES:**
*CABRILLO POWER I, LLC

MCT By: Keith S Richards

Title: PRESIDENT

Date: NOVEMBER 24, 2008

*POSEIDON RESOURCES (CHANNELSIDE), LLC

By: Peter MacLaggan

Title: VICE PRESIDENT

Date: NOVEMBER 24, 2008

**LESSOR:**
STATE OF CALIFORNIA
STATE LANDS COMMISSION

By: _____

Date: _____

OFFICIAL SEAL
JESSE ALO
NOTARY PUBLIC-CALIFORNIA
COMM. NO. 1817329
SAN DIEGO COUNTY
MY COMM. EXP. OCT. 12, 2012

State of California
County of San Diego
On November 24, 2008 before me, Jesse Alo, Notary Public, personally appeared Keith S Richards and Peter MacLaggan who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.
I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.
WITNESS my hand and official seal.

*All signatures must be acknowledged

This Lease was authorized by the California State Lands Commission on _____

# EXHIBIT A
# PRC 8727.1 LEASE AMENDMENT

## GUARANTY

1. **Poseidon Water LLC, a Delaware limited liability company** ("Guarantor"), owns **Poseidon Carlsbad LLC,** which in turn owns **Poseidon Resources (Channelside) LLC** (Poseidon Resources). POSEIDON RESOURCES is a Co-Lessee under General Lease – Industrial Use Lease No. PRC 8727.1 (the "Lease") granted by the State of California acting by and through the State Lands Commission ("Lessor"). For valuable consideration, the receipt and sufficiency of which are hereby acknowledged by the undersigned, Guarantor hereby unconditionally guarantees performance of all the terms, covenants, conditions, agreements, and obligations of POSEIDON RESOURCES under the Lease in the same manner and to the same extent as though Guarantor were the co-lessee thereunder (the "Obligation").

2. This is a continuing and absolute Guaranty relating to the Obligation, irrespective of any release of, or granting of time or any other forbearance or indulgence to POSEIDON RESOURCES. Modifications of or alterations or changes which may be made in the Lease, or in the terms, duties and obligations imposed thereunder shall not in any way release the Guarantor, either in whole or in part, from any liability arising under this Guaranty. Notice to the Guarantor of any such modifications, alterations, changes, extensions or forbearance is hereby waived.

3. If, during the term this Guaranty is in effect, POSEIDON RESOURCES fails to timely perform any Obligation including without limitation, any obligation of POSEIDON

RESOURCES to make any monetary payment provided for thereunder, and fails to cure any such failure in the manner and within the period of time provided within the Lease, Guarantor will tender performance of such obligation directly for Lessor's benefit promptly upon Lessor's demand therefor, and without Lessor having to make prior demand upon POSEIDON RESOURCES. Notwithstanding the preceding sentence, the obligations of the Guarantor hereunder are independent of the obligations of POSEIDON RESOURCES, and a separate action or actions may be brought and prosecuted against the Guarantor whether an action is brought against POSEIDON RESOURCES or whether POSEIDON RESOURCES is joined in any such action or actions.

4. The Guarantor waives: (a) any right to require the Lessor to (i) proceed against POSEIDON RESOURCES; (ii) proceed against or exhaust any security or other guarantor; or (iii) pursue any other remedy in Lessor's power whatsoever; and (b) notice of acceptance of this Guaranty.

5. The Guarantor represents and warrants to Lessor that (a) all authorizations, approvals, notices, filings and other action required by the internal documents governing the Guarantor and the regulatory authorities having jurisdiction over the Guarantor in connection with the due authorization, execution and delivery of this Guaranty has been duly obtained or made and are in full force and effect; and (b) this Guaranty has been duly executed and delivered by the Guarantor and constitutes the legal, valid and binding obligation of the Guarantor enforceable against the Guarantor in accordance with its terms.

6. THIS GUARANTY SHALL BE GOVERNED BY AND CONSTRUED IN ACCORDANCE WITH THE LAW OF THE STATE OF CALIFORNIA WITHOUT REGARD TO PRINCIPLES OF CONFLICTS OF LAWS. The Guarantor, by its execution of this Guaranty, hereby submits to the non-exclusive jurisdiction of the courts of the State of California and of the United States of America in connection with any action or proceeding relating to this Guaranty and hereby consents to service of process or other summons in any such action or proceeding brought by Lessor against it in any such court by means of registered mail to the last known address of the Guarantor. Nothing herein, however, shall prevent service of process by any other means permitted by law or the bringing of any such action or proceeding in any other jurisdiction.

7. None of the terms or provisions hereof may be waived, altered, modified or amended except by a writing duly signed by the Lessor and by the undersigned. If any term hereof shall be held to be invalid, illegal or unenforceable in any jurisdiction, the validity of all other terms shall in no way be affected thereby in that jurisdiction, and the unenforceability in that jurisdiction shall in no way affect the validity or enforceability of that or any other terms hereof in any other jurisdiction.

8. This Guaranty shall be binding on the Guarantor and its successors and assigns and shall inure to the benefit of the Lessor. This Guaranty shall not be deemed to benefit any person except POSEIDON RESOURCES and Lessor.

In witness whereof, the Guarantor has caused this Guaranty to be executed on its behalf by its duly authorized representative, as of this _____ day of August, 2008.

**POSEIDON WATER LLC**

By: _____

Name: _____

Title: _____

(Attach Notary of Authorized Signature)

(Attach Delegation of Authority of Signatory)



SLC018000

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to the report addendum.

# W16a

## RECOMMENDED REVISED CONDITION COMPLIANCE FINDINGS

**November 21, 2008**

| | |
|---|---|
| **To:** | To Commissioners and Interested Parties |
| **From:** | Peter Douglas, Executive Director<br>Alison Dettmer, Deputy Director<br>Tom Luster, Staff Environmental Scientist |
| **Regarding:** | **Condition Compliance for CDP No. E-06-013** – Poseidon Resources (Channelside), LLC; **Special Condition 8**: Submittal of a Marine Life Mitigation Plan |
| **Commissioners on Prevailing Side:** | Commissioners Achadjian, Blank, Burke, Hueso, Kram, Lowenthal, Neely, Potter, Reilly, Shallenberger, and Chair Kruer |
| **Exhibit 1:** | Approved Marine Life Mitigation Plan (MLMP) |
| **Exhibit 2:** | Staff's Proposed Draft MLMP Conditions (June 2008) |
| **Exhibit 3:** | Poseidon's August 2, 2008 Proposed MLMP and attachments |
| **Exhibit 4:** | Transcript of August 6, 2008 hearing (Commission deliberations only) |

### STAFF NOTE

Staff prepared these recommended Revised Findings to reflect the Commission's August 6, 2008 decision approving a Marine Life Mitigation Plan for the Poseidon desalination facility in Carlsbad, San Diego County. The Plan is required pursuant to ***Special Condition 8*** of Coastal Development Permit #E-06-013. The Commission's approval at the August hearing included modifications to the Plan proposed by both staff and Poseidon. Because the Commission's action differed from staff's recommendation, revised findings are necessary. The recommended Revised Findings herein support the Plan as approved by the Commission and are based on staff's review of the August 6, 2008 hearing transcript and the record before the Commission. Recommended changes from the August 6th document are shown in ~~strikethrough~~ and **underline** text.

Please note that the Commission required Poseidon to submit within 60 days of Commission approval a revised Plan for Executive Director review and approval that incorporates the Commission's approved modifications. Poseidon submitted a plan in early October 2008, which has been reviewed and approved by the Executive Director, and is attached as Exhibit 1.

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## SUMMARY

On November 15, 2007, the Commission conditionally approved CDP E-06-013 for Poseidon Resources (Channelside), LLC (Poseidon) for construction and operation of a desalination facility to be located adjacent to the Encina Power Plant in Carlsbad, San Diego County. As part of the Adopted Findings for its approval, the Commission imposed **Special Condition 8**, which required Poseidon to submit for further Commission review and approval, a Marine Life Mitigation Plan **(MLMP, or the Plan)**.[1]

**In June 2008, Commission staff provided to Poseidon recommended conditions to include in its Plan (see Exhibit 2).** On July 7, 2008, Poseidon submitted to Commission staff ~~its~~ **a** proposed Marine Life Mitigation Plan (the Plan). **On August 2, Poseidon submitted a revised version of that Plan (see Exhibit 3).** ~~This report provides staff's analysis of the Plan, staff's evaluation of whether the Plan conforms to the Adopted Findings and **Special Condition 8**, and staff's recommendation as to whether the Commission should approve the Plan.~~

~~In brief, staff's analysis shows that the Plan as submitted does not conform to the Adopted Findings and ***Special Condition 8***. However, if modified as described herein, staff believes the modified Plan would conform to the applicable Findings and ***Special Condition 8***. Staff therefore recommends the Commission **approve** the Plan, as modified herein. The modifications staff has identified as being necessary for Plan approval are summarized below and are further detailed in Sections 1.1 and 4.0 of this memorandum.~~ **At its August 6, 2008 hearing, the Commission approved a modified Plan. Because the Commission's action differed from staff's recommendation, revised findings are necessary.**

~~Staff recommends the Plan be modified to include the following~~**The Commission modified the Plan as follows**:

1) Poseidon ~~shall~~ **is to** create or restore ~~between~~ **up to** 55.4 ~~and 68~~ acres of coastal estuarine wetland habitat within the Southern California Bight. **For Phase I, within 10 months of issuance of the desalination facility's coastal development permit (CDP), Poseidon must submit proposed site(s) and a Preliminary Restoration Plan for Commission review and approval. Within two years of issuance of the CDP for the desalination facility, Poseidon must submit a complete CDP application to restore at least 37**

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[1] The Commission's approval of this CDP also included **Special Condition 10**, which required Poseidon to submit for Commission review and approval an Energy Minimization and Greenhouse Gas Reduction Plan. ~~That Special Condition and Poseidon's submitted plan are evaluated in a separate staff report under Item W5a of the August 6, 2008 Commission hearing.~~ **The Commission approved the Energy Minimization and Greenhouse Gas Emission Reduction Plan at its August 6, 2008 hearing. The recommended Revised Findings for that Plan are on the Commission's December 2008 hearing agenda as Item W16b.**

**acres of estuarine wetlands. For Phase II, Poseidon must within five years of issuance of the Phase I CDP submit a complete CDP application either to restore an additional 18.4 acres of estuarine wetlands or to propose reducing or eliminating this Phase II restoration requirement by instead implementing technologies not currently available or feasible that would reduce entrainment levels below currently anticipated levels or by undertaking dredging in Agua Hedionda Lagoon in a manner that warrants mitigation credit. Poseidon may apply to do all 55.4 acres of restoration during Phase I.**

2) Poseidon shall implement its Marine Life Mitigation Plan in conformity to the conditions provided in Exhibit 2 of ~~this memorandum~~ **these Findings**.

3) Within 60 days of the Commission's approval of ~~this modified~~ **the** Plan **(i.e., as approved at the August 6, 2008 hearing)**, Poseidon shall submit for the Executive Director's review and approval a revised Plan that includes these modifications.

The first ~~recommendation~~ **modification** is based on a review of Poseidon's proposed Plan by staff and the Commission's independent scientific experts.[2] Poseidon's entrainment study identified impacts that these reviewers believe require more mitigation than Poseidon ~~has~~ **had** proposed. ~~Staff further believes that t~~**T**his amount of mitigation is necessary to ensure the project conforms to **Special Condition 8** and Sections 30230, 30231, and 30260 of the Coastal Act. Based on results from Poseidon's entrainment study, ~~this range in acreage – from 55 to 68 acres – represents the range in statistical confidence that would~~ **55.4 acres of wetland restoration will** provide the Commission with 80% ~~(i.e., 55 acres) to 95%~~ confidence ~~(i.e., 68 acres)~~ that the mitigation ~~would~~ **will** fully mitigate the impacts identified in the study. Section 4.2 of ~~this memorandum~~ **these Findings** provides a more detailed discussion.[3]

The second ~~recommendation is meant to~~ **modification** ensure**s** that mitigation is timely and successful. It ~~would~~ require**s** Poseidon to implement its mitigation subject to the conditions similar to those the Commission required of Southern California Edison at its San Dieguito Restoration Project (see, for example CDPs #183-73 and #6-04-88). Although Poseidon's current Plan does not commit to provide mitigation at a particular site, Poseidon had previously identified a mitigation site in San Dieguito Lagoon adjacent to Edison's as ~~the best~~ **its preferred** location to mitigate for its entrainment impacts. ~~Staff recommends the two projects be held to similar standards.~~ The Commission's scientific experts ~~concur with this recommendation~~ **recommend that the two restoration projects be subject to similar standards (see Exhibit 1 – Approved Conditions for Marine Life Mitigation Plan)**. Section 4.2 provides a more detailed discussion of this ~~recommendation~~ **modification**.

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[2] Staff consulted with members of the Commission's ~~Marine Review Committee~~ **Scientific Advisory Panel (SAP)**. Committee members are identified in Section 3.0 of this memorandum.

[3] ~~As an alternative to staff's recommendation, the Commission may wish to require mitigation in a manner similar to past decisions in which it applied a mitigation ratio to the identified level of impact. If the Commission selects this alternative approach, staff recommend mitigation be provided at between a 2:1 to 3:1 ratio, which would result in from 85 to 127.5 acres of coastal estuarine wetland habitat as mitigation.~~

The third ~~recommendation~~ **modification** is ~~meant~~ to help **ensure** Poseidon ~~and the Commission~~ implement**s** the ~~approved~~ mitigation plan **as approved**. Additionally, the 60-day deadline in the recommendation ~~would be~~ **is** consistent with the requirement imposed by the San Diego Regional Water Quality Control Board that Poseidon provide a mitigation plan for Board approval by October 9, 2008.[4]

~~With these recommended modifications, staff believes Poseidon's Plan would conform to applicable provisions of *Special Condition 8.*~~

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## 1.0 MOTION & RESOLUTION

**Motion:**

"~~*I move that the Commission approve the Marine Life Mitigation Plan attached to the staff recommendation as Exhibit 1 if modified as shown in Section 1.1 below and Exhibit 2 of this memorandum, as compliant with* ***Special Condition 8*** *of CDP E-06-013.*~~ ***I move that the Commission adopt the revised findings in support of the Commission's action on August 6, 2008 to approve the Marine Life Mitigation Plan as compliant with Special Condition 8 of CDP E-06-013.***"

[4] The Regional Board's Order, adopted on April 9, 2008 requires, in part: "*Within six months of adoption of this resolution, Poseidon shall submit to the Regional Board Executive Officer, for approval by the Regional Board an amendment to the Plan that includes a specific proposal for mitigation of the impacts, by impingement and entrainment upon marine organisms resulting from the intake of seawater from Agua Hedionda Lagoon, as required by Section VI.C.2(e) of Order No. R9-2006-0065; and shall resolve the concerns identified in the Regional Board's February 19, 2008 letter to Poseidon Resources, and the following additional concerns:*

*a) Identification of impacts from impingement and entrainment;*
*b) Adequate monitoring data to determine the impacts from impingement and entrainment;*
*c) Coordination among participating agencies for the amendment of the Plan as required by Section 13225 of the California Water Code;*
*d) Adequacy of mitigation; and*
*e) Commitment to fully implement the amendment to the Plan.*

**Resolution to Approve:**

~~*The Commission hereby finds that the compliance plan titled "Marine Life Mitigation Plan" prepared and submitted by the permittee, Poseidon Resources (Channelside) LLC, dated July 3, 2008, if modified as shown in Section 1.1 and Exhibit 2 of the July 24, 2008 Commission staff report, is adequate, if fully implemented to comply with* **Special Condition 8** *of CDP E-06-013.*~~ ***The Commission hereby adopts the findings set forth below for the Commission's approval of the Marine Life Mitigation Plan as compliant with Special Condition 8 of CDP E-06-013 on the ground that the findings support the Commission's decision made on August 6, 2008 and accurately reflect the reasons for it.***

**Staff Recommendation:**

~~Staff recommends a "**YES**" vote, which will result in the **approval** of the modified plan as compliant with the Adopted Findings and **Special Condition 8** and adoption of the motion, resolution, and findings herein. The motion passes only by an affirmative vote of a majority of the Commissioners present. Staff's recommended modifications are provided in Section 1.1 below, and further detailed in Section 4.0 of this memorandum. If these recommended modifications are not incorporated into the Plan, staff recommends the Commission find the Plan, as submitted, does not conform to **Special Condition 8** and staff would therefore recommend the Plan be denied.~~ **Staff recommends a "YES" vote on the motion. Passage of the motion will result in the adoption of revised findings as set forth in this staff report. The motion requires a majority vote of the members from the prevailing side present at the revised findings hearing, with at least three of the prevailing members voting. Only those Commissioners on the prevailing side of the Commission's action are eligible to vote on the revised findings.**

## 1.1 ~~RECOMMENDED~~ MODIFICATIONS

1) Poseidon shall create or restore ~~between~~ **up to** 55.4 ~~and 68~~ acres of coastal estuarine wetland habitat within the Southern California Bight. **For Phase I, within 10 months of issuance of the desalination facility's coastal development permit (CDP), Poseidon must submit proposed site(s) and a Preliminary Restoration Plan for Commission review and approval. Within two years of issuance of the CDP for the desalination facility, Poseidon must submit a complete CDP application to restore at least 37 acres of estuarine wetlands. For Phase II, Poseidon must within five years of issuance of the Phase I CDP submit a complete CDP application either to restore an additional 18.4 acres of estuarine wetlands or to propose reducing or eliminating this Phase II restoration requirement by instead implementing technologies not currently available or feasible that would reduce entrainment levels below currently anticipated levels or by undertaking dredging in Agua Hedionda Lagoon in a manner that warrants mitigation credit. Poseidon may apply to do all 55.4 acres of restoration during Phase I.**

2) Poseidon shall implement its Marine Life Mitigation Plan in conformity to the conditions provided in Exhibit 2 of ~~this memorandum~~ **these Findings**.

3) Within 60 days of the Commission's approval of ~~this modified~~ the Plan **(i.e., as approved at the August 6, 2008 hearing)**, Poseidon shall submit for the Executive Director's review and approval a revised Plan that includes these modifications.

## 2.0 STANDARD OF REVIEW

The ~~Commission must determine whether the~~ subject plan **must** conforms to **Special Condition 8 of CDP E-06-013**, which states:

*"**Marine Life Mitigation Plan:** PRIOR TO ISSUANCE OF THE PERMIT, the Permittee shall submit to and obtain from the Commission approval of a Marine Life Mitigation Plan (the Plan) that complies with the following:*

*a) Documentation of the project's expected impacts to marine life due to entrainment and impingement caused by the facility's intake of water from Agua Hedionda Lagoon. This requirement can be satisfied by submitting a full copy of the Permittee's Entrainment Study conducted in 2004-2005 for this project.*
*b) To the maximum extent feasible, the mitigation shall take the form of creation, enhancement, or restoration of aquatic and wetland habitat.*
*c) Goals, objectives and performance criteria for each of the proposed mitigation sites. It shall identify specific creation, restoration, or enhancement measures that will be used at each site, including grading and planting plans, the timing of the mitigation measures, monitoring that will be implemented to establish baseline conditions and to determine whether the sites are meeting performance criteria. The Plan shall also identify contingency measures that will be implemented should any of the mitigation sites not meet performance criteria.*
*d) Requires submittals of "as-built" plans for each site and annual monitoring reports for no less than five years or until the sites meet performance criteria.*
*e) Defines legal mechanism(s) proposed to ensure permanent protection of each site – e.g., conservation easements, deed restriction, or other methods.*

*The Permittee shall comply with the approved Plan. Prior to implementing the Plan, the Permittee shall submit a proposed wetlands restoration project that complies with the Plan in the form of a separate coastal development permit application for the planned wetlands restoration project."*

The Commission's **Permit** Findings supporting **Special Condition 8** state that the Plan is **to** ensure that all project-related entrainment impacts will be fully mitigated and that marine resources and the biological productivity of coastal waters, wetlands, and estuaries, will be enhanced and restored in compliance with Coastal Act Sections 30230 and 30231. The **Permit** Findings further state that the Plan must provide mitigation to the maximum extent feasible through creating, enhancing, or restoring aquatic and wetland habitat and must include acceptable performance standards, monitoring, contingency measures, and legal mechanisms to ensure permanent protection of the proposed mitigation sites.

## 3.0 PLAN DEVELOPMENT AND REVIEW

On November 15, 2007, the Commission approved CDP No. E-06-013 for Poseidon's proposal to construct and operate a desalination facility in Carlsbad, San Diego County. As part of that approval, the Commission required Poseidon, through **Special Condition 8**, to submit for additional Commission review and approval a Marine Life Mitigation Plan addressing the impacts that will be caused by the facility's use of estuarine water and entrainment of marine organisms.

~~Since~~ **After** the Commission's project approval in November 2007, staff and Poseidon ~~have~~ worked to develop a Plan that would meet the requirements of ***Special Condition 8*** and would be consistent with the Commission's **Permit** Findings. In March 2008, and as required by ***Special Condition 8***, Poseidon provided a copy of its entrainment study for Commission staff review. Staff provided the study to Dr. Pete Raimondi, an independent scientist with expertise in evaluating entrainment studies, for his review and recommendations (described in more detail in Section 4.0 below).[5] Dr. Raimondi provided the initial results of his review and recommendations to Poseidon in April 2008. In May 2008, staff conducted with Poseidon an interagency meeting with representatives from state and local agencies to determine what mitigation options might be available and feasible for Poseidon to include as part of its Plan.

Attendees include**d** representatives from:

| | |
|---|---|
| California Department of Fish and Game | City of Carlsbad |
| California Department of Transportation | City of Vista |
| California State Lands Commission | U.S. Fish and Wildlife Service |
| San Diego Regional Water Quality Control Board | |

In June 2008, based in part on concerns Poseidon expressed about Dr. Raimondi's review and recommendations, staff asked the Commission's ~~Marine Review Committee (MRC)~~ **Scientific Advisory Panel (SAP)**[6] to review Dr. Raimondi's conclusions and make further

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[5] Dr. Raimondi is Professor and Chair of Ecology and Evolutionary Biology at the University of California, Santa Cruz Center for Ocean Health, Long Marine Lab. Dr. Raimondi is considered by many to be California's leading expert on entrainment analysis. He has been a key participant and reviewer of most of the entrainment studies done along the California coast during the past decade, including those done for the Diablo Canyon Nuclear Power Plant, the Huntington Beach Generating Station, Morro Bay Power Plant, and Moss Landing Power Plant. He is also a member of the Coastal Commission's ~~Marine Review Committee~~ **Scientific Advisory Panel (SAP)** responsible for determining mitigation needed for the San Onofre Nuclear Generating Station (SONGS) and providing review and oversight for the SONGS mitigation work at San Dieguito Lagoon.

[6] The ~~Marine Review Committee~~ **SAP** is a team of independent scientists that provides guidance and oversight to the Commission on ecological issues associated with the San Dieguito Restoration Project. That Project is being implemented by Southern California Edison pursuant to requirements of coastal development permits issued by the Commission and is meant to mitigate for marine resources losses caused by the San Onofre Nuclear Generating Station (SONGS). The ~~Marine Review Committee~~ **SAP currently** consists of ***Dr. Richard Ambrose***, Professor and Director of Environmental Science & Engineering Program, Department of Environmental Health Sciences, University of California Los Angeles; ***Dr. John Dixon***, Senior Ecologist, California Coastal Commission; ***Dr. Mark Page***, Marine Science Institute, University of California at Santa Barbara; ***Dr. Pete Raimondi***, Professor and Chair of Ecology and Evolutionary Biology, University of California at Santa Cruz; ***Dr. Dan Reed***, Marine Science Institute, University of California at Santa Barbara; ***Dr. Steve Schroeter***, Marine Science Institute, University of

recommendations for Poseidon to include in its proposed Plan. The ~~MRC~~ **SAP** review is described in more detail in Section 4.0.

Also in June 2008, staff provided Poseidon a copy of the conditions the Commission had required of Southern California Edison (Edison) for its wetland restoration project at San Dieguito Lagoon **(see Exhibit 2)**. Until June, Poseidon had been proposing a site adjacent to Edison's as ~~the best~~ **its preferred** site for ~~its~~ mitigation. Based on the Commission's **Permit** Findings and discussion at the November 2007 hearing, staff recommended to Poseidon that it incorporate modified versions of the Edison conditions into its proposed Plan to ensure the two adjacent mitigation sites would be subject to compatible and consistent mitigation requirements. These conditions are in Exhibit 2**1**.

On July 7, 2008, staff received Poseidon's ~~currently~~ proposed Plan for review by the Commission ~~(see Exhibit 1)~~. On July 14, 2008, staff again consulted with the ~~MRC~~ **SAP** to evaluate changes Poseidon had proposed in this most recent submittal. **On August 2, 2008, Poseidon submitted a revised** ~~Poseidon's current~~ proposed Plan**,** **(see Exhibit 3).** ~~and~~ **T**he results of reviews by staff, Dr. Raimondi, and the ~~MRC~~ **SAP** are described in Section 4.0 below.

## 4.0 ANALYSIS FOR CONFORMITY TO SPECIAL CONDITION 8

~~Staff's evaluation of the proposed Plan shows that the~~**Poseidon's proposed** Plan, as submitted, ~~does~~ **did** not ensure conformity to ***Special Condition 8***. ~~Staff recommends the Plan be modified~~ **The Commission therefore required modifications to the Plan** to address two main areas in which the Plan ~~does not yet~~ **did not** conform to the condition: 1) the adequacy of mitigation proposed in the Plan; and, 2) assurances that the Plan will result in successful mitigation being implemented in a timely manner.

Section 4.1 below describes the submitted Plan's key elements **and the Commission's adopted modifications (shown in Exhibit 1)**. Sections 4.2 and 4.3 evaluate elements of the Plan that ~~staff believes~~ require modification. ~~Staff's recommendations~~ **The modifications** are based on review by staff and by members of the Commission's ~~Marine Review Committee (MRC)~~ **Scientific Advisory Panel (SAP)**, as described in Section 3.0. They also reflect comments received from other agencies, including the U.S. Fish and Wildlife Service and the California State Lands Commission. ~~The discussions below also identify concerns Poseidon expressed about staff's recommendations and staff's response to those concerns. Staff believes its third recommendation~~ **The third modification**, which ~~would~~ requires Poseidon to submit a revised Plan that incorporates these modifications, ~~would~~ helps **ensure** ~~the Commission and~~ Poseidon ~~in implementing~~ **implements** the modified Plan.

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California at Santa Barbara; and, ***Dr. Russ Schmitt***, Director of Coastal Research Center, University of California at Santa Barbara.

### 4.1 PLAN DESCRIPTION

Poseidon's proposed Plan includes**d** the following main elements:

- **Phased Mitigation Approach:** Poseidon proposes**d** that it implement necessary mitigation in two phases. Phase I would result in 37 acres of wetland restoration or creation within the Southern California Bight. During this phase, Poseidon would also conduct technology review to determine whether new or developing technologies would be reasonably feasible to reduce entrainment. It would also conduct a new entrainment study ten years after beginning operations to determine whether additional mitigation is needed for the facility's entrainment impacts. Phase I would apply during the time Poseidon's desalination facility operations are concurrent with operations of the power plant's cooling water system.

  Phase II would occur if the power plant stops operating or, for three consecutive years, operates at a level that provides less than 15% of the water Poseidon needs to operate the desalination facility (i.e., about 16.6 billion gallons per year)[7]. This amount would be based on the power plant's average water use over any three-year period. Under Phase II, Poseidon would conduct a new entrainment analysis and evaluate potential new technologies, similar to the review described in Phase I. Poseidon would then provide the results of those analyses to the Commission for review. If the Commission determines the analyses show a need for additional mitigation or the evaluations show certain technologies might reduce entrainment impacts, Poseidon would request its Plan be amended to require those changes. If additional mitigation is needed, Poseidon would propose one of the following:
  - Assume dredging obligations for Agua Hedionda Lagoon from the power plant and obtain mitigation credit of up to 81 acres of restoration credit for conducting dredging; or,
  - Provide additional wetland mitigation of up to 5.5 acres.

- **Suggested Conditions:** ~~The~~ **Poseidon's proposed** Plan includes**d** suggested conditions that Poseidon would use to implement further studies, evaluate new technologies, select its mitigation site(s), and implement mitigation options. Many of these are modified versions of conditions the Commission required Edison use to implement its mitigation measures for the impacts to marine life from the San Onofre Nuclear Generating Station. These are discussed in Section 4.3 below.

**In adopting the final MLMP, the Commission incorporated several concepts from Poseidon's proposed Plan with a number of modifications, including:**

- **Entrainment impacts: The Commission determined that Poseidon's entrainment impacts resulted in a loss of marine organisms equivalent to that produced in a 55.4-acre area of estuarine and nearshore habitat (see Sections 4.2.1 & 4.2.2 below for details).**

[7] Poseidon's average withdrawal of 304 million gallons per day would equal almost 111 billion gallons per year. 15% of that amount is about 16.6 billion gallons, or about 45 million gallons per day.

- **Phased mitigation: The Commission required mitigation in up to two phases:**
  - **During Phase I, Poseidon is to create or restore at least 37 acres of coastal estuarine wetland habitat in one or two sites within the Southern California Bight. Within 10 months of issuance of the CDP for the desalination facility, Poseidon is to submit a preliminary site selection and restoration plan for Commission approval, and with 24 months of issuance of that CDP, Poseidon is to submit a complete CDP application for restoration of at least 37 acres of estuarine wetlands. Poseidon may choose to restore the full 55.4 acres of wetlands during Phase I.**

  - **For Phase II, Poseidon must within five years of issuance of the Phase I CDP submit a complete CDP application to restore an additional 18.4 acres of estuarine wetlands, or as part of that application may request to reduce or eliminate this Phase II restoration requirement by instead implementing technologies that are not currently available or feasible to reduce entrainment impacts below currently anticipated levels or undertaking dredging in Agua Hedionda lagoon in a manner that warrants mitigation credit.**

- **Required conditions: Poseidon is to implement its Marine Life Mitigation Plan as modified by the Commission and in conformity to the conditions provided in Exhibit 1 of these Findings. Those modifications require Poseidon to submit within sixty days of the Commission's August 6, 2008 approval a revised Plan that includes all required conditions and modifications for the Executive Director's review and approval.**

### 4.2 ANALYSIS – ADEQUACY OF MITIGATION

This section evaluates the following elements of Poseidon's proposed Plan:

Section 4.2.1: Analysis of Poseidon's entrainment study
Section 4.2.2: Determining the mitigation needed to address identified impacts
Section 4.2.3: Analysis of Poseidon's phased approach
Section 4.2.4: Analysis of dredging as proposed mitigation

#### *4.2.1 Analysis of Poseidon's Entrainment Study*

**Special Condition 8** required Poseidon to submit its entrainment study for Commission staff review. In March 2008, Poseidon submitted data and modeling results from its study. The study was conducted using the Empirical Transport Model (ETM), which is used to identify the level of adverse effect caused by entrainment. The model compares the portion of a population at risk of entrainment to the portion of that population actually entrained. It calculates this proportional mortality for each of the main species subject to entrainment, and uses the source water area of each species – that is, the total volume or area of water in which species are at risk of being entrained – to calculate the Area of Production Foregone (APF), which provides an estimate of the average area of habitat that would be needed to produce the organisms lost to entrainment. As shown below, this APF provides the basis for determining the amount of mitigation needed to address entrainment impacts.

As described in Section 3 above, staff provided Poseidon's data and study results to Dr. Raimondi for review. In reviewing the study, Dr. Raimondi concluded the following:

- **Adequacy of Study:** Dr. Raimondi found that, as submitted, Poseidon's study could not be evaluated for its technical merits or its estimates of impacts. However, by reviewing additional relevant Poseidon documents and documents from the associated power plant's entrainment study, and by working with the consultants that had conducted Poseidon's study (Tenera Consultants), Dr. Raimondi was able to determine that the study's sampling and data collection methods were consistent with those used in other recent studies conducted in California pursuant to the protocols and guidelines used by the U.S. EPA, Regional Water Quality Control Boards, California Energy Commission, and Coastal Commission.

  Dr. Raimondi also found that the study provided adequate data to determine the types and numbers of organisms that would be subject to entrainment and to determine the area of the source water bodies – that is, the area of Agua Hedionda and nearshore ocean waters where entrainable organisms would be subject to entrainment. The study identified a source water area within Agua Hedionda of 302 acres and a nearshore source water area of about 22,000 acres. Poseidon's calculations were generally consistent with those used in other recent studies, although the calculations Poseidon used to determine its source water areas differed from those used in other recent studies to reflect the tidal exchange between Agua Hedionda Lagoon and the nearshore ocean environment.

- **Determining the Effects of Poseidon's Entrainment:** Poseidon concluded that the entrainment caused by 302 MGD of water withdrawal by the desalination facility would result in an APF of 37 acres in Agua Hedionda Lagoon. Dr. Raimondi's review revealed that Poseidon's APF calculation was accurate, albeit at the 50% confidence level – that is, the 37-acre APF represented the area for which the study could assure **with** at least 50% confidence that the area reflected the full extent of Poseidon's entrainment impacts in the Lagoon. This calculation is based on applying standard statistical techniques to the error rates Poseidon generated in its study. Dr. Raimondi also used those error rates to calculate APFs at the 80% and 95% confidence levels – that is, the number of acres for which the area of full entrainment impacts could be described with at least 80% or 95% confidence. This resulted in APFs of 49 and 61 acres, respectively.

  Poseidon's study did not include an APF for the area of nearshore ocean waters that would be affected by entrainment; therefore, using Poseidon's data, Dr. Raimondi calculated an APF for the entrainment effects Poseidon would cause in these nearshore waters. At the same 50%, 80%, and 95% confidence levels, the APFs would be 55, 64, and 72 acres, respectively. The APFs for both source water areas and each confidence level are shown in Table 1 below.

***Table 1: APF Totals***

| **Source water areas:** | **APF (in acres) at three levels of confidence:** | | |
|---|---|---|---|
| | ***50%*** | ***80%*** | ***95%*** |
| Estuarine: 302 acres of source water | 37 | 49 | 61 |
| Nearshore: 22,000 acres of source water | 55 | 64 | 72 |
| **Total APF** | **92 acres** | **113 acres** | **133 acres** |

**In its July 3, 2008 proposed MLMP submittal,** Poseidon raised a number of concerns with staff's and Dr. Raimondi's review (see **also** Exhibit B of **Poseidon's August 2, 2008 submittal in Exhibit 3** ~~of the MLMP~~). In response, and to supplement Dr. Raimondi's review, Commission staff requested that the ~~MRC~~ **SAP** assess the review and respond to Poseidon's concerns.

Poseidon stated its study made a number of conservative assumptions that result in an overestimate of the mitigation needed**.** ~~and that t~~**T**hose ~~conservative~~ assumptions**, and the SAP's response,** include:

- *The study overestimated the number of larvae in the lagoon and assumed a greater amount of entrainable larvae than are actually present.* In response, Dr. Raimondi and the ~~MRC~~ **SAP** noted that this type of study is based on actual sampling data, not estimates. The data reviewed were those Poseidon provided from its sampling efforts, so there should be no overestimate or assumption of a greater number of larvae than were actually sampled. If Poseidon believes the data are incorrect, that would suggest either that the raw data should be re-evaluated or the study should be run again. Further, if Poseidon's contention were true – that is, if the study overstated the number of larvae in the Lagoon – this would result in a higher APF and would therefore result in a need for *more* mitigation.[8]

- *The study assumes the project will render all affected acreage (i.e., the APF) non-functional, even though that acreage would only be partially affected and would continue to allow numerous other species to function.* In response, the ~~MRC~~ **SAP** reiterated that these entrainment studies do not assume the complete loss of ecosystem function within an area of APF; instead, they identify only the area that would be needed to replace the numbers and types of species identified in the study as subject to entrainment. The APF is used to determine impacts to only those species most affected by entrainment, and the mitigation resulting from the APF is meant to account only for those effects.

[8] To provide a simple example, the APF is based in part on proportional mortality, which is the ratio of the number of organisms entrained compared to those at risk of being entrained. Assuming the number of entrained organisms remains the same, the fewer organisms in the Lagoon, the higher the proportion of those organisms entrained – therefore, Poseidon's contention results in a higher proportional impact area.

- *The study protocols assume 100% mortality for entrained organisms; however, Poseidon believes actual mortality will be significantly lower. Poseidon also contends that it should be required to provide less mitigation based on its contention of a lower mortality rate.* In response, the ~~MRC~~ **SAP** noted that the protocols used in these entrainment studies include an assumption of 100% mortality based on guidance from the U.S. EPA and reflecting the practice of California's State and Regional Water Boards, the California Energy Commission, and the Coastal Commission in conducting and evaluating these studies. This assumption applies to these studies regardless of the type of intake and discharge system being evaluated. For example, although each power plant or desalination facility may use different water volumes, have different and variable water velocities and levels of turbulence, use different types of screens, pumps, and other equipment, and draw in a different mix of organisms, all entrainment studies similar to Poseidon's have used this same 100% mortality rate. Further, there are no peer-reviewed scientific studies that support using a lower mortality rate for different types of power plant or desalination systems that cause entrainment. In the case of Poseidon's desalination facility, entrained organisms will be subject to a number of stressors – including high pressures, significant changes in salinity, possible high temperature differences if the power plant is operating, etc. – and they will then be discharged to a different environment than is found in Agua Hedionda. Any one or a combination of these stressors could result in mortality.

  Poseidon's proposed phased mitigation approach, which is based in part on its contention of lower mortality rates, is evaluated in more detail below. One element of this approach, however, is that Poseidon states it might use alternative screening systems to reduce entrainment or entrainment mortality. ~~However, staff considers this only speculative at this time, and notes that screening systems that have been tested for reducing entrainment have not been found effective in the marine environment. The current scientific understanding is that entrainment impacts are based on an assumption of 100% mortality of organisms present in the full volume of water drawn into an intake system, and that is the basis of the analysis herein.~~ **Pursuant to the Commission's action, if Poseidon proposes to adopt alternative technologies that are not currently available or feasible to reduce entrainment, it may apply for reduced mitigation requirements as part of its Phase II CDP application.**

**Based on the above, and on the reviews conducted by Dr. Raimondi and the SAP, the Commission concurs with the conclusions of the scientific reviews showing that the facility's expected entrainment impacts result in the above-referenced APFs and incorporates those conclusions into its approval of the Plan.**

### *4.2.2 Determining the mitigation needed to address identified impacts*

The APFs generated from the study and shown in Table 1 identify the extent of expected entrainment impacts, and also serve as the basis for identifying the type and amount of mitigation needed to address those impacts. Past entrainment studies have generally used the 50% confidence level APF as the basis for mitigation and applied a mitigation ratio (e.g., 1:1, 2:1, 3:1, etc.) to compensate for mitigation occurring at a distance from the affected area, to reflect a temporal loss of habitat functions caused by the impact, to reflect mitigation that provides a different type of habitat than the affected area, or other concerns. This option is described briefly later in this Section.

For this review, however, Dr. Raimondi provided an alternative approach to determine the amount of mitigation needed, based on two main assumptions:

- First, that any mitigation provided would be in the form of restored habitat similar to the types of habitat that produced or supported the affected entrained organisms – that is, that mitigation would consist of tidally-influence salt marsh or shallow water areas similar to those found in Agua Hedionda Lagoon.

- Second, that the mitigation provided would be fully successful – that is, the mitigation site would provide fully functioning habitat that would meet required performance standards, contingency plans, etc., required for such projects to ensure success. This was based on an additional assumption – that Poseidon would be providing mitigation at a site in San Dieguito Lagoon adjacent to Edison's restoration site and would be subject to the same conditions the Commission required of Edison. Dr. Raimondi and the ~~MRC~~ **SAP** believe the conditions required of Edison provide a high level of certainty that Edison's restoration efforts will be successful and that they would provide a similar level of certainty for Poseidon's mitigation at this location.

Using the above assumptions, and using the APF figures noted above, Dr. Raimondi concluded with at least 50% confidence that creating or restoring 37 acres of suitable and fully functioning estuarine habitat would fully replace the lost productivity of Agua Hedionda Lagoon, that 49 acres would be needed to provide an 80% level of certainty, and that 61 acres would be needed to reach a 95% level of certainty. By applying the same approach to the nearshore APFs, Dr. Raimondi concluded that creating or restoring 55 acres of open water habitat would be needed to provide at least 50% certainty that that entrainment effects in that source water area would be fully mitigated, that 64 acres were needed to provide 80% certainty, and 72 acres would provide 95% certainty. However, in recognition of the impracticality of creating 55 to 72 acres of offshore open water habitat and recognizing the relatively greater productivity rates per acre of estuarine wetland habitats, Dr. Raimondi suggested that these offshore impacts be "converted" to estuarine mitigation areas. That is, by assuming that successfully restored wetland habitat would be ten times more productive than a similar area of nearshore ocean waters, every ten acres of nearshore impacts could be mitigated by creating or restoring one acre of estuarine habitat.[9] Applying this 10:1 ratio to the nearshore APFs results in 5.5, 6.4, and 7.2 acres, respectively. Although this approach would result in "out of kind" mitigation, it is also expected to produce overall better mitigation – not only is it not practicable to create nearshore, open water habitat, that habitat type is already well-represented along the shoreline, whereas creating or restoring coastal estuarine habitat types would support a long-recognized need to increase the amount of those habitat types in Southern California.[10] These totals are shown Table 2 below.

[9] This approach – converting offshore entrainment impacts to areas of wetland mitigation – has been used to help determine mitigation in several recent California power plant siting cases, including Huntington Beach (00-AFC-13), Morro Bay (00-AFC-12), and others.

[10] See, for example, the Southern California Wetlands Recovery Project at http://www.scwrp.org/index.htm

***Table 2: Adjusted APF Totals***

| Habitat Type | APF (in acres) at three levels of confidence | | | Conversion ratio | Resulting APF (in acres) at three levels of confidence | | |
|---|---|---|---|---|---|---|---|
| | *50%* | *80%* | *95%* | | *50%* | *80%* | *95%* |
| Estuarine | 37 | 49 | 61 | 1:1 | 37 | 49 | 61 |
| Nearshore | 55 | 64 | 72 | 10:1 | 5.5 | 6.4 | 7.2 |
| **Total Mitigation** | | | | | **42.5** | **55.4** | **68.2** |

In sum, Dr. Raimondi concluded that creating 55.4 to 68.2 acres of fully functioning estuarine habitat similar to habitat in Agua Hedionda Lagoon would provide between 80 to 95% confidence that Poseidon's entrainment impacts would be fully mitigated. This conclusion is also based on Poseidon's mitigation being subject to conditions similar to Edison's, which is discussed in more detail in Section 4.2.3 below.

Poseidon contends that ~~Dr. Raimondi's~~ **staff's** recommendation to apply an 80-95% level of certainty for mitigation is "extraordinary and unprecedented" and would result in excess mitigation for the project's expected impacts. In response, Dr. Raimondi and the ~~MRC~~ **SAP** state that ~~the confidence levels used are based on the error rates Poseidon calculated as part of its study, and generating these calculations is a standard practice for this type of entrainment study~~ **considering uncertainty is a standard practice in data analysis and that such consideration provides a context for understanding the likelihood that a particular amount of mitigation will provide full compensation for identified impacts. Staff notes that Poseidon's entrainment study included error rates that Dr. Raimondi used initially to calculate a higher estuarine APF of 87 acres at the 80% confidence level. Dr. Raimondi then used a different error rate, which he considered more appropriate for this study, to calculate an APF of 49 acres at the 80% confidence level.**[11]

Dr. Raimondi's recommendation of using the 80-95% confidence level is "unprecedented" only in that past studies have used the 50% confidence level **to describe the expected impact** and then applied a mitigation ratio, such as 2:1 or 3:1, to reflect the lower confidence level**,** ~~and~~ to include consideration of mitigation that may be "out of kind"**,** ~~or~~ provided at some distance from the affected area**, or may not be fully successful**. Dr. Raimondi's proposal, as supported by the ~~MRC~~ **SAP** and Commission staff, would actually result in less mitigation acreage than that standard mitigation approach, but it would have higher certainty of success.

~~Staff recognizes that the Commission could apply a mitigation ratio to the identified level of impact, consistent with past mitigation determinations for wetland impacts. For example, applying a 2:1 ratio to the 50% 42.5 acre total APF would yield 85 acres of restored coastal wetland habitat, and applying a 3:1 ratio would yield 127.5 acres of habitat. If the Commission selects this approach, staff believes these ratios would be appropriate minimums to apply to reflect that the Plan does not identify specific mitigation sites and the site(s) selected could be more than a hundred miles from the impact site at and near Agua Hedionda.~~

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**[11] Poseidon's study included error rates based on source water sampling, which Dr. Raimondi believed were unreasonably high. He instead calculated an error rate based on the proportional mortality of each species being an independent replicate, which he believes better meshes with the logic behind the use of the APF to determine impacts.**

~~However, as described previously, Commission staff believes that Dr. Raimondi's proposed approach of creating 55.4 to 68.2 acres would be an adequate and preferable approach—if Poseidon's proposed Plan is also modified to include staff's other recommended modifications, including the one described in the next section of this memorandum.~~

**Based on the discussion above and on the record, the Commission finds that requiring 55.4 acres of estuarine wetland restoration in the Southern California Bight subject to the conditions shown in Exhibit 1 provides a sufficient degree of certainty that the facility's entrainment impacts will be fully mitigated and brings the Plan into conformity to Special Condition 8 and the Coastal Act's marine life protection policies.**

### *4.2.3 Analysis of Proposed Mitigation Phasing*

As noted above, Poseidon's Plan includes a proposed phased approach to mitigation, which would be based on changes in power plant operations or possible changes in technology. **Because of the possibility that Poseidon might in the future adopt technologies that are not currently available or feasible to reduce entrainment and because of uncertainty regarding future power plant operations, the Commission finds that it is appropriate to allow phasing of the mitigation. For the first phase, Poseidon must submit within two years of the issuance of the CDP for the desalination facility a complete CDP application for wetland restoration of at least 37 acres. Poseidon may apply during Phase I to implement the entire 55.4 acres of wetland restoration. For the second phase, Poseidon must within five years of issuance of the Phase I CDP submit a complete CDP application to restore the additional 18.4 acres of restoration, or as part of that application request the Commission reduce or eliminate the amount of required restoration if Poseidon implements the above-referenced technologies that result in reduced entrainment or if, as explained below, Poseidon performs dredging in Agua Hedionda Lagoon in a manner that warrants mitigation credit.** ~~For several reasons, staff recommends the Commission not accept this aspect of the Plan and instead require a specific type and amount of mitigation as described above. The entrainment impacts described in the Commission's Findings were based on Poseidon application to withdraw 304 million gallons per day of estuarine water to operate its desalination facility, and staff recommends the Commission use this as the basis for its decision on the amount of mitigation needed to address this impact.~~

~~Staff believes this phasing approach is speculative in that it is tied to unknown future operations of the power plant. Additionally, information in the record shows that the power plant owner expects to replace the existing power plant within the next few years and to operate the existing plant only at very low levels or on a back-up basis until it is no longer needed to support the regional electrical power grid. More recently, the power plant owner announced that it would consider constructing its own desalination facility to provide water for its proposed new power plant. If built, this facility would use only about one percent of the water Poseidon proposes to use, and so would likely have a relatively minor affect on the overall mitigation needed to adequately address the impacts of both facilities.~~

~~Staff also believes that tying Poseidon's mitigation to power plant operations would be inappropriate for purposes of the coastal development permit and the Commission's Findings. Poseidon's coastal development permit application did not include the power plant owner as a co-applicant, and the Commission has made no determinations about how the power plant should or may operate.~~

### *4.2.4 Analysis of dredging as project mitigation*

~~Similarly, staff recommends the Commission not approve Poseidon's proposal to allow it to use as mitigation during Phase II the dredging activities now being conducted by the power plant owner.~~ Poseidon proposes a formula by which it could obtain up to 81 acres of credit for conducting dredging in Agua Hedionda Lagoon. **The Commission does not accept this formula because it does not currently have sufficient information to evaluate the purpose, nature, or extent of potential dredging, or whether Poseidon would be able to conduct the proposed dredging. It is possible, however, that Poseidon might carry out future dredging in a manner that warrants mitigation credit. Poseidon may therefore apply as part of its Phase II mitigation CDP application for a reduction in restoration requirements in exchange for mitigation credits that the Commission may consider for Poseidon's dredging activities.** ~~However, the Commission has not considered dredging in and of itself to be mitigation. Dredging that the power plant has conducted in the past has been done to maintain its intake channel, and similarly, Poseidon's main purpose for dredging would be to maintain that channel. The Commission has considered habitat benefits resulting from dredging for that primary purpose as merely incidental to the primary purpose of the dredging activities rather than mitigation. Had those dredging activities instead been considered mitigation, the power plant owner may have been required to continue dredging to maintain the area of mitigation, regardless of the need for an intake structure.~~

~~Further, as noted in the Findings, the power plant owner also owns the Lagoon and has expressed its intentions to maintain the Lagoon for the foreseeable future. Additionally, the power plant owner is not a permit co-applicant with Poseidon, and the permit record includes no agreement between Poseidon and the owner regarding dredging, so staff believes it would not be appropriate for the Commission to approve a plan that may create an expectation that Poseidon would take on these activities on the owner's property without landowner approval.~~

~~As Poseidon notes in its Plan, the Commission accepted as part of Edison's San Dieguito restoration project a commitment by Edison to maintain the San Dieguito tidal inlet in an open condition in perpetuity. However, in that instance, dredging was necessary for that project to support the more than 100 acres of restored tidal wetlands Edison had created as a substantial portion of the mitigation required pursuant to its SONGS coastal development permit. The Commission's acceptance of that mitigation element was also based on multiple years of study by the MRC, whose recommendation the Commission used in its decision. The MRC has not made a similar recommendation for Poseidon's proposal. Further, Poseidon has not proposed mitigation within Agua Hedionda that would require dredging.~~

~~Finally, Poseidon's proposal would not meet the provision of **Special Condition 8** requiring mitigation to be in the form of creation, enhancement, or restoration of aquatic and wetland habitat, to the maximum extent feasible. As noted above, there are wetland mitigation opportunities within the Southern California Bight well in excess of the amount needed to mitigate for this project's impacts, and Poseidon has not shown that it would be infeasible to provide the required type of mitigation.~~

**4.3 ANALYSIS – ASSURANCE THAT MITIGATION WILL SUCCEED**

Until recently, Poseidon had proposed that it provide wetland restoration at a site in San Dieguito Lagoon, adjacent to Edison's restoration project. Review by staff, Dr. Raimondi, and the ~~MRC~~ **SAP** had been based on determining whether that site would provide suitable mitigation. In April 2008, Dr. Raimondi concluded that Poseidon's proposed San Dieguito site would likely provide suitable habitat for the losses of estuarine larvae at Agua Hedionda if the restored habitat was similar to the habitat affected at Agua Hedionda. In June 2008, Dr. Raimondi and the ~~MRC~~ **SAP** also concluded that the San Dieguito site would also provide at least partial mitigation for some species affected in Poseidon's nearshore impact area. Also in June, staff provided Poseidon with a modified version of the conditions the Commission required Edison to meet for conducting its site selection, construction, monitoring, and other aspects of its restoration plan, and recommended that Poseidon include these conditions as part of its proposed Plan. These are provided in Exhibit 2.

~~Since then,~~ **Several weeks before the August 2008 hearing,** Poseidon altered its Plan so that San Dieguito ~~is~~ **was** no longer necessarily Poseidon's preferred site. The Plan instead proposes that Poseidon select a site or sites somewhere within the Southern California Bight that meet conditions shown in Sections 3.1 and 3.2 of the Plan. Those conditions include**d** further modifications to the conditions staff provided in June.

Staff asked the ~~MRC~~ **SAP** to review Poseidon's two proposed changes – that is, its proposal to consider sites other than San Dieguito and the modifications in its Plan to staff's previously recommended conditions. Regarding, staff's proposed conditions, the ~~MRC~~ **SAP** believes those conditions – i.e., Exhibit 2 – would generally provide adequate assurance of success for a restoration project to be implemented in most coastal estuarine areas of Southern California, although a higher degree of assurance would result if specific sites were identified. The ~~MRC~~ **SAP** also determined that the changes Poseidon proposed to staff's conditions and included in its Plan would result in lesser mitigation standards than those required of Edison and would not provide equal assurance of mitigation success. The changes Poseidon proposed include the following:[12]

- Staff recommended that Poseidon submit a complete coastal development permit application for its Final Restoration Plan within 24 months of Commission approval of its Preliminary Plan (i.e., the Plan being reviewed herein). Poseidon **proposed** modifi~~ed~~**ying** that recommendation in Section 4 of its Plan to allow submittal of that application either 24 months after issuance of the project coastal development permit or commencement of

[12] For a full comparison, see **Exhibit 3,** ~~Section 3 of~~ Poseidon's **proposed** Plan, and Exhibit 2 showing staff's originally recommended conditions.

commercial operations of the desalination facility, whichever is later. This could substantially delay the implementation of mitigation and could result in several years of impacts occurring without mitigation.

- A proposed change to Poseidon's Plan at Section 3.1(d) and at Section 3.2(c) would **allow the Executive Director or Commission to** reduce the required buffer zone at its mitigation sites from ~~no less than~~ **at least** 100 feet wide to an average that could be ~~much~~ less than 100 feet **wide**.
- ~~A proposed change at Section 3.1(i) would allow the Plan to affect endangered species in a way not allowed under the Edison requirements.~~
- Poseidon proposes to change Section 3.3(c) to allow mitigation to occur in up to four sites, rather than up to two sites, as required of Edison, which could fragment the mitigation and reduce its overall value.
- ~~Poseidon also proposed deleting a requirement at Section 5.4 that would require a designed tidal prism be maintained to ensure the wetland mitigation site has adequate tidal action.~~
- ~~Poseidon proposes that any fees it pays for coastal development permits or amendments be credited against the budget needed to implement the mitigation plan.~~

Staff and the ~~MRC~~ **SAP** reviewed these proposed changes and believe they would result in inadequate assurance that successful mitigation would be conducted in a timely manner**, and the Commission did not include those proposed revisions in its Plan approval**. ~~Staff's recommendation, therefore, is~~ **The Commission finds** that the Plan be modified to include the conditions in Exhibit 2.

## CONCLUSION

**The Commission finds that, as modified as described above and with the conditions in Exhibit 1, the Marine Life Mitigation Plan complies with *Special Condition 8* and the marine life protection policies of the Coastal Act. The Commission further finds that implementation of the Plan will ensure the project's entrainment-related impacts will be fully mitigated and will enhance and restore the marine resources and biological productivity of coastal waters in conformity to Coastal Acts Sections 30230 and 30231.**

# Item W16a
# Exhibit 1

# Approved Marine Life Mitigation Plan (MLMP)

**Item W16a – Exhibit 1**
**Special Condition 8 of E-06-013 – Poseidon Resources**
**November 21, 2008**

# APPROVED MARINE LIFE MITIGATION PLAN

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## INTRODUCTION

Poseidon's Carlsbad desalination facility will be co-located with the Encina Power Station and will use the power plant's once-through cooling intake and outfall structures. The desalination facility is expected to use about 304 million gallons per day (mgd) of estuarine water drawn through the structure. The facility will operate both when the power plant is using its once-through cooling system and when it is not.

This Marine Life Mitigation Plan (the Plan) will result in mitigation necessary to address the entrainment impacts caused by the facility's use of estuarine water. The Plan includes two phases of mitigation – Poseidon is required during Phase I to provide at least 37 acres of estuarine wetland restoration, as described below. In Phase II, Poseidon is required to provide an additional 18.4 acres of estuarine wetland restoration. However, as described below, Poseidon may choose to provide all 55.4 acres of restoration during Phase I. Poseidon may also choose during Phase II to apply for a CDP to reduce or eliminate the required 18.4 acres of mitigation and instead conduct alternative mitigation by implementing new entrainment reduction technology or obtaining mitigation credit for conducting dredging.

## CONDITION A: WETLAND RESTORATION MITIGATION

The permittee shall develop, implement and fund a wetland restoration project that compensates for marine life impacts from Poseidon's Carlsbad desalination facility.

### 1.0 PHASED IMPLEMENTATION

**Phase I:** Poseidon is to provide at least 37 acres of estuarine wetland restoration. Within two years of issuance of the desalination facility's coastal development permit (CDP), Poseidon is to submit a complete CDP application for a proposed restoration project, as described below.

**Phase II:** Within five years of issuance of the Phase I CDP, Poseidon is to submit a complete CDP application proposing up to 18.4 acres of additional estuarine wetland restoration, subject to reduction as described in Section 6.0 below.

## 2.0 SITE SELECTION

In consultation with Commission staff, the permittee shall select a wetland restoration site or sites for mitigation in accordance with the following process and terms.

Within 10 months of the effective date of this permit, the permittee shall submit the proposed site(s) and preliminary wetland restoration plan to the Commission for its review and approval or disapproval.

The location of the wetland restoration project(s) shall be within the Southern California Bight. The permittee shall select from sites including, but not limited to, the following eleven sites: Tijuana Estuary in San Diego County; San Dieguito River Valley in San Diego County; Agua Hedionda Lagoon in San Diego County; San Elijo Lagoon in San Diego County; Buena Vista Lagoon in San Diego County; Huntington Beach Wetland in Orange County, Anaheim Bay in Orange County, Santa Ana River in Orange County, Los Cerritos Wetland in Los Angeles County, Ballona Wetland in Los Angeles County, and Ormond Beach in Ventura County. The permittee may also consider any sites that may be recommended by the California Department of Fish & Game as high priority wetlands restoration projects. Other sites proposed by the permittee may be added to this list with the Executive Director's approval.

The basis for the selection shall be an evaluation of the site(s) against the minimum standards and objectives set forth in subsections 3.1 and 3.2 below. The permittee shall take into account and give serious consideration to the advice and recommendations of the Scientific Advisory Panel (SAP) established and convened by the Executive Director pursuant to Condition B.1.0. The permittee shall select the site(s) that meet the minimum standards and best meet the objectives.

## 3.0 PLAN REQUIREMENTS

In consultation with Commission staff, the permittee shall develop a wetland restoration plan for the wetland site(s) identified through the site selection process. The wetland restoration plan shall meet the minimum standards and incorporate as many as feasible of the objectives in subsections 3.1 and 3.2, respectively.

### 3.1 Minimum Standards

The wetland restoration project site(s) and preliminary plan(s) must meet the following minimum standards:

a. Location within Southern California Bight;

b. Potential for restoration as tidal wetland, with extensive intertidal and subtidal areas;

c. Creates or substantially restores a minimum of 37 acres and up to at least 55.4 acres of habitat similar to the affected habitats in Agua Hedionda Lagoon, excluding buffer zone and upland transition area;

d. Provides a buffer zone of a size adequate to ensure protection of wetland values, and at least 100 feet wide, as measured from the upland edge of the transition area.

e. Any existing site contamination problems would be controlled or remediated and would not hinder restoration;

f. Site preservation is guaranteed in perpetuity (through appropriate public agency or nonprofit ownership, or other means approved by the Executive Director), to protect against future degradation or incompatible land use;

g. Feasible methods are available to protect the long-term wetland values on the site(s), in perpetuity;

h. Does not result in a net loss of existing wetlands; and

i. Does not result in an adverse impact on endangered animal species or an adverse unmitigated impact on endangered plant species.

**3.2 Objectives**

The following objectives represent the factors that will contribute to the overall value of the wetland. The selected site(s) shall be determined to achieve these objectives. These objectives shall also guide preparation of the restoration plan.

a. Provides maximum overall ecosystem benefits, e.g. maximum upland buffer, enhancement of downstream fish values, provides regionally scarce habitat, potential for local ecosystem diversity;

b. Provides substantial fish habitat compatible with other wetland values at the site(s);

c. Provides a buffer zone of an average of at least 300 feet wide, and not less than 100 feet wide, as measured from the upland edge of the transition area.

d. Provides maximum upland transition areas (in addition to buffer zones);

e. Restoration involves minimum adverse impacts on existing functioning wetlands and other sensitive habitats;

f. Site selection and restoration plan reflect a consideration of site specific and regional wetland restoration goals;

g. Restoration design is that most likely to produce and support wetland-dependent resources;

h. Provides rare or endangered species habitat;

i. Provides for restoration of reproductively isolated populations of native California species;

j. Results in an increase in the aggregate acreage of wetland in the Southern California Bight;

k. Requires minimum maintenance;

l. Restoration project can be accomplished in a reasonably timely fashion; and,

m. Site(s) in proximity to the Carlsbad desalination facility.

### 3.3 Restrictions

a. The permittee may propose a wetland restoration project larger than the minimum necessary size specified in subsection 3.1(c) above, if biologically appropriate for the site(s), but the additional acreage must (1) be clearly identified, and (2) must not be the portion of the project best satisfying the standards and objectives listed above.

b. If the permittee jointly enters into a restoration project with another party: (1) the permittee's portion of the project must be clearly specified, (2) any other party involved cannot gain mitigation credit for the permittee's portion of the project, and (3) the permittee may not receive mitigation credit for the other party's portion of the project.

c. The permittee may propose to divide the mitigation requirement between a maximum of two wetland restoration sites, unless there is a compelling argument, approved by the Executive Director, that the standards and objectives of subsections 3.1 and 3.2 will be better met at more than two sites.

## 4.0 PLAN IMPLEMENTATION

### 4.1 Coastal Development Permit Applications

The permittee shall submit complete Coastal Development Permit applications for the Phase I and Phase II restoration plan(s) that include CEQA documentation and local or other state agency approvals. The CDP application for Phase I shall be submitted within 24 months following the issuance of the Coastal Development Permit for the Carlsbad desalination facility. The CDP application for Phase II shall be submitted within 5 years of issuance of the CDP for Phase I. The Executive Director may grant an extension to these time periods at the request of and upon a demonstration of good cause by the permittee. The restoration plans shall substantially conform to Section 3.0 above and shall include, but not be limited to the following elements:

a. Detailed review of existing physical, biological, and hydrological conditions; ownership, land use and regulation;

b. Evaluation of site-specific and regional restoration goals and compatibility with the goal of mitigating for Poseidon's marine life impacts;

c. Identification of site opportunities and constraints;

d. Schematic restoration design, including:

1. Proposed cut and fill, water control structures, control measures for stormwater, buffers and transition areas, management and maintenance requirements;
2. Planting program, including removal of exotic species, sources of plants and or seeds (local, if possible), protection of existing salt marsh plants, methods for preserving top soil and augmenting soils with nitrogen and other necessary soil amendments before planting, timing of planting, plans for irrigation until established, and location of planting and elevations on the topographic drawings;
3. Proposed habitat types (including approximate size and location);
4. Assessment of significant impacts of design (especially on existing habitat values) and net habitat benefits;
5. Location, alignment and specifications for public access facilities, if feasible;
6. Evaluation of steps for implementation e.g. permits and approvals, development agreements, acquisition of property rights;
7. Cost estimates;
8. Topographic drawings for final restoration plan at 1" = 100 foot scale, one foot contour interval; and
9. Drawings shall be directly translatable into final working drawings.

e. Detailed information about how monitoring and maintenance will be implemented;

f. Detailed information about construction methods to be used;

g. Defined final success criteria for each habitat type and methods to be used to determine success;

h. Detailed information about how Poseidon will coordinate with the Scientific Advisory Panel including its role in independent monitoring, contingency planning review, cost recovery, etc.;

i. Detailed information about contingency measures that will be implemented if mitigation does not meet the approved goals, objectives, performance standards, or other criteria; and,

j. Submittal of "as-built" plans showing final grading, planting, hydrological features, etc. within 60 days of completing initial mitigation site construction.

### 4.2 Wetland Construction Phase

Within 6 months of approval of the Phase I restoration plan, subject to the permittee's obtaining the necessary permits, the permittee shall commence the construction phase of the wetland restoration project. The permittee shall be responsible for ensuring that construction is carried out in accordance with the specifications and within the timeframes specified in the approved final restoration plan and shall be responsible for any remedial work or other intervention necessary to comply with final plan requirements.

### 4.3 Timeframe for Resubmittal of Project Elements

If the Commission does not approve any element of the project (i.e. site selection, restoration plan), the Commission will specify the time limits for compliance relative to selection of another site or revisions to the restoration plan.

## 5.0 WETLAND MONITORING, MANAGEMENT AND REMEDIATION

Monitoring, management (including maintenance), and remediation shall be conducted over the "full operating life" of Poseidon's desalination facility, which shall be 30 years from the date "as-built" plans are submitted pursuant to subsection 4.1(l).

The following section describes the basic tasks required for monitoring, management and remediation. Condition B specifies the administrative structure for carrying out these tasks, including the roles of the permittee and Commission staff.

### 5.1 Monitoring and Management Plan

A monitoring and management plan will be developed in consultation with the permittee and appropriate wildlife agencies, concurrently with the preparation of the restoration plan to provide an overall framework to guide the monitoring work. It will include an overall description of the studies to be conducted over the course of the monitoring program and a description of management tasks that are anticipated, such as trash removal. Details of the monitoring studies and management tasks will be set forth in a work program (see Condition B).

### 5.2 Pre-restoration site monitoring

Pre-restoration site monitoring shall be conducted to collect baseline data on the wetland attributes to be monitored. This information will be incorporated into and may result in modification to the overall monitoring plan.

### 5.3 Construction Monitoring

Monitoring shall be conducted during and immediately after each stage of construction of the wetland restoration project to ensure that the work is conducted according to plans.

### 5.4 Post-Restoration Monitoring and Remediation

Upon completion of construction of the wetland(s), monitoring shall be conducted to measure the success of the wetland(s) in achieving stated restoration goals (as specified in the restoration plan(s)) and in achieving performance standards, specified below. The permittee shall be fully responsible for any failure to meet these goals and standards during the facility's full operational years. Upon determining that the goals or standards are not achieved, the Executive Director shall prescribe remedial measures, after consultation with the permittee, which shall be immediately implemented by the permittee with Commission staff direction. If the permittee does not agree that remediation is necessary, the matter may be set for hearing and disposition by the Commission.

Successful achievement of the performance standards shall (in some cases) be measured relative to approximately four reference sites, which shall be relatively undisturbed, natural tidal wetlands within the Southern California Bight. The Executive Director shall select the reference sites. The standard of comparison, i.e., the measure of similarity to be used (e.g., within the range, or within the 95% confidence interval) shall be specified in the work program.

In measuring the performance of the wetland project, the following physical and biological performance standards will be used:

a. **Longterm Physical Standards.** The following long-term standards shall be maintained over the full operative life of the desalination facility:

   1. ***Topography.*** The wetland(s) shall not undergo major topographic degradation (such as excessive erosion or sedimentation);
   2. ***Water Quality.*** Water quality variables [to be specified] shall be similar to reference wetlands;
   3. ***Tidal prism.*** If the mitigation site(s) require dredging, the tidal prism shall be maintained and tidal flushing shall not be interrupted; and,
   4. ***Habitat Areas.*** The area of different habitats shall not vary by more than 10% from the areas indicated in the restoration plan(s).

b. **Biological Performance Standards.** The following biological performance standards shall be used to determine whether the restoration project is successful. Table 1, below, indicates suggested sampling locations for each of the following biological attributes; actual locations will be specified in the work program:

   1. ***Biological Communities.*** Within 4 years of construction, the total densities and number of species of fish, macroinvertebrates and birds (see Table 1) shall be similar to the densities and number of species in similar habitats in the reference wetlands;
   2. ***Vegetation.*** The proportion of total vegetation cover and open space in the marsh shall be similar to those proportions found in the reference sites. The percent cover of algae shall be similar to the percent cover found in the reference sites;
   3. ***Spartina Canopy Architecture.*** The restored wetland shall have a canopy architecture that is similar in distribution to the reference sites, with an equivalent proportion of stems over 3 feet tall;

4. ***Reproductive Success.*** Certain plant species, as specified by in the work program, shall have demonstrated reproduction (i.e. seed set) at least once in three years;
5. ***Food Chain Support.*** The food chain support provided to birds shall be similar to that provided by the reference sites, as determined by feeding activity of the birds; and,
6. ***Exotics.*** The important functions of the wetland shall not be impaired by exotic species.

**Table 1: Suggested Sampling Locations**

| | Salt Marsh | | | Open Water | | | Tidal |
|---|---|---|---|---|---|---|---|
| | Spartina | Salicornia | Upper | Lagoon | Eelgrass | Mudflat | Creeks |
| 1) Density/spp: | | | | | | | |
| – Fish | | | | X | X | X | X |
| – Macroinvert-ebrates | | | | X | X | X | X |
| – Birds | X | X | X | X | | X | X |
| 2) % Cover | | | | | | | |
| Vegetation | X | X | X | | X | | |
| algae | X | X | | | | X | |
| 3) Spartina architecture | X | | | | | | |
| 4) Reproductive success | X | X | X | | | | |
| 5) Bird feeding | | | | X | | X | X |
| 6) Exotics | X | X | X | X | X | X | X |

## 6.0 ALTERNATIVE MITIGATION

As part of Phase II, Poseidon may propose in its CDP application alternatives to reduce or eliminate the required 18.4 acres of mitigation. The alternative mitigation proposed may be in the form of implementing new entrainment reduction technology or may be mitigation credits for conducting dredging, either of which could reduce or eliminate the 18.4 acres of mitigation.

## CONDITION B: ADMINISTRATIVE STRUCTURE

### 1.0 ADMINISTRATION

Personnel with appropriate scientific or technical training and skills will, under the direction of the Executive Director, oversee the mitigation and monitoring functions identified and required by Condition A. The Executive Director will retain scientific and administrative support staff needed to perform this function, as specified in the work program.

This technical staff will oversee the preconstruction and post-construction site assessments, mitigation project design and implementation (conducted by permittee), and monitoring activities (including plan preparation); the field work will be done by contractors under the Executive Director's direction. The contractors will be responsible for collecting the data, analyzing and interpreting it, and reporting to the Executive Director.

The Executive Director shall convene a Scientific Advisory Panel to provide the Executive Director with scientific advice on the design, implementation and monitoring of the wetland restoration. The panel shall consist of recognized scientists, including a marine biologist, an ecologist, a statistician and a physical scientist.

### 2.0 BUDGET AND WORK PROGRAM

The funding necessary for the Commission and the Executive Director to perform their responsibilities pursuant to these conditions will be provided by the permittee in a form and manner reasonably determined by the Executive Director to be consistent with requirements of State law, and which will ensure efficiency and minimize total costs to the permittee. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution.

The budget to be funded by the permittee will be for the purpose of reasonable and necessary costs to retain personnel with appropriate scientific or technical training and skills needed to assist the Commission and the Executive Director in carrying out the mitigation and lost resource compensation conditions. In addition, reasonable funding will be included in this budget for necessary support personnel, equipment, overhead, consultants, the retention of contractors needed to conduct identified studies, and to defray the costs of members of any scientific advisory panel(s) convened by the Executive Director for the purpose of implementing these conditions.

Costs for participation on any advisory panel shall be limited to travel, per diem, meeting time and reasonable preparation time and shall only be paid to the extent the participant is not otherwise entitled to reimbursement for such participation and preparation. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction

with its review of the restoration plan. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution. Total costs for such advisory panel shall not exceed $100,000 per year adjusted annually by any increase in the consumer price index applicable to California.

The work program will include:

a. A description of the studies to be conducted over the subsequent two year period, including the number and distribution of sampling stations and samples per station, methodology and statistical analysis (including the standard of comparison to be used in comparing the mitigation project to the reference sites);

b. A description of the status of the mitigation projects, and a summary of the results of the monitoring studies to that point;

c. A description of four reference sites;

d. A description of the performance standards that have been met, and those that have yet to be achieved;

e. A description of remedial measures or other necessary site interventions;

f. A description of staffing and contracting requirements; and,

g. A description of the Scientific Advisory Panel's role and time requirements in the two year period.

The Executive Director may amend the work program at any time, subject to appeal to the Commission.

## 3.0 ANNUAL REVIEW AND PUBLIC WORKSHOP REVIEW

The permittee shall submit a written review of the status of the mitigation project to the Executive Director no later than April 30 each year for the prior calendar year. The written review will discuss the previous year's activities and overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next year's program.

To review the status of the mitigation project, the Executive Director will convene and conduct a duly noticed public workshop during the first year of the project and every other year thereafter unless the Executive Director deems it unnecessary. The meeting will be attended by the contractors who are conducting the monitoring, appropriate members of the Scientific Advisory Panel, the permittee, Commission staff, representatives of the resource agencies (CDFG, NMFS, USFWS), and the public. Commission staff and the contractors will give presentations on the previous biennial work program's activities, overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next upcoming period's biennial work program.

The public review will include discussions on whether the wetland mitigation project has met the performance standards, identified problems, and recommendations relative to corrective measures necessary to meet the performance standards. The Executive Director will use information presented at the public review, as well as any other relevant information, to determine whether any or all of the performance standards have been met, whether revisions to the standards are necessary, and whether remediation is required. Major revisions shall be subject to the Commission's review and approval.

The mitigation project will be successful when all performance standards have been met each year for a three-year period. The Executive Director shall report to the Commission upon determining that all of the performance standards have been met for three years and that the project is deemed successful. If the Commission determines that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission. A public review shall thereafter occur every five years, or sooner if called for by the Executive Director. The work program shall reflect the lower level of monitoring required. If subsequent monitoring shows that a standard is no longer being met, monitoring may be increased to previous levels, as determined necessary by the Executive Director.

The Executive Director may make a determination on the success or failure to meet the performance standards or necessary remediation and related monitoring at any time, not just at the time of the workshop review.

## 4.0 ADDITIONAL PROCEDURES

### 4.1 *Dispute Resolution*

In the event that the permittee and the Executive Director cannot reach agreement regarding the terms contained in or the implementation of any part of this Plan, the matter may be set for hearing and disposition by the Commission.

### 4.2 Extensions

Any of the time limits established under this Plan may be extended by the Executive Director at the request of the permittee and upon a showing of good cause.

## CONDITION C: SAP DATA MAINTENANCE

The permittee shall make available on a publicly-accessible website all scientific data collected as part of the project. The website and the presentation of data shall be subject to Executive Director review and approval.

# Item W16a
# Exhibit 2

# Staff's Proposed Draft MLMP Conditions (June 2008)

# CDP E-06-013
# Condition Compliance
# Special Condition 8

# Exhibit 2

# July 24, 2008

| EXHIBIT NO. 2 |
| --- |
| APPLICATION NO. E-06-013 |
| Condition Compliance |
| Special Condition 8 |

# Staff's Proposed Draft MLMP Conditions

This is a modified version of conditions the Commission required of Southern California Edison in implementing its wetland restoration project at San Dieguito Lagoon pursuant to Coastal Development Permit xx

Staff provided these conditions to Poseidon on June 20, 2008 and recommended Poseidon include them in its Marine Life Mitigation Plan to present to the Commission. The modifications shown in ~~strikethrough~~ and underline reflect differences between Poseidon's proposal and Edison's and provide updated wetland mitigation standards since the Commission's approval of Edison's project. Staff's notes to Poseidon are shown in [***brackets and bold italics***].

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## CONDITION A: WETLAND RESTORATION MITIGATION

The permittee shall develop, implement and fund a wetland restoration project that compensates for ~~past, present and future fish~~ marine life impacts from ~~SONGS Units 2 and 3, as identified by the Marine Review Committee~~ Poseidon's Carlsbad desalination facility.

### 1.0 SITE SELECTION AND PRELIMINARY PLAN

In consultation with Commission staff, the permittee shall select a wetland restoration site and develop a preliminary plan in accordance with the following process and terms.

Within 9 months of the effective date of this permit, the permittee shall submit the proposed site and preliminary wetland restoration plan to the Commission for its review and approval or disapproval.

### 1.1 Site Selection

The location of the wetland restoration project shall be within the Southern California Bight. The permittee shall evaluate and select from sites including, but not limited to, the following eight sites: Tijuana Estuary in San Diego County, San Dieguito River Valley in San Diego County, Huntington Beach Wetland in Orange County, Anaheim Bay in Orange County, Santa Ana River in Orange County, Los Cerritos Wetland in Los Angeles County, Ballona Wetland in Los Angeles County, and Ormond Beach in Ventura County. Other sites proposed by the permittee may be added to this list with the Executive Director's approval.

The basis for the selection shall be an evaluation of the sites against the minimum standards and objectives set forth in subsections 1.3 and 1.4 below. The permittee shall take into account and give serious consideration to the advice and recommendations of an Interagency Wetland Advisory Panel, established and convened by the Executive Director. The permittee shall select the site that meets the minimum standards and best meets the objectives.

### 1.2 Preliminary Restoration Plan

[***Note: This is the type of Preliminary Plan we anticipate you'll provide for the August hearing. The Plan should include the elements in Sections 1.2 – 1.4 below.***]

In consultation with Commission staff, the permittee shall develop a preliminary wetland restoration plan for the wetland site identified through the site selection process. The preliminary wetland restoration plan shall meet the minimum standards and incorporate as many as possible of the objectives in subsections 1.3 and 1.4, respectively.

The preliminary wetland restoration plan shall include the following elements:

a. Review of existing physical, biological, and hydrological conditions; ownership, land use and regulation.

b. Site-specific and regional restoration goals and compatibility with the goal of mitigating for ~~SONGS impact to fish~~ Poseidon's marine life impacts.

c. Identification of site opportunities and constraints.

d. Conceptual restoration design, including:

   1. Proposed grading and excavation; water control structures; planting; integration of public access, if feasible; buffers and transition areas; management and maintenance requirements.

   2. Proposed habitat types (including approximate size and location).

3. Preliminary assessment of significant impacts of design (especially on existing habitat values) and net habitat benefits.

4. Evaluation of steps for implementation e.g. permits and approvals, development agreements, acquisition of property interests.

5. A graphic depiction of proposed plan.

***[Note: As part of the elements above, the Preliminary Plan should describe the current and anticipated relationship between Poseidon's proposed mitigation and Edison's, including applicable conditions of the MOA and any written agreements between Poseidon, Edison, and/or the JPA, measures included that will ensure Poseidon's mitigation will not adversely affect Edison's mitigation, coordination with Edison's Scientific Advisory Panel, etc.]***

## 1.3 Minimum Standards

The wetland restoration project site and preliminary plan must meet the following minimum standards:

a. Location within Southern California Bight.

b. Potential for restoration as tidal wetland, with extensive intertidal and subtidal areas;

c. Creates or substantially restores a minimum of ~~150 acres (60 hectares)~~ 55.4 to 68.2 acres of ~~wetlands~~ habitat similar to the affected habitats in Agua Hedionda Lagoon, excluding buffer zone and upland transition area; [***Note: the acreage figures are from Pete Raimondi's evaluation at the 80% and 95% confidence levels.***]

d. Provides a buffer zone of a size adequate to ensure protection of wetland values, and not less than at least 100 feet wide, as measured from the upland edge of the transition area.

e. Any existing site contamination problems would be controlled or remediated and would not hinder restoration.

f. Site preservation is guaranteed in perpetuity (through appropriate public agency or nonprofit ownership, or other means approved by the Executive Director), to protect against future degradation or incompatible land use.

g. Feasible methods are available to protect the longterm wetland values on the site, in perpetuity.

h. Does not result in loss of existing wetlands.

i. Does not result in impact on endangered species.

### 1.4 Objectives

The following objectives represent the factors that will contribute to the overall value of the wetland. The selected site shall be that with the best potential to achieve these objectives. These objectives shall also guide preparation of the restoration plan.

a. Provides maximum overall ecosystem benefits e.g. maximum upland buffer, enhancement of downstream fish values, provides regionally scarce habitat, potential for local ecosystem diversity.

b. Provides substantial fish habitat compatible with other wetland values at the site.

c. Provides a buffer zone of an average of at least 300 feet wide, and not less than 100 feet wide, as measured from the upland edge of the transition area.

d. Provides maximum upland transition areas (in addition to buffer zones);

e. Restoration involves minimum adverse impacts on existing functioning wetlands and other sensitive habitats.

f. Site selection and restoration plan reflect a consideration of site specific and regional wetland restoration goals.

g. Restoration design is that most likely to produce and support wetland-dependent resources.

h. Provides rare or endangered species habitat.

i. Provides for restoration of reproductively isolated populations of native California species.

j. Results in an increase in the aggregate acreage of wetland in the Southern California Bight.

k. Requires minimum maintenance.

l. Restoration project can be accomplished in a timely fashion.

m. Site is in proximity to ~~SONGS~~ the Carlsbad desalination facility.

### 1.6 Restrictions

(a) The permittee may propose a wetland restoration project larger than the minimum necessary size specified in subsection 1.3(c) above, if biologically appropriate for the site, but the additional acreage must (1) be clearly identified, and (2) must not be the portion of the project best satisfying the standards and objectives listed above.

(b) If the permittee jointly enters into a restoration project with another party: (1) the permittee's portion of the project must be clearly specified, (2) any other party involved cannot gain mitigation credit for the permittee's portion of the project, and (3) the permittee may not receive mitigation credit for the other party's portion of the project.

(c) The permittee may propose to divide the mitigation requirement between a maximum of two wetland restoration sites, unless there is a compelling argument, approved by the Executive Director, that the standards and objectives of subsections 1.3 and 1.4 will be better met at more than two sites.

[***Note: We'll probably recommend the text below, or similar, as conditions for the Commission to adopt in August to determine what will be required as follow-up to the Preliminary Plan to ensure it results in an adequate Final Plan – that is, while you may include them in your Plan for August, we'll probably handle them as conditions for approval.***]

## 2.0 FINAL PLAN AND PLAN IMPLEMENTATION

### 2.1 Final Restoration Plan

Within ~~12~~ 24 months [***Note: based on anticipated 18-month CEQA process***] following the Commission's approval of a site selection and preliminary restoration plan, the permittee shall submit a complete Coastal Development Permit application for a final restoration plan along with CEQA documentation ~~generated in connection with~~ and local or other state agency approvals~~, to the Executive Director of the Coastal Commission for review and approval~~. [***Note: the changes above reflect a difference between SONGS and Poseidon's processes. With SONGS, Edison applied for a CDP for its Preliminary Plan after Marine Resource Committee review and Commission approval of the selected site and applied for a CDP for its Final Plan. With Poseidon, your CDP application for the mitigation site work will come after CEQA is done and after other approvals are obtained.***] The final restoration plan shall substantially conform to the approved preliminary restoration plan as originally submitted or as amended by the Commission pursuant to a request by the permittee. The final restoration plan shall include, but not be limited to the following elements:

a. Detailed review of existing physical, biological, and hydrological conditions; ownership, land use and regulation.

b. Evaluation of site-specific and regional restoration goals and compatibility with the goal of mitigating for ~~SONGS impacts to fish~~ Poseidon's marine life impacts.

c. Identification of site opportunities and constraints.

[***Note: the above three elements should include a complete description of the relationship between Poseidon's mitigation and Edison's, and any legal/contractual relationships between***

***Poseidon, Edison, the JPA, and other involved entities. This should also describe how Poseidon's ongoing sampling, monitoring, maintenance, contingency planning, etc. may be associated with Edison's.***]

d. Schematic restoration design, including:

1. Proposed cut and fill, water control structures, control measures for stormwater, buffers and transition areas, management and maintenance requirements.

2. Planting Program, including removal of exotic species, sources of plants and or seeds (local, if possible), protection of existing salt marsh plants, methods for preserving top soil and augmenting soils with nitrogen and other necessary soil amendments before planting, timing of planting, plans for irrigation until established, and location of planting and elevations on the topographic drawings.

3. Proposed habitat types (including approximate size and location).

4. Assessment of significant impacts of design (especially on existing habitat values) and net habitat benefits. [***Note: this should include a description of any effects on existing habitat values within Poseidon's mitigation site (e.g., are there existing wetlands within your site that would be altered by your project?) and Edison's site, along with proposed measures to mitigate those impacts – e.g., methods, locations, etc.***]

5. Location, alignment and specifications for public access facilities, if feasible.

6. Evaluation of steps for implementation e.g. permits and approvals, development agreements, acquisition of property rights.

7. Cost estimates.

8. Topographic drawings for final restoration plan at 1" = 100 foot scale, one foot contour interval.

9. Drawings shall be directly translatable into final working drawings.

g. Detailed information about how monitoring and maintenance will be implemented.

h. Detailed information about construction methods to be used.

i. Defined final success criteria for each habitat type and methods to be used to determine success.

j. Detailed information about how Poseidon will coordinate with the SONGS Scientific Advisory Panel, including its role in independent monitoring, contingency planning review, cost recovery, etc.

k. Detailed information about contingency measures that will be implemented if mitigation does not meet the approved goals, objectives, performance standards, or other criteria.

l. Submittal of "as-built" plans showing final grading, planting, hydrological features, etc. within 60 days of completing initial mitigation site construction.

[***Note: the additions above reflect conditions generally included in more recent mitigation plans or needed to coordinate with Edison's efforts.***]

### 2.2 Wetland Construction Phase

Within 6 months of approval of the final restoration plan, subject to the permittee's obtaining the necessary permits, the permittee shall commence the construction phase of the wetland restoration project. The permittee shall be responsible for ensuring that construction is carried out in accordance with the specifications and within the timeframes specified in the approved final restoration plan and shall be responsible for any remedial work or other intervention necessary to comply with final plan requirements.

### 2.3 Timeframe for Resubmittal of Project Elements

If the Commission does not approve any element of the project (i.e. site selection, restoration plan), the Commission will specify the time limits for compliance relative to selection of another site or revisions to the restoration plan.

## 3.0 WETLAND MONITORING, MANAGEMENT AND REMEDIATION

Monitoring, management (including maintenance), and remediation shall be conducted over the "full operating life" of ~~SONGS Units 2 and 3~~ Poseidon's desalination facility. ~~"Full operating life" as defined in this permit includes past and future years of operation of SONGS units 2 and 3 including the decommissioning period to the extent there are continuing discharges. The number of past operating years at the time the wetland is ultimately constructed, shall be added to the number of future operating years and decommission period, to determine the length of the monitoring, management and remediation requirement.~~

The following section describes the basic tasks required for monitoring, management and remediation. Condition II-D specifies the administrative structure for carrying out these tasks, including the roles of the permittee and Commission staff.

### 3.1 Monitoring and Management Plan

A monitoring and management plan will be developed in consultation with the permittee and appropriate wildlife agencies, concurrently with the preparation of the restoration plan, to

provide an overall framework to guide the monitoring work. It will include an overall description of the studies to be conducted over the course of the monitoring program and a description of management tasks that are anticipated, such as trash removal. Details of the monitoring studies and management tasks will be set forth in a work program (see Section II-D).

### 3.2 Pre-restoration site monitoring

Pre-restoration site monitoring shall be conducted to collect baseline data on the wetland attributes to be monitored. This information will be incorporated into and may result in modification to the overall monitoring plan.

### 3.3 Construction Monitoring

Monitoring shall be conducted during and immediately after each stage of construction of the wetland restoration project to ensure that the work is conducted according to plans.

### 3.4 Post-Restoration Monitoring and Remediation

Upon completion of construction of the wetland, monitoring shall be conducted to measure the success of the wetland in achieving stated restoration goals (as specified in restoration plan) and in achieving performance standards, specified below. The permittee shall be fully responsible for any failure to meet these goals and standards during the facility's full operational years ~~of SONGS Units 2 and 3~~. Upon determining that the goals or standards are not achieved, the Executive Director shall prescribe remedial measures, after consultation with the permittee, which shall be immediately implemented by the permittee with Commission staff direction. If the permittee does not agree that remediation is necessary, the matter may be set for hearing and disposition by the Commission.

Successful achievement of the performance standards shall (in some cases) be measured relative to approximately four reference sites, which shall be relatively undisturbed, natural tidal wetlands within the Southern California Bight. The Executive Director shall select the reference sites. The standard of comparison i.e. the measure of similarity to be used (e.g. within the range, or within the 95% confidence interval) shall be specified in the work program.

In measuring the performance of the wetland project, the following physical and biological performance standards will be utilized:

a. Longterm Physical Standards. The following longterm standards shall be maintained over the full operative life of ~~SONGS Units 2 and 3~~ the desalination facility.

   1) Topography. The wetland shall not undergo major topographic degradation (such as excessive erosion or sedimentation).

2) Water Quality. Water quality variables (to be specified) shall be similar to reference wetlands.

3) ~~Tidal prism. The designed tidal prism shall be maintained, and tidal flushing shall not be interrupted~~. [***Note: this is Edison's requirement, but could be part of Poseidon's obligiation based on the agreement you develop with Edison.***]

4) Habitat Areas. The area of different habitats shall not vary by more than 10% from the areas indicated in the final restoration plan.

b. Biological Performance Standards. The following biological performance standards shall be used to determine whether the restoration project is successful. Table 1, below, indicates suggested sampling locations for each of the following biological attributes; actual locations will be specified in the work program.

1) Biological Communities. Within 4 years of construction, the total densities and number of species of fish, macroinvertebrates and birds (see table 1) shall be similar to the densities and number of species in similar habitats in the reference wetlands.

2) Vegetation. The proportion of total vegetation cover and open space in the marsh shall be similar to those proportions found in the reference sites. The percent cover of algae shall be similar to the percent cover found in the reference sites.

3) Spartina Canopy Architecture. The restored wetland shall have a canopy architecture that is similar in distribution to the reference sites, with an equivalent proportion of stems over 3 feet tall.

4) Reproductive Success. Certain plant species, as specified by in the work program, shall have demonstrated reproduction (i.e. seed set) at least once in three years.

5) Food Chain Support. The food chain support provided to birds shall be similar to that provided by the reference sites, as determined by feeding activity of the birds.

6) Exotics. The important functions of the wetland shall not be impaired by exotic species.

**Table 1: Suggested Sampling Locations**

| | Salt Marsh | | | Open Water | | | Tidal |
|---|---|---|---|---|---|---|---|
| | Spartina | Salicornia | Upper | Lagoon | Eelgrass | Mudflat | Creeks |
| 1) Density/spp: | | | | | | | |
| Fish | | | | X | X | X | X |
| Macroinverts | | | | X | X | X | X |
| Birds | X | X | X | X | | X | X |
| 2) % Cover | | | | | | | |
| Vegetation | X | X | X | | X | | |
| algae | X | X | | | | X | |
| 3) Spar. arch. | X | | | | | | |
| 4) Repro. suc. | X | X | X | | | | |
| 5) Bird feeding | | | | X | | X | X |
| 6) Exotics | X | X | X | X | X | X | X |

...

## CONDITION D: ADMINISTRATIVE STRUCTURE

[***Note: The conditions below will likely vary based on the relationship you develop with Edison and the JPA regarding monitoring, review, administration, etc.***]

### 1.0 ADMINISTRATION

Personnel with appropriate scientific or technical training and skills will, under the direction of the Executive Director, oversee the mitigation and monitoring functions identified and required by conditions II-A through C. The Executive Director will retain approximately two scientists and one administrative support staff to perform this function.

This technical staff will oversee the preconstruction and post-construction site assessments, mitigation project design and implementation (conducted by permittee), and monitoring activities (including plan preparation); the field work will be done by contractors under the

Executive Director's direction. The contractors will be responsible for collecting the data, analyzing and interpreting it, and reporting to the Executive Director.

The Executive Director shall convene a scientific advisory panel to provide the Executive Director with scientific advice on the design, implementation and monitoring of the wetland restoration and artificial reef. The panel shall consist of recognized scientists, including a marine biologist, an ecologist, a statistician and a physical scientist.

## 2.0 BUDGET AND WORK PROGRAM

The funding necessary for the Commission and the Executive Director to perform their responsibilities pursuant to these conditions will be provided by the permittee in a form and manner determined by the Executive Director to be consistent with requirements of State law, and which will ensure efficiency and minimize total costs to the permittee. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission. If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution.

The budget to be funded by the permittee will be for the purpose of reasonable and necessary costs to retain personnel with appropriate scientific or technical training and skills needed to assist the Commission and the Executive Director in carrying out the mitigation and lost resource compensation conditions (II-A through C) approved as part of this permit action. In addition, reasonable funding will be included in this budget for necessary support personnel, equipment, overhead, consultants, the retention of contractors needed to conduct identified studies, and to defray the costs of members of any scientific advisory panel(s) convened by the Executive Director for the purpose of implementing these conditions.

Costs for participation on any advisory panel shall be limited to travel, per diem, meeting time and reasonable preparation time and shall only be paid to the extent the participant is not otherwise entitled to reimbursement for such participation and preparation. Total costs for such advisory panel shall not exceed $100,000 per year adjusted annually by any increase in the consumer price index applicable to California.

The work program will include:

a. A description of the studies to be conducted over the subsequent two year period, including the number and distribution of sampling stations and samples per station, methodology and statistical analysis (including the standard of comparison to be used in comparing the mitigation projects to the reference sites.)

b. A description of the status of the mitigation projects, and a summary of the results of the monitoring studies to that point.

c. A description of the performance standards that have been met, and those that have yet to be achieved.

d. A description of remedial measures or other necessary site interventions.

e. A description of staffing and contracting requirements.

f. A description of the Scientific Advisory Panel's role and time requirements in the two year period.

The Executive Director may amend the work program at any time, subject to appeal to the Commission.

## 3.0 ANNUAL REVIEW

A duly noticed public workshop will be convened and conducted by the Executive Director or the Commission each year to review the status of the mitigation projects. The meeting will be attended by the contractors who are conducting the monitoring, appropriate members of the Scientific Advisory Panel, the permittee, Commission staff, representatives of the resource agencies (CDFG, NMFS, USFWS), and the public. Commission staff and the contractors will give presentations on the previous year's activities, overall status of the mitigation projects, identify problems and make recommendations for solving them, and review the next year's program. The permittee shall report on the status of the behavioral barrier devices.

The public review will include discussions on whether the artificial reef and wetland mitigation projects have met the performance standards, identified problems, and recommendations relative to corrective measures necessary to meet the performance standards. The Executive Director will utilize information presented at the annual public review, as well as any other relevant information, to determine whether any or all of the performance standards have been met, whether revisions to the standards are necessary, and whether remediation is required. Major revisions shall be subject to the Commission's review and approval.

The mitigation projects will be successful when all performance standards have been met each year for a three-year period. The Executive Director shall report to the Commission upon determining that all of the performance standards have been met for three years and that the project is deemed successful. If the Commission determines that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission. A public review shall thereafter occur every five years, or sooner if called for by the Executive Director. The work program shall reflect the lower level of monitoring required. If subsequent monitoring shows that

a standard is no longer being met, monitoring may be increased to previous levels, as determined necessary by the Executive Director.

The Executive Director may make a determination on the success or failure to meet the performance standards or necessary remediation and related monitoring at any time, not just at the time of the annual public review.

## CONDITION E: MRC DATA MAINTENANCE

The scientific data collected by the MRC will be stored in the Commission library in San Francisco, and at the Los Angeles County Museum of Natural Science, or at an alternative location in Southern California, as determined by the Executive Director; and will be made available for public use. The permittee shall purchase the necessary computer equipment for the Commission and the Southern California location to store and retrieve the data, and shall fund appropriate staff training on data storage and retrieval at both locations.

# Item W16a
# Exhibit 3

# Poseidon's August 2, 2008 Proposed MLMP and attachments



# POSEIDON RESOURCES

August 2, 2008

**Agenda Item**
**W 5b**

**VIA OVERNIGHT DELIVERY**

Chairman Kruer and Honorable Commissioners
California Coastal Commission
North Central Coast District
45 Fremont, Suite 2000
San Francisco, CA 94105-2219

RECEIVED
AUG 04 2008
CALIFORNIA
COASTAL COMMISSION

Re: Carlsbad Desalination Project CDP Application No. E-06-013
Special Condition 8: Marine Life Mitigation Plan

Dear Chairman Kruer and Honorable Commissioners:

Poseidon Resources (Channelside) LLC ("Poseidon") requests that the Commission approve Poseidon's proposed Marine Life Mitigation Plan ("MLMP") attached hereto as Exhibit A, which Poseidon has prepared pursuant to Special Condition 8 of the above-referenced Coastal Development Permit (the "Permit") for the Carlsbad Seawater Desalination Facility (the "Project"). The Commission approved the Permit at its November 15, 2007 hearing, including Special Condition 8, which requires the Applicant to submit a Marine Life Mitigation Plan for Commission review and approval before the Permit will issue.

Following months of extensive collaboration with experts, Commission Staff, and state and local agencies,[1] Poseidon submitted its MLMP to the Commission on July 3, 2008. The MLMP contains the following elements that ensure Poseidon will implement and fund a wetland restoration project or projects that not only fully mitigate any Project impacts to marine life, but also provide additional mitigation that creates, enhances, and restores aquatic and wetland habitat consistent with Coastal Act Sections 30230 and 30231 and Special Condition 8:

- Contains **performance standards and objectives** that are consistent with those applied in Edison's San Onofre Nuclear Generating Station ("SONGS") project;

[1] Poseidon has consulted with the Department of Fish and Game, the Department of Transportation, the State Lands Commission, the San Diego Regional Water Quality Control Board, the City of Carlsbad, Coastal Commission Staff, and the U.S. Fish and Wildlife Service, among others.

**These materials have been provided to Coastal Commission Staff**

**Poseidon Resources Corporation**
501 West Broadway, Suite 840, San Diego, CA 92101, USA
619-595-7802 Fax: 619-595-7892
Project Office: 4600 Carlsbad Boulevard, Carlsbad, CA 92008

- Provides for up to **42.5 acres of wetland restoration**, which is consistent with California Energy Commission ("CEC") methodology and Commission precedent;

- Implements a **phased mitigation program** to ensure that Poseidon is incentivized to incorporate emerging technologies that are not currently available into Project operations **to further reduce marine impacts**;

- Requires Poseidon to submit a new Coastal Development Permit application for Phase I of the restoration project **within 24 months** of MLMP approval;

- Ensures long-term **performance, monitoring, and protection** of the mitigation measures; and

- Allows for the Commission **to determine in the future** whether Lagoon dredging should entitle Poseidon to restoration credit applicable to all or part of its Phase II mitigation obligations.

On July 24, 2008, Commission Staff released its Staff Report recommending approval of the MLMP if it is modified and amended to include Staff's recommendations. In response to the Staff Report, Poseidon revised the MLMP to address substantially all of Staff's concerns (excluding the three issues discussed in the remainder of this letter), and to ensure that the MLMP substantially complies with Staff's recommendations.[2] For the Commission's convenience, we have attached as Exhibit B a document that sets forth the issues raised in the Staff Report and how Poseidon responded to those issues, including citations to the changes made to the MLMP. Poseidon's proposed MLMP is attached hereto as Exhibit A in redline format showing all of the changes made in response to the Staff Report that are discussed in Exhibit B. These documents demonstrate that Poseidon has made significant compromises to its positions regarding the MLMP to address and resolve Staff's concerns.

## A. Key Differences With Staff Report

Poseidon believes there remain only three key differences between Poseidon's MLMP and Staff's position in the Staff Report that require the Commission's further consideration, including:

- (1) the amount of mitigation acreage;

- (2) whether mitigation may be phased; and

[2] Poseidon forwarded these revisions to Staff on July 31, 2008 and hoped to have Staff confirm, prior to finalizing this letter, that these revisions addressed their concerns, but Staff cancelled the planned conference call to discuss these changes.

- (3) whether the Commission should have the discretion to decide at a later date if Poseidon may receive restoration credit for dredging the Agua Hedionda Lagoon (the "Lagoon").

Poseidon contends that the MLMP's proposed 42.5 acres of mitigation is soundly based on CEC methodology; that the phased approach to mitigation ensures the Project's marine life impacts will be fully mitigated during all Project operating scenarios; and that the Commission should be allowed to determine whether Poseidon may receive restoration credit for evidence demonstrating the environmental benefits attributable to Lagoon dredging at the time Poseidon actually requests such credit (if ever) for its Phase II obligations. Accordingly, for those reasons and the reasons summarized below and set forth in detail in Exhibit C ("Marine Life Mitigation Rationale"), Poseidon requests that the Commission not adopt Staff's recommended modifications and instead adopt Poseidon's MLMP as revised and attached hereto as Exhibit A.

## B. Poseidon's Restoration Acreage is Consistent with Commission Practice

Independent review has confirmed that Poseidon's proposed 42.5 acres is sufficient restoration to fully mitigate the Project's marine life impacts, consistent with Coastal Act Sections 30230 and 30231. Poseidon's entrainment study, which provides the basis for Poseidon's proposed 42.5 acres of wetland restoration, was reviewed by the Coastal Commission's independent expert, Dr. Pete Raimondi of UC Santa Cruz. Dr. Raimondi confirmed, among other things, that: (1) Poseidon's study design is consistent with recent entrainment studies conducted in California;[3] and (2) using CEC methodology, the habitat restoration required to mitigate the Project's "stand-alone" operations would be 42.5 acres. This methodology is also consistent with the peer-reviewed and approved methodology the CEC applied to the Morro Bay Power Plant and the Moss Landing Power Plant.

Notably, Commission Staff originally recommended that Poseidon use CEC methodology to determine Project mitigation acreage, but Staff is now recommending a substantial *increase* in the mitigation acreage by *applying a new standard that has never been peer-reviewed and which adjusts variables in the modeling estimates*. Specifically, Dr. Raimondi suggested that in order to provide a *greater* level of assurance that impacts to lagoon and ocean species will be mitigated, Poseidon could restore a total of 55.4 to 68.2 acres, which would provide an unprecedented level of mitigation for the Project's "stand-alone" impacts that the Commission has never applied before. This "enhanced mitigation" proposal is not consistent with CEC methodology and established, peer-reviewed methodology and precedent. Notably, Dr. Raimondi has not advocated that the Commission should apply the "enhanced mitigation" methodology, and has appropriately left to the Commission the decision of which methodology should be used.

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[3] As Set forth in the Staff Report, "Dr. Raimondi was able to determine that the study's sampling and data collection methods were consistent with those used in other recent entrainment studies conducted in California pursuant to the protocols and guidelines used by the U.S. EPA, Regional Water Quality Control Boards, California Energy Commission, and Coastal Commission." (*Staff Report re: Condition Compliance for CDP No. E-06-013; Special Condition 8: Submittal of Marine Life Mitigation Plan*, July 24, 2008, at p. 8.)

## C. Phased Mitigation is Appropriate for this Project

Poseidon's phased approach to mitigation would fully compensate for the Project's impacts to marine life under either of the power plant's operating scenarios. The initial phase would provide 37 acres of wetland restoration, which would fully compensate for Project-related impacts during the period when both the Encina Power Station ("EPS") and the Project are operating ("Phase I"). The second phase would provide up to 5.5 acres of additional restoration to address any additional unmitigated impacts occurring if the Project ever operates "stand-alone"; that is, when the EPS is decommissioned or when the EPS is providing less than 15% of the water needed for the Project based on the EPS's average water use over any three-year period ("Phase II").

- ***Phase I Substantially Over-mitigates Project Impacts.*** *The 37 acres provided* under Phase I would fully mitigate the Project's impacts as long as at least 13% of the Project's seawater requirements are provided by the EPS. In the last 18 months, the EPS would have provided over 65% of the water needed for the Project. Based on that number, the 37 acres provided by Poseidon under Phase I would have been about 2.5 times the mitigation actually required. Through the phased approach to mitigation, Poseidon will substantially over-mitigate its impacts while the EPS continues to operate.

- **Phase II Mitigation Provides New Opportunities to Reduce Impacts.** Under Phase II, the MLMP ensures that Poseidon will fully mitigate its "stand-alone" impacts by requiring Poseidon to: (1) analyze the environmental effects of ongoing Project operations; (2) use that analysis to investigate and evaluate reasonably feasible technologies that are unavailable today, which may reduce any marine life impacts; (3) provide its analysis of environmental effects and its evaluation of any reasonably feasible technologies to reduce impacts to the Commission; and (4) undertake Lagoon dredging obligations, if feasible. The Commission will then be able to determine if actual Project operations have less of an impact to marine life than originally estimated, if Poseidon can further reduce the Project's impacts through reasonably feasible technologies, or if Poseidon should receive restoration credit for demonstrated environmental benefits attributable to dredging (as discussed further in Section D below). Based on these determinations, the Commission may proportionally reduce Poseidon's habitat restoration obligation for Phase II mitigation. Accordingly, phased mitigation will incentivize Poseidon to investigate new technologies that are not available today to reduce impacts so that it can potentially reduce its restoration obligation, and it will enable the Commission to make mitigation decisions based on the Project's actual operational impacts rather than estimates. If the mitigation obligation is not reduced, the MLMP requires Poseidon to restore an additional 5.5 acres of wetland habitat subject to the same performance standards and objectives required under Phase I.

**These materials have been provided to Coastal Commission Staff**

## D. Lagoon Dredging Credit Should Be Evaluated in the Future

Pursuant to Poseidon's MLMP, the Commission may decide at a later date whether Poseidon should receive any restoration credit for assuming Lagoon dredging obligations. Poseidon has not requested that dredging credit be applied to its mitigation obligations now; on the contrary, Poseidon is asking the Commission only to leave open the possibility of allowing such credit in the future if Poseidon assumes dredging obligations. The Staff Report, however, recommends that the Commission should decide *now* that Poseidon's potential dredging is not subject to restoration credit because dredging is inconsistent with Special Condition 8's requirement that mitigation be in the form of creation, enhancement or restoration of wetland habitat.

The Staff Report, however, fails to acknowledge that Lagoon dredging is necessary to preserve the Lagoon's beneficial uses, and that sand dredged from the Lagoon would be used to maintain, restore and enhance habitat for grunion spawning and enhance opportunities for public access and recreation along the shoreline. Moreover, the Commission has applied dredging credit in the past for the SONGS project. Further, approval of the MLMP would not constitute approval of a particular dredging proposal or grant of dredging credit. Rather, any dredging proposal would require a separate Coastal Development Permit pursuant to Special Condition 12, so it would be premature for the Commission to analyze dredging that Poseidon cannot perform. Accordingly, it is perfectly appropriate for the Commission to determine whether Poseidon should receive restoration credit for dredging at the time it applies for such credit in the future (if ever).

We appreciate the Commission's consideration of these important issues and respectfully request that the Commission approve Poseidon's proposed Marine Life Mitigation Plan attached hereto as Exhibit A at its August 6, 2008 meeting.

Sincerely,

Peter MacLaggan
Poseidon Resources

Attachments

cc: Tom Luster;
Rick Zbur, Esq.

These materials have been provided to Coastal Commission Staff

POSEIDON RESOURCES

**Agenda Item**
**W 5b**

# EXHIBITS TO POSEIDON'S

# AUGUST 2, 2008

# RESPONSE TO STAFF REPORT

# REGARDING THE

# MARINE LIFE MITIGATION PLAN

Exhibit A Marine Life Mitigation Plan

Exhibit B Responses to Issues Identified in July 24, 2008 Staff Report

Exhibit C Marine Life Mitigation Plan Rationale

These materials have been provided to California Coastal Commission Staff

# EXHIBIT A

# MARINE LIFE MITIGATION PLAN

## CONDITION A: WETLAND RESTORATION MITIGATION

The permittee shall develop, implement and fund a wetland restoration project that compensates for marine life impacts from Poseidon's Carlsbad desalination facility.

### 1.0 PHASED IMPLEMENTATION

Poseidon's Carlsbad desalination facility will function under two operating scenarios: (1) using the Encina Power Station's seawater intake while the Power Station continues to operate ("Phase I "); and (2) as a stand-alone facility ("Phase II"). The permittee's restoration project shall be phased to address marine life impacts from each of the applicable operating scenarios.

To mitigate marine life impacts for Phase I operations, the permittee shall develop, implement and fund a 37-acre wetland restoration project consistent with the terms and conditions set forth in this Plan. The permittee's additional obligations to mitigate marine life impacts for Phase II operations, which may include up to 5.5 acres of additional wetland restoration, are set forth in section 6.0. Combined, mitigation for Phase I and Phase II would require up to 42.5 acres of wetland restoration.

### 1.1 Technology Review During Phase I Operations

On or before April 30 of each year following the commencement of the Carlsbad desalination facility's commercial operations, the permittee shall provide the Executive Director with data demonstrating the Encina Power Station's cooling water intake for the prior calendar year. On or before April 30 following the first three years of the Carlsbad desalination facility's commercial operations, the permittee shall also provide the Executive Director with the calculation demonstrating the Power Station's average water use during the prior three-year period. The permittee shall thereafter provide the Executive Director with that calculation annually, on or before April 30, until either of the occurrence of either of the "Phase II Pre-Conditions," as defined in subsection 1.2 below.

Consistent with the permittee's approvals from the State Lands Commission, the permittee shall perform the following ten years after the commencement of commercial operations, unless either of the "Phase II Pre-Conditions" occur before that time (as defined in subsection 1.2 below):

a. Conduct a new analysis of the environmental effects of ongoing desalination facility operations ten years after the commencement of commercial operations. The analysis

shall provide information about the project's actual impacts from operations, taking into account all project features and mitigation measures;

b. Using that analysis, the permittee shall investigate and evaluate new and developing technologies that are reasonably feasible and unavailable today, which may further reduce any marine life impacts; and

c. Within 24 months of the date that the permittee commenced its analysis of the environmental effects of ongoing desalination facility operations, the permittee shall provide that analysis and its evaluation of potential and reasonably feasible technologies to the Commission for review. The determination of feasibility shall consider costs, potential impacts, and acceptability to the Encina Power Station, among other things.

Upon receiving the analysis of environmental effects of ongoing desalination facility operations and the evaluation of new and available technologies from the permittee, the Commission may request a hearing to determine whether those technologies are reasonably feasible and whether the permittee can implement any of the technologies to reduce marine life impacts. If the Commission determines that any such technologies are reasonably feasible and may further reduce marine impacts, this Marine Life Mitigation Plan may, after a public hearing before the Commission, be amended to require implementation of reasonably feasible technologies.

### 1.2 Implementation of Phase II Mitigation

The permittee's Phase I mitigation obligations will not be affected by whether or not the permittee is ultimately required to undertake mitigation for Phase II. If either the Encina Power Station stops using its existing seawater intake for cooling water, or the Encina Power Station's use of its seawater intake provides less than 15% of Poseidon's needed water based on the Power Station's average water use over any three-year period ("Phase II Pre-Conditions"), then the permittee shall also undertake the Phase II mitigation obligations set forth in section 6.0.

## 2.0 PHASE I SITE SELECTION

In consultation with Commission staff, the permittee shall select a wetland restoration site for Phase I mitigation in accordance with the following process and terms.

**Within 10 months of the effective date of this permit, the permittee shall submit the proposed site and preliminary Phase I restoration plan to the Commission for its review and approval or disapproval.**

The location of the wetland restoration project shall be within the Southern California Bight. The permittee shall select from sites including, but not limited to, the following eleven sites:

Tijuana Estuary in San Diego County; San Dieguito River Valley in San Diego County; Agua Hedionda Lagoon in San Diego County; San Elijo Lagoon in San Diego County; Buena Vista Lagoon in San Diego County; Huntington Beach Wetland in Orange County, Anaheim Bay in Orange County, Santa Ana River in Orange County, Los Cerritos Wetland in Los Angeles County, Ballona Wetland in Los Angeles County, and Ormond Beach in Ventura County. The permittee may also consider any sites that may be recommended by the California Department of Fish & Game as high priority wetlands restoration projects.

The basis for the selected site shall be an evaluation of the site against the minimum standards and objectives set forth in subsections 3.1 and 3.2 below. The permittee shall take into account and give consideration to the advice and recommendations of the scientific advisory panel established and convened by the Executive Director pursuant to Condition B.1.0. The permittee shall select the site that meets the minimum standards and best meets the objectives.

**2.1 Preliminary Phase I Restoration Plan**

**In consultation with Commission staff, the permittee shall develop a preliminary wetland restoration plan for Phase I mitigation of the wetland site identified through the site selection process. The preliminary Phase I restoration plan shall meet the minimum standards and incorporate as many as possible of the objectives in subsections 3.1 and 3.2, respectively.**

**The preliminary Phase I restoration plan shall include the following elements:**

**a. Review of existing physical, biological, and hydrological conditions; ownership, land use and regulation.**

**b. Site-specific and regional restoration goals and compatibility with the goal of mitigating Poseidon's marine life impacts.**

**c. Identification of site opportunities and constraints.**

**d. Conceptual restoration design, including:**

**1. Proposed grading and excavation; water control structures; planting; integration of public access, if feasible; buffers and transition areas; management and maintenance requirements.**

**2. Proposed habitat types (including approximate size and location).**

**3. Preliminary assessment of significant impacts of design (especially on existing habitat values) and net habitat benefits.**

4. **Evaluation of steps for implementation e.g. permits and approvals, development agreements, acquisition of property interests.**

5. **A graphic depiction of proposed plan.**

## 3.0 PHASE I PLAN REQUIREMENTS

In consultation with Commission staff, the permittee shall develop a **final** wetland restoration plan for the wetland site ~~identified through the site selection process for Phase I. The wetland restoration~~**based on the preliminary Phase I plan, which the permittee shall submit to the Commission as part of the Coastal Development Permit Application described in Section 4.0. The final** plan shall **also** meet the minimum standards and incorporate as many as feasible of the objectives in subsections 3.1 and 3.2, respectively.

### 3.1 Minimum Standards

The Phase I wetland restoration project site and preliminary plan must meet the following minimum standards:

a. Location within Southern California Bight;

b. Potential for restoration as tidal wetland, with extensive intertidal and subtidal areas;

c. Creates or substantially restores a minimum of 37 acres of habitat similar to the affected habitats in Agua Hedionda Lagoon, excluding buffer zone and upland transition area;

d. Provides a buffer zone of a size adequate to ensure protection of wetland values, and ~~substantially~~ at least 100 feet wide, as measured from the upland edge of the transition area. The Executive Director or the Commission may make exceptions to the 100-foot buffer requirement in certain locations if they determine that the exceptions are de minimis, or that a lesser buffer is sited and/or designed to prevent impacts that would significantly degrade wetland areas and that they are compatible with the continuance of those areas;

e. Any existing site contamination problems would be controlled or remediated and would not hinder restoration;

f. Site preservation is guaranteed in perpetuity (through appropriate public agency or nonprofit ownership, or other means approved by the Executive Director), to protect against future degradation or incompatible land use;

g. Feasible methods are available to protect the long-term wetland values on the site, in perpetuity;

h. Does not result in a net loss of existing wetlands; and

i. Does not result in an adverse~~,~~ **impact on endangered animal species, or an adverse** unmitigated impact on endangered **plant** species.

### 3.2 Objectives

The following objectives represent the factors that will contribute to the overall value of the wetland. The selected site shall be determined to achieve these objectives. These objectives shall also guide preparation of the restoration plan.

a. Provides ~~substantial~~**maximum** overall ecosystem benefits, e.g. ~~substantial~~**maximum** upland buffer, enhancement of downstream fish values, provides regionally scarce habitat, potential for local ecosystem diversity;

b. Provides substantial fish habitat compatible with other wetland values at the site;

c. Provides a buffer zone of ~~at least~~**an average of at least 300 feet wide, depending on the feasibility at the selected site(s), and not less than** 100 feet wide, as measured from the upland edge of the transition area, subject to the exemptions set forth in subsection 3.1(d);

d. Provides ~~substantial~~**maximum** upland transition areas (in addition to buffer zones);

e. Restoration involves minimum adverse impacts on existing functioning wetlands and other sensitive habitats;

f. Site selection and restoration plan reflect a consideration of site specific and regional wetland restoration goals;

g. Restoration design is that most likely to produce and support wetland-dependent resources;

h. Provides potential habitat for rare or endangered species;

i. Provides for restoration of reproductively isolated populations of native California species;

j. Results in an increase in the aggregate acreage of wetland in the Southern California Bight;

k. Requires minimum maintenance;

l. Restoration project can be accomplished in a reasonably timely fashion; and

m. Site is in proximity to the Carlsbad desalination facility.

### 3.3 Restrictions

(a) The permittee may propose a wetland restoration project larger than the minimum necessary size specified in subsection 3.1(c) above, if biologically appropriate for the site, but the additional acreage must (1) be clearly identified, and (2) must not be the portion of the project best satisfying the standards and objectives listed above.

(b) If the permittee jointly enters into a restoration project with another party: (1) the permittee's portion of the project must be clearly specified, (2) any other party involved cannot gain mitigation credit for the permittee's portion of the project, and (3) the permittee may not receive mitigation credit for the other party's portion of the project.

(c) The permittee may propose to divide the mitigation requirement between a maximum of ~~four~~two wetland restoration sites, unless the Executive Director determines that the standards and objectives of subsections 3.1 and 3.2 will be better met at more than ~~four~~two sites.

## 4.0 PHASE I PLAN IMPLEMENTATION

### 4.1 Coastal Development Permit Application

The permittee shall submit a complete Coastal Development Permit application for the Phase I restoration plan along with CEQA documentation and local or other state agency approvals by either 24 months following the issuance of the Coastal Development Permit for the Carlsbad desalination facility~~, or the commencement of commercial operations at the facility, whichever is later~~. The Executive Director may grant an extension to this time period at the request of and upon a demonstration of good cause by the permittee. The restoration plan shall substantially conform to Section 3.0 above and shall include, but not be limited to the following elements:

a. Detailed review of existing physical, biological, and hydrological conditions; ownership, land use and regulation;

b. Evaluation of site-specific and regional restoration goals and compatibility with the goal of mitigating for Poseidon's marine life impacts;

c. Identification of site opportunities and constraints;

d. Schematic restoration design, including:

    1. Proposed cut and fill, water control structures, control measures for stormwater, buffers and transition areas, management and maintenance requirements;

    2. Planting Program, including removal of exotic species, sources of plants and or seeds (local, if possible), protection of existing salt marsh plants, methods for preserving

top soil and augmenting soils with nitrogen and other necessary soil amendments before planting, timing of planting, plans for irrigation until established, and location of planting and elevations on the topographic drawings;

3. Proposed habitat types (including approximate size and location);
4. Assessment of significant impacts of design (especially on existing habitat values) and net habitat benefits;
5. Location, alignment and specifications for public access facilities, if feasible;
6. Evaluation of steps for implementation e.g. permits and approvals, development agreements, acquisition of property rights;
7. Cost estimates;
8. Topographic drawings for final restoration plan at 1" = 100 foot scale, one foot contour interval; and
9. Drawings shall be directly translatable into final working drawings.

g. Detailed information about how monitoring and maintenance will be implemented;

h. Detailed information about construction methods to be used;

i. Defined final success criteria for each habitat type and methods to be used to determine success;

j. Detailed information about how Poseidon will coordinate with any other agency or panel that will have a role in implementing and monitoring the restoration plan, including the respective roles of the parties in independent monitoring, contingency planning review, cost recovery, etc.;

k. Detailed information about contingency measures that will be implemented if mitigation does not meet the approved goals, objectives, performance standards, or other criteria; and

l. Submittal of "as-built" plans showing final grading, planting, hydrological features, etc. within 60 days of completing mitigation site construction.

**4.2 Wetland Construction Phase**

Within 12 months of approval of the Phase I restoration plan, subject to the permittee's obtaining the necessary permits, the permittee shall commence the construction phase of the wetland restoration project. The permittee shall be responsible for ensuring that construction is carried out in accordance with the specifications and within the timeframes specified in the approved

restoration plan and shall be responsible for any remedial work or other intervention necessary to comply with plan requirements.

### 4.3 Timeframe for Resubmittal of Project Elements

If the Commission does not approve any element of the project (i.e. site selection, restoration plan), the Commission will specify the time limits for compliance relative to selection of another site or revisions to the restoration plan.

## 5.0 PHASE I WETLAND MONITORING, MANAGEMENT AND REMEDIATION

Monitoring, management (including maintenance), and remediation shall be conducted over the "full operating life" of Poseidon's desalination facility, which shall be 30 years from the date "as-built" plans are submitted pursuant to subsection 4.1(*l*).

The following section describes the basic tasks required for monitoring, management and remediation for Phase I. Condition B specifies the administrative structure for carrying out these tasks, including the roles of the permittee and Commission staff.

### 5.1 Monitoring and Management Plan

A monitoring and management plan will be developed in consultation with the permittee and appropriate wildlife agencies, concurrently with the preparation of the restoration plan for Phase I, to provide an overall framework to guide the monitoring work. It will include an overall description of the studies to be conducted over the course of the monitoring program and a description of management tasks that are anticipated, such as trash removal. Details of the monitoring studies and management tasks will be set forth in a work program (see Condition B).

### 5.2 Pre-restoration site monitoring

Pre-restoration site monitoring shall be conducted to collect baseline data on the wetland attributes to be monitored. This information will be incorporated into and may result in modification to the overall monitoring plan.

### 5.3 Construction Monitoring

Monitoring shall be conducted during and immediately after each stage of construction of the wetland restoration project to ensure that the work is conducted according to plans.

### 5.4 Post-Restoration Monitoring and Remediation

Upon completion of construction of the wetland, monitoring shall be conducted to measure the success of the wetland in achieving stated restoration goals (as specified in restoration plan) and in achieving performance standards, specified below. The permittee shall be fully responsible for any failure to meet these goals and standards during the facility's full operational years. Upon determining that the goals or standards are not achieved, the Executive Director shall prescribe remedial measures, after consultation with the permittee, which shall be implemented by the permittee as soon as practicable with Commission staff direction. If the permittee does not agree with the remedial measures prescribed by the Executive Director, or that remediation is necessary, the matter may be set for hearing and disposition by the Commission.

Successful achievement of the performance standards shall (in some cases) be measured relative to approximately four reference sites, which shall be relatively undisturbed, natural tidal wetlands within the Southern California Bight. The reference sites and the standard of comparison, i.e. the measure of similarity to be used, shall be specified in the work program.

In measuring the performance of the wetland project, the following physical and biological performance standards will be utilized:

a. Longterm Physical Standards. The following long-term standards shall be maintained over the full operative life of the desalination facility:

   1) Topography. The wetland shall not undergo major topographic degradation (such as excessive erosion or sedimentation);

   2) Water Quality. Water quality variables [to be specified] shall be similar to reference wetlands; and

   **3) Tidal Prism. If the plan requires dredging, the permittee shall provide such dredging for the duration of the "full operating life" of the project (as defined in Section 5.0), in exchange for a dredging credit consistent with the credit provided to Edison for the SONGS restoration project, and any designed tidal prism shall be maintained, and tidal flushing shall not be interrupted.**

   4) ~~3)~~ Habitat Areas. The area of different habitats shall not vary by more than 10% from the areas indicated in the restoration plan.

b. Biological Performance Standards. The following biological performance standards shall be used to determine whether the restoration project is successful. Table 1, below, indicates suggested sampling locations for each of the following biological attributes; actual locations will be specified in the work program:

1) Biological Communities. Within 4 years of construction, the total densities and number of species of fish, macroinvertebrates and birds (see Table 1) shall be similar to the densities and number of species in similar habitats in the reference wetlands;

2) Vegetation. The proportion of total vegetation cover and open space in the marsh shall be similar to those proportions found in the reference sites. The percent cover of algae shall be similar to the percent cover found in the reference sites;

3) Spartina Canopy Architecture. The restored wetland shall have a canopy architecture that is similar in distribution to the reference sites, with an equivalent proportion of stems over 3 feet tall;

4) Reproductive Success. Certain plant species, as specified by in the work program, shall have demonstrated reproduction (i.e. seed set) at least once in three years;

5) Food Chain Support. The food chain support provided to birds shall be similar to that provided by the reference sites, as determined by feeding activity of the birds; and

6) Exotics. The important functions of the wetland shall not be impaired by exotic species.

**Table 1: Suggested Sampling Locations**

| | Salt Marsh | | | Open Water | | | Tidal |
|---|---|---|---|---|---|---|---|
| | Spartina | Salicornia | Upper | Lagoon | Eelgrass | Mudflat | Creeks |
| 1) Density/spp: | | | | | | | |
| Fish | | | | X | X | X | X |
| Macroinverts | | | | X | X | X | X |
| Birds | X | X | X | X | | X | X |
| 2) % Cover | | | | | | | |
| Vegetation | X | X | X | | X | | |
| Algae | X | X | | | | X | |
| 3) Spar. arch. | X | | | | | | |
| 4) Repro. suc. | X | X | X | | | | |
| 5) Bird feeding | | | | X | | X | X |
| 6) Exotics | X | X | X | X | X | X | X |

## 6.0 MITIGATION REQUIRED AFTER PHASE II PRECONDITION

### 6.1 Reasonably Feasible Technologies

Following the occurrence of either of the Phase II Pre-Conditions, as defined in subsection 1.1, the permittee shall:

a. Conduct a new analysis of the environmental effects of ongoing desalination facility operations. The analysis shall provide information about the project's actual impacts from operations, taking into account all project features and mitigation measures;

b. Using that analysis, the permittee shall investigate and evaluate new and developing technologies that are reasonably feasible and unavailable today, which may further reduce any marine life impacts;

c. Within 24 months of the occurrence of the applicable Phase II pre-condition, the permittee shall provide that analysis and its evaluation of potential and reasonably feasible technologies to the Commission for review. The determination of feasibility shall consider costs, potential impacts, and acceptability to the Encina Power Station, among other things; and

d. The analysis and evaluation provided to the Commission shall also include an evaluation of whether the 37 acres of wetland restoration implemented by the permittee has fully or only partially mitigated marine life impacts for stand-alone operations, taking into account actual operating conditions from facility operations for Phase I and potential reductions to impacts that would occur as a result of any new and reasonably feasible technologies that the permittee may implement pursuant to this subsection 6.1.

Upon receiving the evaluation of new and available technologies from the permittee, the Commission may request a hearing to determine whether those technologies are reasonably feasible and whether the permittee can implement any of the technologies to reduce marine life impacts. If the Commission determines that any such technologies are reasonably feasible and may further reduce marine impacts, this Marine Life Mitigation Plan may be amended after a public hearing before the Commission to require implementation of reasonably feasible technologies. The Commission also may determine the additional mitigation, if any, required after implementation of available technologies to reduce marine life impacts from Phase II operations.

### 6.2 Additional Mitigation

The permittee also shall comply with the following mitigation measures after the occurrence of either Phase II Pre-Condition:

a. If within 24 months of the occurrence of the applicable Phase II Pre-Condition, the permittee assumes dredging obligations of the Agua Hedionda Lagoon from the Encina Power Station or other applicable entity, the permittee shall provide evidence to the Executive Director in the form of a contract or other agreement that demonstrates the permittee's assumption of dredging obligations, along with an evaluation of the permittee's dredging activities and supporting documentation for the proposed mitigation credit the permittee is seeking for this activity. Pursuant to Special Condition 12 of this Permit, the permittee shall not dredge the Agua Hedionda Lagoon without obtaining a new Coastal Development Permit approval from the Commission for dredging activities. If such dredging obligations are assumed, the Commission shall evaluate and determine the mitigation credit the permittee is entitled to receive for Lagoon dredging using substantially the same methodology the Commission used for the San Onofre Nuclear Generating Station's dredging approvals. If the Commission's evaluation set forth in subsection 6.1 determines that there is any remaining mitigation obligation following the implementation of reasonably feasible technologies to reduce marine impacts, the credit for Lagoon dredging shall be applied to satisfy any remaining mitigation obligation of the permittee; or

b. If the permittee does not assume the dredging obligations for the Agua Hedionda Lagoon (for any reason other than delays by the Commission in issuing the Coastal Development Permit for dredging) and the analysis and evaluation set forth in subsection 6.1 identifies that additional wetland restoration is necessary to mitigate Phase II impacts not fully mitigated by the 37-acre restoration project, then within 24 months of the occurrence of the applicable Phase II Pre-Condition, the permittee shall apply for a new Coastal Development Permit to perform additional wetland mitigation to mitigate marine life impacts for Phase II operations that meets the following criteria:

   (i) the Phase II wetland mitigation shall credit the 37-acres of restoration required under this Plan for Phase I, and may require additional mitigation of up to an additional 5.5 acres. The Commission shall proportionally reduce the potential 5.5 acre restoration requirement based on: (1) any reduction to marine life impacts caused by the permittee's implementation of reasonably feasible technologies, as set forth in subsection 6.1; and (2) any demonstration that actual plant operations have caused less marine life impacts than originally anticipated during the project's initial evaluation;

   (ii) the permittee shall apply for a new Coastal Development Permit to perform the wetland restoration, and the restoration shall be of habitat similar to the affected habitats in Agua Hedionda Lagoon, excluding buffer zone and upland transition area, and consistent with the objectives and restrictions in subsections 3.1 (excluding subsection 3.1(c)), 3.2 and 3.3 above;

(iii) the permittee shall select a wetland restoration site for Phase II mitigation in a manner generally in accordance with section 2.0 above;

(iv) the restoration plan for Phase II mitigation shall be generally in accordance with the requirements in section 4.0 above, and shall be monitored in a manner generally in accordance with that set forth in section 5.0 above; and

(v) Phase II wetland restoration shall be included in and administered as part of the same administrative structure created for Phase I mitigation and set forth in Condition B of this Plan.

## CONDITION B: ADMINISTRATIVE STRUCTURE

### 1.0 ADMINISTRATION

Personnel with appropriate scientific or technical training and skills will, under the direction of the Executive Director, oversee the mitigation and monitoring functions identified and required by Condition A. The Executive Director will retain scientific and administrative support staff to perform this function, as specified in the work program.

This technical staff will oversee the preconstruction and post-construction site assessments, mitigation project design and implementation (conducted by permittee), and monitoring activities (including plan preparation); the field work will be done by contractors under the Executive Director's direction. The contractors will be responsible for collecting the data, analyzing and interpreting it, and reporting to the Executive Director.

The Executive Director shall convene a scientific advisory panel to provide the Executive Director with scientific advice on the design, implementation and monitoring of the wetland restoration. The panel shall consist of recognized scientists, including a marine biologist, an ecologist, a statistician and a physical scientist.

### 2.0 BUDGET AND WORK PROGRAM

The funding necessary for the Commission and the Executive Director to perform their responsibilities pursuant to these conditions will be provided by the permittee in a form and manner reasonably determined by the Executive Director to be consistent with requirements of State law, and which will ensure efficiency and minimize total costs to the permittee. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. ~~Permit application fees paid by the permittee for Coastal~~

~~Development Permits (or amendments thereto) for the restoration program shall be credited against the budget to be funded by the permittee.~~ If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution.

The budget to be funded by the permittee will be for the purpose of reasonable and necessary costs to retain personnel with appropriate scientific or technical training and skills needed to assist the Commission and the Executive Director in carrying out the mitigation. In addition, reasonable funding will be included in this budget for necessary support personnel, equipment, overhead, consultants, the retention of contractors needed to conduct identified studies, and to defray the costs of members of any scientific advisory panel(s) convened by the Executive Director for the purpose of implementing these conditions.

Costs for participation on any advisory panel shall be limited to travel, per diem, meeting time and reasonable preparation time and shall only be paid to the extent the participant is not otherwise entitled to reimbursement for such participation and preparation. The amount of funding will be determined by the Commission on a biennial basis and will be based on a proposed budget and work program, which will be prepared by the Executive Director in consultation with the permittee, and reviewed and approved by the Commission in conjunction with its review of the restoration plan. **Total costs for such advisory panel shall not exceed $100,000 per year adjusted annually by any increase in the consumer price index applicable to California.** If the permittee and the Executive Director cannot agree on the budget or work program, the disagreement will be submitted to the Commission for resolution.

The work program will include:

a. A description of the studies to be conducted over the subsequent two year period, including the number and distribution of sampling stations and samples per station, methodology and statistical analysis (including the standard of comparison to be used in comparing the mitigation project to the reference sites);

b. A description of the status of the mitigation projects, and a summary of the results of the monitoring studies to that point;

c. A description of up to four reference sites;

d. A description of the performance standards that have been met, and those that have yet to be achieved;

e. A description of remedial measures or other necessary site interventions;

f. A description of staffing and contracting requirements; and

g. A description of the scientific advisory panel's role and time requirements in the two year period.

~~Any amendment to the work program requested by the permittee shall require an amendment to the Coastal Development Permit for the restoration plan, unless the Executive Director determines that no Coastal Development Permit amendment is necessary or required. Any amendment to the work program proposed by the Executive Director shall be made in consultation with the permittee. If the permittee and the Executive Director cannot agree on an amendment to the work program, the disagreement will be submitted to the Commission for resolution.~~

**The Executive Director may amend the work program at any time, subject to appeal to the Commission.**

## 3.0 ANNUAL REVIEW AND PUBLIC WORKSHOP REVIEW

The permittee shall submit a written review of the status of the mitigation project to the Executive Director each year on April 30 for the prior calendar year. The written review will discuss the previous year's activities and overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next year's program.

Every fifth year, the Executive Director or the Commission shall also convene and conduct a duly noticed public workshop to review the status of the mitigation project. The meeting will be attended by the contractors who are conducting the monitoring, appropriate members of the Scientific Advisory Panel, the permittee, Commission staff, representatives of the resource agencies (CDFG, NMFS, USFWS), and the public. Commission staff and the contractors will give presentations on the previous five years' activities and the overall status of the mitigation project, identify problems and make recommendations for solving them, and review the next period's program.

The workshop review will include discussions on whether the wetland mitigation project has met the performance standards, identified problems, and recommendations relative to corrective measures necessary to meet the performance standards. The Executive Director will utilize information presented at the public review, as well as any other relevant information, to determine whether any or all of the performance standards have been met, whether revisions to the standards are necessary, and whether remediation is required. Major revisions shall be subject to the Commission's review and approval.

The mitigation project will be successful when all performance standards have been met each year for a three-year period. The Executive Director shall report to the Commission upon determining that all of the performance standards have been met for three years and that the

project is deemed successful. If the Commission determines that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission. The work program shall reflect the lower level of monitoring required. If subsequent monitoring shows that a standard is no longer being met, monitoring may be increased to previous levels, as determined necessary by the Executive Director.

The ~~Commission~~**Executive Director** may make a determination on the success or failure to meet the performance standards or necessary remediation and related monitoring at any time, not just at the time of the workshop review.

## 4.0 ADDITIONAL PROCEDURES

### 4.1 Dispute Resolution

In the event that the permittee and the Executive Director cannot reach agreement regarding the terms contained in or the implementation of any part of this Plan, the matter may be set for hearing and disposition by the Commission.

### 4.2 Extensions

Any of the time limits established under this Plan may be extended by the Executive Driector at the request of the permittee and upon a showing of good cause.

## EXHIBIT B

## RESPONSES TO ISSUES IDENTIFIED IN JULY 24, 2008 STAFF REPORT

In response to Commission Staff's specific concerns regarding Poseidon's proposed Marine Life Mitigation Plan ("MLMP"), as identified on page 15 of the July 24, 2008 Staff Report, Poseidon has modified its MLMP to address Staff's concerns. Below we have listed each of Staff's identified concerns, followed by Poseidon's response. In addition to the responses herein, Exhibit A is a redline of Poseidon's MLMP that shows the changes Poseidon has made in response to Staff's concerns. Note that this document does not address the three issues discussed in Poseidon's letter responding to the Staff Report: mitigation acreage, phased mitigation and restoration credit for lagoon dredging.

**I. Responses to Bullet Points on Page 15:** In this section, Poseidon has responded to each of the bullet points listed on page 15 of the Staff Report.

**Issue 1:** *Staff recommended that Poseidon submit a complete coastal development permit application for its Final Restoration Plan within 24 months of Commission approval of its Preliminary Plan (i.e., the Plan being reviewed herein). Poseidon modified that recommendation in Section 4 of its Plan to allow submittal of that application either 24 months after issuance of the project coastal development permit or commencement of commercial operations of the desalination facility, whichever is later. This could substantially delay the implementation of mitigation and could result in several years of impacts occurring without mitigation.*

- **Poseidon Response to Issue 1:** In Section 4.1 of Poseidon's MLMP, Poseidon has revised its Plan so that the Coastal Development Permit for the Final Restoration Plan will be submitted within 24 months of Commission approval of its Preliminary Plan.

**Issue 2:** *A proposed change to Poseidon's Plan at Section 3.1(d) and at Section 3.2(c) would reduce the required buffer zone at its mitigation sites from no less than 100 feet wide to an average that could be much less than 100 feet.*

- **Poseidon Response to Issue 2:** Poseidon has removed the word "substantially" from Section 3.1(d) so that it is evident that buffer zones will be at least 100 feet wide. (See Poseidon's MLMP, Page 4 of 16.)

**Issue 3:** *A proposed change to Section 3.1(i) would allow the Plan to affect endangered species in a way not allowed under the Edison requirements.*

- **Poseidon Response to Issue 3:** Poseidon has revised Section 3.1(i) to indicate that Poseidon's Plan will not result in an adverse impact on endangered animal species, and that it will require mitigation for Plan impacts on endangered plant species. (See Poseidon's MLMP, Page 5 of 16.) The formulation of this provision in the Edison plan does not take into account that substantially all wetlands restoration projects will have impacts on sensitive plant species, which would likely be mitigated through relocation

to upland areas. The Edison plan's formulation would not allow mitigation in any area where there is a sensitive plant. Accordingly, Poseidon modified this language to ensure there are no adverse impacts to endangered animals, but to allow for mitigation and relocation of sensitive plants.

**Issue 4:** *Poseidon proposes to change Section 3.3(c) to allow mitigation to occur in up to four sites, rather than up to two sites, as required of Edison, which could fragment the mitigation and reduce its overall value.*

- **Poseidon Response to Issue 4:** Poseidon has revised Section 3.3(c) to allow mitigation to occur only at up to two sites without Executive Director approval. (See Poseidon's MLMP, Page 6 of 16.)

**Issue 5:** *Poseidon also proposed deleting a requirement at Section 5.4 that would require a designed tidal prism to be maintained to ensure the wetland mitigation site has adequate tidal action.*

- **Poseidon Response to Issue 5:** Poseidon has revised its Plan to include a requirement at Section 5.4(a)(3) that would require a designed tidal prism be maintained if the Plan requires dredging. (See Poseidon's MLMP, Page 9 of 16.)

**Issue 6:** *Poseidon Proposes that any fees it pays for coastal development permits or amendments be credited against the budget needed to implement the mitigation plan.*

- **Poseidon Response to Issue 6:** Poseidon has revised Condition B, Section 2.0 to remove its proposal regarding the crediting of fees paid for coastal development permits or amendments. (See Poseidon's MLMP, Pages 13-14 of 16.)

**II. <u>Responses to Staff's Recommendation to Include Conditions in Exhibit 2</u>:** In this section we have responded to Staff's comment on page 15 of the Staff Report that Poseidon's Plan should be modified to include the conditions in Exhibit 2 by identifying each of the differences between Poseidon's Plan and Staff's Exhibit 2, followed by Poseidon's response.

- Poseidon's Plan removes the requirement in Section 2.0 that would require Poseidon to submit the proposed site and preliminary plan to the Commission within 9 months of the effective date of the approval, and removes Exhibit 2's "Preliminary Plan" requirements set forth in Staff's Exhibit 2 at §1.2.
    - **Poseidon Response:** Poseidon has revised its Plan to include the "Preliminary Plan" requirements (Poseidon's MLMP § 2.1, Pages 3-4 of 16.) and has modified its Plan so that a proposed site and preliminary plan will be submitted to the Commission within 10 months of the effective date of the approval. (See Poseidon's MLMP § 2.0, Page 2 of 16.)
- Poseidon's Plan adds three potential restoration sites (Agua Hedionda, San Elijo, and Buena Vista) for a total of 11 sites in Section 2.0.

- **Poseidon Response:** This remains part of Poseidon's proposal because these sites are in close proximity to the Project site, and have been recommended as potential mitigation sites by local and state agencies.

- Poseidon's Plan allows Poseidon to consider other sites that may be recommended by the Department of Fish and Game ("DFG") as high-priority wetlands restoration projects, while Staff's MLMP only allows additional sites to be considered with approval from the Executive Director. (Section 2.0.)

    - **Poseidon Response:** This remains part of Poseidon's proposal to allow consideration of sites that could be proposed by DFG.

- Poseidon's MLMP has objectives of providing "substantial' upland buffer and upland transition areas, as compared to Staff's objective of providing "maximum" upland buffer and upland transition areas. (See Poseidon's MLMP §§ 3.2(a),(d).)

    - **Poseidon Response:** Poseidon has revised Sections 3.2(a) and (d) of its Plan to incorporate Staff's proposed "maximum" language. (See Poseidon's MLMP, Page 5 of 16.)

- Poseidon's Plan deletes Staff's Objective in Section 3.2(c) of providing a buffer zone of an average of at least 300 feet wide, and includes a 100 feet-wide Objective.

    - **Poseidon Response:** Poseidon has revised Section 3.2(c) so that the Objective provides for a buffer zone that is an average of 300 feet wide, depending on the feasibility at the selected site(s), and not less than 100 feet wide. (See Poseidon's MLMP, Page 5 of 16.) This modification addresses Staff's concerns and will allow Poseidon to have necessary flexibility in selecting the mitigation site(s).

- Poseidon proposes commencing restoration construction within 12 months of approval of the restoration plan (Poseidon's MLMP § 4.2), while Staff proposes construction within 6 months of approval of the restoration plan (Staff's Exhibit 2 at § 2.2).

    - **Poseidon Response:** This remains part of Poseidon's proposal because it is a more reasonable estimate of time that will be required to undertake the restoration efforts.

- Poseidon's Plan adds a provision to assure that the mitigation is in place for 30 years, and therefore adds a definition of the facility's "full operating life" of 30 years from the date as-built plans are submitted. (See Poseidon's MLMP § 5.0)

    - **Poseidon Response:** This remains part of Poseidon's proposal because it provides clarity for Poseidon's responsibilities and obligations under the Plan.

- Poseidon modifies the requirement that the Executive Director will retain approximately two scientists and one administrative support staff to oversee the plan's mitigation and monitoring functions, and provides that the Executive Director shall retain staff as set forth in the "work program." (See Poseidon's MLMP Condition B § 1.0, Page 13 of 16.)

- **Poseidon Response:** This remains part of Poseidon's proposal because Poseidon does not believe this amount of staffing is necessary given the significantly smaller scope of Poseidon's restoration obligations compared to SONGS. Poseidon's proposal provides that the work program will identify the necessary staffing.

- Poseidon's Plan removes the cap on total costs for the advisory panel of $100,000 per year contained in Staff's Exhibit 2, and requires the Executive Director to submit a proposed budget for the advisory panel to the Commission for approval on a biennial basis, and provides that any disagreement over the budget to be submitted to the Commission for resolution. (Poseidon's MLMP Condition B § 2.0.)

    - **Poseidon Response:** Poseidon has revised Condition B Section 2.0 to include Staff's language regarding the $100,000 cap, but has retained its procedures for the budget due to the fact that the scope of Poseidon's restoration obligations will be significantly smaller than Edison's, and the budget for the advisory panel should bear a reasonable relationship to the scope of restoration. (See Poseidon's MLMP, Page 14 of 16.)

- Poseidon's Plan modifies the Executive Director's ability to amend the work program. (Poseidon's MLMP Condition B § 2.0.)

    - **Poseidon Response:** Poseidon has modified Condition B, § 2.0 so that it is now consistent with the language in Staff's Exhibit 2. (See Poseidon's MLMP, Page 15 of 16.)

- Poseidon's Plan requires submission of a written review of the restoration project's previous year by April 30 instead of an annual public workshop. Poseidon provides for a public workshop every fifth year, regardless of whether the project's performance standards have been met. (Poseidon's MLMP Condition B § 3.0, Pages 15-16 of 16.) Staff's Exhibit 2 provides for an annual public workshop, and would lower the frequency of this obligation to a five year review once performance standards are achieved.

    - **Poseidon Response:** This remains part of Poseidon's proposal because of the substantially limited size of the Poseidon's restoration project as compared to Edison's SONGS restoration project, and the significant cost already imposed on Poseidon's mitigation program.

- Poseidon's Plan gives the Commission, rather than the Executive Director, the authority to determine the success or failure to meet the performance standards, or necessary remediation and related monitoring.

    - **Poseidon Response:** Poseidon has modified Condition B, § 3.0 so that it is consistent with the language in Staff's Exhibit 2. (See Poseidon's MLMP, Page 10 of 16.)

- Poseidon's Plan adds a general dispute resolution provision that would allow any disputes to be heard by the Commission. (Poseidon's MLMP Condition B § 4.1, Page 16 of 16.)

- **Poseidon Response:** This remains part of Poseidon's proposal because it retains and states the permittee's implicit rights.

- Poseidon's MLMP allows for time extensions by the Executive Director at Poseidon's request upon a showing of good cause. Poseidon's MLMP Condition B § 4.2, Page 16 of 16.)

    - **Poseidon's Response:** This remains part of Poseidon's proposal.

## EXHIBIT C

## MARINE LIFE MITIGATION PLAN RATIONALE

In addition to the reasons set forth in Poseidon's letter to the Commission, below Poseidon has provided more detailed support for its position that the Commission should accept Poseidon's arguments concerning mitigation acreage, mitigation phasing and dredging over those offered by Staff. Accordingly, and for the following reasons, Poseidon respectfully asks the Commission to adopt Poseidon's Marine Life Mitigation Plan ("MLMP") as amended and set forth in Exhibit A, and without Staff's requested modifications from the Staff Report.

### I. POSEIDON'S RESTORATION ACREAGE IS CONSISTENT WITH COMMISSION PRACTICE

Independent review has confirmed that Poseidon's proposed 42.5 acres is sufficient restoration to fully mitigate the Project's marine life impacts. Poseidon's entrainment study, which provides the basis for Poseidon's proposed 42.5 acres of wetland restoration, was reviewed by the Coastal Commission's independent expert, Dr. Pete Raimondi of UC Santa Cruz. Dr. Raimondi confirmed, among other things, that: (1) Poseidon's study design is consistent with recent entrainment studies conducted in California; (2) using CEC methodology and Coastal Commission precedent, the habitat restoration required to mitigate the Project's "stand-alone" operations would be 42.5 acres (37 acres to compensate for Agua Hedionda Lagoon ("Lagoon") species impacts, and 5.5 acres to compensate for open ocean species impacts); and (3) habitat mix for mitigation should include mudflat/tidal channel and open water habitat. This methodology is also consistent with the peer-reviewed and approved methodology the CEC applied to the Morro Bay Power Plant and the Moss Landing Power Plant.

Notably, Commission Staff originally recommended that Poseidon use CEC methodology to determine the Project's mitigation requirement. Staff, however, is now recommending a substantial *increase* in the mitigation acreage by applying a new standard that has not been peer-reviewed and which adjusts variables in the modeling estimates. Specifically, Dr. Raimondi suggested that in order to provide an even *greater* level of assurance that impacts to lagoon and ocean species will be mitigated, Poseidon could restore 12.9 to 25.7 acres above the 42.5 acres required under CEC methodology – for a total of 55.4 to 68.2 acres – to provide an unprecedented level of mitigation for the Project's "stand-alone" impacts that the Commission has never applied before. This "enhanced mitigation" proposal is inconsistent with CEC methodology and established, peer-reviewed methodology and precedent. Notably, Dr. Raimondi has not advocated that the Commission should apply the "enhanced mitigation" methodology, and has appropriately left to the Commission the decision of which methodology should be used.

In contrast to the "enhanced mitigation" proposal, Poseidon's restoration acreage methodology conforms entirely to Commission-accepted precedent, and Staff has not identified any mitigation projects using this methodology that have resulted in under-compensation for marine impacts. Poseidon's Area Production Foregone ("APF") calculation is extremely conservative because it assumes that the proportional mortality resulting from entrainment occur

across the entire area of the Lagoon. In fact, the habitat areas in the Lagoon for the three species used to calculate the APF estimate are all much smaller than the entire Lagoon. Accordingly, an averaging approach was used because it accounts for the uncertainty associated with the estimates of the exact areas of habitat associated for each species. This methodology is considered conservative and conforms entirely to standards and procedures used for APF determination at the Moss Landing project.

Staff has also suggested that if Poseidon does not use Staff's "enhanced mitigation" proposal, that Poseidon should be required to apply a mitigation ratio (such as 2:1 or 3:1) to its mitigation acreage so that Poseidon considers mitigation that may be "out of kind" or provided at some distance from the affected area. Staff, however, has not and cannot provide examples of any California entrainment mitigations that have applied a mitigation ratio on top of a conservative "in-kind" approach to mitigation that is consistent with CEC methodology, such as the mitigation acreage contained in the MLMP. Moreover, the MLMP ensures that Poseidon will provide "in-kind" restoration in the Southern California Bight similar to the affected area in the Lagoon.

For these reasons, Poseidon asks the Commission to approve its 42.5 acreage calculation over that proposed by Staff to ensure that the Project's mitigation is consistent with prior Commission approvals rather than subject to an obligation that is based on un-proven methodology.

## II. PHASED MITIGATION IS APPROPRIATE FOR THIS PROJECT

Poseidon's phased approach to mitigation would fully compensate for the Project's impacts to marine life under either of the power plant's operating scenarios. The initial phase of the mitigation plan would provide 37 acres of wetland restoration, which would fully compensate for Project-related impacts during the period when both the Encina Power Station ("EPS") and the Project are operating ("Phase I"). The second phase would provide up to 5.5 acres of additional restoration to address any additional unmitigated impacts occurring from Project operations when the EPS is decommissioned or when the EPS is providing less than 15% of the water needed for the Project based on the EPS's average water use over any three-year period[1] ("Phase II"). Below, Poseidon has identified the benefits of phased mitigation for this Project and explained why Staff's arguments against phasing are unsupported and inconsistent with the benefits that phasing would provide.

### A. Phase I Mitigation Over-mitigates Project Impacts

Under Phase I, Poseidon would restore 37 acres of wetland habitat similar to the affected habitats in Agua Hedionda Lagoon. Using CEC and prior Coastal Commission methodology, the Phase I mitigation would mitigate 87% of the total requirements for the Project's "stand alone" operations (when the EPS has ceased operating). Accordingly, the Phase I mitigation

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[1] This threshold is very conservative. The Phase I restoration project would fully mitigate the Project's impacts as long as at least 13% of the Project's seawater requirements are provided by the EPS. Poseidon's MLMP is conservative in that it requires Poseidon to implement Phase II mitigation if the EPS is providing an average of less than 15% of the Project's seawater requirements over a three-year period.

would fully mitigate the Project's impacts as long as at least 13% of the Project's seawater requirements are provided by the EPS. By providing this level of mitigation while the Project and the power plant are both operating, Poseidon will perform more mitigation than what is necessary to mitigate this stage of the Project's operations. For example, in the last 18 months the EPS would have provided over 65% of the water needed for the Project. Based on that number, Poseidon would have been required to provide only 14.9 acres of mitigation using CEC methodology and Commission precedent. Poseidon's Phase I restoration of 37 acres would be approximately 2.5 times the mitigation actually required. Therefore, through the phased approach to mitigation, Poseidon is actually providing the substantial majority of the mitigation required for the Project's stand-alone operations up front.

### B. Phase II Mitigation Provides New Opportunities to Reduce Impacts

The MLMP requires Poseidon to implement mitigation measures for Phase II (including up to 5.5 acres of additional restoration) if the EPS stops using its existing seawater intakes for cooling purposes, or if the intakes provide less than 15% of Poseidon's needed water based on the EPS' average water use over any three-year period ("Phase II Pre-Conditions"). To ensure that the Commission is aware of the amount of water the EPS is providing to the Project, and when Phase II mitigation should commence, the MLMP requires Poseidon to submit that information to the Executive Director annually.

Wetland habitat restoration under Phase II would credit the 37 acres of restoration already provided for under Phase I, and provide assurances that stand-alone operations are fully mitigated in Phase II. Once either of the Phase II Pre-Conductions occur, the MLMP requires Poseidon to: (1) analyze the environmental effects of ongoing Project operations; (2) use that analysis to investigate and evaluate reasonably feasible technologies that are unavailable today, which may reduce any marine life impacts; and (3) provide its analysis of environmental effects and its evaluation of any reasonably feasible technologies to reduce marine life impacts to the Commission within 24 months. Accordingly, the Commission will be able to determine if Poseidon can further reduce the Project's impacts to marine life through reasonably feasible technologies, and may proportionally reduce Poseidon's habitat restoration obligation for Phase II mitigation based on that mitigation.[2]

In addition, Poseidon may assume dredging obligations of the Agua Hedionda Lagoon from the EPS within 24 months of the occurrence of either Phase II Pre-Condition, if feasible.[3] If Poseidon assumes dredging obligations, it will provide evidence of its obligations to the Commission, along with an analysis of how Lagoon dredging is beneficial to the Lagoon and

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[2] Note that in the event the Phase II Pre-Conditions do not occur, Poseidon's approval from the State Lands Commission requires Poseidon to undertake a substantially similar evaluation of environmental effects of ongoing Project operations and to investigate and evaluate new and developing technologies that are unavailable today to reduce any marine life impacts ten years after Project operations commence. Accordingly, if the State Lands Commission requires Poseidon to implement any such technologies that constitute "development", such development would be subject to Coastal Commission review and approval.

[3] Since Special Condition 12 of the Project's Coastal Development Permit requires Poseidon to obtain a new Permit approval from the Coastal Commission for any dredging activities, the Commission shall have oversight over any Lagoon dredging.

how such dredging activities may entitle Poseidon to some amount of restoration credit. (See Section C below).

In the event that Poseidon does not assume Lagoon dredging obligations (for example, if the EPS never fully ceases use of its intakes but operates the intakes at very low levels and continues to dredge the Lagoon), Poseidon's MLMP requires it to develop a plan within 24 months in which: (1) the Commission shall evaluate whether Poseidon's 37 acres of wetland restoration under Phase I has fully mitigated the Project's stand-alone operations; and (2) the Commission may reduce Poseidon's Phase II restoration based on the reduction to marine impacts caused by Poseidon's implementation of new, reasonably feasible technologies (as discussed above).

Accordingly, phased MLMP implementation would provide a tremendous incentive for Poseidon to investigate and invest in new technologies and opportunities to further reduce Project impacts and avoid additional mitigation costs. If Poseidon is required to provide all of the mitigation for the "stand-alone" operations upfront, there is substantially less incentive to invest in additional avoidance measures. In addition, the opportunity for the Commission to consider these issues once Project operations have commenced is another valuable benefit of phased implementation of the MLMP: with phased mitigation, Poseidon, the Commission and other regulatory agencies would have an opportunity to measure the actual impacts of the Project, and to evaluate new opportunities to further reduce the impacts and refine the scope of the Phase II mitigation as necessary to ensure the "stand-alone" Project impacts are fully mitigated.

If the Commission determines that none of the above-opportunities are feasible or if these opportunities in combination with the Phase I mitigation plan do not fully mitigate the "stand-alone" Project impacts, then the MLMP requires Poseidon to restore up to an additional 5.5 acres consistent with the performance standards and objectives used for the 37 acres provided under Phase I restoration.

### C. Phased Mitigation is Not Speculative

Commission Staff argue in the Staff Report that the Commission should require Poseidon to provide all mitigation up-front, rather than in two phases, because it considers "phasing to be speculative in that it is tied to unknown future operations of the power plant." Staff's argument is without merit. As set forth in MLMP Section 1.1, Poseidon will be obligated to provide the Executive Director annually with data demonstrating the power plant's seawater intake for the prior year, which will ensure that the Commission is always informed of the power plant's operations. Since the MLMP requires Poseidon to undertake Phase II mitigation when the power plant is decommissioned or when it provides less than 15% of the Project's water over a three-year period, the Commission will have the necessary data about power plant operations so that it will not need to "speculate" about when Poseidon will need to implement Phase II mitigation.

Staff also contends in the Staff Report that tying phased mitigation to the power plant's operations would be "inappropriate" because the power plant is not a co-applicant on the Project's Permit. Poseidon's Permit application and the Commission's approval, however, provide that the desalination facility's intake would be connected to the power plant's discharge

channel. Accordingly, the discharge from the power plant, to the extent it is available, will serve the Project's needs. In the past 18 months, the power plant would have provided over 65% of the water needed for the Project. It is both appropriate and there is no prohibition on allowing the phased approach proposed by Poseidon.

In addition to the reasons discussed above, a phased approach to mitigation for this Project is based on sound policy for the following three reasons:

- (1) EPS will operate indefinitely: As discussed above, while the EPS continues to operate, it will provide a significant portion of the seawater required for the Project, and the need for Project mitigation would be proportionally reduced. The power plant's generating capacity is subject to "Reliability Must Run" status, as contracted by the California Independent System Operator (Cal-ISO), which is meant to provide electrical grid reliability. At the October 2007 State Lands Commission meeting, an EPS representative testified that the units will remain in service indefinitely and that Cal-ISO would determine when they are no longer needed for grid stability. Further, in a July 12, 2007 letter to the Commission, EPS stated that at least two of its generating units "can be reliably operated for the foreseeable future." Because the power plant will continue to operate in some capacity and provide water to the Project, requiring more than 37 acres of mitigation up-front would substantially over-mitigate the Project's impacts for many years.

- (2) Phasing allows the Commission to retain authority and evaluate impacts: Due to the phased approach, the Commission would have ongoing involvement in the implementation of the MLMP alongside other regulatory agencies. This will allow the Commission to evaluate the impacts of the Project's *actual* operations, rather than relying on estimates, and will enable the Commission to more accurately determine what additional mitigation should be required to fully mitigate the Project's marine impacts (if any).

- (3) Other regulatory agencies retain authority to evaluate and address impacts: The Regional Water Quality Control Board ("Regional Board") and the State Lands Commission have indicated that upon decommissioning of the power plant, they will undertake an environmental review of the Project to determine what, if any, additional design, technology or mitigation measures should be required. Further, and to the extent that there are modifications to the Project as a result of power plant decommissioning or to comply with State Lands Commission or Regional Board requirements, such modifications would also be subject to review by the Coastal Commission for Coastal Act compliance.

For these reasons, Poseidon asks the Commission to reject Staff's argument about phasing, and to approve Poseidon's MLMP as set forth in Exhibit A, without Staff's recommended changes from the Staff Report.

## III. LAGOON DREDGING CREDIT SHOULD BE EVALUATED IN THE FUTURE

Pursuant to Poseidon's proposed MLMP, the Commission may decide at a later date whether Poseidon should receive any restoration credit for assuming dredging obligations of the Agua Hedionda Lagoon. Poseidon has not requested that dredging credit be applied to its mitigation obligations now; on the contrary, Poseidon is asking the Commission only to leave open the possibility of allowing such credit in the future if Poseidon assumes dredging obligations. Staff argues, however, that the Commission should decide now that Poseidon's potential dredging is not subject to restoration credit – even though approval of the MLMP does not involve any dredging approval.

Staff argues that Lagoon dredging would be inconsistent with Special Condition 8's requirement that mitigation be in the form of creation, enhancement or restoration of wetland habitat, but that argument is not supported by the evidence. The Lagoon supports a wide range of beneficial uses, including over 300 acres of marine wetlands and a variety of recreational activities, and needs to be dredged for those uses to continue. The sand dredged from the Lagoon would be placed on adjacent beaches so as to maintain, restore and enhance habitat for grunion spawning and enhance opportunities for public access and recreation along the shoreline. In recognition of the value these uses, the Commission previously granted wetlands restoration credit for inlet maintenance for Edison's SONGS project, and this precedent allowed one acre of restoration credit for every 3.3 acres of tidally exchanged wetlands supported by dredging. As applied to Poseidon, such credit would represent seventeen times the required 5.5 acres of mitigation required under Phase II. The MLMP does not specify the amount of restoration credit Poseidon should receive for dredging, and ultimately the Commission would need to determine the amount of credit to which Poseidon is entitled (if any) if Poseidon applies for such credit.

Finally, Staff argues that credit for dredging cannot be granted because EPS is obligated to dredge the Lagoon, and there is neither an agreement with EPS for Poseidon to undertake dredging nor is EPS a co-applicant for the Project. As discussed above, Poseidon is not asking for dredging credit now, only the possibility of such credit in the future, and Poseidon would provide the Commission with any dredging agreement with EPS, or a new Coastal Development Permit Application that may include EPS as a co-applicant, at the time it requests such credit. Accordingly, Staff's argument is without merit, and Poseidon asks the Commission to approve the MLMP as proposed by Poseidon in Exhibit A.

# Item W16a
# Exhibit 4

# Transcript of August 6, 2008 hearing (Commission deliberations only)

whoever makes the motion.

**CHAIR KRUER:** Exactly.

**EXECUTIVE DIRECTOR DOUGLAS:** Right.

**CHAIR KRUER:** Exactly, and your process sounds rational, but then it might even take longer. I am not sure.

**EXECUTIVE DIRECTOR DOUGLAS:** Yes, those are the points of differences, right.

**CHAIR KRUER:** Okay.

You don't get to speak, Mr. Geever.

**MR. GEEVER:** Mr. Chairman, I am going to ask you for an exception.

**CHAIR KRUER:** No, I am not going to give any exceptions tonight, at this hour, no, sir, cannot do it.

**MR. GEEVER:** I wanted to take issue with --

**CHAIR KRUER:** Well, you are not entitled to rebuttal. We have closed the public hearing, first of all.

**MR. GEEVER:** Okay.

**CHAIR KRUER:** Thank you, sir.

Okay, Commissioner Hueso.

[ **MOTION** ]

**COMMISSIONER HUESO:** Thank you.

I am going to move that we approve the Marine Life Mitigation Plan attached to the staff recommendation, as Exhibit 1, if modified as shown in Section 1.1 below, and Exhibit 2 of this memorandum as compliant with Special

Condition 8 of CDP E-06-013.

And, I will have some modifications.

**CHAIR KRUER:** Okay, it has been moved by Commissioner Hueso, seconded by --

Is there a "seconded" to your motion?

Anyone want to "seconded" it.

**COMMISSIONER LOWENTHAL:** Second.

**CHAIR KRUER:** Seconded by Commissioner Lowenthal.

Would you like to speak to your motion?

**COMMISSIONER HUESO:** I would actually like to go through some of the modifications with staff, and maybe go over some of their recommendations that they have made, just to understand how they apply it.

We have gone over this in the discussion, but I would like to go over, for example, Modification No. 1, says Poseidon shall create or restore between 55 and 68 acres of coastal estuarine wetland habitat within the Southern California bite.

My question to staff about that, I mean, there were a lot of complaints about there not being a specific area, and staff also followed up that there aren't really expressed locations, in terms of where this mitigation will take place. In your recommendation, is that still the condition, in terms of we don't know where this is going to take place?

**ENVIRONMENTAL SPECIALIST LUSTER:** Staff consulted with the SONGS Scientific Advisory Panel, and our recommendation is based on input we got from the panel.

The conditions that the Commission imposed on Edison for the San Dieguito site, those were issued before Edison had selected its site, and so we feel that if Poseidon meets the same conditions that Edison was held to, and selects a site within the Southern California bite, that would provide adequate assurance that subsequent plans that come to you would be sufficient.

**COMMISSIONER HUESO:** So, we can still work out locations, in terms of optimizing the location, and there is the benefit of the improvements.

**ENVIRONMENTAL SPECIALIST LUSTER:** Right, as long as they are held to the same conditions SONGS was.

**COMMISSIONER HUESO:** And, getting to this specific acreage, you put a range of 55 to 68, that was your recommendation. Now, that is not a very, very specific number. Is that based on, again, putting the burden on the applicant to come back with a plan that mitigates the impacts of the project?

**ENVIRONMENTAL SPECIALIST LUSTER:** Staff felt that that was a decision for the Commission.

The two figures are based on the levels of confidence that derive from the study. If the Commission

wants 80 percent confidence that they would insure full mitigation for the impacts, the 55 acres, staff believes, would be sufficient. If you want 95 percent confidence in your decision, then you go with the higher number.

So, the Commission could either decide on a specific figure, this evening, or if Poseidon came back later, with a mitigation proposal, somewhere within that range, that would be the other option.

**COMMISSIONER HUESO:** So, is it so accurate, is it possible to get 95 percent with 37 acres? You are saying, is it impossible? is it improbable? is it that accurate? in terms of the possibility of getting the kind of mitigation that we want within a certain amount of acreage? Can that be achieved through a very intense mitigation monitoring of a specific acreage amount?

**ENVIRONMENTAL SPECIALIST LUSTER:** If you don't mind I will ask Dr. Raimondi to answer that.

**COMMISSIONER HUESO:** Sure.

**ENVIRONMENTAL SPECIALIST LUSTER:** He has far more expertise.

**MR. RAIMONDI:** There are really two issues here, you have addressed one of the. One of them is the amount of acreage that is required, and the other is insuring that it works, because, clearly, you could put in 50, 70, 100 acres and if it doesn't work, you get no compensation.

The key thing here is using the information that Poseidon provided, and just using what I laid out there -- and again, we are not using any data that didn't come from Poseidon -- the 80 percent really is 55 acres, and the 95 really is 68. In addition, you would still need to monitor it, to make sure that it works, because 68 acres of garbage is no compensation.

So, there are two issue, really.

**COMMISSIONER HUESO:** So, in terms of maybe hearing from Poseidon's representatives, in terms of what they can guarantee, in terms of providing the adequate mitigation for the project, you are saying you can do it with 42.5 acres is the claim that you are making?

**MR. ZBUR:** Yes, I mean I think we think that based upon the standards that were used for the Morro Bay Plant, and for the Moss Landing Plant, that the acreage amount consistent with that would be 42.5 acres.

**COMMISSIONER HUESO:** And, what level of mitigation would 42 acres provide?

**MR. ZBUR:** It would provide --

**COMMISSIONER HUESO:** In terms of a percentage?

**MR. ZBUR:** It would present 100 percent mitigation for the stand-alone operations.

**COMMISSIONER HUESO:** If monitoring showed that it didn't, would that mean that you are not let off the hook.

You would have to come back and do some work?

**MR. ZBUR:** Well, I think that one of the concerns that we have about the adoption of the staff recommendation is that it, basically, is just a very vague recommendation, if we conform it to the SONGS approach, which had a lot of details, which were related to a much, much larger restoration program, including very significant costs.

So, one of the things that we were hoping you would do is to use the -- start with the Poseidon plan, and if you wanted to make changes with respect to the acreage, and I think we want -- phasing is an important thing. Not having any phasing, really restricts the number of sites that we can do, that we can get entitled and ready to go on line, within the 24 months that the plan has required.

I mean, one of the things that is very important for us is that we are able to not delay the operation of the plant, and in order to not delay the operation of the plant, we need as broad a number of sites, as possible, and obviously, we are requiring all of that up front, so it potentially restricts the number of sites, and that makes it less likely --

**COMMISSIONER HUESO:** And, that would be required to come back to the Coastal Commission for approval, for each project?

**MR. ZBUR:** What the Poseidon proposal does is it

would require 37 acres up front. We would have to come back to the Coastal Commission within 24 months for a CDP for that project, at least 37 acres.

**COMMISSIONER HUESO:** That is 24 for the 37 acres? and, then?

**MR. ZBUR:** And, then, the Poseidon proposal was that we would have to do the additional acreage at the time that there was stand alone operations occurring, which would be that the power plant would completely shut down, or provides less than 15 percent of the water.

And, I actually wanted to dispute, there is a lot of information on the record which we can site, that provides explanation as to what the basis was of those figures.

**COMMISSIONER HUESO:** So, how did you come up with the 42.5? that is the 37 plus the 5.5 acres?

**MR. ZBUR:** Yes, the 37 plus the 5.5 acres. The 42 acres is using the CEC methodology that was used for the Morro Bay and Moss Landing. The 37 acres was, in part, picked because the San Dieguito site, which is not the site that we will, necessarily, go to -- there are still issues with respect to permitting on that site -- but, we know that we can get 37 acres out of the San Dieguito site, if we can resolve issues with the JPA and some of the other entities involved in the site.

**COMMISSIONER HUESO:** So, under of the staff's

recommended modifications, now where it says, under 1.1 on 1 we have to come up with a determination on the acres, and on No. 2 in conformity with Exhibit 2 -- and we will get to that a little bit later -- and in No. 3 it says when the 60 days of the Commission's approval of the modified plan, Poseidon shall submit for Executive Director's review an approval and review -- excuse me -- of a revised plan that includes these modifications.

So, that is not necessarily -- you are asking for 24 months, as opposed to 60 days? does that condition apply to that?

**MR. ZBUR:** I didn't think we had any disagreement with the staff on the timing of when the CDP had to come back.

**ENVIRONMENTAL SPECIALIST LUSTER:** Right, and the 60 days refers to once we decide on a plan this evening, that Poseidon returns within 60 days, and that incorporates all of the changes that are made. If we end up with some conditions, some Poseidon has proposed, and some staff has proposed, that there is one plan that encapsulates all of that.

**COMMISSIONER HUESO:** So, that would be taken care of by No. 3? there is no disagreement on timing for that?

**ENVIRONMENTAL SPECIALIST LUSTER:** I don't think there is any disagreement.

**COMMISSIONER HUESO:** Special Condition No. 2, that refers to Exhibit 2, are there any disagreements on Item No. 2?

**ENVIRONMENTAL SPECIALIST LUSTER:** Yes, staff's recommendation in Exhibit 2, those are the conditions that the Commission required of SONGS. Staff modified some of those conditions to reflect some updates, and mitigation approaches, and you know, removed references to SONGS and Edison and replaced them with Poseidon.

**COMMISSIONER HUESO:** Why are we referencing SONGS, specifically, because of their approach to the mitigation? what you are doing is recommending that exact same approach?

**ENVIRONMENTAL SPECIALIST LUSTER:** Yes, going back a ways, over the last several months we have been working with Poseidon and up until about a month ago, Poseidon's proposal was to mitigate at San Dieguito adjacent to the SONGS restoration site, and they had come up with a very detailed preliminary plan, showing the number of acres of the different types of habitat, hydraulic analyses, showing the change in tidal flows, that sort of thing. And, so we were basing our approach, up until then on consistency with the adjacent SONGS restoration site. It all changed in the last month.

We now no longer have that site as the selected mitigation area, but in consulting with the SONGS scientists,

we believe that the conditions that SONGS was held to would be applicable to Poseidon if they did estuarine restoration somewhere else in the Southern California bite.

So, that is how we ended up with proposing the SONGS conditions.

**COMMISSIONER HUESO:** Okay, and what part of those conditions can't you achieve?

**MR. ZBUR:** The SONGS conditions?

**COMMISSIONER HUESO:** Yes.

**MR. ZBUR:** I think what you have attached to the motion that we suggested that you make, included many things to respond to the staff's concerns relating to the inconsistencies within the SONGS plan. I don't think that there are very many, but I am trying to figure out what they are, frankly.

I think the only change, really, is with respect to how significant the funding and -- you know, the SONGS plan required the funding of a number of scientists, and really very frequent reports back to the Commission about the restoration plan. And, I think our plan, because it is a much smaller restoration effort, did not anticipate imposing that kind of costs, I mean, the number of scientists that would be employed full time with annual reports -- workshops, it wasn't even reports -- workshops back to the Commission.

So, I think that is the major change that remains

isn't it? plus the phasing and the number of acres.

**COMMISSIONER HUESO:** Couldn't you propose that as part of your mitigation plan? I mean, tell me here where it is that specific, where it calls out a specific number of scientists, and project management staff, and the other things you alluded to?

**MR. ZBUR:** Well, basically, it is not in our plan. It is in, basically, the old SONGS plan. There is a general recommendation, and a staff recommendation that we make this consistent with the SONGS plan.

It is in Section 1.0 Administration, and 2.0 Budget and Work Program. There are differences between the SONGS approach, which required --

**EXECUTIVE DIRECTOR DOUGLAS:** Mr. Chairman, if I may, I think this is going to be virtually impossible for us to work through tonight.

**COMMISSIONER HUESO:** I agree, I mean --

**EXECUTIVE DIRECTOR DOUGLAS:** I think, if you would just work on major issues --

**COMMISSIONER HUESO:** Exactly.

**EXECUTIVE DIRECTOR DOUGLAS:** -- and then ask us to work with Poseidon, in terms of how we implement it, I think that is what everybody is looking to at the end of the day.

You know what our recommendations are on the points of contention. If you go with our recommendation on

acreage, fine, we will work through what the nature of the plan will have to be. If you go through each one of these, at least you will be able to act on the plan tonight, and we then come back and work through some of the details of what exactly has to be in the plan, relative to whether or not it is exactly tracking with the SONGS approach, or not.

But, that is something that we can work out. You have to decide the fundamental questions here, and if we have a dispute over any of those other items, we can bring those back to you, too. But, at least, in terms of what you have got before you, and what you have asked us to bring to you, was something that you could act on today that would lead to the issuance of the permit, and we were trying to do that.

I think the best way for you to go through it is to address the issues in contention.

**MR. ZBUR:** I think we would be comfortable in working out the issues with the staff, in terms of consistent with the SONGS, as they really are not that different.

I think the one thing we would ask that the Commission consider as part of the motion is that the detail with respect to the budget is something that we could work out with the staff, and potentially that would be -- the budget, in terms of how much we have to spend could be determined at the time the CDP comes forward.

**COMMISSIONER HUESO:** And, would you like a

specific acreage amount to be decided today? or could that be done through your discussions with the applicant?

**EXECUTIVE DIRECTOR DOUGLAS:** I think that is pretty fundamental. I get the sense, from talking with them, that that is what they want you to decide, and we would like that guidance, too.

**COMMISSIONER HUESO:** Well, I am going to propose then, a --

**CHAIR KRUER:** Well, you have prefaced your --

**COMMISSIONER HUESO:** Okay.

**COMMISSIONER LOWENTHAL:** [ Inaudible ]

**COMMISSIONER POTTER:** Mr. Chair, if I might, I am prepared to move through these items in an amending form, and then we can give direction accordingly.

**CHAIR KRUER:** Well, just a --

Yes, go ahead, sir.

**COMMISSIONER LOWENTHAL:** [ Inaudible ]

**COMMISSIONER POTTER:** Unless there is the desire to belabor this kind of conversation, anyway.

**CHAIR KRUER:** Commissioner Lowenthal, you don't have a problem with Commissioner Potter going?

**COMMISSIONER LOWENTHAL:** No.

**CHAIR KRUER:** Okay, thank you.

[ **MOTION** ]

**COMMISSIONER POTTER:** Okay, I offer an amending

motion that the restoration acreage be 55.4 acres.

I need a "second" and then I will speak to it, briefly.

**COMMISSIONER HUESO:** I'll second it.

**CHAIR KRUER:** It has been moved by Commissioner Potter, seconded by Commissioner Hueso.

**COMMISSIONER POTTER:** My concern is that wetland restoration, I am compelled by the testimony by staff that the higher percentage of success is with the 55 or 68 number. That said, I also am concerned that this deal of like-kind restoration, that they not get credit for a restoration project that is not similar to this wetland.

The attachment that is here, Exhibit A, it does go through a fairly involved criteria, with minimum standards and objectives. I believe that that incorporated with the increased acreage would get us to a successful wetland mitigation project. That is my logic.

**CHAIR KRUER:** Okay, and the "seconder" Commissioner Hueso, no question, please. Do you want to speak to it?

**COMMISSIONER HUESO:** No.

**CHAIR KRUER:** Okay, any other Commissioners?

Yes, Commissioner Shallenberger.

**COMMISSIONER SHALLENBERGER:** Question to the maker of the motion. If it turns out that this doesn't adequately

-- I mean, are there any performance standards that you are proposing to put in so that we know whether or not at the end of monitoring that 55.4 has, in fact, mitigated it?

**COMMISSIONER POTTER:** I think the CDP that comes in is going to be conditioned for the project, is due in 24 months, and is going to have all of those necessary standards as part of that CDP application, that is my belief.

**COMMISSIONER SHALLENBERGER:** My question is which one rules? In other words, if we adopt the 5.4 now, and --

**COMMISSIONER POTTER:** It is 55.4.

**COMMISSIONER SHALLENBERGER:** -- 55.4, sorry, and right you are, and when we, in 24 months when we get the CDP, and the performance standard show that maybe that doesn't --

**COMMISSIONER POTTER:** It is proposed --

**EXECUTIVE DIRECTOR DOUGLAS:** No, if I may.

**CHAIR KRUER:** Yes, Director Douglas.

**EXECUTIVE DIRECTOR DOUGLAS:** The way that I understand this would work is that 55.4 acres is what they have to restore. There are performance standards that have to be met, and to the extent that those performance standards aren't met, they have to take remedial action, but that doesn't necessarily mean an increase. It means that they have to go back and make the changes that are necessary to make it function to the level that it meets the performance standards. And, that is built into the --

**COMMISSIONER POTTER:** And, specific to that, the 5.0 in here, with the wetlands monitoring management remediation, reads monitoring management remediation shall be conducted over the full operating life of Poseidon's desalination facility, which shall be 30 years.

So, there is never going to be a lapse of non-monitoring or mitigation.

**CHAIR KRUER:** Okay.

Commissioner Wan.

**COMMISSIONER WAN:** Yeah, along the lines of what Commissioner Shallenberger was talking about, you know, I don't have -- I think the problem here is that, as it has been pointed out, we don't really have the plan in front of us. We have the elements here of what will be a plan, and that makes things very difficult and very uncomfortable, because you can say, well, they will come in in 24 months, and they will be required to do 55.4 acres of restoration, and there will be some performance standards, of which I don't know what they are now.

There will be monitoring, of which I, essentially, don't know what that monitoring is, and then they will be required to meet these performance standards on these 55.4 acres, but what happens if it turns out that they can't? what happens if it turns out that after all is said and done, because at this point, we do not even know where these acres

are going to be located, so it is very difficult to really know if it is adequate. What happens then? and there is where I am really uncomfortable with what we am doing now.

I was going to talk about the total issue of uncertainty, and whether you use 50 percent uncertainty, or 80 percent in the 50 percent, plus mitigation.

But, even if you go with the 55.4 it is the uncertainty because we don't have a plan in front of us now. We are putting off the actual plan for 24 months that I don't know how you can do it.

**CHAIR KRUER:** Okay.

Commissioner Reilly.

**COMMISSIONER REILLY:** Well, the uncertainty isn't with performance standards or whether they are going to be able to do it. The uncertainty has to do with the impact of their project. And, it is not going to change.

Whatever performance standards we put on their mitigation, for success, is not going to change the analysis or the level of confidence that this Commission needs to be able to set mitigation acreage, so those are two separate issues, I believe.

And, you know, when this comes back, and you know a couple of us were here for Edison -- little grayer than we were then -- but, we were here, and when this comes back what is going to be before the Commission is adoption of an entire

restoration plan, you know, agreement on baselines, agreement on what performance standards we are going to use on this, and I am sure we are going to go back to some of the ones we have done before, and take a look at that. We are going to make decision on status reports. We are going to make decision on workshops and what period of time we do them over, and so all of those things will be before us, along with we will have an identification, hopefully, by then, of the sites that are involved, and but none of that has to do with setting the acreage. The acreage is based on the analysis, and the percentage level of confidence we have based on uncertainties.

I don't have a problem with going forward with this.

**CHAIR KRUER:** Okay, thank you, Commissioner Reilly.

**EXECUTIVE DIRECTOR DOUGLAS:** And, this is the approach that we took in San Onofre.

**CHAIR KRUER:** And, I am going to call for the question.

**COMMISSIONER HUESO:** I do want to include the concept of phasing into --

**COMMISSIONER POTTER:** I am going to move each one individually.

**CHAIR KRUER:** Phasing is in there.

Okay, with that, again the maker and seconder are asking for a "Yes" vote on the amending motion.

Would the Clerk call the roll.

**SECRETARY MILLER:** Commissioner Blank?

**COMMISSIONER BLANK:** Yes.

**SECRETARY MILLER:** Commissioner Burke?

**COMMISSIONER BURKE:** Yes.

**SECRETARY MILLER:** Commissioner Lowenthal?

**COMMISSIONER LOWENTHAL:** Yes.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.

**SECRETARY MILLER:** Commissioner Kram?

**COMMISSIONER KRAM:** [ Absent ]

**SECRETARY MILLER:** Commissioner Neely?

**VICE CHAIR NEELY:** Yes.

**SECRETARY MILLER:** Commissioner Potter?

**COMMISSIONER POTTER:** Aye.

**SECRETARY MILLER:** Commissioner Reilly?

**COMMISSIONER REILLY:** Yes.

**SECRETARY MILLER:** Commissioner Shallenberger?

**COMMISSIONER SHALLENBERGER:** No.

**SECRETARY MILLER:** Commissioner Wan?

**COMMISSIONER WAN:** No.

**SECRETARY MILLER:** Commissioner Achadjian?

**COMMISSIONER ACHADJIAN:** Aye.

**SECRETARY MILLER:** Chairman Kruer?

**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Nine, two.

**CHAIR KRUER:** Nine, two, the motion passes. Next, on this.

**COMMISSIONER POTTER:** Yes, Mr. Chair --

**CHAIR KRUER:** Yes, Commissioner Potter.

[ **MOTION** ]

**COMMISSIONER POTTER:** -- before the tech crew took away the chart of options, and decided it was better to look at us -- okay, there we go.

I believe the next issue was the phased implementation, and I am prepared to move the phased implementation approach, that is proposed in the Poseidon recommendation, and if I get a "second" I'll speak to it.

**COMMISSIONER HUESO:** Second.

**COMMISSIONER POTTER:** The original approach was to take the 37.5 and then the balance up to the 42 and phase that. I am under the impression that they can do the 37 in the 2-year period, so then it leaves, basically, the balance between the 37 and 55, so whatever that is -- and my math says it is 18.4, so that would be the second phase.

And, the details of that is to be worked out by staff. What staff wanted was direction on these items, and so for that reason I would throw that out as the approach.

**CHAIR KRUER:** Okay, Commissioner Hueso?

Commissioner Reilly.

**COMMISSIONER REILLY:** I would be willing to support that if the Phase 2 had a time certain placed on it. And, you know, we are talking about bringing it back within 2 years. They are anxious to get this project up and going, I understand, and in their concern, they may not be able to get -- well, they were concerned that they weren't going to be able to get 42.5 acres, I am assuming they are concerned they are not going to be able get 55.4 within a 2-year period.

I am willing to let them come back with 37 on a Phase 1, but from the time of that approval of Phase 1, I don't think we should let more than 5 years pass before we require the Phase 2 to come back.

**COMMISSIONER POTTER:** And, I would include that --

**CHAIR KRUER:** Is that okay with you, Commissioner Potter, as the maker of the motion?

**COMMISSIONER POTTER:** -- in my recommendation.

**CHAIR KRUER:** Commissioner Hueso, is that okay with you?

**COMMISSIONER HUESO:** Yes.

**CHAIR KRUER:** Okay, is there anyone else who wants to speak to that amending motion?

Commissioner Lowenthal.

**COMMISSIONER LOWENTHAL:** So, with the acreage

change to 55.4 what would Phase 2 acreage be?

**COMMISSIONER POTTER:** It would be 18.4.

**COMMISSIONER LOWENTHAL:** So, it will be clearly the difference as what is in the report?

**COMMISSIONER POTTER:** Yes.

**CHAIR KRUER:** Yes, and thank you, Commissioner Lowenthal.

**EXECUTIVE DIRECTOR DOUGLAS:** What I understand the motion to be is that the initial acreage is 37, that has to be done, and then according to their suggestion for phasing, which is when the power plant goes down --

**COMMISSIONER POTTER:** No, that got changed to 5 years.

**EXECUTIVE DIRECTOR DOUGLAS:** Okay, so the second phase comes in when?

**COMMISSIONER POTTER:** Within 5, that is per the Reilly idea.

**COMMISSIONER REILLY:** Five years after your approval on Phase 1.

**EXECUTIVE DIRECTOR DOUGLAS:** All right, that is more workable, thank you.

**CHAIR KRUER:** Commissioner Wan.

**COMMISSIONER WAN:** I still have a problem with the phasing, although with the time certain, it is a little bit better, because we are going to have a long period of time

where are going to have impacts, and we are not going to have any mitigations for those impacts.

And, in part, that is because I don't know when this is going to come on line, relative to these dates, and you have to remember, that if you start with 37 acres 2 years from now, it takes time to build it, and it takes even more time, quite a few years, before it is actually functioning.

So, we are now looking at 2 years before they start, to, probably, you know, 5 or 6 years down the road before we even start to get anything out of the first phase, and if you add some time on it, by the time you get, quote, full mitigation, if you ever do, you are talking about 10 years, and you have had all of those impacts you haven't accounted for.

And, so pushing this out, remember it takes time for all of this. Pushing it out this way really leaves us with a whole lot of impacts to that ocean without any mitigation.

**CHAIR KRUER:** Commissioner Reilly.

**COMMISSIONER REILLY:** I don't disagree with what Commissioner Wan said, but I would point out that SONGS operated for 20 years before we got that mitigation, so and we finally got it, and it is happening, and I think there is a balance here betweem being able to move forward on this project, for the local water needs, and our being able to

nail down the mitigation that fully mitigates what is going on, in terms of impacts.

**EXECUTIVE DIRECTOR DOUGLAS:** And, I might add that the 5-year component is 5 years from what?

**COMMISSIONER REILLY:** Adoption of Phase 1.

**EXECUTIVE DIRECTOR DOUGLAS:** The permit for Phase 1. It may be that they decide, in looking at that, that it is better to do it all at once, and they may, indeed, find an area that is big enough to accommodate the whole thing, so that would be an option open to them.

But, at least, this way, it is workable and we don't get into the ambiguity of when does it trigger, and when does it not.

**CHAIR KRUER:** Commissioner Scarborough, then Commissioner Shallenberger.

**COMMISSIONER SCARBOROUGH:** That was -- thank you, Chair, that was part of my question, was it 2 plus 5, or how did you get to the 5 plus 5, but I also wondered what would be the association, or the relationship between the 5 years, versus when the power plant does, potentially, close? I didn't understand why Poseidon had chosen the plant closing, and was wondering if I could enquire with them why that was chosen, and how it relates to 5?

**CHAIR KRUER:** Okay.

**MR. ZBUR:** The reason why we had suggested doing

the phasing at the plant closing is because, essentially, at that time we think there will be other kinds of technologies we can put in place that would reduce the potential impingement entrainment impacts that we don't have now, because we have to, basically, rely on the power plant flow, so that is why we thought that at that point we would have a technology incentive to avoid additional mitigation by doing it through avoidance and technology.

So, that is why we prefer doing it at the power plant closure.

**COMMISSIONER SCARBOROUGH:** What is the estimated time of that? time frame?

**MR. ZBUR:** It is uncertain. I mean, it could be a few years, or it could be a long time. According to the methodology, we are fully mitigated in the interim on the 37 acres, under the 50 percent compensated criteria, we would be fully mitigated, 2.5 times mitigated at the get go, until -- that is where that 15 percent number came from. We are fully mitigated until you get to the power plant only operating 15 percent of the time.

**COMMISSIONER REILLY:** That is where we got the 7 years.

**CHAIR KRUER:** Commissioner Shallenberger.

**COMMISSIONER SHALLENBERGER:** Yes, I would like to hear from staff, Dr. Raimondi, about what you think about the

phasing? and how workable that is?

**MR. RAIMONDI:** I am not going to comment about the motivation for the phasing, but the practicality of it, as we have had some experience with SONGS.

In the SONGS permit there was language that allowed there to be restoration, and up to 2 wetland areas. There was the initial phase where there was the selection of the wetlands, where restoration could be done, and in the end, Southern California Edison, and their partners, decided it was logistically more easily to do it at a single wetland for all sorts of reasons. It minimized the monitoring, it minimized the costs associated with the permitting, it minimized the construction costs, it was just cheaper to do it.

Another thing about it, and again, it is going to matter how you decide to do the monitoring, but with SONGS they are on the hook for working for what they call the full operating life of the plant.

So with phasing you are going to have two sequences. You will have the first 37 acres, which will go for a 30-year period, if you adopt that, and then the second 17 or 16 acres that will be out of phase with that, and will go longer, so that becomes problematic from a monitoring standpoint, financially, as well, because you have to carry the monitoring longer.

**COMMISSIONER SHALLENBERGER:** But, it is problematic to the project proponent, not to us, in terms, I mean, they could decide to do them all at once.

**MR. RAIMONDI:** Yes, but there is a stronger issue, and that is it is way better. It is possible, and I am sympathetic to them, at this point, about being able to find the acreage, but it is way better for the system if it is 55 rather than two pieces. You are going to have much more likelihood of it working, and it is probably going to link into other restorations, so from an ecological point of view, bigger is better.

**CHAIR KRUER:** Right, okay.

**COMMISSIONER POTTER:** Well, just as the maker, to that issue. It is a real estate issue. I mean if the opportunity is out there, and during this period of working with staff, they realize we would do better to do it in one fell swoop, fine then come back and tell us that.

I understand the logic behind what you are saying, but it is going to be more of a property acquisition problem is my suspicion.

**CHAIR KRUER:** Okay.

Commissioner Lowenthal, and then we are going to call for the question, if that is okay with everybody, unless there is somebody who hasn't spoken yet.

**COMMISSIONER LOWENTHAL:** I wanted to just be clear

on when the second -- I know we have the 5-year time frame, but just from the proponent's presentation there were different triggering mechanisms, so under our new scheme what would actually trigger Phase 2?

**EXECUTIVE DIRECTOR DOUGLAS:** It would be 5 years from the first phase, that is, the 37 acres, which has to come in for a permit within 24 months, as I understand it, right, and then once that permit is issued, that is what I understand, then the 5-year period is triggered.

But, I would suggest that the maker of the motion also incorporate in it that if they want to do the entire amount together, that that would be okay, they don't have to wait.

**COMMISSIONER POTTER:** I literally stated that 3 minutes ago, but that is my intention, and I think everybody else concurs, that if they come back and can do it great, okay.

**EXECUTIVE DIRECTOR DOUGLAS:** Okay.

**CHAIR KRUER:** Okay, and we are going --

Ms. Schmeltzer, we are going to call for the question. I thought I mentioned.

**CHIEF COUNSEL SCHMELTZER:** I am sorry, I just did want to make sure, on this timing question, I thought I heard the Executive Director say two different things.

There is the provision of coming in for a permit

within 24 months, and it being issued within the 24 months --

**COMMISSIONER POTTER:** Specific to the 37, and if they want to go ahead and try to do more at that time, for economy sake, then fine, they can go to the full 55.4, but they have an option to go ahead and do it in a phase.

**CHIEF COUNSEL SCHMELTZER:** Right, and I understand that, but if they just do the 37 within the first 24 months, that the trigger is not -- the trigger is within 24 months. It is not if the permit takes longer than that to issue.

**COMMISSIONER POTTER:** No.

**EXECUTIVE DIRECTOR DOUGLAS:** No, my understanding was, that they have to come in for a permit within 24 months, and then it depends on what the Commission does. They may have conditions about the issuance of that permit. My understanding was that the 5 years starts from the issuance of the permit.

**COMMISSIONER REILLY:** That is correct.

**COMMISSIONER POTTER:** Correct.

**CHAIR KRUER:** That is correct, Mr. Douglas, thank you.

Yes, Commissioner.

**COMMISSIONER SCARBOROUGH:** I am not sure where you are headed with your phasing in your motions, where does the dredging fit into this?

**COMMISSIONER POTTER:** I was going to that in the

next --

**CHAIR KRUER:** We will get to -- I think we are going to call the question, here, and then we will get to the other amending, if there are other amending things.

Again, the amending motion, the maker and seconder are asking for a "Yes" vote.

Would the Clerk call the roll, please.

**MR. ZBUR:** Mr. Chair, can I just so there is not a dispute on this, can I just make sure there is clarity on what the timing is on the motion. We are assuming it is 24 months --

**COMMISSIONER POTTER:** I am hoping it gets moved sometime tonight.

**MR. ZBUR:** -- 24 months -- well, only because I -- 24 months to get our application in, which is what we thought it was, and then from the date that the permit is issued, so if it takes 9 months or a year to get the permit approved, from the date the permit is issued, then the 5 years runs, and then I assume that we have to get another permit application in within that 5 years?

**COMMISSIONER POTTER:** That is correct.

**CHAIR KRUER:** Correct.

**MR. ZBUR:** Thank you for that clarification.

**CHAIR KRUER:** Okay, thank you.

*Would the Clerk call the roll, please.*

**SECRETARY MILLER:** Commissioner Burke?
**COMMISSIONER BURKE:** Yes.
**SECRETARY MILLER:** Commissioner Lowenthal.
**COMMISSIONER LOWENTHAL:** Yes.
**SECRETARY MILLER:** Commissioner Hueso?
**COMMISSIONER HUESO:** Yes.
**SECRETARY MILLER:** Commissioner Kram?
**COMMISSIONER KRAM:** Yes.
**SECRETARY MILLER:** Commissioner Neely?
**VICE CHAIR NEELY:** Yes.
**SECRETARY MILLER:** Commissioner Potter?
**COMMISSIONER POTTER:** Aye.
**SECRETARY MILLER:** Commissioner Reilly?
**COMMISSIONER REILLY:** Yes.
**SECRETARY MILLER:** Commissioner Shallenberger?
**COMMISSIONER SHALLENBERGER:** Yes.
**SECRETARY MILLER:** Commissioner Wan?
**COMMISSIONER WAN:** Yes.
**SECRETARY MILLER:** Commissioner Achadjian?
**COMMISSIONER ACHADJIAN:** Aye.
**SECRETARY MILLER:** Commissioner Blank?
**COMMISSIONER BLANK:** Yes.
**SECRETARY MILLER:** Chairman Kruer?
**CHAIR KRUER:** Yes.
**SECRETARY MILLER:** Unanimous.

**CHAIR KRUER:** Okay, the amending motion passes.

Commissioner Potter, do you have anymore amending motions?

**COMMISSIONER POTTER:** I am going to actually ask for staff clarification on these last two items. I think they blend together.

Staff is saying that new technologies not appropo, or in this consideration, and the applicant is saying they would like the ability to utilize new technology.

And, the other one is this dredging credits, can you explain what the conflicts are here?

**EXECUTIVE DIRECTOR DOUGLAS:** What I understand, relative to the new technology, that is that if they can come up the way that they had originally proposed it, if they come up with technology that shows that they can filter the water and avoid entrainment impacts, because of new technology, that there ought to be some adjustment in the mitigation requirement.

It seems to me that one way you could address that, and you know, we have some sympathy for that position. Obviously, if we could avoid the impacts altogether, that would be the best. But, if in that 5-year period, for the second phase, they can come up with technology that shows that they are not having impacts, you could then factor that into whether or not it necessary to add that. But, take that

into account in the permit that would be applied for in the Phase 2.

**COMMISSIONER POTTER:** Okay, with that said, I move that we amend to allow to encourage the use of new technologies --

**CHAIR KRUER:** Commissioner Potter.

**COMMISSIONER POTTER:** He spoke, I didn't preface.

**CHAIR KRUER:** Let me, just to be clear on it. I am not sure about that.

Let me just go to Vice Chair Neely for one second, and then I am coming right back to you for your motion. There is a question of you prefacing.

**COMMISSIONER POTTER:** I would like to know where in the law you can't speak anyway. I think that is something that Rusty Arias made up from his stay in the state assembly.

**VICE CHAIR NEELY:** Mr. Chairman, I don't have any questions at this time.

**CHAIR KRUER:** Okay, Commissioner Potter.

[ **MOTION** ]

**COMMISSIONER POTTER:** All right, I'll move to amend, and incorporate in the motion that we encourage the use of new technologies under the framework that was expressed by the Executive Director.

**COMMISSIONER HUESO:** I'll second it.

**COMMISSIONER POTTER:** With the intent of lessening

the impact.

**CHAIR KRUER:** Just a second.

Commissioner Potter has made the motion, and recommending a "Yes" vote, and Commissioner Hueso seconded that motion.

Commissioner Potter, would you like to speak to that motion?

**COMMISSIONER POTTER:** No, I think Mr. Douglas and I worked pretty well on that item. That was exactly what I wanted him to say, so thank you.

**COMMISSIONER REILLY:** Mr. Chairman.

**CHAIR KRUER:** That is why it was prefaced.

**COMMISSIONER REILLY:** Let me ask.

Staff is going to be incorporating the concept of the 2-year application, and the 5 years afterwards, is staff willing, in discussing that 5 years, willing to incorporate language that suggests that they look into new technology to lessen impacts, and that as part of that 5-year hearing, if they are able to do that, could be a review of mitigation requirement?

**EXECUTIVE DIRECTOR DOUGLAS:** Well, that is what I discussed, and I think that is what the motion would do, and we don't have a problem with that.

**COMMISSIONER REILLY:** Are you willing to just incorporate that into the staff?

**EXECUTIVE DIRECTOR DOUGLAS:** I would rather have the Commission do it.

**COMMISSIONER REILLY:** That's fine, okay.

**CHAIR KRUER:** Commissioner Wan.

**COMMISSIONER WAN:** I just have a question on this one, and that is, I am assuming it is always okay, if you can avoid the entrainment, that is the best, because the fact is -- I don't care what you say -- no matter what mitigation you perform, no matter how you try to compensate for it, you never get full compensation. So, the best thing is always avoidance, so I am certainly not opposed to that.

The question I want to make sure is that when they come back for the review, that we are talking about a review that requires some kind of proof, and not just a statement, "We want to use it." That there is going to be some real scientific analysis done to make sure that that is the case, because up until now there doesn't seem to be anything that has been developed that can avoid the entrainment, and we went through that in great and painful detail when we did SONGS.

So, I am not aware of it, and I just want to make sure that we know how this is going to be handled.

**EXECUTIVE DIRECTOR DOUGLAS:** Obviously, the proof would have to be that there are reductions in impacts, or elimination of impacts, in order for us to consider -- if

this motion passes -- a reduction of the Phase 2 mitigation requirement.

But, this leaves that open, and it is up to them to try to find that technology, and again, if they decide right up front, we are not going to worry about that, we are just going to do the 55.4 acres, then it becomes a moot point.

**CHAIR KRUER:** Okay.

**EXECUTIVE DIRECTOR DOUGLAS:** But, it leaves open that opportunity.

**CHAIR KRUER:** Okay, I am going to call on the amending motion.

Priscilla's got her pen up, and we'll need a brief break.

Call the roll, please, on the amending motion, on the technology.

**SECRETARY MILLER:** Commissioner Lowenthal?

**COMMISSIONER LOWENTHAL:** [ inaudible ]

**VICE CHAIR NEELY:** Speak up, she can't hear you.

**COMMISSIONER LOWENTHAL:** Yes.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.

**SECRETARY MILLER:** Commissioner Kram?

**COMMISSIONER KRAM:** Yes.

**SECRETARY MILLER:** Commissioner Neely?

**VICE CHAIR NEELY:** Yes.

**SECRETARY MILLER:** Commissioner Potter?

**COMMISSIONER POTTER:** Aye.

**SECRETARY MILLER:** Commissioner Reilly?

**COMMISSIONER REILLY:** Yes.

**SECRETARY MILLER:** Commissioner Shallenberger.

**COMMISSIONER SHALLENBERGER:** Yes.

**SECRETARY MILLER:** Commissioner Wan?

**COMMISSIONER WAN:** Yes.

**SECRETARY MILLER:** Commissioner Achadjian?

**COMMISSIONER ACHADJIAN:** Aye.

**SECRETARY MILLER:** Commissioner Blank?

**COMMISSIONER BLANK:** Yes.

**SECRETARY MILLER:** Commissioner Burke?

**COMMISSIONER BURKE:** Yes.

**SECRETARY MILLER:** Chairman Kruer?

**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Unanimous.

**CHAIR KRUER:** The amending motion passes.

Commissioner Potter, any more?

[ **MOTION** ]

**COMMISSIONER POTTER:** I am going to move that the dredging restoration credit be at the Commission's discretion, and if I get a "second" I'll speak to it.

**COMMISSIONER HUESO:** Second.

**CHAIR KRUER:** Moved by Commissioner Potter, seconded by Commissioner Hueso.

Commissioner Potter, would you like to speak to your motion?

**COMMISSIONER POTTER:** I think my concern is, and this is sort of an open ended question, that whether they can even get ownership of the dredging operations, and can incorporate that in, remains pretty much unanswered, and may remain there for awhile.

So, if there does seem to be a dredging plan that comes forward, and we can get something tangible there about how is going to be operated? who is going to do it? when it is going to occur? all of those ingredients, then it is up to the Commission to decide if that is something that we want to entertain at that time. That is my thought behind it.

**CHAIR KRUER:** Okay, Commissioner Potter or Commissioner Hueso, anything else?

Anyone else? Commissioner Wan.

**COMMISSIONER WAN:** Just very quickly, if you are going to leave this open for the discretion -- and I think I heard Commissioner Potter say this, but I just want to make sure -- there is one thing, there is a big difference between dredging connected with maintaining the project, and dredging for mitigation, because as in SONGS it is required for the mitigation, and as long as the dredging credit is understood,

it is for whatever future project they are going to be dredging for, not for the desal plant, then I would find that acceptable.

**COMMISSIONER POTTER:** That is --

**COMMISSIONER WAN:** You understand the distinction?

**CHAIR KRUER:** Commissioner Reilly.

**COMMISSIONER REILLY:** If I understood the staff correctly, earlier, your statement was if dredging becomes part of the project, and becomes a reality, as opposed to a possibility, then staff would do a full analysis of that activity, at that time, both in terms of impacts and in terms of benefits, and be prepared to make recommendations relative to whether additional conditions had to be added, or benefits would be accorded to that.

I guess, I would prefer to wait to see what happens with that issue, before we pre-judge it, that's all.

**EXECUTIVE DIRECTOR DOUGLAS:** That is the way we understand it, and this motion would just say that they could come in for credit for dredging, but they would have to prove that it warrants it, so that is fine with us.

**CHAIR KRUER:** Okay.

Call for the question.

Clerk, would you call the roll, please. They are asking for a "Yes" vote, on the amending motion.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.
**SECRETARY MILLER:** Commissioner Kram?
**COMMISSIONER KRAM:** Yes.
**SECRETARY MILLER:** Commissioner Neely?
**VICE CHAIR NEELY:** Yes.
**SECRETARY MILLER:** Commissioner Potter?
**COMMISSIONER POTTER:** Aye.
**SECRETARY MILLER:** Commissioner Reilly?
**COMMISSIONER REILLY:** No.
**SECRETARY MILLER:** Commissioner Shallenberger?
**COMMISSIONER SHALLENBERGER:** Yes.
**SECRETARY MILLER:** Commissioner Wan?
**COMMISSIONER WAN:** No.
**SECRETARY MILLER:** Commissioner Achadjian?
**COMMISSIONER ACHADJIAN:** Aye.
**SECRETARY MILLER:** Commissioner Blank?
**COMMISSIONER BLANK:** Aye.
**SECRETARY MILLER:** Commissioner Burke?
**COMMISSIONER BURKE:** No.
**SECRETARY MILLER:** No?
**COMMISSIONER BURKE:** [ Inaudible ]
**SECRETARY MILLER:** Commissioner Lowenthal?
**COMMISSIONER LOWENTHAL:** Yes.
**SECRETARY MILLER:** Chairman Kruer?
**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Nine, three.

**CHAIR KRUER:** Nine, three, the amending motion passes.

And, now we will need back to the main motion, okay. Back to the motion, and again the maker and the seconder are asking for a "Yes" vote.

Commissioner Wan has her hand up.

**COMMISSIONER WAN:** Just on the main motion, this is not an amending motion, and I just want a quick explanation as to why I am going to vote "No" and the reason I am going to vote "No" is that I don't believe, if you look at this whole thing, that we really are getting the kind of assurances we need that this is real mitigation, and the reason is -- and that this is adequate mitigation -- this is going to be doing, this facility, once it becomes a stand alone facility, essentially, what once-through cooling does, and once-through cooling has been found by the courts to be a violation of the *Porter Cologne Act*, and I don't see how -- I don't even know why you bother to phase out the power plant, if you are just going to substitute something that is going to do exactly the same thing. It is not acceptable, because it is not protective of the ocean.

Our oceans are under horrific assault, and this kind of thing is simply not appropriate, particularly, when we get a plan that is -- we deferred our decision, we passed

the power plant, deferred the decision on the mitigation, and now we are again with all of the things that we had in the amending motions, deferring the real plan for another 2 years.

We will not see a full plan, and I don't think you can approve a mitigation without the appropriate plan, and if I had a full plan in front of me, it might be different, but I don't, and without that I don't have the confidence to know just the real extent of the mitigation that is going to take place here.

And, let me, again, say mitigations here, as elsewhere, does not give you complete compensation.

**CHAIR KRUER:** Okay, would the Clerk call the roll on the main motion, please, as amended by the Commission.

**SECRETARY MILLER:** Commissioner Kram?

**COMMISSIONER KRAM:** Yes.

**SECRETARY MILLER:** Commissioner Neely?

**VICE CHAIR NEELY:** Yes.

**SECRETARY MILLER:** Commissioner Potter?

**COMMISSIONER POTTER:** Aye.

**SECRETARY MILLER:** Commissioner Reilly?

**COMMISSIONER REILLY:** Yes.

**SECRETARY MILLER:** Commissioner Shallenberger?

**COMMISSIONER SHALLENBERGER:** Yes.

**SECRETARY MILLER:** Commissioner Wan?

**COMMISSIONER WAN:** No.

**SECRETARY MILLER:** Commissioner Achadjian?

**COMMISSIONER ACHADJIAN:** Aye.

**SECRETARY MILLER:** Commissioner Blank?

**COMMISSIONER BLANK:** Yes.

**SECRETARY MILLER:** Commissioner Burke?

**COMMISSIONER BURKE:** Yes.

**SECRETARY MILLER:** Commissioner Lowenthal?

**COMMISSIONER LOWENTHAL:** Yes.

**SECRETARY MILLER:** Commissioner Hueso?

**COMMISSIONER HUESO:** Yes.

**SECRETARY MILLER:** Chairman Kruer?

**CHAIR KRUER:** Yes.

**SECRETARY MILLER:** Eleven, one.

**CHAIR KRUER:** Okay, the Commission hereby approves the main motion, as amended by the Commission.

We will take a break.

*

*

[ Whereupon the hearing concluded at 7:35 p.m. ]

# W 15a
# W 16b

## ADDENDUM TO COMMISSION PACKET

## FOR

## ENERGY, OCEAN RESOURCES and

## FEDERAL CONSISTENCY

For Wednesday, December 10, 2008

**Item No. W 15a** **E-08-012**
Chevron

- Staff Modifications

**Item Nos. 16b** **E-06-013**
Revised Condition Compliance Findings
Poseidon Resources Corporation

- Staff Modifications
- Ex Parte Communications
- Correspondence

STATE OF CALIFORNIA – THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, GOVERNOR

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# W15a

December 10, 2008

TO: Coastal Commissioners and Interested Parties

FROM: Alison Dettmer, Deputy Director

RE: **Addendum to Staff Report for Coastal Development Permit (CDP) Application E-08-012**

The Commission staff recommends the following modifications to the staff report for CDP Application E-08-012. Proposed changes are illustrated by ~~strikethroughs for deletions~~ and underlines for additions.

The first paragraph on Page 2 shall read:

> In this application, Chevron proposes to construct a 5,060-foot long segment of a perimeter fence and remove 90 feet of existing fencing at the former Guadalupe Oil Field in San Luis Obispo County. The new fence is required by Condition 106 of ~~Chevron's~~ County-issued Coastal Development Permit/Development Plan ("CDP/DP") D890558D...

The third paragraph on Page 2 shall read:

> The entire site is designated ESHA in the County's LCP. The site includes the mouth of the Santa Maria River and wetland ponds A, B and C. Although Chevron designed the fence and its location to minimize impacts to wetlands, ESHA and wildlife, construction of the fence will unavoidably cause temporary and minor impacts to about .23 acres of jurisdictional wetlands and ESHA within the Coastal Commission's original jurisdiction. All work will be done manually with hand tools. The fencing project will provide long-term habitat preservation benefits by preventing cattle from accessing the site and damaging those habitat areas.

Special Condition 2 on Page 4 shall read:

> 2. **Public Access Signs.** Prior to construction of Segment 1 of the fence, Chevron shall submit to the Coastal Commission's Executive Director for review and approval final

design of ~~the~~ a beachfront ~~fence~~ signs (including size, color, and wording) and sign locations.

The fourth paragraph on Page 6 shall read:

*In this application, Chevron proposes to construct a 5,060-foot long segment of a perimeter fence at the former Guadalupe Oil Field.* The former oil field (now called the Guadalupe Restoration Project) is owned by Union Oil Company of California. In 2005, Union Oil became an indirect subsidiary of Chevron Corporation. Chevron Environmental Management Company now conducts the site activities on behalf of Union Oil....

The first paragraph on Page 9 shall read:

Of the total length of fence proposed within the Coastal Commission's permit jurisdiction (5,060 feet), 3,105.7 feet would be located in an area designated as State of California jurisdictional wetlands. *The work includes placement of fence posts within wetlands. Fence* posts are "fill" as that term is defined in the Coastal Act.[1] Building the fence would impact 0.14 acres of state-designated wetlands within the Coastal Commission's original jurisdiction (this assumes a two-foot wide fence installation corridor) due to (a) minor trimming of willows along the fence corridor near the Santa Maria River floodplain and dune swales; (b) possible limited occurrences of ORVs driving over herbaceous wetland vegetation; and (c) digging holes for support posts…

Paragraphs 3 and 4 on Page 9 shall read:

**1. Allowable Use:** The proposed fence is a component of the overall *Guadalupe Oil Field* Restoration Project and is required by a condition of ~~Chevron's~~ County-issued CDP/DP for the remediation and restoration of the 2,800 site. ..

**2. No Feasible Less Environmentally Damaging Alternative:** The second test of Coastal Act Section 30233(a) allows for the placement of fill in wetlands if there is no feasible less environmentally damaging alternative to the development. Unocal, the ~~former~~ landowner, pursued a number of alternatives to installing a perimeter fence to keep out cattle. These included: …

The first sentence of the first full paragraph on Page 10 shall read:

Chevron, who now conducts site activities on behalf of Union Oil~~the new former oil field property owner~~, also considered a number of fencing alternatives…

[1] Coastal Act Section 30108.2 states, ""Fill" means earth or any other substance or material, including pilings placed for the purposes of erecting structures thereon, placed in a submerged area."

Paragraphs 1 and 2 under Section 5.3 on Page 13 shall read:

The segment of the fence within the Coastal Commission's jurisdiction would be located in an area bounded on the south by the Rancho Guadalupe County Park. The closest recreational access to the beach west of the former Guadalupe Oil Field is provided by two entrances to the Dunes Complex. One entrance is located at the Rancho Guadalupe County Park in Northern Santa Barbara County, immediately south of the Santa Maria River, and the other entrance is four miles north of the Guadalupe Field at the Oso Flaco Lake Natural Area in San Luis Obispo County. The public uses the beach west of the site along the beach, but presently there is no coastal public access allowed through the field. There is a ~~horizontal~~ limited public access easement[2]~~, however,~~ landward of the mean high tide line. (See Exhibit 2.) The beginning of the fence (Segment 1) starts approximately 250 feet east (landward) of the ~~mean high tide line~~ easternmost boundary of the easement. ~~Lateral public access occurs along the shoreline and is permitted along the western boundary of the overall site.~~ The fence would not impede lateral public access in any manner.

Condition 30 of Chevron's Minor Use Permit DRC2007-00103 for the fence requires Chevron immediately upon completion of Segment 1 of the fence to "post signage at the westernmost terminus of the southern boundary segment of the fence to explain that trespassing onto the project site is not allowed, but the fence is not intended to impede public access, ~~along the easement below the mean high tide line.~~" Chevron proposes ~~to place two~~ an off-white colored 18" by 24" signs ~~on the fence, each 18" by 24"~~. **Special Condition 2** of this permit requires Chevron, prior to construction of Segment 1 of the fence, to submit to the Coastal Commission's Executive Director for review and approval final sign design (including size, color, and wording) and sign location.

[2] Within the easement area public access is to be controlled and restricted to walking and hiking in small organized groups.

STATE OF CALIFORNIA—THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, GOVERNOR

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# W16b

December 9, 2008

**TO:** Coastal Commissioners and Interested Parties

**FROM:** Alison J. Dettmer, Deputy Director
Tom Luster, Staff Environmental Scientist

**SUBJECT:** Addendum to E-06-013 Revised Condition Compliance Findings for proposed Energy Minimization and Greenhouse Gas Reduction Plan – Poseidon Resources (Channelside) LLC – Carlsbad Desalination Facility

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## STAFF NOTE

[Please note that this Staff Note replaces in its entirety the Staff Note in the November 26, 2008 Revised Condition Compliance Findings.]

This Addendum includes recommended modifications to staff's November 26, 2008 Revised Condition Compliance Findings. It also provides several *ex parte* forms Commission staff received before December 9, 2008, and briefing materials Poseidon provided to Commissioners. The recommended modifications herein cover three main areas [note – all page numbers refer to staff's November 26th report]:

- Clarification (on pages 12-13 and 20) that Poseidon may request the Executive Director approve the use of offsets from entities other than the California Air Resources Board, the California Climate Action Registry, or any state air district, if offsets from those entities are not available at a price reasonably equivalent to offsets in the broader domestic market. This modification also corrects a minor typographical error on page 13.

- Clarification (on page 22) that the approved Plan will mitigate the project's net GHG emissions to the maximum extent feasible.

- Added language similar to that from the August 2008 Findings related to the Plan's annual reporting requirements.

- Clarification (on pages 3, 6-7, 10, 12-15, 17, and 19) that Poseidon may obtain RECs from entities other than CARB, CCAR, or the Air District.

Based on staff's review of the record, staff believes the recommended Revised Condition Compliance Findings, as modified herein, accurately reflect the Commission August 6, 2008 approval of Poseidon's Energy Minimization and Greenhouse Gas Reduction Plan. Staff therefore recommends the Commission **approve** the Findings, as modified.

**STAFF RECOMMENDED MODIFICATIONS TO THE REVISED FINDINGS:**

Staff recommends the Commission adopt the modifications as described below, or as shown in ~~strikethrough~~ and **bold underline**. Please note that recommended Findings from the November 26th report are shown in plain text.

**Pages 1 & 2, Staff Note:**

Delete the entire Staff Note.

**Page 3, bulleted paragraph, continuing to page 4:**

1) Except as set forth in the Plan's contingency provisions (as described below in Section 4.0 of these Findings), Poseidon is to implement the Plan's provisions regarding offsetting the project's net GHG emissions using the protocols, criteria, and mechanisms provided by Assembly Bill 32 (AB 32):
   a. Use CARB-, CCAR-, or California Air District-approved protocols and mechanisms for all emission reduction measures proposed**, except for Renewable Energy Credits (RECs)**[3] to offset the net GHG emissions from Poseidon's purchased electricity. On-site and project-related measures identified in the Plan are used to calculate the project's net GHG emissions and therefore are not subject to the CARB, CCAR, or Air District requirements for offsetting the net GHG emissions.[4]
   b. Join the CCAR "Climate Action Reserve" or other entities that require the use of CARB-, CCAR-, and/or California Air District-approved protocols to implement the Plan's emission reduction measures**, except for RECS,** and provide necessary accounting of those measures."

"[3] **Each REC confirms that one megawatt of electricity was generated from renewable energy (e.g., wind, solar, geothermal, etc.). The Plan provides that the acquisition of RECS is not limited to purchase from CARB, CCAR, or the Air Districts.**"

**Pages 6 & 7, Section 1.1, bullets a) and b):**

a) "Use California Air Resources Board (CARB), California Climate Action Registry (CCAR), and/or California Air District approved protocols and mechanisms for all emission reduction measures proposed to offset the net GHG emissions from Poseidon's purchased electricity use**, except for RECs**.[6] On-site and project-related measures identified in the Plan are used to calculate the project's net GHG emissions and are therefore not subject to the CARB, CCAR, or Air District requirements regarding offsetting the net GHG emissions.[7]
b) Join the CCAR "Climate Action Reserve" and other entities that require the use of CARB-, CCAR-, or California Air District-approved protocols to implement the Plan's emission reduction measures and provide necessary accounting of those measures**, except for RECs**."

"[6] **As noted previously, each REC confirms that one megawatt of electricity was generated from renewable energy (e.g., wind, solar, geothermal, etc.). The Plan provides that the acquisition of RECS is not limited to purchase from CARB, CCAR, or the Air Districts.**"

**Page 10, second full paragraph:**

"Based on the above, it is appropriate for the Commission to use AB 32 and its implementing regulations, protocols, criteria, and mechanisms as the basis for its review and approval of the provisions of Poseidon's Plan regarding offsetting the project's net GHG emissions. The Commission includes the Plan's identified on-site and project-related measures as part of Poseidon's calculation of the project's net GHG emissions and these measures**, along with RECs,** therefore will not be subject to the Commission's requirement that Poseidon use CARB-, CCAR-, or Air District- approved AB 32 **regulations,** protocols**, or mechanisms** regarding offsets for net GHG emissions. **The California Center for Sustainable Energy (CCSE) or other consultant will prepare annual reports that will, among other things, analyze whether Poseidon acquired offsets and/or RECs in accordance with the Plan's requirements, including consistency with the six AB 32 criteria identified below. The annual report is subject to the Executive Director's review and approval.** This approach is supported by other agencies that have been involved in Commission staff's review, including CARB, the San Diego Air Pollution Control District (SDAPCD), the State Lands Commission (SLC), and the California Energy Commission (CEC), all of which requested that Poseidon use AB 32 provisions to develop and implement its Plan. Implementing Coastal Act requirements using the terms, criteria, and mechanisms provided through AB 32 would result in the Plan's conformity to **Special Condition 10**. Additionally, this would ensure the Plan is consistent with the state goals and targets expressed in AB 32, and would result in maximum credible and verifiable emissions reductions."

**Page 12, first partial paragraph, last sentence:**

"Only the remaining provisions of the Plan intended to offset the project's net GHG emissions**, except for RECs,** are subject to CARB-, CCAR-, or Air District-approved AB 32 protocols."

**Page 12, last paragraph, continuing to page 13:**

"As recommended by CARB and other agencies, Commission staff provided in its review of Poseidon's proposed Plan an initial application of these six criteria to assess whether Poseidon's suggested emissions reduction measures might conform to AB 32. The Commission finds in Section 4.0 of these Findings that emission reduction measures to offset the project's net GHG emissions**, except for RECs,** must comply with CARB-, CCAR-, and/or Air District-approved measures and protocols and that Poseidon must purchase or implement these offsets through CCAR, CARB, or a California air district. If offsets cannot be acquired through these entities ~~due to price or inadequate supply~~ **at a price that is reasonably equivalent to the price for offsets in the broader domestic market**, Poseidon may request the Commission's Executive Director to approve purchases of offsets or implementation of projects from other entities. Poseidon may also, upon approval of the Executive Director or the Commission, deposit funds into an escrow account in lieu of purchasing offsets/RECs in the event that (i) offset/REC projects in an amount necessary to mitigate the Project's net indirect GHG emissions are not reasonably available; (ii) the "market price" for carbon offsets or RECs is not

reasonably discernable; (iii) the market for offsets/RECs is suffering from significant market disruptions or instability; or, (iv) the market price has escalated to a level that renders the purchase of offsets/RECs economically infeasible to Poseidon. The funds placed in escrow will be paid in an amount equal to $10 per metric ton, adjusted for inflation from 2008, and will be used to fund offset projects as they become available, with the Executive Director or Commission determining the entities that may use these funds and the time period for which this contingency may be used. With these modifications, the Plan is consistent with ***Special Condition 10*** and applicable Coastal Act requirements."

**Page 14, last partial bulleted paragraph describing Section 4.2.1**:

"***Section 4.2.1*** – Use CARB-, CCAR-, and/or California Air District-approved protocols and mechanisms for all emission reduction measures proposed**, except for RECs,** to offset the net GHG emissions from Poseidon's purchased electricity are "net zero"."

**Page 15, bulleted paragraph near top of page describing Section 4.2.2:**

"***Section 4.2.2*** – Join the CCAR "Climate Action Reserve" and other entities that require the use of CARB-, CCAR-, or California Air District-approved protocols to implement the Plan's emission reduction measures**, except for RECs,** and provide necessary accounting of those measures."

**Page 17, last paragraph, continuing to page 18:**

"As noted in Section 2.0, AB 32 includes a number of provisions meant to apply to emission reductions measures such as those Poseidon is proposing to offset its net GHG emissions. The Commission's primary modification is to require that Poseidon's Plan use these provisions to ensure these proposed emission reduction measures (i.e., those needed to reach net zero emissions after on-site and project-related measures are factored in), **except for RECs,** fit within the framework California has established for this type of project. The existing or anticipated protocols and mechanisms being implemented by CARB, CCAR, and/or California Air Districts pursuant to AB 32 can be used to evaluate these proposed emission reduction measures**, except for RECs**."

**Page 19, first partial paragraph:**

"The best way to ensure Poseidon's Plan provides the intended result – that is, to mitigate for Poseidon's net indirect GHG emissions – is for the Plan's offset provisions to be based on the protocols and mechanisms that are already approved or that will be approved pursuant to AB 32. The Commission's approval therefore requires that, with respect to offsetting the project's net GHG emissions (i.e., for other than Poseidon's identified on-site and project-related measures), **except for RECs,** Poseidon ~~to~~ must select emission reduction measures and project proposals for which there are CARB-, CCAR-, or California Air District-approved project protocols and must purchase emission reduction offsets or credits**, except for RECs,** approved by CARB-, CCAR-, or California Air District-accredited verifiers."

**Page 19, last paragraph:**

"As noted above, AB 32's criteria are expected to apply to a wide range of emission reduction measures, including those implemented for both regulatory and voluntary efforts, which include Poseidon's. The Commission has determined, therefore, that the Plan will use one set of criteria – those established in AB 32 – to apply to the measures it proposes to mitigate for the net indirect GHG emissions resulting from its use of purchased electricity.[18] This allows Poseidon's Plan to use a single, clear, and applicable set of criteria by which some of its emission reduction measures can be verified and incorporated into California's emission reduction framework. Trying to implement the Plan using three sets of different and sometimes overlapping or conflicting criteria would likely cause confusion and uncertainty and would not allow some of Poseidon's proposed measures to be adequately reviewed and verified. By relying on these criteria and on ~~CARB's and CCAR's implementation of AB 32~~ **each year's review and approval by the Executive Director of Poseidon's annual report**, the Commission will have adequate assurance that Poseidon's modified Plan will conform to ***Special Condition 10***. The Commission will also be assured that its review will be consistent with the framework the state has selected for addressing the need to reduce GHG emissions, and Poseidon will be able to validate **some of** its GHG **emission reduction efforts** ~~offset measures, including RECs,~~ as part of California's program."

**Page 20, first paragraph, last sentence:**

"The Commission also authorizes the Executive Director to approve, upon Poseidon's request, the use of emission reduction measures that may be available from entities other than CARB, CCAR, or the Air Districts **if offsets are not available from CARB, CCAR, or the Air Districts at a price that is reasonably equivalent to the price of offsets in the broader domestic market**."

**Page 21, second paragraph:**

"The Commission modifies the Plan to require that Poseidon join CCAR's Climate Action Reserve, which is a program within CCAR, so that it could ~~it implement some of~~ **acquire and verify offsets purchased under** its Plan through the Reserve. The Reserve was designed specifically for the voluntary GHG emission reduction market. The Reserve provides account holders accurate and transparent measurement, verification, and tracking of GHG reduction projects and inventories of their GHG ~~reductions~~ **offsets**, thus assuring a high degree of integrity."

**Page 22, first full paragraph:**

"The Commission finds that the Project's energy minimization features described above will minimize the Project's energy consumption in accordance with Coastal Act Section 30253(4) and reduce impacts to coastal resources. Additionally, the Plan will mitigate impacts from the desalination facility's net GHG emissions from electrical usage by requiring all such net GHG impacts of the project be offset, and the Commission finds that the Plan will mitigate to the **maximum** extent feasible impacts on coastal resources

of the project's net GHG emissions, in accordance with applicable Coastal Act policies, including Section 30260."

**Page 22-23, Section 4.3:**

**4.3 Submit annual reports for Commission staff review and approval**

"Poseidon's Plan includes an annual review process to ensure that the Commission has an opportunity to review the results of Poseidon's implemented emission reduction measures each year and to determine conformity to ***Special Condition 10***. Poseidon has agreed to provide an annual report for Executive Director review and approval (see Exhibit 1 insert: July 24, 2008, *Memorandum to File – Plan Modifications Agreed to By Poseidon and Commission Staff*). **As noted in the Plan, Poseidon will have its contractor initially analyze and validate the project's annual GHG emission calculations, the positive or negative balance of Poseidon's net emissions, the acquisition of offsets and/or RECs, and other related information.** The type and amount of emission reductions is expected to vary each year based on the annual update of SDG&E's certified emission factor and the amount of electricity Poseidon purchases each year from SDG&E.

~~However, the current Plan proposes a complex reporting method involving different timelines, committee review, RFP submittals and approvals, accounting methods, and other elements. Staff's recommendation is that Poseidon's annual report submittal be based on the review and timing needed to conform to the particular AB 32-related review processes Poseidon chooses to implement its Plan.~~ The report ~~should~~ **is to** describe and account for all approved emission reduction measures and **is to** include both an annual and cumulative balance of Poseidon's net emissions~~; however, the particular mechanisms to develop each year's report may vary. For example, as a member of the Reserve described above, Poseidon will have its own account that reflects the amount of emission reductions credits it owns. This accounting service negates the need for Poseidon's committee, SDAPCD, or Commission staff to perform this function. It also eliminates the need for the committee to serve as a third-party reviewer, as this would be provided by the Reserve.~~

~~If Poseidon were to join the Reserve and use its accounting services for the annual report, the review process would be simplified and would provide Commission staff with a full account of its emission reduction credits that are CARB and/or CCAR-approved.~~ This ~~recommendation would also~~ provide**s** the Commission with the necessary level of assurance that Poseidon's Plan is conforming to **Special Condition 10** and meeting the Commission's expectations as expressed in its Findings."

# W 16b

# E-06-013
## Revised Condition Compliance Findings
## (Poseidon Resources Corporation)

# EX PARTE COMMUNICATIONS

# FORM FOR DISCLOSURE OF EX PARTE COMMUNICATIONS

Name or description of project , LCP, etc: Poseidon Resources Corporation Carlsbad Desalination Facility CDP E-06-013, Agenda Items W16a, and W16b

Date and time of receipt of communication: December 2, 2008; 10:00 a.m.

Location of communication: Telephonic

Type of communication (letter, facsimile, etc.): Telephonic meeting with Chair Patrick Kruer

Person(s) initiating communication: Susan McCabe, McCabe & Company
Rick Zbur, Latham & Watkins LLP
David Goldberg, Latham & Watkins LLP
Peter MacLaggan, Poseidon Resources
Charlie Stringer, Renewable Resources

**Detailed substantive description of content of communication:**
(Attach a copy of the complete text of any written material received.)

Poseidon representatives discussed Poseidon's concerns regarding Staff's Revised Condition Compliance Findings for the project's Energy Minimization and Greenhouse Gas Reduction Plan ("GHG Plan") and Marine Life Mitigation Plan ("MLMP"), and the contents of Poseidon's December 10, 2008 Briefing Materials that Poseidon provided to Commission Staff.

Poseidon representatives indicated that two issues involving the GHG Plan findings remain. The first issue involved Staff's interpretation of the GHG Plan's requirements for Renewable Energy Credits (RECs), which would require Poseidon to purchase RECs from CARB, CCAR or an Air District. Poseidon explained that Staff's interpretation would eliminate its ability to use RECs under the GHG Plan and would be contrary to the Commission's intent at the August 6, 2008 hearing. Poseidon believes that the plain language in the GHG Plan approved by the Commission allows it to purchase RECs from entities besides CARB, CCAR or the Air Districts, and that there was no discussion on the record modifying that language. Poseidon explained that Staff's interpretation would eliminate its ability to fund specific, local renewable energy projects that are expressly identified in the GHG Plan, which would result in poor public policy and would conflict with established state policy in AB 32 that encourages renewable energy projects.

Regarding the second issue, Poseidon representatives indicated that the Staff failed to correctly incorporate a contingency in the GHG Plan findings allowing Poseidon to acquire offsets from entities other than CARB, CCAR, or the Air Districts in the event that these entities cannot provide sufficient offsets at a price reasonably equivalent to the general domestic market price. Poseidon explained that, instead, the Staff proposed findings imposing a "feasibility" requirement that does not make clear that Poseidon can seek to purchase offsets from other entities if the price of CARB/CCAR/Air District offsets is not reasonably consistent with domestic market prices. Poseidon explained that testimony in the record by Commissioner Hueso and Chair Kruer clearly indicates that the Commission intended for Poseidon to have access to this contingency if CARB, CCAR or the Air Districts could not provide offsets at a price reasonably equivalent to the domestic market price.

Poseidon representatives also indicated that they are in the process of working out one additional issue regarding the GHG Plan findings with Staff, and that all outstanding issues with the MLMP findings were resolved with Staff.

12/5/08
Date

Chair Patrick Kruer

# FORM FOR DISCLOSURE OF EX PARTE COMMUNICATIONS

Name or description of project , LCP, etc: Poseidon Resources Corporation Carlsbad Desalination Facility CDP E-06-013, Agenda Items W16a, and W16b

Date and time of receipt of communication: December 3, 2008; 10:00 a.m.

Location of communication: Telephonic

Type of communication (letter, facsimile, etc.): Telephonic meeting with Commissioner Bonnie Neely

Person(s) initiating communication: Susan McCabe, McCabe & Company
Rick Zbur, Latham & Watkins LLP
Peter MacLaggan, Poseidon Resources
Charlie Stringer, Renewable Resources

**Detailed substantive description of content of communication:**
(Attach a copy of the complete text of any written material received.)

Poseidon representatives indicated that they have worked out all outstanding issues with Staff regarding Staff's Revised Condition Compliance Findings for the Marine Life Mitigation Plan. Poseidon's representative then discussed Poseidon's concerns regarding Staff's Revised Condition Compliance Findings for the project's Energy Minimization and Greenhouse Gas Reduction Plan ("GHG Plan"), and the contents of Poseidon's December 10, 2008 Briefing Materials that Poseidon provided to Commission Staff.

Poseidon representatives indicated that Staff's revised findings for the GHG Plan contained two provisions that Poseidon believes are inconsistent with the Commission's approval. The first issue involved Staff's interpretation of the GHG Plan's requirements for Renewable Energy Credits (RECs), which would require Poseidon to purchase RECs from CARB, CCAR or an Air District. Poseidon explained that Staff's interpretation would eliminate its ability to use RECs under the GHG Plan and would be contrary to the Commission's intent at the August 6, 2008 hearing. Poseidon believes that the plain language in the GHG Plan approved by the Commission allows it to purchase RECs from entities besides CARB, CCAR or the Air Districts, and that there was no discussion on the record modifying that language. Poseidon explained that Staff's interpretation would eliminate its ability to fund specific, local renewable energy projects that are expressly identified in the GHG Plan, which would result in poor public

policy and would conflict with established state policy in AB 32 that encourages renewable energy projects.

Regarding the second issue, Poseidon representatives indicated that the Staff failed to correctly incorporate a contingency in the GHG Plan findings allowing Poseidon to acquire offsets from entities other than CARB, CCAR, or the Air Districts in the event that these entities cannot provide sufficient offsets at a price reasonably equivalent to the general domestic market price. Poseidon explained that, instead, the Staff proposed findings imposing a "feasibility" requirement that does not make clear that Poseidon can seek to purchase offsets from other entities if the price of CARB/CCAR/Air District offsets is not reasonably consistent with domestic market prices. Poseidon explained that testimony in the record by Commissioner Hueso and Chair Kruer clearly indicates that the Commission intended for Poseidon to have access to this contingency if CARB, CCAR or the Air Districts could not provide offsets at a price reasonably equivalent to the domestic market price.

Poseidon representatives also indicated that they are in the process of working out one additional issue regarding the GHG Plan findings with Staff.

12-3-08
Date

Commissioner Bonnie Neely

# EX PARTE COMMUNICATIONS

| | |
|---|---|
| **Name of project**: | Poseidon Resources Corporation<br>Carlsbad Desalination Facility<br>CDP E-06-013, Agenda Items W16a, and W16b |
| **Date and time**: | December 3, 2008; 11:15 a.m. |
| **Location**: | Menlo Park, CA |
| **Type of communication**: | Phone |
| **Persons initiating communication**: | Susan McCabe, McCabe & Company<br>Rick Zbur, Latham & Watkins LLP<br>Peter MacLaggan, Poseidon Resources<br>Charlie Stringer, Renewable Resources |

**Detailed content of communication:**
Poseidon indicated that they have two issues with the Staff's Revised Findings for the Greenhouse Gas Reduction Plan ("GHG Plan") they believe is inconsistent with the Commission's approval.

1. Staff's interpretation of the GHG Plan's requirements for Renewable Energy Credits (RECs) would require Poseidon to purchase RECs from only CARB, CCAR or an Air District. The language in the GHG Plan approved by the Commission allows it to purchase RECs from entities besides CARB, CCAR or the Air Districts, and that there was no discussion on the record modifying that language.
   Poseidon claimed that Staff's interpretation would eliminate its ability to fund local renewable energy projects that are identified in the GHG Plan, would result in poor public policy and would conflict with established state policy in AB 32 that encourages renewable energy projects.

2. Staff failed to incorporate a contingency allowing Poseidon to acquire offsets from entities other than CARB, CCAR, or the Air Districts in the event that these entities cannot provide sufficient offsets at a price reasonably equivalent to the general domestic market price. The Staff's proposed findings imposes a "feasibility" requirement that does not allow Poseidon to purchase offsets from other entities if the price of CARB/CCAR/Air District offsets are not reasonably consistent with domestic market prices. Poseidon said that testimony in the record by Commissioner Hueso and Kruer indicates that the Commission intended for Poseidon to have access to this contingency.

Poseidon representatives also indicated that they are in the process of working out one additional issue regarding the GHG Plan findings with Staff.

Thursday, December 04, 2008
Date

Commissioner Steve Blank

# FORM FOR DISCLOSURE OF EX PARTE COMMUNICATIONS

Name or description of project , LCP, etc: Poseidon Resources Corporation Carlsbad Desalination Facility CDP E-06-013, Agenda Items W16a, and W16b

Date and time of receipt of communication: December 8, 2008; 11:00 a.m.

Location of communication: Telephonic

Type of communication (letter, facsimile, etc.): Telephonic meeting with Assistant Secretary for Ocean and Coastal Policy Brian Baird

Person(s) initiating communication: Susan McCabe, McCabe & Company
Rick Zbur, Latham & Watkins LLP

**Detailed substantive description of content of communication:**
(Attach a copy of the complete text of any written material received.)

Poseidon representatives indicated that they have worked out all outstanding issues with Coastal Commission Staff regarding Staff's Revised Condition Compliance Findings for the Marine Life Mitigation Plan. Poseidon's representative then discussed Poseidon's concerns regarding Staff's Revised Condition Compliance Findings for the project's Energy Minimization and Greenhouse Gas Reduction Plan ("GHG Plan"), and the contents of Poseidon's December 10, 2008 Briefing Materials that Poseidon provided to Commission Staff. Poseidon representatives explained they believe that they have resolved their two primary concerns with the GHG Plan findings with Staff, which Staff indicated to them would be addressed in an Addendum prior to the hearing on the findings.

Poseidon representatives indicated that Staff's revised findings for the GHG Plan had contained two provisions that Poseidon believes are inconsistent with the Commission's approval. The first issue involved Staff's interpretation of the GHG Plan's requirements for Renewable Energy Credits (RECs), which would require Poseidon to purchase RECs from CARB, CCAR or an Air District. Poseidon explained that Staff's interpretation would eliminate its ability to use RECs under the GHG Plan and would be contrary to the Commission's intent at the August 6, 2008 hearing. Poseidon believes that the plain language in the GHG Plan approved by the Commission allows it to purchase RECs from entities besides CARB, CCAR or the Air Districts, and that there was no discussion on the record modifying that language. Poseidon explained that

Staff's interpretation would eliminate its ability to fund specific, local renewable energy projects that are expressly identified in the GHG Plan, which would result in poor public policy and would conflict with established state policy in AB 32 that encourages renewable energy projects.

Regarding the second issue, Poseidon representatives indicated that the Staff failed to correctly incorporate a contingency in the GHG Plan findings allowing Poseidon to acquire offsets from entities other than CARB, CCAR, or the Air Districts in the event that these entities cannot provide sufficient offsets at a price reasonably equivalent to the general domestic market price. Poseidon explained that, instead, the Staff proposed findings imposing a "feasibility" requirement that does not make clear that Poseidon can seek to purchase offsets from other entities if the price of CARB/CCAR/Air District offsets is not reasonably consistent with domestic market prices. Poseidon explained that testimony in the record by Commissioner Hueso and Chair Kruer clearly indicates that the Commission intended for Poseidon to have access to this contingency if CARB, CCAR or the Air Districts could not provide offsets at a price reasonably equivalent to the domestic market price.

Poseidon representatives also indicated that they are in the process of working out one additional issue regarding the GHG Plan findings with Staff.

12/9/08
Date



Brian Baird, California Resources Agency,
Asst. Secretary for Ocean and Coastal Policy

# W 16b

# E-06-013
## Revised Condition Compliance Findings
## (Poseidon Resources Corporation)

# CORRESPONDENCE

STATE OF CALIFORNIA—THE RESOURCES AGENCY ARNOLD SCHWARZENEGGER, GOVERNOR

CALIFORNIA COASTAL COMMISSION

45 FREMONT, SUITE 2000
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# W16b

## REVISED CONDITION COMPLIANCE FINDINGS

**November 26, 2008**

RECEIVED
DEC 0 8 2008
CALIFORNIA
COASTAL COMMISSION

**To:** Commissioners and Interested Parties

**From:** Peter Douglas, Executive Director
Alison Dettmer, Deputy Director
Tom Luster, Staff Environmental Scientist

**Regarding:** **Condition Compliance for CDP No. E-06-013** – Poseidon Resources (Channelside), LLC; **Special Condition 10**: Submittal of a Energy Minimization and Greenhouse Gas Reduction Plan

**Commissioners on Prevailing Side:** Commissioners Achadjian, Blank, Burke, Hueso, Kram, Lowenthal, Neely, Potter, Reilly, and Chair Kruer

**Exhibit 1:** Carlsbad Seawater Desalination Project: August 2, 2008 cover letter and *Energy Minimization and Greenhouse Gas Reduction Plan*

**Exhibit 2:** Assembly Bill 32

**Exhibit 3:** Transcript of Commission deliberations, August 6, 2008

### STAFF NOTE

Staff prepared these recommended Revised Findings based on the Commission's August 6, 2008 decision approving an Energy Minimization and Greenhouse Gas Reduction Plan for Poseidon Resources. Recommended changes from the August 6th document are shown in ~~strikethrough~~ and **bold underline** text.

~~Staff is aware of one area of disagreement with Poseidon regarding these recommended Revised Findings. Staff and Poseidon agree that the Commission approved those parts of Poseidon's Plan that provide emission reduction credit for the Plan's identified on-site and project-related emission reduction measures – including, but not limited to, projected reductions in State Water Project imports. However, based on review of the record before the Commission and of the hearing transcript, staff believe that the Commission required Poseidon to obtain any necessary remaining offsets, credits, or emission reduction measures through the California Air Resources Board (CARB), California Climate Action Registry (CCAR), or a California air district, unless otherwise authorized by the Executive Director. Poseidon, on the other hand, contends the~~

~~Commission allowed Poseidon to obtain a certain type of offset – a REC, or Renewable Energy Credit – from any third-party provider, and that Poseidon is to purchase through CARB, CCAR, or an air district only those offsets or credits that do not qualify as RECs.~~

~~Staff's position is based in part on the clear intent expressed by the Commission that any emission reduction measures Poseidon will need after accounting for its on-site and project-related measures are to be obtained and verified through CARB, CCAR, or an air district. Poseidon's position is based in part on text in its Plan that the Commission did not specifically change – particularly, a statement added to the August 2, 2008 version of the Plan providing that "[c]onsistent with Staff's recommendation, acquisition of RECs are not limited to purchase from CCAR, CARB, or any other Third Party Provider." Poseidon has also stated that it believes its Plan differentiates more generally between offsets and RECs.~~

~~Staff, however, believes Poseidon's contentions are not supported by the record or the hearing transcript. With regard to Poseidon's first contention, the quoted statement in the Plan is inaccurate and contradictory. The staff recommendation proposed that all emission reduction measures (apart from on-site measures that directly reduced the project's electricity use)be verified by CARB, CCAR, or an air district. It did not distinguish RECs from other forms of offsets. Moreover, the Plan Poseidon presented to the Commission (see Exhibit 1)describes offsets and credits interchangeably, and in fact defines a REC as a type of offset.[†] The Plan also categorizes renewable energy projects not as RECs, but as a type of offset. In presenting its Plan to the Commission at the August 6th hearing, Poseidon also used the terms "offsets" and "credits" interchangeably, as did staff in its recommendation to the Commission based on Poseidon's proposal. Staff notes that in discussions with Poseidon prior to the Commission hearing, staff had recommended that both offsets and RECs be handled through one of the three entities referenced above. Finally, and importantly, the Commission in its discussion and its motions at the hearing clearly stated that Poseidon is to obtain its necessary offsets and credits through CARB, CCAR, or an air district in the same manner as other types of offsets, and made no distinction that would allow RECs to be handled differently (see, for example, pages 197, 200, and 211-213 of Exhibit 3). Staff therefore believes that the record viewed as a whole establishes that the Commission intended RECs to be handled through CARB, CCAR, or an air district in the same manner as other kinds of offsets.~~

---

[†] ~~Poseidon's Plan at pages 18 and 19 states:~~

> ~~An offset is created when a specific action is taken that reduces, avoids or sequesters greenhouse gas (GHG)emissions in exchange for a payment from an entity mitigating its GHG emissions. Examples of offset projects include, but are not limited to: increasing energy efficiency in buildings or industries, reducing transportation emissions, *generating electricity from renewable resources such as solar or wind*, modifying industrial processes so that they emit fewer GHGs, installing cogeneration, and reforestation or preserving forests.~~
>
> ~~*One type of offset project is Renewable Energy Credits (RECs)*, also known as Green Tags. Renewable Energy Certificates or Tradable Renewable Certificates. Each REC represents proof that 1 MW of electricity was generated from renewable energy (wind, solar or geothermal). For GHG offsetting purposes, purchasing a REC is the equivalent of purchasing 1 MW of electricity from a renewable energy source, effectively offsetting the GHGs otherwise associated with the production of that electricity.... [emphasis added]~~

Staff ~~therefore~~ recommends the Commission ***approve*** these Recommended Revised Findings.

## SUMMARY

On November 15, 2007, the Commission conditionally approved CDP E-06-013 for Poseidon Resources (Channelside), LLC (Poseidon)for construction and operation of a desalination facility to be located adjacent to the Encina Power Plant in Carlsbad, San Diego County. The Commission imposed as part of its approval ***Special Condition 10***, which required Poseidon to submit for further Commission review and approval, an Energy Minimization and Greenhouse Gas Reduction Plan (the Plan)(see the full text and requirements of ***Special Condition 10*** in Section 2.0 below).[2]

On July ~~7~~3, 2008, Poseidon submitted to Commission staff ~~its~~ a proposed Plan**, which staff received on July 7, 2008** ~~(see Exhibit 1)~~. **Commission staff reviewed the Plan and prepared a staff report for the August 2008 hearing recommending the Commission approve the Plan with modifications. After several conversations with Commission staff, Poseidon on August 2, 2008 submitted a revised Plan for Commission consideration (see Exhibit 1). At its August 6, 2008 hearing, the Commission approved the Plan submitted on August 2nd with modifications. Because the Commission's action differed from staff's recommendation, revised findings are necessary.** ~~This report provides staff's analysis of the Plan, staff's evaluation of whether the Plan conforms to Special Condition 10 as described in the Findings, and staff's recommendation as to whether the Commission should approve the Plan.~~

~~In brief, staff's analysis shows that the Plan as submitted does not conform to Special Condition 10. However, if modified as described herein, staff believes the modified Plan would conform to Special Condition 10. Staff therefore recommends the Commission approve the Plan, as modified herein. The primary modifications staff has identified as being necessary for Plan approval are summarized below and are further detailed in Sections 1.1 and 4.0 of this memorandum.~~

~~Staff recommends the Plan be~~ **The Commission** modified **Poseidon's August 2, 2008 version of the Plan** as follows:

1) **Except as set forth in the Plan's contingency provisions (as described below in Section 4.0 of these Findings), Poseidon is to** ~~I~~implement the Plan**'s provisions regarding offsetting the project's net GHG emissions** using the protocols, criteria, and mechanisms provided by Assembly Bill 32 (AB 32):

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[2] The Commission's approval of this CDP also included **Special Condition 8**, which required Poseidon to submit for Commission review and approval a Marine Life Mitigation Plan. ~~That Special Condition and Poseidon's submitted plan are evaluated in a separate staff report under Item W5b of the August 6, 2008 Commission hearing.~~ **The Commission approved the Marine Life Mitigation Plan at that hearing. The recommended Revised Findings for that Plan are on the Commission's December 2008 hearing agenda as Item W16a.**

a. Use CARB-, ~~and/or~~ CCAR-, **or California Air District-**approved protocols and mechanisms for all emission reduction measures proposed, **except for Renewable Energy Credits ("RECs"),**[3] to ~~ensure~~ **offset the net GHG** emissions from Poseidon's purchased electricity ~~are "net zero"~~. **On-site and project-related measures identified in the Plan are used to calculate the project's net GHG emissions and therefore are not subject to the CARB, CCAR, or Air District requirements for offsetting the net GHG emissions.**[4] ~~This requirement does not apply to measures Poseidon identified in its Plan as "on-site" or "project-related" measures.~~

b. Join the CCAR "Climate Action Reserve" ~~and~~ **or** other entities that require the use of CARB-, ~~or~~ CCAR-, **and/or California Air District-approved** protocols to implement the Plan's emission reduction measures, **except for RECs,** and provide necessary accounting of those measures.

~~2) Submit annual reports for Executive Director review and approval that show the results of Poseidon's verified emission reduction measures as determined pursuant to CARB or CCAR approved verification procedures.~~

~~3) Modify the Plan's GHG template to conform to AB 32 based review processes.~~

~~4) Within 60 days of the Commission's approval of this modified Plan, submit for the Executive Director's review and approval a revised Plan that includes these modifications.~~

**These recommended Revised Findings incorporate the modifications described above. Staff recommends the Commission *approve* these Findings.**

~~Staff's main recommendation – that the Plan be implemented using AB 32 protocols for verifying greenhouse gas reductions – is based on recommendations from the California Air Resources Board, the San Diego Air Pollution Control District, the California State Lands Commission, and the California Energy Commission. The other recommendations are meant to help Poseidon and the Commission implement the Plan in a manner consistent with the Commission's approval and with AB 32.~~

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[3] Each REC confirms that one megawatt of electricity was generated from renewable energy (wind, solar, geothermal, hydroelectric). The Plan provides that the acquisition of RECs is not limited to purchase from CARB, CCAR or any other designated provider.

[4] The "on site" and "project-related" measures identified in the Plan consist of the following:

- use of an energy recovery system for the desalination facility.
- implementation of "green building" design. • on-site solar power generation.
- addition of carbon dioxide ($CO_2$) from a $CO_2$ recovery facility into produced water.
- avoided emissions from reduced energy use at a Carlsbad water reclamation facility.
- avoided emissions from displaced imported water.
- avoided emissions from carbon sequestration in project-related wetland mitigation.

~~With these modifications, staff believes Poseidon's Plan would conform to **Special Condition 10** and applicable provisions of the Commission's Findings. Further, staff believes that the modified Plan would also be fully consistent with the goals and provisions of AB 32. By using CARB and CCAR approved methods and protocols to quantify and verify its emission reductions, Poseidon would also be able to participate in the state's approved program, which will allow it to transition smoothly to any future AB 32 regulations that may apply to its facility.~~

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## 1.0 MOTION & RESOLUTION

**Motion:**

*"I move that the Commission* ***adopt the revised findings in support of the Commission's action on August 6, 2008 to*** *approve the Energy Minimization and Greenhouse Gas Reduction Plan* ~~*attached to the staff recommendation as Exhibit 1, if modified as shown in Section 1.1 below,*~~ *as compliant with* ***Special Condition 10*** *of CDP E-06-013."*

**Resolution to Approve:**

*The Commission hereby* ***adopts the findings set forth below for the Commission's approval of the Energy Minimization and Greenhouse Gas Reduction Plan as compliant with Special Condition 10 of CDP E-06-13 on the grounds that the findings support the Commission's decision made on August 6, 2008, and accurately reflect the reasons for it*** ~~*finds that the compliance plan titled "Carlsbad Seawater Desalination Project: Energy Minimization and Greenhouse Gas Reduction Plan" prepared and submitted by the permittee, Poseidon Resources (Channelside)LLC, dated July 3, 2008, if modified as shown in Section 1.1 of the July 24, 2008 Commission staff report, is adequate, if fully implemented to comply with* **Special Condition 10** *of CDP E-06-013.*~~

**Staff Recommendation:**

Staff recommends a **"YES"** vote **on the motion. Passage of this motion will result in the adoption of revised findings as set forth in this staff report. The motion requires a majority vote of the members from the prevailing side present at the revised findings hearing, with at least three of the prevailing members voting. Only those Commissioners on the prevailing side of the Commission's action are eligible to vote on the revised findings,** ~~which will result in the approval of the modified plan as compliant with Special Condition 10 and adoption of the motion, resolution, and findings herein. The motion passes only by an affirmative vote of a majority of the Commissioners present. Staff's recommended modifications are provided in Section 1.1 below, and are further detailed in Section 4.0 of this memorandum. If these recommended modifications are not incorporated into the Plan, staff recommends the Commission find the Plan, as submitted, does not conform to Special Condition 10 and staff would therefore recommend the Plan be denied~~.

## 1.1 RECOMMENDED MODIFICATIONS TO POSEIDON'S PROPOSED PLAN

1) Implement the Plan**'s provisions regarding offsetting the project's net GHG emissions** using the protocols, criteria, and mechanisms provided by Assembly Bill 32 (AB 32)[5]:

   a) Use California Air Resources Board (CARB), ~~and/or~~ California Climate Action Registry (CCAR)**, and/or California Air District** approved protocols and mechanisms for all emission reduction measures **proposed to offset the net GHG emissions from Poseidon's purchased electricity use, except for RECs[6]. On-site and project-related measures identified in the Plan are used to calculate the project's net GHG emissions and are therefore not subject to the CARB, CCAR, or Air District requirements regarding offsettingthe net GHG emissions.[7]** ~~proposed to ensure emissions from Poseidon's purchased electricity are "net-zero".~~

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[5] See Exhibit 3: The Global Warming Solutions Act of 2006, also known as **Assembly Bill 32** (AB 32)– from http://www.arb.ca.gov/cc/docs/ab32text.pdf (last visited June 30, 2008).

[6] **As noted, each REC confirms that one megawatt of electricity was generated from renewable energy (wind, solar, geothermal, hydroelectric). The Plan provides that the acquisition of RECs is not limited to purchase from CARB, CCAR or any other designated provider.**

[7] ~~This would not include measures Poseidon implments at the desalination facility to avoid or reduce its need for purchased electricity. These measures include, for example~~**The on-site measures consist of**:

- Poseidon's installation of a high efficiency energy recovery system;
- Its use of green building design components; and,
- Installation of solar photovoltaics on the facility's roof to generate electricity for Poseidon's use.

Each of these measures, if implemented, would result in the facility needing less purchased electricity, which would therefore reduce the GHG emissions for which Poseidon's emission reduction measures would be needed.

b) Join the CCAR "Climate Action Reserve" and other entities that require the use of CARB-, ~~or~~ CCAR-, **or California Air District-**approved protocols to implement the Plan's emission reduction measures and provide necessary accounting of those measures, **except for RECs**.

~~2) Submit annual reports for Executive Director review and approval that show the results of Poseidon's verified emission reduction measures as determined pursuant to AB 32-approved review processes.~~

~~3) Modify the Plan's GHG template to conform to AB 32-based review processes.~~

~~4) Within 60 days of the Commission's approval of this modified Plan, submit for the Executive Director's review and approval a revised Plan that includes these modifications.~~

## 2.0 STANDARD OF REVIEW

The ~~Commission must determine whether the~~ subject plan **must** conforms to ***Special Condition 10*** of CDP E-06-013, which states:

> *PRIOR TO ISSUANCE OF THE PERMIT, the Permittee shall submit to the Commission a Revised Energy Minimization and Greenhouse Gas Reduction Plan that addresses comments submitted by the staffs of the Coastal Commission, State Lands Commission, and the California Air Resources Board. The permit shall not be issued until the Commission has approved a Revised Energy Minimization and Greenhouse Gas Reduction Plan after a public hearing.*

As shown in the **Permit** Findings and in the Commission's November 15, 2007 hearing transcript, Poseidon offered as part of the project to make its facility operations "carbon neutral" or "net carbon neutral".[8] It offered a Climate Action Plan to implement this part of its project. The Commission required through ***Special Condition 10*** that Poseidon submit a revised Plan to ensure conformity to applicable Coastal Act provisions. In its **Permit** Findings, the Commission stated that this Plan was to "ensure that Poseidon minimizes ~~electricity~~ **energy** consumption of

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**The "project-related" measures Poseidon identified in its Plan are recovery of CO2 for injection into produced desalinated water, emission reductions from reducing electricity used at the Carlsbad water treatment facility, avoided emissions expected from imported water offsets, and carbon sequestration in the project's wetland mitigation site(s).**

[8] These terms generally refer to a broader range of emissions than are addressed in Poseidon's Plan. For example, "carbon neutral" is defined as providing mitigation for the amount of carbon emitted from both direct and indirect emissions. Poseidon's Plan identifies only those indirect emissions that would result from Poseidon's use of electricity generated by, and purchased from, SDG&E **(or any other entity from which the desalination facility may obtain all or part of its electricity in the future)**, and proposes mitigation for just those emissions. Similarly, the analyses in the Findings and in this memorandum are focused only on identifying, avoiding, reducing, offsetting, or otherwise mitigating just those indirect emissions rather than the full suite of emissions that would need to be addressed to determine whether the project was "carbon neutral".

the project and mitigates any effects ~~of the project's emissions~~ on coastal resources **of the project's net GHG emissions**..." The Plan was to ensure that the project would "avoid, minimize, or mitigate adverse impacts to a wide range of coastal resources, including public access, recreation, marine resources, wetlands, ESHA, agriculture, natural land forms, and existing development associated with its minimized and mitigated energy consumption." The Commission further found that, with such a Plan, the project would be consistent with the requirements of Section 30253(4)and other relevant Coastal Act provisions related to minimizing energy use and mitigating any adverse effects on coastal resources from greenhouse gas emissions.

## 2.1 APPLICABILITY OF AB 32

In reviewing the proposed Plan for conformity to ***Special Condition 10*** and the Commission's **Permit** Findings, staff used as guidance the state's primary statute applicable to greenhouse gas emissions reductions. The Global Warming Solutions Act of 2006 (AB 32)is California's landmark greenhouse gas (GHG)emissions reduction law (see Exhibit 2). It sets a statewide target to reduce GHG emissions in the state to 1990 levels by 2020. This target will be achieved through the implementation of regulations, policies, and programs that lead to maximum technically feasible and cost-effective emission reduction measures.

**Role of the California Air Resources Board (CARB):** AB 32 recognizes CARB as the agency primarily responsible for implementing its provisions. Last year, CARB adopted regulations that require certain entities to report and verify their GHG emissions and to monitor those emissions and enforce compliance.[9] In June 2008, CARB released its draft AB 32 implementation scoping plan. AB 32 also directs CARB to adopt regulations on GHG limits and emissions reductions measures by January 2011 and to implement those regulations by January 2012.

CARB is anticipating that it will first focus on developing regulations for the largest sources of GHGs and that it will phase in additional sources later. However, reaching the statewide target will also depend on GHG emitters that are not initially regulated to voluntarily undertake actions to reduce or mitigate their GHG emissions. In recognition of this need, AB 32 includes several provisions to adopt acceptable methods for verifying and quantifying voluntary emissions reductions that may be used to meet the AB 32 goals. For example, AB 32 requires CARB to adopt a plan by 2009 that identifies how the state will meet its goal of reducing emissions to their 1990 levels, and that plan is to, among other things, "identify opportunities for emission reductions measures from all verifiable and enforceable voluntary actions, including, but not limited to, carbon sequestration projects and best management practices".[10] Further, the regulations AB 32 requires be adopted by 2011 are to "ensure that entities that have voluntarily reduced their greenhouse gas emissions prior to the implementation of this section receive

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[9] *See* Air Resources Board, Mandatory Reporting of GHG Emissions, http://www.arb.ca.gov/regact/2007/ghg2007/ghg2007.htm (last visited June 30, 2008).

[10] See Section 38561(f).

appropriate credit for early voluntary reductions".[11] In support of this policy, AB 32 also requires CARB to adopt methods to quantify voluntary GHG emission reductions.[12]

**Relevance of AB 32 to Special Condition 10 and Poseidon's proposed Plan:** AB 32 clearly anticipates and applies to the types of emission reductions that will be needed from entities like Poseidon – that is, entities that may not initially be regulated directly through AB 32, but that are implementing measures meant to conform to other requirements and be consistent with AB 32. The statute applies to all sources of GHG emissions and, as mentioned above, explicitly includes electricity consumed in the state (see AB 32, Section 38530(b)(2)). Any new, large, significant electricity load will make reaching this statewide target more difficult. Poseidon's desalination facility will be a new, large, significant electricity consumer, thereby increasing the electricity sector's GHG emissions at a time when a statewide effort is underway to dramatically decrease this source of emissions. By implementing its proposed Plan using AB 32 guidance and regulations, Poseidon will likely minimize GHG emissions in a manner that is well integrated with AB 32's framework.

Poseidon's desalination facility is not anticipated to be included in the initial regulatory mechanism CARB plans to implement in 2012. Therefore, although Poseidon's proposed GHG emissions reduction measures are required pursuant to **Special Condition 10** of its coastal development permit, they would be reviewed as "voluntary" measures for purposes of AB 32. As noted above, AB 32 establishes provisions to ensure such "voluntary" measures meet AB 32 standards, and CARB has already adopted some regulations to ensure voluntary measures are consistent with AB 32, and is planning to adopt additional similar regulations. For example, CARB has established protocols for voluntary forestry projects meant to sequester carbon, and Commission staff and other agencies have recommended that Poseidon follow these protocols to implement its $1 million ~~purchase of trees for carbon sequestration~~ **payment for reforestation of areas in San Diego County burned by the 2007 wildfires**. These protocols will allow Poseidon's anticipated carbon "credits" to be quantified and verified and meet other applicable AB 32 provisions. CARB is expected to approve additional methodologies and protocols during the next several years that will allow Poseidon to participate in other verified emission reduction programs.

CARB is also scheduled in 2009 to require emission reporting from electricity-generating facilities, including San Diego Gas & Electric Company (SDG&E), from which Poseidon plans to purchase its electricity.[13] In recognition of this requirement, Commission staff recommended

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[11] See Section 38562(b)(3).

[12] Section 38571 states: *"The state board shall adopt methodologies for the quantification of voluntary greenhouse gas emission reductions. The state board shall adopt regulations to verify and enforce any voluntary greenhouse gas emission reductions that are authorized by the state board for use to comply with greenhouse gas emission limits established by the state board. The adoption of methodologies is exempt from the rulemaking provisions of the Administrative Procedure Act (Chapter 3.5 (commencing with Section 11340)of Part 1 of Division 3 of Title 2 of the Government Code)."*

[13] Personal communication between Commission staff and CARB staff on June 5, 2008. According to CARB staff, SDG&E will be required to report to CARB by June 2009 its 2008 GHG emissions. The emission report is to be

to Poseidon that the emission factors[14] and emission reductions in its Plan be based on the mandatory reports provided to CARB. For the period before these mandatory reports are required, Commission staff accepted Poseidon's proposal to use SDG&E's voluntary reports to the California Climate Action Registry.

AB 32 also recognizes the California Climate Action Registry (CCAR)as one of the mechanisms to be used to implement the state's GHG emission reduction programs. CCAR is a non-profit public organization initiated by the State of California to serve as a voluntary GHG registry to encourage and protect early actions to reduce GHG emissions. CCAR has established the Climate Action Reserve, which is specifically designed for the voluntary GHG emission reduction market and provides accurate and transparent measurement, verification, and tracking of GHG reduction projects and their inventories of GHG reduction tons, thus assuring a high degree of reliability. Commission staff ~~has~~ recommended that Poseidon join CCAR's Reserve and use it in implementing its proposed emission reduction measures.

Based on the above, it is appropriate for the Commission to use AB 32 and its implementing regulations, protocols, criteria, and mechanisms as the basis for its review and approval of **the provisions of** Poseidon's Plan **regarding offsetting the project's net GHG emissions, except for RECs. The Commission includes the Plan's identified on-site and project-related measures as part of Poseidon's calculation of the project's net GHG emissions and these measures therefore will not be subject to the Commission's requirement that Poseidon use CARB-, CCAR-, or Air District- approved AB 32 protocols regarding offsets for net GHG emissions.** This approach is supported by other agencies that have been involved in Commission staff's review, including CARB, the San Diego Air Pollution Control District (SDAPCD), the State Lands Commission (SLC), and the California Energy Commission (CEC), all of which requested that Poseidon use AB 32 provisions to develop and implement its Plan. ~~Staff believes that i~~Implementing Coastal Act requirements using the terms, criteria, and mechanisms provided through AB 32 would result in the Plan's conformity to **Special Condition 10**. Additionally, ~~staff believes~~ this would ensure the Plan is consistent with the state goals and targets expressed in AB 32, and would result in maximum credible and verifiable emissions reductions.

**Relationship between AB 32 and the Coastal Act:** ~~Staff believes t~~This approach would also be fully consistent with Coastal Act Section 30414. For example, Section 30414(c)states:

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verified by an accredited third party by December 2009, and by February 2010, annual reports will be available to the public.

[14] An emission factor represents the average amount of GHG emissions produced from an electricity generator's portfolio of energy sources as measured in pounds per megawatt-hour. Each type of electricity generator has a different emission factor – for example, a natural gas-fired power plant may produce 800 pounds of GHG emissions for every megawatt-hour of electricity it produces, and a coal-fired plant may produce 2000 pounds of GHG emissions for the same amount of electricity. SDG&E's emission factor varies each year based on where it purchases or generates its electricity – for example, its emission factor this year was about 780 pounds per megawatt-hour and its previous emission factor was less than 600 pounds per megawatt-hour. SDG&E currently certifies its annual emission factor using CCAR, and will be required to certify it through CARB starting in 2009.

> *The State Air Resources Board and any air pollution control district may recommend ways in which actions of the commission or any local government can complement or assist in the implementation of established air quality programs.*

As noted above, both CARB and the SDAPCD are implementing provisions of AB 32 and have recommended the Commission and Poseidon use AB 32 as the basis of the proposed Plan**'s provisions regarding offsetting the project's net GHG emissions**. ~~Staff believes t~~The Commission's action requiring the use of these provisions would also be consistent with Section 30414(a), which recognizes that CARB and the state's regional air pollution control districts are the principal agencies responsible for establishing air quality and emission standards. Section 30414 states, in relevant part, that the Coastal Act does not authorize the Commission "to establish any ambient air quality standard or emission standard, air pollution control program or facility, or to modify any ambient air quality standard, emission standard, or air pollution control program or facility which has been established by the state board or by an air pollution control district." The Commission's requirement that Poseidon implement **the offset provisions of** its Plan in a manner consistent with AB 32 ensures that the Plan is consistent with and supportive of programs established by CARB or the SDAPCD, and does not establish or modify emissions standards or programs. Further, this approach is consistent with AB 32's Section 38598(a), which states that "nothing in this division shall limit the existing authority of a state entity to adopt and implement greenhouse gas emissions reduction measures." As noted in the **Permit** Findings, the Commission determined that Poseidon must mitigate for its indirect GHG emissions and their effects on coastal resources.

**Applicability of AB 32 goals, terms, criteria, and related mechanisms to ensure emissions reductions:** Commission staff incorporated into its review several of the relevant terms defined in AB 32, including the following:

- "***Greenhouse gas***" or "***greenhouse gases***": Section 38505(g)states that greenhouse gas or gases "includes all the following gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexaflouride."

- "***Statewide greenhouse gas emissions***": Section 38505(m)defines these as "the total annual emissions of greenhouse gases in the state, including all emissions of greenhouse gases from the generation of electricity delivered to and consumed in California, accounting for transmission and distribution line losses, whether the electricity is generated in state or imported. Statewide emissions shall be expressed in tons of carbon dioxide equivalents."

  ~~Commission staff recognizes that t~~The desalination facility will contribute to "statewide greenhouse gas emissions" because its baseline electricity use ~~will~~ **is expected to** result in about 90,000 tons of CO2 each year. As noted in AB 32, any new, large, significant electricity load, such as that represented by Poseidon's desalination facility, will unless adequately mitigated, adversely affect the electricity sector's ability to achieve statewide targets.

- "***Emissions reduction measure***": Section 38505(f)defines these as "programs, measures, standards, and alternative compliance mechanisms authorized pursuant to this division, applicable to sources or categories of sources, that are designed to reduce emissions of greenhouse gases."

  Commission staff reviewed Poseidon's Plan based on this definition, which encompasses all the proposed measures, offsets, reductions, or other methods Poseidon proposes in its Plan – that is, all the measures Poseidon proposes to meet a "net zero" emission level for its use of purchased electricity are considered by AB 32 to be "emission reduction measures". As noted ~~throughout this memorandum~~ **previously in these Findings**, three of the **on-site** measures Poseidon currently proposes would not be subject to this review, because**, if implemented,** they **would** result in direct reductions of Poseidon's purchased electricity use and therefore reduce the amount of emissions that must be accounted for – these include Poseidon's installation of a high efficiency energy recovery system, its use of green building design components, and its installation of solar photovoltaics on the facility roof to generate electricity for Poseidon's use. **The Commission also finds that the project-related measures Poseidon identified in its Plan are not subject to this review. These measures are the use of recovered CO2 for injection into water produced at the facility, emissions avoided by reducing energy needs at the Carlsbad water reclamation facility, emissions avoided from the expected displacement of imported water, and sequestration from project-related wetland mitigation. The Commission is satisfied that these project-related measures will reduce the GHG emissions attributable to the project and that they therefore should be included in the calculations used to determine the project's net GHG emissions. This approach was supported by the Chair of the California Air Resources Board, the Executive Director of the California Energy Commission, and the General Manager of the Metropolitan Water District. Only the remaining provisions of the Plan intended to offset the project's net GHG emissions, except for RECs, are subject to CARB-, CCAR-, or Air District-approved AB 32 protocols.**

AB 32 also identifies six criteria to be used to determine whether proposed GHG emission reduction measures are adequate to ensure conformity to AB 32. The criteria, at Section 38562(d)require that any measures approved by CARB are "real", "permanent", "quantifiable", "verifiable", "enforceable", and are "in addition to" any GHG emission reduction otherwise required by law or regulation and any other GHG emissions reduction that otherwise would occur. While AB 32 does not define these criteria, CARB staff indicated that they are defined in other state air regulations and recommended those existing definitions be used, such as:[15]

- "Real" and "in addition to": Real or additional emission reductions are those that have actually occurred, not emissions that could have been emitted but were not or are avoided

[15] CARB staff stated examples of criteria definitions were available from various sources, such as 2008 modifications to its regulations for reporting GHG emissions at (17 CCR Subchapter 10), San Diego Air Pollution Control District's August 2004 operating permit regulations (Regulation XIV, Title V), August 2004 proposed rulemaking to control GHG emissions from motor vehicles, etc.

emissions. This means that the emission reductions result from actions taken that are beyond the course of normal activity such that the emission reductions are not considered "business as usual."

- "Permanent": Permanent means that the life of the emission reductions is reasonably established and commensurate with the proposed use of the credits. Projects should be "irreversible"; that is, the reductions achieved should not be subject to backsliding or vulnerable to changes in external conditions.

- "Quantifiable": Quantifiable means that the amount of the emission reductions can be measured with reasonable certainty.

- "Verifiable": Verification means the process used to ensure that an operator's emissions data report is free of material misstatement and complies with CARB's procedures and methods for calculating and reporting GHG emissions.

- "Enforceable": Enforceable means that the reductions can be independently verified and are legally binding. Enforcement is an essential element of any alternative compliance strategy. Projects thus must be accessible to inspection by California staff.

As recommended by CARB and other agencies, Commission staff provided in its review of Poseidon's proposed Plan an initial application of these six criteria to assess whether Poseidon's suggested emissions reduction measures might conform to AB 32. ~~Staff's conclusions,~~ **The Commission finds** in Section 4.0 of **these Findings that emission reduction measures to offset the project's net GHG emissions, except for RECs, must comply with CARB-, CCAR-, and/or Air District-approved measures and protocols and that Poseidon must purchase or implement these offsets through CCAR, CARB, or a California air district. If offsets cannot ~~feasibly~~ be acquired through these entities ~~due to price or inadequate supply~~ at a price that is reasonably equivalent to the price for offsets in the broader domestic market, Poseidon may request the Commission's Executive Director to approve purchases of offsets or implementation of projects from other entities. Poseidon may also, upon approval of the Executive Director or the Commission, deposit funds into an escrow account in lieu of purchasing offsets/RECs in the event that (i)offset/REC projects in an amount necessary to mitigate the Project's net indirect GHG emissions are not reasonably available; (ii)the "market price" for carbon offsets or RECs is not reasonably discernable; (iii)the market for offsets/RECs is suffering from significant market disruptions or instability; or, (iv)the market price has escalated to a level that renders the purchase of offsets/RECs economically infeasible to Poseidon. The funds placed in escrow will be paid in an amount equal to $10 per metric ton, adjusted for inflation from 2008, and will be used to fund offset projects as they become available, with the Executive Director or Commission determining the entities that may use these funds and the time periof for which this contingency may be used. With these modifications, the Plan is consistent with *Special Condition 10* and applicable Coastal Act requirements** ~~this memorandum, suggest that several of Poseidon's proposed measures would likely conform to the criteria; however, as~~

~~reflected in staff's recommendations, the actual assessment of Poseidon's proposals, should be done by a certified independent verifier as established through AB 32~~.

~~In sum, Commission staff, on advice from CARB and other agencies, have recommended that Poseidon implement its Plan consistent with the provisions, guidance, and regulations established pursuant to AB 32, and that the Commission base its approval and ongoing review of Poseidon's Plan on the guidance provided by AB 32.~~

## 3.0 PLAN DEVELOPMENT AND REVIEW

Between November 2007 and July 2008, Commission staff worked with Poseidon and with other agencies to develop an acceptable Plan to present for Commission review and approval. Commission staff's research included determining appropriate GHG accounting methods, evaluating current and pending legislation related to GHG emission reductions, identifying and assessing the effectiveness of various measures meant to avoid or reduce GHG emissions, and other similar issues. Commission staff met with Poseidon and agency representatives at various times during the process to discuss various proposed modifications to the Plan, determine the feasibility and effectiveness of proposed measures, and develop other aspects of the Plan. Throughout the process, Commission staff provided comments and guidance to Poseidon, and Poseidon provided several drafts of its proposed Plan.

This review process included Commission staff hosting a May 2, 2008 interagency meeting in Carlsbad. The purpose of the meeting was to inform other involved agencies about the status of Poseidon's Plan and to seek input and guidance from those agencies about the proposed approach, about potential mitigation projects for Poseidon to develop, and to establish contacts for ongoing review. Along with Commission staff and Poseidon, participants included:

California State Lands Commission
California Energy Commission
California State Parks
California Department of Forestry & Fire Protection
San Diego Air Pollution Control District
San Diego Association of Governments
San Diego County Water Authority
City of Carlsbad
City of Vista

Through this process, and with the assistance and guidance from these agencies as well as CARB, Commission staff developed the recommended modifications ~~described in Sections 1.1 and 4.0 of this memorandum for Poseidon to incorporate into in its Plan. The recommendations also provide the basis for the analyses herein~~ **to Poseidon's Plan**.

On July 7, 2008, Commission staff received a ~~the currently~~ proposed Plan for review by the Commission. **After several conversations with Commission staff, Poseidon subsequently submitted a revised Plan on August 2, 2008. At its August 6, 2008 hearing, the Commission approved the revised Plan with modifications as described herein.**

## 4.0 ANALYSIS FOR CONFORMITY TO ADOPTED FINDINGS & SPECIAL CONDITION 10

**Special Condition 10** states:

> *PRIOR TO ISSUANCE OF THE PERMIT, the Permittee shall submit to the Commission a Revised Energy Minimization and Greenhouse Gas Reduction Plan that addresses comments submitted by the staffs of the Coastal Commission, State Lands Commission, and the California Air Resources Board. The permit shall not be issued until the Commission has approved a Revised Energy Minimization and Greenhouse Gas Reduction Plan after a public hearing.*

The **Permit** Findings state that this Plan is to ensure that Poseidon minimizes its ~~electricity~~ **energy** consumption and mitigates any effects ~~of indirect emissions resulting from the project's use of purchased electricity~~ on coastal resources **of the Project's net GHG emissions** to ensure conformity to Coastal Act Section 30253(4)and other applicable Coastal Act provisions.

***Section 4.1*** below provides a description of the submitted Plan's key elements. The Plan **submitted by Poseidon on August 2, 2008** is attached as Exhibit 1. ***Sections 4.2*** ~~through 4.4~~ describe**s** ~~staff's recommended~~ **the** modifications ~~needed~~ to **the Plan adopted by the Commission that will** ensure the Plan conforms to the Adopted **Permit** Findings and ***Special Condition 10***. ~~Each section also includes concerns Poseidon expressed about the recommendations and staff's response to those concerns.~~ Briefly, the ~~recommended~~ modifications described herein are:

- **Section 4.2:** Implement the Plan**'s provisions regarding offsetting the project's net GHG emissions** using the protocols, criteria, and mechanisms provided by Assembly Bill 32 (AB 32):
  - *Section 4.2.1* – Use CARB-**,** ~~and/or~~ CCAR-**, and/or California Air District-**approved protocols and mechanisms for all emission reduction measures (**except for RECs)** proposed to ~~ensure emissions from Poseidon's purchased electricity are "net zero"~~ **offset the net GHG emissions from Poseidon's purchased electricity are "net zero". On-site and project-related measures in the Plan are used to calculate the project's net GHG emissions and therefore are not subject to CARB, CCAR, or Air District requirements for offsetting the net GHG emissions.**[16]

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[16] **On-site measures consist of:**

- **Poseidon's installation of a high efficiency energy recovery system;**
- **Its use of green building design components; and,**
- **Installation of solar photovoltaics on the facility's roof to generate electricity for Poseidon's use.**

**Each of these measures, if implemented, would result in the facility needing less purchased electricity, which would therefore reduce the GHG emissions for which Poseidon's emission reduction measures would be needed.**

- *Section 4.2.2* – Join the CCAR "Climate Action Reserve" and other entities that require the use of CARB-~~, or~~ CCAR-**, or California Air District-**approved protocols to implement the Plan's emission reduction measures and provide necessary accounting of those measures**, except for RECs**.

- ~~**Section 4.3:** Submit annual reports for Executive Director review and approval that show the results of Poseidon's verified emission reduction measures as determined pursuant to AB 32 approved review processes.~~

- ~~**Section 4.4:** Modify the Plan's GHG template to conform to AB 32 based review processes.~~

~~The key recommended modifications are those in Section 4.2 related to the Plan's use of AB 32. Poseidon states that parts of its Plan are meant to be consistent with AB 32, and although staff's analysis shows that the Plan, as submitted, is not yet consistent with AB 32's protocols regarding reducing and offsetting GHG emissions, staff believes it would be if modified as recommended in Section 4.2. The recommendations in Sections 4.3 and 4.4 would change the process Poseidon has proposed for Plan review in a manner consistent with AB 32 provisions and in a way that would ensure the Commission has adequate certainty and oversight over ongoing condition compliance. Similarly, staff's recommendation in Section 1.1 that Poseidon submit a revised Plan that incorporates these modifications would assist the Commission in ensuring conformity to its decision.~~

## 4.1 PLAN DESCRIPTION

Poseidon's submitted Plan include**d** three main steps for the desalination facility to accomplish "net zero" emissions from its electricity use:

1) Identify the amount of indirect GHG emissions: determine by multiplying annual electricity use (as measured by electric meter readings of delivered electricity)by the annual emission factor certified by CARB or CCAR.

2) Identify on-site and project-related reduction of indirect GHG emissions. This includes seven proposed measures to reduce emissions.

3) Identify mitigation options to offset any remaining indirect GHG emissions. These include:

   - A proposed process for obtaining, reviewing, approving, and validating emission reduction projects, including formation of a committee and database.
   - An annual process to "true-up" emission reduction credits

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**The "project-related" measures Poseidon identified in its Plan are recovery of CO2 for injection into produced desalinated water, emission reductions from reducing electricity used at the Carlsbad water treatment facility, avoided emissions expected from imported water offsets, and carbon sequestration in the project's wetland mitigation site(s).**

- A contingency approach if Poseidon determines no GHG emission reduction projects are reasonably available.
- A contingency approach if new GHG emission reduction regulatory programs are created.
- Examples of potential emission reduction projects.
- A general description of Poseidon's reforestation sequestration project.
- A table reflecting Poseidon's projected annual net-zero GHG emissions balance.
- An implementation schedule that includes an annual report to the Commission describing Poseidon's conformity to the above provisions.

The Plan's focus ~~is~~**was** on the process by which Poseidon will select and implement its emission reduction measures. Because Poseidon does not anticipate operating its facility for about three years, and because the policies, regulations, and acceptable emission reduction measures are expected to change significantly over the next three years and beyond, many of the measures described in the Plan are subject to change and additional review. Given these likely changes, **the** Commission ~~staff~~ concurs with Poseidon that the ~~Commission's approval~~ **Plan** should emphasize the process by which Poseidon will identify, select, and verify its emission reduction measures. However, as shown in the discussions below, ~~staff believes~~ **the Commission required** the Plan**'s provisions regarding offsetting the project's net GHG emissions,** ~~as submitted, is not adequate~~ **be modified** to ensure conformity to ***Special Condition 10*** ~~or~~**and** the Commission's direction as expressed in the **Permit** Findings.

**Section II.A of the Plan also requires the desalination facility to incorporate on-site energy minimization features including numerous Project components designed to ensure that the Project will use only the minimum energy necessary. These include energy efficiency measures like the state of the art "pressure exchanger" energy recovery technology that allows recovery and reuse of 33.9% of the energy associated with desalination's reverse osmosis process, as well as high efficiency and premium efficiency motors and variable frequency drives on the intake water pumps to improve their efficiency. As discussed below, the Commission finds that these energy minimization measures will reduce impacts to coastal resources that would have been caused through additional energy usage, and will minimize energy consumption consistent with Coastal Act section 30253(4)and other applicable Coastal Act policies.**

## 4.2 ~~RECOMMENDATION – USE PROVISIONS~~ APPLICATION OF AB 32

~~Staff's~~ **A** central issue of concern is ~~an inability to verify~~ **verification of** the Plan's ~~emission reductions~~ **offsets of the net GHG emissions** against accepted protocols and criteria. ~~This results in a lack of assurance that the proposed~~**Adequate protocols and criteria are necessary to ensure that the** Plan**'s offset provisions** will provide the stated level of mitigation – that is, a "net zero" increase in indirect **net** GHG emissions from the facility's operations.

~~Staff's k~~**K**ey concerns include the following:

- **Poseidon had proposed using several sets of criteria and various third-party providers to implement its Plan.** The process proposed in the Plan would not ~~provide~~

~~verification for most of the proposed emission reduction measures, including those that Poseidon is relying on for the bulk of its emission reductions. The Plan creates a new category of emission reductions – "project-related" measures – and suggests these should be evaluated under criteria unique to this project. Staff believes these measures, regardless of the term used to describe them, would best be reviewed using~~ **necessarily use** the protocols, mechanisms, and criteria established by CARB, ~~or~~ CCAR, **or a California Air District** pursuant to implementation of AB 32.

- ~~The Plan would establish a committee to select and verify Poseidon's emission reduction measures; however, this committee would not provide the degree of third-party independence identified in AB 32 as necessary for emission reduction verification.~~

- The Plan ~~does~~ **as proposed would** not provide assurance that adequate emission reductions would ever be implemented due to its contingency provision that would allow Poseidon to forego mitigation when it deems market conditions to be unfavorable. In lieu of mitigation, Poseidon states that it would deposit $10 per ton of unmitigated GHG emissions into an escrow account, but the Plan does not describe how these funds would be used.

~~Staff's recommended modifications are meant to~~**The modifications adopted by the Commission** resolve these **and other** concerns and to ensure the Plan would conform to ***Special Condition 10*** **and Coastal Act requirements**. Further, ~~staff believes~~ these modifications will provide Poseidon with the certainty and flexibility needed for it to select and implement verifiable emission reduction measures to operate at its anticipated "net zero" level of indirect electricity-related emissions *and* to be credited for its efforts as part of the state's approach under AB 32. These are each described in detail below.

### 4.2.1 *Use CARB-, ~~and/or~~ CCAR-, and/or California Air District-approved protocols and mechanisms for emission reduction measures.*[17]

As noted in Section 2.0, AB 32 includes a number of provisions meant to apply to emission reductions measures such as those Poseidon is proposing **to offset its net GHG emissions**. ~~Staff's primary recommendation is~~**The Commission's primary modification is to require** that Poseidon's Plan use these provisions to ensure ~~its~~ **these** proposed emission reduction measures **(i.e., those needed to reach net zero emissions after on-site and project-related measures are factored in), except for RECs,** fit within the framework California has established for this type of project. The existing or anticipated protocols and mechanisms being implemented by CARB, ~~and~~ CCAR**, and/or California Air Districts** pursuant to AB 32 can be used to evaluate~~d~~ ~~Poseidon's~~ **these** proposed emission reduction measures**, except for RECs.**

The ongoing implementation of AB 32 has jumpstarted the voluntary emission reduction market in California, although similar to the situation elsewhere, it is not always clear that measures being proposed are real or verifiable. AB 32 addresses this issue by requiring CARB to develop approved methodologies and protocols for the voluntary market that meet the AB 32 criteria – that the emission reduction measures are real, permanent, quantifiable, verifiable, enforceable, and additional to any reduction that would otherwise occur. By 2012, CARB will have a list of CARB-approved project protocols and CARB-accredited verifiers to identify valid emission reductions. CARB has already approved a forestry-project protocol and is in the process of reviewing additional protocols.

CCAR, like CARB, also approves project protocols and third-party verifiers for the voluntary GHG emission reduction market, pursuant to AB 32.[18] CCAR currently has certified project protocols for forestry, landfill, and livestock projects. As mentioned above, CARB has already approved the forestry protocol and is in the process of reviewing the CCAR-approved livestock project protocol. CCAR estimates that by 2009 it will have approved several additional CCAR project protocols and it has just issued a Request for Proposals to begin work on ten new project

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[17] **As noted previously, T**this would not include measures Poseidon implements at the desalination facility to avoid or reduce its need for purchased electricity. ~~These measures include, for example~~:

- Poseidon's installation of a high efficiency energy recovery system;
- Its use of green building design components; and,
- Installation of solar photovoltaics on the facility's roof to generate electricity for Poseidon's use.

Each of these measures, if implemented, would result in the facility needing less purchased electricity, which would therefore reduce the GHG emissions for which Poseidon's emission reduction measures would be needed.

***This would also not include the "project-related" measures Poseidon identified in its Plan – i.e., recovery of CO2 for injection into produced desalinated water, emission reductions from reducing electricity used at the Carlsbad water treatment facility, avoided emissions expected from imported water offsets, and carbon sequestration in the project's wetland mitigation site(s).***

[18] Section 38530(b)(1)directs CARB to, "where appropriate and to the maximum extent feasible, incorporate the standards and protocols developed by the CCAR."

protocols. Staff notes that CCAR's approved protocols have received strong support within California.[19]

Poseidon is concerned that some of its proposals **for offsetting the project's net GHG emissions** do not yet have accepted protocols and it would not be able to get emission reduction credits for them – that is, Poseidon has proposed a number of emission reduction measures that cannot yet be quantified or verified using adopted protocols. ~~Staff notes, however, that o~~One of Poseidon's key proposals – its $1 million ~~tree purchase for sequestration~~ **payment for reforestation of areas in San Diego County affected by the 2007 wildfires** – does have approved protocols in place, and that other protocols are being developed over the next several years **and may be in place** before Poseidon plans to start operations. Further, and importantly, California's emission reduction framework is based on accepting only those emission reduction measures that can be verified. Verification relies on there being accepted protocols by which to determine the validity, extent, and effectiveness of any emission reduction measure. ~~For example, Poseidon has offered to verify the emission reductions it expects from its proposed imported water offsets by providing Commission staff a contract from the Metropolitan Water District that confirms the offsets; however, staff is uncertain as to whether this contract would adequately verify that these expected emission reductions would occur. Staff suggests, therefore, that the Commission address this concern *not* by accepting proposed measures for which there is a current lack of approved protocols, but by ensuring that whatever measures Poseidon proposes in its Plan are verified using approved protocols. Staff believes t~~The best way to ensure Poseidon's Plan provides the intended result – that is, to mitigate for Poseidon's **net** indirect GHG emissions – is for the Plan**'s offset provisions** to be based on the protocols and mechanisms that are already approved or that will be approved pursuant to AB 32. ~~Staff therefore recommends that~~ **The Commission's approval therefore requires that, with respect to offsetting the project's net GHG emissions (i.e., for other than Poseidon's identified on-site and project-related measures), except for RECs,** Poseidon ~~to~~ **must** select emission reduction measures and project proposals for which there are CARB-, or CCAR-**, or California Air District-**approved project protocols and **must** purchase emission reduction **offsets or** credits, **except for RECs,** approved by CARB-, ~~or~~ CCAR-**, or California Air District-**accredited verifiers.

Additionally, for proposed emission reduction measures that may be unique to Poseidon and do not have approved protocols, there are mechanisms in place that would allow Poseidon to propose protocols for CARB to approve. CARB has already initiated this "one-off" process for ten projects, and this same process is available for Poseidon to ensure its proposed measures conform to provisions of AB 32.

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[19] For example, the CARB Chair, Mary Nichols, has stated that, "the Registry's Forest Protocols are among the world's most accurate and environmentally sound, which led the State of California to adopt them." See also Climate Action Reserve at: http://www.climateregistry.org/resources/docs/press-releases/climate-action-reserve-release_final_1A.doc (last visited July 19, 2008), which includes statements of support from Linda Adams, Secretary of the California Environmental Protection Agency and Chair of CCAR, and others.

Poseidon has also stated that the AB 32 criteria are not meant to apply to some of its proposed measures, and has additionally contended that it is not required to adhere to those criteria. Its Plan references at least three different sets of criteria to apply to its various emission reduction proposals – those in AB 32, some based on the Kyoto Protocols, and a set of Evaluation Criteria developed for its Plan. It is not clear from the Plan which criteria would apply to the various proposed emission reduction measures, as the criteria sometimes overlap or are contradictory.

As noted above, AB 32's criteria are expected to apply to a wide range of emission reduction measures, including those implemented for both regulatory and voluntary efforts, which include Poseidon's. ~~Staff therefore recommends that Poseidon's~~ **The Commission has determined, therefore, that the** Plan **will** use one set of criteria – those established in AB 32 – to apply to ~~all~~ the **offset** measures it proposes to mitigate for **the net** indirect GHG emissions resulting from its use of purchased electricity.[20] This ~~would~~ allows Poseidon's Plan to ~~have~~ **use** a single, clear, and applicable set of criteria by which ~~some of~~ its ~~emission reduction~~ **offset** measures ~~could~~ **can** be verified and incorporated into California's emission reduction framework. Trying to implement the Plan using three sets of different and sometimes overlapping or conflicting criteria would likely cause confusion and uncertainty and would not allow some of Poseidon's proposed measures to be adequately reviewed and verified. By relying on these criteria and on CARB's and CCAR's implementation of AB 32, the Commission will have adequate assurance that Poseidon's modified Plan will conform to ***Special Condition 10***. The Commission will also be assured that its review will be consistent with the framework the state has selected for addressing the need to reduce GHG emissions, and Poseidon will be able to validate its GHG ~~emission reduction efforts~~ **offset ~~measures, including RECs,~~ purchases** as part of California's program.

Poseidon's Plan also includes a proposed contingency mechanism to be used if offset projects or mitigation measures are not reasonably available (see Section 3.h of the Plan, pages 24-25). ~~It suggests that Poseidon would not implement some emission reduction measures~~ **The Commission's approval modifies that contingency to allow Poseidon to request an Executive Director determination that GHG reduction projects are not reasonably available** under certain conditions: 1)if there are not enough projects available; 2)if the market price for offsets or RECs is not reasonably discernable; 3)if the market price for those mitigation measures is suffering from significant market disruptions or instability; or, 4)if the price of those measures has escalated to a level Poseidon deems economically infeasible. ~~If any of those circumstances occur, Poseidon proposes, instead of funding projects or offsets, to deposit money into an escrow account equal to $10 per ton of offsets needed.~~ **If the Executive Director determines that one or more of these conditions apply, Poseidon may deposit money into an escrow account to be expended on carbon offset projects. The Executive Director would have the authority to determine the duration of the escrow account and to approve Poseidon's proposal identifying one or more entities to use funds deposited into the escrow account to implement emission reduction projects. In the event of a dispute, Poseidon could appeal the Executive Director's determination to the Commission. The Commission**

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[20] **As stated previously, this requirement does not apply to the on-site and project-related measures identified in the Plan. These measures are instead factored into the determination of the net GHG emissions that Poseidon is responsible for offsetting. Nor does this requirement apply to RECs.**

**also authorizes the Executive Director to approve, upon Poseidon's request, the use of emission reduction measures that may be available from entities other than CARB, CCAR, or the Air Districts if offsets are not available from CARB, CCAR or the Air Districts at a price that is reasonably equivalent to the price for offsets in the broader domestic market.**

~~Staff believes this provision would prevent the Plan from conforming to **Special Condition 10**, as it could result in far fewer emission reductions than the Commission anticipates Poseidon will provide. The Plan does not define the terms used (e.g., "reasonably discernable", "market disruptions", etc.)and Poseidon has not established at what level various measures might become economically infeasible. Additionally, determining when the various conditions might occur appears to be solely under the purview of Poseidon. The Plan does not identify how funds in the escrow account would be used or who would decide their use. These characteristics each prevent the Commission from having the necessary level of assurance that Poseidon will adequately mitigate for its indirect GHG emissions. Further, because AB 32 requires CARB to consider cost-effectiveness in developing its regulations and protocols, this contingency is likely not necessary. The broad application of the AB 32 processes to a wide variety of projects should ensure that Poseidon's proposed measures are not held to a different standard than others in the emission reduction marketplace.~~

### 4.2.2 *Join CCAR's "Climate Action Reserve" or other entities u ing CARB- or CCAR-approved protocols*

~~Poseidon's Plan proposes that Poseidon form a committee to evaluate its emission reduction measures and account for its total emission reduction credits. The committee would include three members – Poseidon, the California Center for Sustainable Energy (CCSE), which is Poseidon's consultant, and a member from academia with expertise in energy or air regulatory policy and emission reduction. The committee would identify, evaluate, and select suitable projects, subject to Poseidon approval. Projects implemented would be included in an annual report to be presented to the SDAPCD and to Commission staff for review and approval. The Plan also proposes that the SDAPCD provide annual oversight of the committee's work and manage a publicly accessible database showing how the Plan is being implemented.~~

~~Staff believes this proposal is overly complex and is duplicative of procedures and mechanisms already available to Poseidon through CCAR. Additionally, the committee would not represent the independent third-party review identified in AB 32 as a necessary component for verifying emission reductions. Further, as currently proposed, the committee would be charged with implementing the Plan using its three sets of criteria, which, as described above, do not ensure adequate validation of the proposed measures. Staff notes, too, that Poseidon's proposal relies on the SDAPCD to perform a role for which it has not yet agreed, and staff therefore recommend the Commission not impose this requirement on the SDAPCD.~~

~~As an alternative, staff recommends~~ **The Commission modifies the Plan to require** that Poseidon join CCAR's Climate Action Reserve, which is a program within CCAR, so that it could ~~it implement some of~~ **acquire and verify offsets purchased under** its Plan through the Reserve. The Reserve was designed specifically for the voluntary GHG emission reduction market. The Reserve provides account holders accurate and transparent measurement,

verification, and tracking of GHG reduction projects and inventories of their GHG ~~reductions~~ **offsets**, thus assuring a high degree of integrity.

Poseidon has been supportive of CCAR – it stated that it has already joined CCAR, and as noted in the ~~Adopted~~ **Permit** Findings, it used CCAR's certified emission factor in determining its total expected GHG emissions. By participating in CCAR's Reserve program, Poseidon will have at least two additional ways to pursue fully verified GHG emission reduction measures – it can elect to purchase CCAR-approved emission reduction credits, and it can request implementation of CCAR-approved emission reduction project proposals. For example, Poseidon could immediately begin implementing its forestry project in San Diego through the Reserve. The Reserve will ensure Poseidon follows CARB/CCAR-approved forestry protocols, will provide independent third-party verification of results, and will provide an accounting mechanism for emission reductions credits Poseidon accrues over time. Poseidon would maintain an account with the Reserve that provides verification of the amount of emission reduction credits it has accrued in the form of public reports available on the Reserve's website, which would provide a high level of transparency.

Poseidon has expressed concerns to Commission staff that the Reserve may not have enough emission reduction credits and project protocols available to meet Poseidon's needs. However, according to the Reserve, it has had available about 200,000 "carbon reduction tons"[21] so far in 2008 and expects to have at least five million available in 2012 when Poseidon plans to start operations.[22] ~~Even if Poseidon were to rely entirely on the Reserve for all its necessary emission reduction credits (about 90,000 tons per year), this would represent less than two percent of the Reserve's expected supply~~**This is well in excess of the amount of credits that Poseidon is expected to need (approximately 16,000 credits per year)**.

**Summary and Conclusion:** In sum, ~~staff recommends above that Poseidon's~~ **the Commission finds that the** Plan's **provisions regarding offsetting the project's net GHG emissions** ~~is~~ **are to** be implemented through the available and applicable provisions of AB 32, as carried out by CARB, ~~and~~ CCAR**, and California Air Districts**. This would ensure the Plan conforms to the provisions of the Commission's approval of Poseidon's coastal development permit and would allow Poseidon's Plan to be part of the state's approach to reducing its GHG emissions. In recognition of Poseidon's concerns that implementation of AB 32 may not proceed at a pace necessary to provide Poseidon with its needed emission reduction credits, Poseidon may at any time apply to the Commission for a permit amendment to modify its Plan to address this issue. Staff notes, however, that consultation with the various agencies has identified a number of AB 32-based protocols and mechanisms that are already in place or expected to be in place before Poseidon begins its operations and needs to implement its Plan. **As noted previously, the Commission has also authorized the Executive Director to approve, upon Poseidon's**

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[21] A "carbon reduction ton" or "CRT" is the Reserve's unit of measure used as a credit for reducing GHG emissions by one ton.

[22] Personal communication with the CCAR Reserve's Joel Levin, Vice President for Business Development, on July 22, 2008.

**request, the use of offsets, credits, or other emission reduction measures that may be available from other sources.**

**The Commission finds that the Project's energy minimization features described above will minimize the Project's energy consumption in accordance with Coastal Act Section 30253(4)and reduce impacts to coastal resources. Additionally, the Plan will mitigate impacts from the desalination facility's net GHG emissions from electrical usage by requiring all such net GHG impacts of the project be offset, and the Commission finds that the Plan will mitigate to the maximum extent feasible impacts on coastal resources of the project's net GHG emissions, in accordance with applicable Coastal Act policies, including Section 30260.**

~~**4.3 SUBMIT ANNUAL REPORTS FOR COMMISSION STAFF REVIEW AND APPROVAL**~~

~~Poseidon's Plan includes an annual review process to ensure that the Commission has an opportunity to review the results of Poseidon's implemented emission reduction measures each year and to determine conformity to ***Special Condition 10***. Poseidon has agreed to provide an annual report for Executive Director review and approval (see Exhibit 1 insert: July 24, 2008, *Memorandum to File – Plan Modifications Agreed to By Poseidon and Commission Staff*). The type and amount of emission reductions is expected to vary each year based on the annual update of SDG&E's certified emission factor and the amount of electricity Poseidon purchases each year from SDG&E.~~

~~However, the current Plan proposes a complex reporting method involving different timelines, committee review, RFP submittals and approvals, accounting methods, and other elements. Staff's recommendation is that Poseidon's annual report submittal be based on the review and timing needed to conform to the particular AB 32 related review processes Poseidon chooses to implement its Plan. The report should describe and account for all approved emission reduction measures and include both an annual and cumulative balance of Poseidon's net emissions; however, the particular mechanisms to develop each year's report may vary. For example, as a member of the Reserve described above, Poseidon will have its own account that reflects the amount of emission reductions credits it owns. This accounting service negates the need for Poseidon's committee, SDAPCD, or Commission staff to perform this function. It also eliminates the need for the committee to serve as a third-party reviewer, as this would be provided by the Reserve.~~

~~If Poseidon were to join the Reserve and use its accounting services for the annual report, the review process would be simplified and would provide Commission staff with a full account of its emission reduction credits that are CARB and/or CCAR approved. This recommendation would also provide the Commission with the necessary level of assurance that Poseidon's Plan is conforming to **Special Condition 10** and meeting the Commission's expectations as expressed in its Findings.~~

~~**4.4 MODIFY THE PLAN TEMPLATE TO CONFORM TO AB 32-BASED REVIEW PROCESSES.**~~

~~Commission staff provided to Poseidon a template to use as the basis for its Plan. Staff's template included three main steps:~~

~~1) Determine expected indirect GHG emissions based on electricity use.~~

~~2) Identify measures that will reduce electricity use at the facility or use renewable energy and thereby reduce indirect GHG emissions.~~

~~3) Identify emission reduction measures that will be used to offset any remaining indirect emissions.~~

~~In its submitted Plan, Poseidon modified the template in a manner that would remove some of its proposed emission reduction measures from the necessary review process. For example, Part II of staff's template was meant to include only those measures that would directly avoid or reduce the amount of electricity purchased for use at the desalination facility (such as those described in footnote xx of this memorandum). Poseidon modified this step to include "project-related" measures that involve potential electricity or emission reductions that may occur elsewhere or through the actions of other entities. The submitted Plan also suggests that these "project-related" measures added to Part II be automatically deducted from the facility's baseline electricity use to derive its net use and net GHG emission level. However, staff's review shows that these measures would not necessarily reduce electricity use or emissions from the facility and are therefore appropriate to include in Part III of the template to ensure they are verified through the elements of AB 32 described above in Section 4.2.2.~~

~~Similar to the previous recommendation, staff recommends Poseidon modify the template in a manner appropriate to the AB 32 approved processes Poseidon chooses to implement for its Plan. As long as the template shows that all emission reduction measures needed to account for the indirect emissions from Poseidon's purchased electricity use are reviewed using the protocols, mechanisms, criteria, and other elements approved pursuant to AB 32, the Commission will have the necessary level of assurance that ongoing implementation of the Plan can conform to the provisions of *Special Condition 10*.~~

## CONCLUSION

**The Commission finds that, as modified, Poseidon's Energy Minimization and Greenhouse Gas Emission Reduction Plan complies with *Special Condition 10* and with the Coastal Act's requirements to minimize energy consumption, protect coastal resources, and minimize the adverse environmental effects of coastal-dependent industrial facilities.**

POSEIDON RESOURCES

December 5, 2008

**Agenda Item**
**W 16b**

**VIA FEDEX**

Chairman Kruer and Honorable Commissioners
California Coastal Commission
North Central Coast District
45 Fremont, Suite 2000
San Francisco, CA 94105-2219

RECEIVED
DEC 0 8 2008
CALIFORNIA
COASTAL COMMISSION

Re: Carlsbad Desalination Project CDP Application No. E-06-013
Energy Minimization and Greenhouse Gas Reduction Plan

Dear Chairman Kruer and Honorable Commissioners:

Poseidon Resources (Channelside) LLC ("Poseidon") submits this letter in response to the Coastal Commission Staff Report dated November 26, 2008 setting forth proposed revised findings ("Revised Findings") reflecting the Commission's August 6, 2008 approval of the Energy Minimization and Greenhouse Gas Reduction Plan ("Plan") pursuant to Special Condition 10 of the above-referenced Coastal Development Permit ("Permit") for the Carlsbad Seawater Desalination Facility (the "Project"). The Revised Findings are scheduled to be considered by the Commission at its December 10, 2008 meeting.

Poseidon believes that the Revised Findings conflict with the Commission's approval of the Plan in three important ways, as discussed below. However, based on discussions with Commission staff we understand that staff agrees with Poseidon on these points and will release an Addendum to the November 26, 2008 Staff Report early next week which will modify the proposed Revised Findings to address the inconsistencies with the Commission's approval of the Plan described below.

First, the Staff Report interprets the Plan to require Renewable Energy Credits ("RECs")[1] to be purchased from the California Air Resources Board ("CARB"), the California Climate Action Registry ("CCAR"), or an Air District, even though plain language in the approved Plan states that "[c]onsistent with Staff's recommendation, acquisition of RECs are not limited to purchase from CCAR, CARB, or any other Third Party Provider." The Commission adopted the

[1] A renewable energy credit represents proof that one MW of electricity was generated from renewable energy (wind, solar, geothermal or hydroelectric).

**These materials have been provided to Coastal Commission Staff**

**Poseidon Resources Corporation**
501 West Broadway, Suite 840, San Diego, CA 92101, USA
619-595-7802 Fax: 619-595-7892
Project Office: 4600 Carlsbad Boulevard, Carlsbad, CA 92008

Plan on August 6, 2008 without discussing RECs or modifying this language in any way. Further, because CCAR does not have verification protocols for RECs and does not intend to develop them in the near future, the Staff Report's position would effectively bar Poseidon from acquiring RECs and would thus favor post-emission mitigation over the development of renewable energy. The Revised Findings also would eliminate specific provisions in the Plan providing for the purchase of RECs, in particular from projects proposed in the San Diego Region, a number of which were specifically identified in the Plan. The interpretation of the Plan set forth in the Staff Report would therefore result in poor public policy while also being contrary to the plain language of the Plan and the intent of the Commission.

Second, the proposed Revised Findings in the Staff Report fail to incorporate a contingency in the Plan allowing Poseidon to acquire offsets from entities other than CARB, CCAR, or the Air Districts in the event that these entities cannot provide sufficient offsets at a price reasonably equivalent to the general domestic market price. To the contrary, the proposed Revised Findings state that this contingency is only available if offsets cannot "feasibly be acquired through these entities due to price or inadequate supply." This language provides no protection in the event that CARB, CCAR, or the Air Districts cannot provide offsets at a reasonable price; fails to describe the correlation in the contingency between the price of offsets provided by these entities and the price of offsets available on the broader domestic market; and could require Poseidon to purchase offsets at several times the domestic market price unless it could establish that it would be "infeasible" for Poseidon to do so. This would not conform to the contingency approved by the Commission, which will protect Poseidon from being required to purchase offsets at unreasonably high prices.

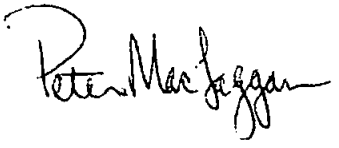
Third, in what we understand was an unintentional omission, the proposed Revised Findings state that the Plan "will mitigate to the extent feasible impacts on coastal resources of the project's net GHG emissions, in accordance with Section 30260", while Coastal Act section 30260 requires, where applicable, a finding that "adverse environmental effects are mitigated to the *maximum* extent feasible." (emphasis added). In making the requisite findings under section 30260 in connection with its November 15, 2007 adoption of the Permit, the Commission found that the Plan would result "in reduction in electrical use and reduction or offset of greenhouse gas emissions associated with the project's operations to the maximum extent feasible through Poseidon's agreement that the project will be net carbon neutral." It is critical that the Commission's Revised Findings reflect a finding that the Plan will mitigate to the maximum extent feasible the impacts of the Project's net GHG emissions on coastal resources, so that the Revised Findings accurately reflect the Commission's approval of the Permit and the Plan, as well as the administrative record for these approvals, which fully demonstrates that the Plan will minimize the Project's impacts from net GHG emissions to the "maximum extent feasible" through the imposition of energy minimization measures and a requirement that all net GHG emissions be offset.

Attached hereto as Exhibit A is a modified version of Staff's proposed Revised Findings which reflects the changes described above (Poseidon's revisions are in red font, with additions bolded and underlined and deletions in double strike-through). Exhibit A reflects Poseidon's understanding of modifications to the Revised Findings that will be incorporated in the Addendum to the November 26, 2008 Staff Report to be released in the near term. Poseidon

respectfully requests that the Commission approve Revised Findings that are consistent with the modifications outlined above and set forth in Exhibit A.

Thank you for your consideration of these issues.

Sincerely,



Peter MacLaggan
Poseidon Resources

Enclosure

cc: Tom Luster (via email and FedEx)
Rick Zbur, Esq

**These materials have been provided to Coastal Commission Staff**

# Poseidon Resources
# Carlsbad Desalination Project

## Briefing Materials - GHG Plan Revised Findings



December 10, 2008

Agenda Item W16b

**These materials have been provided to Coastal Commission Staff**

# Poseidon's Concerns with Staff's Proposed Revised Findings for the GHG Plan

- *Issue #1*: Staff's Proposed Revised Findings are inconsistent with the Commission's action by not incorporating the contingency that Poseidon may acquire offsets from entities other than CARB, CCAR or the Air Districts when they cannot provide sufficient offsets at a reasonable price, based on the generally domestic market price.
- *Issue #2*: Staff's Proposed Revised Findings are inconsistent with the Commission's action by requiring that Renewable Energy Credits ("RECs") be acquired from CARB, CCAR or the Air Districts.

# *Issue # 1*: The Contingency Approved by the Commission Contemplates Cost Effectiveness

- Poseidon initially requested flexibility to purchase offsets from members of the Offset Quality Initiative, as well as CCAR/CARB, to ensure the availability of sufficient offsets at a reasonable price.
- At the August 6, 2008 hearing, Poseidon agreed to limit its offset purchases to offsets from CCAR, CARB, and the Air Districts if there was a contingency available to purchase from other entities if sufficient offsets were not available at the domestic market price.
- In response to Poseidon's proposal, the Commission approved a contingency, which allows Poseidon to purchase offsets from other entities where sufficient offsets are not available at the reasonable market price.



# Staff's Proposed Findings Do Not Incorporate a Reasonable Cost Standard in the Contingency

- Staff's proposed findings state that the contingency measure is only applicable when "offsets cannot *feasibly* be acquired through" CARB/CCAR or the Air Districts.
- Staff's language provides no protection in the event that CARB/CCAR/Air Districts cannot provide sufficient offsets at a reasonable price.
- Under Staff's language, Poseidon could potentially have to purchase offsets at several times the domestic market price unless it could establish that it would be "infeasible" to do so.
- By subjecting Poseidon to purchasing offsets at unreasonably high prices, Staff's feasibility requirement would undercut the Commission's intent.



# Feasibility Requirement is Not Consistent With the Record

- At the August 6, 2008 hearing, the Commissioners made clear their intent that the contingency measure was to ensure that offset costs would be reasonable:
  - **Rick Zbur**: ...really the key issue for us we are worried that we are not going to have enough credits, and we would actually like that the infeasibility issue be focused in part on ***whether the credits are available at a generally domestic market price***... (transcript p. 200) (emphasis added)
  - **Commissioner Hueso**: I am fine with CCAR being the first choice, and then having any other options available pursuant to the approval of the executive director, just so long as they have the opportunity just so long as they have the ***opportunity to look at other cost effective savings***...

    **Executive Director Douglas**: Okay, there are a couple of issues, just to make clear, because we don't want to come back and have an argument over this. Poseidon would only purchase from CCAR, unless the Executive Director approves other sources for acquisition because they don't have enough credits available. That is what I understood on that part of it.

    **Chair Kruer**: And, ***reasonably priced***. Price was one of the issues, too... they added a caveat on that. (transcript pp. 211-212) (emphasis added)



# *Issue # 2:* The Commission's Intent Was to Treat RECs Differently than Carbon Offsets

- The Plan submitted to the Commission by Poseidon on August 2, 2008 stated that "[c]onsistent with Staff's recommendation, acquisition of RECs are not limited to purchase from CCAR, CARB, or any other Third Party Provider."
- At the August 6, 2008 hearing, the Commission adopted this version of the GHG Plan without discussing RECs or in any way modifying the above language.
- The GHG Plan approved by the Commission thus does not restrict Poseidon's purchases of RECs to CCAR, CARB, or the Air Districts.

# Differences Between RECs and Offsets

- Renewable Energy Credits (RECs) are a special type of offset based on the environmental attributes of a renewable energy project (e.g., wind, solar, or geothermal).
- Each REC represents proof that 1 megawatt-hour of electricity was generated by an eligible renewable energy source.
- The quantity of carbon offsets from a REC are based on the carbon production otherwise associated with 1 megawatt-hour of electricity it is displacing.
- RECs are verified using the same basic AB 32 criteria applied to other voluntary offsets – they must be real, permanent, quantifiable, enforceable and additional.
- Not all offsets are RECs, and the terms are not interchangeable.



# Staff Proposes to Limit the Acquisition of RECs to the Same Entities Providing Carbon Offsets

- Staff's Proposed Findings assert that the Commission intended to limit the acquisition of RECs in the same manner as offsets.
- The record does not support Staff's position.
  - Discussions that Staff cites in the hearing testimony about offsets concerned a specific contingency in the GHG Plan that only applied to offsets (it mentioned the Offset Quality Initiative), and not to RECs. Staff is applying the discussion at the hearing related to offsets to extend CCAR/CARB purchase limitations to RECs.
- The GHG Plan included specific REC projects that now would be disallowed under Staff's proposal, many of which are in San Diego County, when the Commission did not evidence any intent to preclude such options.

# Funding of Local Projects Through RECs Contemplated by GHG Plan

- Staff's proposal eliminates San Diego County renewable energy projects, which were specifically included in the GHG Plan adopted by the Commission.

*Table 5 – Potential Renewable Energy Partnerships*

| Desalination Project Public Partner / Location | Green Power Project Description | Annual Capacity of Green Energy Projected to be Generated by the Project (MWh/yr) |
|---|---|---|
| City of Encinitas | 95 KW Solar Panel System Installed on City Hall Roof | 160 |
| Valley Center Municipal Water District | 1,000 KW Solar Panel System | 1,680 |
| Rainbow Municipal Water District | 250 KW Solar Panel System | 420 |
| Olivenhain Municipal Water District / Carlsbad Municipal Water District / City of Oceanside | Various solar and hydroelectric generation opportunities | To Be Determined |
| Santa Fe Irrigation District | Hydropower generation facility at R.E. Badger Filtration Plant | To Be Determined |
| | **Total Renewable Power Generation Capacity (MWh/yr)** | 2,260 |

- There was no direction by the Commission to eliminate these projects.





# California Regional Water Quality Control Board
## San Diego Region

Over 50 Years Serving San Diego, Orange, and Riverside Counties
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Linda S. Adams
*Secretary for Environmental Protection*

Arnold Schwarzenegger
*Governor*


December 2, 2008

In reply, please refer to:
Reg. Meas. ID 308381
Place ID 640063

Mr. Peter MacLaggan
Senior Vice President
Poseidon Resources
501 West Broadway
Suite 840
San Diego, CA 92101

Dear Mr. MacLaggan:

**SUBJECT:** *Review of Proposed Poseidon Resources Carlsbad Desalination Plant* Marine Life Mitigation Plan, Resolution No. R9-2008-0039

The California Regional Water Quality Control Board, San Diego Region (Regional Board) has received the document entitled Poseidon Resources Plant Marine Life Mitigation Plan dated November 14, 2008 (MLMP). According to Poseidon Resources' (Poseidon) transmittal letter, the MLMP is intended to satisfy the requirements the Regional Board established in Resolution No. R9-2008-0039, adopted on April 9, 2008 (Resolution). The Resolution requires Poseidon to submit an amendment to the March 6, 2008 Flow, Entrainment and Impingement Minimization Plan (Minimization Plan) within six months of adoption of the Resolution, or not later than October 8, 2008. The Resolution specifies that the amendment must include a specific proposal for mitigation of impacts caused by impingement and entrainment of marine organisms resulting from seawater intake from Agua Hedionda Lagoon (Resolution, ¶ 3). In addition, the Resolution directs Poseidon to address the concerns identified in February 19, 2008 correspondence from the Regional Board to Poseidon Resources (copy attached) as well as additional enumerated concerns (Resolution, ¶ 3):

The MLMP, due not later than October 8, 2008, was not timely submitted. In any event, the MLMP fails to comply with the directives in the Resolution. The MLMP does not propose a specific mitigation site or specific proposal for mitigation at an identified site. It appears to staff that the MLMP merely presents an outline of how mitigation sites will be evaluated and selected, what elements will comprise a restoration plan, how an as-yet unidentified mitigation site will be monitored, and how mitigation site success criteria will be evaluated. Furthermore, the MLMP does not address the Regional Board's prior concerns outlined in its February 19, 2008 correspondence nor does it address all of the enumerated concerns (a) through (e) identified in paragraph 3 of the Resolution.

I intend to inform the Regional Board at its upcoming meeting that the directives of Resolution No. R9-2008-0039 remain unsatisfied, and, in light of the pending litigation filed by Surfrider and San Diego Coastkeeper against the Regional Board, anticipate discussing this matter with the Regional Board in closed session, as noted on the agenda for the December 10, 2008 meeting.

If you have any questions regarding the content of this letter, please contact Mike Porter directly at (858) 467-2726 or by email mporter@waterboards.ca.gov.

Respectfully,

John H. Robertus
Executive Officer

cc: (Interested Parties List)

**Interested Parties**
**Order No. R9-2006-0065**
**NPDES Permit No. CA0109223**

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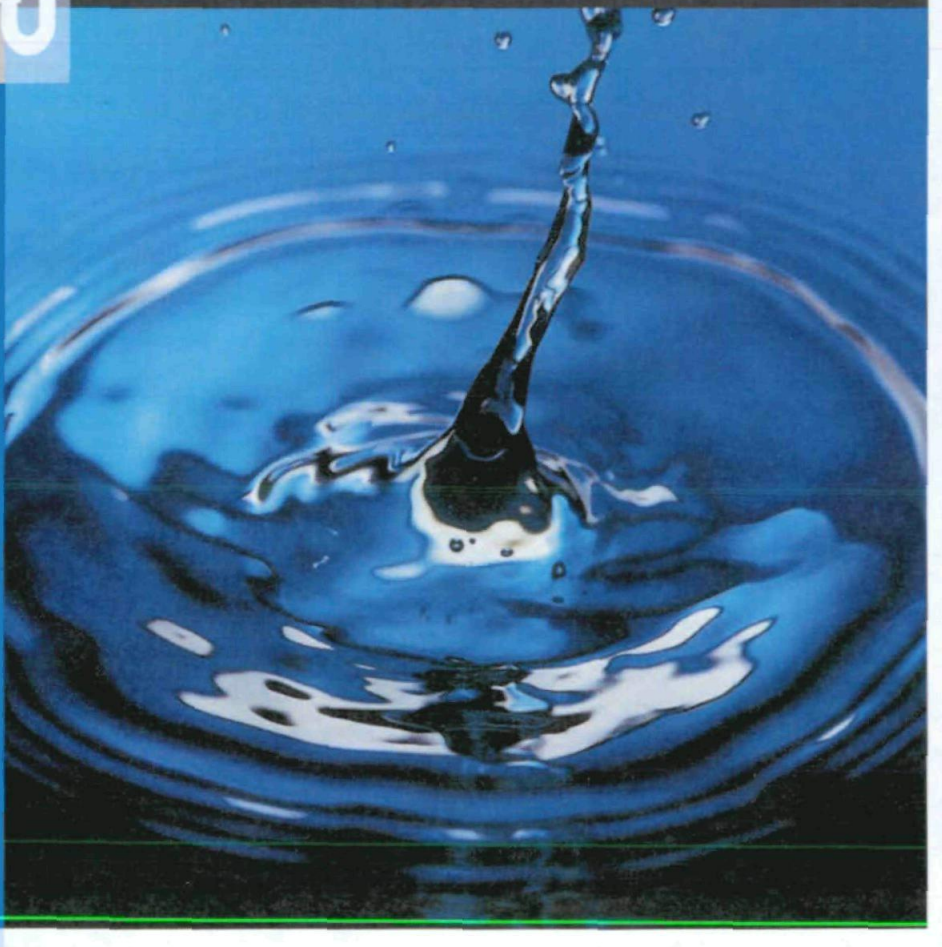
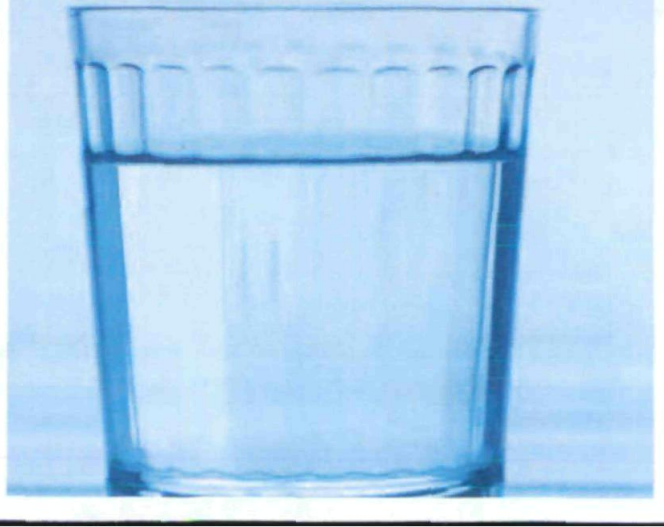
# 2005 UPDATED URBAN WATER MANAGEMENT PLAN





San Diego County
Water Authority

# UPDATED 2005 URBAN WATER MANAGEMENT PLAN

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## 2005 UWMP ABBREVIATIONS

| | |
|---|---|
| 2000 Plan | 2000 Urban Water Management Plan |
| 2005 Plan | 2005 Urban Water Management Plan |
| AAC | All-American Canal |
| Act | Urban Water Management Planning Act |
| AF | acre-feet |
| AF/YR | acre-feet per year |
| Bay-Delta | San Francisco Bay/Sacramento-San Joaquin River Delta |
| BMPs | Best Management Practices (Water Conservation) |
| CC | Coachella Canal |
| CEQA | California Environmental Quality Act |
| cfs | cubic feet per second |
| CII | Commercial, Industrial, and Institutional |
| CIMIS | California Irrigation Management Information System |
| CIP | Capital Improvement Program |
| CRA | Colorado River Aqueduct |
| CSP | Carryover Storage Project |
| CUWA | California Urban Water Agencies |
| CUWCC | California Urban Water Conservation Council |
| CVP | Central Valley Project (Federal) |
| CVWD | Coachella Valley Water District |
| CWA-MAIN | County Water Authority - Municipal and Industrial Needs |
| Delta | Sacramento - San Joaquin River Delta |
| DHS | Department of Health Services (State of California) |
| DIP | Delta Improvement Package |
| DMP | Drought Management Plan |
| DWR | Department of Water Resources (State of California) |
| EIR/EIS | Environmental Impact Report/Environmental Impact Statement |
| EOC | Emergency Operations Center |
| EPA | Environmental Protection Agency |
| ERP | Emergency Response Plan |
| ESA | Endangered Species Act (Federal) |
| ESP | Emergency Storage Project |
| EWA | Environmental Water Account |
| EWDP | Emergency Water Delivery Plans |
| EWMPs | Efficient Water Management Practices |
| FAP | Financial Assistance Program |
| FFY | Federal Fiscal Year |

| | |
|---|---|
| Forum | Colorado River Basin Salinity Control Forum |
| FY | Fiscal Year |
| GRP | Groundwater Recovery Program |
| HEWs | high-efficiency clothes washers |
| IAWP | Interim Agricultural Water Program |
| IID | Imperial Irrigation District |
| IRP | Integrated Resources Plan |
| IRWMP | Integrated Regional Water Management Plan |
| lb/day | pounds per day |
| LCR MSCP | Lower Colorado River Multi-Species Conservation Program |
| LRP | Local Resource Program |
| M&I | municipal & industrial |
| MAF | million acre-feet |
| MAF/YR | million acre-feet per year |
| MAIN | Institute for Water Resources - Municipal and Industrial Needs |
| MCB Camp Pendleton | Marine Corps Base Camp Pendleton |
| mg/l | milligrams per liter |
| mgd | million gallons per day |
| Metropolitan | Metropolitan Water District of Southern California |
| MOA | Memorandum of Agreement |
| MOU | Memorandum of Understanding Regarding Urban Water Conservation in California |
| MTBE | Methyl Tertiary Butyl Ether |
| MWDOC | Municipal Water District of Orange County |
| NEPA | National Environmental Policy Act |
| OAEP | Operational Area Emergency Plan |
| Omnibus Act | Omnibus Appropriations Act |
| OM&R | Operation, Maintenance, and Repair |
| O&M | Operations and Maintenance |
| PEIR | Programmatic Environmental Impact Report |
| ppb | parts per billion |
| ppm | parts per million |
| QSA | Quantification Settlement Agreement |
| Regional Board | California Regional Water Quality Control Board |
| RO | reverse osmosis |
| ROD | Record of Decision |
| RUWMP | Regional Urban Water Management Plan |
| RWDF | Reclaimed Water Development Fund |
| RWFMP | Regional Water Facilities Master Plan |
| SANDAG | San Diego Association of Governments |
| SDP | Metropolitan Water District of Southern California's Seawater Desalination Program |
| SDCWA | San Diego County Water Authority |
| SDWA | Safe Drinking Water Act |
| SEMS | Standardized Emergency Management System |
| Skinner TP | Lake Skinner Water Treatment Plant |
| SONGS | San Onofre Nuclear Generating Station |
| SRF | State Revolving Fund |
| SSOA | Surface Storage Operating Agreement |
| SWA | Source Water Assessment |
| SWP | State Water Project |
| SWRCB | State Water Resources Control Board |
| TAC | Technical Advisory Committee |
| Transfer Agreement | Water Authority-Imperial Irrigation District Transfer Agreement |
| TOC | total organic carbon |
| TDS | total dissolved solids |
| ULFTs | ultra-low flush toilets |
| USBR | U.S. Bureau of Reclamation |
| USFWS | U.S. Fish and Wildlife Service |
| VIP | Voucher Incentive Program |
| Water Authority | San Diego County Water Authority |
| Water Use Plan | California's Colorado Water Use Plan |
| WRLP | Water Reclamation Loan Program |
| WSDM Plan | Water Surplus and Drought Management Plan |

UPDATED UWMP

In accordance with the Urban Water Management Planning Act, the San Diego County Water Authority (Water Authority) Board of Directors adopted the 2005 Urban Water Management Plan (2005 Plan) in November 2005. Since November 2005, the Board of Directors has taken two significant actions that result in the need to update the 2005 Plan. These include a change on seawater desalination development within San Diego county from a regional supply project at the Encina Power Station to a local supply project (**Sections 4.3** and **5.4**), and adoption of the Water Authority's Drought Management Plan (**Section 9.2**). Updating the plan to address these changed conditions also provides an opportunity to make clarifying edits requested by Department of Water Resources staff after its review of the 2005 Plan.

The Urban Water Management Planning Act requires an update of the plan every five years. This update is being done, prior to 2010, to maintain the Water Authority's eligibility for state grant funding and also provides updated information on the Water Authority's supplies. In accordance with its Administrative Code, the Water Authority will also prepare annual water supply reports commencing in 2008 to provide updated information on development of local and imported water supplies. The following is the Water Authority's Updated 2005 Plan:

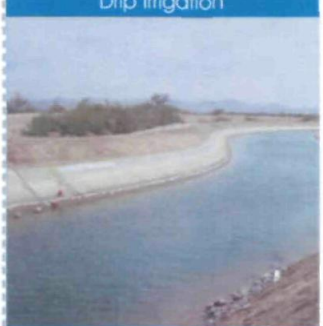
# SECTION 1 INTRODUCTION

The mission of the San Diego County Water Authority (Water Authority) is to provide a safe and reliable supply of water to its member agencies serving the San Diego region. This Updated 2005 Urban Water Management Plan (Updated 2005 Plan) identifies a diverse mix of water resources projected to be developed over the next 25 years to ensure long-term water supply reliability for the region.

Since adopting the 2000 Urban Water Management Plan (2000 Plan), the Water Authority and its member agencies have made great strides in conserving and diversifying its supplies. With an aggressive conservation program, the region has conserved an average of 40,500 acre-feet per year (AF/YR) over the last five years. In 2003, conserved agricultural transfer water from the Imperial Valley began flowing to the region, which will provide 200,000 AF/YR by 2021. In 2003, the Water Authority was assigned rights to 77,700 AF/YR of conserved water from projects that will line the All-American and Coachella Canals. Deliveries of this conserved water from the Coachella Canal reached the region in 2007, and deliveries from the All-American Canal are projected to reach the region in 2010.



Drip Irrigation



Coachella Canal




Recyled Water at Otay Ranch

Developing these supplies is key to diversifying the region's supply sources, but other factors are also important, such as member agencies implementing and managing local resources. Indeed, local surface water, groundwater, recycled water, and desalinated seawater are all important elements of a diverse water supply portfolio. Likewise, it is critical that the Metropolitan Water District of Southern California (Metropolitan) continue to provide a reliable supply of imported water to the region. The Water Authority, its member agencies, and Metropolitan must work together to ensure a diverse and reliable supply for the region.

This section of the Updated 2005 Plan describes the state laws that influence preparation of the plan, including the Urban Water Management Planning Act (Act) and Water Code Sections that were enacted with the passage of Senate Bills 610 and 221 in 2001. It also includes a discussion of the coordination that occurred in preparation of the Updated 2005 Plan as well as a general description of the Water Authority, with its physical water delivery system, service area characteristics, climate, and population projections.

## SECTION 1.1 CALIFORNIA URBAN WATER MANAGEMENT PLANNING ACT

The California Water Code requires all urban water suppliers in the state to prepare urban water management plans and update them every five years. These plans satisfy the requirements of the Act of 1983, including amendments that have been made to the Act. Sections 10610 through 10657 of the California Water Code details the information that must be included in these plans, as well as who must file them.

**Major amendments made to the Act since the Water Authority's 2000 Plan was prepared include:**

- Description of specific water supply projects and implementation schedules to meet projected demands over the planning horizon;
- Description of the opportunities for the development of desalinated water;
- Additional information on groundwater, where groundwater is identified as an existing or planned water source;
- Description of water quality over the planning horizon; and
- Description of water management tools that maximize local resources and minimize imported water supplies.

In addition, the California Department of Water Resources (DWR) will consider whether the urban water supplier has submitted an updated plan when determining eligibility for funds made available pursuant to any program administered by the department.

According to the Act, "The conservation and efficient use of urban water supplies are of statewide concern; however, the planning for that use and the

implementation of those plans can best be accomplished at the local level." The Act requires that each urban water supplier that provides water for municipal purposes either directly or indirectly to more than 3,000 customers or supplies more than 3,000 AF of water annually, shall prepare, update, and adopt its urban water management plan at least once every five years or before December 31, in years ending in five and zero. In accordance with the Act, the Water Authority is required to update and adopt its plan for submittal to the DWR by December 31, 2005. **Appendix A** contains the text of the Act.



## SECTION 1.2 SENATE BILLS 610 AND 221

Water Code Sections 10910 through 10914 and Government Code Sections 65867.5, 66455.3, and 66473.7 (commonly referred to as SB 610 and SB 221) amended state law to improve the link between information on water supply availability and certain land use decisions made by cities and counties. SB 610 requires that the water purveyor of the public water system prepare a water supply assessment to be included in the environmental documentation of certain large proposed projects. SB 221 requires affirmative written verification from the water purveyor of the public water system that sufficient water supplies are available for certain large residential subdivisions of property prior to approval of a tentative map.

**Section 4** of the Updated 2005 Plan contains documentation on the existing and planned water supplies being developed by the Water Authority. This documentation may be used by the Water Authority's member agencies in preparing the water supply assessments and written verifications required under state law. Specific documentation on member agency supplies and Metropolitan supplies may be found in their respective plans.

## SECTION 1.3 WATER AUTHORITY'S UPDATED 2005 URBAN WATER MANAGEMENT PLAN

This report constitutes an update to the Water Authority's 2005 Plan. To adequately demonstrate how the region will be reliable over the next 25 years, the Updated 2005 Plan quantifies the regional mix of existing and projected local and imported supplies necessary to meet future retail demands within the Water Authority's service area. While the Updated 2005 Plan includes specific documentation on development of the Water Authority's supplies, the plans submitted by the member agencies and Metropolitan will provide details on their supplies that contribute to the diversification and reliability of supplies for the San Diego region.

Striving for consistency among the plans of Metropolitan, the Water Authority, and its member agencies is important to accurately reflect the projected supplies available to meet regional demands. In order to facilitate coordination within the Water Authority's service area, the Water Authority formed an Urban Water Management Plan Working Group made up of staff from the Water Authority and its member agencies. This group provided a forum for exchanging demand and supply information. In addition, DWR and the California Urban Water Conservation Council (CUWCC) hosted a special workshop to review the requirements of the Act. At a separate workshop, the Working Group received a briefing from Metropolitan on its regional plan, and participants discussed strategies for coordination between the supply agencies.



Some members of the UWMP working group

The Water Authority further coordinated its efforts by working with the appropriate wastewater agencies. These agencies helped prepare the water recycling element of the Updated 2005 Plan, which describes

the wastewater treatment requirements and water recycling potential. The Water Authority also coordinated with Metropolitan regarding projected needs for imported water deliveries. A member agency draft 2005 Plan was distributed for technical review by the Water Authority's member agencies and their comments incorporated.

In accordance with the Act, the Water Authority notified the land use jurisdictions within its service area that it was preparing an Updated 2005 Plan. Prior to adoption, the Water Authority mailed the Updated 2005 Plan to interested parties that included the Water Authority's member agencies, the San Diego Regional Chamber of Commerce, the Sierra Club, the County of San Diego, and cities within the Water Authority's service area. The Updated 2005 Plan was also available for public review at the Water Authority and on the Water Authority's internet homepage.

The Water Authority reviewed all of the comments received and revised the plan accordingly. The Water Authority Board of Directors held a public hearing on October 27, 2005, and adopted the Water Authority's Updated 2005 Plan on November 17, 2005. The Board of Directors adopted the Updated 2005 Plan on April 26, 2007. **Appendix B** contains a copy of the resolution adopting the Updated 2005 Plan and the Updated Updated 2005 Plan.

DWR prepared a checklist based on the Act of items that must be addressed in an agency's plan. This checklist allows an agency to identify where in its plan it has addressed each item. The Water Authority has completed the checklist, referencing the sections and page numbers included in the Updated 2005 Plan. The completed checklist is included in **Appendix C**.

## SECTION 1.4 HISTORY AND DESCRIPTION OF THE WATER AUTHORITY

### 1.4.1 HISTORY

The Water Authority was established pursuant to legislation adopted by the California State Legislature in 1943 to provide a supplemental supply of water as the San Diego region's civilian and military population expanded to meet wartime activities. Due to the strong military presence, the federal government arranged for supplemental supplies from the Colorado River in the 1940s. In 1947, water began to be imported from the Colorado River via a single pipeline that connected to Metropolitan's Colorado River Aqueduct (CRA) located in Riverside County. To meet the water demand for a growing population and economy, the Water Authority constructed four additional pipelines between the 1950s and early 1980s that are all connected to Metropolitan's distribution system and deliver water to San Diego County. The Water Authority is now the county's predominant source of water, supplying from 75 to 95 percent of the region's needs depending upon weather conditions and yield from surface, recycled, and groundwater projects.

### 1.4.2 SERVICE AREA

The Water Authority's boundaries extend from the border with Mexico in the south, to Orange and Riverside counties in the north, and from the Pacific Ocean to the foothills that terminate the coastal plain in the east. With a total of 920,463 acres (1,438 square miles), the Water Authority's service area encompasses the western third of San Diego County. **Figure 1-1** shows the Water Authority's service area, its member agencies, and aqueducts.



In 1947 water began to be imported from the Colorado River.

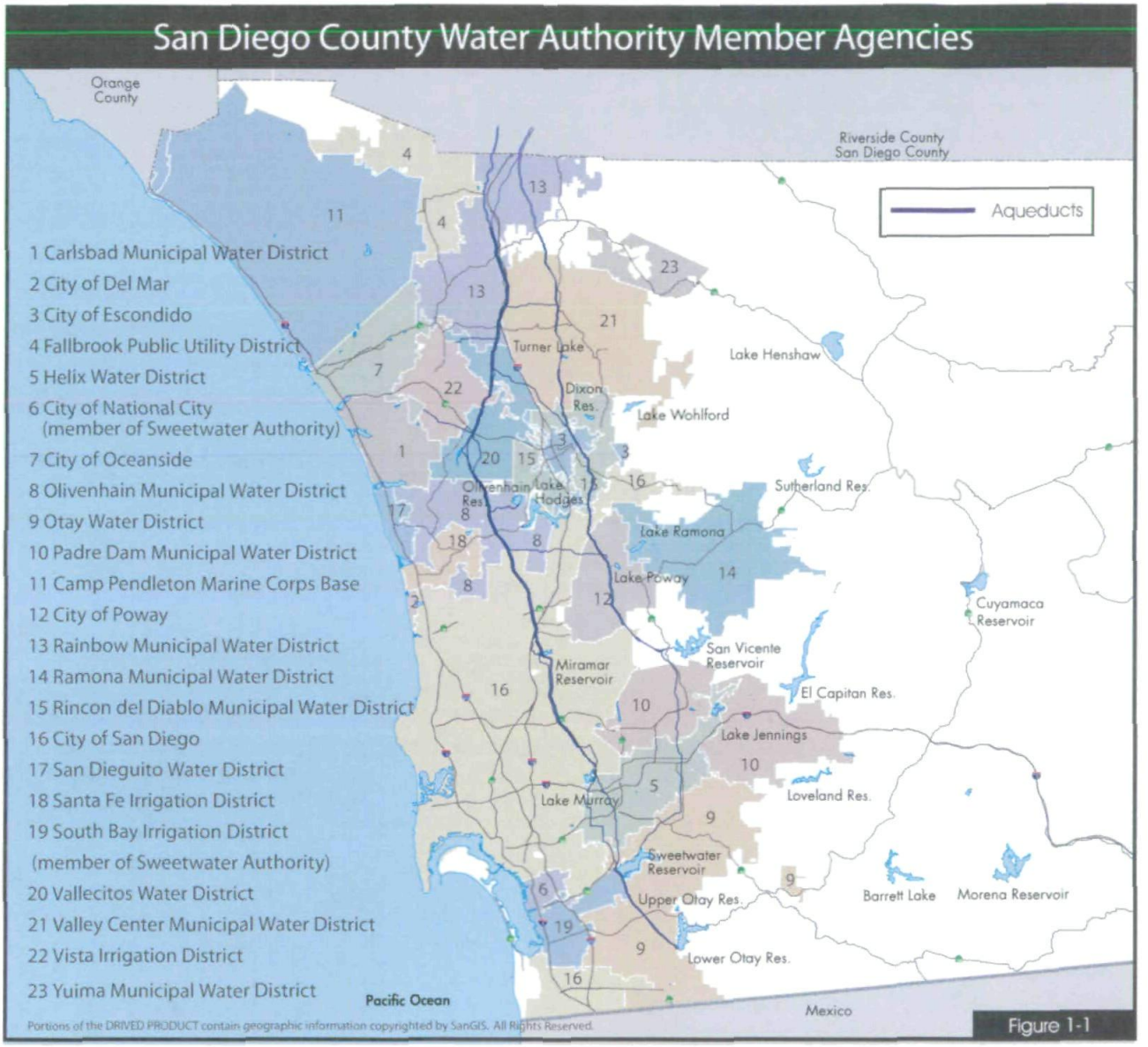


Figure 1-1

### 1.4.3 MEMBER AGENCIES

The Water Authority's 23 member agencies purchase water from the Water Authority for retail distribution within their service territories. A 34-member Board of Directors comprised of member agency representatives governs the Water Authority. The member agencies' six cities, four water districts, eight municipal water districts, three irrigation districts, a public utility district, and a federal military reservation have diverse and varying water needs.

In terms of land area, the City of San Diego is the largest member agency with 210,726 acres. The smallest is the City of Del Mar, with 1,159 acres. Some member agencies, such as the cities of National City and Del Mar, use water almost entirely for municipal and industrial purposes. Others, including Valley Center, Rainbow, and Yuima Municipal Water Districts, deliver water that is used mostly for agricultural production.

## SECTION 1.5 WATER AUTHORITY PHYSICAL WATER DELIVERY SYSTEM

The Water Authority currently purchases water from Metropolitan and transferred water from the Imperial Irrigation District (IID). These supplies are delivered to its member agencies through two aqueducts containing five large-diameter pipelines. The aqueducts follow general north-to-south alignments, and the water is delivered largely by gravity, which allows the distribution system to operate during a power outage. The Water Authority has an exchange agreement with

Metropolitan, which allows delivery of the IID transfer water through Metropolitan's system. Delivery points from Metropolitan are located about six miles south of the Riverside/San Diego county line. The largest single-year of sales of imported water ever recorded by the Water Authority was 644,000 acre-feet (AF) in fiscal year (FY) 2004.

The First Aqueduct includes Pipelines 1 and 2, located in a common right-of-way. They share five common tunnels and are operated as a unit. They have a combined capacity of 180 cubic feet per second (cfs). Pipelines 3, 4, and 5 form the Second Aqueduct. These pipelines are operated independent of the First Aqueduct and are located in separate rights-of-way. Pipeline 3 has a capacity of 280 cfs; Pipeline 4 carries 470 cfs, and Pipeline 5 carries 500 cfs. **Figure 1-1** shows the locations of the Water Authority's aqueducts within San Diego County.

### 1.5.1 CAPITAL IMPROVEMENT PROGRAM (CIP)

The Water Authority completed a Regional Water Facilities Master Plan (RWFMP) process in 2004. The RWFMP defines the regional facilities needed to meet water demands within the Water Authority's service area through the year 2030. The Water Authority examined the changing water supply and demand forecast patterns using a probabilistic approach to facilities planning. A computer model analyzed various facility options under a range of supply and demand scenarios. This modeling resulted in an assessment of the reliability of the system measured in terms of the probability, frequency, and magnitude of water shortages for each facility option.

Table 1-1: CIP Cost Summary by Category (in $ millions)

| PROJECT CATEGORY | PROJECT COST[2] |
|---|---|
| Pipeline Projects | $1,768.3 |
| System-wide Improvements | $63.4 |
| Emergency Storage Projects | $1,176.0 |
| Water Supply Projects | $496.6 |
| Flow Control & Pumping Facilities | $67.5 |
| Reimbursable Projects–Total Cost | $13.9 |
| Total Costs of Active & Future Projects | $3,585.7 |
| Less All Reimbursable Costs[1] | $121.8 |
| Net Water Authority Costs[3] | $3,463.9 |

1 There are project costs within the CIP that are considered reimbursable.
2 Project costs are from the recommended FY 08/09 Multi-Year Water Authority CIP Budget.
3 In June 2004, the Water Authority Board of Directors voted unanimously to select seawater desalination as the preferred RWFMP alternative and added it and 21 other major water facilities projects to the CIP. This action, the largest investment in water supply reliability and system infrastructure in the Water Authority's 60-year history, more than doubled the agency's CIP, from $1.3 billion to more than $3.19 billion. In July 2006, the Water Authority Board of Directors decided not to certify the final environmental impact report for the regional seawater desalination project and not to pursue the project further. The table reflects this change. See Sections 4.3 and 5.4 for more information.

The water supply and capital improvements currently under way and planned for the future are designed to serve the region's needs through 2030. They include new pipelines and pump stations to convey the water, a water treatment facility, improvements to the existing water delivery system, the All-American and Coachella Canal Lining Projects, and projects to increase storage capacity throughout the county (see **Table 1-1** for the CIP cost summary by category).

The timing for implementation of the CIP projects will be evaluated based on the reliability analysis prepared for the Updated 2005 Plan. If necessary, project schedules will be adjusted to accurately reflect when the project is needed for reliability purposes.

Table 1-2: Member Agency Treatment Plant Capacity

| MEMBER AGENCY | WATER TREATMENT PLANT | CAPACITY* |
|---|---|---|
| Escondido, City of/ Vista Irrigation District | Escondido/Vista | 65 |
| Helix Water District | Levy | 106 |
| Olivenhain Municipal Water District | Olivenhain | 34 |
| Oceanside, City of | Weese | 25 |
| Poway, City of | Berglund | 24 |
| Ramona Municipal Water District | Bargar | 4 |
| San Diego, City of | Alvarado | 150 |
| San Diego, City of | Miramar | 140 |
| San Diego, City of | Lower Otay | 40 |
| San Dieguito Water District/ Santa Fe Irrigation District | Badger | 40 |
| Sweetwater Authority | Perdue | 30 |

*million gallons/day

#### WATER AUTHORITY REGIONAL TREATMENT FACILITY

The treated water that serves the San Diego region is presently produced at local water treatment plants owned by several Water Authority member agencies, and is also imported from Metropolitan's Skinner Water Treatment Plant (Skinner TP) in Riverside County. The member agency treatment plants and capacity are shown in **Table 1-2**. A rapid increase in treated water demand over the last five years has produced significant strains on these treated water supply sources. During peak periods, local plants in the San Diego region typically operate at maximum capacity, and imported water from the Skinner TP meets the remaining demand.

To maintain an adequate level of capacity to meet increased retail customer demands throughout the San Diego region, in September 2005, the Water Authority's Board of Directors certified an environmental impact report for the Twin Oaks Valley Water Treatment Plant and awarded a design-build-operate contract to begin final design and construction of the plant. The plant will be the Water Authority's first water treatment plant and will produce 100-million gallons of drinking water per day beginning in 2008. The plant will help address the growing demand for additional treated water supplies in the region, especially during hot summer days.

### EMERGENCY STORAGE PROJECT

Also part of the CIP, the Emergency Storage Project (ESP) is a $1,176 million system of reservoirs, pipelines, pump stations, and other facilities that will work together to store and move water around the county in case of a prolonged interruption of the region's imported water supply. The facilities that make up the ESP are located throughout San Diego County and are being constructed in phases. The initial phase includes the recently completed 318-foot-high Olivenhain Dam and accompanying 24,789 AF Olivenhain Reservoir. **Section 9.1.2** contains additional information on the ESP.



The Olivenhain Dam is an integral part of the Emergency Storage Project.

### CARRYOVER STORAGE PROJECT

The CIP also includes budget for the Carryover Storage Project (CSP). The Water Authority's RWFMP identifies the need for additional water storage capacity to improve water supply reliability for the region. The Water Authority is currently conducting environmental reviews of project alternatives, including a possible expansion of the San Vicente Reservoir.

**The Water Authority has identified three main needs for carryover storage:**

1.) Enhance water supply reliability – Carryover storage provides a reliable and readily available source of water during periods of potential shortage, such as during dry years.

2.) Increase system efficiency – Carryover storage provides operational flexibility to serve above-normal demands, such as those occurring in dry years, from storage rather than by the over-sizing of the Water Authority's imported water transmission facilities.

3.) Better management of water supplies – Carryover storage allows the Water Authority to accept additional imported deliveries during periods of availability, such as during wet years, to ensure water availability during dry years. As described in **Section 6**, the Water Authority receives delivery of State Water Project (SWP) supplies from Metropolitan, which can be significantly influenced by the need to protect environmental resources in the Sacramento-San Joaquin Bay-Delta region. This protection requires that the SWP reduce deliveries in dry years, but similarly allows for increased deliveries during wet years. Efficient management of this system therefore requires carryover storage to absorb the annual fluctuations in supply.

## SECTION 1.6 SERVICE AREA CHARACTERISTICS

The Water Authority's service area characteristics have undergone dramatic changes over the last several decades. The region's population grew on average by 50,000 people per year, resulting in a shifting of large amounts of rural land to urban uses. This shift in land use has resulted in the region's prominent urban and suburban character. San Diego County also has a rich history of agriculture, beginning with the large cattle ranches established in the 18th century and continuing through the diverse range of crops and products grown today. Although the total number of agricultural acres under production has declined, the region maintains a significant number of high value crops, such as flowers, vegetables, nursery plants, turf grass, avocados, and citrus.

Based on the last survey conducted by DWR, irrigated agricultural land in the Water Authority's service area totaled 73,769 acres. San Diego County agriculture is a $1.3 billion per year industry, eighth in farm production value in the state. Shifting market forces, including the increasing cost of water, may

cause a change in agricultural practices and ultimately result in the retirement of some economically marginal lands.

### 1.6.1 REGIONAL ECONOMY AND DEMOGRAPHICS

Historically, defense-related contracting and manufacturing – particularly the aerospace industry – drove the local economy. This pattern peaked in the 1980s as federal spending fueled economic growth, and local defense-related expenditures surged to $9.6 billion in 1987. When this level of federal spending experienced sharp cuts in the early 1990s, widespread layoffs resulted and triggered a recession that lasted until 1995.

San Diego County has since rebounded, due in part to the emergence of a diversified employment base that includes telecommunications, electronics, computers, software, and biotechnology. High technology and bioscience related employment now exceeds 160,000 jobs. San Diego's gross regional product is forecast to reach $151.1 billion in 2005, a 6.6 percent increase over 2004's $141.7 billion estimate. The number of people actively working averaged 1.42 million in 2004, and that number is forecast to rise by 2.1 percent in 2005, to 1.45 million. Compared to the pace of expansion recorded in the 1980s, the current growth is more moderate, and perhaps more healthy and sustainable.

### 1.6.2 CLIMATE

Climatic conditions within the county area are characteristically Mediterranean along the coast, with mild temperatures year-round. Inland area weather patterns are more extreme, with summer temperatures often exceeding 90 degrees Fahrenheit and winter temperatures occasionally dipping below freezing. Average annual rainfall is approximately 10 inches per year on the coast and in excess of 33 inches per year in the inland mountains. More than 80 percent of the region's rainfall occurs between December and March.

Variations in weather patterns affect regional short-term water requirements, causing reductions in water use during wet cycles and demand spikes during hot, dry periods. Over the last seven years, San Diego has experienced the latter event. Since 1999, local

**Rainfall – Evapotranspiration – Temperature Comparison**

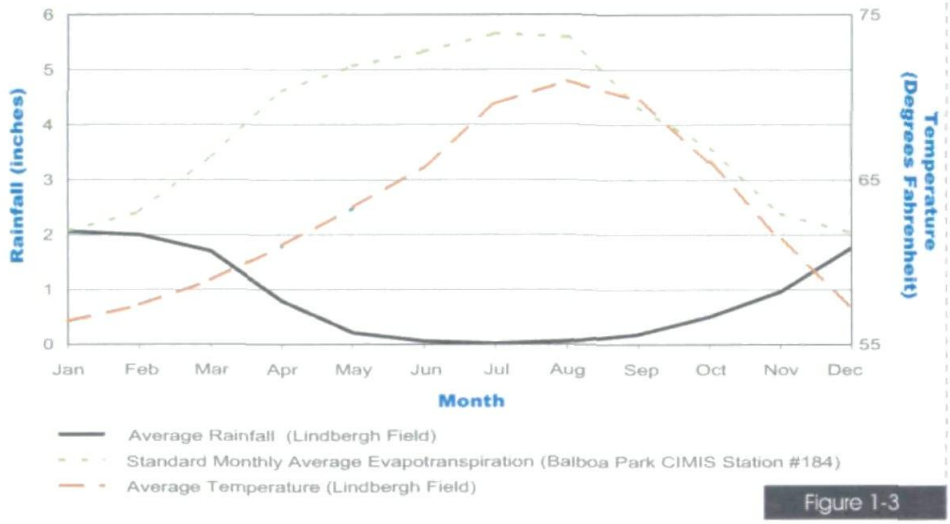



Figure 1-3

**Annual Rainfall (Lindbergh Field Station)**

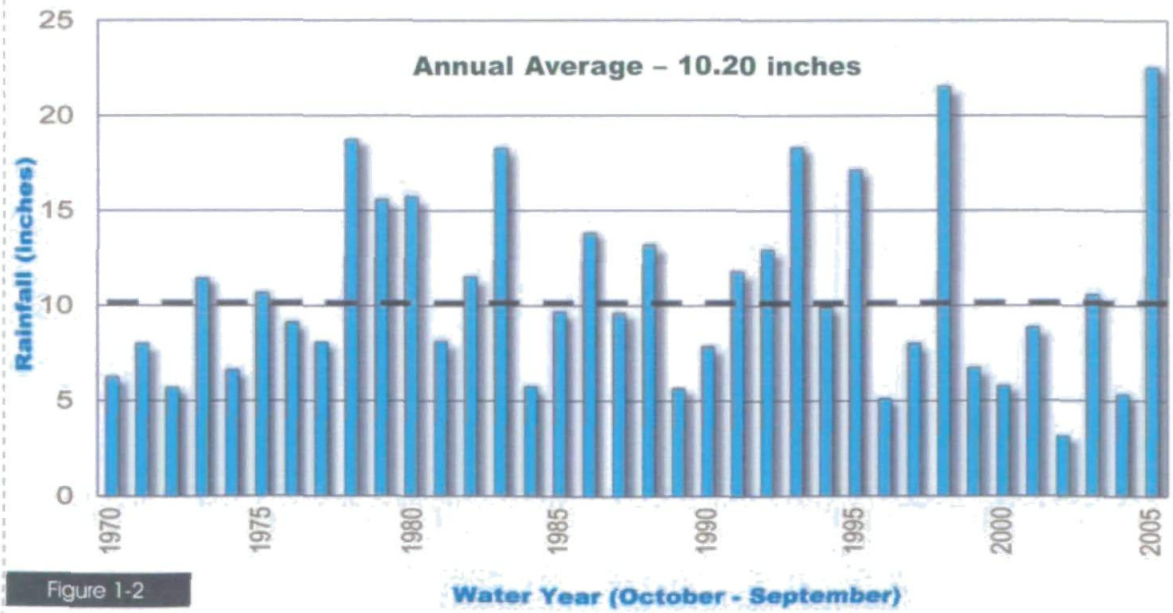



Figure 1-2

rainfall exceeded the historic annual average only twice (**Figure 1-2**). These conditions resulted in record level demands during FY 2004, with total local and imported water use surpassing 715,700 AF. With record rainfall in FY 2005, total demands decreased to 642,152 AF. On a monthly basis, water requirements tend to increase during the summer months when a decrease in rainfall combines with an increase in temperatures and an increase in evapotranspiration levels (**Figure 1-3**).

### 1.6.3 POPULATION

When the Water Authority was formed in 1944, the population of San Diego County totaled roughly 260,000 people. In 2004, total population within the service area reached 2.8 million. The City of San Diego represents the largest population of any member agency, with approximately 1.3 million people. The Yuima Municipal Water District has the smallest population, at just under 2,000 people. The average population density in 2004 was 3.43 people per acre, with National City having the highest density (9.32/acre) and Yuima Municipal Water District the lowest (0.15/acre).

The population of San Diego County is projected to increase by 842,300 people between 2005 and 2030, for a total county population in excess of 3.8 million. This change represents an average annual increase of about 33,700 people, for an annual growth rate of roughly 1.1 percent. These regional growth projections are based on the San Diego Association of Governments (SANDAG) 2030 Cities/County Forecast.

The Water Authority's service area population projections are also based on SANDAG's 2030 Cities/ County Forecast and appear in **Table 1-3**. Water Authority member agencies are projected to have varying future growth. Some, such as the Santa Fe Irrigation District and the City of Del Mar, are expected to experience relatively little growth. Others, including the Otay and Vallecitos water districts, anticipate large increases in both population and water demand.

Table 1-3: Population Forecast – Water Authority Service Area (2005-2030)

| YEAR | POPULATION |
|---|---|
| 2005 | 2,947,262 |
| 2010 | 3,113,498 |
| 2015 | 3,261,691 |
| 2020 | 3,414,068 |
| 2025 | 3,554,815 |
| 2030 | 3,703,243 |
| Average Annual Growth | 30,239 |

Source: SANDAG 2030 Cities/County Forecast

# SECTION 2 WATER DEMANDS

Demand for water in the Water Authority's service area falls into two basic categories: municipal and industrial (M&I), and agricultural. M&I uses currently constitute about 80 to 85 percent of regional water consumption. Agricultural water, used mostly for irrigating groves and crops, accounts for the remaining 15 to 20 percent of demand. This section describes these use categories along with the total historic, current, and projected water demands. By 2030, total normal water demands are projected to reach 829,030 AF (includes projected near-term annexation demands), which represents about a 29 percent increase from the 642,152 AF of demand that occurred in FY 2005.

## SECTION 2.1 MUNICIPAL AND INDUSTRIAL WATER DEMAND

M&I demand can be subdivided into residential demand (water used for human consumption in the home, domestic purposes, and residential landscaping) and water used for commercial and industrial purposes.

### 2.1.1 RESIDENTIAL DEMAND

Residential water consumption covers both indoor and outdoor uses. Indoor water uses include sanitation, bathing, laundry, cooking, and drinking. Most outdoor water use entails landscaping irrigation requirements. Other minor outdoor uses include car washing, surface cleaning, and similar activities. For single-family homes and rural areas, outdoor demands may be as high as 60 percent of total residential use.



Outdoor residential water consumption includes car washing.

Based on SANDAG data, the 2004 composition of San Diego regional housing stock was approximately 61 percent single-family homes, 35 percent multi-family homes, and 4 percent mobile homes. Single-family residences generally contain larger landscaped areas, predominantly planted in turf, and require more water for outdoor application in comparison to other types of housing. The general characteristics of multi-family and mobile homes limit outdoor landscaping and water use, although some condominium and apartment developments do contain green belt areas.



Single-family homes often have more turf.

### 2.1.2 COMMERCIAL AND INDUSTRIAL DEMAND

Commercial water demands generally consist of incidental uses, but are necessary for the operation of a business or institution, such as drinking, sanitation, and landscape irrigation. Major commercial water users include service industries, such as restaurants, car washes, laundries, hotels, and golf courses. Economic statistics developed by the San Diego Regional Chamber of Commerce indicate that almost half of San Diego's residents are employed in commercial (trade and service) industries.

Industrial water consumption consists of a wide range of uses, including product processing and small-scale equipment cooling, sanitation, and air conditioning. Water-intensive industrial uses in the City of San Diego, such as electronics manufacturing and aerospace manufacturing, typically require smaller amounts of water when compared to other water-intensive industries found elsewhere in Southern California, such as petroleum refineries, smelters, chemical processors, and canneries.

The tourism industry in San Diego County affects water usage within the Water Authority's service area not only by the number of visitors, but also through expansion of service industries and attractions,

which tend to be larger outdoor water users. Tourism is primarily concentrated in the summer months and affects seasonal demands and peaking. SANDAG regional population forecasts do not specifically account for tourism, but tourism is reflected in the economic forecasts, and it causes per capita use to increase.

## SECTION 2.2 AGRICULTURAL WATER DEMAND

The coastal and inland valley areas of the county possess a moderate and virtually frost-free climate able to support a variety of sub-tropical crops, making the San Diego area a unique agricultural region.



Citrus is a common crop for the area.

The primary crops grown for the national and international markets are avocados, citrus, cut flowers, and nursery products. To a lesser extent, local fresh market crops and livestock are produced in the Water Authority's service area. In recent years, agriculture has accounted for 10 to 20 percent of the Water Authority's total water demand depending on weather conditions.

The Water Authority is the largest consumer of agricultural water within Metropolitan's service area, accounting for over 65 percent of Metropolitan's total agricultural water demands in FY 2004. Agricultural water use within the Water Authority's service area is concentrated mainly in the north county, and includes member agencies such as the Rainbow, Valley Center, Ramona, and Yuima Municipal Water Districts, the Fallbrook Public Utility District, and the City of Escondido.

## SECTION 2.3 TOTAL CURRENT AND HISTORIC WATER USE

Water use in the San Diego area is closely linked to the local economy, population, and weather. Over the last half-century a prosperous local economy has stimulated population growth, which in turn produced a relatively steady increase in water demand. By 1999, a new combination of natural population increases and job creation surfaced as the primary drivers of long-term water consumption increases.

In FY 2004, water demand in the Water Authority's service area reached a record level of 715,763 AF, only to drop to 642,152 AF in FY 2005 due to above average rainfall. **Table 2-1** shows the historic water demand within the Water Authority's service area.

Table 2-1: Historic Water Demand within Water Authority Service Area (1995 - 2005)

| FISCAL YEAR | WATER USE (AF) |
|---|---|
| 1995 | 526,053 |
| 1996 | 615,900 |
| 1997 | 621,739 |
| 1998 | 562,225 |
| 1999 | 619,409 |
| 2000 | 694,995 |
| 2001 | 646,387 |
| 2002 | 686,530 |
| 2003 | 649,622 |
| 2004 | 715,763 |
| 2005 | 642,152 |

**Figures 2-1** and **2-2** show the estimated and projected relative percentages of various categories of water demand within the Water Authority's service area for FY 2005 and FY 2030. In these figures, residential demand includes single-family residential and multi-family residential.

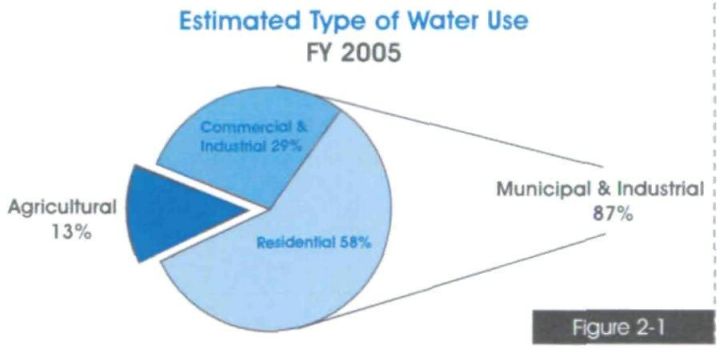



Figure 2-1

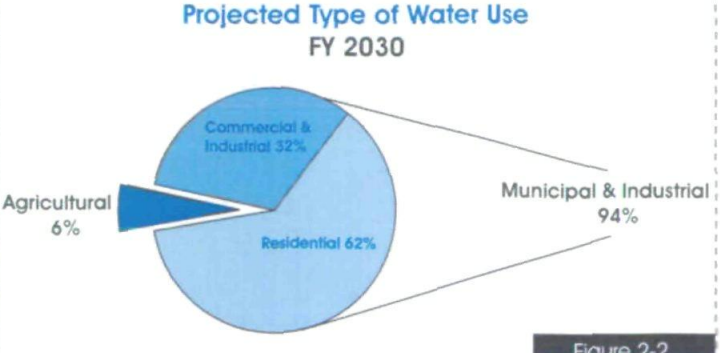



Figure 2-2

## SECTION 2.4 PROJECTED WATER DEMANDS

In 1994, the Water Authority selected the Institute for Water Resources – Municipal And Industrial Needs (MAIN) computer model to forecast M&I water use for the San Diego region. The MAIN model uses demographic and economic data to project sector-level water demands (i.e. residential and non-residential demands). This econometric model has over a quarter of a century of practical application and is used by many cities and water agencies throughout the United States. The Water Authority's version of the MAIN model was modified to reflect the San Diego region's unique parameters and is known as CWA-MAIN.

As stated, the foundation of the water demand forecast is the underlying demographic and economic projections. This was a primary reason why, in 1992, the Water Authority and SANDAG entered into a Memorandum of Agreement (MOA), in which the Water Authority agreed to use SANDAG's current regional growth forecast for water supply planning purposes. In addition, the MOA recognizes that water supply reliability must be a component of San Diego County's regional growth management strategy as required in Proposition C (passed by San Diego County voters in 1988). The MOA ensures a strong linkage between local general plan land use forecasts and water demand projections for the San Diego region.

Consistent with previous CWA-MAIN modeling efforts, the 2005 water demand forecast update utilized the latest official SANDAG demographic projections. The new SANDAG 2030 Forecast, released in December 2003, extended the projection horizon an additional ten years to 2030. Member agency-level demographic and economic projections were compiled from this SANDAG forecast and incorporated into the MAIN model. Demand projections for the Marine Corps Base Camp Pendleton (MCB Camp Pendleton) were forecast outside of the MAIN model due to uncertainty regarding future land use development. Water-use projections for the various developments within the MCB Camp Pendleton area were based on historic demand trends, which were then added to the baseline forecast.

The M&I forecast also included an updated accounting of projected conservation savings based on projected regional implementation of the CUWCC Best Management Practices and SANDAG demographic information for the period 2005 through 2030. These savings estimates were then factored into the baseline M&I forecast. **Section 3.3** discusses the derivation of the estimated savings.

A separate agricultural model, also used in prior modeling efforts, was used to forecast water demands within the Water Authority service area. This model estimates agricultural demand met by the Water Authority's member agencies based on agricultural acreage projections provided by SANDAG, crop distribution data derived from the DWR and the California Avocado Commission, and average crop-type watering requirements based on California Irrigation Management Information System (CIMIS) data.



Demographic and economic data is used to project water demand.

Utilizing SANDAG's most recent growth forecast to project future water demands is an important link to the land use plans of the cities and the county. This process ensures supplies are being planned to meet future growth. Any revisions to the land use plans are captured in SANDAG's updated forecasts. The Water Authority will update its demand forecast based on SANDAG's most recent forecast approximately every five years to coincide with preparation of the urban water management plan. Prior to the next forecast update, local jurisdictions may require water supply availability reports under Senate Bills 610 and 221 for proposed land use developments that have a higher density than reflected in the existing growth forecast. The increased density could result in a higher demand for the parcel than originally anticipated. In evaluating the availability of supply, the Water

Authority's member agency can determine if "offset" supplies are available as a result of other land use decisions which lower water use within their service area. In addition, Metropolitan's draft 2005 Regional Urban Water Management Plan identified potential reserve supplies in the supply capability analysis (Tables II-7, II-8, II-9), which could be available to meet the unanticipated demands. The Water Authority's next forecast and other supply planning documents would then capture this increase in demands.

To fully quantify probable demands served by the Water Authority, lands with impending applications for annexation to the Water Authority's service area were identified. Working with its member agencies, the Water Authority identified potential near-term annexations as being parcels that may be annexed to the Water Authority within the next five years. Estimated water demands for those parcels were provided to the Water Authority by the member agency or project proponent and then added to the forecast. Including the demands provides no assurance of annexation; approval by the Water Authority Board would be required before water service is provided to these lands. It is difficult to know exactly which parcels will be annexed and when, but including this additional demand will provide for more comprehen-

Table 2-2: Normal Year Water Demand Forecast Adjusted for Water Conservation (2010-2030)

| Year | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|
| M&I Baseline Forecast (AF) | 699,250 | 739,020 | 780,350 | 830,550 | 877,740 |
| Esimated Conservation Savings (AF) | 79,960 | 87,310 | 94,170 | 101,950 | 108,400 |
| M&I Forecast Reduced by Conservation (AF)[1] | 619,290 | 651,710 | 686,180 | 728,600 | 769,340 |
| Agricultural Forecast (AF)[2] | 89,700 | 83,130 | 77,270 | 58,980 | 51,630 |
| **Total Projected Demand (AF)** | 708,990 | 734,840 | 763,450 | 787,580 | 820,970 |
| **Total Projected Demand with pending Annexations**[3] | 715,450 | 742,900 | 771,510 | 795,640 | 829,030 |

Source: CWA-MAIN Forecast (August 2005)
1 Includes M&I demands for Camp Pendleton area customers.
2 Includes certified IAWP agricultural water and non-credited agricultural water.
3 Estimated near-term annexation demands are 6,455 AF/YR in 2010, and 8,060 AF/YR in years 2015, 2020, 2025, and 2030. The potential near-term annexations used to calculate the estimate include Otay Ranch Village 13 (1,961 AF), Peaceful Valley Ranch (51 AF), Syeuan Reservation (392 AF), San Luis Rey MWD (includes the Meadowood development) (4,217 AF), and four potential annexations to Yuima MWD (1,435 AF). Including the demands for these parcels does not limit the Board's discretion to deny or approve these or other annexations not contemplated at this time.

## 2.4.1 PROJECTED NORMAL WATER DEMANDS

**Table 2-2** shows projected normal water demand for the Water Authority through 2030. The baseline M&I demand forecast reflects an adjustment for estimated water conservation, MCB Camp Pendleton area demands, and forecasted agricultural water use, to produce total projected demand. Water conservation measures are expected to reduce total M&I demands by approximately 12 percent in 2030, with an estimated savings of 108,400 AF. Agricultural water use is projected to decrease by approximately 42 percent between 2010 and 2030, to an estimated 51,630 AF, primarily due to the conversion of agricultural land to residential use.

**Regional Historic and Projected Normal Water Demands**

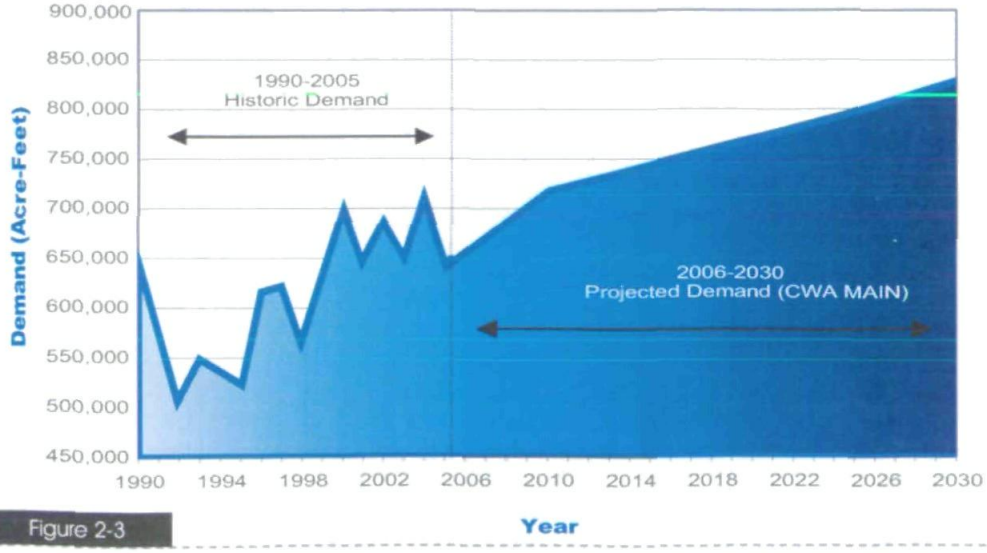



Figure 2-3

sive supply planning and assist member agencies in complying with Senate Bills 610 and 221.

**Figure 2-3** illustrates the projected trend in water demands over the 2005 to 2030 time frame. This figure combines historic water use and forecasted CWA-MAIN model demands based on SANDAG 2030 demographic and economic projections.

### 2.4.2 PROJECTED DRY-YEAR WATER DEMANDS

To assess water service reliability during dry-year events, the Act requires single dry-year and multiple dry-year demand projections in five-year increments. Based on observed historic demand impacts associated with each of these events, separate approaches were taken to project single and multiple dry-year conditions.

Since the CWA-MAIN model was constructed to project water demands over discrete twelve-month periods and it utilizes weather as a predictive variable, it was utilized to forecast single dry-year demands for the region. By inserting annual dry-year weather data into the model and holding all non-weather related predictive variables constant for a given year, the model produces an annual forecast of weather-driven demand. An analysis of historic dry-year events was performed to select a representative year. This analysis evaluated the relative impact of weather (e.g. high temperature and low rainfall) to resulting total water demand, and also the availability of local supplies. Using this criterion, 1989 was selected as the representative single dry-year event. Weather data for 1989 was then run through the model for each five year increment. Projected single dry-year demands are shown in **Table 2-3**.

The Act requires agencies to prepare multiple dry-year demand scenarios every five years for at least 20 years. An analysis of historic water demands reveals that multiple dry-year events may have a compounding effect on demands that is not captured through the modeling of discrete yearly weather patterns. For this reason, the CWA-MAIN model was not directly used to project multiple dry-year demands. Instead, an alternative method which utilized a 7% annual increase in demands was used to develop the multiple dry-year scenarios. This value is supported by the projected yearly increase in demands generated from the CWA-MAIN model single dry-year forecast. The annual 7% factor was applied to the normal year demand estimates to generate the multiple dry-year demand projections shown in **Tables 2-4, 2-5, 2-6, 2-7,** and **2-8.**

Table 2-3: Single Dry-Year Total Water Demand Forecast (5-Year Increments)

| NORMAL YEAR | AF/YR |
|---|---|
| 2010 | 767,650 |
| 2015 | 795,970 |
| 2020 | 825,560 |
| 2025 | 848,610 |
| 2030 | 883,030 |

### Multiple Dry-Year Total Water Demand Forecast
(5-Year Increments)

Table 2-4

| YEAR | TOTAL ESTIMATED DEMANDS AF/YR |
|---|---|
| 2006 | 744,520 |
| 2007 | 749,780 |
| 2008 | 755,030 |

Table 2-5

| YEAR | TOTAL ESTIMATED DEMANDS AF/YR |
|---|---|
| 2011 | 771,410 |
| 2012 | 777,280 |
| 2013 | 783,150 |

Table 2-6

| YEAR | TOTAL ESTIMATED DEMANDS AF/YR |
|---|---|
| 2116 | 801,030 |
| 2017 | 807,150 |
| 2018 | 813,270 |

Table 2-7

| YEAR | TOTAL ESTIMATED DEMANDS AF/YR |
|---|---|
| 2121 | 830,680 |
| 2022 | 835,840 |
| 2023 | 841,010 |

Table 2-8

| YEAR | TOTAL ESTIMATED DEMANDS AF/YR |
|---|---|
| 2026 | 858,480 |
| 2027 | 865,630 |
| 2028 | 872,770 |

### 2.4.3 MEMBER AGENCY IMPORTED DEMAND ON THE WATER AUTHORITY

**Table 2-9** shows the Water Authority's historical, current, and projected imported water demands (sales) by member agency. The projected demands were calculated from the baseline demands for each member agency, as forecasted in **Section 2.4**, minus the projected local supplies and conservation savings. Therefore, the projected imported demands (sales) are directly tied to the success of local supply development (**Section 5**) and water conservation savings (**Section 2**). The forecasted sales figures in **Table 2-9**, should not be considered a member agency's allocation of supplies from the Water Authority.

**Table 2-9: Member Agency Imported Demand (Sales) on Water Authority (AF) [1,2] (2000 – 2030) Normal Year Forecast**

| | 2000 | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|
| Carlsbad M.W.D.[3] | 19,952 | 20,155 | 19,093 | 0 | 0 | 0 | 0 |
| Del Mar, City of | 1,556 | 1,324 | 1,370 | 1,317 | 1,312 | 1,321 | 1,342 |
| Escondido, City of | 26,977 | 25,103 | 26,122 | 25,063 | 25,456 | 25,942 | 26,669 |
| Fallbrook P.U.D. | 16,824 | 15,809 | 16,239 | 16,276 | 16,586 | 17,056 | 17,402 |
| Helix W.D. | 38,483 | 32,060 | 35,050 | 35,533 | 36,274 | 37,284 | 38,348 |
| Oceanside, City of | 32,073 | 31,181 | 30,088 | 31,310 | 31,501 | 33,039 | 35,473 |
| Olivenhain M.W.D. | 19,433 | 21,052 | 19,401 | 21,059 | 22,740 | 25,268 | 26,606 |
| Otay W.D. | 29,901 | 37,787 | 43,761 | 50,337 | 57,787 | 64,547 | 73,097 |
| Padre Dam M.W.D. | 21,824 | 19,246 | 21,266 | 22,542 | 23,690 | 25,656 | 27,491 |
| Pendleton MCB | 105 | 834 | 850 | 850 | 850 | 850 | 850 |
| Poway, City of | 15,625 | 13,975 | 16,372 | 16,890 | 17,448 | 17,986 | 18,317 |
| Rainbow M.W.D. | 29,929 | 25,252 | 27,146 | 26,427 | 26,352 | 22,878 | 22,822 |
| Ramona M.W.D. | 8,267 | 10,359 | 11,858 | 12,198 | 12,438 | 12,638 | 13,650 |
| Rincon del Diablo M.W.D. | 9,119 | 7,732 | 8,968 | 5,471 | 5,939 | 6,401 | 6,905 |
| San Diego, City of | 206,433 | 204,039 | 197,320 | 201,109 | 207,584 | 217,449 | 226,821 |
| San Dieguito W.D. | 5,112 | 5,605 | 4,703 | 4,730 | 4,910 | 5,063 | 5,118 |
| Santa Fe I.D. | 8,056 | 9,737 | 11,473 | 11,437 | 11,703 | 12,000 | 12,103 |
| Sweetwater Authority | 5,520 | 11,331 | 12,398 | 10,136 | 10,546 | 10,999 | 12,180 |
| Vallecitos W.D. | 16,409 | 18,150 | 19,409 | 19,741 | 20,365 | 21,317 | 22,903 |
| Valley Center M.W.D. | 48,550 | 38,105 | 43,850 | 35,751 | 35,019 | 30,417 | 28,212 |
| Vista I.D. | 17,123 | 21,229 | 17,417 | 18,389 | 19,617 | 21,412 | 23,197 |
| Yuima M.W.D. | 2,849 | 2,984 | 2,949 | 2,929 | 2,895 | 2,984 | 3,053 |
| SUB-TOTAL | 580,120 | 573,049 | 587,103 | 569,493 | 591,012 | 612,508 | 642,559 |
| Near-term annexation area demands[4] | 0 | 0 | 6,455 | 8,062 | 8,062 | 8,062 | 8,062 |
| TOTAL | 580,120 | 573,049 | 574,465 | 577,555 | 599,074 | 620,570 | 650,621 |

1 Based on SANDAG 2030 Cities/County Forecast.
2 Includes water conservation.
3 For years 2015 – 2030, the Water Authority demand forecast assumes that Carlsbad MWD total demands will be met by local supplies (desalinated seawater and recycled water).
4 Near-term annexation area demands are listed for planning purposes and are not assigned to any specific member agency.

# SECTION 3 DEMAND MANAGEMENT

## SECTION 3.1 DESCRIPTION

Demand management, or water conservation, is frequently the lowest-cost resource available to the Water Authority and its member agencies. Water conservation is a critical part of the Water Authority's Updated 2005 Plan and long-term strategy for meeting water supply needs of the San Diego region.

**The goals of the Water Authority's water conservation program are to:**

- Reduce demand for more expensive, imported water;
- Demonstrate continued commitment to the Best Management Practices (BMPs) and Agricultural Efficient Water Management Practices (EWMPs);
- Ensure a reliable future water supply; and
- Reduce consumption during periods of high treated-water demand.

## SECTION 3.2 BEST MANAGEMENT PRACTICES

The California Urban Water Conservation Council (CUWCC) was formed in 1991 through a Memorandum of Understanding Regarding Urban Water Conservation in California (MOU). The urban Best Management Practices, or BMPs, for water conservation included in the MOU are intended to reduce California's long-term urban water demands.

**Table 3-1** provides an overview of the Water Authority and its member agencies' progress in the implementation of the BMPs. Most member agencies are signatories to the MOU and submit biennial BMP reports to show compliance with the appropriate BMPs. **Appendix D** shows the Water Authority's FY 01, 02, 03, and 04 BMP Reports, as well as the Coverage Reports for FY 04. Major Water Authority activities include actively participating to develop and implement statewide BMPs; participating with member agencies, Metropolitan, the CUWCC, and the American Water Works Association Research Foundation in research and development activities; and implementing public information and education programs.

### IMPLEMENTATION OF BMPS

The Water Authority began implementing its aggressive conservation program in 1990. Some of the early programs to address the BMPs provided financial incentives for retrofitting high-water-use toilets with ultra-low-flush models and distributing low-flow showerheads to consumers. Since the program's inception, the Water Authority and its member agencies have provided incentives for the installation of over 528,000 ultra-low-flush toilets (ULFTs). In addition, financial incentives have been provided for the installation of more than 45,100 residential high-efficiency clothes washers (HEWs), 7,600 coin-operated HEWs, 355 cooling tower conductivity controllers, and 3,200 pre-rinse spray valves. The Water Authority, its member agencies, and San Diego Gas & Electric also distributed over half-a-million showerheads to customers.

Since 1990, the Water Authority has invested more than $12 million to help implement these and other conservation programs. In addition, the Water Authority's member agencies have invested a similar amount to co-fund these conservation programs.

The Water Authority's FY 05 budget included $972,000 for conservation programs that are anticipated to save 68,000 AF/YR over the useful life of the measures. The Water Authority's member agencies, Metropolitan, and the DWR augment this funding. In FY 05, this additional funding totaled $4.74 million, bringing the total FY 05 amount budgeted for all conservation programs to $5.7 million.



Financial incentives are offered for commercial high-efficiency washers

The Water Authority provides approximately 20 percent of all conservation funding and manages most of the programs for its member agencies. The Water Authority also administers the Agriculture Water Management Program and CIMIS for agricultural use. **Appendix D**, the CUWCC BMP Reports for FY 01, 02, 03, and 04, contains additional information on implementation of the BMPs by the Water Authority.

Table 3-1: Best Management Practices for Urban Water Conservation in California

| BMP | DESCRIPTION | CONSERVATION PROGRAMS | COMPLIANCE [1] | SDCWA Assistance [2] |
|---|---|---|---|---|
| 1 | Residential Water Surveys | Residential Survey Program | Yes | Yes |
| 2 | Residential Plumbing Retrofit | Showerhead distribution | Yes | Yes |
| 3 | Distribution System Water Audits | Water Authority and member agencies independently operate separate system audits | Yes | |
| 4 | Metering with Commodity Rates | Member agencies operate | Yes | |
| 5 | Large Landscape Programs and Incentives | • Commercial Landscape Incentive Program<br>• Landscape Assistance Program for Business and Home<br>• Protector Del Agua | Yes | Yes |
| 6 | High Efficiency Washing Machine (HEW) Rebate Programs | • Residential HEW Voucher Program | Yes | Yes |
| 7 | Public Information Program | • Media Coverage<br>• Xeriscape Awards<br>• WebSite<br>• Water Conservation Literature | Yes | |
| 8 | School Education Programs | • Classroom Presentations<br>• Splash Science Mobile Lab<br>• Youth Merit Badge Program<br>• Assembly Program<br>• Teaching Garden<br>• Mini-grants of up to $250 | Yes | |
| 9 | Commercial, Industrial & Institutional (CII) Water Conservation Programs | • CII Voucher Program<br>• Industrial Process Improvement Program | Yes | Yes |
| 10 | Wholesale Agency Assistance Programs | Ongoing | Yes | |
| 11 | Conservation Pricing | Member agencies operate | Yes | |
| 12 | Water Conservation Coordinator | Water Resources staff | Yes | |
| 13 | Water Waste Prohibition | Member agencies operate | Yes | |
| 14 | Residential Ultra-Low-Flush Toilet (ULFT) Replacement Programs | Residential ULFT Voucher Program | Yes | Yes |

1 The Water Authority and one or more of its member agencies comply with the statewide BMPs listed.
2 The Water Authority provides financial assistance to its member agencies to implement conservation programs.

### REVENUE IMPACTS

Water conservation is a well-established practice in ensuring that there will be a reliable water supply in the future for the increasing population and commerce of our local region. However, conservation occasionally suffers from the perception that it reduces revenues. Over the long-term, conservation measures actually serve to defer or limit rate increases by reducing the region's need for other, more expensive supplies and increased infrastructure. The Water Authority's FY 05 budget included $972,000 for conservation programs, which represents an average cost of $1.74 per acre-foot of projected water sales during FY 05. Conservation programs also reduce imported water demand that in turn allows the Water Authority to purchase less of Metropolitan's more expensive Tier 2 water. Tier 2 water is more expensive since it represents Metropolitan's cost to develop additional supplies.

## SECTION 3.3 FUTURE WATER CONSERVATION SAVINGS

Projected water savings and effectiveness provided in the Updated 2005 Plan are based on industry standard methodologies for calculating savings, as defined by the CUWCC. The Water Authority assists the CUWCC in conducting pilot programs and analyzing ways to increase the accuracy of savings calculation methodologies. Projections show that implementing existing and proposed urban BMPs would produce water savings of approximately 108,396 AF/YR by the year 2030 within the Water Authority's service area (**Table 3-2**).

This conservation target is appropriate to implement the BMPs and fulfill the Water Authority's commitment to the MOU. Additionally, this target coincides with the availability of anticipated funds from member agencies, the Water Authority, and/or Metropolitan. The estimates presented in **Table 3-2** are based on savings projections from implementing various conservation measures and the result of state and national efficiency standards. The table represents a projection of the amount of water that will be conserved based on the best information available at this time.

Future water conservation savings are based on historical activity for Residential Surveys, Residential Retrofits, High-Efficiency Clothes Washer Incentives, and Toilet Incentives. Efficiency Standards include water-saving devices installed in new residential construction as part of state-required codes, as well as toilets replaced through natural replacement

Table 3-2: Potential Water Conservation Savings Through 2030 within the Water Authority Service Area (AF)

| Best Management Practices | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| **Existing BMPs** | | | | | | |
| Residential Surveys | 1,620 | 1,620 | 1,620 | 1,620 | 1,620 | 1,620 |
| Residential Retrofits | 8,100 | 8,100 | 8,100 | 8,100 | 8,100 | 8,100 |
| Landscape[1] | 3,524 | 18,484 | 21,793 | 24,783 | 27,744 | 30,718 |
| Clothes Washer Incentives | 495 | 1,281 | 1,672 | 1,672 | 1,672 | 1,672 |
| Commercial/Industrial/Institutional | 2,260 | 3,328 | 5,056 | 6,801 | 8,533 | 10,272 |
| Toilet Incentives | 17,553 | 23,616 | 23,616 | 23,616 | 23,616 | 23,616 |
| **Subtotal** | 33,551 | 56,792 | 61,857 | 66,593 | 71,286 | 75,998 |
| **Potential BMPs and Efficiency Standards** | | | | | | |
| Efficiency Standards[2] | 19,837 | 23,137 | 25,409 | 27,526 | 30,598 | 32,323 |
| Graywater | 0 | 25 | 30 | 40 | 50 | 50 |
| On Demand Water Heaters | 0 | 5 | 10 | 15 | 20 | 25 |
| **Subtotal** | 19,837 | 23,167 | 25,449 | 27,581 | 30,668 | 32,398 |
| **TOTAL[3]** | **53,389** | **79,960** | **87,306** | **94,174** | **101,954** | **108,396** |

1 Includes savings from Audits, Artificial Turf, WBIC (residential & commercial), Water Budget, and CLIP programs.
2 Code Compliance: new construction, ULFT natural replacement @ 4%, commercial HEWs natural replacement.
3 Values may not add to exact total due to rounding.

outside of the toilet incentive. Updated SANDAG demographic information is utilized to determine savings for new construction through BMP implementation.

On average, more than 50 percent of the water used in San Diego County goes to outdoor watering, and the savings potential from this irrigation is significant. Landscape savings are based on full implementation of BMP 5, through water budgets, large landscape audits, and irrigation hardware replacements.



Weather-based irrigation controllers provide landscape water savings.

Some of these measures are labor intensive and may be a challenge to achieve due to the limited resources of member agencies.

Water savings in the Commercial, Industrial, and Institutional (CII) sector are based on both historical activity and anticipated new water-efficient products that will experience expanded use. These products include multi-load commercial HEWs, food steamers, commercial dishwashers, and waterless urinals.

Some of the BMPs that are not quantified in **Table 3-2,** such as public information and school education, do not directly result in water savings. Instead, these BMPs result in a decision by a water user to take an action that will result in savings. For example, a water user may learn about the availability of HEWs through a public information program, but water will not be saved until the user installs a new HEW. To avoid double counting, the projected savings from the machine is reflected only in the high-efficiency washing machine BMP.

The Water Authority is a statewide leader of innovative programs in water conservation. Efforts have been so successful, however, that many of the conservation programs implemented in the early 1990s are maturing. Additional measures are now being taken to achieve further water savings, particularly in the CII and landscape sectors.

### 3.3.1 LANDSCAPE

Additional landscape water savings can potentially be achieved through incentives, regulations, and rates. In 2004, new programs included financial incentives for purchasing and installing self-adjusting, weather-based irrigation controllers, financial incentives to purchase improved efficiency irrigation devices, additional conservation literature, expanded water user efficient irrigation training programs, an artificial turf incentive program, and support for the Water Conservation Garden.

As a result of the passage of the Water Authority-sponsored Assembly Bill 2717, the Landscape Water Conservation Task Force has convened a stakeholders workgroup to evaluate and recommend proposals for improving the efficiency of water use in new and existing urban irrigated landscapes. Potential regulations include the requirement that residential sites have a dedicated water meter for outdoor use and a dedicated water meter for indoor use. Another potential regulation would require homeowners associations to allow water-efficient landscape if desired by the homeowner.

### 3.3.2 COMMERCIAL, INDUSTRIAL, & INSTITUTIONAL

For the past decade, the Water Authority has used its extensive relationships with manufacturers, suppliers, and contractors to increase participation in the CII Voucher Incentive Program (VIP) with a point-of-purchase service to customers. A number of new water-saving devices have recently been incorporated into the CII Program, including a hospital x-ray processor recirculating system that can save up to 3.2 acre-feet per year per system; water pressurized brooms, which save as much as 50,000 gallons per year per location; and pre-rinse spray valves, which can save up to 50,000 gallons of water annually.

The Industrial Process Improvement Program offers financial assistance to local industries to encourage investment in water saving process improvements. In the future, the Water Authority may consider providing additional funds to qualified projects to maximize water saving possibilities in the commercial, industrial, and institutional sectors. Ever-advancing technologies coupled with an aggressive marketing

plan provides solid foundations for these growing programs.

### 3.3.3 RESIDENTIAL

Programs, such as the HEW and ULFT VIP that target residential customers, have been highly effective in achieving conservation savings. The Residential ULFT VIP has been effective in encouraging toilet retrofits and is being expanded to serve other markets such as new residential construction. The current program focuses on multi-family sites and incentives for dual-flush toilets to maximize the water savings. Dual-flush toilets have two flushing mechanisms, one for liquid waste (0.8-1.1 gallons per flush) and one for solid matter (1.6 gallons per flush). Each of these toilets saves 2,250 gallons per year more than standard ULFTs.



Dual-flush toilets save 2,250 gallons per year more than standard ULFTs.

The Residential HEW VIP has evolved to encourage consumers to purchase the most water efficient models. Clothes washers eligible for incentives use 65 percent less water than standard washers. This savings will be expanded by further limiting the amount of water used in the washers that are eligible for vouchers. Effective in July 2005, only HEWs with a water efficiency factor of 6.0 or less are eligible for incentives. The water efficiency factor is determined by the amount of water it takes to wash a cubic foot of laundry. The lower the water efficiency factor, the greater the water efficiency of the clothes washer.

Studies for hot-water-on-demand systems are proceeding, and the outcome of those studies will help determine appropriate programs for encouraging the use of these systems in new homes.

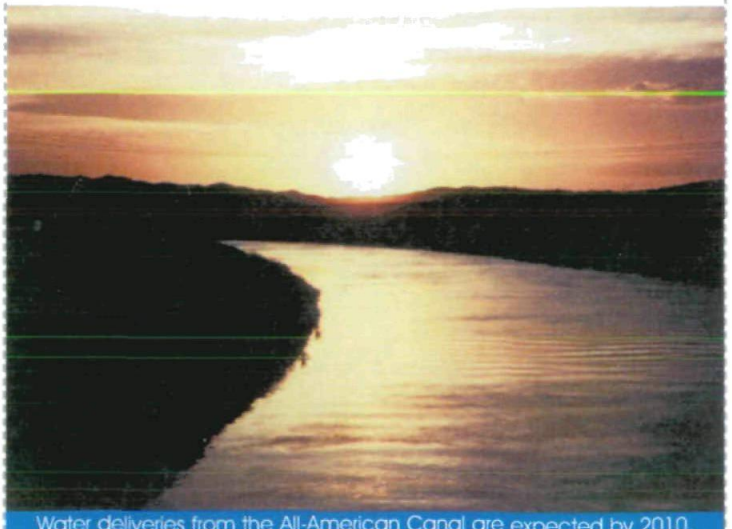
Finally, the Water Authority and its member agencies will continue to cooperate with the CUWCC and Metropolitan to identify future opportunities for water conservation savings.

# SECTION 4 SAN DIEGO COUNTY WATER AUTHORITY SUPPLIES

Historically, the Water Authority relied on imported water supplies purchased from Metropolitan to meet the needs of its member agencies. Metropolitan's supplies come from two primary sources, the State Water Project (SWP) and the Colorado River. After experiencing severe shortages from Metropolitan during the 1987-1992 drought, the Water Authority began aggressively pursuing actions to diversify the region's supply sources. Comprehensive supply and facility planning over the last 12 years provided the direction for implementation of these actions.

A Water Resources Plan developed in 1993 and updated in 1997 emphasized the development of local supplies and core water transfers. Consistent with the direction provided in the 1997 Water Resources Plan, the Water Authority entered into a Water Conservation and Transfer Agreement with IID, an agricultural district in neighboring Imperial County, in 1998. Through the transfer agreement, the Water Authority will receive 30,000 AF in 2005, with the volume increasing annually until it reaches 200,000 AF/YR in 2021.

To further diversify regional supplies, the Water Authority's 2000 Plan identified seawater desalination as a potential supply for meeting future demands. In response to the direction provided in the 2000 Plan, the Water Authority Board of Directors approved a Seawater Desalination Action Plan in 2001. More recently, in October 2006, the Water Authority Board of Directors approved the 2006 Desalination Action Plan, which reflects seawater desalination development, including a local supply program of participating Water Authority member agencies rather than an exclusively regional program of the Water Authority (**see Section 4.3.2**).



Water deliveries from the All-American Canal are expected by 2010.

The 2000 Plan identified the need for other competitive imported water sources to meet the demands of the region. In 2003, as part of the execution of the Quantification Settlement Agreement (QSA) on the Colorado River, the Water Authority was assigned rights to 77,700 AF/YR of conserved water from projects to line the All-American and Coachella Canals. Deliveries of this conserved water from the Coachella Canal reached the region in 2007, and deliveries from the All-American Canal are expected to begin by 2010. This section provides specific documentation on the existing and projected supply sources being implemented by the Water Authority.



Construction on the Coachella Canal.

## SECTION 4.1 WATER AUTHORITY - IID WATER CONSERVATION AND TRANSFER AGREEMENT

On April 29, 1998, the Water Authority signed a historic agreement with IID for the long-term transfer of conserved Colorado River water to San Diego County. The Water Authority-IID Water Conservation and Transfer Agreement (Transfer Agreement) is the largest agriculture-to-urban water transfer in United States history. Colorado River water will be conserved by Imperial Valley farmers who voluntarily participate in the program and then transferred to the Water Authority for use in San Diego County.

### 4.1.1 IMPLEMENTATION STATUS

On October 10, 2003, the Water Authority and IID executed an amendment to the original 1998 Transfer Agreement. This amendment modified

certain aspects of the 1998 Agreement to be consistent with the terms and conditions of the QSA and related agreements. It also modified other aspects of the agreement to lessen the environmental impacts of the transfer of conserved water. The amendment was expressly contingent on the approval and implementation of the QSA, which was also executed on October 10, 2003. **Section 6.2.1** contains details on the QSA.



In 2003, the QSA was finalized at a signing ceremony at the Hoover Dam.

On November 5, 2003, IID filed a complaint in Imperial County Superior Court seeking validation of 13 contracts associated with the Transfer Agreement and the QSA. Imperial County and various private parties filed additional suits in Superior Court, alleging violations of the California Environmental Quality Act (CEQA), the California Water Code, and other laws related to the approval of the QSA, the water transfer, and related agreements. The lawsuits have been coordinated for trial. The IID, Coachella Valley Water District, Metropolitan, the Water Authority, and State are defending these suits and coordinating to seek validation of the contracts. Implementation of the transfer provisions is proceeding during litigation. For further information regarding the litigation, please contact the Water Authority's General Counsel.

### 4.1.2 EXPECTED SUPPLY

Deliveries into San Diego County from the transfer began in 2003 with an initial transfer of 10,000 AF. The Water Authority received 20,000 AF in 2004, 30,000 in 2005, and 40,000 in 2006. The quantities will increase annually to 200,000 AF by 2021, then remain fixed for the duration of the transfer agreement. The initial term of the Transfer Agreement is 45 years, with a provision that either agency may extend the agreement for an additional 30-year term.


Transfer water comes from the Imperial Valley.

During dry years, when water availability is low, the conserved water will be transferred under IID's Colorado River rights, which are among the most senior in the Lower Colorado River Basin. Without the protection of these rights, the Water Authority could suffer delivery cutbacks. In recognition for the value of such reliability, the 1998 contract required the Water Authority to pay a premium on transfer water under defined regional shortage circumstances.

**The shortage premium period duration is the period of consecutive days during which any of the following exist:**

- a Water Authority shortage;
- a shortage condition for the Lower Colorado River as declared by the Secretary; and
- a Critical Year.

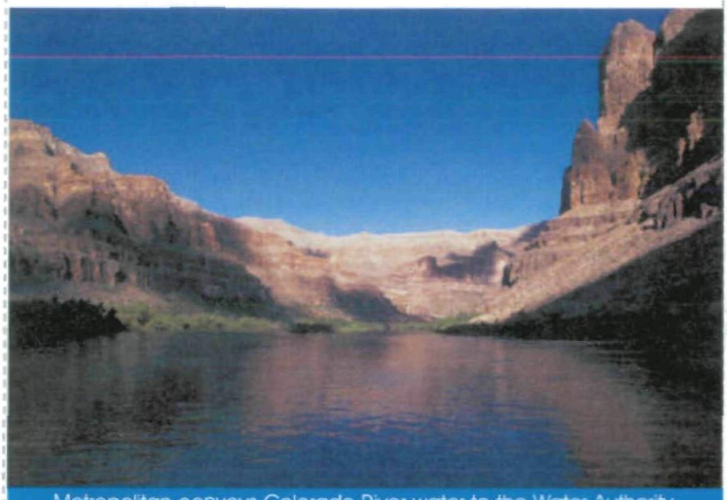
Under terms of the October 2003 amendment, the shortage premium will not be included in the cost formula until Agreement Year 16.

### 4.1.3 TRANSPORTATION

The Water Authority entered into a water exchange agreement with Metropolitan on October 10, 2003, to transport the Water Authority-IID transfer water from the Colorado River to San Diego County. Under the exchange agreement, Metropolitan will take delivery of the transfer water through its Colorado River Aqueduct. In exchange, Metropolitan will deliver to the Water Authority a like quantity and quality of water. The Water Authority will pay Metropolitan's applicable wheeling rate for each acre-foot of exchange water delivered. According to the water exchange agreement, Metropolitan will make delivery of the transfer water for 35 years, unless the Water Authority elects to extend the agreement another 10 years for a total of 45 years.

### 4.1.4 COST/FINANCING

The costs associated with the transfer are proposed to be financed through the Water Authority's rates and charges. In the agreement between the Water Authority and IID, the price for the transfer water started at $258/AF and increases by a set amount for the first five years. The 2005 price for transfer water is $276/AF. Procedures are in place to evaluate and determine market-based rates following the first five-year period.



Metropolitan conveys Colorado River water to the Water Authority.

In accordance with the October 2003 amended exchange agreement between Metropolitan and the Water Authority, the initial cost to transport the conserved water was $253/AF. Thereafter, the price would be equal to the charge or charges set by Metropolitan's Board of Directors pursuant to applicable laws and regulation, and generally applicable to the conveyance of water by Metropolitan on behalf of its member agencies. The transportation charge in 2005 is $258/AF.

The Water Authority is providing $10 million to help offset potential socioeconomic impacts associated with temporary land fallowing. IID will credit the Water Authority for these funds during years 16 through 45. At the end of the fifth year of the transfer agreement (2007), the Water Authority will prepay IID an additional $10 million for future deliveries of water. IID will credit the Water Authority for this up-front payment during years 16 through 30.

As part of implementation of the QSA and water transfer, the Water Authority also entered into an environmental cost-sharing agreement. The agreement specifies that the Water Authority will contribute $64 million for the purpose of funding environmental mitigation costs and contributing to the Salton Sea Restoration Fund..

### 4.1.5 WRITTEN CONTRACTS OR OTHER PROOF

**Appendix E** contains a list of the specific written contracts, agreements, and environmental permits associated with implementation of the Water Authority-IID Transfer.

### 4.1.6 EXISTING AND FUTURE SUPPLIES

Based on the terms and conditions in the Transfer Agreement, **Table 4-1** shows the anticipated delivery schedule of the conserved transfer water in 5-year increments. There is adequate documentation to demonstrate the availability of this supply, and therefore, the supply yields shown in **Table 4-1** will be included in the reliability analysis found in **Section 8** of this Updated 2005 Plan.

## SECTION 4.2 ALL-AMERICAN CANAL AND COACHELLA CANAL LINING PROJECTS

As part of the QSA and related contracts, the Water Authority was assigned Metropolitan's rights to 77,700 AF/YR of conserved water from projects that will line the All-American Canal (AAC) and Coachella Canal (CC). The projects will reduce the loss of water that currently occurs through seepage, and the conserved water will be delivered to the Water Authority. This conserved water will provide the San Diego region with an additional 8.5 million acre-feet over the 110-year life of the agreement.

Table 4-1: Existing and Projected Water Authority – IID Transfer Supplies

| YEAR | AF/YR |
|---|---|
| 2005 | 30,000 |
| 2010 | 70,000 |
| 2015 | 100,000 |
| 2020 | 190,000 |
| 2025 | 200,000 |
| 2030 | 200,000 |

### 4.2.1 IMPLMENTATION STATUS

Earthwork for the Coachella Canal lining project began in November 2004, and involves approximately 37 miles of canal. National Environmental Policy Act (NEPA) and CEQA documentation is complete, including an amended Record of Decision by the U.S. Bureau of Reclamation (USBR). The amendment was required after revising the project design: instead of

lining the canal in place, the project entailed the construction of a parallel canal. The project was completed in 2006, and deliveries of conserved water started in 2007.



Construction on the All-American Canal lining project began in 2007.

Preliminary design-related activities have begun on the AAC lining project, including ground and aerial surveying, mapping cultural resources, and geotechnical investigations. The lining project consists of constructing a concrete-lined canal parallel to 24 miles of the existing AAC from Pilot Knob to Drop 3. NEPA and CEQA documentation is complete, environmental mitigation measures have been identified, and Endangered Species Act consultations are pending. Construction of the project is expected to be completed in 2010.



Coachella Canal lining construction

In July 2005, a lawsuit (*CDEM v United States*, Case No. CV-S-05-0870-KJD-PAL) was filed in the U. S. District Court for the District of Nevada on behalf of U.S. and Mexican groups challenging the lining of the AAC. The lawsuit, which names the Secretary of the Interior as a defendant, claims that seepage water from the canal belongs to water users in Mexico. California water agencies note that the seepage water is actually part of California's Colorado River allocation and not part of Mexico's allocation. The plaintiffs also allege a failure by the United States to comply with environmental laws. Federal officials have stated that they intend to vigorously defend the case.

### 4.2.2 EXPECTED SUPPLY

The AAC lining project will yield 67,700 AF of Colorado River water per year for allocation upon completion of construction. The CC lining project will yield 26,000 AF of Colorado River water each year available for allocation upon completion of construction. The October 10, 2003 Allocation Agreement states that 16,000 AF/YR of conserved canal lining water will be allocated to the San Luis Rey Indian Water Rights Settlement Parties. The remaining amount, 77,700 AF/YR, will be available to the Water Authority. According to the Allocation Agreement, IID has call rights to a portion (5,000 AF/YR) of the conserved water upon termination of the QSA for the remainder of the 110 years of the Allocation Agreement and upon satisfying certain conditions. The term of the QSA is for up to 75 years.

### 4.2.3 TRANSPORTATION

The October 10, 2003, Exchange Agreement between the Water Authority and Metropolitan also provides for the delivery of the conserved water from the canal lining projects. The Water Authority will pay Metropolitan's applicable wheeling rate for each acre-foot of exchange water delivered. In the Exchange Agreement, Metropolitan will deliver the canal lining water for the term of the Allocation Agreement (110 years).

### 4.2.4 COST/FINANCING

Under California Water Code Section 12560 et seq., the Water Authority will receive $200 million in state funds for construction of the projects. In addition, under California Water Code Section 79567, $20 million from Proposition 50 is also available for the lining projects. Additionally, the Water Authority will receive $35 million for groundwater conjunctive use projects as part of the agreement. The Water Authority would be responsible for additional expenses above the funds provided by the state.

The rate to be paid to transport the canal lining water will be equal to the charge or charges set by Metropolitan's Board of Directors pursuant to applicable law and regulation and generally applicable to the conveyance of water by Metropolitan on behalf of its member agencies.

In accordance with the Allocation Agreement, the Water Authority will also be responsible for a portion of the net additional Operation, Maintenance, and Repair (OM&R) costs for the lined canals. Any costs associated with the lining projects as proposed, are to be financed through the Water Authority's rates and charges.

### 4.2.5 WRITTEN CONTRACTS OR OTHER PROOF

**Appendix E** contains a list of the specific written contracts, agreements, and environmental permits associated with implementation of the canal lining projects.

### 4.2.6 FUTURE SUPPLIES

**Table 4-2** shows the anticipated delivery schedule of conserved supplies from the canal lining projects in 5-year increments. Adequate documentation exists to demonstrate the availability of this supply, and therefore, the reliability analysis found in **Section 8** of this Updated 2005 Plan will show the supply yields shown in **Table 4-2**.

Table 4-2: Projected Supply from Canal Lining Projects (AF/YR)

| Year | CC Lining Project[1] | AAC Lining Project[2] | TOTAL |
|---|---|---|---|
| 2005 | 0 | 0 | 0 |
| 2010 | 21,500 | 56,200 | 77,700 |
| 2015 | 21,500 | 56,200 | 77,700 |
| 2020 | 21,500 | 56,200 | 77,700 |
| 2025 | 21,500 | 56,200 | 77,700 |
| 2030 | 21,500 | 56,200 | 77,700 |

1 The project was completed in 2006, and deliveries started in 2007.
2 The estimated completion date is 2010.

## SECTION 4.3 WATER AUTHORITY SEAWATER DESALINATION PROGRAM

The development of seawater desalination in San Diego County will assist the region in diversifying its water resources, reducing dependence on imported supplies, and providing a new drought-proof treated water supply.

The Water Authority has been evaluating seawater desalination as a potential highly reliable local water resource since the early 1990s. From 1991 to 1993, the Water Authority conducted detailed studies on the feasibility of developing a seawater desalination facility at the South Bay Power Plant in the City of Chula Vista and the Encina Power Station in the City of Carlsbad. During that period, the Water Authority also participated in a study for a desalination plant that would be sited at a power plant in Rosarito Beach, Mexico. The studies concluded that the environmental, regulatory, and cost issues combined to make desalinated seawater more expensive than other available water resources options.



Seawater desalination is a potential supply for meeting water demands.

Data gathered from recently completed projects worldwide seem to indicate that the cost of seawater desalination has decreased since the Water Authority completed its last study in 1993. This decrease is mainly due to significant technological advances in the development and manufacture of membranes. The reverse osmosis (RO) membranes used in the desalination process cost approximately half the price and are twice as productive as membranes produced ten to fifteen years ago.

Based on the potential reduction in project costs, the Water Authority's 2000 Plan identified seawater desalination as a potential supply for meeting future demands. In response to the direction provided in the 2000 Plan, the Water Authority's Board approved a Seawater Desalination Action Plan in January 2001. The 2001 Action Plan covered activities related to the evaluation of seawater desalination opportunities along the San Diego County coastline.

In June 2004, following the Water Authority's RWFMP process, the Water Authority Board of Directors approved adding $668 million to the CIP to develop a desalinated seawater supply at the Encina Power Station. However, due to uncertainties regarding the site owner's facility plans at the Encina Power Station and disparity in negotiations with the plant's private

developer, the Water Authority Board of Directors, in July 2006, decided not to certify the final environmental impact report for the regional project and not to pursue the project further.

### 4.3.1 REGIONAL SEAWATER DESALINATION

Even with the Water Authority Board of Director's action in July 2006, seawater desalination remains a key component of the Water Authority's diversification strategy. This Plan includes a goal of 56,000 acre-feet of local seawater desalination (see **Section 5.4**) that is expected to come from the local project at the Encina Power Station beginning in 2011, as well as a long-term regional goal of an additional 33,600 acre-feet by 2020.

In October 2006, the Water Authority Board of Directors approved the 2006 Desalination Action Plan. The plan focuses on quantifying and evaluating other local and regional water supply opportunities that can help to meet the anticipated goal of 89,000 acre-feet of new local and regional seawater desalination supplies by 2030. Given the importance of seawater desalination to San Diego county, the action plan also requires that the Water Authority stay actively engaged in the pursuit of external funding for desalination and the statewide policy debate regarding the implementation of seawater desalination as a significant new water supply for California.

### 4.3.2 DESALINATION ACTION PLAN

The 2006 Desalination Action Plan consists of the following elements:

#### COMPLETE SAN ONOFRE/ CAMP PENDLETON REGIONAL DESALINATION FEASIBILITY STUDY

The Water Authority is currently preparing a detailed feasibility study of a 50-100 mgd desalination facility located along the coastline of Marine Corps Base Camp Pendleton. The majority of the cost of the study is being funded by federal appropriation grant funding and Proposition 50 state grant funding. The study scope of work is being modified in response to changes in site conditions.



The San Onofre Nuclear Generating Station

#### EVALUATE OTHER POTENTIAL REGIONAL SEAWATER DESALINATION PROJECTS

In addition to Encina and Camp Pendleton, there are other potential regional project sites that could warrant further evaluation such as South County. With the South Bay Power Plant currently planned to be replaced with an air-cooled power plant and the environmental sensitivity of south San Diego Bay, it is unlikely that a desalination plant could be sited adjacent to the bay. However, other projects identified in the Feasibility Study of Seawater Desalination Development Opportunities for the San Diego/ Tijuana Region, completed by the Water Authority in March 2005, may warrant further attention. These projects include a site located adjacent to the International Boundary and Water Commission Treatment Plant on the U.S. side of the border that would utilize the International Outfall for concentrate discharge. The project could potentially provide up to 25 mgd to serve demand in the South County. The study also identified a potential project in Mexico located at the Rosarito Power Plant. There are planning activities occurring in Mexico related to a project at that location.



Environmental impacts are being studied.

#### EXPLORE AND QUANTIFY THE POTENTIAL TO DEVELOP SMALLER LOCAL SEAWATER DESALINATION AND BRACKISH WATER DESALINATION PROJECTS

Until now, the focus of the Water Authority's effort to implement desalination has been the development of larger, regional projects, with a capacity greater than 25 mgd. This is due to the economies of scale present at larger desalination facility sizes. However, smaller member agency-driven brackish and seawater desalination projects could also help to meet the regional need for new water supplies.

For example, the city of Oceanside recently released a request for proposals for a seawater desalination

pilot facility and feasibility study. The purpose of the study is to develop accurate production and treatment data to facilitate the implementation of a 5-10 mgd seawater desalination project at the Mission Basin Groundwater Purification Facility Site. Feedwater for the project would come from extraction wells located at the mouth of the San Luis Rey River. Another local project example would be the development of a new, brackish desalination project in South County. The Sweetwater Authority was recently awarded Proposition 50 funds to study the feasibility of an Otay River brackish groundwater desalination project. With Proposition 50 funds also recently awarded to the Water Authority to study a regional concentrate conveyance pipeline in the South County, the opportunity exists to consider potential integration of these facilities with a proposed regional seawater desalination facility at the border.

Both of these potential projects highlight the potential to integrate local seawater desalination projects with existing or proposed groundwater desalination projects. By integrating these facilities together, the potential joint use of product water conveyance and concentrate discharge pipelines could significantly improve the economics of these facilities.

### CONTINUE WATER AUTHORITY'S EFFORTS TO SECURE OUTSIDE FUNDING FOR SEAWATER DESALINATION PROJECTS

Past experience in developing local supplies illustrates the importance of external funding as a catalyst to project implementation. Through federal, state, and local funding partnerships, the risk of project development is shared along with the benefits of new supplies for California. These partnerships also minimize the cost to local ratepayers. For example, almost $95 million in federal Title XVI funds have gone to water recycling projects in San Diego County and have been instrumental in their implementation. To date, the Water Authority has received $985,026 in federal grant funding for its seawater desalination program, as well as $250,000 in state funding through Proposition 50.

The Water Authority is actively working to secure external funding from Metropolitan's Seawater Desalination Program. The funding would provide a $250 per AF incentive for its member agencies that have contracted for water purchases from the privately-owned Carlsbad Desalination Project currently being developed at the Encina Power Station. The Water Authority is also a member of the New Water Supply Coalition, formerly the U.S. Desalination Coalition. The purpose of the coalition is to pass federal legislation that would provide for the issuance of federal tax credit bonds for desalination, water recycling, and groundwater remediation projects.



Seawater desalination will play an important role in San Diego's future.

### CONTINUE TO ADVOCATE FOR SEAWATER DESALINATION AT THE STATEWIDE LEVEL

Development of new supplies in California has always had a significant regulatory and legislative component in order to create a climate conducive to project implementation. Since the Water Authority first renewed its pursuit of seawater desalination as a water supply for San Diego County in 2001, it has been engaged in efforts both locally and statewide to facilitate the implementation of seawater desalination in California.

The Water Authority is working to facilitate the development of the privately-owned Carlsbad Desalination Project, including supporting the permitting of the project through state regulatory agencies such as the California Coastal Commission and the State Lands Commission. The Water Authority also participated on the State Desalination Task Force and currently is working with other Metropolitan member agencies developing seawater desalination projects to advocate for science-based and site-specific regulation for seawater desalination projects. This effort is focused on key state

permitting agencies including the State Water Resources Control Board and the California Coastal Commission. The Water Authority is also working with the Association of California Water Agencies (ACWA) Desalination Subcommittee to ensure that its policies are properly focused on ensuring the successful implementation of seawater and brackish water desalination projects in California. Continuation of this effort is important to assuring that the Water Authority maintains its options and flexibility with regard to future desalination project intake configuration.

### 4.3.3 WATER AUTHORITY SEAWATER DESALINATION PROGRAM GOAL

The Water Authority is currently focusing its efforts on the actions outlined in the Desalination Action Plan. Because seawater desalination will play an important role in both the near-term and long-term, the Water Authority established a long-term goal for future development of this supply. The goal for the Water Authority's Regional Seawater Desalination Program is 33,600 AF/YR starting in 2020, and continuing at this level through the 2030 planning period.

## SECTION 4.4 SUMMARY OF WATER AUTHORITY SUPPLIES

**Table 4-3** shows the documented Water Authority supplies existing and currently planned to assist in meeting future demands within the Water Authority's service area. In 2005, the Water Authority's IID transfer water accounted for 30,000 AF of supply. By 2030, deliveries of water from the IID transfer and AAC and CC Lining Projects will provide an expected supply of 277,700 AF/YR. The expected Water Authority supplies from **Table 4-3** are utilized in the reliability analysis included in **Section 8**.

**Table 4-3: Projected Water Authority Supplies (AF/YR)**

| | 2005 | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| IID Water Transfer | 30,000 | 70,000 | 100,000 | 190,000 | 200,000 | 200,000 |
| All-American Canal Lining Project | 0 | 56,200 | 56,200 | 56,200 | 56,200 | 56,200 |
| Coachella Canal Lining Project | 0 | 21,500 | 21,500 | 21,500 | 21,500 | 21,500 |
| **TOTAL WATER AUTHORITY SUPPLIES** | **30,000** | **147,700** | **177,700** | **267,700** | **277,700** | **277,700** |

# SECTION 5 MEMBER AGENCY SUPPLIES

Local resources developed and managed by the Water Authority's member agencies are critical to securing a diverse and reliable supply for the region. Local projects, such as recycled water and groundwater recovery, reduce demands for imported water and often provide agencies with a drought-proof supply. This section provides general information on the local resources being developed and managed by the member agencies. These supplies include surface water, groundwater, recycled water, and desalinated seawater.

**The Water Authority, working closely with its member agencies, took the following steps to update the anticipated yields from the member agencies' local supplies:**

1. Provided the member agencies with the projected supply numbers included in the Water Authority's 2000 Plan and requested they update the figures for their specific project(s);
2. Prepared revised projections based on input from agencies;
3. Separated the recycled water, groundwater, and seawater desalination projects into two categories, "verifiable" and "other potential projects," based on the likelihood of development. "Verifiable" projects are those with adequate documentation regarding implementation and supply utilization. "Other potential projects" are not far enough along in the planning process, but they are included with the verifiable projects to form an Updated 2005 Plan water supply goal;
4. Presented revised supply numbers to member agencies at several meetings and requested input; and
5. Distributed administrative draft of the 2005 Plan to member agencies for their review, providing them another opportunity to review and revise the updated local supply figures prior to the Water Authority's Board of Directors' approval.

Before 1947, the San Diego region relied on local surface water runoff in normal and wet weather years and on groundwater pumped from local aquifers during dry years when stream flows were reduced. As the economy and population grew, local resources became insufficient to meet the region's water supply needs. From the 1950s onward, the region became increasingly reliant on imported water supplies. Since 1980, a range of 5 to 36 percent of the water used within the Water Authority's service area has come from local sources, primarily from surface water reservoirs with yields that vary directly with annual rainfall. A small but growing share of local supply comes from recycled water and groundwater recovery projects, with additional local supply planned from seawater desalination. Yield from these projects are considered drought-proof since they are primarily independent of precipitation. In FY 2005, total local water sources provided eleven percent of the water used in the Water Authority's service area.

## SECTION 5.1 SURFACE WATER

### 5.1.1 DESCRIPTION

Seven watersheds in San Diego County contain water supply reservoirs. These watersheds start at the crest of the Peninsular Range and drain into the Pacific Ocean. Runoff within these watersheds is largely developed. The oldest functional reservoir in the county, Cuyamaca Reservoir, was completed in 1887. The Olivenhain Reservoir, completed in 2003, is the region's newest. It is part of the Water Authority's ESP and has a storage capacity of 24,789 AF. Twenty-five surface reservoirs with a combined capacity of 593,915 AF are located in the Water Authority's service area (**Table 5-1**). **Figure 5-1** shows the location of local reservoirs.

### 5.1.2 ISSUES

#### MANAGEMENT

Managing the region's reservoir system to achieve the optimal use of local and imported water is an important element of resources planning. Local surface water supplies can offset dry-year shortfalls in imported water. However, water use records indicate that local reservoirs are generally operated to maximize the use of local supplies in wet and normal years in order to reduce the need for imported water purchases. While this mode of reservoir operation reduces losses due to evaporation and spills, it also results in increased demands for imported water during dry years when imported water is more likely to be in short supply. Most member agencies also maintain a portion of their storage capacity for emergency storage. Many local reservoirs could be operated to maintain carryover storage, but this practice would tend to decrease their average annual yield. An environmental analysis of dedicated carryover storage capacity is being evaluated as part of the expansion of the San Vicente Reservoir, which is being implemented under the ESP. The RWFMP identified carryover storage as necessary to supplement supplies during dry weather events and to maximize the efficient use of existing and planned infrastructure.

## Major San Diego County Reservoirs




Figure 5-1

## Table 5-1: Major San Diego County Reservoirs

| MEMBER AGENCY | | RESERVOIR | CAPACITY(AF) |
|---|---|---|---|
| Carlsbad M.W.D. | ♦ | Maerkle | 600 |
| Escondido, City of | ♦ | Dixon | 2,606 |
| Escondido, City of | | Wohlford | 6,506 |
| Fallbrook P.U.D. | ♦ | Red Mountain | 1,335 |
| Helix W.D. | | Cuyamaca | 8,195 |
| Helix W.D. | ♦ | Jennings | 9,790 |
| Poway, City of | ♦ | Poway | 3,330 |
| Rainbow M.W.D. | ♦ | Beck | 625 |
| Rainbow M.W.D. | ♦ | Morro Hill | 465 |
| Ramona M.W.D. | ♦ | Ramona | 12,000 |
| San Diego, City of | | Barrett | 37,947 |
| San Diego, City of[1] | ♦ | El Capitan | 112,807 |
| San Diego, City of[2] | | Hodges | 33,550 |
| San Diego, City of | ♦ | Lower Otay | 49,510 |
| San Diego, City of | ♦ | Miramar | 7,185 |
| San Diego, City of | | Morena | 50,207 |
| San Diego, City of | ♦ | Murray | 4,818 |
| San Diego, City of | ♦ | San Vicente | 90,230 |
| San Diego, City of | | Sutherland | 29,685 |
| San Dieguito W.D./ Santa Fe I.D. | ♦ | San Dieguito | 883 |
| SDCWA/Olivenhain M.W.D. | ♦ | Olivenhain | 24,789 |
| Sweetwater Authority | | Loveland | 25,387 |
| Sweetwater Authority | ♦ | Sweetwater | 28,079 |
| Valley Center M.W.D. | | Turner | 1,612 |
| Vista I.D. | | Henshaw | 51,774 |
| TOTAL CAPACITY | | | 593,915 |

♦Connected to Water Authority's aqueduct system.

1 Imported water can be delivered via San Vicente.
2 System connection is part of the Emergency Storage Project.

### WATER QUALITY

See **Section 7** for water quality information.

### 5.1.3 ENCOURAGING OPTIMIZATION OF LOCAL SURFACE WATER RESERVOIRS

To optimize the use of local storage, the Water Authority and its member agencies participate in Metropolitan's Surface Storage Operating Agreement (SSOA). The SSOA, initiated in October 2003, allows Metropolitan to store up to 70,000 AF/YR of water in the Water Authority's member agency reservoirs. The water is placed into storage in the winter months when demand is low and pipeline capacity is available, and withdrawn by the member agencies in the summer months when demand increases and pipeline capacity is restricted due to increased demands. Benefits of the SSOA include decreased peak demands on the Skinner Treatment Plant, enhancement of local storage operations, and a credit on the member agency's invoice when water is withdrawn from the reservoir by the member agency. Up to 32 percent of the regional water demands have been met in the peak demand months utilizing SSOA water.

### 5.1.4 PROJECTED SURFACE WATER SUPPLIES

Surface water supplies represent the largest single local resource in the Water Authority's service area. However, annual surface water yields can vary substantially due to fluctuating hydrologic cycles. Since 1980, annual surface water yields have ranged from a low of 24,000 AF to a high of 174,000 AF. Planned ESP projects are expected to increase local yield due to the more efficient use of local reservoirs; the volume has not been determined. Based on information provided by the Water Authority's member agencies, the local surface water supplies are assumed to have an average annual yield of 59,649 AF.

A list of the individual reservoirs, expected yield and basis for the supply figure can be found in **Appendix F, Table F-1. Table 5-2** shows the projected average surface water supply within the Water Authority's service area. Specific information on the projected yields from local reservoirs is expected to be included in the member agencies' 2005 Plans.

Table 5-2: Projected Water Supply (Normal Year – AF/YR)

| YEAR | WATER SUPPLY AF/YR |
|---|---|
| 2005[1] | 45,521 |
| 2010 | 59,649 |
| 2015 | 59,649 |
| 2020 | 59,649 |
| 2025 | 59,649 |
| 2030 | 59,649 |

1 Based on FY 2005 totals.

## SECTION 5.2 GROUNDWATER

Groundwater is being used to meet demands throughout the Water Authority's service area, from the City of Oceanside in the north to National City in the south. This section provides a general description of groundwater development within the Water Authority's service area, the issues associated with development of this supply, and projected regional yield. Specific information required under the Act on groundwater basins and projects is expected to be included in the member agencies' 2005 Plans.

### 5.2.1 DESCRIPTION

Agencies within the Water Authority's service area used approximately 17,844 AF of groundwater in FY 2005, which is lower than the average due to an extended period of low rainfall, which resulted in limited natural recharge into the basins. In fact, over the last five years groundwater production used to meet potable demands has been below average at about 17,000 AF/YR. Many private well owners also draw on groundwater to help meet their domestic water needs, which helps to offset demand for imported water. The amount of groundwater pumped by private wells is significant, but to date has not been accurately quantified.

Groundwater production in the Water Authority's service area is limited by a number of elements, including lack of storage capacity in local aquifers, availability of groundwater recharge, and degraded water quality. Narrow river valleys filled with shallow sand and gravel deposits are characteristic of the most productive groundwater basins in the San Diego region. Outside of the principal alluvial aquifers and farther inland, groundwater occurs in fractured crystalline bedrock and semi-consolidated sedimentary deposits where yield and storage are limited and the aquifers are best suited for lower-yielding domestic water supply wells. **Figure 5-2** shows the location of the principal alluvial groundwater basins located within the Water Authority's service area.

Although groundwater supplies are less plentiful in the San Diego region than in some other areas of California, such as the Los Angeles Basin in Southern California and the Central Valley in Northern




Figure 5-2

California, the Water Authority believes that sufficient undeveloped supplies exist that could help meet a greater portion of the region's future water supply and storage needs. Several agencies within the Water Authority's service area have documented potential projects that could provide an additional 21,400 AF/YR of groundwater production in the coming years. Existing, planned and potential projects can be grouped into the following three categories:

### GROUNDWATER EXTRACTION AND DISINFECTION PROJECTS

These projects are generally located in basins with higher water quality levels, where extracted groundwater requires minimal treatment for use as a potable water supply. Examples of this type of groundwater project include projects currently operated by MCB Camp Pendleton, Yuima MWD, and the Sweetwater Authority (National City Well Field). Another high yielding basin is the upper San Luis Rey, which provides groundwater supplies to the Vista Irrigation District and City of Escondido and is operated in conjunction with surface water supplies. The unit cost of water produced from simple groundwater extraction and disinfection projects is generally well below the cost of imported water. Because most of the higher quality groundwater within the Water Authority's service area is already being fully utilized, a relatively small amount of this "least cost" groundwater is available for new supplies. However, these basins are good candidates for conjunctive-use operations, which can significantly increase the average annual production rate of groundwater.

### BRACKISH GROUNDWATER RECOVERY PROJECTS

Groundwater that is high in Total Dissolved Solids (TDS) is typically found in basins that have been impacted by imported-water irrigation or by seawater intrusion resulting from the historical overdraft of coastal basins. Brackish groundwater recovery projects use desalination technologies, principally reverse osmosis, to treat extracted groundwater to potable water standards. The City of Oceanside's 6.37-mgd capacity Mission Basin Desalter and the Sweetwater Authority's existing 4.0-mgd Richard A. Reynolds Groundwater Desalination Facility are two currently operating brackish groundwater recovery projects in the Water Authority's service area. Unit costs for brackish groundwater recovery projects are considerably higher than those for simple groundwater extraction projects due to the additional treatment requirements, including concentrate disposal needs. However, where economical options exist for disposal of brine, this type of groundwater project has proven to be an economically sound water supply option.

### GROUNDWATER RECHARGE AND RECOVERY PROJECTS

Artificial recharge and recovery projects, or conjunctive-use projects, improve groundwater basin yields by supplementing natural recharge sources with potable or recycled water, and/or inducing additional natural recharge. These projects can supply stored water to the region if imported deliveries are limited due to supply and facility constraints. The Water Authority and City of Oceanside completed a study in 2005 that evaluated the potential for a conjunctive-use project in the Mission Basin. Results from the study indicate that use of the basin for recharge and recovery may be limited due to the impact on sensitive riparian habitat and costs for recharge facilities. Oceanside plans to complete expansion of its existing demineralization facility and then monitor groundwater levels in the basin prior to proposing development of a potential conjunctive-use project. The study approach and information generated by this conjunctive-use study is being made available to other agencies within the Water Authority's service area considering development of such a project. Refer to **Section 5.2.3** for additional information on the study.



The City of Oceanside's groundwater desalter

## 5.2.2 ISSUES

Local agencies must consider a number of issues when developing groundwater projects, including economic and financial considerations, legal, institutional, regulatory, environmental, and water quality issues. These issues can limit the amount of groundwater development in San Diego County.

Please see **Section 5.3.4** for information on the Water Authority's Financial Assistance Program funding opportunities for facility planning, feasibility investigations, preliminary engineering studies, environmental impact reports, and research projects related to groundwater development.

### ECONOMIC AND FINANCIAL CONSIDERATIONS

Because of the saline nature of the groundwater basins in San Diego County, the cost of groundwater development usually includes demineralization, which can be costly to construct and operate. One of the more costly elements is the facility necessary to dispose of the brine generated from the treatment process. To address this element, the United States Bureau of Reclamation (USBR), in coordination with numerous public agencies including the Water Authority, is conducting a multiyear planning study to evaluate brine concentrate management and disposal technologies.

### INSTITUTIONAL, LEGAL, AND REGULATORY ISSUES

Institutional and legal issues can also impact project development. Because most basins involve multiple water agencies and numerous private wells, water rights are a concern. Agencies are often reluctant to implement groundwater development projects unless jurisdiction and water rights issues are resolved beforehand.

Uncertainty over future regulatory requirements for drinking water supplies can pose another barrier to project development. When developing facilities and compliance plans for groundwater recharge projects, agencies must take into account proposed or potential regulatory changes related to water quality issues. Some of the regulations for which changes are expected over the next decade include state and federal drinking water standards and California Department of Health Services groundwater recharge regulations.

### ENVIRONMENTAL REGULATORY CONSTRAINTS

Regulatory issues related to environmental protection are common to many of the groundwater projects proposed within the Water Authority's service area. These issues include potential impacts to endangered species and groundwater-dependent vegetation. Impacts may occur if a project results in seasonal or long-term increases in the depth of the groundwater. Although potential environmental impacts can generally be mitigated, mitigation costs can reduce the cost-effectiveness of a project. Concentrate disposal requirements for brackish groundwater recovery projects can also constrain projects sited in inland basins without access to an ocean outfall.



Sweetwater Authority's demineralization facility

### WATER QUALITY

See **Section 7** for water quality information.

## 5.2.3 PROJECTED GROUNDWATER SUPPLIES

The Water Authority worked closely with its member agencies to determine the projected yield from existing and planned groundwater projects. **Table 5-3** shows the estimated annual yield from groundwater projects in 5-year increments, based on the implementation schedules provided by the member agencies and the likelihood of development. The reliability analysis found in **Section 8** of this Updated 2005 Plan includes these projected supply yields. **Table F-2, Appendix F,** contains a detailed list of the projects and projected supplies.

Table 5-3: Projected Groundwater Supply (Normal Year – AF/YR)

| YEAR | WATER SUPPLY AF/YR |
|---|---|
| 2005[1] | 17,844 |
| 2010 | 28,575 |
| 2015 | 30,345 |
| 2020 | 31,175 |
| 2025 | 31,175 |
| 2030 | 31,175 |

1 Based on FY 2005 totals.

**Table 5-3** shows the increase in groundwater production from the current yield of 17,844 AF/YR resulting from the expansion of projects operated by the Sweetwater Authority and the City of Oceanside. To achieve this increase in groundwater yield, funding assistance is critical, as is overcoming the regulatory constraints associated with development.

The City of Oceanside anticipates that its proposed 6.37 mgd Mission Basin Desalter (4.0-mgd expansion) will be completed by the end of the year 2006. The project will include the development of the estimated remaining "safe yield" of the basin through expansion of the existing demineralization facility. The Sweetwater Authority is participating in studies with the United States Geological Survey to evaluate the San Diego Formation Aquifer and make safe use of the available yield from the aquifer.

### REGIONAL GROUNDWATER GOAL

Maximizing groundwater development is critical to diversifying the region's water supply portfolio. Beyond the verifiable yield included in **Table 5-3**, the member agencies are considering developing an estimated 21,400 AF/YR of additional yield by 2030. These projects are generally not expansions of existing projects and are still in the planning and/or conceptual stage. Funding assistance and overcoming regulatory constraints is critical to the development of this additional supply. **Table F-2, Appendix F,** includes a list of the projects. When these projects become more certain, they will be included in future updates of the Water Authority's Urban Water Management Plan.

To highlight the importance of maximizing groundwater supplies within the region, a regional groundwater goal has been established: 52,575 AF/YR by 2030, in combination with the yields shown in **Table 5-3**.

### CONJUNCTIVE-USE

As mentioned above, conjunctive-use projects can supply stored water to the region if imported deliveries are limited due to supply and/or facility constraints. The City of San Diego, Otay Water District, Olivenhain Municipal Water District, and the City of Oceanside are considering developing conjunctive-use projects in the future. **Table F-2, Appendix F,** includes the estimated potential storage yield from these projects. If developed, they could provide 17,450 AF/YR of storage yield for the region by 2030.

Because the imported conjunctive-use projects produce minimum amounts of new yield, the regional reliability analysis in **Section 8** does not include the supply figures. In addition, the projects are still in the conceptual and/or planning stages.

Results from the Lower San Luis Rey River Valley Groundwater Storage and Recovery Feasibility Study, prepared by the Water Authority in conjunction with the City of Oceanside, also identifies significant constraints to the development of groundwater conjunctive-use projects in San Diego County.

**These constraints relate to the following:**

- Cost to install infrastructure to deliver and extract the recharge water;
- Injecting higher quality imported water into brackish basins and then having to demineralize the water when it is extracted;
- Potential impact on sensitive riparian habitat; and
- Lack of opportunities for spreading basins.

## SECTION 5.3 WATER RECYCLING

A fundamental element to developing a diverse supply mix for the region and to using existing water supplies more efficiently is through implementation of water recycling projects. This section provides a general description of recycled water development within the Water Authority's service area, the issues associated with developing this supply, and projected regional yield. Documentation on specific existing and future recycling projects is expected to be in the 2005 Plans for those agencies that include water recycling as a supply. The Water Authority coordinated the preparation of this section with its member agencies and those wastewater agencies that operate water recycling facilities within the Water Authority's service area.

### 5.3.1 DESCRIPTION

Water recycling is the treatment and disinfection of municipal wastewater to provide a water supply suitable for non-drinking purposes. Agencies in San Diego County use recycled water to fill lakes, ponds, and ornamental fountains; to irrigate parks, campgrounds, golf courses, freeway medians, community greenbelts, school athletic fields, food crops, and nursery stock; and to control dust at construction sites. Recycled water can also be used in certain industrial processes and for flushing toilets and urinals in non-residential buildings. As an example, the detention facility in the Otay Mesa area of San Diego County is dual-plumbed to allow use of recycled water for toilet and urinal flushing. However, current regulations allow only new buildings to be dual-plumbed for this specific use. Additional uses for recycled water are being identified and approved as local agencies and regulators become comfortable with its use.

### 5.3.2 ISSUES

Local agencies must consider a number of issues when developing recycled water projects, including economic and financial considerations, regulatory, institutional, public acceptance, and water quality concerns related to unknown or perceived health and environmental risks. These issues, if unresolved, can limit the amount of wastewater recycled in San Diego County. In fact, the impact from the challenges associated with recycled water are apparent when comparing the 2005 recycled water projections from the Water Authority's 2000 Plan (33,400 AF) to actual FY 2005 recycled water demand (11,479 AF). The following sections discuss some of the specific challenges associated with recycled water development.



General Atomics uses recycled water in its pond.

#### ECONOMIC AND FINANCIAL CONSIDERATIONS

The capital-intensive cost of constructing recycled water projects has traditionally been a barrier to project implementation. The up-front capital costs for construction of treatment facilities and recycled water distribution systems can be high, while full market implementation is usually phased in over a number of years, resulting in very high initial unit costs that affect cash flow in the early project years.

Costs associated with converting existing potable water customers to recycled water customers have also proved challenging. This situation is compounded by the seasonal nature of recycled water demands and the lack of large industrial water users in San Diego County that can use recycled water. The lack of sizeable opportunities for groundwater recharge storage compounds this situation. Recycled water demands tend to peak during the hot summer months and drop off during the winter

months when landscape irrigation demands are low. Projects that serve a large portion of irrigation demands, like the majority of the projects in the Water Authority's service area, often use only half of their annual production capacity due to these seasonal demand patterns. The costs of these projects tend to be higher than those of projects that serve year-round demands, since the project facilities must be sized to accommodate seasonal peaking. Projects that serve mostly irrigation demands also tend to have less stable revenue bases since irrigation demands are heavily influenced by hydrologic conditions.

To be financially feasible, a project's benefits must offset or exceed its associated costs.

**Project benefits can take the form of:**

- Revenues from the sale of recycled water;
- increased supply reliability;
- increased control over the cost of future water supplies; and
- avoided water and wastewater treatment, storage, and conveyance costs.

Agencies developing recycled water projects must be able to quantify these benefits in order to determine the financial feasibility of a project. In addition, financial incentives and grant funding from the Water Authority, Metropolitan, and federal and state agencies are critical to offsetting project costs and project implementation.

### REGULATORY

Two state agencies have primary responsibility for regulating the application and use of recycled water: the Department of Health Services (DHS) and the California Regional Water Quality Control Board (Regional Board). Planning and implementing water recycling projects entail numerous interactions with these regulatory agencies prior to project approval.

The DHS establishes the statewide effluent bacteriological and treatment reliability standards for recycled water uses in Title 22 of the California Administrative Code. Under Title 22, the standards are established for each general type of use based on the potential for human contact with recycled water. The highest degree of standards for recycled water is for unrestricted body contact.

The Regional Board is charged with establishing and enforcing requirements for the application and use of recycled water within the state. Permits are required



The City of San Diego's South Bay Reclamation Plant

from the Regional Board for each water recycling operation. As part of the permit application process, applicants are required to demonstrate that the proposed recycled water operation will not exceed the ground and surface water quality objectives in the basin management plan, and that it is in compliance with Title 22 requirements.

Coordination between the regulatory agencies responsible for monitoring development of recycled water is important, along with the development of a reasonable and consistent application of regulations. Regulatory agencies also need to work closely and cooperatively with project proponents in their efforts to satisfy the regulations and still be able to develop a much needed, cost-effective water-recycling project.

A regulatory issue that may hinder development of projects is the DHS groundwater recharge rule that requires treatment prior to injection of recycled water in order to reduce the total organic carbon (TOC) concentration to less than 2.0 mg/l. This requirement may increase the cost and reduce the ability to develop the limited opportunities for groundwater recharge in San Diego County.

### INSTITUTIONAL

The primary institutional issue related to the development of water recycling in San Diego County is interagency coordination, such as when the wastewater agency that produces the recycled water is not the water purveyor within the reuse area. At those times, effective communication and cooperation between both agencies regarding the distribution of recycled water and providing service to the water customer is vital and should begin early in the planning process.

These institutional arrangements require contracts and/or agreements between the parties and/or agencies involved, the terms of which must be established on a case-by-case basis. The agreements usually define the reporting and compliance responsibilities, the amount of recycled water deliveries, water pricing, and a financing plan that identifies which agency will receive the financial incentives.

#### PUBLIC ACCEPTANCE

Without public acceptance, siting, financing, constructing, and operating a water-recycling project becomes increasingly difficult. The most successful means to obtaining public acceptance is through education and involvement. Agencies in the San Diego region have formed citizens' advisory groups and held public workshops in an effort to increase public involvement in projects. In the Water Authority's service area, the Regional Public Information and Customer Marketing Program is being developed to promote the increased use of recycled water.

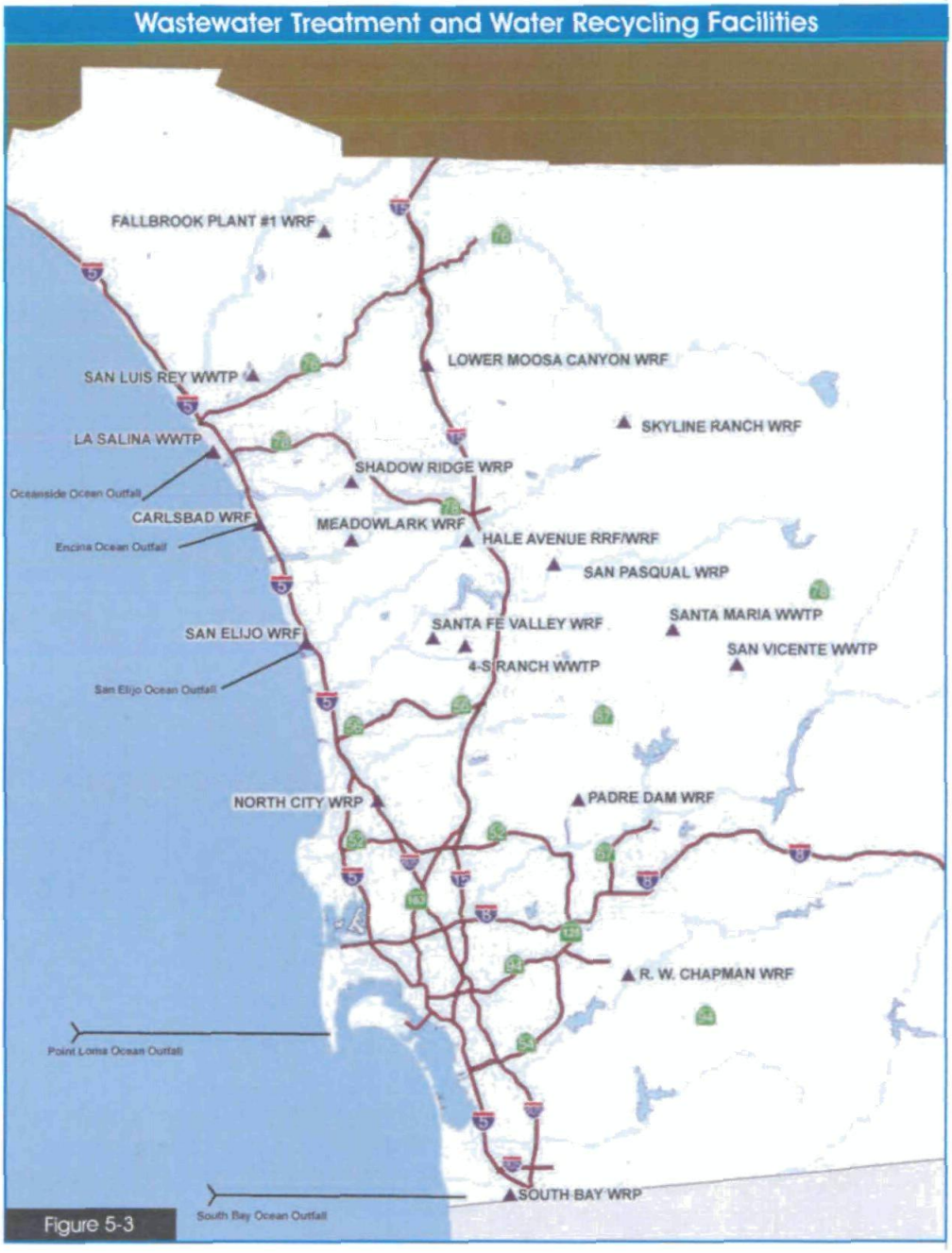


Figure 5-3

### 5.3.3 WASTEWATER GENERATION, COLLECTION, TREATMENT, AND DISPOSAL

Approximately 300-mgd of wastewater is currently being generated, collected, treated, and disposed of within the Water Authority's service area. Most of the large wastewater treatment plants are located along the coast for easy and convenient access to an ocean outfall. These plants serve most of the San Diego region's highly urbanized areas. **Figure 5-3** identifies the location of the wastewater treatment plants and the associated outfall systems. The coastal location of the plants is not always conducive to development of recycled water. Most of the market for recycled water is located at higher elevations, making distribution systems costly. **Table F-3, Appendix F,** shows a detailed list of the wastewater treatment plants within the county, their capacities at various levels of treatment, and the type of disposal. In addition, approximately 10- to 15-mgd of wastewater within the Water Authority's service area is generated and disposed of through private systems, such as septic tanks.

### 5.3.4 ENCOURAGING RECYCLED WATER DEVELOPMENT

The Act requires agencies to describe in their plan the actions, including financial incentives, that

| Table 5-4: Programs to Encourage Recycled Water Use |
|---|
| **Incentive Programs** |
| Reclaimed Water Development Fund (Water Authority)<br>Local Resources Program (Metropolitan) |
| **Grants** |
| Title XVI Funding Program (US Bureau of Reclamation)<br>Proposition 13 Grant (State of California)<br>Proposition 50 Grant (State of California) |
| **Low -Interest Loans** |
| Financial Assistance Program (Water Authority)<br>State Revolving Fund (State of California)<br>Water Reclamation Loan Program (State of California)<br>Proposition 13 Loan (State of California) |
| **Long-Term Contracts** |
| Ensure price and reliability |
| **Funding assistance to State Water Resources Control Board to fund staff position to expedite water recycling projects.** |
| **Rate Discounts** |
| **Public Education/Information** |
| **Regional Planning** |
| ***Model Water Reclamation Ordinance and Implementation Handbook*** |
| Dual Plumbing Standards<br>Prohibits Specific Potable Water Uses |

agencies may take to encourage the use of recycled water. **Table 5-4** summarizes the programs used by the Water Authority's member agencies. The water-recycling agencies develop some of the programs, while others are developed or funded by the water providers, such as the Water Authority, Metropolitan, and state and federal agencies.

### FUNDING PROGRAMS

Another important component of a successful recycling project is securing diversified funding and establishing funding partnerships. The Water Authority has focused on providing and facilitating the acquisition of outside funding for water-recycling projects.

A number of financial assistance programs available to San Diego County agencies include: the Water Authority's Financial Assistance Program (FAP) and Reclaimed Water Development Fund (RWDF); Metropolitan's Local Resources Program (LRP); the USBR Title XVI Grant Program; and the State Water Resources Control Board (SWRCB) low-interest loan programs. Together, these programs offer funding assistance for all project phases, from initial planning and design to construction and operation. Financial assistance programs administered by the Water Authority, Metropolitan, and the USBR provided $10.4 million to San Diego County agencies during FY 04. It is anticipated that approximately $7.9 million will be awarded in 2005 from these funding sources. These programs are projected to ultimately reuse approximately 54,000 AF/YR.

**Financial Assistance Program**. The Water Authority offers FAP funding to encourage facility planning; feasibility investigations; preliminary engineering studies; environmental impact reports; and research projects related to water recycling, groundwater development, and seawater desalination. Since its inception in June 1988, the FAP has provided local agencies with more than $1.8 million for water recycling studies, $797,000 for groundwater development studies, and over $200,000 for seawater desalination studies. Agencies may apply for FAP funding through either a loan or a grant. FAP funds are distributed on a loan basis for feasibility studies, master plans, facility plans, and environmental reports. Repayment of the

loan is required when the project has satisfactorily met CEQA requirements, or when the planned project is complete. Grant funding is also distributed through the FAP for research and development projects. To receive funding as a grant, the agency must have already secured partial funding for the project from another source.

**Reclaimed Water Development Fund.** To aid agencies in overcoming financial constraints associated with development of water-recycling projects, the Water Authority's Board of Directors adopted the RWDF program in April 1991, which provided incentive funding of up to $100/AF for beneficial reuse for recycling projects that demonstrated a financial need. Recently, the incentive level was increased to $147/AF. This incentive contribution offsets costs, especially in the early years of project start-up. In order to qualify, project expenses must exceed project revenues. To date, the Water Authority has entered into RWDF agreements with nine agencies for a combined project yield of 29,857 AF/YR. In FY 04, the Water Authority provided local agencies with $880,500 in RWDF incentives.

**Local Resources Program.** Metropolitan also has a program that currently underwrites local projects during the initial years of operation. The LRP provides incentives of up to $250 AF/YR for recycled water and groundwater recovery projects. Currently, fifteen water-recycling projects in San Diego County have agreements for LRP funding. Metropolitan provided $2,111,752 in FY 04, and $1,796,642 in FY 05, for LRP funding. Metropolitan also provided funding through its Groundwater Recovery Program (GRP) for two groundwater recovery projects in the amounts of $1,292,686 in FY 04, and $709,105 in FY 05.

**The Reclamation Wastewater and Groundwater Study and Facilities Act – Title XVI.** The Title XVI Grant Program is a significant source of funding for San Diego-area recycling projects. Title XVI of Public Law 102-575, the Reclamation Wastewater and Groundwater Study and Facilities Act, authorizes the federal government to fund up to 25 percent of the capital cost of authorized recycling projects, including the San Diego Area Water Reclamation Program, an inter-connected system of recycling projects serving the Metropolitan Sewage System service area. PL104-266, the Reclamation Recycling and Water Conservation Act of 1996, authorized two additional projects in northern San Diego County: the North San Diego County Area Water Recycling Project and the Mission Basin Brackish Groundwater Desalting Demonstration Project. To date, San Diego agencies have been authorized to receive more than $195 million under the Title XVI grant program, including more than $7.3 million obligated during Federal Fiscal Year (FFY) 04. A total of $94,591,000 has been received from this funding source to date. It is critical that funding from this program be maintained each year.

**State Revolving Fund/Water Reclamation Loan Program.** The SWRCB, through the Division of Financial Assistance, provides financial assistance for water-recycling projects in the form of low-interest loans and/or grants for project construction and grants for project planning. The State Revolving Fund (SRF) and the Water Reclamation Loan Program (WRLP) provides agencies with low-interest construction loans for water recycling and groundwater projects. This below-market interest rate can result in substantial savings on debt service. The SRF and WRLP loans carry an interest rate equal to 50 percent of the state's general obligation bond interest rate. Approximately $42 million was appropriated to the SWRCB in FY 03 and 04 for the funding of water-recycling projects. Additional funding for FY 03 from the SWRCB included $4 million from Proposition 13 and the 2000 Bond Law for San Diego-area water recycling projects. In FY 04, an additional $75,000 was awarded to local water-recycling projects through SWRCB funding sources. An example of funding recently awarded to one of the Water Authority's member agencies was the $1.08 million grant given to the Olivenhain Municipal Water District.



Drillers work at the Mission Basin Brackish Groundwater Desalting site.

California voters passed Proposition 50, known as the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002 on November 5, 2002. In spring 2005, more than $10 million was earmarked from this bond measure for San Diego area water- recycling projects. It is anticipated that disbursements will begin in late-2005.

### POLICIES, ORDINANCES AND GUIDANCE DOCUMENTS

The Water Authority has adopted a number of policies, guidance documents, and a model ordinance to assist local agencies with water-recycling project implementation. Many local agencies have adopted the Water Authority-sponsored ordinance, which includes provisions that typically require new development projects to install recycled water systems. The ordinance also states that where allowed by law and available in sufficient quantities at a reasonable cost and quality, recycled water shall be the sole water supply delivered for non-potable uses.

### TRAINING

The Water Authority, in partnership with other water agencies, offers a one-day course designed to provide irrigation supervisors with a basic understanding of recycled water. Completion of the Recycled Water Site Supervisor Training fulfills the training requirement as mandated by regulatory authorities. The class provides information to supervisors on the water recycling process, recycled water quality and safety issues, the duties and responsibilities of the supervisor, landscape irrigation fundamentals, maintenance and management, and cross connection control shut-down tests and inspections. Understanding similarities and differences between recycled and potable water is important to the successful operation of a recycled water system. The first class started in 1993 with 14 participants. At this time, more than 1,000 participants have been certified. Instructors include a state registered environmental health specialist, environmental assessor, water quality chemist/reclamation specialist, and landscape specialists.



The Water Authority's one-day recycled water training class

### OPTIMIZING THE USE OF RECYCLED WATER - REGIONAL PERSPECTIVE

While local agencies typically expand and develop their respective recycled water projects independently based on local interests, the Water Authority is conducting studies that will identify opportunities to expand the region's use of recycled water. These studies, namely, the San Diego County Water Authority Regional Recycled Water System Study, completed in March 2002, and the Regional Recycled Water Study – Phase II, scheduled for completion in December 2005, took a regional approach to water recycling project planning and development. Primary tasks to be completed under the Regional Recycling Water Study – Phase II include: developing strategies to overcome identified obstacles to water recycling; developing a marketing plan and regional strategies to market recycled water to target industries and customers; investigating and examining to what extent — and levels — TDS in source water affect the use and application of recycled water for local end-users; researching and identifying the impediments to the implementation of water repurification projects; and funneling planning grant funding to regional agencies to further expand the use of recycled water.

The Water Authority also participated in the California Recycled Water Task Force. This legislated task force identified constraints, impediments, and opportunities for the increased use of recycled water, and reported its findings to the California Legislature by July 1, 2003. Many of the recommendations identified in the completed report entitled, "Water Recycling 2030: Recommendations of California's Recycled Water Task Force," dated June 2003, have been regionally supported and adopted. Six of the key issue areas identified in the report are currently being addressed via the Phase II Study efforts and through legislative means either supported or initiated by the Water Authority. These areas include: (1) Funding for water recycling; (2) Public dialogue/ Public outreach; (3) Plumbing Code/Cross-connection control; (4) Regulations and permitting; (5) Economics of water recycling; and (6) Science and health/Indirect potable reuse.

## 5.3.5 PROJECTED RECYCLED WATER USE

The Water Authority worked closely with its member agencies to determine the projected yield from existing and planned recycled water projects. **Table 5-5** shows the estimated annual yield from the projects in 5-year increments, based on the implementation

schedules provided by the member agencies and the likelihood of development. These projected supply yields will be included in the reliability analysis found in **Section 8** of this Updated 2005 Plan. **Table F-4, Appendix F,** contains a detailed list of the projects and projected supplies.

Table 5-5: Projected Recycled Water Use (AF/YR)

| YEAR | AF/YR |
|---|---|
| 2005[1] | 11,479 |
| 2010 | 33,668 |
| 2015 | 40,662 |
| 2020 | 45,548 |
| 2025 | 46,492 |
| 2030 | 47,584 |

1 Based on FY 2005 totals.

The increase in recycled water use shown in **Table 5-5**, from the current use of 11,479 AF/YR, is primarily from the expansion of existing facilities. The City of Carlsbad is constructing a new treatment and distribution system to deliver close to 3,000 AF/YR of recycled water. The Otay Water District is constructing a distribution system to deliver an estimated 5,000 AF/YR of recycled water by 2030 purchased from the City of San Diego's South Bay Water Reclamation Plant.

#### REGIONAL WATER RECYCLING GOAL

Maximizing recycled water development is critical to diversifying the region's water supply portfolio. Beyond the verifiable yield included in **Table 5-5**, the member agencies are considering development of an additional 6,829 AF/YR by 2030. These projects are still in the planning and/or conceptual stage. Funding assistance and overcoming regulatory constraints is critical to the development of this additional supply. **Table F-4, Appendix F,** contains a list of the projects. When development of these projects becomes more certain, they will be included in future updates of the Water Authority's Updated 2005 Plan. In order to highlight the importance of maximizing recycled water use within the region, a regional water recycling goal has been established. In combination with the figures shown in **Table 5-5**, the regional water-recycling goal is 54,413 AF/YR by 2030.

## SECTION 5.4 SEAWATER DESALINATION

The development of local seawater desalination provides a number of benefits to the San Diego region. Seawater desalination will assist the region in diversifying its water resources, reduce dependence on imported supplies, and provide a new drought-proof, treated local water supply.

### 5.4.1 DESCRIPTION

Poseidon Resources is pursuing the development of a local, privately-owned desalination project located adjacent to the Encina Power Station. The project will consist of a reverse osmosis desalination treatment facility as well as ancillary intake, discharge, and product water distribution pipelines and facilities. Poseidon has executed water purchase agreements with the following Water Authority member agencies: Carlsbad Municipal Water District; Valley Center Municipal Water District; Rincon del Diablo Municipal Water District; and Sweetwater Authority; *and is pursuing water purchase agreements with* other member agencies. The facility is projected to ultimately produce 56,000 AF/YR of desalinated seawater by 2011. The major planning items completed to date include certification of an environmental impact report by the City of Carlsbad, approval of a concentrate discharge permit by the San Diego Regional Water Control Board, and submittal of a Coastal Development Permit application to the California Coastal Commission.



A local, privately owned desalination project is in the planning stages.

### 5.4.2 ISSUES

No large-scale seawater desalination facility has ever been permitted/constructed in California. Perhaps the most significant issue facing this desalination project as well as others proposed along the California coastline is the ability to permit the facility, including obtaining a Coastal Development Permit from the California Coastal Commission. This project must also secure arrangements for the delivery of product water from the facility to the local water agencies. These arrangements are currently in the planning stage.

### 5.4.3 PROJECTED SEAWATER DESALINATION SUPPLIES

Seawater desalination supplies represent a significant future local resource in the Water Authority's service area. To date, the local, privately-owned seawater desalination project has contracted with the Carlsbad Municipal Water District (up to 28,000 AF/YR depending on demands), Valley Center Municipal Water District (7,500 AF/YR), Rincon Del Diablo Municipal Water District (4,000 AF/YR), and Sweetwater Authority (2,400 AF/YR) to supply up to 41,900 AF/YR of desalinated seawater. The verifiable seawater desalination figure to be used in the Updated 2005 Plan will be based on the contract amounts and projected seawater desalination deliveries to Carlsbad MWD. As shown in **Table 5-6**, the verifiable projected local seawater desalination supplies vary each year based on Carlsbad MWD's demands (which are less than their desalinated seawater contract amount of 28,000 AF/YR). These projected supply yields will be included in the reliability analysis found in **Section 8** of this Updated 2005 Plan. There are several contingencies related to Poseidon's agreements with the member agencies that must be satisfied before implementation of the project and its ultimate yield can be determined. These contingencies include obtaining legal entitlements for construction of the project, determination of a mutually acceptable delivery interconnection point and delivery charge, and engagement of a third party exchange agency partner where physical delivery to the contracting agency is not practical.

*Table 5-6: Projected Local Seawater Desalination Water Supplies*[1]
(Normal Year – AF/YR)

| YEAR | AF/YR |
|---|---|
| 2005 | 0 |
| 2010 | 0 |
| 2015 | 34,689 |
| 2020 | 36,064 |
| 2025 | 37,754 |
| 2030 | 40,000 |

1 Deliveries to Carlsbad MWD will vary based on their actual demands and local use of recycled water. See Appendix F-4 for information on Carlsbad MWD's projected recycled water use.

#### LOCAL SEAWATER DESALINATION GOAL

In order to highlight the importance of maximizing the supply of seawater desalination used within the region, a local seawater desalination goal has been established. The project proponent, Poseidon Resources, is pursuing additional agreements with other local water agencies for the remaining 16,000 AF of annual production. When the 16,000 AF/YR is combined with a verifiable maximum local supply of 40,000 AF/YR, a local seawater desalination goal of 56,000 AF/YR is established.

## SECTION 5.5 SUMMARY OF MEMBER AGENCY SUPPLIES

**Table 5-6** shows the projected supply figures for existing and projected local resources for the Water Authority's service area based on input from the member agencies. These supplies are considered verifiable and will be used in the regional reliability analysis included in **Section 8**.

The estimates for projected member agency local supplies included in **Table 5-7** could be even greater with increased funding opportunities, technological advances, and by successfully addressing regulatory and environmental issues. Maximizing groundwater, recycled water, and desalinated seawater development can provide further diversification of regional supplies. In order to highlight the importance of maximizing these supplies, a local resources goal has been established. In combination with the figures shown in **Table 5-7**, the total regional local resources goal, excluding supply from conjunctive use projects using imported or recycled water, is 220,683 AF/YR by 2030.

**Table 5-7: Projected Member Agency Local Supplies (Normal Year - AF/YR)**

| Local Supply | 2005[1] | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| Surface Water | 45,521 | 59,649 | 59,649 | 59,649 | 59,649 | 59,649 |
| Groundwater | 17,844 | 28,575 | 30,345 | 31,175 | 31,175 | 31,175 |
| Recycled Water | 11,479 | 33,668 | 40,662 | 45,548 | 46,492 | 47,584 |
| Desalinated Seawater | 0 | 0 | 34,689 | 36,064 | 37,754 | 40,000 |
| **Total Member Agency Supplies** | **74,844** | **121,892** | **165,345** | **172,436** | **175,070** | **178,408** |

1 Based on FY 2005 totals.

# SECTION 6 METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

## SECTION 6.1 DESCRIPTION

Metropolitan was formed in 1928 to develop, store, and distribute supplemental water in Southern California for domestic and municipal purposes. Metropolitan supplies water to approximately 18 million people in a service area that includes portions of Ventura, Los Angeles, Orange, San Bernardino, Riverside, and San Diego counties. The Metropolitan service area, shown in **Figure 6-1**, covers a 70-mile-wide strip of the Southern California coastal plain, extending from the city of Oxnard on the north to the Mexican border. Close to half of the water used in this 5,200-square-mile region is supplied by Metropolitan, and about 90 percent of its population receives at least some of its water from Metropolitan.

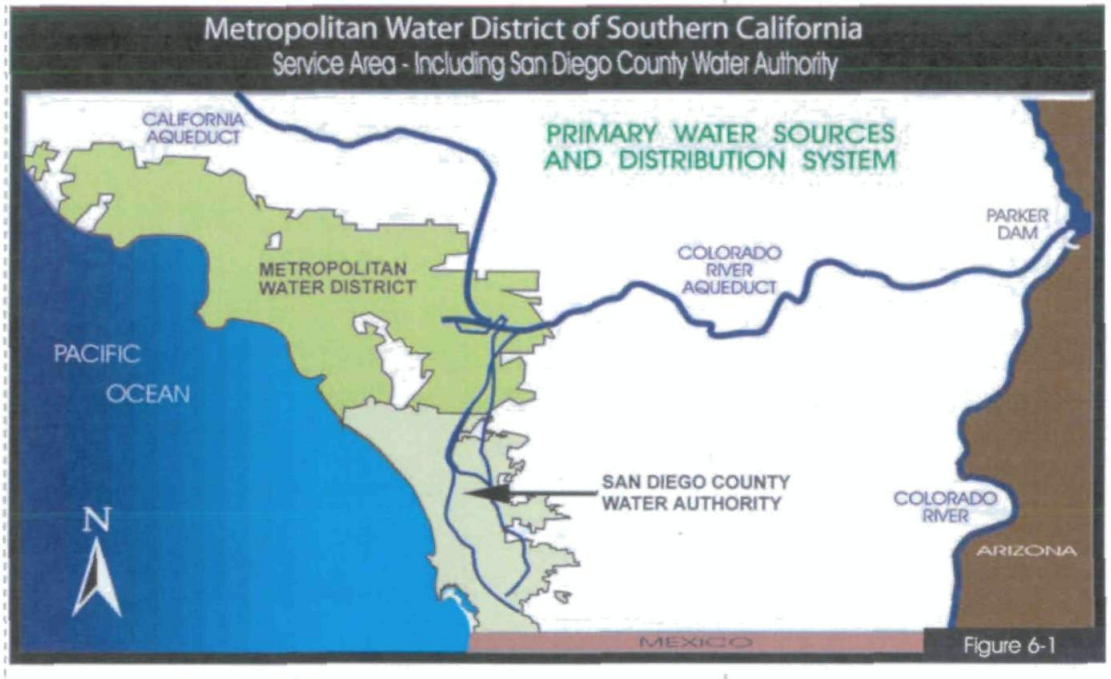


Figure 6-1

The Water Authority, one of 27 Metropolitan member agencies, is the largest agency in terms of deliveries, purchasing 518,625 AF, about 25 percent of all the water Metropolitan delivered in FY 05. The extent to which Metropolitan's member agencies rely upon Metropolitan supplies varies by the amount of local supplies available.

### 6.1.1 METROPOLITAN ACT SECTION 135; PREFERENTIAL RIGHT TO WATER

Under Section 135 of the Metropolitan Act, preferential rights are determined by each agency's total historic payments to Metropolitan from property taxes, stand-by charges, readiness-to-serve charges, and other revenue. Revenue resulting from the purchase of Metropolitan water is excluded, even though a portion of such revenues is used to pay for capital projects. While the Water Authority had a preferential right to 15.8 percent of Metropolitan's water in FY 04, it purchased about 25 percent of Metropolitan's available supply. At any time under preferential rights rules, Metropolitan may allocate water without regard to historic water use or dependence on Metropolitan. **Figure 6-2** shows the Water Authority's projected preferential rights for the years 2005 through 2030.

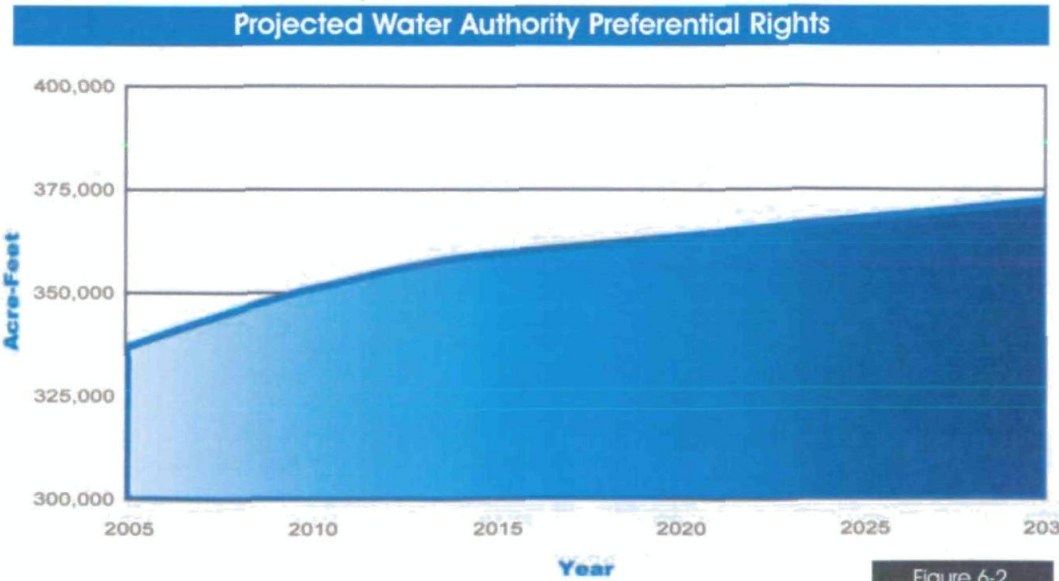


Figure 6-2

To seek clarification regarding the current application and legality of Section 135, the Water Authority Board of Directors voted in April 2004 to appeal an appellate court ruling that preserves Metropolitan's preferential right process. In July 2004, the State Supreme Court denied the Water Authority's appeal of an appellate court decision that Metropolitan might continue to exclude water purchases from the preferential rights calculation. The decision makes clear how much water the Water Authority may count on from Metropolitan should a member agency invoke its preferential right.

Metropolitan stated, consistent with Section 4202 of its Administrative Code, that it is prepared to provide the Water Authority's service area with adequate supplies of water to meet expanding and increasing needs in the years ahead. When, and as additional water resources are required to meet increasing needs, Metropolitan stated that it will be prepared to deliver such supplies. In their 2005 Regional Urban Water Management Plan (RUWMP), Section II.2, Metropolitan presents its supply availability at the regional level, rather than at the member agency level. With that, the Water Authority is not able to quantify the availability of imported supplies from Metropolitan specifically for the Water Authority. However, in its plan (Section II.2, *Evaluating Supply Reliability*), Metropolitan stated that it can maintain 100% reliability in meeting direct consumptive demand under the conditions that represent normal, single-dry, and multiple-dry years through 2030.

Inferring from the supply reliability finding stated by Metropolitan, the Water Authority concludes that Metropolitan is capable of supplying imported water to meet projected demands by the Water Authority under various hydrologic conditions if the supply targets identified in their 2005 RUWMP are met. Implementation risks exist in local supply development and imported supply projects and programs. The Water Authority is working with its counterparts at Metropolitan to help ensure that Metropolitan's planning is realized, and that the necessary programs and projects are implemented.

### 6.1.2 METROPOLITAN'S INTEGRATED RESOURCES PLAN

The Integrated Resources Plan (IRP) identifies a mix of resources (imported and local) that when implemented will provide 100 percent reliability for full-service demands through the attainment of regional targets set for conservation, local supplies, SWP supplies, Colorado River supplies, groundwater banking, and water transfers. The 2004 update to the IRP now includes a planning buffer supply to mitigate against the risks associated with implementation of local and imported supply programs. The planning buffer identifies an additional increment of water that could potentially be developed if other supplies are not implemented as planned. As part of implementation of the planning buffer, Metropolitan periodically evaluates supply development to ensure that the region is not over-developing supplies. If managed properly, the planning buffer will help ensure that the Southern California region, including San Diego County, will have adequate supplies to meet future demands. Specific information on Metropolitan's IRP and Water Surplus and Drought Management Plan (WSDM Plan) are contained in their 2005 RUWMP.

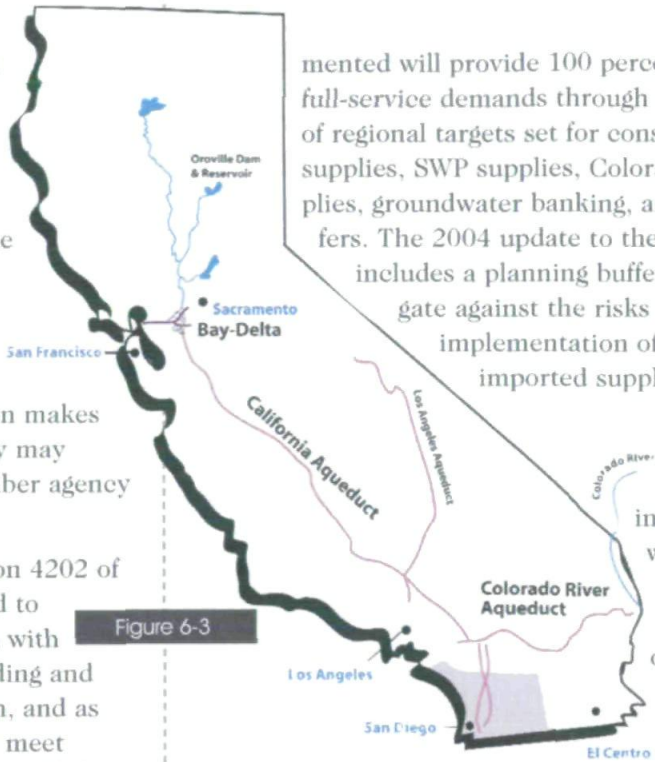



Figure 6-3

## SECTION 6.2 METROPOLITAN'S WATER SUPPLIES

Metropolitan obtains its water from two sources: the CRA, which it owns and operates, and the SWP. **Figure 6-3** shows these imported water supply sources, and they are described below. Detailed documentation on Metropolitan's supplies can be found in its 2005 RUWMP.

### 6.2.1 COLORADO RIVER

Metropolitan was formed to import water from the Colorado River. During the 1930s, Metropolitan built the CRA to convey this water. Metropolitan's member agencies received the first deliveries in 1941. The aqueduct is more than 240 miles long, beginning at Lake Havasu on the Arizona/California border and ending at Lake Mathews in Riverside County. The aqueduct has capacity to deliver up to 1.3 million acre-feet per year (MAF/YR). **Figure 6-3** shows the location of the aqueduct.

## RELIABILITY ISSUES

Before 1964, Metropolitan had a firm annual allocation of 1.212 million acre-feet (MAF) of Colorado River water through contracts with the U.S. Department of the Interior, which was enough to keep Metropolitan's aqueduct full. However, as a result of the U.S. Supreme Court decision in Arizona vs. California, Metropolitan's firm supply fell to 550,000 AF. Due to growth in demand from the other states and drought conditions, since 2003, Metropolitan's deliveries have been limited to their base apportionment plus water from a conservation program with IID.

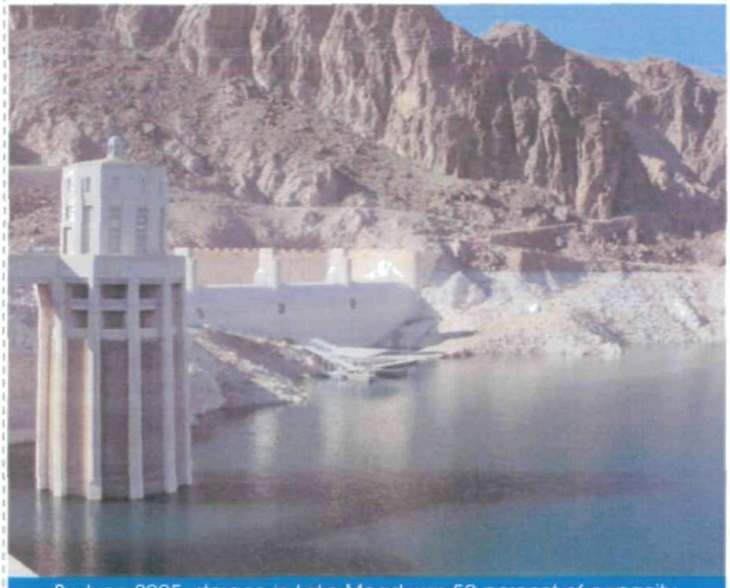
Water availability from the Colorado River is governed by a system of priorities and water rights that has been established over many years. The Colorado River Lower Basin states (California, Arizona, and Nevada) have an annual apportionment of 7.5 MAF of water divided as follows: (1) California, 4.4 MAF; (2) Arizona, 2.8 MAF; and (3) Nevada, 300,000 AF. The 1931 Seven Party Agreement established California's priorities for water. As shown in **Table 6-1**, Metropolitan's 4th priority of 550,000 AF is junior to that of the first three priorities, 3.85 MAF to California agricultural agencies. Water used to satisfy priorities 5(a)-6(b) must come from unused allocations within California, Arizona, or Nevada, or from surplus.

Table 6-1: Seven Party Agreement Priorities

| PRIORITY | DESCRIPTION | ACRE-FEET/YEAR |
|---|---|---|
| 1 | Palo Verde Irrigation District | Priorities 1, 2, and 3 shall not exceed 3,850,000 |
| 2 | Yuma Project Reservation Division | Same as above |
| 3(a) | Imperial Irrigation District and lands in Imperial and Coachella valleys to be served by All-American Canal | Same as above |
| 3(b) | Palo Verde Irrigation District | Same as above |
| 4 | Metropolitan Water District | 550,000 |
| 5(a) | Metropolitan Water District | 550,000 |
| 5(b) | City/County of San Diego[1] | 112,000 |
| 6(a) | Imperial Irrigation District | |
| 6(b) | Palo Verde Irrigation District | 300,000 |
| | TOTAL | 5,362,000 |

1 In 1946, San Diego's rights were merged with and added to the rights of Metropolitan as one condition of the Water Authority's annexation to Metropolitan.

In recent years, Arizona and Nevada have increased water demand to near-apportionment levels, limiting the availability of unused apportionments to Metropolitan. Arizona's demand has been substantially increased by deliveries to an in-state groundwater banking program. Nevada began banking water under an interstate water banking rule established by the Department of Interior in 1999, which allows Nevada to bank water in Arizona for Nevada's future use.



By June 2005, storage in Lake Mead was 59 percent of capacity.

Five consecutive years of drought conditions throughout the Colorado River Basin were somewhat relieved during the winter of 2004-05, and water storage levels in the main reservoirs rebounded from a rapid and steep decline. Inflow into Lake Powell was above average for water year 2005 and for the first time since 1999, the water surface elevation in Lake Powell increased. As of the end of June 2005, storage in Lake Powell was 51 percent of capacity; storage in Lake Mead was 59 percent of capacity. The draft U.S. Bureau of Reclamation Annual Operating Plan for Colorado River System Reservoirs anticipates a "partial domestic surplus" condition for calendar year 2006, which provides limited surplus water for Metropolitan. However, since the Interim Surplus Guidelines were implemented in 2001, Metropolitan has not taken any surplus water, and instead has left those supplies as system storage in Lake Mead. It is not yet clear whether Metropolitan will take any available surplus water in calendar year 2006.

### ENVIRONMENTAL CONSIDERATIONS

In 1994, the U.S. Fish and Wildlife Service (USFWS) designated 1,980 miles of the Colorado River and its tributaries in Colorado, Utah, New Mexico, Arizona, California, and Nevada as critical habitat for four endangered species of native fish. In response to the 1994 designation, the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) was formed. The program is a partnership of federal agencies; state and local agencies in Arizona, California, and Nevada, including the Water Authority; Native American tribes; and other non-federal participants. The partnership is responding to the need to balance the legal use of lower Colorado River water resources and the conservation of threatened and endangered species and their habitats in compliance with the federal Endangered Species Act (ESA). Taking over ten years to develop, the LCR MSCP was approved in April 2005. The program is designed to benefit at least 26 species and restore a range of habitats along the lower Colorado River, including 8,132 acres of riparian, marsh, and backwater habitat. The $626 million program will be cooperatively funded and implemented by the partnership over the next 50 years. By meeting the needs of fish and wildlife under the ESA and preventing the listing of additional species, the program provides greater certainty of continued water and power supplies from the river for Nevada, California, and Arizona.



The "endangered" Humpback chub

### CURRENT SUPPLIES

Metropolitan currently has a firm supply from two sources: its fourth priority of 550,000 AF/YR, and the yield of a conservation program that Metropolitan completed with IID in 1988. This program currently yields about 106,000 AF/YR, giving Metropolitan a total supply of approximately 656,000 AF/YR. Under certain conditions, however, Metropolitan must provide 50,000 AF/YR of the conservation program water to the Coachella Valley Water District (CVWD). Thus, Metropolitan's firm supply is now about 606,000 AF/YR. The remaining 600,000 AF/YR of water needed to fill the CRA must come from the unused apportionments of other states or from surplus water.

### QUANTIFICATION SETTLEMENT AGREEMENT AND FUTURE SUPPLIES

The Water Authority, together with CVWD, IID, and Metropolitan, entered into the QSA in October 2003. The QSA resolved longstanding disputes regarding Colorado River water use among the agencies, and established a water budget for the agricultural agencies. This permitted the implementation of several water conservation and transfer agreements, including the Water Authority's transfer agreement with IID.

Transfers from IID began in late-2003 with the signing of the QSA. The Water Authority will receive up to 200,000 AF of water per year after an initial 19-year ramp-up in the water deliveries. Other supplies include about 77,700 AF/YR from conservation projects to line the AAC and CC, located in Imperial and Coachella valleys.


The SWP's Banks Pumping Plant lifts water to the California Aqueduct.

## 6.2.2 STATE WATER PROJECT

Metropolitan's other water source, the SWP, is owned by the State of California and operated by the DWR. The project stretches more than 600 miles, from Lake Oroville in the north to Lake Perris in the south. Water is stored at Lake Oroville and released when needed into the Feather River, which flows into the Sacramento River and to the Sacramento-San Joaquin River Delta (Delta). In the north Delta, water is pumped into the North Bay Aqueduct for delivery to

Napa and Solano counties. In the south Delta, water is diverted into the SWP's Banks Pumping Plant, where it is lifted into the 444 mile-long California Aqueduct. Some of this water flows into the South Bay Aqueduct to serve areas in Alameda and Santa Clara counties. The remainder flows southward to cities and farms in central and southern California. In the winter, when demands are lower, water is stored at the San Luis Reservoir located south of the Delta. SWP facilities provide drinking water to 23 million Californians and 755,000 acres of irrigated farmland. **Figure 6-3** *(on page 6-2)* shows the California Aqueduct.



A big portion of the county's imported water moves through the Delta.

### RELIABILITY ISSUES

The reliability of SWP supplies is limited by both the level of SWP supply development and pumping restrictions due to state and federal environmental regulations. Actions taken by the CALFED Bay-Delta Program have improved the situation. *(See below for more on the impact of CALFED on SWP supplies.)*

When approved by the voters in the 1960s, the SWP was planned to deliver 4.2 MAF to 32 contracting agencies. Subsequent contract amendments reduced total contracted deliveries to 4.13 MAF and the number of contracting agencies to 29. Metropolitan's contracted entitlement is 2,011,500 AF/YR, or almost 49 percent of the annual total. It is important to note that when voters approved construction of the SWP in 1960, state planners did not expect the full amount of contracted water to be needed for at least the first 20 years of the project. As such, the planners anticipated that the facilities needed to produce the full contracted amount would be constructed over time as demands on the system increased. However, decisions about these additional facilities were repeatedly deferred as public attitudes and environmental regulations changed and costs increased. New state and federal environmental laws put some potential water supply sources off limits to development. More stringent water quality standards adopted by the SWRCB to protect the San Francisco Bay/Sacramento-San Joaquin River Delta (Bay-Delta) have also reduced the amount of water available for diversion. At the same time, California's population and water demand continued to grow.

By the late 1980s, the SWP could not meet contractor demands during drought periods. During the initial years of the 1987 – 1992 drought, DWR maintained SWP deliveries using water stored at Lake Oroville and the San Luis Reservoir. In 1991, however, the SWP delivered only 549,113 AF of entitlement water. Of this amount, Metropolitan received 381,070 AF, or about 20 percent of its annual entitlement.

DWR's *Draft 2005 State Water Project Delivery Reliability Report* projected average SWP deliveries to increase slightly, and multiple dry-year deliveries to remain generally unchanged. Minimum SWP deliveries may be as low as 4% to 5% of the full Table A basic contract amount in the single driest year (1977 hydrology). However, DWR has suggested that adjustments would be made to reflect more realistic operations where carryover storage and other provisions would enhance SWP dry-year deliveries to a level that is comparable in quantity to the previous reliability report from DWR.

### ENVIRONMENTAL CONSIDERATIONS

In recent years, actions taken to protect the ecosystem of the Bay-Delta have placed additional restrictions on SWP operations. The Bay-Delta is the largest estuary on the west coast and supports more than 750 plant and animal species. However, 150 years of human activity, dating back to 19th century gold mining, has taken its toll on the Bay-Delta ecosystem and the fish that live there. Between 1989 and 1999, the winter-run Chinook salmon was designated, or "listed," as an endangered species




The "threatened" Chinook salmon

under the federal ESA and the Delta smelt, steelhead trout, and spring-run Chinook salmon were placed on the list of threatened species.

The degradation of the Bay-Delta ecosystem and the decline of Delta fisheries can be traced to numerous factors, including habitat loss, water diversions, pollution, over-fishing, and the introduction of non-native species. Regulatory protection efforts have nevertheless tended to focus on the operations of the SWP and the federal Central Valley Project (CVP).

For example, in 1999, the SWP was forced to reduce pumping by about 500,000 AF to protect Delta smelt and spring-run Chinook salmon. These pumping reductions were in addition to fish protection measures built into the water quality standards established by the SWRCB. Actions taken by CALFED have stabilized this situation over the past four years, but this situation is temporary unless further actions are taken to extend it over the longer-term.



Protecting habitats is part of the Bay-Delta Plan.

### WATER QUALITY CONSIDERATIONS

Please see **Section 7** for water quality information.

### CURRENT SUPPLIES

SWP delivery contracts were amended in 1995 to reflect principles developed under the December 1994 Monterey Agreement. Under the Monterey amendments, all SWP supplies are allocated to contractors in proportion to their contractual entitlements. Metropolitan's approximately 49 percent share of total SWP contract entitlements, entitles it to a proportionate share of SWP supplies. According to Metropolitan's RUWMP, Metropolitan received an average of 1.04 million AF/YR from the SWP from 1995-2004. From 2000-2004, the annual average was 1.46 MAF.

DWR's implementation of the Monterey Agreement was successfully challenged in court by the Planning and Conservation League and others. On September 15, 2000, the Third District Court of Appeal reversed a trial court ruling for DWR and ordered a new environmental impact report (EIR) and a trial on the validity of the agreement. DWR is conducting the new environmental review, which is due for completion in 2005.



A CALFED Bay-Delta Program goal is levee system integrity.

### FUTURE SUPPLIES AND THE CALFED BAY-DELTA PROGRAM

Metropolitan's Integrated Water Resources Plan Update (IRP Update), adopted by the Metropolitan Board of Directors in July 2004, indicates that Metropolitan's SWP target for a dry year (based on 1977 hydrology) is 463,000 AF in 2010, and 650,000 AF in 2020. The IRP Update also estimates that in the 2020-2025 period, Metropolitan's annual supply range from the SWP will be between 418,000 AF and 1.74 MAF. This figure does not include another 75,000 to 200,000 AF estimated from San Luis Reservoir carryover storage, 200,000 AF from planned CALFED projects, and 45,000 AF from the Sacramento Valley Water Management Agreement (the latter two programs are still in development and subject to change). The 2005 RUWMP estimates that the SWP will be capable of serving 1.5 MAF to Metropolitan through 2030 in an average year.

Work being done by the CALFED Bay-Delta Program, which is administered by the California Bay-Delta Authority, is expected to provide the greatest opportunity for SWP supply reliability and water quality improvements. However, the outcome of this process remains uncertain. The state and federal governments organized the CALFED Program in 1995 to develop and implement a balanced, comprehensive, and long-term plan to restore the Bay-Delta's ecological health and improve water management for beneficial uses of the estuary. CALFED is working in four inter-related, over-arching categories: ecosystem restoration, levee stability, water

quality improvement, and water supply reliability. The CALFED Program made the transition from planning to implementation in 2000 with the release of the Record Of Decision, final programmatic environmental EIS/EIR and *California's Water Future: A Framework for Action*.

The elements of the CALFED Program that have the greatest potential for increasing the reliability and quality of SWP supplies are included in the Delta Improvements Package (DIP), approved by the California Bay-Delta Authority in 2004 as the first major action by CALFED to implement its long-term Bay-Delta plan. Among the activities in the DIP, the most important are improvements to the existing Delta conveyance system, including expansion of the permitted capacity of the SWP pumping plant from its current level of 6,680 cfs to 8,500 cfs (and ultimately to 10,300 cfs subject to certain conditions). The conveyance system improvements would improve the reliability and quality of SWP supplies by allowing the SWP to increase pumping during those times of the year when additional water is available and when water quality is highest, and they would reduce pumping when endangered fish are migrating through the Delta. The improvements will also increase the amount of pumping capacity available for other purposes, such as water transfers.



CALFED has a long-term Bay-Delta plan.

The ability of CALFED to work with its member agencies to implement the DIP and other projects was called into question by a state appellate court decision issued on October 7, 2005, concerning CALFED's programmatic environmental impact report (PEIR), which served as the foundation of the Bay-Delta Program record of decision. While the court upheld the PEIR on a number of issues in the case, it concluded that the PEIR should have analyzed an alternative that reduced water exports from the Delta. The court also found that the PEIR inadequately discussed the environmental impacts of diverting water to meet CALFED's goals and did not include sufficient information about the Environmental Water Account. The state attorney general has asked the court for a rehearing of its ruling. If the decision stands, CALFED will have to draft a supplement to its PEIR that considers the "reduced exports" alternative, at the very least. It is currently unclear how much the ruling may affect programs and projects involving the Bay-Delta that are being undertaken by CALFED member agencies.

Another essential element of the CALFED Program is the Environmental Water Account (EWA), a pilot program that provides water at critical times for meeting ecosystem needs while minimizing water supply impacts on water-users. In addition, new surface and groundwater storage could also enhance the reliability and quality of SWP supplies. The CALFED framework calls for the construction of up to 4.75 MAF of new surface and groundwater storage over the life of the CALFED Program; however, it is not known whether any of the new storage would be constructed as part of the SWP.

The amount of water produced through the proposed conveyance improvements will depend on how the individual facilities are operated and on the level of assurances provided by the state and federal regulatory agencies. The EWA provides the SWP and CVP with regulatory assurances intended to ensure that the projects will not face additional water supply impacts due to regulatory actions taken under the federal ESA or other federal or state laws or regulations. However, while the EWA has been extended as a pilot program through 2007, it has not yet been made permanent. If CALFED succeeds in its mission of restoring stability to the Bay-Delta system, and the EWA, and the regulatory assurances, are extended beyond the initial four-year period, then the improvements described in the DIP have the potential to increase Metropolitan's share of average SWP supplies by between 93,000 and 168,000 AF/YR. If CALFED is not successful, and the Bay-Delta system continues to decline, Metropolitan's SWP supplies could even decrease in size and quality relative to existing levels.

# SECTION 7 WATER QUALITY

The Act requires that the Updated 2005 Plan include information, to the extent practicable, on the quality of existing supply sources and the manner in which water quality affects water supply reliability. This section summarizes water quality issues associated with supplies serving the San Diego region. Information on Colorado River and SWP supplies came in part from Metropolitan's 2005 RUWMP.



The Colorado River

## SECTION 7.1 COLORADO RIVER

High salinity levels and perchlorate contamination represent two areas of concern regarding the quality of Colorado River supplies. In Moab, Utah, a pile of radioactive waste near the Colorado River is also considered to be a potential threat to the Colorado River's water quality. Research on the potential impact to water quality is inconclusive, but removal of the radioactive waste is being investigated.

### SALINITY

The salts in the Colorado River System are indigenous and pervasive, mostly resulting from saline sediments in the basin that were deposited in prehistoric marine environments. They are easily eroded, dissolved, and transported into the river system. Agricultural development and water diversions over the past 50 years increase the already high naturally occurring levels of TDS.

Water imported via the CRA has a TDS averaging around 650 mg/l during normal water years. During the high water flows of 1983-1986, salinity levels in the CRA dropped to a historic low of 525 milligrams per liter (mg/l). However, during the 1987-1990 drought, higher salinity levels returned. During an extreme drought, CRA supplies could exceed 900 mg/l. High TDS in water supplies leads to high TDS in wastewater, which lowers the usefulness of the water and increases the cost of recycled water. (Refer to **Section 7.5** for details on salinity impacts to water recycling.) In addition to the link between water supply and water quality, high levels of TDS in water supplies can damage water delivery systems and home appliances.

To reduce the effects of high TDS levels on water supply reliability, Metropolitan approved a Salinity Management Policy in April 1999. One of the policy goals is to blend Colorado River supplies with lower-salinity water from the SWP to achieve delivered water salinity levels less than 500 mg/l TDS. In addition, to foster interstate cooperation on this issue, the seven basin states formed the Colorado River Basin Salinity Control Forum (Forum). To lower TDS levels in Colorado River supplies, the Forum develops programs designed to prevent a portion of the abundant salt supply from moving into the river system. The Colorado River Basin Salinity Control Program targets the interception and control of non-point sources, such as surface runoff, as well as wastewater and saline hot springs.

### PERCHLORATE

Ammonium perchlorate is used as the main component in solid rocket propellant, and it can also be found in some types of munitions and fireworks. Ammonium perchlorate and other perchlorate salts are readily soluble in water, dissociating into the perchlorate ion, which does not readily interact with the soil matrix or degrade in the environment. The primary human health concern related to perchlorate is its effects on the thyroid. Perchlorate has been detected at low levels in Metropolitan's CRA water supply.

Because of the growing concerns over perchlorate levels in drinking water, in 2002 Metropolitan adopted a Perchlorate Action Plan. Objectives include expanded monitoring and reporting programs and continued tracking of remediation efforts in the Las Vegas Wash. Metropolitan has been conducting monthly monitoring of Colorado River supplies. The perchlorate originates in the Las Vegas Wash, and the most likely source was a chemical manufacturing site located in Henderson, Nevada. The Nevada Department of Environmental Protection manages a comprehensive groundwater remediation program in

the Henderson area. As of December 2004, the amount of perchlorate entering the Colorado River system from Henderson has been reduced from approximately 900 pounds per day (lb/day) to less than 150 lb/day.

## SECTION 7.2 STATE WATER PROJECT


The Delta

The quality of SWP water as a drinking water source is affected by a number of factors, most notably seawater intrusion and agricultural drainage from peat soil islands in the Delta. SWP water contains relatively high levels of bromide and total organic carbon, two elements that are of particular concern to drinking water agencies. Bromide and total organic carbon combine with chemicals used in the water treatment process to form disinfection by-products that are strictly regulated under the federal Safe Drinking Water Act (SDWA). Wastewater discharges from cities and towns surrounding the Delta also add salts and pathogens to Delta water, and they reduce its suitability for drinking and recycling.

### MEETING WATER STANDARDS

Water agencies treat all water to meet stringent state and federal drinking water standards before delivering it to customers. However, source water of poor quality will make it increasingly expensive and difficult to meet such standards. The California Urban Water Agencies (CUWA) retained the assistance of a panel of drinking water quality and treatment experts to evaluate the source water quality necessary to allow agencies treating Delta water to comply with future drinking water regulations under a plausibly conservative regulatory scenario. The expert panel identified target bromide and total organic carbon concentrations of 50 parts per billion (ppb) and 3 parts per million (ppm), respectively. These targets were written into the Record Of Decision (ROD) adopted by CALFED in 2000.

The ROD states that CALFED will either achieve these targets at Clifton Court Forebay and drinking water intakes in the south and central Delta, or it will achieve an "equivalent level of public health protection using a cost-effective combination of alternative source waters, source control, and treatment technologies." CALFED did not establish a similar target for the salinity of Delta water, a particular concern in Southern California, because of the high salinity levels in Colorado River water, but the 2004 CALFED Drinking Water Quality Program Plan lists two "numeric targets," less than 220 ppm over a 10-year average and less than 440 ppm as a monthly average.

Actions to protect Delta fisheries have exacerbated existing water quality problems by forcing the SWP to shift its diversions from the springtime to the fall, when salinity and bromide levels are higher. Closure of the Delta Cross-Channel gates to protect migrating fish has also degraded SWP water quality by reducing the flow of higher quality Sacramento River water to the SWP pumps at critical times.


The State Water Project

Water supplies from the SWP have significantly lower TDS levels than the Colorado River, averaging 250 mg/l in water supplied through the East Branch and 325 mg/l on the West Branch. Because of this lower salinity, Metropolitan blends SWP water with high salinity CRA water to reduce the salinity levels of delivered water. However, both the supply and the TDS levels of SWP water can vary significantly in response to hydrologic conditions in the Sacramento-San Joaquin watersheds.

The TDS levels of SWP water can also vary widely over short periods of time. These variations reflect seasonal and tidal flow patterns, and they pose an

additional problem to blending as a management tool to lower the higher TDS from the CRA supply. For example, in the 1977 drought, the salinity of SWP water reaching Metropolitan increased to 430 mg/l, and supplies became limited. During this same event, salinity at the Banks pumping plant exceeded 700 mg/l. Under similar circumstances, Metropolitan's 500 mg/l salinity objectives could only be achieved by reducing imported water from the CRA. Thus, it may not be possible to maintain both salinity standards and water supply reliability unless salinity levels of source supplies can be reduced.

The CALFED Bay-Delta Program's EIS/EIR, Technical Appendix, July 2000 Water Quality Program Plan identified targets that are consistent with TDS objectives in Article 19 of the SWP Water Service Contract: a ten-year average of 220 mg/l and a maximum monthly average of 440 mg/l. These objectives were set in the 1960s when Metropolitan expected to obtain a greater proportion of its total supplies from the SWP. Because of reductions in expected SWP deliveries, Metropolitan's Board believes that this standard is no longer appropriate, so it has adopted a statement of needs from the Bay-Delta. Under the drinking water quality and salinity targets element, the Board states its need "to meet Metropolitan's 500 mg/l salinity-by-blending objective in a cost-effective manner while minimizing resource losses and ensuring the viability of recycling and groundwater management programs."



## SECTION 7.3 SURFACE WATER

The region's water quality is influenced by a variety of factors depending on its source. As stated above, water from the Colorado River and from Northern California are vulnerable to a number of contributors to water quality degradation. Regional surface and groundwater are primarily vulnerable to increasing urbanization in the watershed, agriculture, recreational uses, wildlife, and fires.

Source water protection is fundamentally important to all of California. The DHS requires large utilities delivering surface water to complete a Watershed Sanitary Survey every five years to examine possible sources of drinking water contamination. The survey includes suggestions for how to protect water quality at the source.

A similar requirement from the United States Environmental Protection Agency (EPA) calls for utilities to complete a Source Water Assessment (SWA). Information collected in SWAs is used to evaluate changes in potential sources of contamination and to help determine if more protection measures are needed. The EPA requires utilities to complete a SWA that uses information collected in the sanitary surveys. The SWA is also used to evaluate the vulnerability of water sources to contamination and also helps determine whether more protective measures are needed.

The monitoring of key constituents in source waters is critical in helping to identify constituents that should be controlled at the source and to determine the best ways to operate the water system so as to improve the quality of water delivered to the consumer. The effect of urban runoff on receiving water quality is a recently recognized problem. Most of the work up to the present has centered on characterizing urban runoff: measuring concentrations of various constituents, attempting to relate these concentrations to such factors as land use type and rainfall intensity, and studying the effects of these constituents on street surfaces.

It appears that considerable quantities of contaminants, heavy metals in particular, may enter the receiving waters through urban runoff. The federal Water Pollution Control Act Amendments of 1972 stress future "control of treatment of all-point and non-point sources of pollution." Thus, the federal government has concluded that non-point sources, such as urban runoff, are indeed harmful to the aquatic environment and that measures should be taken to control such emissions.

**There are four basic approaches to controlling pollution from urban runoff:**

- Prevent contaminants from reaching urban land surfaces;
- Improve street cleaning and cleaning of other areas where contaminants may be present;
- Treat runoff prior to discharge to receiving waters; and
- Control land use and development.

Which approach or combination of approaches is most effective or economical has not yet been studied extensively. Thus, only the basic characteristics of each approach can be discussed. In addition to these direct approaches, measures to reduce the volume of runoff from urban areas are also available.

The fourth approach, control land use and development, is to encourage controls on urbanization in order to reduce the volume of runoff. The usual pattern is that increased urbanization leads to higher runoff coefficients, reflecting the many impervious surfaces associated with development. Roof drains to storm sewers, paved parking lots and streets, installation of storm sewers, filling of natural recharge areas, and increased efficiency in realigned and resurfaced stream channels all are characteristics of urban growth.



Urban growth impacts surface water.

Development near streams and on steep slopes harms water resources. It is less disruptive to develop the lower portions of a watershed than the headwater areas, both from the standpoint of the length of channel affected and the extent of channel enlargement necessary to convey storm water. Use of porous pavements and less reliance on roof connections to storm drains and more emphasis on local recharge would reduce the peak volume of runoff from storms. An area's mass emissions of urban drainage constituents should be quantified. Urban planning should be more cognizant of land constraints to permit greater natural recharge where possible and feasible, and to discourage intensive development of steep land, particularly in headwater areas.

To address the issues associated with surface water quality, the Water Authority, the City of San Diego, and the County of San Diego formed a Regional Water Management Group to coordinate development of an Integrated Regional Water Management Plan (IRWMP) for the San Diego region. An important element in the IRWMP is to protect and enhance the region's local surface water quality. As part of this process, projects will be identified and implemented to assist in watershed protection, and thereby protect the quality of surface water supplies.

### Integrated Regional Water Management Plan




In the past, regional surface water quality has been considered good to excellent. Water quality can vary with imported water inflows and surface water contamination. Source water protection is considered a key element in regional water quality. The Water Authority and its member agencies are working together to improve watershed awareness and management. Currently, the most significant water quality issue that affects the public is algae blooms, which can create taste and odor problems.

In San Diego County, DHS has primacy over the implementation of the SDWA. The SDWA regulates source water protection to ensure public health through the multiple barrier approach, an approach that anticipates that the public will participate in source water protection. Member agencies in the Water Authority's service area that have surface water have a good, long-standing, working relationship with DHS.

## SECTION 7.4 GROUNDWATER

Two water quality parameters that can affect reliability of groundwater resources in San Diego County are contamination from Methyl Tertiary Butyl Ether (MTBE) and high salinity levels.

### SALINITY

Increased TDS in groundwater basins occurs either when basins near the ocean are over drafted, leading to seawater intrusion, or when agricultural and urban


Groundwater demineralization facility

return flows add salts to the basins. Much of the water used for agricultural or urban irrigation infiltrates into the aquifer, so where high TDS irrigation water is used or where the water transports salts from overlying soil, the infiltrating water will increase the salinity of the aquifer. Using this resource requires costly demineralization projects. (Refer to **Section 5.2.1** for discussion on groundwater recovery projects.)

To protect the quality of these basins, the Regional Board often places restrictions on the salinity levels of water used for basin recharge or for irrigation of lands overlying the aquifers. Where these restrictions are in place, water reuse and aquifer recharge may be restricted, or expensive mitigation measures may be required.

### METHYL TERTIARY BUTYL ETHER

Until recently, MTBE was the primary oxygenate in virtually all the gasoline used in California. In January 2004, the Governor's executive order to remove MTBE from gasoline became effective, and now ethanol is the primary oxygenate. MTBE is very soluble in water and has low affinity for soil particles, thus allowing the chemical to move quickly in the groundwater. MTBE is also resistant to chemical and microbial degradation in water, making treatment more difficult than the treatment of other gasoline components.

MTBE presents a significant problem to local groundwater basins. Leaking underground storage tanks and poor fuel-handling practices at local gas stations may provide a large source of MTBE. Improved underground storage tank requirements and monitoring, and the phase-out of MTBE as a fuel additive, will probably decrease the likelihood of MTBE groundwater problems in the future.

## SECTION 7.5 RECYCLED WATER

Water quality, as it pertains to high salinity supplies, is a significant implementation issue for recycled water projects. High TDS source water poses a special problem for water recycling facilities because conventional treatment processes are designed to remove suspended particles, but not dissolved particles. TDS removal, or demineralization, requires an advanced treatment process, which can increase project costs significantly.

Residential use of water typically adds 200 to 300 mg/l of TDS to the wastewater stream. Self-regenerating water softeners can add another 60 to 100 mg/l. Infiltration of brackish groundwater into sewer lines can also cause an increase in TDS. If an area receives a water supply with TDS of more than 700 mg/l, and residents add 300 mg/l or more through normal use, the recycling facility will produce recycled water with a TDS concentration of 1,000 mg/l or higher.

**Figure 7-1** shows the average TDS at several of the existing and projected water recycling treatment plants. In general, TDS concentrations over 1,000

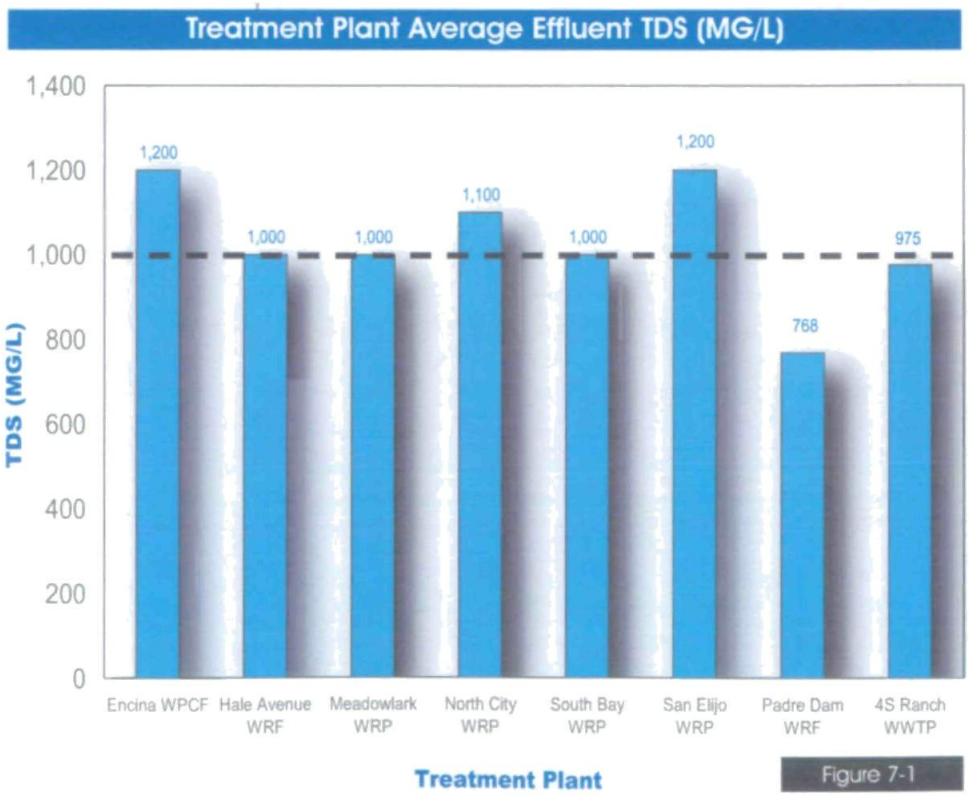
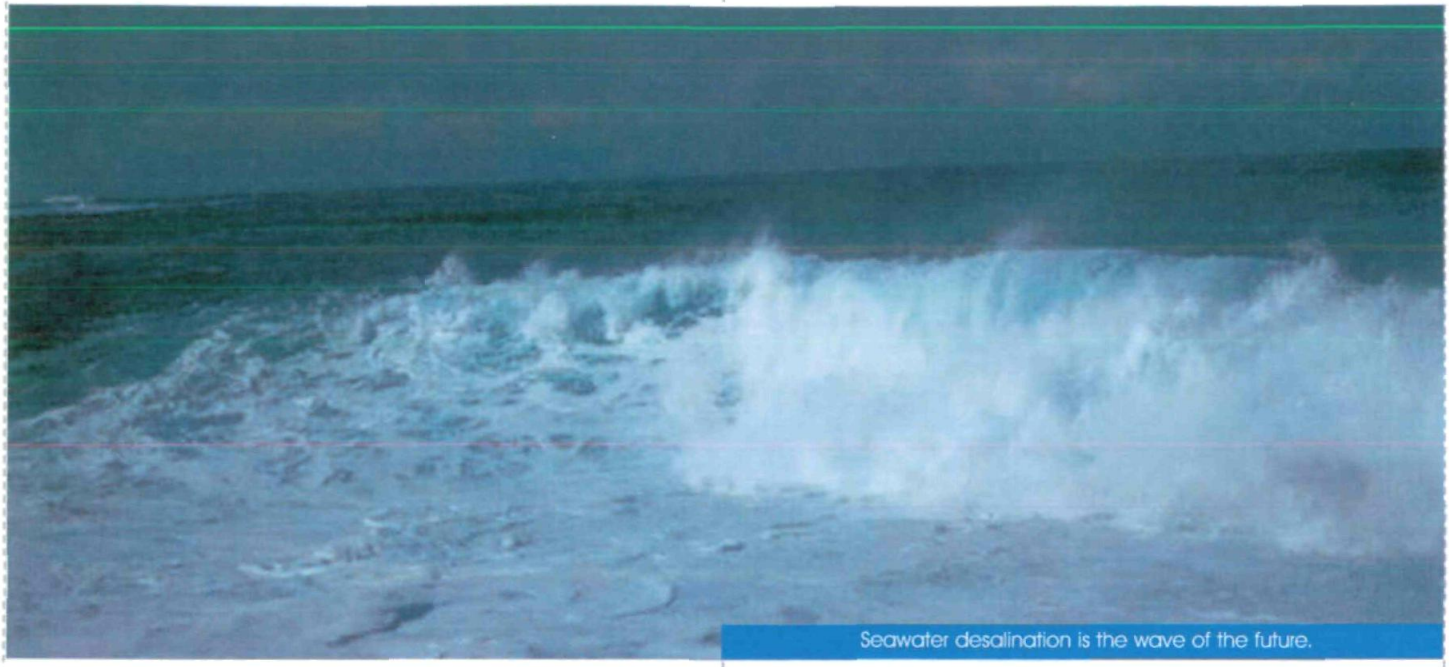


Figure 7-1



Seawater desalination is the wave of the future.

mg/l become problematic for irrigation and industrial reuse customers. This problem greatly limits the potential uses and marketability of recycled water, particularly for agricultural purposes, because certain crops and nursery stock cannot be irrigated with high-TDS water.

## SECTION 7.6 SEAWATER DESALINATION

The feedwater source for the proposed regional seawater desalination project at the Encina Power Station in Carlsbad is the Pacific Ocean. The salinity of the Pacific Ocean in San Diego County is fairly stable, with a TDS concentration around 34,000 mg/l. To address TDS concentrations at this level, the desalination facility will use a RO membrane treatment process to reduce the TDS to less than 350 mg/l, resulting in approximately 99 percent removal of TDS and a supply that meets drinking water standards.

Prior to the RO process, the feedwater will be pretreated to remove suspended solids, including organic material. The RO process will then remove the dissolved solids. Next, the product water will be post-treated to prevent corrosion in the distribution system and improve the aesthetic quality of the water. This process generally involves adding alkalinity to the treated water. The final step, a disinfection process, provides a disinfection residual in the treated water.

A single-pass RO process of seawater generally results in about 50 percent recovery of treated water. The remaining 50 percent is discharged as concentrate, with about twice the salinity of the original feedwater. The concentrate will be diluted to avoid negative impacts to the marine environment from the elevated salinity levels at the point of discharge.

# SECTION 8 WATER SUPPLY RELIABILITY

As stated in the Act, every urban water supplier shall include, as part of its plan, an assessment of the reliability of its water supply. The water supply and demand assessment must compare the total projected water use with the expected water supply over the next 20 years in 5-year increments. This reliability assessment is required for normal, single dry-year, and multiple dry water years. The assessment contained in the Updated 2005 Plan projects reliability through the next 25 years to correspond with the growth forecast developed by SANDAG and ensure compliance with Senate Bills 610 and 221. In addition to the expected mix of resources utilized in the reliability assessment, a resources goal has been established. The goal includes the expected supplies plus other potential projects that are important to maximizing development of local resources, but are still in the conceptual phase. This section presents a summary of the water demands and supplies within the Water Authority's service area along with the reliability assessment and resources goal.

## SECTION 8.1 DEVELOPMENT OF PROJECTED WATER RESOURCES MIX

In summary, development of the projected mix of resources to meet future demands was based on the following factors:

I. Local agency information on projected water recycling, groundwater, surface water, and local seawater desalination supplies (**Section 5**);

II. Update of the Water Authority's 2000 Plan to reflect Board action taken over the last five years related to the following items:

a. Adoption of QSA related agreements (**Section 6.2.1**);
b. Fourth Amendment to the Transfer Agreement (**Section 4.1**); and
c. Agreement between Metropolitan and the Water Authority regarding assignment of agreements related to the AAC and CC Lining Projects (**Section 4.2**).

## SECTION 8.2 NORMAL WATER YEAR ASSESSMENT

**Table 8-1** shows the normal year assessment, summarizing the total water demands for the Water Authority through the year 2030, along with the supplies necessary to meet demands under normal conditions. **Section 2** contains a discussion of the normal year water demands in the Water Authority's service area. If the Water Authority and member agency supplies are developed as planned, along with implementation of Metropolitan's IRP, no shortages are anticipated within the Water Authority's service area in a normal year through 2030.

Table 8-1: Normal Water Year Supply and Demand Assessment (AF/YR)[1]

| | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|
| **Water Authority Supplies** | | | | | |
| IID Water Transfer | 70,000 | 100,000 | 190,000 | 200,000 | 200,000 |
| AAC and CC Lining Projects | 77,700 | 77,700 | 77,700 | 77,700 | 77,700 |
| **Subtotal** | 147,700 | 177,700 | 267,700 | 277,700 | 277,700 |
| **Member Agency Supplies** | | | | | |
| Surface Water | 59,649 | 59,649 | 59,649 | 59,649 | 59,649 |
| Water Recycling | 33,668 | 40,662 | 45,548 | 46,492 | 47,584 |
| Groundwater | 17,175 | 18,945 | 19,775 | 19,775 | 19,775 |
| Groundwater Recovery | 11,400 | 11,400 | 11,400 | 11,400 | 11,400 |
| Seawater Desalination | 0 | 34,689 | 36,064 | 37,754 | 40,000 |
| **Subtotal** | 121,892 | 165,345 | 172,436 | 175,070 | 178,408 |
| **Metropolitan Water District Supplies** | 445,858 | 399,855 | 311,374 | 342,870 | 372,922 |
| **TOTAL PROJECTED SUPPLIES** | 715,450 | 742,900 | 771,510 | 795,640 | 829,030 |
| **TOTAL ESTIMATED DEMANDS w/Conservation** | 715,450 | 742,900 | 771,510 | 795,640 | 829,030 |

1 Normal water year demands based on 1960 – 2002 hydrology.

## SECTION 8.3 DRY WATER YEAR ASSESSMENT

In addition to a normal water year assessment, the Act requires an assessment to compare supply and demands under single dry and multiple dry water years over the next 20 years, in five-year increments. **Section 2** describes the derivation of the dry water year demands. **Table 8-2** shows the single dry-year assessment. The projected groundwater and surface water yields shown in the table are based on historic 1991 supplies during the 1987-1992 drought years. The supplies available from projected recycling and groundwater recovery projects are assumed to experience little, if any, reduction in a dry-year. The Water Authority's existing and planned supplies from the IID transfer, canal lining projects, and seawater desalination are also considered "drought-proof" supplies as discussed in **Section 4**. Therefore, estimated normal yields from these supplies are also included in the analysis.

In accordance with the Act, **Tables 8-3, 8-4, 8-5, 8-6,** and **8-7** show the multiple dry water year assessments in five-year increments. The member agencies' surface and groundwater yields shown in these tables are reflective of supplies available during the 1987-92 drought in years 1990, 1991 and 1992.

As shown in the above tables, if the projected Water Authority and member agency supplies are developed as planned, along with implementation of Metropoli-

### Table 8-2: Single Dry Water Year Supply and Demand Assessment
Five Year Increments (AF/YR)

| | 2010 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|
| **Water Authority Supplies** | | | | | |
| IID Water Transfer | 70,000 | 100,000 | 190,000 | 200,000 | 200,000 |
| AAC and CC Lining Projects | 77,700 | 77,700 | 77,700 | 77,700 | 77,700 |
| **Subtotal** | 147,700 | 177,700 | 267,700 | 277,700 | 277,700 |
| **Member Agency Supplies** | | | | | |
| Surface Water | 22,284 | 22,284 | 22,284 | 22,284 | 22,284 |
| Water Recycling | 33,668 | 40,662 | 45,548 | 46,492 | 47,584 |
| Groundwater | 10,838 | 10,838 | 10,838 | 10,838 | 10,838 |
| Groundwater Recovery | 11,400 | 11,400 | 11,400 | 11,400 | 11,400 |
| Seawater Desalination | 0 | 34,698 | 36,064 | 37,754 | 40,000 |
| **Subtotal** | 78,190 | 119,882 | 126,134 | 128,768 | 132,106 |
| **Metropolitan Water District Supplies** | 541,760 | 498,388 | 431,726 | 442,142 | 473,224 |
| **TOTAL PROJECTED SUPPLIES** | 767,650 | 795,970 | 825,560 | 848,610 | 883,030 |
| **TOTAL ESTIMATED DEMANDS w/Conservation** | 767,650 | 795,970 | 825,560 | 848,610 | 883,030 |

### Multiple Dry Water Year Supply and Demand Assessment
5-Year Increments (AF/YR)

Table 8-3

| | 2006 | 2007 | 2008 |
|---|---|---|---|
| Water Authority Supplies | 40,000 | 71,500 | 71,500 |
| Member Agencies | 56,670 | 60,230 | 80,900 |
| Metropolitan Supplies | 647,850 | 618,050 | 602,630 |
| TOTAL ESTIMATED SUPPLIES | 744,520 | 749,780 | 755,030 |
| TOTAL ESTIMATED DEMANDS | 744,520 | 749,780 | 755,030 |

Table 8-4

| | 2011 | 2012 | 2013 |
|---|---|---|---|
| Water Authority Supplies | 157,700 | 167,700 | 177,700 |
| Member Agencies | 101,012 | 100,431 | 116,970 |
| Metropolitan Supplies | 512,698 | 500,149 | 488,480 |
| TOTAL ESTIMATED SUPPLIES | 771,410 | 777,280 | 783,150 |
| TOTAL ESTIMATED DEMANDS | 771,410 | 777,280 | 783,150 |

| Table 8-5 | | | |
|---|---|---|---|
| | 2016 | 2017 | 2018 |
| Water Authority Supplies | 177,700 | 177,700 | 207,700 |
| Member Agencies | 109,214 | 108,149 | 124,194 |
| Metropolitan Supplies | 514,116 | 521,301 | 481,376 |
| TOTAL ESTIMATED SUPPLIES | 801,030 | 807,150 | 813,270 |
| TOTAL ESTIMATED DEMANDS | 801,030 | 807,150 | 813,270 |

| Table 8-6 | | | |
|---|---|---|---|
| | 2021 | 2022 | 2023 |
| Water Authority Supplies | 277,700 | 277,700 | 277,700 |
| Member Agencies | 114,752 | 112,960 | 128,288 |
| Metropolitan Supplies | 438,228 | 445,180 | 435,022 |
| TOTAL ESTIMATED SUPPLIES | 830,680 | 835,840 | 841,010 |
| TOTAL ESTIMATED DEMANDS | 830,680 | 835,840 | 841,010 |

| Table 8-7 | | | |
|---|---|---|---|
| | 2026 | 2027 | 2028 |
| Water Authority Supplies | 277,700 | 277,700 | 277,700 |
| Member Agencies | 117,524 | 115,873 | 131,343 |
| Metropolitan Supplies | 463,256 | 472,057 | 463,727 |
| TOTAL ESTIMATED SUPPLIES | 858,480 | 865,630 | 872,770 |
| TOTAL ESTIMATED DEMANDS | 858,480 | 865,630 | 872,770 |

tan's IRP, no shortages are anticipated within the Water Authority's service area under single dry-year or multiple dry water years through 2030. However, the Water Authority is at risk for shortages should the supplies identified in Metropolitan's IRP not be developed as planned or a Metropolitan member agency such as the City of Los Angeles invoke its Section 135, Preferential Right to Water (discussed in **Section 6.1.1**). To alleviate this risk, the Water Authority is pursuing the following options: 1) the development of additional storage; and 2) development of additional seawater desalination. Storage opportunities include local carryover storage facilities to accumulate and store water during periods of availability, as well as the acquisition of out-of-the-region conjunctive-use facilities to develop additional groundwater storage (refer to **Section 1.5.1** for discussion on the Water Authority's proposed carryover storage project). A combination of storage and new supply appears to provide the most reliable solution to alleviating risks during a dry period.

## SECTION 8.4 RELIABILITY OF SUPPLY

The previous sections identify the diverse mix of resources planned to meet future demands in both a normal and dry-year. Implementation of this regional resource mix will require development of projects and programs by the Water Authority, its member agencies, and Metropolitan. The Water Authority coordinated with its member agencies and Metropolitan during preparation of the Updated 2005 Plan on the future demands and supplies projected for the region. The steps being taken by the member agencies and Metropolitan to develop supplies are addressed in their respective urban water management plans. **Section 4** contains the steps taken and remaining actions necessary to develop and maintain the Water Authority supplies.

The Act requires that, for any water source that may not be available at a consistent level of use, given specific legal, environmental, water quality, or climatic factors, that the agency describe, to the extent practicable, plans to replace that source with alternative sources or water demand management measures. As stated throughout the Updated 2005 Plan, the Water Authority and its member agencies are planning to develop a diverse supply of resources. The unavailability of any one supply source will be buffered because of the diversity of the supplies; the region is not reliant on a single source. To replace or supplement an existing supply, the Water Authority could take steps to increase development of transfers or seawater desalination. Member agencies could also further maximize development of recycled water, groundwater, and seawater desalination. With a successful conservation program already in place, the Water Authority and its member agencies could effectively implement extraordinary conservation measures to assist in ensuring reliability. Another element of reliability is Metropolitan's IRP planning buffer, described in **Section 6.1.2**, which identifies an additional increment of water that could be potentially developed if other supplies are not implemented as planned. A combination of these resources would be necessary to ensure a reliable supply.



Quail Botanical Gardens irrigates with recycled water.

As stated in **Section 4.3.1** and **5.3**, seawater desalination remains a key component of the region's diversification strategy. However, because there are a number of factors that could affect implementation of seawater desalination, alternative options are being considered. This includes accelerating construction of an additional imported water conveyance pipeline, Pipeline 6, that would allow for additional supply deliveries from Metropolitan. With a regional seawater desalination project in place, Pipeline 6 would not be needed until approximately 2023. To meet demands without seawater desalination, preliminary results from Metropolitan's draft System Overview Study show that Pipeline 6 would be needed by 2018 and that it would take an estimated nine years to construct. A decision on implementation of a seawater desalination project prior to 2009 would allow adequate time to construct the facility.

**Activities associated with implementation of Pipeline 6 include the following:**

- Coordination between Metropolitan and the Water Authority regarding planning and design of the pipeline is ongoing; and
- An alignment for the entire approximately 30-mile pipeline was identified in the original 1993 Environmental Impact Report. Metropolitan is conducting a feasibility study to re-visit the 1993 alignment and evaluate alternative alignments north of the San Luis Rey River in light of changed conditions since 1993. The Water Authority plans to conduct a similar feasibility study of Pipeline 6 alignments south of the San Luis Rey River. Based on these updated feasibility studies, an updated environmental analysis for the project is also planned.

## SECTION 8.5 REGIONAL WATER SUPPLY GOALS

As stated in **Sections 4 and 5**, those projects with adequate documentation regarding implementation and supply utilization or existing projects already planned for expansion were considered for inclusion in the assessments discussed in **Sections 8.2 and 8.3**. In addition to these verifiable projects, the Water Authority and its member agencies have conceptually identified other potential projects. Combining the verifiable projects and these conceptual projects forms the regional water supply goals.

These supply goals are critical to the region for a number of reasons. The Water Authority and member agencies must continue to strive to develop cost-effective local resources that can further diversify

**2030 Water Supply Goals**

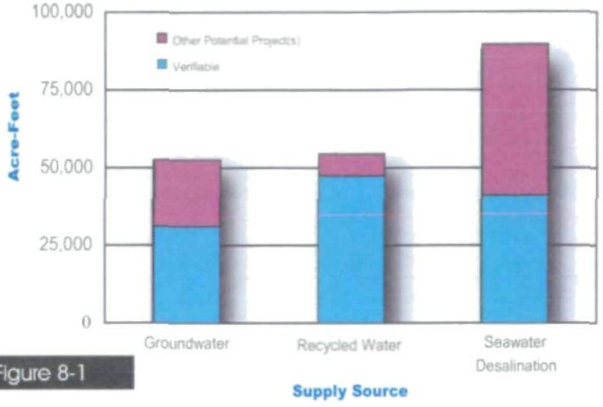



Figure 8-1

the region's supplies and reduce demands for imported water from Metropolitan. They provide objectives for the region to work towards by resolving any funding, regulatory, and other constraints associated with implementation. **Figure 8-1** shows the water supply goals for groundwater, recycled water, and seawater desalination.

The Water Authority worked with its member agencies to determine the verifiable supplies to be included in the assessment and those projects to be included in the supply goals. Including the verifiable supplies contained in the assessment, the regional groundwater production goal is 52,575 AF/YR by 2030. The recycled water goal is 54,413 AF/YR by 2030. The specific local projects are listed in **Table F-2** and **F-4** in **Appendix F**.

The total regional seawater desalination goal for 2030 is 89,600 AF/YR. The goal is achieved through implementation of 40,000 AF/YR of verifiable supply from the local project at the Encina Power Station, based on the contracted amounts and supply utilization, 16,000 AF/YR of additional local supply from the same project, and 33,600 AF/YR of regional supply (Water Authority goal). Refer to **Sections 4.3** and **5.4** for additional information on the derivation of the verifiable and goal supply figures.

# SECTION 9 SHORTAGE CONTINGENCY ANALYSIS

The Act requires that urban water agencies conduct a water shortage contingency analysis as part of their Updated 2005 plan. This section includes the Water Authority's analysis, which addresses a catastrophic shortage situation and drought management.

## SECTION 9.1 CATASTROPHIC WATER SHORTAGE

A catastrophic water shortage occurs when a disaster, such as an earthquake, results in insufficient available water to meet the region's needs or eliminates access to imported water supplies. The following section describes the Water Authority's Emergency Response Plan (ERP) and the ESP, both developed to protect public health and safety and to prevent or limit economic damage that could occur from a severe shortage of water supplies.

### 9.1.1 EMERGENCY RESPONSE PLAN

The Water Authority's ERP provides staff with the information necessary to respond to an emergency that causes severe damage to the Water Authority's water distribution system or impedes the Water Authority's ability to provide reliable water service to its member agencies. The ERP describes the situations and incidents that will trigger the activation of the Water Authority's ERP and Emergency Operations Center (EOC). It also provides direction and strategies for responding to a crisis.

**The Water Authority's ERP includes:**

- Authorities, policies, and procedures associated with emergency response activities;
- EOC activities – including EOC activation and deactivation guidelines;
- Multi-agency and multi-jurisdictional coordination, particularly between the Water Authority, its member agencies, and Metropolitan in accordance with Standardized Emergency Management System (SEMS) guidelines;
- Emergency staffing, management, and organization required to assist in mitigating any significant emergency or disaster;
- Mutual Aid Agreements and covenants that outline the terms and conditions under which mutual aid assistance will be provided;
- Pre-emergency planning and emergency operations procedures.

In addition, the Water Authority's ERP Manual uses a step-by-step approach to emergency response planning by providing such procedural tools as action checklists, resource and information lists, personnel rosters, and listings of established policies and procedures. The Water Authority's plan parallels many of the same plan components contained in the Unified San Diego County Emergency Services Organization's "Operational Area Emergency Plan" (OAEP). In turn, the OAEP serves to support and supplement the Water Authority's ERP.



The San Vicente Reservoir is important to the next phase of the ESP.

### 9.1.2 WATER AUTHORITY'S EMERGENCY STORAGE PROJECT

In June, 1998, the Water Authority's Board authorized implementation of the ESP to reduce the risk of potential catastrophic damage that could result from a prolonged interruption of imported water due to earthquake, drought, or other disasters.

The ESP is a system of reservoirs, pipelines, and other facilities that will work together to store and move water around the county in the event of a natural disaster. The facilities are located throughout San Diego County and are being constructed in phases. The entire project is expected to be complete by 2012. Its initial phase includes the recently completed 318-foot-high Olivenhain Dam and accompanying 24,789 AF Olivenhain Reservoir. When completed, the ESP will provide 90,100 AF of stored water for emergency purposes to meet the county's needs through at least 2030.

In sizing the ESP, the Water Authority assumed a 75 percent level of service to all Water Authority

member agencies during an outage and full implementation of the water conservation BMPs.

**The following steps from the final draft of the August 2002 Emergency Water Delivery Plans show the methodology for calculating the allocation of ESP supplies to member agencies in a prolonged outage situation without imported supplies:**

1. Estimate the duration of the emergency (i.e. time needed to repair damaged pipelines);
2. Determine each member agency's net demand during the emergency period by adding M&I water demands and agricultural water demands and then subtracting recycled water supplies;
3. Determine each member agency's useable local supplies during the emergency period (local supplies include surface water and groundwater);
4. Determine each member agency's level of service based on usable local supplies and net demand;
5. Adjust the allocation of ESP supplies based on a member agency's participation in the IAWP. IAWP customers will be required to take a reduction in deliveries during a water shortage due to an emergency at double the system-wide reduction up to a maximum of 90%. Water not delivered to IAWP customers will be redistributed to member agencies based on the "system-wide" level of service targets;
6. Determine the amount of local supplies that can be transferred between member agencies, with transfers occurring only after a member agency has a level of service greater than 75% based on their usable local supplies; and
7. Allocate delivery of useable ESP storage supplies and Metropolitan supplies to member agencies with the goal of equalizing the level of service among the member agencies.

The Board of Directors may authorize that supplies from the ESP be used in a prolonged drought situation where imported and local supplies do not meet 75 percent of the Water Authority's member agencies M&I demands.

## SECTION 9.2 DROUGHT MANAGEMENT PLANNING

### 9.2.1 INTRODUCTION

The last major drought in California occurred between 1987 and 1992 and caused severe water supply shortages throughout the state. During early March 1991, at the peak of the drought, Metropolitan's SWP supplies were reduced by 90 percent. Subsequently, Metropolitan voted to impose a 50 percent reduction in imported deliveries to the Water Authority. The results of Metropolitan's cutback would have been devastating to the Water Authority's businesses and residents except for the miracle March rainfall that occurred later that month. These rains allowed the SWP to reduce its level of cutback to 80 percent, and Metropolitan later rolled back its call for reduction from 50 to 31 percent. Even at this level the Water Authority was impacted more than other Metropolitan members because of its high dependence upon imported supplies from Metropolitan.

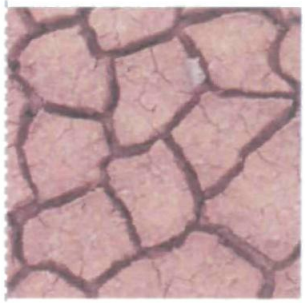
Since the 1987-1992 drought, the Water Authority and its member agencies have developed plans and implemented projects to reduce reliance on a single supply source. As mentioned in **Section 8**, if projected supplies are developed as planned and Metropolitan's IRP is fully implemented, no shortages are anticipated within the Water Authority's service area through 2030. While the region has plans to provide a high level of reliability, there will always be some level of uncertainty associated with maintaining and developing local and imported supplies. Therefore, the Water Authority developed a comprehensive Drought Management Plan (DMP) in the event that the region faces supply shortages due to drought conditions. The sections below describe the development of the DMP. A copy of the DMP is included in this Updated 2005 Plan as **Appendix G**.


Drought-tolerant plants thrive if water is scarce.

In 1999, Metropolitan adopted the Water Surplus and Drought Management Plan (WSDM Plan) to integrate planned operational actions with respect to both surplus and shortage situations. (For further details on the WSDM Plan actions, refer to Metropolitan's 2005 RUWMP.) The WSDM Plan's final action, to be taken in an extreme shortage stage, is the implementation of an allocation plan. An allocation plan was not developed as part of the WSDM Plan, and it

is not known when Metropolitan will consider and adopt such a plan. During development of the DMP, the Water Authority made assumptions regarding the Metropolitan supplies available during drought stages. The Water Authority will adjust the DMP as necessary following Metropolitan's adoption of an allocation plan.

One of the requirements of the shortage contingency analysis included in the Act is an estimate of the minimum supplies available during each of the next three years. **Table 8-3** of **Section 8.3** shows this estimate. The sections below address other requirements of the Act applicable to the Water Authority.



### 9.2.2 DMP PURPOSE

The DMP provides the Water Authority and its member agencies with a series of actions to take when faced with a shortage of imported water supplies from Metropolitan due to drought conditions. The potential actions will help the region minimize the impacts of shortages and ensure an equitable allocation of supplies.

The DMP includes a drought response matrix containing actions to be taken by the Water Authority at different drought stages. One of the actions, if warranted, is an allocation of available supplies. The Water Authority developed an allocation methodology to include in the DMP. This methodology determines the supplies available to member agencies and how local resources will be handled. A communication strategy was also prepared to help the Water Authority and its member agencies implement the DMP actions. When ultimately faced with a supply shortage, there may be factors unknown at this time that could influence the actions taken. The DMP will provide guidance on how to move forward and minimize the impacts of a shortage situation.

### 9.2.3 DMP TECHNICAL ADVISORY COMMITTEE

Preparing and implementing a DMP for the San Diego region required input and support from the Water Authority's member agencies. Recognizing the importance of member agency involvement, the Water Authority formed a TAC – Technical Advisory Committee – to provide input on development of the DMP. The TAC included a representative from each of the member agencies. The meetings were facilitated to ensure full involvement from all participants.

To gain an initial understanding of the TAC members' positions on the DMP elements, each member completed a questionnaire. Results from this questionnaire provided valuable information used to develop a set of principles for preparing the DMP.

Proposed elements of the DMP that were developed through the DMP TAC meetings are presented in **Sections 9.2.4, 9.2.5,** and **9.2.6**.

### 9.2.4 DMP PRINCIPLES

**The TAC developed principles to provide guidance to the Water Authority and its member agencies in developing and implementing the DMP. The principles are grouped under elements of the DMP.**

#### Overall Plan

1. The DMP will be developed in cooperation with the member agencies and include all aspects of drought planning - including steps to avoid rationing, drought response stages, allocation methodology, pricing, and communication strategy.

#### Communication Strategy

2. An on-going, coordinated and regional public outreach program shall be developed by the Water Authority that provides a clear and consistent message to the public regarding water supplies and specific conservation measures. The outreach program will also recognize and support member agency communication efforts that address specific retail level allocations.
3. A Drought Coordination Team, made up of one representative from each member agency, will be established to assist the Water Authority in implementation of the DMP. This includes items such as formulation and implementation of the public outreach program, timing of drought stages, selection of drought supply actions, and addressing potential issues surrounding implementation of the shortage allocation methodology.
4. The drought management plan should specify actions and timing of communications.

#### Drought Supply Enhancement

5. The Water Authority and its member agencies will work cooperatively to avoid and/or minimize rationing during droughts through supply enhancement and voluntary demand reduction measures.

6. Future Water Authority carryover storage supplies will be managed and utilized to assist in meeting demands during drought periods. Member agencies will be encouraged to develop carryover storage.
7. The Water Authority will consider securing option and/or spot water transfers to meet the reliability goal set by the Board. The cost of this regional supply will be melded into the Water Authority's supply costs for all classes of service that benefit.
8. Subject to the Water Authority's wheeling policy, if a member agency purchases transfer water from a source other than the Water Authority, the full cost of the transfer, including, but not limited to, purchase costs, wheeling costs, and administrative costs, will be borne by said member agency.
9. ESP supplies may be available when any member agency's non-interruptible firm demands drop below a 75 percent service level.
10. The quantities of supplies from the ESP to be removed from storage will be based on a minimum amount necessary to meet essential health, safety, and firefighting needs, and maximum amount based on the need to ensure adequate supplies remain for a catastrophic event (e.g. earthquake).

## Drought Response Stages

11. Develop drought response stages, which at a minimum, accomplish the following:
    - Can be easily communicated to the public;
    - Flexible to handle unexpected changes in demand and supply conditions;
    - Includes percent reduction (voluntary or mandatory) per stage; and
    - Includes both supply augmentation and emergency demand reduction methods.
12. Targets for achieving the emergency demand reduction measures should take into account the region's already aggressive long-term water conservation program.
13. The decision on when, and in which sequence drought augmentation supplies will be utilized during different stages will include consideration of the following factors:
    - Location – Out-of-region supplies will be utilized in the earlier stages, prior to in-county storage, because these supplies are more vulnerable to implementation risks such as seismic events;
    - Cost – Priority will be given to maximizing supply reliability and at the same time using the most cost-effective supplies; and
    - Limitations – Potential restrictions on the use of drought augmentation supplies is a factor in determining supply availability (e.g. potential restrictions on ESP supplies).

## Allocation Methodology

14. The allocation methodology will be equitable, easy to administer, contain financial penalties and pricing signals, and a communication strategy to ensure member agencies and the public are informed and understand the need to conserve.
15. In order to protect the economic health of the entire region, it is very important for the allocation methodology to avoid large, uneven retail impacts across the region. The methodology should include a minimum level of retail agency reliability to ensure equitable allocation among the member agencies.
16. With the exception of allocating water from the ESP, the Water Authority shall make no distinction among customers paying the same M&I rate (e.g. non-Interim Agricultural Water Program (IAWP) agriculture, residential, commercial, and industrial).
17. Additional IAWP cutbacks beyond the initial 30 percent faced by IAWP customers should be equally applied to both IAWP and M&I customers.
18. A member agency that has developed local projects and instituted conservation measures should not be penalized in the computation of allocations.
19. To help balance out the financial costs and risks associated with development of local resources, the shortage allocation methodology should provide an incentive to those member agencies that have developed local supplies.
20. The base-year, upon which allocations will be derived, will be based on historic demands. Adjustments to the base-year will be made for demographic changes, growth, local supplies, demand hardening, and supplies allocated under interruptible service programs.
21. A member agency's base-year will be adjusted to reflect the regional financial contribution from the Water Authority for development of local projects. The adjustment will take into account the risks associated with developing the local projects.
22. A member agency will not be able to market its unused allocation to other agencies within the Water Authority's service area at a cost higher than the Water Authority's charges for those supplies.
23. Penalty rates, along with other demand reduction measures, will be used by the Water Authority to encourage conservation during a drought.

### 9.2.5 DROUGHT RESPONSE MATRIX

The Act requires information on the stages of action to be undertaken in response to water supply shortages, including up to a 50 percent reduction in water supply. To meet the requirements, the Water Authority, with input from the TAC, developed a regional drought response matrix. The matrix provides guidance to the Water Authority and member agencies in selecting potential regional actions to lessen the severity of shortage conditions. Member agencies will independently adopt retail-level actions to manage potential shortages.

As shown in **Table 9-1**, the matrix proposes three main stages and identifies potential actions available to the Water Authority at each stage. To determine the specific actions that should be taken at each stage, the Water Authority and its member agencies will evaluate conditions specific to the timing and supply availability along with other pertinent variables. Numerous variables can influence the reduction levels adopted during a drought. These variables include, but are not limited to, SWP allocation, conditions on the Colorado River, Water Authority supplies, local storage, local demands, and timing.

#### MATRIX STAGES AND ACTIONS

Three drought stages have been identified in the matrix. The first stage of the drought response matrix is considered voluntary. The voluntary stage would likely occur when Metropolitan has been experiencing shortages in its imported water supply (from either the Colorado River or the SWP, or both) and is withdrawing water from storage due to the drought conditions to meet normal demands. Actions initiated at this stage include monitoring supply conditions and storage levels, calling for voluntary conservation, and utilizing a prudent amount of supplies from Water Authority planned carryover storage. These actions would continue throughout the drought stages.

The second stage, supply enhancement, could occur in year three or four of a dry period and represents that point in time when Metropolitan reduces water deliveries to its member agencies. The Water Authority's Board of Directors will then consider the potential actions in this stage, or others that may surface, to eliminate any cutbacks to the member agencies from the reduction in Metropolitan supplies.

The final stage follows once both Metropolitan and the Water Authority Board have exhausted all supply enhancement options due to lack of supplies and/or increasing costs, and mandatory cutbacks are required. The actions taken at this stage include implementation of the allocation methodology and potential utilization of ESP supplies. As stated in the DMP Principles, ESP supplies may be available when any member agency's non-interruptible firm demands drop below a 75 percent service level. In addition, the quantities of supplies utilized from ESP storage will be based on a minimum amount necessary to meet essential health, safety, and

Table 9-1: Drought Response Matrix — Firm Demands

| | STAGES | | |
|---|---|---|---|
| **Potential SDCWA Drought Actions** | Voluntary | SDCWA Supply Enhancement | Mandatory Cutbacks |
| Ongoing BMP implementation | X | X | X |
| Communication strategy | X | X | X |
| Monitoring supply conditions & storage levels | X | X | X |
| Call for voluntary conservation | X | X | X |
| Draw from SDCWA carryover storage | X | X | X |
| Secure transfer option contracts | X | X | X |
| Buy phase 1 spot transfers (cost at or below Tier 2 rate) | | X | X |
| Call transfer options | | X | X |
| Buy phase 2 spot transfers (cost at or above Tier 2 rate) | | X | X |
| Implement allocation methodology | | | X |
| Utilize ESP Supplies | | | X |

firefighting needs, and maximum amount based on the need to ensure adequate supplies remain for a catastrophic event (e.g. earthquake).

### 9.2.6 SUPPLY ALLOCATION METHODOLOGY

With the implementation of the member agencies' local projects, the Water Authority's core supplies, and potential drought supply enhancement supplies, the impact from supply shortages from Metropolitan on M&I customers will be reduced and potentially avoided. Preparing a supply allocation methodology is important in order to be prepared for situations that warrant an allocation of supplies to the member agencies. Implementing a supply allocation plan is part of the Water Authority's drought response matrix.

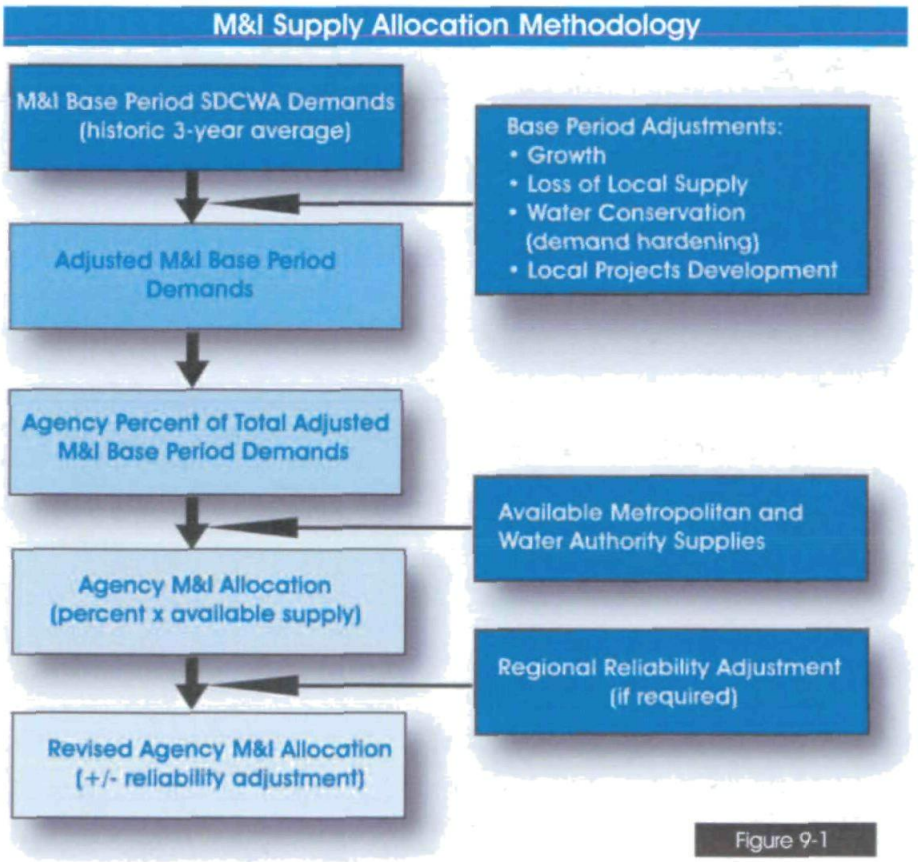



Figure 9-1

Starting with the accepted principles listed in **Section 9.2.4,** the Water Authority worked with the TAC to develop a methodology that is equitable and that recognizes the investments made by agencies that have developed local supplies. The Water Authority's current rate structure notes two classes of service, M&I and IAWP. They receive different levels of service based on the rate paid and are managed separately in the allocation methodology.

IAWP customers have agreed to a reduced level of service in exchange for a discounted supply rate from Metropolitan. Metropolitan prepared draft IAWP Reduction Guidelines that state that IAWP customers will be cut by 30 percent prior to cutbacks to M&I customers. The guidelines do not specify stages and/or levels of cutbacks beyond 30 percent. Based on the guidelines and Principle 17, up to a 30 percent cut will be made to the IAWP base prior to M&I cutbacks. Beyond 30 percent, supplies will be allocated equally between IAWP and M&I. In preparing the allocation methodology for the DMP, the Water Authority incorporated the conditions included in the guidelines.

The Water Authority developed a separate allocation methodology for those customers paying the M&I rate. They include residential, commercial, industrial, and non-IAWP agricultural customers. **Figure 9-1** provides the general approach to allocate supplies to M&I customers in a shortage situation.

The elements of the proposed allocation methodology:

#### HISTORICAL BASE PERIOD

A historic base period demand is required to establish an agency's pre-allocation demand on the Water Authority. Base period M&I demands are calculated using data from the three most recently completed fiscal years immediately preceding the year in which an allocation process is needed due to supply shortages. Each agency's base period M&I demand is established by calculating their three-year average of demand.

Base period demands for agriculture are certified through Metropolitan's IAWP program and are calculated using a different approach. For IAWP demands, only the most recently completed single fiscal year prior to the imposition of an allocation is considered. This calculation is required by Metropolitan's Draft IAWP Reduction Guidelines.

#### ADJUSTMENTS

M&I adjustments to be applied to the base period were developed to equitably account for relevant factors in calculating each agency's allocation. Such factors include growth, demand hardening levels due to conservation, local supply availability from groundwater and surface reservoirs, and efforts taken by local agencies to develop reliable local projects such as recycled water, groundwater recovery, and seawater desalination. The adjustments are intended to acknowledge unique agency characteristics and provide an incentive for agencies to decrease their reliance on imported supplies over the long-term. Consistent with the Draft IAWP Reduction Guidelines, no adjustments are made to the IAWP base demand.

#### ADJUSTED BASE PERIOD

An agency's adjusted base period M&I demand is calculated by adding the applicable adjustments to their initial base period M&I demand. The adjusted base period M&I demand amount is then used to generate an agency's pro-rata percent share of the total adjusted base period M&I demand. It is this percentage that is used to calculate an agency's imported M&I supply allocation volume.

#### ALLOCATION OF AVAILABLE SUPPLIES

To determine the amount of the Water Authority and Metropolitan supplies that will be available to each member agency, a member agency's percent share of the total M&I adjusted base period is calculated. This percent is then applied to supplies available for M&I demands to derive an allocation for each member agency. For IAWP customers, a percent share of the total IAWP base-year demands is calculated. This percent is applied to the IAWP supplies available following the initial 30 percent cutback and subsequent cutbacks to calculate an allocation of IAWP supplies for each member agency.

#### REGIONAL RELIABILITY ADJUSTMENT (IF NEEDED)

In accordance with Principle 15, which states, "*In order to protect the economic health of the entire region, it is very important for the allocation methodology to avoid large, uneven retail impacts across the region. The methodology should include a minimum level of retail agency reliability to ensure equitable allocation among the member agencies,*" a regional M&I reliability floor was established. The floor, if needed, is set at 5% below the region's total M&I level of service and is triggered when the net cutback to total Water Authority supplies reaches or exceeds 30 percent. Taking into account the supply development by the Water Authority, its member agencies, and Metropolitan, this level of cutback is very unlikely.

### 9.2.7 REVENUE IMPACTS

The Water Authority has taken significant steps to reduce potential revenue impacts resulting from fluctuating water sales. In FY 1990, the Water Authority created a Rate Stabilization Fund (RSF) to provide funds that would mitigate the need for rate increases in the event of an unexpected decline in water sales. The RSF is structured in accordance with Board policy to maintain a minimum balance of at least 25 percent of the Water Authority's net water sales revenue. RSF is constrained by a maximum balance of 100 percent of the average annual water sales projected over a four-year period. As a result, the RSF is a crucial water rate management tool.

Additionally, on January 1, 2003, the Water Authority implemented a new rate structure that substantially increased the percentage of water revenues generated from fixed charges. This increase replaced the previous variable "postage stamp" rate, which historically generated as much as 80 percent or more of total annual revenues, with two fixed charges, and one variable rate. These new fixed charges – Customer Service and Storage – are key components to the Water Authority's future revenue stability.

### 9.2.8 MANDATORY WATER USE PROHIBITIONS

The Water Authority's powers to enforce restrictions on use are constrained by the provision of the County Water Authority Act, which states, "If available supplies become inadequate to fully meet the needs of its member agencies, the board shall adopt reasonable rules, regulations, and restrictions so that the available supplies are allocated among its member agencies for the greatest public interest and benefit." (West's Cal. Wat. C, Append. § 45-5, para. (11).) Pursuant to this authority, the Water Authority developed a drought management plan that includes rules and regulations for water allocation among its member agencies during a water shortage. These rules take into consideration whether its member agencies have developed shortage management plans to meet targeted reductions

in total water demand during a shortage. Because the Water Authority's member agencies, not the Water Authority, have the direct customer service relationship with water users, the member agencies have responsibility to address mandatory use prohibitions during water shortages in their individual urban water management plans.

### 9.2.9 PENALTIES FOR EXCESSIVE WATER USE

Should the Water Authority have to allocate imported water supplies from Metropolitan due to drought conditions, as identified in Section 5 of the Water Authority's DMP (**Appendix G**), Metropolitan can impose surcharges (penalty pricing) on water consumption in excess of the Water Authority's imported water allocation from Metropolitan. Penalties are expected to be severe, as much as three times Metropolitan's full service water rate. See **Appendix G, page D-9**, for more information on Metropolitan's Water Surplus and Drought Management Plan (WSDM Plan).

The Water Authority's Board of Directors has the authority to adjust water rates to reflect any penalties imposed by Metropolitan under Metropolitan's WSDM Plan or other allocation programs as determined necessary by the Board of Directors. Rates may also be adjusted based on any other allocation program implemented by the Water Authority as determined necessary by the Board of Directors. The Water Authority may also reduce the amount of water it allocates to a member agency if the member agency fails to adopt or implement water use restrictions.

## SECTION 9.3 SUMMARY

The shortage contingency analysis included in this section and in **Appendix G** demonstrates that the Water Authority and its member agencies, through the ERP and ESP, are taking actions to prepare for and appropriately handle a catastrophic interruption of water supplies. The analysis also described the coordinated development of a DMP for the San Diego region. The DMP identifies the actions to be taken by the Water Authority to minimize the impacts of a supply shortage due to a drought and includes an allocation methodology to be used if cutbacks are necessary. The analysis and **Appendix G** address the appropriate requirements of the Act that are applicable to the Water Authority.

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Federal Register

Tuesday,
December 18, 2001

Part II

# Environmental Protection Agency

40 CFR Parts 9, 122, et al.
National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities; Final Rule

## ENVIRONMENTAL PROTECTION AGENCY

### 40 CFR Parts 9, 122, 123, 124, and 125

[FRL–7105–4]

RIN 2040–AC34

### National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Final rule.

**SUMMARY:** Today's final rule implements section 316(b) of the Clean Water Act (CWA) for new facilities that use water withdrawn from rivers, streams, lakes, reservoirs, estuaries, oceans or other waters of the United States (U.S.) for cooling purposes. The final rule establishes national technology-based performance requirements applicable to the location, design, construction, and capacity of cooling water intake structures at new facilities. The national requirements establish the best technology available, based on a two-track approach, for minimizing adverse environmental impact associated with the use of these structures.

Based on size, Track I establishes national intake capacity and velocity requirements as well as location- and capacity-based requirements to reduce intake flow below certain proportions of certain waterbodies (referred to as "proportional-flow requirements"). It also requires the permit applicant to select and implement design and construction technologies under certain conditions to minimize impingement mortality and entrainment. Track II allows permit applicants to conduct site-specific studies to demonstrate to the Director that alternatives to the Track I requirements will reduce impingement mortality and entrainment for all life stages of fish and shellfish to a level of reduction comparable to the level the facility would achieve at the cooling water intake structure if it met the Track I requirements.

EPA expects that this final regulation will reduce impingement and entrainment at new facilities. Today's final rule establishes requirements that will help preserve aquatic organisms and the ecosystems they inhabit in waters used by cooling water intake structures at new facilities. EPA has considered the potential benefits of the rule; these include a decrease in expected mortality or injury to aquatic organisms that would otherwise be subject to entrainment into cooling water systems or impingement against screens or other devices at the entrance of cooling water intake structures. Benefits may also accrue at population, community, or ecosystem levels of ecological structures. The preamble discusses these benefits to the extent possible in qualitative terms.

**DATES:** This regulation shall become effective January 17, 2002. For judicial review purposes, this final rule is promulgated as of 1:00 p.m. Eastern Standard Time (EST) on January 2, 2002, as provided in 40 CFR 23.2.

**ADDRESSES:** The public record for this rule is established under docket number W–00–03. Copies of comments received, EPA responses, and all other supporting documents (except for information claimed as Confidential Business Information (CBI)) are available for review in the EPA Water Docket, East Tower Basement, Room EB–57, 401 M Street, SW., Washington, DC 20460. The record is available for inspection from 9:00 a.m. to 4:00 p.m. Monday through Friday, excluding legal holidays. For access to the docket materials, please call (202) 260–3027 to schedule an appointment.

**FOR FURTHER INFORMATION CONTACT:** For additional technical information contact Deborah G. Nagle at (202) 260–2656. For additional biological information contact Debbi Hart at (202) 260–0905. For additional economic information contact Ghulam Ali at (202) 260–9886. The e-mail address for the above contacts is *rule.316b@epa.gov*.

**SUPPLEMENTARY INFORMATION:**

#### What Entities Are Regulated by This Action?

This final rule applies to new greenfield (defined by example in section I. of this preamble) and stand alone facilities that use cooling water intake structures to withdraw water from waters of the U.S. and that have or require a National Pollutant Discharge Elimination System (NPDES) permit issued under section 402 of the CWA. New facilities subject to this regulation include those that have a design intake flow of greater than two (2) million gallons per day (MGD) and that use at least twenty-five (25) percent of water withdrawn for cooling purposes. Generally, facilities that meet these criteria fall into two major groups: new steam electric generating facilities and new manufacturing facilities. If a new facility meets these conditions, it is subject to today's final regulations. If a new facility has or requires an NPDES permit but does not meet the two MGD intake flow threshold or uses less than 25 percent of its water for cooling water purposes, the permit authority will implement section 316(b) on a case-by-case basis, using best professional judgment. This final rule defines the term "cooling water intake structure" to mean the total physical structure and any associated constructed waterways used to withdraw water from a water of the U.S. The cooling water intake structure extends from the point at which water is withdrawn from the surface water source up to and including the intake pumps. Today's rule does not apply to existing facilities including major modifications to existing facilities that would be "new sources" in 40 CFR 122.29 as that term is used in the effluent guidelines and standards program. Although EPA has not finished examining the costs of technology options at existing facilities, the Agency anticipates that existing facilities would have less flexibility in designing and locating their cooling water intake structures than new facilities and that existing facilities might incur higher compliance costs than new facilities. For example, existing facilities might need to upgrade or modify existing intake structures and cooling water systems to meet requirements of the type contained in today's rule, which might impose greater costs than use of the same technologies at a new facility. Retrofitting technologies at an existing facility might also require shutdown periods during which the facility would lose both production and revenues, and certain retrofits could decrease the thermal efficiency of an electric generating facility. Site limitations, such as lack of undeveloped space, might make certain technologies infeasible at existing facilities. Accordingly, EPA does not intend that today's rule or preamble serve as guidance for developing section 316(b) requirements for existing facilities. Permit writers should continue to apply best professional judgment in making case-by-case section 316(b) determinations for existing facilities, based on existing guidance and other legal authorities. EPA will address existing facilities fully in Phase II and Phase III rulemakings.

The following table lists the types of entities that EPA believes are potentially subject to this final rule. This table is not intended to be exhaustive; rather, it provides a guide for readers regarding entities likely to be regulated by this action. Other types of entities not listed in the table could also be regulated. To determine whether your facility is regulated by this action, you should carefully examine the applicability criteria at § 125.81 of the rule. If you

have questions regarding the applicability of this action to a particular entity, consult one of the persons listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

| Category | Examples of regulated entities | Standard Industrial Classification (SIC) Codes | North American Industry Classification System (NAICS) Codes |
|---|---|---|---|
| Federal, State and Local Government. | Operators of steam electric generating point source dischargers that employ cooling water intake structures. | 4911 and 493 | 221111, 221112, 221113, 221119, 221121, 221122, 221111, 221112, 221113, 221119, 221121, 221122. |
| Industry | Operators of industrial point source dischargers that employ cooling water intake structures. | See below | See below. |
| | Steam electric generating | 4911 and 493 | 221111, 221112, 221113, 221119, 221121, 221122, 221111, 221112, 221113, 221119, 221121, 221122. |
| | Agricultural production | 0133 | 111991, 11193. |
| | Metal mining | 1011 | 21221. |
| | Oil and gas extraction (excluding offshore and coastal subcategories). | 1311, 1321 | 211111, 211112. |
| | Mining and quarrying of nonmetallic minerals. | 1474 | 212391. |
| | Food and kindred products | 2046, 2061, 2062, 2063, 2075, 2085 | 311221, 311311, 311312, 311313, 311222, 311225, 31214. |
| | Tobacco products | 2141 | 312229, 31221. |
| | Textile mill products | 2211, 2261 | 31321. |
| | Lumber and wood products, except furniture. | 2415, 2421, 2436, 2493 | 321912, 321113, 321918, 321999, 321212, 321219. |
| | Paper and allied products | 2611, 2621, 2631, 2676, 2679 | 3221, 322121, 32213, 322121, 322122, 32213, 322291. |
| | Chemical and allied products | 28 (except 2822, 2835, 2836, 2842, 2843, 2844, 2861, 2895, 2893, 2851, and 2879). | 325 (except 325182, 32591, 32551, 32532). |
| | Petroleum refining and related industries. | 2911, 2999 | 32411, 324199. |
| | Rubber and miscellaneous plastics products. | 3011, 3069 | 326211, 31332, 326192, 326299. |
| | Stone, clay, glass, and concrete products. | 3241 | 32731. |
| | Primary metal industries | 3312, 3313, 3315, 3316, 3317, 3334, 3339, 3353, 3357. | 324199, 331111, 331112, 331492, 331222, 332618, 331221, 22121, 331312, 331419, 331315, 331521, 331524, 331525. |
| | Fabricated metal products, except machinery and transportation equipment. | 3421, 3499 | 332211, 337215, 332117, 332439, 33251, 332919, 339914, 332999. |
| | Industrial and commercial machinery and computer equipment. | 3523, 3531 | 333111, 332323, 332212, 333922, 22651, 333923, 33312. |
| | Transportation equipment | 3724, 3743, 3764 | 336412, 333911, 33651, 336416. |
| | Measuring, analyzing, and controlling instruments; photographic, medical, and optical goods; watches and clocks. | 3861 | 333315, 325992. |
| | Electric, gas, and sanitary services | 4911, 4931, 4939, 4961 | 221111, 221112, 221113, 221119, 221121, 221122, 22121, 22133. |
| | Educational services | 8221 | 61131. |
| | Engineering, Accounting, Research, Management, and Related Services. | 8731 | 54171. |

**Supporting Documentation**

The final regulation is supported by two major documents:

1. *Economic Analysis of the Final Regulations Addressing Cooling Water Intake Structures for New Facilities* (EPA–821–R–01–035), hereafter referred to as the *Economic Analysis*. This document presents the analysis of compliance costs, barrier to entry, and energy supply effects. In addition, the document provides an assessment of potential benefits.

2. *Technical Development Document for the Final Regulations Addressing Cooling Water Intake Structures for New Facilities* (EPA–821–R–01–036), hereafter referred to as the *Technical Development Document*. This document presents detailed information on the methods used to develop unit costs and describes the set of technologies that may be used to meet the rule's requirements.

*How To Obtain Supporting Documents*

You can obtain the *Economic Analysis* and *Technical Development Document* from the Agency's 316(b) website (http://www.epa.gov/ost/316b). The documents are also available from the National Service Center for Environmental Publications, P.O. Box

42419, Cincinnati, OH 45242–2419; telephone (800) 490–9198 and the Water Resource Center , U.S. EPA, 1200 Pennsylvania Avenue, N.W. (RC 4100), Washington D.C. 20460 (202) 260–2814.

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## I. Scope of This Rulemaking

Today's final rule establishes technology-based performance requirements applicable to the location, design, construction, and capacity of cooling water intake structures at new facilities under section 316(b) of the Clean Water Act. The rule establishes the best technology available for minimizing adverse environmental impact associated with the use of these structures. Today's final rule also partially fulfills EPA's obligation to comply with a consent decree entered in the United States District Court, Southern District of New York in *Riverkeeper Inc., et al.* v. *Whitman*, No. 93 Civ. 0314 (AGS). (For a more detailed discussion of the consent decree, see II.C.2).

This final rule applies to new greenfield or stand alone facilities: (1) that use a newly constructed cooling water intake structure, or a modified existing cooling water intake structure whose design capacity is increased that withdraws water from waters of the U.S.; and (2) that has or is required to have a National Pollutant Discharge Elimination System (NPDES) permit issued under section 402 of the CWA. Specifically, the rule applies to you if you are the owner or operator of a facility that meets all of the following criteria:

- Your greenfield or stand alone facility meets the definition of new facility specified in § 125.83 of this rule;
- Your new facility uses a newly constructed or modified existing cooling water intake structure or structures, or your facility obtains cooling water by any sort of contract or arrangement with an independent supplier who has a cooling water intake structure;
- Your new facility's cooling water intake structure(s) withdraw(s) water from waters of the U.S. and at least twenty-five (25) percent of the water withdrawn is used for contact or noncontact cooling purposes;
- Your new facility has a design intake flow of greater than two (2) million gallons per day (MGD); and
- Your new facility has an NPDES permit or is required to obtain one.

If a new facility meets these conditions, it is subject to today's final regulations. If a new facility has or requires an NPDES permit but does not meet the two MGD intake flow threshold or the twenty-five percent cooling water use threshold, it is not subject to permit conditions based on today's rule; rather, it is subject to permit conditions implementing section 316(b) of the CWA set by the permit director on a case-by-case basis, using best professional judgment.

### *A. What Is a New Facility?*

A new facility subject to this regulation is any facility that meets the definition of "new source" or "new discharger" in 40 CFR 122.2 and 122.29(b)(1), (2), and (4); commences construction after January 17, 2002; and uses either a newly constructed cooling water intake structure, or an existing cooling water intake structure whose design capacity is increased; or obtains cooling water by any sort of contract or arrangement with an independent supplier who has a cooling water intake structure. The term "commence construction" is defined in 40 CFR 122.29(b)(4).

As stated above, this rule applies to only "greenfield" and "stand-alone" facilities. A greenfield facility is a facility that is constructed at a site at which no other source is located, or that totally replaces the process or production equipment at an existing facility (see 40 CFR 122.29(b)(1)(i) and (ii)). A stand-alone facility is a new, separate facility that is constructed on property where an existing facility is located and whose processes are substantially independent of the existing facility at the same site (see 40 CFR 122.29(b)(1)(iii)). An example of

total replacement is as follows: The power plant or manufacturer demolishes the power plant or manufacturing facility and builds a new plant or facility in its place. The pumps of the existing cooling water intake structure are replaced with new pumps that increase design capacity to accommodate additional cooling water needs, but the intake pipe is left in place. In this situation, the facility would be a new facility. Modifications to an existing cooling water intake structure that do not serve the cooling water needs of a greenfield or stand-alone facility in 40 CFR 122.2 and 122.29(b)(1), (2), and (4) (i.e., a facility that meets the definition of new source or new discharger and commences construction after the effective date of the rule) do not constitute a new facility subject to this rule. Thus, the definition of new facility under this rule is narrower than the definition of new source under section 306 of the CWA.

The definition of new facility also requires that the greenfield or stand-alone facility use "a newly constructed cooling water intake structure or an existing cooling water intake structure whose design capacity is increased to accommodate the intake of additional cooling water." This means a facility that would otherwise be a "new facility" would *not* be treated as a new facility under this rule if it withdraws water from an existing cooling water intake structure whose design capacity has not been increased to accommodate the intake of additional cooling water. Routine maintenance and repair, such as replacement of pumps that does not increase the capacity of the structure, cleaning in response to biofouling, and repair or replacement of moving parts at a cooling water intake that is part of a greenfield or stand-alone facility, and that occur simply for operation and maintenance purposes, would not be a modification of that intake structure. One way to distinguish whether replacement of the pipes or the pumps is for maintenance and repair purposes or whether it is to accommodate construction of a new facility is to determine whether the replacement increases the original design capacity. Today's rule specifies that changes to a cooling water intake structure are considered modifications for purposes of this rule only if such changes result in an increase in design capacity. Thus, routine maintenance or repair of the cooling water intake structure, including the pumps, that does not result in an increase in design capacity does not modify a cooling water intake structure. However, if a change is made to the cooling water intake structure, including the pumps, that increases design capacity to any extent, then the cooling water intake structure has been modified; use of this structure by a greenfield or stand-alone facility would make the facility a new facility subject to this rule.

*B. What Is a Cooling Water Intake Structure?*

For the purposes of this rule a "cooling water intake structure" is defined as the total physical structure and any associated constructed waterways used to withdraw water from waters of the U.S. The cooling water intake structure extends from the point at which water is withdrawn from waters of the U.S. up to and including the intake pumps. EPA has defined "cooling water" as water used for contact or noncontact cooling, including water used for equipment cooling, evaporative cooling tower makeup, and dilution of effluent heat content. The Agency has specified that the intended use of cooling water is to absorb waste heat from production processes or auxiliary operations. In addition, for the final rule EPA has amended the definition of cooling water to ensure that the rule does not discourage the reuse of cooling water as process water. As such, heated cooling water that is subsequently used in a manufacturing process is considered process water for the purposes of calculating the percentage of a new facility's intake flow that is used for cooling purposes.

*C. What Cooling Water Use and Design Intake Flow Thresholds Result in a New Facility Being Subject to This Final Rule?*

This rule applies to new facilities that (1) withdraw cooling water from waters of the U.S. and use at least twenty-five (25) percent of the water withdrawn for cooling purposes and (2) have a cooling water intake structure with a design intake capacity of greater than or equal to two (2) million gallons per day (MGD) of source water. See 40 CFR 125.81 of this rule. The percentage of total water withdrawn that is used for cooling purposes is to be measured on an average monthly basis over a period of one year. See 40 CFR 125.81(c) of this rule. A new facility meets the 25 percent cooling water use threshold if, on the basis of the new facility's design when measured over a period of one year, any monthly average percentage of cooling water withdrawn is expected to equal or exceed 25 percent of the total water withdrawn. Waters of the U.S. include the broad range of surface waters that meet the regulatory definition at 40 CFR 122.2, which can include lakes, ponds, reservoirs, nontidal rivers or streams, tidal rivers, estuaries, fjords, oceans, bays, and coves.

Some commenters questioned whether the discussion of cooling ponds in the preamble to the proposal (65 FR 49067, col. 2) meant that EPA considers cooling ponds to be "waters of the United States." EPA did not intend that discussion to change the regulatory status of cooling ponds. Cooling ponds are neither categorically included nor categorically excluded from the definition of "waters of the United States" at 40 CFR 122.2. EPA interprets 40 CFR 122.2 to give permit writers discretion to regulate cooling ponds as "waters of the United States" where cooling ponds meet the definition of "waters of the United States." The determination whether a particular cooling pond is or is not "waters of the United States" is to be made by the permit writer on a case-by-case basis, informed by the principles enunciated in *Solid Waste Agency of Northern Cook County* v. *US Army Corps of Engineers*, 531 U.S. 159 (2001).

*D. Does This Rule Apply to My Facility If It Does Not Have a Point Source Discharge Subject to an NPDES Permit?*

Today's final rule applies only to new facilities as defined in § 125.83 that have an NPDES permit or are required to obtain one because they discharge or might discharge pollutants, including storm water, from a point source to waters of the United States. Requirements for minimizing the adverse environmental impact of cooling water intake structures will continue to be applied through NPDES permits.

*E. What Requirements Must I Meet Under the Final Rule?*

Today's final rule establishes a two-track approach for regulating cooling water intake structures at new facilities. Track I establishes uniform requirements based on facility cooling water intake capacity. Track II provides dischargers with the opportunity to establish that alternative requirements will achieve comparable performance. The regulated entity has the opportunity to choose which track it will follow. The Track I and Track II requirements are summarized below.

Under Track I, new facilities with a design intake flow equal to or greater than 10 MGD, must meet the following requirements:

(1) Cooling water intake flow must be at a level commensurate with that achievable with a closed-cycle,

recirculating cooling system; (40 CFR 125.84(b)(1))

(2) Through-screen intake velocity must be less than or equal to 0.5 feet per second; (40 CFR 125.84(b)(2))

(3) Location- and capacity-based limits on proportional intake flow must be met (for fresh water rivers or streams, intake flow must be less than or equal to 5 percent of the mean annual flow; for lakes or reservoirs, intake flow may not disrupt natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies); for estuaries or tidal rivers, intake flow must be less than or equal to 1 percent of the tidal excursion volume; for oceans, there are no proportional flow requirements); (40 CFR 125.84(b)(3)) and

(4) Design and construction technologies for minimizing impingement mortality and entrainment must be selected and implemented if certain conditions exist where the cooling water intake structure is located. (40 CFR 125.84(b)(4) and (5))

Under Track I, new facilities with a design intake flow equal to or greater than 2 MGD, but less than 10 MGD, must meet the following requirements:

(1) Through-screen intake velocity must be less than or equal to 0.5 feet per second; (40 CFR 125.84(c)(1))

(2) Location- and capacity-based limits on proportional intake flow must be met (for fresh water rivers or streams, intake flow must be less than or equal to 5 percent of the mean annual flow; for lakes or reservoirs, intake flow may not disrupt natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies); for estuaries or tidal rivers, intake flow must be less than or equal to 1 percent of the tidal excursion volume; for oceans, there are no proportional flow requirements); (40 CFR 125.84(c)(2)) and

(3) Design and construction technologies for minimizing impingement mortality must be selected if certain conditions exist where the cooling water intake structure is located 125.84(c)(3); and design and construction technologies for minimizing entrainment must be selected and implemented. (40 CFR 125.84(c)(4))

Under Track II, new facilities must meet the following requirements:

(1) Employ technologies that will reduce the level of adverse environmental impact to a comparable level to that which would be achieved under the Track I requirements (as demonstrated in a Comprehensive Demonstration Study); (40 CFR 125.84(d)(1))

(2) The same proportional intake flow limitations as in Track I, based on the intake source water, must be met; (40 CFR 125.84(d)(2)).

Section IV.B and V. of this preamble provides a more detailed discussion of the requirements included under this two-track approach. The two-track approach provides new facilities with a well-defined set of requirements that constitute best technology available (BTA) for minimizing adverse environmental impact and can be implemented relatively quickly. This approach also provides flexibility to operators who believe alternative or emerging technologies would be just as effective at reducing impingement and entrainment.

## II. Legal Authority, Purpose and Background of Today's Regulation

### *A. Legal Authority*

Today's final rule is issued under the authority of sections 101, 301, 304, 306, 308, 316, 401, 402, 501, and 510 of the Clean Water Act (CWA), 33 U.S.C. 1251, 1311, 1314, 1316, 1318, 1326, 1341, 1342, 1361, and 1370. This rule partially fulfills the obligations of the U.S. Environmental Protection Agency (EPA) under a consent decree in *Riverkeeper Inc., et al.* v. *Whitman*, United States District Court, Southern District of New York, No. 93 Civ. 0314 (AGS).

### *B. Purpose of Today's Regulation*

Section 316(b) of the CWA provides that any standard established pursuant to section 301 or 306 of the CWA and applicable to a point source must require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impact. Today's final rule defines a cooling water intake structure as the total physical structure, including the pumps, and any associated constructed waterways used to withdraw water from waters of the U.S. Cooling water absorbs waste heat from processes employed or from auxiliary operations on a facility's premises. Single cooling water intake structures might have multiple intake bays. Today's final rule establishes requirements applicable to the location, design, construction, and capacity of cooling water intake structures at new facilities that withdraw at least two (2) million gallons per day (MGD) and use at least twenty-five (25) percent of the water they withdraw for cooling purposes. Today's final rule establishes best technology available for minimizing adverse environmental impact associated with the intake of water from waters of the U.S. at these structures. See part III for further discussion of the environmental impact associated with cooling water intake structures.

### *C. Background*

#### 1. The Clean Water Act

The Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), 33 U.S.C. 1251 *et seq.*, seeks to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." 33 U.S.C. 1251(a). The CWA establishes a comprehensive regulatory program, key elements of which are (1) a prohibition on the discharge of pollutants from point sources to waters of the U.S., except as authorized by the statute; (2) authority for EPA or authorized States or Tribes to issue National Pollutant Discharge Elimination System (NPDES) permits that regulate the discharge of pollutants; and (3) requirements for EPA to develop effluent limitation guidelines and standards and for States to develop water quality standards that are the basis for the limitations required in NPDES permits.

Today's final rule implements section 316(b) of the CWA as it applies to "new facilities" as defined in this rule. 316(b) addresses the adverse environmental impact caused by the intake of cooling water, not discharges into water. Despite this special focus, the requirements of section 316(b) are closely linked to several of the core elements of the NPDES permit program established under section 402 of the CWA to control discharges of pollutants into navigable waters. For example, section 316(b) applies to facilities that withdraw water from the waters of the United States for cooling through a cooling water intake structure and are point sources subject to an NPDES permit. Conditions implementing section 316(b) are included in NPDES permits and will continue to be included in NPDES permits under this final rule.

Section 301 of the CWA prohibits the discharge of any pollutant by any person, except in compliance with specified statutory requirements. These requirements include compliance with technology-based effluent limitation guidelines and new source performance standards, water quality standards,

NPDES permit requirements, and certain other requirements.

Section 402 of the CWA provides authority for EPA or an authorized State or Tribe to issue an NPDES permit to any person discharging any pollutant or combination of pollutants from a point source into waters of the U.S. Forty-four States and one U.S. territory are authorized under section 402(b) to administer the NPDES permitting program. NPDES permits restrict the types and amounts of pollutants, including heat, that may be discharged from various industrial, commercial, and other sources of wastewater. These permits control the discharge of pollutants primarily by requiring dischargers to meet effluent limitations and other permit conditions. Effluent limitations may be based on promulgated federal effluent limitation guidelines, new source performance standards, or the best professional judgment of the permit writer. Limitations based on these guidelines, standards, or best professional judgment are known as technology-based effluent limits. Where technology-based effluent limits are inadequate to ensure compliance with water quality standards applicable to the receiving water, more stringent effluent limits based on applicable water quality standards are required. NPDES permits also routinely include monitoring and reporting requirements, standard conditions, and special conditions.

Sections 301, 304, and 306 of the CWA require that EPA develop technology-based effluent limitation guidelines and new source performance standards that are used as the basis for technology-based minimum discharge requirements in wastewater discharge permits. EPA issues these effluent limitation guidelines and standards for categories of industrial dischargers based on the pollutants of concern discharged by the industry, the degree of control that can be attained using various levels of pollution control technology, consideration of various economic tests appropriate to each level of control, and other factors identified in sections 304 and 306 of the CWA (such as non-water quality environmental impacts including energy impacts). EPA has promulgated regulations setting effluent limitation guidelines and standards under sections 301, 304, and 306 of the CWA for more than 50 industries. See 40 CFR parts 405 through 471. Among these, EPA has established effluent limitation guidelines that apply to most of the industry categories that use cooling water intake structures (e.g., steam electric power generation, iron and steel manufacturing, pulp and paper manufacturing, petroleum refining, chemical manufacturing).

Section 306 of the CWA requires that EPA establish discharge standards for new sources. For purposes of section 306, new sources include any source that commenced construction after the promulgation of applicable new source performance standards, or after proposal of applicable standards of performance if the standards are promulgated in accordance with section 306 within 120 days of proposal. CWA section 306; 40 CFR 122.2. New source performance standards are similar to the technology-based limitations established for existing sources, except that new source performance standards are based on the best available demonstrated technology instead of the best available technology economically achievable. New facilities have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. Therefore, Congress directed EPA to consider the best demonstrated process changes, in-plant controls, and end-of-process control and treatment technologies that reduce pollution to the maximum extent feasible. In addition, in establishing new source performance standards, EPA is required to take into consideration the cost of achieving the effluent reduction and any non-water quality environmental impacts and energy requirements. As stated above, a "new source" under CWA section 306 applies to a broader set of facilities than the group of facilities subject to this rule.

2. Consent Decree

Today's final rule partially fulfills EPA's obligation to comply with an amended Consent Decree entered in the United States District Court, Southern District of New York, in *Riverkeeper Inc., et al.* v. *Whitman*, No. 93 Civ 0314 (AGS), a case brought against EPA by a coalition of individuals and environmental groups. The consent decree as entered on October 10, 1995, provided that EPA propose regulations implementing section 316(b) by July 2, 1999, and take final action with respect to those regulation by August 13, 2001. Under subsequent orders and an amended consent decree, EPA has divided the rulemaking into three phases and is working under new deadlines. In addition to taking final action on this rule governing new facilities by November 9, 2001, EPA must propose regulations for, at a minimum, existing power plants that use large volumes of cooling water by February 28, 2002, and take final action 18 months later. EPA must propose regulations for, at a minimum, smaller-flow power plants and factories in four industrial sectors (pulp and paper making, petroleum and coal products manufacturing, chemical and allied manufacturing, and primary metal manufacturing) by June 15, 2003.

3. What Prior EPA Rulemakings Addressed Cooling Water Intake Structures?

In April 1976 EPA published a rule under section 316(b) that addressed cooling water intake structures. 41 *FR* 17387 (April 26, 1976), proposed at 38 *FR* 34410 (December 13, 1973). The rule added a new § 401.14 to 40 CFR Chapter I that reiterated the requirements of CWA section 316(b). It also added a new part 402, which included three sections: (1) § 402.10 (Applicability), (2) § 402.11 (Specialized definitions), and (3) § 402.12 (Best technology available for cooling water intake structures). Section 402.10 stated that the provisions of part 402 applied to "cooling water intake structures for point sources for which effluent limitations are established pursuant to section 301 or standards of performance are established pursuant to section 306 of the Act." Section 402.11 defined the terms "cooling water intake structure," "location," "design," "construction," "capacity," and "Development Document." Section 402.12 included the following language:

> The information contained in the Development Document shall be considered in determining whether the location, design, construction, and capacity of a cooling water intake structure of a point source subject to standards established under section 301 or 306 reflect the best technology available for minimizing adverse environmental impact.

In 1977, fifty-eight electric utility companies challenged these regulations, arguing that EPA had failed to comply with the requirements of the Administrative Procedure Act (APA) in promulgating the rule. Specifically, the utilities argued that EPA had neither published the development document in the **Federal Register** nor properly incorporated the document into the rule by reference. The United States Court of Appeals for the Fourth Circuit agreed and, without reaching the merits of the regulations themselves, remanded the rule. *Appalachian Power Co.* v. *Train*, 566 F.2d 451 (4th Cir. 1977). EPA later withdrew part 402. 44 *FR* 32956 (June 7, 1979). 40 CFR 401.14 remains in effect.

4. How Is Section 316(b) Being Implemented Now?

Since the Fourth Circuit remanded EPA's section 316(b) regulations in 1977, NPDES permit authorities have made decisions implementing section 316(b) on a case-by-case, site-specific basis. EPA published draft guidance addressing section 316(b) implementation in 1977. See *Draft Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) P.L. 92–500* (U.S. EPA, 1977). This draft guidance describes the studies recommended for evaluating the impact of cooling water intake structures on the aquatic environment and recommends a basis for determining the best technology available for minimizing adverse environmental impact. The 1977 section 316(b) draft guidance states, "The environmental-intake interactions in question are highly site-specific and the decision as to best technology available for intake design, location, construction, and capacity must be made on a case-by-case basis." (Section 316(b) Draft Guidance, U.S. EPA, 1977, p. 4). This case-by-case approach also is consistent with the approach described in the 1976 development document referenced in the remanded regulation.

The 1977 section 316(b) draft guidance suggests the general process for developing information needed to support section 316(b) decisions and presenting that information to the permitting authority. The process involves the development of a site-specific study of the environmental effects associated with each facility that uses one or more cooling water intake structures, as well as consideration of that study by the permitting authority in determining whether the facility must make any changes for minimizing adverse environmental impact. Where adverse environmental impact is present, the 1977 draft guidance suggests a stepwise approach that considers screening systems, size, location, capacity, and other factors.

Although the draft guidance describes the information that should be developed, key factors that should be considered, and a process for supporting section 316(b) determinations, it does not establish national standards based on the best technology available for minimizing adverse environmental impact. Rather, the guidance leaves the decisions on the appropriate location, design, capacity, and construction of each facility to the permitting authority. Under this framework, the Director determines whether appropriate studies have been performed and whether a given facility has minimized adverse environmental impact. The Director's determinations of whether the appropriate studies have been performed or whether a given facility has minimized adverse environmental impact have often been subject to challenges that can take a long time to resolve and may impose significant resource demands on permitting agencies, the public, and the permit applicant.

5. Proposed New Facility Rule

On August 10, 2000, EPA published proposed requirements for cooling water intake structures at new facilities to implement section 316(b) of the Clean Water Act. EPA proposed a tiered approach for reducing adverse environmental impact, with three degrees of stringency based on EPA's view of the relative vulnerability of each category of waterbody. EPA received numerous comments and data submissions concerning the proposal. See 65 *FR* 49060.

6. Notice of Data Availability

On May 25, 2001, EPA published a Proposed Rule Notice of Data Availability (NODA). This notice presented a summary of the data EPA had received or collected since proposal, an assessment of the relevance of the data to EPA's analysis, some modified technology options suggested by commenters, and an alternative regulatory approach suggested by a trade group representing the utility industry as well as EPA's ideas about how it might modify this suggested approach. See 66 *FR* 28853. On July 6, 2001, EPA reopened the comment period for certain documents and issues related to those documents. See 66 *FR* 35572.

7. Public Participation

EPA has worked extensively with stakeholders from the industry, public interest groups, State agencies, and other Federal agencies in the development of this final rule. In addition to comments received during the comment periods of the original proposal, the NODA, and the reopened comment period for certain documents referenced in the NODA, EPA conducted two public meetings: in June 1998, in Arlington, Virginia (63 *FR* 27958) and in September, 1998, in Alexandria, Virginia (63 *FR* 40683). In addition, in September 1998, EPA staff participated in a technical workshop sponsored by the Electric Power Research Institute on issues relating to the definition and assessment of adverse environmental impact. EPA staff have participated in other industry conferences, met upon request on numerous occasions with industry representatives, and met on a number of occasions with representatives of environmental groups. EPA has also met with stakeholders, attended conferences and held workshops concerning topics related to the existing source rulemaking effort.

In the months leading up to publication of the proposed rule, EPA conducted a series of stakeholder meetings to review the draft regulatory framework for the proposed rule and invited stakeholders to provide their recommendations for the Agency's consideration. EPA managers have met with the Utility Water Act Group, Edison Electric Institute, representatives from an individual utility, and with representatives from the petroleum refining, pulp and paper, and iron and steel industries. EPA conducted meetings with environmental groups attended by representatives from between 3 and 15 organizations. EPA also met with the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) and, with the assistance of ASIWPCA, conducted a conference call in which representatives from 17 states or interstate organizations participated. After publication of the proposed rule, EPA continued to meet with stakeholders at their request. These meetings are summarized in the record.

## III. Environmental Impact Associated With Cooling Water Intake Structures

The proposed rule provided an overview of the magnitude and type of environmental impacts associated with cooling water intake structures, including several illustrative examples of documented environmental impacts at existing facilities (see 65 *FR* 49071 through 4). The majority of biological impacts associated with intake structures are closely linked to water withdrawals from the various waters in which the intakes are located.

Based on preliminary estimates from a questionnaire sent to more than 1,200 existing power plants and factories, industrial facilities in the United States withdraw more than 279 billion gallons of cooling water a day from waters of the U.S. The withdrawal of such large quantities of cooling water affects vast quantities of aquatic organisms annually, including phytoplankton (tiny, free-floating photosynthetic organisms suspended in the water column), zooplankton (small aquatic animals, including fish eggs and larvae, that consume phytoplankton and other

zooplankton), fish, crustaceans, shellfish, and many other forms of aquatic life. Aquatic organisms drawn into cooling water intake structures are either impinged on components of the cooling water intake structure or entrained in the cooling water system itself.

Impingement takes place when organisms are trapped against intake screens by the force of the water passing through the cooling water intake structure. Impingement can result in starvation and exhaustion (organisms are trapped against an intake screen or other barrier at the entrance to the cooling water intake structure), asphyxiation (organisms are pressed against an intake screen or other barrier at the entrance to the cooling water intake structure by velocity forces that prevent proper gill movement, or organisms are removed from the water for prolonged periods of time), and descaling (fish lose scales when removed from an intake screen by a wash system) and other physical harms.

Entrainment occurs when organisms are drawn through the cooling water intake structure into the cooling system. Organisms that become entrained are normally relatively small benthic,[1] planktonic,[2] and nektonic[3] organisms, including early life stages of fish and shellfish. Many of these small organisms serve as prey for larger organisms that are found higher on the food chain. As entrained organisms pass through a plant's cooling system they are subject to mechanical, thermal, and/or toxic stress. Sources of such stress include physical impacts in the pumps and condenser tubing, pressure changes caused by diversion of the cooling water into the plant or by the hydraulic effects of the condensers, sheer stress, thermal shock in the condenser and discharge tunnel, and chemical toxemia induced by antifouling agents such as chlorine. The mortality rate of entrained organisms varies by species and can be high under normal operating conditions.[4] [5] In the case of either impingement or entrainment, a substantial number of aquatic organisms are killed or subjected to significant harm.

In addition to impingement and entrainment losses associated with the operation of the cooling water intake structure, EPA is concerned about the cumulative overall degradation of the aquatic environment as a consequence of (1) multiple intake structures operating in the same watershed or in the same or nearby reaches and (2) intakes located within or adjacent to an impaired waterbody. Historically, impacts related to cooling water intake structures have been evaluated on a facility-by-facility basis. The potential cumulative effects of multiple intakes located within a specific waterbody or along a coastal segment are largely unknown (one relevant example is provided for the Hudson River; see discussion below). There is concern, however, about the effects of multiple intakes on fishery stocks. As an example, the Atlantic States Marine Fisheries Commission has been requested by its member States to investigate the cumulative impacts on commercial fishery stocks, particularly overutilized stocks, attributable to cooling water intakes located in coastal regions of the Atlantic.[6] Specifically, the study will focus on revising existing fishery management models so that they accurately consider and account for fish losses from intake structures.

EPA analyses suggest that over 99 percent of the existing facilities with cooling water withdrawal that EPA surveyed in its section 316(b) survey of existing facilities are located within 2 miles of waters that are identified as impaired and listed by a State or Tribe as needing development of a total maximum daily load (TMDL) to restore the waterbody to its designated use. EPA notes that the top four leading causes of waterbody impairment (siltation, nutrients, bacteria, and metals) affect the aquatic life uses of a waterbody. The Agency believes that cooling water intakes potentially contribute additional stress to waters already showing aquatic life impairment from other sources such as industrial discharges and urban stormwater.

EPA is also concerned about the potential impacts of cooling water intake structures located in or near habitat areas that support threatened, endangered, or other protected species. Although limited information is available on locations of threatened or endangered species that are vulnerable to impingement or entrainment, such impacts do occur. For example, EPA is aware that from 1976 to 1994, approximately 3,200 threatened or endangered sea turtles entered enclosed cooling water intake canals at the St. Lucie Nuclear Generating Plant in Florida.[7] The plant developed a capture-and-release program in response to these events. Most of the entrapped turtles were captured and released alive; however, approximately 160 turtles did not survive. More recently, the number of sea turtles being drawn into the intake canal increased to approximately 600 per year; this increase led to a requirement for barrier nets to minimize entrapment.

Finally, in the proposed rule EPA expressed concern about environmental impacts associated with the construction of new cooling water intake structures. Three main factors contribute to the environmental impacts: displacement of biota and habitat resulting from the physical placement of a new cooling water intake structure in an aquatic environment, increased levels of turbidity in the aquatic environment, and effects on biota and habitat associated with aquatic disposal of materials excavated during construction. Existing programs, such as the CWA section 404 program, National Environmental Policy Act (NEPA) program, and programs under State/Tribal law, include requirements that address many of the environmental impact concerns associated with the construction of new intakes (see Section VII. G for applicable Federal statutes). EPA recognizes that impacts related to construction of cooling water intake structures can occur and defers to the regulatory authority provided within the above-listed programs to evaluate the potential for impacts and minimize their extent.

In the proposed rule and NODA, EPA provided a number of examples of impingement and entrainment impacts that can be associated with existing facilities. It is important to note that these examples were *not* meant to predict effects at new facilities but rather to illustrate that the number of organisms impinged and entrained by a facility can be substantial. EPA also

[1] Refers to bottom dwellers that are generally small and sessile (attached) such as mussels and anemones, but can include certain large motile (able to move) species such as crabs and shrimp. These species can be important members of the food chain.

[2] Refers to free-floating microscopic plants and animals, including the egg and larval stages of fish and invertebrates that have limited swimming abilities. Plankton are also an important source of food for other aquatic organisms and an essential component of the food chain in aquatic ecosystems.

[3] Refers to free-swimming organisms (e.g., fish, turtles, marine mammals) that move actively through the water column and against currents.

[4] Mayhew, D.A., L.D. Jensen, D.F. Hanson, and P.H. Muessig. 2000. A comparative review of entrainment survival studies at power plants in estuarine environments. *Environmental Science and Policy* 3:S295–S301.

[5] EPRI. 2000. Review of entrainment survival studies: 1970–2000. Prepared by EA Engineering Science and Technology for the Electric Power Research Institute, Palo Alto, CA.

[6] Personal communication, telephone conversation between D. Hart (EPA) and L. Kline (ASMFC), 2001.

[7] Florida Power and Light Company. 1995. Assessment of the impacts at the St. Lucie Nuclear Generating Plant on sea turtle species found in the inshore waters of Florida.

notes that these are examples of the types of impacts that may occur without controls, that these examples are not representative of all sites whose facilities use cooling water intake structures, and that these examples may not reflect subsequent action that may have been taken to address these impacts on a site-specific basis. With these notes, EPA provides the following examples, illustrating that the impacts attributable to impingement and entrainment at individual facilities may result in appreciable losses of early life stages of fish and shellfish (*e.g.*, three to four billion individuals annually [8]), serious reductions in forage species and recreational and commercial landings (*e.g.*, 23 tons lost per year [9]), and extensive losses over relatively short intervals of time (*e.g.*, one million fish lost during a three-week study period [10]).

Further, some studies estimating the impact of impingement and entrainment on populations of key commercial or recreational fish have predicted substantial declines in population size. This has lead to concerns that some populations may be altered beyond recovery. For example, a modeling effort evaluating the impact of entrainment mortality on a representative fish species in the Cape Fear estuarine system predicted a 15 to 35 percent reduction in the species population.[11]

In addition, studies of entrainment at five Hudson River power plants during the 1980s predicted year-class reductions ranging from six percent to 79 percent, depending on the fish species.[12] An updated analysis of entrainment at three of these power plants predicted year-class reductions of up to 20 percent for striped bass, 25 percent for bay anchovy, and 43 percent for Atlantic tom cod, even without assuming 100 percent mortality of entrained organisms.[13] The New York Department of Environmental Conservation concluded that these reductions in year-class strength were "wholly unacceptable" and that any "compensatory responses to this level of power plant mortality could seriously deplete any resilience or compensatory capacity of the species needed to survive unfavorable environmental conditions."[14]

The following are summaries of other, documented examples of impacts occurring at existing facilities sited on a range of waterbody types. Also, see the discussion of the benefits of today's final rule in Section IX.

*Brayton Point Generating Station.* The Brayton Point Generating Station is located on Mt. Hope Bay, in Somerset, Massachusetts, within the northeastern reach of Narragansett Bay. Because of problems with electric arcing caused by salt drift and lack of fresh water for the closed-cycle recirculating cooling water system, the company converted Unit 4 from a closed-cycle, recirculating system to a once-through cooling water system in July 1984. The modification of Unit 4 resulted in a 41 percent increase in coolant flow, amounting to an intake flow of approximately 1.3 billion gallons per day and increased thermal discharge to the bay.[15] An analysis of fisheries data by the Rhode Island Division of Fish and Wildlife using a time series-intervention model showed an 87 percent reduction in finfish abundance in Mt. Hope Bay coincident with the Unit 4 modification.[16] The analysis also indicated that, in contrast, species abundance trends have been relatively stable in adjacent coastal areas and portions of Narragansett Bay that are not influenced by the operation of Brayton Point station.

*San Onofre Nuclear Generating Station.* The San Onofre Nuclear Generating Station (SONGS) is located on the coastline of the Southern California Bight, approximately 2.5 miles southeast of San Clemente, California.[17] The marine portions of Units 2 and 3, which are once-through, open-cycle cooling systems, began commercial operation in August 1983 and April 1984, respectively.[18] Since then, many studies evaluated the impact of the SONGS facility on the marine environment.

In a normal (non-El Niño) year, an estimated 121 tons of midwater fish (primarily northern anchovy, queenfish, and white croaker) are entrained at SONGS, of which at least 57 percent are killed during plant passage.[19] The fish lost include approximately 350,000 juveniles of white croaker, a popular sport fish; this number represents 33,000 adult individuals or 3.5 tons of adult fish. Within 3 kilometers of SONGS, the density of queenfish and white croaker in shallow-water samples decreased by 34 and 36 percent, respectively. Queenfish declined by 50 to 70 percent in deepwater samples.[20] A subsequent EPA review of the SONGS 316(b) demonstration concluded that although the plant incorporated technologies for minimizing adverse environmental impact, operations at SONGS cause adverse impacts to organisms in the cooling water system and to biological populations and communities in the vicinity of the intake and discharge locations for the plant.[21] These effects included mortality of fish, especially losses of millions of eggs and larvae, that are taken into the plant with cooling water and creation of a sometimes turbid plume that affects kelp, fish, and invertebrates in the San Onofre kelp bed.[22]

*Pittsburg and Contra Costa Power Plants.* The Pittsburg and Contra Costa Power Plants are located in the San Francisco Estuary, California. Because the San Francisco Bay Delta ecosystem has changed dramatically over the past century, several local species (e.g., Delta smelt, Sacramento splittail, chinook salmon, and steelhead) have been listed as threatened or endangered. Facility estimates for one of these species.

[8] EPA Region IV. 1979. Brunswick Nuclear Steam Electric Generating Plant of Carolina Power and Light Company, historical summary and review of section 316(b) issues.

[9] EPA Region IV. 1986. Findings and determination under 33 U.S.C. 1326, In the Matter of Florida Power Corporation Crystal River Power Plant Units 1, 2, and 3, NPDES permit no. FL0000159.

[10] Thurber, N.J and D. J. Jude. 1985. Impingement losses at the D.C. Cook Nuclear Power Plant during 1975–1982 with a discussion of factors responsible and possible impact on local populations. Special report no. 115 of the Great Lakes Research Division, Great Lakes and Marine Waters Center, University of Michigan.

[11] EPA Region IV. 1979. Brunswick Nuclear Steam Electric Generating Plant of Carolina Power and Light Company, historical summary and review of section 316(b) issues.

[12] Boreman J. and P. Goodyear. 1988. Estimates of entrainment mortality for striped bass and other fish species inhabiting the Hudson River Estuary. *American Fisheries Society Monograph* 4:152–160.

[13] Consolidated Edison Company of New York. 2000. Draft environmental impact statement for the state pollutant discharge elimination system permits for Bowline Point, Indian Point 2 & 3, and Roseton steam electric generating stations.

[14] New York Department of Environmental Conservation (NYDEC). 2000. Internal memorandum provided to the USEPA on NYDEC's position on SPDES permit renewals for Roseton, Bowline Point 1 & 2, and Indian Point 2 & 3 generating stations.

[15] Metcalf & Eddy. 1992. Brayton Point station monitoring program technical review. Prepared for USEPA.

[16] Gibson, M. 1995 (revised 1996). Comparison of trends in the finfish assemblages of Mt. Hope Bay and Narragansett Bay in relation to operations of the New England Power Brayton Point station. Rhode Island Division of Fish and Wildlife, Marine Fisheries Office.

[17] Southern California Edison. 1988. Report on 1987 data: marine environmental analysis and interpretation, San Onofre Nuclear Generating Station.

[18] Ibid.

[19] Swarbrick, S. and R.F. Ambrose. 1989. Technical report C: entrapment of juvenile and adult fish at SONGS. Prepared for Marine Review Committee.

[20] Kastendiek, J. and K. Parker. 1989. Interim technical report: midwater and benthic fish. Prepared for Marine Review Committee.

[21] SAIC. 1993. Draft review of Southern California Edison, San Onofre Nuclear Generating Station (SONGS) 316(b) demonstration. Prepared for USEPA Region IX.

[22] Ibid.

chinook salmon, indicate that the Pittsburg and Contra Costa intakes have the potential to impinge and entrain up to 36,567 chinook salmon each year.[23] Based on restoration costs, EPA estimates that losses for this species alone can be valued at $25–40 million per year.

*Power Plants with Flows Less Than 500 MGD.* The following information from facility studies documents impingement and entrainment losses for facilities with lower flows than the previous examples:

1. The Pilgrim Nuclear Power Station, located on Cape Cod Bay, Massachusetts, has an intake flow of 446 MGD.[24] The average annual total losses of fish (all life stages) was 26,800 due to impingement and 3.92 billion due to entrainment[25]

2. The Coleman Power Plant, located on the Ohio River in Henderson, Kentucky, has an intake flow of 337 MGD[25] and combined average impingement and entrainment losses of 702,630,800 fish per year (30,800 impinged and 702,600,000 entrained).[26]

Existing and historical studies like those described in this section may provide only a partial picture of the severity of environmental impact associated with cooling water intake structures. Most important, the methods for evaluating adverse environmental impact used in the 1970s and 1980s, when most section 316(b) evaluations were performed, were often inconsistent and incomplete, making detection and consideration of all impacts difficult in some cases, and making cross-facility comparison difficult for developing a national rule. For example, some studies reported only gross fish losses; others reported fish losses on the basis of species and life stage; still others reported percent losses of the associated population or subpopulation (e.g., young-of-year fish). Recent advances in environmental assessment techniques provide new and in some cases better tools for monitoring impingement and entrainment and detecting impacts associated with the operation of cooling water intake structures.[27] [28] EPA acknowledges that these new assessment techniques may in some cases provide additional rather than better tools and perspectives.

[23] Southern Energy. 2000. Habitat conservation plan for the Pittsburg and Contra Costa Power Plants.

[24] Edison Electric Institute. 1994. EEI Power Statistics Database. Prepared by the Utility Data Institute.

[25] Data compiled by EPA from annual reports of impingement and entrainment losses from the Pilgrim Nuclear Power Station for the years 1991–1999.

[26] Hicks, D.B. 1977. Statement of findings for the Coleman Power Plant, Henderson, Kentucky.

[27] Schmitt, R.J. and C.W. Osenberg. 1996. *Detecting Ecological Impacts.* Academic Press, San Diego, CA.

[28] EPRI. 1999. Catalog of assessment methods for evaluating the effects of power plant operations on aquatic communities. TR–112013, EPRI, Palo Alto, CA.

## IV. Summary of the Most Significant Revisions to the Proposed Rule

### *A. Data Updates*

#### 1. Number and Characteristics of New Facilities

Chapter 5 of the *Economic Analysis* provides a detailed discussion of the data and methodology used to estimate the number of new electric generating facilities and new manufacturing facilities subject to the final section 316(b) new facility rule. This section provides a summary of primary revisions to the analyses since the proposal. The section discusses new combined-cycle facilities, new coal facilities, and new manufacturing facilities separately.

##### a. New Combined-Cycle Facilities

The general approach for estimating the number of new combined-cycle facilities subject to the final section 316(b) new facility rule has not changed since proposal. However, and as discussed in the notice of data availability (NODA), EPA has used new data, which have become available since the proposal, to update the analysis. As a result, the number of new combined-cycle facilities now projected to be in scope of this rule has increased from 24 in the proposed rule analysis to 69 in the updated analysis for the final rule.

##### (1) Proposed Rule

For the proposal analysis, EPA used a three-step approach to estimating the number of new combined-cycle facilities: (1) Determination of future combined-cycle capacity additions; (2) estimation of the percentage of all regulated combined-cycle facilities that are in-scope; and (3) estimation of the number of new facilities. EPA used the *Annual Energy Outlook 2000* (AEO2000), prepared and published by the Energy Information Administration (EIA) of the U.S. Department of Energy, as the basis for the projected number of new in-scope combined-cycle facilities. The AEO2000 forecast 131 gigawatts (GW) of new combined-cycle capacity to begin operation between 2001 and 2020. Since the AEO does not have any information on the number of new facilities, their size, or their cooling water characteristics, EPA used the January 2000 version of Resource Data International's NEWGen Database to determine the in-scope percentage of new combined-cycle facilities and their facility and cooling water characteristics.

In the January 2000 NEWGen database, 94 of 466 projects met the following screening criteria: (1) New facility; (2) located in the United States; (3) active project (*i.e.*, not canceled or tabled); (4) anticipated date of initial commercial operation after August 13, 2001; and (5) steam electric prime mover. All 94 facilities were included in the analysis of new combined-cycle facilities. EPA then consulted permitting authorities, other public agencies, and company websites to obtain data on the planned facility cooling water use. EPA obtained sufficient data to assess the in-scope status for 56 of the 94 facilities. Seven of the 56 facilities, or 12.5 percent, were found to be in scope of the proposed rule; 49 were found to be out of scope. To estimate the total number of new in-scope combined-cycle facilities projected to begin operation between 2001 and 2020, EPA applied the average facility size of the seven in-scope NEWGen facilities (723 MW) and the in-scope percentage (12.5 percent) to EIA's forecast of new combined-cycle capacity additions. EPA made the conservative assumption that all new combined-cycle capacity would be built at new facilities rather than at existing facilities. These calculations resulted in an estimate of 24 new in-scope combined-cycle facilities over the 2001–2020 period (see also Exhibit 1 below).

##### (2) Final Rule

For the final rule analysis and as discussed in the NODA, EPA used the same general methodology but obtained updated information. In particular, EPA used the forecast of capacity additions from the U.S. Department of Energy's *Annual Energy Outlook* (AEO2001) and the February 2001 NEWGen Database. AEO2001's forecast of new combined-cycle capacity additions between 2001 and 2020 was 204 GW, compared with 131 GW in the AEO2000. Similarly, the February 2001 NEWGen Database contains considerably more new energy projects than the version used for the proposed rule analysis: The database contains 941 new projects, of which 361 met the screening criteria discussed above. Of the 361 facilities, 320 are combined-cycle facilities. To increase the number of facilities upon which facility and cooling water use characteristics are based, EPA excluded the anticipated date of initial commercial operation as a screening criterion. The analysis for the final rule

therefore includes all facilities that meet the other four screening criteria, even if a facility will already have begun construction when the rule is promulgated and will therefore not be subject to the final rule.

EPA again consulted permitting authorities, other public agencies, and company websites to obtain data on the facilities' planned cooling water use. EPA obtained sufficient data to assess the cooling water characteristics for 199 of the 320 combined-cycle facilities. Of the 199 facilities, 57, or 28.6 percent, were found to be in scope of the final rule; 142 were found to be out of scope. The average size of all 199 facilities with cooling water information was approximately 741 MW. The average size of the 57 in-scope facilities was 747 MW. EPA made one other revision in estimating the total number of new in-scope combined-cycle facilities projected to begin operation between 2001 and 2020: Instead of assuming that all new combined-cycle capacity would be built at new facilities, EPA used information on combined-cycle capacity additions at existing facilities from the NEWGen Database to determine the actual share of capacity that will be built at new facilities. The database showed that 88 percent of new combined-cycle capacity is proposed at new facilities. EPA used the Department of Energy's estimate of new combined-cycle capacity additions (204 GW) and multiplied it by the percentage of capacity that will be built at new facilities (88 percent) to determine that 179 GW of new capacity will be constructed at new facilities. EPA then divided this value by the average facility size (741 MW) to determine that there would be a total of 241 potential new combined-cycle facilities (both in scope and out of scope of today's final rule). Finally, on the basis of EPA's estimate of the percentage of facilities that meet the two (2) MGD flow threshold (28.6 percent), EPA now estimates there will be 69 new in-scope combined-cycle facilities over the 2001–2020 period. Exhibit 1 summarizes the data differences for combined-cycle facilities between the proposal and the final rule analyses.

EXHIBIT 1.—SUMMARY OF COMBINED-CYCLE FACILITY RESEARCH (2001 TO 2020)

| Information category | Proposed rule analysis | Final rule analysis |
|---|---|---|
| AEO2000 combined-cycle capacity additions | 135 GW[a] | |
| AEO2001 combined-cycle capacity additions | | 204 GW |
| Percentage of combined-cycle capacity additions from new facilities | 100% | 88% |
| Capacity additions from new facilities | 135 GW | 179 GW |
| Average size of all combined-cycle facilities | 723 MW | 741 MW |
| Total number of new combined-cycle facilities | 187 | 241 |
| In-scope percentage | 12.5% | 28.6% |
| Number of new in-scope combined-cycle facilities | 24 | 69 |
| Average size of in-scope combined-cycle facilities | 723 MW | 747 MW |

[a] Includes 4 GW of new coal capacity additions for 2001–2010.

The final step in the costing analysis for the final rule was to project cooling water characteristics of the 69 new in-scope combined-cycle facilities on the basis of the characteristics of the 57 in-scope NEWGen facilities. EPA developed six model facility types based on three main characteristics: (1) The facility's type of cooling system (once-through or recirculating system); (2) the type of water body from which the intake structure withdraws (freshwater or marine water); and (3) the facility's steam-electric generating capacity. The model facility characteristics were then applied to the 69 projected new combined-cycle facilities. EPA estimated that 64 new in-scope combined-cycle facilities will employ a recirculating system and only five will employ a once-through system. Of the 64 facilities with a recirculating system, 58 will withdraw from a freshwater body and six will withdraw from a marine water body. All five facilities with a once-through system are projected to withdraw from a marine water body.

b. New Coal Facilities

The general approach for estimating the number of new coal facilities subject to this final rule has not changed since proposal. However, as discussed in the NODA, EPA has used new data, which have become available since the proposal, to update the analysis. As a result, the number of new coal facilities projected to be in scope of this rule, decreased slightly, from 16 in the proposed rule analysis to 14 in the final rule analysis. However, most of the new in-scope coal facilities are now expected to begin operation earlier than under the proposal analysis.

(1) Proposed Rule

For the years 2001–2010, the AEO2000 projected limited new coal-fired steam electric generating capacity. In addition, the January 2000 NEWGen Database included no new coal-fired generating facilities. EPA therefore did not project any new coal facilities for 2001–2010. For the years 2011–2020, EPA used EIA's projected new capacity addition from coal-fired facilities, 17 GW, and information from the following sources to estimate the number and cooling water characteristics of new coal-fired power facilities subject to the rule: Form EIA–767 (Steam Electric Plant Operation and Design Report, Energy Information Administration, U.S. Department of Energy, 1994, 1997); Form EIA–860 (Annual Electric Generator Report, Energy Information Administration, U.S. Department of Energy, 1994, 1997); and Power Statistics Database (Utility Data Institute, McGraw-Hill Company, 1994). EPA estimated that 16 new coal facilities of 800 MW each would be subject to the proposed section 316(b) new facility rule and would begin operation between 2011 and 2020. Of these, 12 were projected to operate a recirculating system in the baseline, while four were projected to operate a once-through system.

(2) Final Rule

EPA used a similar methodology for the final rule analysis but obtained updated information and added data from the section 316(b) industry survey of existing facilities *(Industry Screener Questionnaire: Phase I Cooling Water Intake Structures, Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures, and Industry Short Technical Questionnaire: Phase II Cooling Water Intake Structures)*. To be consistent with the analysis for combined-cycle facilities, EPA used the forecast of capacity additions from the

AEO2001, which predicts 22 GW of new coal capacity between 2001 and 2020. In contrast to the proposal analysis, EPA considered the entire 2001–2020 period for the final rule analysis. In addition, EPA used information from the section 316(b) industry survey to determine the average size, in-scope percentage, and cooling water characteristics of new coal plants. The three surveys identified 111 unique coal-fired facilities that began commercial operation between 1980 and 1999. The facilities have a combined generating capacity of 53 GW, with an average of 475 MW each. The surveys further showed that 45 of the 111 facilities, or 40.5 percent, would be in scope of today's final rule if they were new facilities. These 45 facilities have an average generating capacity of 763 MW.

Information in the February 2001 version of the NEWGen Database on capacity additions at new and existing facilities showed that approximately 76 percent of new coal capacity will be built at new facilities. Applying this percentage (76 percent), as well as the average facility size (475 MW) and the in-scope percentage (40.5 percent), to EIA's forecast of new coal capacity additions resulted in 14 new in-scope coal facilities, with an average capacity of 763 MW, over the 2001–2020 period. Exhibit 2 summarizes the data differences for coal facilities between the proposal and the final rule analyses.

EXHIBIT 2.—SUMMARY OF COAL FACILITY RESEARCH

| | Proposed rule analysis (2011–2020) | Final rule analysis (2001–2020) |
|---|---|---|
| AEO2000 coal capacity additions | 17 GW | |
| AEO2001 coal capacity additions | | 22 GW |
| Percentage of coal capacity additions from new facilities | 82% | 76% |
| Capacity additions from new faciliteis | 14 GW | 17 GW |
| Average size of all coal facilities | 800 MW | 475 MW |
| Total number of new coal facilities | 18 | 35 |
| In-scope percentage | 99.0% | 40.5% |
| Number of new in-scope coal facilities | 16 | 14 |
| Average size of in-scope coal facilities | 800 MW | 763 MW |

EPA projected cooling water characteristics of the 14 new in-scope coal facilities using data for recently-constructed plants from the section 316(b) industry survey. Similar to the combined-cycle facility analysis, EPA developed eight model facility types based on three main characteristics: (1) The facility's type of cooling system (once-though or recirculating system); (2) the type of water body from which the intake structure withdraws (freshwater or marine water); and (3) the facility's steam-electric generating capacity. The model facility characteristics were then applied to the 14 projected new coal facilities. EPA estimated that 10 new in-scope coal facilities will employ a recirculating system and three will employ a once-through system. One coal facility has a recirculating cooling pond and will exhibit characteristics more like a once-through facility. Of the10 facilities with a recirculating system, nine will withdraw from a freshwater body and only one facility will withdraw from a marine water body. All three facilities with a once-through system and the one facility with a cooling pond are projected to withdraw from a freshwater body.

c. Manufacturing Facilities

The general methodology used to estimate the number of new manufacturing facilities subject to the final section 316(b) new facility rule has not changed since proposal. However, on the basis of comments, EPA has altered some estimates and used new data to update the analysis. As a result, the number of new manufacturing facilities projected to be in scope of this rule has decreased from 58 at proposal to 38 in the final rule analysis.

(1) Proposed Rule

In the proposal analysis, EPA used three industry-specific estimates to project the number of new in-scope manufacturing facilities: (1) Industry growth forecasts; (2) the estimated percentage of the projected capacity growth accounted for by new facilities; and (3) data on the cooling water use at existing facilities. EPA used the projected growth of value of shipments in each industry to estimate likely future growth in capacity. A number of sources provided growth forecasts, including the annual U.S. Industry & Trade Outlook, *AEO2001*, and other sources specific to each industry. EPA assumed that the growth in capacity will equal growth in value of shipments, except where industry-specific information supported alternative assumptions. Not all industry growth, however, is expected to occur at new facilities: Some of the projected growth in capacity may result from increased utilization of existing capacity or capacity additions at existing facilities. Where information on the share of growth from new facilities was available, EPA used these data. For example, EIA projected that all increases in petroleum shipments will result from expanded capacity at existing facilities. Where this information was not available, EPA made the conservative estimate that 50 percent of the projected growth in capacity will be attributed to new facilities. Finally, EPA assumed that the cooling water use characteristics of new facilities in each industry, including the in-scope percentage, would be similar to those of existing facilities. Cooling water use data for existing facilities came from the *Industry Screener Questionnaire: Phase I Cooling Water Intake Structures*. To calculate the total number of new in-scope manufacturing facilities, EPA applied the industry-specific growth rate and the percentage of capacity growth from new facilities to the sample-weighted number of in-scope screener facilities in each industry.

(2) Final Rule

For the final rule analysis, EPA updated the projected growth in value of shipments for each industry using the most recent data available. On the basis of comments, three changes were made to the percentage of projected capacity growth that is attributed to new facilities. First, the American Chemistry Council stated that EPA overestimated the number of new in-scope chemical facilities in the proposal analysis because the percentage of growth that comes from new facilities (50 percent) was overstated. The comment did not provide a more accurate estimate. EPA

therefore revised this estimate for the chemical industry to 25 percent, which reduced the number of new chemical facilities by half. (The *Economic Analysis* documents the effect of using an alternative assumption of 37.5 percent, the midpoint between the proposal analysis estimate and the final rule analysis estimate, in analyzing the economic impacts of this rule.) Second, the petroleum industry commented that the assumption of no new petroleum refineries over the next 20 years is invalid. Even though the AEO2001 projects no new refineries in the United States, to be conservative EPA nevertheless revised this estimate and included two new in-scope petroleum refineries in the final rule analysis. Third, the American Forest & Paper Association stated that one or two new greenfield paper mills will be built over the next decade. EPA added two new in scope paper mills over the 20-year analysis period in response to this comment. In addition, EPA updated the water use characteristics of the projected new facilities by using data from the *Detailed Industry Questionnaire: Phase II Cooling Water Intake Structures instead of the Screener Questionnaire*. In the proposal analysis, EPA erroneously used the average daily intake flow rate, instead of the design intake flow rate, to determine whether a facility meets the two MGD flow threshold and is subject to the rule. Since the average intake flow is either lower than or equal to the design intake flow, this error likely underestimated the number of new in-scope manufacturing facilities. For the analysis of the final rule, EPA used the design intake flows reported in the section 316(b) industry survey.

Overall, because of the revisions described above, EPA's estimate of the number of new in-scope manufacturing facilities dropped from 58 at proposal to 38 in the cost analysis for this final rule.

2. Revisions to the Costing Estimates

Chapter 2 of the *Technical Development Document* provides a detailed description of the data and methodology used to develop compliance cost estimates for the final regulation. This section provides a summary of the main revisions in the costing inputs since the proposal.

At the time of the proposal, EPA included cost estimates for plume abatement at 50 percent of the electric generating facilities anticipated to install recirculating wet cooling towers to comply with the rule. This was an error. As described in the NODA (66 FR 28866 and 28867), EPA has since refined its estimates of cooling tower costs on a national basis to reflect plume abatement costs at a significantly lower proportion of facilities. EPA determined, on the basis of further research and information received from vendor manufacturers, that plume abatement measures were installed at only 3 to 4 percent of recent wet cooling tower projects. Therefore, the costing estimates for the final rule reflect this change.

At the time of the proposal, EPA included cost estimates for pumping of recirculating cooling water in the towers based on a flow rate equal to 15 percent of a comparable once-through cooling flow (based on the flow of make-up water). As explained in the NODA (66 FR 28866), this was an error. EPA has since refined its costing estimates to include the entire cooling flow. EPA's cost estimates for both capital and O&M costs for the final rule reflect appropriately sized pumps to recirculate the full design cooling water flow. The in-tower cooling water flow is now based on the level of cooling necessary for the condenser and the plants' cooling needs.

Since proposal, EPA has included costs from additional projects in the calculation of its costing estimates for recirculating wet cooling towers. EPA obtained further "turn-key" vendor project costs that have been incorporated into the specific costing equations used to calculate the capital and operation and maintenance (O&M) costs of the final rule. Turn-key project costs represents all costing elements necessary to estimate engineering costs, such as vendor overhead, equipment, wiring, foundations and contingencies. EPA included these project costs in the calculation of the costing equations in order to increase the number of real-world projects upon which the final cost estimates are based.

EPA has refined its estimates of O&M costs for recirculating wet cooling towers since proposal. At the time of proposal, EPA estimated economy of scale for O&M costs for recirculating, wet cooling towers as their size increases. EPA based this estimate primarily on the economy of scale savings for wastewater treatment systems as wastewater flow increases. The overall effect of this approach showed that for very large cooling towers, a savings of nearly two-thirds was achieved compared with smaller cooling towers. On the basis of comments received and further research, EPA has refined its estimates of O&M costs and economies of scale. The cost estimates presented for the final rule reflect this revision to the analysis.

In the final rule, EPA has included cost estimates for energy penalties due to operating power losses from recirculating cooling tower systems. Further information on this subject can be found in Section IV.A.3 of this preamble, below.

3. Energy Penalty Estimates for Recirculating Wet Cooling and Dry Cooling Towers

Since proposal, as discussed in the NODA (66 FR 28866), EPA has included in its estimates of O&M costs the performance penalties that may result in reductions of energy or capacity produced because of adoption of recirculating cooling tower systems. The cost estimates for the final rule include consideration of these penalties. The final rule cost estimates account for the energy penalty at facilities that are projected to install recirculating wet cooling tower systems in lieu of once-through cooling systems. EPA's cost estimates for dry cooling regulatory alternatives account for the appropriate energy penalty of this technology at each facility projected to install such a system.

For the final rule, EPA's costing methodology for performance penalties is based on the concept of lost operating revenue due to a mean annual performance penalty. EPA estimated the mean annual performance penalty for each tower technology as compared with once-through or recirculating wet cooling systems (where applicable for the dry cooling analysis). EPA then applied this mean annual penalty to the annual revenue estimates for each facility projected to install a recirculating cooling tower technology as a result of the rule or a regulatory option. EPA considers these revenue losses as representative of the cost to the facility for either replacing the power lost via the market or expanding the capacity of the new power plant.

Chapter 3 of the *Technical Development Document* discusses performance penalties in more detail.

4. Significant Changes to the Economic Analysis a. Revisions to Costing Analysis

EPA has made a methodological change for estimating the cost for today's rule. For the proposal, EPA directly estimated the incremental cost of the rule without estimating the baseline cost. This made it difficult to identify the magnitude of changes in relevant components of a system of a facility and their individual costs. For the final rule, EPA separately estimated the baseline costs and the cost after meeting the requirements of the rule.

Thus, the incremental cost attributed to the rule is derived from the difference between the baseline cost and the cost after compliance with the requirements of the rule.

For the proposal, EPA estimated the cost of the rule to be $12 million. This estimate was in part based on the assumption that 90 percent of the coal facilities would be within the scope of the rule. Since the publication of the proposal, EPA has analyzed additional information regarding coal facilities. This information shows that 40.5 percent of the coal facilities would be within the scope of the rule. EPA also revised the baseline characteristics for these facilities. For the final rule, EPA estimates that 71 percent of new in-scope coal facilities would have recirculating cooling towers independent of the rule. For combined-cycle facilities, EPA used the January 2000 version of the NEWGen database at proposal to estimate the proportion of the facilities that would be within the scope of the proposal. In view of the changes in the energy market, EPA is using a more current version (February 2001) of the NEWGen database for the final analysis. Consequently, EPA is revising the in-scope percentage for combined-cycle facilities to 28.6 percent for the final analysis, instead of 12.5 percent used for the proposal.

For the proposal, EPA used the average flow from the section 316(b) industry survey, screener questionnaire for existing manufacturing facilities to estimate the technology and O&M costs for new manufacturing facilities. EPA believes that the average flow would underestimate the costs because costs mostly depend on design of a facility. Therefore, EPA is using the design flow for estimating the cost for manufacturing facilities for the final rule. For the proposal, EPA assumed that 50 percent of the growth in product demand in the chemical industry would be met from new facilities. Commenters pointed out that this assumption leads to an overestimation of the number of new facilities and EPA agrees. Therefore, EPA has revised this assumption to 25 percent for the analysis supporting today's rule.

EPA has also examined the cost of the rule as a percentage of (annual) revenue for purposes of determining whether the options are economically practicable. The worst-case, or upper-limit, cost estimate for the rule is between 3.3 to 5.2 percent of estimated revenues (for three coal facilities), between 1 and 3 percent for an additional six facilities, and less than 1 percent for the rest of the facilities. EPA concludes that those costs are economically practicable and will not pose a barrier to entry for new facilities. The initial compliance cost of the rule (i.e., capital costs and *permitting costs*) as a percentage of construction cost of an electric generation facility is 3.4 percent for one coal facility, between 1.0 and 3.0 percent for an additional seven facilities, and less than 1.0 percent for the rest of the electric generation facilities. EPA finds that these are relatively low compliance costs. EPA does not consider that the cost of the rule would be a barrier to entry for new facilities and also finds that cost to be economically practicable.

5. Air Emissions Increases as a Result of Certain Regulatory Options

For the final rule, and as discussed in the NODA, EPA includes estimates of annual air emissions increases for certain pollutants from new power plants as a result of certain regulatory options considered. EPA developed estimates for air emissions increases for $SO_2$, $NO_X$, $CO_2$, and Hg for the regulatory options based on near-zero intake (dry cooling) and for those based on uniform national requirements of flow reduction commensurate with closed-cycle recirculating wet cooling systems (wet cooling towers) or with wet-cooling systems in Track I of a two-track rule. EPA anticipates, because of measurable performance penalties associated with cooling tower systems (see Section IV.A.3 of this preamble), that, depending on the regulatory option, air emissions nationally could increase from all or a small subset of new power plants as a result of the installation of cooling tower systems. EPA estimates the marginal air emissions increases by assuming that the energy lost by the facility cannot be replaced through additional fuel consumption at that facility, but rather, the energy will be replaced by the entire grid as a whole. Thus, the replacement energy necessary to compensate for the performance penalty is generated by the mix of fuels present in the entire grid. This is because, in EPA's view and on the basis of comments received, power plants are not always capable of compensating for an energy shortfall due to a performance penalty of a recirculating cooling tower by increasing their fuel consumption. Even though the estimated mean annual performance penalty for recirculating wet cooling towers is small, EPA estimates that facilities designed for once-through cooling would not always be designed with sufficient excess capacity to compensate for the performance penalties caused by recirculating wet cooling tower installations as a result of this rule. Therefore, EPA determines that marginal increases in air emissions due to performance penalties are best represented by estimating that the entire grid will replace the energy loss. EPA's estimates of marginal increases of air emissions are presented in Exhibit 3.

EXHIBIT 3.—ESTIMATES OF MARGINAL INCREASES OF AIR EMISSIONS FOR RECIRCULATING WET COOLING TOWERS [a]

| | Capacity (MW) | Annual $CO_2$ (tons) | Annual $SO_2$ (tons) | Annual $NO_X$ (tons) | Annual Hg (lbs) |
|---|---|---|---|---|---|
| National Emissions from Electricity Generation | 828,631 | 2,575,814,488 | 13,581,673 | 6,437,710 | 86,722 |
| **Air Emission Increases if Plants Compensate With Increased Fuel Consumption** | | | | | |
| National Electricity Generation Air Emissions Increases for Wet Cooling. | | 712,886 (.0028%) | 1,543 (.0011%) | 1,518 (.0024%) | 23 (.0026%) |
| **Air Emission Increases if Plants Purchase Replacement Power From Market** | | | | | |
| National Electricity Generation Air Emissions Increases for Wet Cooling. | | 485,860 (.0019%) | 2,561 (.0019%) | 1,214 (.0019%) | 16 (.0019%) |

[a] This analysis assumes that annual emissions from energy generation are constant from 1998 to 2020, even though generation is projected to increase steadily over the next twenty years. Therefore, these estimates are slightly overstated.

*B. Regulatory Approach*

1. Proposed Rule

EPA proposed flow, velocity, and other design and construction technologies requirements based on the type of waterbody in which the intake structure is located and, for certain types of waters, the location of the intake in the water body. EPA proposed to group surface water into four categories: freshwater rivers and streams, lakes and reservoirs, estuaries and tidal rivers, and oceans. For each of these waterbody types, EPA divided the waterbody into sections based on the defined "littoral zone." At proposal, littoral zone was defined as any nearshore area in a freshwater river or stream, lake or reservoir, or estuary or tidal river extending from the level of highest seasonal water to the deepest point at which submerged aquatic vegetation can be sustained (i.e., the photic zone extending from shore to the substrate receiving one (1) percent of incident light); where there is a significant change in slope that results in changes to habitat or community structure; and where there is a significant change in the composition of the substrate (e.g., cobble to sand, sand to mud). In oceans, the littoral zone encompassed the photic zone of the neritic region. The photic zone is that part of the water that receives sufficient sunlight for plants to be able to photosynthesize. The neritic region is the shallow water or nearshore zone over the continental shelf.

In general, the closer the intake structure was to the littoral zone, the more stringent the proposed best-technology-available requirements for minimizing adverse environmental impact became. For example, an intake structure located within the littoral zone would have required the most stringent capacity and velocity controls as well as the use of other design and construction technologies. EPA also proposed the most stringent requirements for best technology available for minimizing adverse environmental impact in all parts of tidal rivers and estuaries because of the potential for high biological productivity in these waters.

2. Notice of Data Availability

In the NODA, EPA sought comment on various versions of a two-track approach resulting from comments received on the proposal. Under this approach, a facility would choose to pursue one of two tracks. In general (based on size), Track I would establish national technology-based performance requirements, whereas Track II would allow the facility to conduct site-specific studies to demonstrate to the permit director that alternative technologies or approaches could reduce impingement and entrainment to the same or a greater degree than the Track I technology-based performance standards. See 66 *FR* 28868 to 28872.

3. Final Rule

In this rule, EPA is establishing a two-track technology-based approach that does not distinguish between waterbody types or the location of the intake structure within the waterbody type. Track I establishes capacity (for facilities with a design intake flow equal to or greater than 10 MGD), velocity, and capacity- and location-based proportional flow requirements to reduce impingement and entrainment of fish, shellfish, eggs, and larvae and requires the applicant to select and implement design and control technologies to minimize impingement and entrainment in certain areas. Track I applicants with intake flow between 2 and 10 MGD do not have to comply with a capacity limitation but then must use technologies to reduce entrainment at all locations. Track II allows a facility to conduct a comprehensive demonstration study to show that alternative controls will achieve comparable performance. The two-track approach balances the goal of providing regulatory certainty and fast permitting for new facilities with the goal of allowing flexibility by including a performance-based alternative. Track I streamlines the permitting process, providing a high degree of certainty that a facility will obtain a National Pollutant Discharge Elimination System (NPDES) permit without delays. In EPA's view, Track II provides an incentive for the development of innovative technologies that will represent best technology available for minimizing impingement and entrainment from cooling water intake structures.

## V. Basis for the Final Regulation

*A. Major Options Considered for the Final Rule*

EPA considered and analyzed several technology-based regulatory options to determine the best technology available for minimizing adverse environmental impact for new facilities. All of these options were analyzed and compared with the current requirements applied to NPDES permits for existing facilities with cooling water intake structures. Although the Agency considered numerous regulatory options during rule development, the primary options considered in development of today's final rule include: (1) Technology-based performance requirements for different types of waters, with intake capacity limits based on closed-cycle recirculating wet cooling systems required only in estuaries, tidal rivers, the Great Lakes, and oceans; (2) national technology-based performance requirements for all waterbodies, with flow reduction commensurate with the level achieved with closed-cycle recirculating wet cooling; (3) national technology-based performance requirements for all waterbodies with a near-zero intake level (based on dry cooling);[29] and (4) a case-by-case, site-specific approached based on the 1977 draft guidance document.[30] In addition to these options, EPA also considered variations on each of the technology-based options using on a two-track permitting approach. The two-track options include one presented by industry for consideration. The two-track approach establishes a specific set of technology-based performance requirements that a permittee can implement that reflect best technology available for minimizing adverse environmental impact; this approach also provides permittees with flexibility to demonstrate that an alternative set of requirements achieves a comparable level of performance.

For all the options except for those based on dry cooling, EPA also considered requiring a design through-screen velocity of 0.5 ft/s, location- and capacity-based flow restrictions proportional to the size of the waterbody (such as a requirement for streams and rivers allowing no more than 5 percent withdrawal of the mean annual flow), and design and construction technologies to minimize impingement mortality and entrainment. In addition, EPA considered requiring post-operational monitoring of impinged and entrained organisms, monitoring of the through-screen velocity, and periodic visual inspections of the intake structures.

1. Technology-Based Performance Requirements for Different Types of Waterbodies

Under this option, EPA would establish requirements for minimizing adverse environmental impact from cooling water intake structures based on

[29] EPA also examined subcategorization strategies for the dry cooling based option, on the basis of regional distribution of facilities, size of facilities, and type of facility (i.e., steam electric power plants versus manufacturing facilities).

[30] U.S. Environmental Protection Agency. 1977. *Draft guidance for evaluating the adverse impact of cooling water intake structures on the aquatic environment: section 316(b) P.L. 92-500.*

the type of waterbody in which the intake structure is located, the location of the intake in the waterbody, the volume of water withdrawn, and the design intake velocity. EPA would also establish additional requirements or measures for location, design, construction, or capacity that might be necessary for minimizing adverse environmental impact. Under this option, the best technology available for minimizing adverse environmental impact would constitute a technology suite that would vary depending on the type of waterbody in which a cooling water intake structure is located and the location of the cooling water intake structure within the waterbody. EPA would set technology-based performance requirements; the Agency would not mandate the use of any specific technology.

Under this option, EPA considered only requiring intake flow reduction commensurate with the level that can be achieved using a closed-cycle recirculating wet cooling system for intakes located in estuaries, tidal rivers, oceans, and the Great Lakes. For all other waterbody types, the only capacity requirements would be proportional flow reduction requirements. In all waterbodies, velocity limits and a requirement to study, select, and install design and construction technologies would apply. EPA determined that the annual compliance cost to industry for this option would be $36.3 million. EPA found that the regulatory implementation burden would be of an acceptable level but that the delay in permitting of new facilities could be up to 6 months if all new facilities were required to complete a baseline biological characterization study prior to submitting an application for a permit. This study would detail the potential design and construction technologies that would apply to all new facilities and would be required beyond the flow reduction requirements for facilities located in estuaries, tidal rivers, oceans, and the Great Lakes. This option was, in part, rejected due to the potential of delays in permitting. More significantly, this option was rejected because closed-cycle recirculating cooling water systems are available and economically practicable across all waterbody types.

2. National Technology-Based Performance Requirements for All Waterbodies

a. Flow Reduction Commensurate With the Level Achieved by Closed-Cycle Recirculating Wet Cooling Systems

EPA also considered a regulatory option for new facilities based primarily on intake-flow reduction from all cooling water intake structures commensurate with the level that can be achieved using a closed-cycle recirculating cooling water system. This option does not distinguish between facilities on the basis of the waterbody from which they withdraw cooling water. In addition to reducing design intake velocity and complying with capacity- and location-based proportional flow requirements, all facilities need to complete a baseline biological characterization study prior to submitting the application for a permit. This study would detail the design and construction technologies necessary to maximize the survival of impinged adult and juvenile fish and to minimize the entrainment of eggs and larvae. The applicant would also need to comply with any additional requirements established by the Director as reasonably necessary to minimize impingement and entrainment as a result of the effects of multiple cooling water intake structures in the same waterbody, seasonal variations in the aquatic environment affected by the cooling water intake structures controlled by the permit, or the presence of regionally important species. EPA did not determine the annual compliance cost to industry for this option. EPA found that the permit writer's regulatory implementation burden would be of an acceptable level. EPA adopted this option, in part, as Track I of the two-track approach.

b. Intake Capacity Reduction Commensurate with the Level Achieved by Use of a Dry Cooling System

EPA considered a regulatory option for new facilities based primarily on intake flow reduction from all cooling water intake structures commensurate with zero or very low-level intake (dry cooling). This option does not distinguish between facilities on the basis of the waterbody from which they withdraw cooling water. Dry cooling systems use either a natural or a mechanical air draft to transfer heat from condenser tubes to air. EPA determined that the annual compliance cost to industry for this option would be at least $490 million. EPA also found that the permit writer's regulatory implementation burden would be of an acceptable level and there would be no delay in the permitting of new facilities. The option would require no baseline biological characterization study prior to submission of the application for a permit, due to the requirement of near-zero intake.

In addition, EPA analyzed three subcategorization strategies for the final rule based on the dry cooling technology. EPA considered establishing zero or very low-level intake requirements only for steam electric power plants locating in cold northern climates. See Section V.C.1. EPA also separately analyzed a zero or very low-level intake requirement for steam electric power plants of small capacity (those with total capacity less than 500 MW). See Section V.C.1. For both of these subcategorization strategies, all facilities not complying with dry cooling technology-based performance requirements would comply with the national requirement of capacity reduction based on closed-cycle recirculating wet cooling. The dry cooling subcategories would require no baseline biological characterization study prior to submission of the application for permit, because of the requirement of near-zero intake. EPA found that the permit writer's regulatory implementation burden would be of an acceptable level and there could be a delay of up to 6 months in the permitting of new facilities under the dry cooling based subcategories. EPA discusses why it is not adopting the dry cooling approach for subcategories based on size and/or climate in Section V.C. below.

3. Two-Track Options

For each of the regulatory options outlined above that requires reduction of flow commensurate with the level achieved with closed-cycle recirculating cooling systems, EPA also considered a number of two-track options. The two-track options provide flexibility to the permittee in that the facility may choose to comply by meeting the specific technology-based performance requirements defined in the "fast track" (Track I), or by demonstrating that a level of performance would be achieved comparable to the level that would be achieved under the Track I requirements under the "demonstration track" (Track II).

Under one of the two-track options (referred to as the "preferred two-track" option), EPA considered a fast-track based on a commitment by the facility to employ a suite of technologies that would represent best technology available for minimizing adverse environmental impact. The technologies

considered include reduction in capacity commensurate with that achievable by use of a closed-cycle recirculating cooling water system; a velocity limitation of less than or equal to 0.5 ft/s; and location where intake capacity would be no more than five (5) percent of the mean annual flow of a freshwater stream or river, no more than one (1) percent of the tidal excursion volume of a tidal river or estuary or where the intake capacity would not disrupt the natural stratification and turnover patterns of a lake or reservoir. Applicants also would be required to conduct baseline biological characterization monitoring; these data would be used to determine which design and construction technologies are needed on a case-by-case basis. EPA also considered allowing the permit applicant to specify design and construction technologies and to require monitoring so that the performance of these technologies could be evaluated in a subsequent NPDES permit. In order to speed up the issuance of the first permit at the new facility, EPA considered waiving any mandatory baseline biological characterization monitoring under Track I. In this case, the applicant would have the opportunity to rely on and present historical or literature information to support its selection of design and construction technologies. Under this approach, applicants would propose what design and construction requirements are most appropriate to reduce impingement and entrainment or to maximize impingement survival resulting from water withdrawn as make-up water at these facilities. The biological characterization information would support the design and construction technologies that the permittee chose to implement. The Director could revisit these design and construction technologies at the time of permit renewal. (Most design and construction technologies can be implemented without stopping operation at the facility.) As an alternative to the case-by-case designation of design and construction technologies, EPA also considered designating the following two design and construction technologies as part of a fast-track, best technology available suite of technologies: a fine mesh traveling screen with a fish return system, variable speed pumps, and a low pressure spray; or a submerged wedgewire fine mesh screen.

Under Track II, a facility would need to conduct a comprehensive demonstration study that documents that an alternative suite of technologies can be used by the facility to reduce impingement mortality and entrainment for all life stages of fish and shellfish to achieve a level of reduction comparable to the level that would be achieved under Track I. The estimated annual compliance cost to facilities for the preferred two-track option is $47.7 million.

EPA also considered a less stringent variation of the two-track option above, in which Track I would not require cooling water intake structures located in fresh rivers or streams and lakes or reservoirs to reduce capacity to a level commensurate with that achievable by use of a closed-cycle cooling system. EPA did not select this option because other available technologies that are economically practicable achieve greater reduction in impingement and entrainment.

EPA also considered a third two-track option as suggested by industry. Under this option, an applicant choosing Track I would install "highly protective" technologies in return for expedited permitting without the need for pre-operational or operational studies in the source waterbody. According to the commenters, these technologies would "exceed the section 316(b) standards" because they would "avoid adverse environmental impact," defined as proven population or ecosystem impacts. Such fast-track technologies might include technologies that reduce intake flow to a level commensurate with a wet closed-cycle cooling at that site and that achieve an average approach velocity (measured in front of the cooling screens or the opening to the cooling water intake structure) of no more than 0.5 ft/s, or any technologies that achieve a level of protection from impingement and entrainment within the expected range for a closed-cycle cooling (with 0.5 ft/s approach velocity) given the waterbody type where the facility is to be located. This option was intended to allow facilities to use standard or new technologies that have been demonstrated to be effective for the species, type of waterbody, and flow volume of the cooling water intake structure proposed for their use. Examples of candidate technologies include (a) wedgewire screens, where there is constant flow, as in rivers; (b) traveling fine mesh screens with a fish return system designed to minimize impingement and entrainment; and (c) aquatic filter barrier systems, at sites where they would not be rendered ineffective by high flows or fouling. The operator of a proposed new facility would elect which set of technologies to install and validate its performance as necessary. In return, the permitting agency would not require additional section 316(b) protective measures for the life of the facility.

Under the industry approach, Track II would provide an applicant who does not want to commit to any of the above technology options with an opportunity to demonstrate that site-specific characteristics, including the local biology, would justify another cooling water intake structure technology, such as once-through cooling. For these situations, the applicant could demonstrate to the permitting agency, on the basis of site-specific studies, either that the proposed intake would not create an appreciable risk of adverse environmental impact or, if it would create an appreciable risk of adverse environmental impact, that the applicant would install technology to "minimize" adverse environmental impact. Such demonstrations would recognize that some entrainment and impingement mortality can occur without creating "adverse environmental impact," but, where there is an appreciable risk of adverse environmental impact (e.g., population effects), the technology that would "minimize" it would be the technology that maximized net benefits. EPA determined that the annual compliance cost to industry for this option would be $24.9 million. EPA discusses why it is not accepting the industry's two-track approach in full in Section V.D below.

EPA also considered a waterbody-based two track option. Under this option, Track I would require, depending on the waterbody type, screens, fish return systems, or reduction in capacity to a level commensurate with that achievable by use of a closed-cycle cooling system. The delineation of waterbody types would correlate with greater or lesser potential for impingement and entrainment. Under Track II , a permit applicant would be able to demonstrate how alternative technology performance measures would reduce impingement mortality and entrainment for all life stages of fish and shellfish to a level of reduction comparable to the level that would be achieved under Track I.

EPA did consider a two-track option based on dry cooling. EPA did not promulgate this option for reasons discussed at Section V.C. of this preamble for not adopting dry cooling as best technology available for minimizing adverse environmental impact. In addition, there are very limited alternatives for achieving a dry cooling-level reduction in impingement and entrainment in a second track. EPA did not select this option because other available technologies that are economically practicable achieve

significant reduction in impingement and entrainment at far lower cost.

*B. Why EPA Is Establishing EPA's Preferred Two-Track Option as the Best Technology Available for Minimizing Adverse Environmental Impact?*

For new facilities subject to this rule, EPA finds that the preferred two-track option represents the best technology available for minimizing adverse environmental impact. With respect to new facilities, the technologies used as the basis for this option are commercially available and economically practicable for the industries affected as a whole, and have acceptable energy impacts. EPA estimates that only nine electric generators who were planning to install a once-through cooling system will have to install recirculating wet cooling towers as a result of this rule. The energy impacts associated with these nine facilities is estimated to comprise only 0.026 percent of total new electric generating capacity. Similarly, the technologies used as the basis for this option also have acceptable non-aquatic environmental impacts. The non-aquatic environmental impacts associated with increased air emissions ($SO_2$, $NO_2$, $CO_2$, and Hg) is very small. The increased $SO_2$, $NO_X$, $CO_2$, and Hg attributed to the nine facilities that would be required to install recirculating wet cooling towers in lieu of once-through cooling systems is negligible in comparison to the total annual air emissions from new power plants. EPA finds that the requirements contained in the preferred two-track approach meet the requirement of section 316(b) of the CWA that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact. The components of the two-track approach are illustrated in Appendix 1 to this preamble.

1. What Are the Performance Requirements for the Location, Design, Construction, and Capacity for Cooling Water Intake Structures?

Under the final rule, EPA has adopted a two-track approach. Under Track I, for facilities with a design intake flow equal to or greater than 10 MGD, the capacity of the cooling water intake structure is restricted, at a minimum, to a level commensurate with that which could be attained by use of a closed-cycle recirculating system. Then for facilities with a design intake flow equal to or greater than 2 MGD, the design through-screen intake velocity is restricted to 0.5 ft/s and the total quantity of intake is restricted to a proportion of the mean annual flow of a freshwater river or stream, or to maintain the natural thermal stratification or turnover patterns (where present) of a lake or reservoir except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies), or to a percentage of the tidal excursions of a tidal river or estuary. In addition, an applicant with intake capacity greater than 10 MGD must select and implement an appropriate design and construction technology for minimizing impingement mortality and entrainment if certain conditions exist. (Applicants with 2–10 MGD flows are not required to reduce capacity but must install technologies for reducing entrainment at all locations.) Under Track II, the applicant has the opportunity to demonstrate that impacts to fish and shellfish, including important forage and predator species, within the watershed will be comparable to these which you would achieve were you to implement the Track I requirements for capacity and design velocity. See § 125.84(b)(1) and (2). Proportional flow requirements also apply under Track II.

a. Capacity

In Track I, all new facilities with cooling water intake structures having a design intake flow equal to or greater than 10 MGD must:

Reduce the total design intake flow to a level, at a minimum, commensurate with that which can be attained by a closed-cycle recirculating cooling water system using minimized make-up and blowdown flows.

Reducing the cooling water intake structure's capacity is one of the most effective means of reducing entrainment (and impingement). Capacity includes the volume of water that can be withdrawn through a cooling water intake structure over a period of time. Limiting the volume of the water withdrawn from a waterbody typically reduces the number of aquatic organisms in that waterbody that otherwise would be entrained. Under Track I, EPA requires that all new facilities, with intake flows equal to or greater than 10 MGD, limit their flow to a level commensurate with that which could be attained by use of a closed-cycle recirculating cooling water system using minimized make-up and blowdown flows. *See* § 125.84 (b)(1).

Closed-cycle, recirculating cooling water systems are known to reduce the amount of cooling water needed and in turn to directly reduce the number of aquatic organisms entrained in the cooling water intake structure. For the traditional steam electric utility industry, facilities located in freshwater areas that have closed-cycle recirculating cooling water systems can, depending on the quality of the make-up water, reduce water use by 96 to 98 percent from the amount they would use if they had once-through cooling water systems. Steam electric generating facilities that have closed-cycle recirculating cooling water systems using salt water can reduce water usage by 70 to 96 percent when make-up and blowdown flows are minimized. [31]

Manufacturing facilities that reuse and recycle water withdrawn from a water of the U.S. in a manner that reduces intake flow to a level commensurate with that which can be attained by a closed-cycle, recirculating cooling water system that has minimized make-up and blow down flows will be in accordance with the rule. *See* § 125.86(b)(1). For purposes of this regulation, EPA considers reuse and recycling at manufacturing facilities to be equivalent to closed-cycle, recirculating cooling water systems at steam-electric power plants.

Although EPA has not projected that any once-through electric generating facilities with an intake capacity of less than 10 MGD will be built in the next 20 years, EPA acknowledges that projecting the numbers and characteristics of facilities over long timeframes may lead to uncertainties in EPA's analysis. (*See* Sections 5.1.4 and 5.2.4 of the Economic Analysis for a discussion of uncertainties and limitations in EPA's baseline projections of new facilities.) In the event that such facilities might be built in the future (for example, as a stand-alone, combined-cycle, cogeneration facility associated with a manufacturer), EPA has concluded that the application of the intake capacity requirements in the selected option is not economically practicable for facilities with the smallest cooling water intake structures, those that withdraw less than 10 MGD. Based on EPA's estimate, the compliance cost-to-revenue ratio for combined-cycle facilities with these flows is 4.9 to 8.8 percent or higher. Even if these facilities installed a closed-cycle recirculating cooling system to reduce dynamic flow below the regulatory threshold for this rule and avoided all other costs of the rule, their cost-to-revenue ratio still would be from 2 to 3.2 percent or more (and they

[31] The lower range would be appropriate where State water quality standards limit chloride to a maximum increase of 10 percent over background and therefore require a 1.1 cycle of concentration. The higher range may be attained where cycles of concentration up to 2.0 are used for the design.

still might have to bear additional cost to comply with requirements the Director establishes on a case-by-case basis). EPA's analysis shows that the costs for all such facilities generally would be far above the range of impacts for facilities above 10 MGD, which have, compliance cost to-revenue ratios at or below 0.5 percent for more than 70 facilities, between 2 and 3 percent for only six facilities, and above 3 percent for only 3 facilities. EPA believes that the economic impact of complying with the rule would be disproportionate for electric generating facilities with flows below 10 MGD. Thus, the Agency is exercising its discretion under section 316(b) of the CWA to determine what is economically practicable and is creating specific requirements in Track I available to facilities with flows between 2 and 10 MGD. *See* § 125.84(c). These facilities are required to meet the same velocity, proportional flow, and the design and construction technology requirements for impingement that apply in § 125.84(b). *See* § 125.84(c)(1), (2) and (3). However, they are not required to reduce intake flow commensurate with use of a closed-cycle recirculating cooling system. Instead, they are required use design and construction technologies for minimizing entrainment at all locations. *See* 125.84(c)(4). EPA believes that the requirements of § 125.84(c) are an economically practicable way for these facilities to reduce impingement mortality and entrainment. EPA has made similar decisions in establishing technology-based effluent limitations guidelines and standards under 301 and 306, see e.g., Texas Oil & Gas Ass'n v. U.S. EPA, 161 F.3d 923, 940 (5th Cir. 1998) (Court upheld EPA's subcategorization for Cook Inlet based upon disproportionate economic impact).

b. Design and Construction Technologies

i. Velocity

Intake velocity is one of the key factors that can affect the impingement of fish and other aquatic biota. In the immediate area of the intake structure, the velocity of water entering a cooling water intake structure exerts a direct physical force against which fish and other organisms must act to avoid impingement or entrainment. EPA considers velocity to be an important factor that can be controlled for minimizing adverse environmental impact at cooling water intake structures. Because velocity can be minimized through appropriate design of the intake structure relative to intake flow, it is most easily addressed during the design and construction phase of a cooling water intake structure. Alternatively, the facility can install certain hard technologies (e.g., wedgewire screens and velocity caps) to change the configuration of the structure so that the effects of velocity on aquatic organisms are minimized.

Under Track I, for a facility with a design intake flows equal to or greater than 2 MGD, the final regulation requires that the maximum design through-screen velocity at each cooling water intake structure, be no more than 0.5 ft/s. See § 125.84(b)(2). The design through-screen velocity is defined as the value assigned during the design phase of a cooling water intake structure to the average speed at which intake water passes through the open area of the intake screen (taking fouling into account) or other device against which organisms might be impinged or through which they might be entrained.

To develop an appropriate minimum velocity requirement at cooling water intake structures that will be effective in contributing to the overall reduction in impingement, EPA reviewed available literature, State and Federal guidance, and regulatory requirement. EPA found that an approach velocity of 0.5 ft/s has been used as guidance in at least three Federal documents.[32] [33] [34] The 0.5 ft/s approach velocity threshold recommended in the Federal documents is based on a study of fish swimming speeds and endurance performed by Sonnichsen et al. (1973).[35] This study was based on an unknown number of individuals from about 30 different species of fish and eels, with many of the data for adult fish. The three Federal documents recommending a 0.5 ft/s intake velocity often referred to one another or had no references. The lack of abundant and diverse data led EPA to adopt a safety factor to ensure an appropriate level of protection for aquatic organisms. This study concluded that appropriate velocity thresholds should be based on the fishes' swimming speeds (which are related to the length of the fish) and endurance (which varies seasonally and is related to water quality). The data presented showed that the species and life stages evaluated could endure a velocity of 1.0 ft/s. To develop a threshold that could be applied nationally and is effective at preventing impingement of most species of fish at their different life stages, EPA applied a safety factor of two to the 1.0 ft/s threshold to derive a threshold of 0.5 ft/s. This safety factor, in part, is meant to ensure protection when screens become partly occluded by debris during operation and velocity increases through portions of the screen that remain open. EPA compiled the data from three studies on fish swim speeds (University of Washington study, Turnpenny, and EPRI) into a graph. The data suggest that a 0.5 ft/s velocity would protect 96 percent of the tested fish. EPA recognizes that there may be specific circumstances and species for which the 0.5 ft/s requirement might not be sufficiently effective. When issuing NPDES permits, the permit directors will need to comply with any applicable requirements under the Endangered Species Act (ESA). Both the National Marine Fisheries Service and the California Department of Fish and Game have developed fish screen velocity criteria.[36] [37] [38] Under section 510 of the Clean Water Act (CWA) States may impose additional requirements pursuant to State law. When EPA issues an NPDES permit, States may condition the permit pursuant to their certification authority under section 401 of the CWA.

Two velocities are of importance in the assessment and design of cooling water intake structures: the approach velocity and the through-screen or through-technology velocity. The approach velocity is the velocity measured just in front of the screen face or at the opening of the cooling water intake structure in the surface water source, and is biologically the most important velocity. The design through-screen or through-technology velocity is the velocity measured through the screen face or just as the organisms are

[32] Boreman, J. 1977. Impacts of power plant intake velocities on fish. Power Plant Team, U.S. Fish and Wildlife Service.

[33] Christianson, A. G., F. H. Rainwater, M.A. Shirazi, and B.A. Tichenor. 1973. Reviewing environmental impact statements: power plant cooling systems, engineering aspects, U.S. Environmental Protection Agency (EPA), Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon, Technical Series Report EPA-660/2-73-016.

[34] King, W. Instructional Memorandum RB-44: Review of NPDES (National Pollutant Discharge Elimination System) permit applications processed by the EPA (Environmental Protection Agency) or by the State with EPA oversight." In: U.S. Fish and Wildlife Service Navigable Waters Handbook.

[35] Sonnichsen, J.C., Bentley, G.F. Bailey, and R.E. Nakatani. 1973. A review of thermal power plant intake structure designs and related environmental considerations. Hanford Engineering Development Laboratory, Richland, Washington, HEDL-TME 73-24, UC-12.

[36] National Marine Fisheries Service Northwest Region. 1995. Juvenile Fish Screen Criteria.

[37] National Marine Fisheries Service, Southwest Region. 1997. Fish Screening Criteria for Anadromous Salmonids. Published on the Internet at *http://swr.ucsd.edu/hcd/fishscrn.htm* (access date).

[38] California Department of Fish and Game. 1997. Fish screening criteria.

passing through the opening into another device (e.g., entering the opening of a velocity cap). The through-screen velocity is always greater than the approach velocity because the net open area is smaller.

For this final rule, EPA uses the design through-screen velocity as a component of best technology for minimizing adverse environmental impact. EPA anticipates that design through-screen velocity will be simpler to calculate, and monitor (via measurement of head loss) and be more accurate than measuring approach velocity. The approach velocity is a point function. When the cross-section of an intake structure is large, the approach velocity will not be the same at all points across all points in a single cross-section. The approach velocity varies depending on where it is measured: how far from the surface, how far in front of the screen, or the location across the screen. Approach velocity also varies with the number of measurements taken; is 1 taken, or 10? Furthermore, it is much easier to design the intake structure to achieve a specific through-screen velocity. EPA notes that design through-screen velocity will be easier to implement because a number of technologies use it as the standard measure for intake design. In conjunction with the design intake velocity requirement, EPA requires new facilities to monitor the head loss across the screens or other technology on a quarterly basis. See § 125.87(b). EPA requires that head loss across the screens (or other appropriate measurements for technologies other than intake screens) be monitored and correlated with intake velocity once the facility is operating.

ii. Other Design and Construction Technologies

The final rule requires facilities withdrawing more than 10 MGD that choose Track I to select and install design and construction technologies for minimizing impingement mortality and/or entrainment if they locate in certain areas where fish or shellfish resources need additional protection. *See* § 125.84(b)(4) and (5). Facilities withdrawing between 2 and 10 MGD may meet a different set of Track I requirements. *See* § 125.84(c). If they choose to do so, the rule specifies that they must meet the same design and construction requirements to reduce impingement as applies to facilities withdrawing greater than 10 MGD. However, to reduce entrainment, instead of requiring a reduction in intake flow commensurate with use of a closed-cycle recirculating cooling water system, the rule requires these facilities to select and install design and construction technologies at all locations. *See* § 125.84(c)(3) and (4).

EPA is requiring these technologies in Track I because they are technically available, economically practicable and they effectively further reduce impingement mortality and entrainment at new facilities that choose to locate in areas where fish and shellfish resources need additional protection. EPA notes that facilities with closed-cycle recirculating cooling systems can still withdraw large volumes of cooling water, particularly if they operate in brackish or other waters where high rates of recirculation cannot be achieved, and may still impinge or entrain large numbers of aquatic organisms. Thus, EPA believes that facilities that choose to locate in areas where fish and shellfish need additional protection should install these technologies to further reduce impingement mortality and entrainment.

In the Track I requirements at § 125.84(c), which apply to facilities with cooling water intakes between 2 and 10 MGD that choose not to meet the capacity reduction requirements in § 125.84(b), the rule requires these facilities to meet the same design and construction requirements for minimizing impingement mortality as are required for facilities withdrawing greater than 10 MGD, *See* § 125.84(c)(3). These impingement requirements apply if the facility locates where fish and shellfish resources need additional protection. Facilities between 2 and 10 MGD that choose not to meet the capacity reduction requirements in § 125.84(b), however, must install design and construction technologies for reducing entrainment at all locations. *See* § 125.84(c)(4). EPA makes this distinction because, for economic practicality reasons, today's rule does not require smaller new facilities to reduce intake flow commensurate with a closed-cycle recirculating cooling system. In this case, EPA believes that use of design and construction technologies is an alternative, economically practicable and technically available means for reducing entrainment.

Today's rule does not require facilities choosing Track II to install design and construction technologies as specified under 125.84(b)(4) and (5) or 125.84(c)(3) and (4). EPA believes that such facilities will use these technologies, at least in part, to meet the Track II comparability requirements at 125.84(c)(1) and thus achieve comparable performance.

As used in these provisions, "minimize" means to reduce to the smallest amount, extent, or degree reasonably possible. *See* § 125.83. Technologies that minimize impingement mortality and entrainment of all life stages of fish and shellfish at a location might include, but are not limited to, intake screens, such as fine mesh screens and aquatic filter barrier systems, that exclude smaller organisms from entering the cooling water intake structure; passive intake systems such as wedgewire screens, perforated pipes, porous dikes, and artificial filter beds; and diversion and/or avoidance systems that guide fish away from the intake before they are impinged or entrained. In some cases, technologies that might be used to achieve the 0.5 ft/s velocity standard at § 125.85(b)(2) and § 125.85(c)(1), such as passive intake systems, might also minimize impingement mortality and entrainment.

Some technologies minimize impingement mortality by maximizing the survival of impinged organisms. These technologies include, but are not limited to, fish-handling systems such as bypass systems, fish buckets, fish baskets, fish troughs, fish elevators, fish pumps, spray wash systems, and fish sills. These technologies either divert organisms away from impingement at the intake structure, or collect impinged organisms and protect them from further damage so that they can be transferred back to the source water at a point removed from the facility intake and discharge points.

Some additional design and construction technologies have feasibility issues limiting their use to certain types of locations. Some have not been used on a widespread basis above certain intake flow rates. The effectiveness of these technologies also may vary depending on factors such as the speed and variability in direction of currents in a waterbody, the degree of debris loading at a location, etc. Because of these issues, EPA has not established a national performance standard for these technologies more specific than to require the applicant to study literature and available physical and biological data on their proposed location, and then to select and install technology(ies) that minimize impingement mortality and entrainment. (As stated above, "minimize" is defined as a reduction "to the smallest amount, extent or degree reasonably possible.")

In Track I of the final rule, EPA does not require an applicant that installs design and construction technology(ies) to seek the approval of the Director regarding which design and

construction technology(ies) it selects, nor does EPA require the applicant to conduct biological monitoring prior to submitting its application. Rather, to avoid permitting delays Track I only requires the applicant to gather and present historical information and/or literature to support its decision on which design and construction technology(ies) to implement at the new facility. *See* § 125.86(b)(4).

Because an applicant does not need the Director's approval of its design and construction technology(ies) prior to the first permit, EPA has included a provision that requires the Director to determine, at each permit reissuance, whether design and construction technologies at the facility are minimizing impingement mortality and/or entrainment, *See* § 125.89(a)(2). This provision is intended to ensure that the applicant selects and installs appropriate technology(ies).

The framework of these provisions balances a number of factors. One is EPA's interest in ensuring that applicants seeking their first permit under Track I can quickly obtain one without delay and, if they wish, without engaging in a dialogue with the Director about whether additional design and construction technologies are needed at their site, or which technologies will reasonably reduce impingement mortality and entrainment at the location. In this case, an applicant may wish to install some of the more highly protective additional design and construction technologies, to minimize any opportunity for disagreement with the Director at permit reissuance about whether the applicant chose technologies that "minimize" impingement mortality and entrainment at their location.

Alternatively, an applicant under § 125.84(b) who is willing to take the time to engage in a dialogue with the Director prior to the first permit under Track I may be able to obtain the Director's concurrence on a finding that the proposed intake will not be located in an area where fish or shellfish resources need additional protection. *See* § 125.84(b)(4) and (5) for a list of such areas. In this case, the applicant may not need to install any additional design and construction technologies. In the event that the location of the intake structure is such that additional technologies are required, an applicant who is willing to take the time to consult with the Director prior to the first permit under Track I may be able to obtain the Director's concurrence that technologies that are less costly than the most highly-protective ones available are sufficient for its location. (EPA again notes that "minimize" is defined as a reduction "to the smallest amount, extent or degree reasonably possible.")

EPA believes the above framework reasonably balances its interest in minimizing permit delays with its interest in ensuring that applicants willing to take more time and engage in a dialogue with the Director may have an opportunity to reduce their costs. As a general matter, EPA strongly encourages permit applicants to consult with the Director prior to selecting and installing design and construction technology(ies). Today's rule, however, requires no such consultation, and, as discussed elsewhere in this preamble, EPA's costing analysis conservatively assumes that permittees will install additional design and construction technologies at all locations.

EPA recognizes that the condition of biological resources at a location may change over time. The requirement for the Director to review the applicant's design and construction technologies at permit reissuance provides an opportunity for any appropriate changes in the design and construction technologies used at the location. *See* § 125.89(a)(2).

c. Location

Although EPA recognizes that the location of a cooling water intake structure can be a factor that affects the environmental impact caused by the intake structure, today's final rule, apart from the proportional flow requirements, does not include specific national requirements for new facilities based on location of the cooling water intake structure. In EPA's view, the optimal design requirement for location is to place the inlet of the cooling water intake structure in an area of the source waterbody where impingement and entrainment of organisms are minimized by locating intakes away from areas with the potential for high productivity (taking into account the location of the shoreline, the depth of the waterbody, and the presence and quantity of aquatic organisms or sensitive habitat). EPA received significant and convincing comments arguing against the specific proposed requirements and feasibility for locations based on waterbody type and location within the waterbody. Among other things, commenters argued that EPA's proposed requirements would be difficult to implement and relied on generalizations about types of waterbodies that were too simplistic. See section VI.C for further discussion of comments and EPA's responses regarding location. This topic is discussed further in Chapter 5 of the *Technical Development Document*.

Although today's rule does not specifically establish location requirements, several components of the two-track approach inherently consider location as a factor. Under Track I, location is a consideration when the applicant selects and implements the design and construction technologies for minimizing impingement and entrainment and maximizing impingement survival. In addition, EPA estimated that in order to meet the proportional flow requirements in Track I and Track II, facilities may need to site in locations that can support their water withdrawals or find other alternatives, such as, obtaining water from ground water, grey water, or a public water supply system. Under Track II, the new facility may choose location as a key component for minimizing impingement and entrainment. Under Track II, an applicant has the opportunity to conduct site-specific studies to demonstrate that alternative technologies or configurations, including the relocation of an intake to areas of less sensitivity, will reduce impingement mortality and entrainment for all life stages of fish and shellfish to a level of reduction comparable to the level that would be achieved were the applicant to implement the technology-based performance requirements in Track I.

In addition, this new facility rule also regulates location as a performance characteristic of new facilities to minimize entrainment and other adverse environmental impacts that are likely to occur as a result of the withdrawal of makeup water even where a facility uses recirculating systems. Historically, some previous CWA section 316(b) studies conducted for permits proceedings have considered potential impacts from facilities whose cooling water intake flow is large in proportion to the source water flow or tidal volume.[39][40][41] Under this rule, §§ 125.84(b)(3), 125.84(c)(2), and 125.84(d)(2), EPA establishes proportional flow requirements for new facility cooling water intake structures located in freshwater rivers and streams, lakes and reservoirs, and estuaries and

[39] Lewis, Randall B. and Greg Seegert. Entrainment and Impingement Studies at two Power Plants on the Wabash River in Indiana. *Power Plants & Aquatic Resources: Issues and Assessment. Environmental Science & Policy.* Volume 3, Supplement 1. September 2000.

[40] Public Service Indiana. 316(b) Demonstration for the Cayuga and Wabash River Generating Stations. Prepared by Dames and Moore, Cincinnati, Ohio. August 30, 1997.

[41] Public Service Company of Indiana. A 316(b) Study and Impact Assessment for the Cayuga Generating Station. Prepared by EA Science and Technology, Northbrook, IL. April 1988.

tidal rivers, requiring that the total design intake flow from all cooling water intake structures at a facility withdrawing:

- From a freshwater river or stream must be no greater than five (5) percent of the source waterbody mean annual flow;
- From a lake or reservoir must not disrupt the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies);
- From estuaries or tidal rivers must be no greater than one (1) percent of the volume of the water column in the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level.

EPA finds these proportional flow limitations to represent limitations on capacity and location that are technically available and economically practicable for the industry as a whole. EPA examined the performance of existing facilities based on section 308 questionnaire data in terms of proportional flow in order to determine what additional value could be used as a safeguard to protect source waters against entrainment, especially in smaller waterbodies or in waterbodies where the intake is disproportionately large as compared to the source water body. (In practice, EPA expects that these requirements would require a facility to relocate or obtain water from another source, e.g., a public water supply or groundwater, only in smaller waterbodies, because no new facilities in larger waterbodies that use wet recirculating cooling systems would ever run afoul of these requirements.) In order to assess the performance of new facilities in meeting these requirements, EPA examined the performance of existing facilities and determined that 90 percent of existing facilities in freshwater rivers and streams and 92 percent of existing facilities in estuaries or tidal rivers meet these requirements. Based on documents included in the record, EPA also believes that most existing facilities meet the proportional flow requirement for lakes and reservoirs. EPA expects that new facilities would have even more potential to plan ahead to select locations and design intake capacity that meet these requirements. EPA recognizes that these requirements are conservative in order to account for the cumulative impact of multiple facilities' intakes. The 1 percent value for estuaries reflects that the area under influence of the intake will move back and forth near the intake and that withdrawing 1 percent of the volume of water surrounding the intake twice a day over time would diminish the aquatic life surrounding the intake. The 5 percent value for rivers and streams reflects an estimate that this would entrain approximately 5 percent of the river or stream's entrainable organisms and a policy judgment that a greater degree of entrainment reflects an inappropriately located facility. Because they are overwhelmingly achievable for new facilities, EPA believes they are appropriate to this new facility rule.

Proportional flow limitations are one way to provide protection for aquatic life and enhancement of commercial and recreational uses of source waters. Larger proportionate withdrawals of water may result in commensurately greater levels of entrainment. Entrainment impacts of cooling water intake structures are closely linked to the amount of water passing through the intake structure, because the eggs and larvae of some aquatic species are free-floating and may be drawn with the flow of cooling water into an intake structure. Sizable proportional withdrawals from a stream or river might also change the physical character of the affected reach of the river and availability of suitable habitat, potentially affecting the environmental or ecological value to the aquatic organisms. In lakes or reservoirs, the proportional flow requirement limits the total design intake flow to a threshold below which it will not disrupt the natural thermal (and dissolved oxygen) stratification and turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies). See § 125.84(b)(3)(ii). The proportional flow requirement for lakes and reservoirs would primarily protect aquatic organisms in small to medium-sized lakes and reservoirs by limiting the intake flow to a capacity appropriate for the size of the waterbody. In estuaries and tidal rivers, EPA's proportional flow requirement uses a volume that relates specifically to the cooling water intake structure and the area it influences (see § 125.83). Organisms in this area of influence travel back and forth with the tides and so may be exposed to the intake multiple times. The proportional flow requirement for estuaries and tidal rivers will limit the withdrawal of a sizable proportion of the organisms within the area of influence, commensurately reducing the entrainment of aquatic organisms.

d. Additional and Alternative Best Technology Available Requirements

At § 125.84(e), the final rule recognizes that a State may, under sections 401 or 510 of the CWA, ensure the inclusion of any more stringent requirements relating to the location, design, construction, and capacity of a cooling water intake structure at a new facility that are necessary to ensure attainment of water quality standards, including designated uses, criteria, and antidegradation requirements.

EPA interprets the CWA to authorize State and Tribal permit authorities to require more stringent limitations on intake where necessary to protect any provision of State law, including State water quality standards. Commenters have asserted that EPA does not have such authority under CWA section 301(b)(1)(C), arguing that authority is limited to controls on discharges of pollutants. Leaving that question open, there is ample authority under CWA sections 510 and 401, as is consistent with the goals of the CWA articulated in section 101 of the CWA, to provide EPA ample authority for such a provision. Section 510 of the CWA provides, in relevant part:

> Except as provided in this Chapter, nothing in this chapter shall (1) preclude or deny the right of any State or political subdivision therefore * * * to adopt or enforce * * * (B) any requirement respecting control or abatement of pollution * * * except that if an * * * other limitation * * * or standard of performance is in effect under this chapter, such State * * * may not adopt or enforce any * * * other limitation * * * or standard of performance which is less stringent than the * * * other limitation * * * or standard of performance under this chapter.

EPA interprets this to reserve for the States the authority to implement requirements that are more stringent than the Federal requirements under state law. PUD No. 1 of Jefferson *County* v. *Washington Dep't of Ecology*, 511 U.S. 700, 705 (1994). (As recognized by section 510 of the Clean Water Act, 33 U.S.C. 1370, States may develop water quality standards more stringent than required by this regulation.). Further, section 401(d) of the CWA provides, in relevant part,

> Any certification provided under this section shall set forth any effluent limitations and other limitations, and monitoring requirements necessary to assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations, under section 1311 or 1312 of this title, standard of performance under 1316 of this title, or prohibition, effluent standard, or

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pretreatment standard under section 1317 of this title, and with any other appropriate requirement of state law set forth in such certification, and shall become a condition on any Federal license or permit subject to the provisions of this section."

In *PUD No. 1 of Jefferson County* v. *Dep't of Ecology*, 511 U.S. 700, 711 (1994), the Supreme Court held that this provision is not "specifically tied to a 'discharge'." ("The text refers to the compliance of the applicant, not the discharge. Section 401(d) thus allows the State to impose 'other limitations' on the project in general to assure compliance with various provisions of the Clean Water Act and with "any other appropriate requirement of State law.") Thus, section 401(d) provides states with ample authority in their 401 certifications to require EPA to include any more stringent limitations in order to meet the requirements of state law. These two sections of the CWA further the objectives of the act to "restore and maintain the chemical, physical, and biological integrity of the nation's waters," the interim goal to protect water quality and are consistent with the CWA policy to "recognize, preserve, and protect the primary responsibility and rights of States to prevent, reduce, and eliminate pollution" and "to plan the development and use * * * of water resources." CWA sections 101(a) and (b).

2. What Technologies Are Available To Meet the Regulatory Requirements

a. Track I: Capacity

The technical availability of the two-track option is demonstrated by information in EPA's record showing that each component of Track I, the "fast-track" option, can be achieved through the use of demonstrated technologies. Intake capacity reduction commensurate with use of a wet closed-cycle recirculating cooling system as required by § 125.84(b)(1) can be achieved using a recirculating wet cooling tower or cooling pond. Such a closed-cycle recirculating cooling system is a commonly practiced technology among the new facilities controlled by this rule. The Technical Development Document shows that 67 percent of new in-scope facilities (10 new coal-fired power plants, 64 new combined-cycle power plants, and 7 manufacturing facilities) would install a closed-cycle recirculating cooling system independently of this rule.

While manufacturers use closed-cycle recirculating cooling systems to a lesser extent than do electric power generators, manufacturers also have opportunities to recycle or reuse their cooling water to reduce their water intake capacity. To examine the extent to which new manufacturing facilities are likely to reuse and recycle cooling water, the Agency reviewed the engineering databases that support the effluent limitations guidelines for several categories of industrial point sources. In general, this review identified extensive use of recycling or reuse of cooling water in documents summarizing industrial practices in the late 1970s and early 1980s, as well as increased recycling and reuse of cooling water in the 1990s. For example, the reuse of cooling water in the manufacturing processes was identified in the pulp and paper and chemicals industries, in some cases as part of the basis for an overall zero discharge requirement (inorganic chemicals). Other facilities reported reuse of a portion of the cooling water that was eventually discharged as process wastewater, with some noncontact cooling water discharged through a separate outfall or after mixing with treated process water.

For manufacturing facilities, flow reduction techniques differ between facilities and industry sectors. Facilities use unheated noncontact cooling water for condensing of excess steam produced via cogeneration; they use unheated contact and noncontact cooling water for in-process needs; and they frequently reuse process waters and wastewaters for contact and noncontact cooling.

The chemical and allied products sector and the petroleum refining sector demonstrate similar cooling water practices. Both sectors utilize cooling water for condensing of excess steam from cogeneration and for critical process needs. Most process cooling water is noncontact cooling water and generally is not reused as process water (though it may be recirculated). Paper and allied products facilities generally reuse cooling water and cogenerated steam throughout their processes (though the level to which this occurs differs among facilities). Primary metals industries utilize cooling water for contact and noncontact cooling and for condensation of steam from onsite electric power generation. Contrary to the other sectors, the primary metals industries have no general purpose for cogenerated steam in their processes.

In general, the cooling requirement for cogeneration in these manufacturing sectors is less than for the same power generated by utility and nonutility power plants. Regardless of this fact, this rule requires that the intake of water used for this purpose (and not reused as process water) must be minimized according to the same technology-based performance requirements as for other steam electric generating facilities. The condensing of excess steam from cogeneration is the same process at manufacturers as at utility and nonutility power plants. Therefore, EPA does not distinguish between requirements for this activity.

For the purposes of this regulation, EPA considers the withdrawal of water for use and reuse as both process and cooling water analogous to the reduction of cooling water intake flows achieved through the use of a recirculating cooling water system. For example, some facilities transfer excess process heat to a water stream and subsequently reuse the heated stream for other process purposes. In this case there is considerable conservation of water and energy by the reuse of cooling water. Alternatively, some facilities often withdraw water first for a process application and subsequently reuse it as cooling water. EPA encourages such practices and, in turn, considers these techniques analogous to flow reduction for the purposes of meeting the capacity reduction requirements of this rule. To meet the intake capacity requirements at § 125.84(b)(1) a new manufacturing facility must, to the maximum extent practicable, reuse and recycle cooling water withdrawn for purposes other than steam electric condensing. Cooling water intake used for the purposes of condensing of exhaust steam from electricity generation must be reduced to a level commensurate with that which can be attained by a closed-cycle recirculating cooling water system using minimized make-up and blowdown flows. EPA concludes that for manufacturers the capacity requirement meets the criterion of best technology available commercially at an economically practicable cost.

b. Track I: Velocity

EPA examined the technical feasibility of the required through-screen velocity of 0.5 ft/s. This requirement relies on the appropriate design of the intake structure relative to intake flow to reduce velocity or installation of certain hard technologies (e.g., wedgewire screens and velocity caps) to change the configuration of the structure so that the effects of velocity on aquatic organisms are minimized. EPA's record demonstrates that these designs and technologies are widely used in the industries subject to this rule. Since there are a number of intake technologies currently in use that are designed to meet a 0.5 ft/s through-screen velocity, the technologies that can achieve the Track I velocity technology-based performance

requirement meet the criterion of best technology available commercially at an economically practicable cost.

The Agency also reviewed the data from the section 316(b) industry survey with respect to the velocity requirement § 125.84(b)(2). The preliminary results suggest that more than two-thirds of combined cycle and coal-fired electric generating facilities built within the past 15 years would meet the velocity requirement. These currently operating facilities demonstrate that a design intake velocity of 0.5 ft/s is achievable and provides for sufficient cooling water withdrawal.

c. Track I: Other Design and Construction Technologies

EPA also examined the technology availability of the design and construction requirements at § 125.84(b)(4) and (5) in the final rule. While EPA costed this requirement based on the assumption that a facility would install cylindrical wedgewire screen, or fish return systems on traveling screens, EPA's record demonstrates that there are a number of potentially effective design and construction intake technologies available for installation at cooling water intake structures for minimizing adverse environmental impact. The intake technologies that new facilities may consider are in one of four categories that include, but are not limited to,

- Intake screen systems: single-entry, single-exit vertical traveling screens; modified traveling screens (Ristroph screens); single-entry, single-exit inclined traveling screens; single-entry, double-exit vertical traveling screens; double-entry, single-exit vertical traveling screens (dual-flow screens); horizontal traveling screens; fine mesh screens mounted on traveling screens; horizontal drum screens; vertical drum screens; rotating disk screens; and fixed screens.
- Passive intake systems: wedgewire screens, perforated pipes, perforated plates, porous dikes, artificial filter beds, and leaky dams.
- Diversion or avoidance systems: louvers, velocity caps, barrier nets, air bubble barriers, electrical barriers, light barriers, sound barriers, cable and chain barriers, aquatic filter barrier systems, and water jet curtains.
- Fish handling systems: fish pumps, lift baskets, fish bypasses, fish baskets, fish returns, fish troughs, and screen washes.

d. Track II: Alternative Technologies

EPA also notes that certain facilities following Track II may be able to demonstrate reduction of impingement mortality and entrainment for all life stages of fish and shellfish to a level of reduction comparable to the level that would be achieved under Track I using lower-cost alternative technologies. Under 125.84(d), new facilities that choose to comply under Track II must reduce impacts to fish and shellfish, including important forage and predator species, within the watershed to a level comparable to that which would be achieved were they to implement the requirements of § 125.84(b)(1), and (2) under Track I.[42] EPA does not consider this requirement to mandate exactly the same level of reduction in impingement and entrainment as would be achieved under Track I. Rather, given the numerous factors that must be considered to determine the required level of reduction in impingement and entrainment for Track II and the complexity inherent in assessing the level of performance of different control technologies, EPA believes it is appropriate for a new facility following Track II to achieve reductions in impingement and entrainment that are 90 percent or greater of the levels achieved under Track I. EPA believes this approach is reasonable for the several reasons.

New facility determinations regarding flow or impingement and entrainment under Track I or Track II are, by necessity, estimates based on available data as well as certain assumptions. Such estimates have substantial value but cannot reasonably be expected to achieve a high level of precision. This is particularly true where, as here, impingement and entrainment rates must be correlated with reductions in flow (which are themselves estimated), reductions in intake velocity, and other design and construction requirements. It also is important to recognize that the efficacies of different design and construction technologies also are based on estimates that are inexact due to data limitations, variations in ambient conditions, and the presence or absence of different species, among other factors.

Available data suggests that alternative design and construction technologies for cooling water intake structures can achieve the level of reduction in impingement and entrainment required under Track II. For example, technologies such as fine and wide-mesh wedgewire screens, as well as aquatic filter barrier systems, have been shown to reduce mortality from impingement by up to 99 percent or greater compared with conventional once-through systems. In addition, other types of barrier nets may achieve reductions in impingement of 80 to 90 percent, and modified screens and fish return systems, fish diversion systems, and fine mesh traveling screens and fish return systems have achieved reductions in impingement mortality ranging from 60 to 90 percent greater than conventional once-through systems. Similarly, although there is less available full scale performance data regarding entrainment, aquatic filter barrier systems, fine mesh wedgewire screens, and fine mesh traveling screens with fish return systems have in certain places been shown to achieve 80 to 90 percent greater reduction in mortality from entrainment compared with conventional once-through systems. Examples of effective use of technologies that reduce impingement and/or entrainment include:

- Studies from 1996 to 2001 at Lovett Station (New York) show no obvious impingement/contact mortality using aquatic filter barrier systems;
- Fine mesh (0.5 mm) screen performance to reduce entrainment has consistently improved at Big Bend Units 3 and 4 (Florida) with better surveillance and maintenance, including biweekly cleaning of screens to prevent biofouling. The operator's 1988 monitoring data show an efficiency in screening fish eggs (primarily drum and bay anchovy) exceeding 95 percent. For fish larvae (primarily drum, bay anchovies, blennies, and gobies), it was about 86 percent. Latent survival of fish eggs has improved to 65 to 80 percent for drum, and 66 to 93 percent for bay anchovy;
- At the Brunswick Station (North Carolina), 1 mm fine mesh screens have been used on two of four traveling screens (only when temperatures are less than 18 degrees C). Total reduction of fish entrained by the fine mesh versus conventional screens has been found to be 84 percent;
- Wedgewire screens with slot sizes of one, two, and three millimeter were studied by the State of Maryland at the Chalk Point Station. One millimeter screens led to 80 percent exclusion of all species, including larvae. For fish

[42] These Track I provisions require that the new facility reduce its intake flow, at a minimum, to a level commensurate with that which can be attained by a closed-cycle recirculating cooling water system; desgin and construct each cooling water intake structure to a maximum through-screen design intake velocity of 0.5 ft/s; and select and implement design and construction technologies (e.g., wedgewire screens, fine mesh screens, fish handling and return systems, barriers nets, acquatic filter barrier systems) to minimize impingement and entrainment of all life stages of fish and shellfish and to maximize survival of impinged life stages of fish and shellfish.

with greater than 10 mm length, entrainment was eliminated.[43]

Several additional factors suggest that these performance levels can be improved upon. First, some of the cooling water intake structure technology performance data reviewed is from the 1970's and 1980's and does not reflect recent developments and innovation (e.g., aquatic filter barrier systems, sound barriers). Second, the conventional barrier and return system technologies characterized above have not been optimized on a widespread level to date, as would be encouraged by this rule. Such optimization can be best achieved by new facilities, which can match site conditions to available technologies. Third, EPA believes that many facilities could achieve further reductions (estimated 15–30 percent) in impingement and entrainment by providing for seasonal flow restrictions, variable speed pumps, and other innovative flow reduction alternatives.

e. Track II: Location

New facilities seeking to comply under Track II can use the location of their cooling water intake structures to achieve further reductions in impingement and entrainment. Location of the cooling water intake structure can be addressed during the planning and design phases of new facility construction. At that time, it may be possible to choose a particular waterbody type and a specific location on that waterbody where (considering the proposed capacity of the cooling water intake structure) the potential for impingement and entrainment is relatively low. The optimal design requirement for cooling water intake structure location is to place the inlet in an area of the source waterbody where impingement and entrainment of organisms are minimized, i.e., taking into account: the physical and chemical characteristics of the waterbody; the presence and location of sensitive habitats; and the composition, abundance, and spatial/temporal presence of aquatic organisms. It is well known that there are certain areas within every waterbody with increased biological productivity, and therefore where the potential for impingement and entrainment of organisms is greater (e.g., littoral zone in lakes, shore zone in rivers, nearshore coastal waters in oceans). Examples include the following.

- Near the Fort Calhoun Station on the Missouri River, transect studies in 1974 to 1977 indicated higher densities of fish larvae along the cutting bank of the river adjacent to the Station's intake structure and lower densities at the mid-channel location. While densities of fish larvae changed throughout the three month data collection period, the densities collected from the mid channel remained substantially less than those in the cutting bank location.[44]
- Catches of young striped bass from Suisun Bay near the Pittsburg Power Plant (May to July 1976) ranged from 0.062/$m^3$ to 0.496/$m^3$ in the center channel, and from 0.082/$m^3$ to 0.648/$m^3$ along the north shore. Weekly mean densities for striped bass were 0.215/$m^3$ in the center channel, and 0.320/$m^3$ along the north shore.[45]
- A study of densities in the Connecticut River in 1972 showed that fish tended to be more abundant in the more shallow areas near the east shore. Distributions of fish also changed depending upon the time of day and the depth in the water column.[46]

Biologically productive and/or sensitive areas that should be avoided during the intake siting process are those that serve to promote: the congregation and growth of aquatic organisms; the propagation of the early life stages of aquatic organisms (e.g., planktonic stages); and any life stage of a threatened or endangered species. Examples of these sensitive areas would include (but are not limited to) critical nursery areas, spawning grounds, important migratory pathways, refuge areas, and essential fish habitats. Other factors to consider in the intake siting process include the proximity to: aquatic sanctuaries/refuges; national parks, seashores and monuments; wilderness areas; areas of environmental concern or outstanding natural resource waters; and coral reefs. Conversely, potential examples of less-sensitive areas may include: areas outside of the limnetic zone (i.e., no light penetration); areas of significant oxygen depletion; and areas proven to have low densities of organisms.

f. Track II: Restoration

The purpose of section 316(b) is to minimize adverse environmental impact from cooling water intake structures. Restoration measures that result in the performance comparable to that achieved in Track I further this objective while offering a significant degree of flexibility to both permitting authorities and facilities.

EPA recognizes that restoration measures have been used at existing facilities implementing section 316(b) on a case-by-case, best professional judgment basis as an innovative tool or as a tool to conserve fish or aquatic organisms, compensate for the fish or aquatic organisms killed, or enhance the aquatic habitat harmed or destroyed by the operation of cooling water intake structures. Under Track II, this flexibility will be available to new facilities to the extent that they can demonstrate performance comparable to that achieved in Track I. For example, if a new facility that chooses Track II is on an impaired waterbody, that facility may choose to demonstrate that velocity controls in concert with measures to improve the productivity of the waterbody will result in performance comparable to that achieved in Track I. The additional measures may include such things as reclamation of abandoned mine lands to eliminate or reduce acid mine drainage along a stretch of the waterbody, establishment of riparian buffers or other barriers to reduce runoff of solids and nutrients from agricultural or silvicultural lands, removal of barriers to fish migration, or creation of new habitats to serve as spawning or nursery areas. Another example might be a facility that chooses to demonstrate that flow reductions and

[43] EPA acknowledge that there are a limited number of large facilities where alternative technologies have been used. However, the use of fine mesh screens at Brunswick and big Bend have shown performance levels exceeding 70–80 percent. Similarly, fine mesh wedgewire screens at Logan have used to reduce entrainment by 90 percent. While these sites draw water from tidally influenced rivers, they should be equally transferable to large, fresh water rivers in the midwest. In fact, reliability and likely performance should be better than a site such as Big Bend where the bifouling would be a greats issue. The "actual" examples are supported by laboratory testing showing the viability of fine mesh screens that was performed at Delmara Research, TVA, and the proposed Seminole Plant in Florida. These tests found entrainment reductions using fine mesh screens of greater than 90 percent. the use of an aquatic filter barrier system (i.e. gunderboom) at the Lovett Station in New York is entirely transferable to a large, Midwestern river system. This system is now providing consistently greater than 80 percent reductions in entrainment and has the potential to exceed 90 percent. The areas where aquatic filter barrier systems might not be effective/feasible include ocean locations with high waves, limited access areas, and places where navigation could be effected. Note that feasibility should be similar to other barrier net systems, which have been installed at a number of Great Lake sites, e.g., Ludington.

[44] King, R.G. 1977. *Entrainment of Missouri River fish larvae* Fort Calhoun Station. In: Jensen, L.D. (Ed.), *Fourth National Workshop on Entrainment and Impingement* EA Communications, Melville, NY. pp.45–56.

[45] Stevens, D.E. and B.J. Finlayson. 1977. Mortality of young striped bass entrained at two power plants in the Sacramento-San Joaquin Delta, California, In: Jensen, L.D. (Ed.), *Fourth National Workshop on Entrainment and Impingement*. EA Communications, Melville, NY, pp. 57–69.

[46] Marcy, B.C. 1974. Vulnerability and survival of young Connecticut River entrained at a nuclear power plant. In: Jensen, L.D. (Ed.), *Entrainment and Intake Screening: Proceedings of the Second Entrainment and Intake Screening Workshop*. Electric Power Research Institute Publication No. 74–049–00–5, Palo Alto, CA. pp. 281–288.

less protective velocity controls, in concert with a fish hatchery to restock fish being impinged and entrained with fish that perform a similar function in the community structure, will result in performance comparable to that achieved in Track I.

EPA recognizes that it may not always be possible to establish quantitatively that the reduction in impact on fish and shellfish is comparable using the types of measures discussed above as would be achieved in Track I, due to data and modeling limitations. Despite such limitations, EPA believes that there are situations where a qualitative demonstration of comparable performance can reasonably assure substantially similar performance. EPA is thus providing, in § 125.86, that the Track II Comprehensive Demonstration Study should show that either: (1) The Track II technologies would result in reduction in both impingement mortality and entrainment of all life stages of fish and shellfish of 90 percent or greater of the reduction that would be achieved through Track I (quantitative demonstration) or, (2) if consideration of impacts other than impingement mortality and entrainment is included, the Track II technologies will maintain fish and shellfish in the waterbody at a substantially similar level to that which would be achieved under Track I (quantitative or qualitative demonstration).

g. Track I and II: Proportional Flow

Finally, EPA examined the technical feasibility of the proportional flow reduction requirements at §§ 125.84(b)(3), 125.84(c)(2), and 125.84(d)(2) of the rule. EPA based this requirement, in addition to the closed-cycle recirculating cooling water technologies discussed above, on the use of groundwater, municipal sources of water, treated wastewater (grey water), and on locating facilities on waterbodies that can meet the proportional flow requirements.

EPA analyzed the potential siting implications of the proportional flow requirements and determined that within the United States approximately 131,147 river miles have sufficient flow to support the water usage needs of large manufacturing facilities withdrawing up to 18 MGD of water without exceeding the proportional flow limitations in this rule. Approximately 53,964 river miles could support a large non-utility power-producing facility withdrawing 85 MGD, and approximately 14,542 river miles could support a large utility plant requiring 700 MGD without exceeding of the proportional flow limitations in this rule. Under today's final rule, new facilities needing additional cooling water in other areas would need to supplement withdrawals from waters of the U.S. with other sources of cooling water or redesign their cooling systems to use less water.

As another gauge of the siting impacts of the flow requirement for new facilities, the Agency determined, from a 1997 database of the Energy Information Agency and a 1994 Edison Electric Institute database, that 89 percent of existing non-nuclear utility facilities could be sited at their current location under today's final requirements if they also operated in compliance with the capacity reduction requirements at § 125.84(b)(1). (Please note that the Agency does not intend to prejudge or signal in any way whether its final rule for existing facilities will or will not include capacity limitations commensurate with a level that could be attained by a recirculating cooling water system. EPA conducted this analysis to determine whether today's proportional flow requirements would unreasonably limit siting alternatives for new facilities only.)

Finally, to further examine the potential siting implications of today's rule for new facilities, the Agency reviewed data on water use by existing facilities in arid regions of the country. The Agency found that 80 percent of the existing facilities in Arizona, California, Nevada, New Mexico, Oklahoma, and Texas do not use waters of the U.S. in their operations, indicating that new facilities in these areas would similarly use waters other than waters of the U.S. in their operations. Therefore, today's final rule would not affect these facilities if they were being constructed as new facilities subject to the rule.

3. Why Is the Two-Track Option Economically Practicable?

EPA has determined that the two-track option is economically practicable for the industries affected by the rule. For the two-track option that does not distinguish between waterbody types, the cost of compliance to the industry is expected to be no more than $47.7 million annually. Because the Agency cannot predict precisely which track the projected facilities would choose and what the compliance response for Track II facilities would be, EPA estimated the costs based on the assumption that each new facility that does not plan to install a recirculating system in the baseline would choose to conduct the studies required of Track II but then implement the requirements of Track I. This is the most conservative cost estimate because it assumes the highest cost a facility could potentially incur. Presumably, the facilities will choose the most economically favorable track, which would imply that the lowest cost is most representative. For example, at Section VIII.B.3. below, EPA describes how a permit applicant locating a facility with a once-through cooling system in certain waters such as large rivers and reservoirs may be able to demonstrate reduction of impingement mortality and entrainment to a level of reduction comparable to the level that would be achieved if they complied with the Track I requirements. However, the expediency of permitting through Track I may result in reductions in financing costs and market advantages that may outweigh the potential technology cost savings of Track II. The cost estimates above do not incorporate any savings occurring from the increased certainty of Track I faster permitting and reduction in finance costs. As stated above, for new in-scope power plants, EPA's record shows that 64 new combined-cycle facilities and 10 new coal-fired facilities would install a closed-cycle recirculating cooling water system independently of the rule. As discussed in the *Economic Analysis*, for those that would not otherwise install a recirculating cooling system, EPA has determined that the capital costs of such an installation would be economically practicable and would not create a barrier to entry. By barrier to entry, EPA means the requirements would not present costs that would prevent a new facility from being built. For those facilities that would not otherwise install a recirculating cooling system, EPA estimates that the annualized cost of such an installation is $19.1 million for a large coal-fired plant (3,564 MW), $3.8 million for a medium coal-fired plant (515 MW), and $0.7 million for a small coal-fired plant (63 MW). For a large combined-cycle facility (1,031 MW), installation of a recirculating cooling water system would cost approximately $3.2 million annually.

EPA finds that the final rule is economically practicable and achievable nationally for the industries affected because a very small percentage of facilities within the industries are expected to be affected by the regulation and the impact on those that would be affected would be small. For today's final rule, EPA used the compliance cost/revenue test as a basis for determining that the requirements on a national level are economically practicable. EPA used the compliance cost/revenue test to assess economic achievability by comparing the magnitude of annualized compliance

costs with the revenues the facility is expected to generate. Under this test, EPA has determined that on average, the rule will constitute 0.3, 1.2, and 0.14 percent of projected annual revenue for new combined-cycle power plants, coal-fired power plants, and manufacturing facilities, respectively. The cost to-revenue ratio is estimated to range from 0.7 percent to 5.2 percent of revenues for steam electric generating facilities and less than 0.1 percent to 0.5 percent of annual revenues for manufacturing facilities. None of the 38 projected new manufacturing facilities was estimated to incur annualized compliance costs greater than 1 percent of annual revenues. Based on EPA's analysis, the steam electric generating facilities projected to be in scope of this rule are able to afford these economic impacts. In general, the Agency concludes that economic impacts on the electric generating industry from this final rule would be economically practicable, because the facilities required to comply with the requirements would be able to afford the technologies necessary to meet the regulations.

Finally, since the analysis for new facilities entails some uncertainty because it reflects a projection into the future, EPA is maintaining in the final rule a provision in the regulation authorizing alternative requirements where data specific to the facility indicate that compliance with the requirement at issue would result in costs wholly out of proportion to the costs EPA considered in this analysis. See § 125.85 of this rule.

Considering the economic impacts on the electric generating industry as a whole, today's final rule only applies to those electric generating facilities that generate electricity with a steam prime mover and that meet certain requirements (e.g., have or need to have an NPDES permit, withdraw equal to or greater than 2 MGD from waters of the U.S.). As summarized in Exhibit 1 and Exhibit 2 above, an analysis of the NEWGen database shows that only 69 out of the 241 new combined-cycle facilities (28.6 percent) would be subject to this rule, and only 14 out of 35 new coal-fired facilities (40.5 percent).

For the manufacturer industry sectors with at least one new facility that is subject to this final rule, an analysis of the data collected using the Agency's section 316(b) Industry Detailed Questionnaire for existing facilities indicates that only 472 of the 1,976 nationally estimated existing facilities have an NPDES permit and directly withdraw cooling water from waters of the U.S. Of these 472 facilities, only 406 facilities are estimated to withdraw more than two (2) MGD. Of these 406 facilities, only 296 facilities are estimated to use more than 25 percent of their total intake water for cooling water purposes. Thus, this finding of economic practicability is further supported because only 15 percent of the manufacturing industry sectors will incur costs under this rule. According to EPA's analysis, economic impacts on the manufacturing facilities from this final rule would be economically practicable because the facilities projected to be in scope of this rule would be able to afford the technologies necessary to meet the regulations.

*C. Why EPA Is Not Adopting Dry Cooling as the Best Technology Available for Minimizing Adverse Environmental Impact?*

In establishing best technology available for minimizing adverse environmental impact the final rule, EPA considered an alternative based on a zero-intake flow (or nearly zero, extremely low flow) requirement commensurate with levels achievable through the use of dry cooling systems. Dry cooling systems (towers) use either a natural or a mechanical air draft to transfer heat from condenser tubes to air. In conventional closed-cycle recirculating wet cooling towers, cooling water that has been used to cool the condensers is pumped to the top of a recirculating cooling tower; as the heated water falls, it cools through an evaporative process and warm, moist air rises out of the tower, often creating a vapor plume. Hybrid wet-dry cooling towers employ both a wet section and dry section and reduce or eliminate the visible plumes associated with wet cooling towers.

In evaluating dry cooling-based regulatory alternatives, EPA analyzed a zero or nearly zero intake flow requirement based on the use of dry cooling systems as the primary regulatory requirement in either (1) all waters of the U.S. or (2) tidal rivers, estuaries, the Great Lakes, and oceans. The Agency also considered subcategorization strategies for the new facility regulation based on size and types of new facilities and location within regions of the country, since these factors may affect the viability of dry cooling technologies.

EPA rejects dry cooling as best technology available for a national requirement and under the subcategorization strategies described above, because the technology of dry cooling carries costs that are sufficient to pose a barrier to entry to the marketplace for some projected new facilities. Dry cooling technology also has some detrimental effect on electricity production by reducing energy efficiency of steam turbines and is not technically feasible for all manufacturing applications. Finally, dry cooling technology may pose unfair competitive disadvantages by region and climate. Further, the two-track option selected is extremely effective at reducing impingement and entrainment, and while the dry cooling option is slightly more effective at reducing impingement and entrainment, it does so at a cost that is more than three times the cost of wet cooling. Therefore, EPA does not find it to represent the "best technology available" for minimizing adverse environmental impact. EPA recognizes that dry cooling technology uses extremely low-level or no cooling water intake, thereby reducing impingement and entrainment of organisms to dramatically low levels. However, EPA interprets the use of the word "minimize" in CWA section 316(b) to give EPA discretion to consider technologies that very effectively reduce, but do not completely eliminate, impingement and entrainment as meeting the requirements of section 316(b) the CWA.

Although EPA has rejected dry cooling technology as a national minimum requirement, EPA does not intend to restrict the use of dry cooling or to dispute that dry cooling may be the appropriate cooling technology for some facilities. This could be the case in areas with limited water available for cooling or waterbodies with extremely sensitive biological resources (e.g., endangered species, specially protected areas). An application of dry cooling will virtually eliminate use of cooling water and impingement and entrainment, in almost all foreseeable circumstances, would reduce a facility's use of cooling water below the levels that make a facility subject to these national minimum requirements.

1. Barrier to Entry

EPA has determined that higher capital and operating costs associated with dry cooling may pose barrier to entry for some new sources in certain circumstances. (In general, barrier to entry means that it is too costly for a new facility to enter into the marketplace). A minimum national requirement based on dry cooling systems would result in annualized compliance cost of greater than 4 percent of revenues for all of 83 projected electric generators within the scope of the rule. For 12 generators, costs would exceed 10% of revenues. EPA's economic analysis demonstrates that a regulatory alternative based on a

national minimum dry cooling-based requirement would result in annualized compliance costs to facilities of over $490 million, exceeding the annual costs of a regulation based on recirculating wet cooling towers by more than 900 percent ($443 million annually).

Because the technology can cause inefficiencies in operation under certain high ambient temperature conditions and because of the greater capital and operating costs of the dry cooling system compared with the industry standard of using recirculating closed-cycle wet cooling systems, requiring dry cooling as a minimum national requirement could, in some cases, also result in unfair competitive advantages for some facilities. Thus, while at least one state has required dry cooling, EPA does not believe it is appropriate to mandate this requirement on a national basis. In EPA's view the disparity in costs and operating efficiency of the dry cooling systems compared with wet cooling systems is considerable when viewed on a nationwide or regional basis. For example, under a uniform national requirement based on dry cooling, facilities in the southern regions of the U.S. would be at an unfair competitive disadvantage to those in cooler northern climates, far more than if the rule were not based on such a requirement. Even under the regional subcategorization strategy for facilities in cool climatic regions of the U.S., adoption of a minimum requirement based on dry cooling could impose unfair competitive restrictions for new facilities. This relates primarily to the elevated capital and operating costs associated with dry cooling. Adoption of requirements based on dry cooling for a subcategory of facilities under a particular capacity would pose similar competitive disadvantages for those facilities. Furthermore, EPA is concerned that requiring dry cooling for a subcategory of new facilities would create a disincentive to building a new combined-cycle facility (with associated lower flows) in lieu of modifying existing facilities, which may have greater environmental impacts. Dry cooling systems can cost as much as three times more to install than a comparable wet cooling system. For example, the Astoria Energy LLC Queens application filed with the State of New York indicated that a dry cooling system would cost $32 million more to install than a hybrid wet-dry cooling system for a proposed 1,000-MW plant. Operating costs would be $30 million more for the dry cooling system than the hybrid wet-dry system.[47] The State of New York estimates that use of a dry cooling system at the 1,080-MW Athens Generating Company facility would cost approximately $1.9 million more per year, over 20 years, than a hybrid wet-dry cooling system. The total dry cooled projected cost would be approximately $500 million. Because dry cooling systems are so much larger than wet cooling systems, these systems' operation and maintenance require more parts, labor, etc. Costs of this magnitude, when imposed upon one subcategory of facilities but not another, provide a disparate competitive environment, especially for deregulated energy markets. New facilities are competing against the many combined-cycle and coal-fired facilities already in the marketplace or slated for substantial expansion that use wet, closed-cycle cooling systems or even once-through cooling systems. The potential economic impact should EPA not similarly require dry cooling for some or all existing facilities might cause some firms to, at the least, delay their entry into the marketplace until they better understand the regulatory environmental costs faced by their competitors.

2. Energy Penalty and Other Non-Aquatic Impacts

Given the performance penalty of dry cooling versus wet cooling, the incremental air emissions of dry cooling as compared with wet cooling, provide additional support for why EPA is rejecting dry cooling. Dry cooling technology results in a performance penalty for electricity generation that is likely to be significant under certain climatic conditions. By "performance penalty" EPA means that dry cooling technology requires the power producer to utilize more energy than would be required with recirculating wet cooling to produce the same amount of power. EPA concludes that performance penalties associated with dry cooling tower systems pose a significant feasibility problem in some climates. As discussed in Chapter 3 of the *Technical Development Document*, EPA estimates the mean annual performance penalty of a dry cooling system relative to recirculating wet cooling towers at 1.7 and 6.9 percent for combined-cycle and coal-fired facilities, respectively. Peak-summer energy shortfalls for dry cooling towers as compared to wet towers can exceed 2.7 and 9.3 percent for combined cycle and coal-fired facilities, respectively. These performance penalties could have significant technical feasibility implications. For example, dry cooling facilities have as a design feature turbine back pressure limits that often trigger a plant shut down if the back pressure reaches a certain level. Peak summer effects of inefficiency of dry cooling can and do cause turbine back pressure limits to be exceeded at some demonstrated plants which in turn experience shutdown conditions when the back pressure limits are reached. In addition, these performance penalties could pose potential power supply and reliability issues if dry cooling were required on a nationwide or regional basis. For example, EPA estimates that in hot climates dry cooling equipped power plants experience peak summer energy penalties of 3.4 to 4.3 percent for combined cycle plants and 14.8 to 19.4 percent for coal fired plants, as compared to once-through cooling systems. These peak summer penalties represent significant reductions in production at power plants in periods when demand is greatest. Compared to the selected option which a large majority of new facilities were planning to install independent of this rule, all 83 electric generators would be required to install dry cooling technology. The energy impacts (power losses) associated with these 83 facilities is estimated to comprise 0.51 percent of total new electric generating capacity (i.e., a reduction in new design generating capacity of 1,904 MW). These energy impacts raise the concern that on a large scale, dry cooling technology may affect electricity supply reliability. This significant reduction in electricity production is another reason EPA has not selected dry cooling as the best technology available for minimizing adverse environmental impacts on a nationwide or regional basis.

Because of the performance penalty, power producers using dry cooling produce more air emissions per kilowatt-hour of energy produced. Nationally, EPA estimates that a minimum requirement based on dry cooling would cause significant air emissions increases over wet cooling systems. EPA projects for the dry cooling alternative that $CO_2$, $NO_X$, $SO_2$, and Hg emissions would increase by 8.9 million, 22,300, 47,000, and 300 pounds per year, respectively. See Chapter 3 of the *Technical Development Document* for more information on EPA's air emissions analysis, including a discussion of the coincidence between maximum air emissions and the periods of the most severe air pollution problems. These additional non-aquatic

[47] Astoria Energy LLC Queens Facility Application.

environmental impacts (in the form of air emissions) further support EPA's determination that dry cooling does not represent best technology available for minimizing adverse environmental impact on a national or region-specific basis.

3. Cost-Effectiveness

EPA also considered the incremental costs and impingement and entrainment reduction between the selected option and dry cooling. Dry cooling, while very effective in reducing impingement and entrainment, is very expensive to implement. EPA understands that dry cooling can virtually eliminate the need for cooling water and therefore dramatically reduces impingement and entrainment. However, EPA has determined that the costs associated with implementing dry cooling are ten times as expensive as wet cooling. EPA has shown that the selected option, requiring facilities to reduce their intake flows to a level commensurate with that which can be attained by a closed-cycle, recirculating cooling water system, would reduce the amount of water withdrawn for cooling purposes by 70 to 98 percent. In addition, EPA has shown that this would result in corresponding reductions in impingement and entrainment. Further, the record shows that other requirements in the rule, such as velocity and proportional flow limits and the requirement to implement design and construction technologies, would result in additional reductions in impingement and entrainment. Based on the information available in the record, EPA estimates that the selected option may result in reduction of impingement to levels that could possibly exceed 99 percent. Estimated reductions in entrainment could also be substantial on a case-by-case basis (70 to 95 percent). Because EPA's selected option is very effective in reducing impingement and entrainment and is one-tenth the cost, EPA believes that it is reasonable to reject dry cooling as a nationally applicable minimum in all cases.

4. Technical Feasibility of Dry Cooling for Manufacturers

EPA considers that dry cooling technologies for manufacturing cooling water intake structures, as a whole, pose significant engineering feasibility problems. The primary feasibility issue is that dry cooling requires nearly zero water intake and many manufacturers reuse cooling water in their process. This dual use for process and cooling water prevents the application of dry cooling. In addition, many manufacturers require cooling water at an available temperature that is not reliably met by utilizing dry cooling. However, in some specific circumstances, EPA is aware of several demonstrated cases of dry cooling for cogeneration plants that are associated with manufacturers.

*D. Why EPA Is Not Accepting the Industry Two-Track Approach in Full*

While EPA is adopting the general two-track framework suggested by a trade association representing the electric generating industry, EPA is not accepting all aspects of this approach. The primary differences between the approach that EPA is promulgating and the approach industry suggested are: (1) The final two-track approach defines a different level of environmental performance as "best available technology for minimizing adverse environmental impact" for the "fast track" and (2) the final two-track approach contains a different way of measuring equivalence with the environmental performance of the "fast track" in the second track. In short, EPA prefers a more concrete and objective measure of best technology available for minimizing adverse environmental impact for the new facility rule than does the measure suggested by the industry proposal.

Under EPA's approach, best technology available for minimizing adverse environmental impact for new facilities would be the level of impingement and entrainment reduction achievable by (1) technology that reduces intake capacity in a manner comparable to that of a recirculating wet cooling tower; (2) technologies that reduce design through-screen velocity to reduce impingement, as explained in Section V.B.1.c of this preamble; (3) the applicant's selected design and construction technologies for minimizing impingement and entrainment and maximizing impingement survival; and (4) capacity and location-based technology requirements for limiting flow withdrawal to a certain proportion of a waterbody. By contrast, the industry proposal asserts that "closed cycle cooling and low intake velocity reduces entrainment and impingement to such low levels that adverse environmental impact is avoided, thereby not just meeting, but exceeding, the section 316(b) standard of protection."

Further, the industry proposal states that wedgewire screens, traveling fine mesh screens, and aquatic filter barrier systems, either alone or in combination, are sufficient, at least in certain types of waterbodies, in that they "may provide a level of protection within the same range" and thus should be determined to "in almost every case avoid adverse environmental impact, thereby exceeding the requirements of section 316(b)." While EPA's approach does not preclude the use of these alternative technologies if they demonstrate impingement and entrainment reductions equivalent to those of the suite of technologies it has described as "best technology available for minimizing adverse environmental impact," in EPA's view the record does not show that using just one of the technologies listed above in order to qualify for expedited fast-track permitting is equivalent in reducing impingement and entrainment in a manner that reflects best technology available for minimizing adverse environmental impact. While barrier methods are effective at reducing impingement, EPA's record shows that they are currently not as effective at reducing entrainment as EPA's preferred option. This is because larvae and very small organisms can still pass through the barrier and may be entrained. While industry asserts that entrainment does not lead to mortality, there is conflicting evidence in the record on this topic, some of which indicates that in fact a large percentage of organisms can perish or be severely harmed when entrained. For these reasons, EPA does not find that the record supports the notion that the technologies listed by industry in its two-track proposal as "exceeding the requirements of section 316(b)" are as effective at reducing impingement and entrainment as the suite of technologies EPA has found to be technically available and economically practicable to the industries affected as a whole. For further discussion of entrainment and the performance of a variety of cooling water intake structure technologies, see Section III of this preamble and Chapter 5 of the *Technical Development Document*.

The industry two-track approach is based on industry's argument that the CWA compels EPA to determine section 316(b) limits on a case-by-case basis examining first whether the cooling water intake structure causes population or ecosystem effects before requiring any technology, because, industry asserts, this is the only plausible interpretation of the phrase "adverse environmental impact." EPA does not believe that the language of the statute compels this interpretation. Instead, EPA believes it is reasonable to interpret section 316(b)'s requirement to establish "best technology available for minimizing adverse environmental impact" to authorize EPA to promulgate

technology-based performance requirements analogous to those derived for point sources under sections 301 (existing sources) and 306 (new sources) for minimizing a suite of adverse environmental impacts, including impingement and entrainment, diminishment of compensatory reserve, and stresses to populations, communities of organisms, and ecosystems. The controls required today appropriately reflect technologies that for new facilities are available and economically practicable, that do not have unacceptable non-aquatic environmental impacts (including impacts on the energy supply across the United States), and that reduce impingement and entrainment of aquatic organisms in a manner that will help support, maintain, and protect aquatic ecosystems. EPA wants to be very clear that this decision relates only to new facilities. In making the upcoming decisions regarding existing facilities in Phases II and III, EPA will carefully weigh all of the relevant factors, many of which are different for existing facilities than for new facilities.

In addition, while EPA agrees that a two-track approach is an effective way to implement CWA section 316(b) for new facilities, EPA does not believe that a population-based approach for defining both the fast track and equivalent performance in the second track is a workable solution for new facilities.

With respect to the "fast track" suggested by industry, EPA does not have a record indicating that the technologies cited by industry (such as a fish return system alone) are the best technologies available for reducing impingement and entrainment. Moreover, even if population were the only endpoint, the record does not support the assertion that the technology cited by industry would qualify for the fast track because it can be uniformly predicted across the nation not to have population impacts (assuming one can agree upon what are the relevant species of concern) for all new facilities nationally in any location. At the same time, EPA has identified technologies that for new facilities (which, unlike existing facilities, do not have retrofitting costs) that are technically available and economically practicable. Therefore for new facilities, EPA believes it is reasonable to require such technologies on a national basis to reduce impingement and entrainment.

With respect to the second track, EPA does not prefer the population approach for new facilities, because the time and complexity of conducting population studies properly is generally inconsistent with making fast and reliable permitting decisions, an issue of particular importance for permitting new facilities. EPA's record shows that in order to study and demonstrate proper population studies, the permitting approval process would be adversely delayed for some new facilities. Specifically, because of the complexity of biological studies, it is very difficult to assess the cause and effect of cooling water intake structures on ecosystems or on important species within an ecosystem. An overwhelming majority of scientists have stated that biological studies can take multiple years because of the complex nature of biological systems. Moreover, unlike in the laboratory, where conditions are controlled, a multitude of confounding factors make biological studies very difficult to perform and make causation, in particular, difficult to determine. All of these issues take time to assess. EPA estimates that a credible job of studying these issues could take up to 3 years to complete. While some of this study can be conducted prior to start-up of the plant, this could cause delays in many situations. For these reasons, EPA does not believe that a population approach makes sense for new facilities.

## VI. Summary of Major Comments on the Proposed Rule and Notice of Data Availability (NODA)

### *A. Scope/Applicability*

Comments on the scope and applicability of the new facility rule address several issues, including the definition of a new facility, the definition of a cooling water intake structure (including the twenty-five (25) percent cooling water use threshold), the proposed threshold for cooling water withdrawals (i.e., 2 MGD), and the requirement for a facility to hold a NPDES permit.

#### 1. New Facility Definition

EPA proposed to define a "new facility" as any building, structure, facility, or installation that meets the definition of a "new source" or "new discharger" in 40 CFR 122.2 and 122.29(b)(1), (2), and (4); commences construction after the effective date of the final rule; and has a new or modified cooling water intake structure. See proposed 40 CFR 125.83; 65 *FR* 49116.

Numerous commenters supported EPA's determination that the new facility rule should apply only to greenfield and stand-alone facilities but questioned whether EPA had clearly and effectively limited applicability of the proposed rule to such facilities. Some commenters indicated that the proposed regulatory definition of new facility, which references the existing NPDES new source and new discharger definitions, is confusing. For example, some commenters asserted that defining the total replacement of an existing process as a new facility is not consistent with application of the rule only to greenfield or stand-alone facilities. Commenters indicated that the regulation should make it very clear that the new facility rule applies only to greenfield and stand-alone facilities. To clarify the definition of new facility, some commenters encouraged EPA to include language or examples from the proposed preamble in the final regulatory language. Several commenters requested that EPA more explicitly clarify that a new cogeneration plant installed to serve an existing facility would not be considered a new facility under this rule.

The Agency believes that most new facilities subject to this rule will be considered new sources as defined in 40 CFR 122.2 and 122.29(b)(1), (2), and (4) and subject to new source performance standards for effluent discharges.[48] Under 122.29(b), a source is a new source if it meets the definition of new source in 122.2 (effectively, it discharges or may discharge pollutants, and its construction commenced after promulgation—or proposal in specified circumstances—of a new source performance standard) and it meets any of three conditions. The first is that the source is constructed at a site at which no other source is located (40 CFR 122.29(b)(1)(i)). The second is that the source totally replaces the process or production equipment that causes a discharge at an existing facility (40 CFR 122.29(b)(1)(ii)). The third is that the new source's processes are substantially independent of any existing source at the same site (40 CFR 122.29(b)(1)(iii)). EPA stated in the proposed rule that the new facility rule applies to greenfield facilities, described as facilities that meet the first and second conditions above, and stand-alone facilities, which are those that meet the third condition, provided these facilities meet other applicable conditions (*i.e.*, commencement of construction after the effective date of the final rule, new or

[48] Although the Agency believes that most new facilities subject to this rule will be considered new sources, EPA has included the reference to the definition of new discharger at 122.2 to address any new facility that may commence construction prior to the promulgation of a new source performance standard. The Agency notes that the definition of new discharger in 122.2 only applies to facilities not defined as a new source.

modified CWIS). Thus, the Agency believes the language of the regulation does make it clear that the rule applies to greenfield and stand-alone facilities or those whose processes are substantially independent of an existing facility at the same site. As commenters requested, EPA has added some examples to the regulatory section of the rule to serve as guidance regarding the definition of new facility under this final rule.

Several commenters also questioned whether repowering an existing facility would trigger applicability of the new facility requirements. These commenters pointed out that repowering is a common practice that often results in a gain in efficiency (*i.e.*, both increased power output and a reduced need for cooling water withdrawals). Commenters expressed concern that, although repowering an existing facility is distinct from building a greenfield or stand-alone facility, repowering could be interpreted as subject to the new source definition and thereby subject to the new facility rule. Some also asserted that the proposed rule included an arbitrary distinction between completely replacing an existing facility and repowering that facility. By defining the complete replacement of a facility as a new facility but allowing repowering to be defined as an existing facility, these commenters argued, the proposed rule creates an incentive to use less efficient technology for the redevelopment of older sites. Commenters also noted that the proposed rule would regulate a new, greenfield facility and the complete replacement of an existing facility (*i.e.*, a brownfield site) in a similar manner, which creates a disincentive to redevelop or modernize brownfield sites.

The definition of a new facility in the final rule applies to a facility that is repowered only if the existing facility has been demolished and another facility is constructed in its place, and modifies the existing cooling water intake structure to increase the design intake capacity. To the extent commenters assert some inequity of treatment between new facilities and certain existing facilities, EPA will address this comment when it addresses what substantive requirements apply to existing facilities. Further, changes to an existing facility that do not totally replace the process or production equipment that causes a discharge at an existing facility (*e.g.*, partial repowering), and those that do not result in a new separate facility whose processes are substantially independent of any existing source at the same site, do not result in the facility being defined as a new facility, regardless of whether these changes result in the use of a new or modified cooling water intake structure that increases existing design capacity. EPA does not agree that by not addressing most repowering under this rule the Agency is creating an incentive to use less efficient technology. Both the power-generating and manufacturing industries routinely seek greater efficiency when repowering. This is illustrated by the increased use over the past 10 years of combined-cycle technology, which requires significantly less cooling water for a given level of power generation and is a more efficient process than older technologies.

Several commenters supported EPA's definition of new facility as proposed. In contrast to concerns discussed above, some commenters expressed apprehension that the new facility definition would not capture all appropriate facilities. These commenters observed that an existing facility could rebuild its whole facility behind the cooling water intake structure and not be subject to the requirements applicable to a new facility. These commenters asserted that if an operator completely rebuilds an existing facility that facility should be subject to the new facility requirements.

EPA can foresee one instance in which the concern raised by this commenter may be well founded. In this rule EPA has defined a new facility in a manner consistent with existing NPDES regulations, with a limited exception. EPA generally deferred regulation of new sources constructed on a site at which an existing source is located (see 40 CFR 122.29(b)(3)) until the Agency completes analysis of its survey data on existing facilities. However, in addition to meeting the definition of a new source, today's rule requires that a new facility have a new cooling water intake structure or use an existing intake structure that has been modified to increase the design capacity. Thus, it might be possible to completely demolish an existing source, replace it with a smaller-capacity new source, and not be regulated under today's rule as a new facility. This facility would then be an existing facility an as such the requirements applicable to such a facility will be addressed in Phase II and III.

Several commenters requested that EPA define facilities deemed to be substantially independent for purposes of applying the new source criteria under 40 CFR 122.29 as those that could be practicably located at a separate site. Commenters maintained that such an approach is justified because EPA has based the proposed new facility requirements on the assumption that each owner or operator has the option to choose the location of his or her new facility and that such location would be selected to allow the owner or operator to best comply with the intake structure location and operation requirements.

With regard to defining when a facility is substantially independent under 40 CFR 122.29, EPA does not believe it is feasible to project under what circumstances owners and operators are free to select any location they desire for a new facility. For this reason, EPA takes the facility as it is planned for purposes of determining whether it is a new facility. In today's rule EPA does not believe it is appropriate to define the phrase "substantially independent" as used in 122.29(b)(1)(iii) as facilities that could be practicably located at a separate site. Section 122.29(b)(1)(iii) in the existing NPDES regulations already provides that "[i]n determining whether . . . processes are substantially independent, the Director shall consider such factors as the extent to which the new facility is integrated with the existing plant; and the extent to which the new facility is engaged in the same general type of activity as the existing source." EPA does not think it is feasible for the permit authority to judge whether the facility could have been elsewhere for the purpose of determining whether the facility is subject to the new facility rules. Commenters also requested that EPA define what actions constitute routine maintenance to an existing cooling water intake, so that the distinction between changes that constitute maintenance and those that constitute a modification to an existing intake is made clearer.

EPA has not defined "routine maintenance" in the final rule because clarifying what constitutes routine maintenance is not vital to the definition of new facility. Under the new facility rule, to be considered a new facility a facility must be a new source or new discharger and use a newly constructed cooling water intake structure or a modified existing cooling water intake structure whose design intake has been increased. Thus, changes to a cooling water intake structure at an existing facility that is not a new source or new discharger are not subject to this rule. In addition, at facilities that are new sources or new dischargers but may use an existing cooling water intake structure, EPA has clarified in the final rule that the facility is subject to this rule only where changes to the intake result in an

increase in design capacity. At facilities that are new sources or new dischargers, changes to an intake structure that do not result in an increase in design capacity do not result in that facility being subject to this rule.

Finally, some commenters expressed concern about the status of facilities that are under construction or have recently been constructed. These commenters suggested that such facilities should not be defined as new facilities. Others asserted that it is unfair to define a facility that has submitted a permit application but has not started construction as a new facility.

The Agency chose the commencement of construction date because it was generally consistent with the term "new source" in the existing NPDES permitting regulations and it should provide adequate notice and time for facilities to implement the technological changes required under the rule. The date a facility commences construction is clarified at 40 CFR 122.29(b)(4). This provision describes certain installation and site preparation activities that are part of a continuous onsite construction program; it includes entering into specified binding contractual obligations. Thus, under today's rule facilities that are constructed or commence construction within the meaning of 40 CFR 122.29(b)(4) prior to or on the effective date of the final rule are not new facilities. Those that commence construction after the effective date of this rule and meet the other regulatory thresholds defined in § 125.81 are subject to the requirements of this rule.

*2. Definition of Cooling Water Intake Structure*

EPA proposed that the term "cooling water intake structure" means the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of the U.S., provided that at least twenty-five (25) percent of the water withdrawn is used for cooling purposes. See, proposed 40 CFR 125.83; 65 *FR* 49116. In the NODA the Agency requested comments on two additional alternatives. See, 66 *FR* 28854.

Most of the comments addressing the definition of cooling water intake structure focused on the 25 percent threshold for cooling water use. These comments are summarized and addressed under Section VI.A.3, below. EPA has placed the 25 percent threshold in the applicability requirements of the final rule to clarify the definition of cooling water intake structure. Intakes below this threshold are not subject to today's national rule; however, permit writers should determine any appropriate section 316(b) requirements for structures withdrawing less than 25% of intake flow for cooling purposes on a case-by-case basis.

Some commenters suggested that cooling water intake structures should not be defined in a way that would include the pumps in the cooling water system. Commenters maintained that pumps are part of the cooling water system, not part of the intake, and they assert that the Agency has authority under section 316(b) only over cooling water intake structures. Commenters noted that changing pumps is part of the normal routine of maintenance and repair performed at facilities that use water for cooling and that such activity should not trigger applicability of the new facility rule.

In the final rule EPA has clarified the definition of cooling water intake structure to explicitly include the first intake pump or series of pumps. The explicit inclusion of the intake pumps in the cooling water intake structure definition reflects the key role pumps play in determining the capacity (i.e., dynamic capacity) of the intake. These pumps, which bring in water, are an essential component of the cooling water intake structure since without them the intake could not work as designed. Section 316(b) authorizes EPA to impose limitations on the volume of the flow of water withdrawn through a cooling water intake structure as a means of addressing "capacity." *In re Brunswick Steam Electric Plant*, Decision of the General Counsel No. 41 (June 1, 1976). Such limitations on the volume of flow are consistent with the dictionary definition of "capacity,"[49] the legislative history of the Clean Water Act,[50] and the 1976 regulations.[51] *Id.* Indeed, as Decision of the General Counsel No. 41 points out, the major environmental impacts of cooling water intake structures are those affecting aquatic organisms living in the volumes of water withdrawn through the intake structure. (Statement of Mr. Buckley, Senate consideration of the Report of the Conference Committee [discusses intake from once-through systems]. A Legislative History of the WPCA Amendments of 1972, 93rd Cong., 1st Sess., Committee Print at 196, 197). Therefore, regulation of the volume of the flow of water withdrawn also advances the objectives of section 316(b).

*3. Applicability Criteria: Requirement to Withdraw Water From a Water of the U.S., the Twenty-Five (25) Percent Cooling Water Use Threshold, and the Two (2) MGD Intake Flow Threshold*

As was proposed, the final new facility rule applies to any new facility that (1) has or is required to have an NPDES permit; (2) proposes to use a cooling water intake structure to withdraw water from waters of the U.S.; (3) uses at least twenty-five (25) percent of the water withdrawn for cooling purposes; and (4) has a design intake flow of greater than two (2) million gallons per day (MGD). See proposed 40 CFR 125.81 and 125.83; 65 *FR* 49116.

Commenters raised several concerns regarding the proposed 25 percent threshold. A number of commenters asserted that EPA did not provide a rational basis in its record for proposing that use of 25 percent of intake flow for cooling purposes should determine whether an intake structure is a cooling water intake structure. Commenters asserted that it is inappropriate to base the 25 percent cooling water use threshold on the number of cooling water intake structures or amount of cooling water flow this threshold would make subject to this rule. Several commenters observed that no single threshold can be applied to all intakes to accurately distinguish cooling water intakes from other intakes. If EPA is determined to use a single threshold in this definition, numerous commenters favored a threshold of 50 percent cooling water use, which commenters stated is the de facto threshold used under the existing definition of a cooling water intake structure found in 1977 draft guidance. However, some commenters maintained that for an intake to be defined as a cooling water intake structure the vast majority (i.e., 75–100 percent) of water withdrawn must be used for cooling.

As discussed above, in the final rule EPA has placed the 25 percent threshold in the applicability section to clarify the applicability of the rule. Permit writers may determine that an intake structure that withdraws less than 25% of the intake flow for cooling purposes should be subject to section 316(b) requirements, and set appropriate requirements on a case-by-case basis, using Best Professional Judgment. Although cooling water intake structures that fall below the 25% threshold are not subject to today's national rule, today's rule does not inhibit permit writers, including those

[49] "Cubic contents; volume; that which can be contained." *Random House Dictionary of the English Language*, cited in Decision of the General Counsel No. 41.

[50] Legislative History of the Water Pollution Control Act Amendments of 1972, 93d Cong., 1st Sess., at 196–7 (1973).

[51] 40 CFR 402.11(c)(definition of "capacity"), 41 *FR* 17390 (April 26, 1976).

at the Federal, State, or Tribal level, from addressing such cooling water intake structures as deemed necessary.

EPA chose 25 percent as a reasonable threshold for the percent of flow used for cooling purposes in conjunction with the two MGD total flow threshold discussed below to ensure that almost all cooling water withdrawn from waters of the U.S. is addressed by the requirements in this rule for minimizing adverse environmental impact. EPA estimates that approximately 68 percent of manufacturing facilities that meet other thresholds for the rule and 93 percent of power-generating facilities that meet other thresholds for the rule use more than 25 percent of intake water for cooling. In contrast, approximately 49 percent of new manufacturing facilities use more than 50 percent of intake water for cooling. EPA does not believe it is reasonable to exclude from regulation nearly half of those manufacturing facilities that use large volumes of cooling water and, as a result, impinge and entrain aquatic organisms. EPA also considered it important to cover as many of the facilities as possible in order to create regulatory certainty for new facilities and for States and Tribes that must permit these new facilities. EPA predicts this will leave four (4) percent of the electric power generating facilities and thirty-two (32) percent of manufacturing facilities to the discretion of the permit writer. EPA believes that new facilities that use less than 25 percent of water withdrawn for cooling are most effectively addressed by States and Tribes on a best professional judgement (BPJ) basis, rather than under a national rule, since BPJ provides a certain degree of flexibility for a permit writer to consider available technologies and unique factors posed by new facilities that are below the threshold.

Several manufacturers commented that the rule as proposed may create a disincentive to manufacturing operations increasing efficiency through reducing process water use, since such reductions increase the percentage of cooling water used. These commenters observed that since process water is reused for cooling and cooling water may be heated and reused as process water, flexibility is needed in the rule so these practices are not discouraged or penalized. They also stated that process water cannot be reused in a manner consistent with closed-loop cooling. Some commenters also stated that the final rule should address situations in which the percentages of water used for cooling and as process water are not constant, or where the withdrawal of cooling water is intermittent.

In the final rule EPA has amended the definition of cooling water intake structure to ensure that the rule does not discourage the reuse of cooling water as process water. EPA has amended the proposed definition of cooling water intake structure to specify that cooling water that is used in a manufacturing process, either before or after it is used for cooling, is considered process water for purposes of calculating the percentage of a new facility's intake flow that is used for cooling and whether that percentage exceeds 25 percent. In addition, EPA also has added guidance to the regulation that clarifies how the 25 percent threshold should be applied to new facilities that do not maintain a constant ratio of cooling water to process water. See § 125.81(c) of this rule. This guidance provides that the threshold requirement that at least 25 percent of water withdrawn be used for cooling purposes is to be measured, on the basis of facility design, on an average monthly basis over a period of 1 year (any 12-month period). It further clarifies that a new facility meets the 25 percent cooling water threshold if any monthly average, over a year, for the percentage of cooling water withdrawn equals or exceeds 25 percent of the total water withdrawn.

Numerous commenters asserted that the two MGD threshold is too low and is not supported by a credible justification. Some commenters stated that the two MGD cutoff is overly conservative given that many facilities determined to be causing no adverse impact have considerably greater flows. For example, these commenters note that the State of Maryland uses a 10 MGD threshold, which commenters state would capture 99.67 percent of all existing cooling water flows if applied on a national basis. Several commenters supported the use of Maryland's approach. Others stated that the proposed rule contained insufficient data to be science-based (i.e., based on the level of withdrawal above which adverse environmental impact occurs). Commenters also observed that many of the environmental impact data EPA presented in the proposed rule focused on major power plants with flows much greater than two MGD, which does not support the proposition that adverse impacts occur at small facilities with lower flows. Rather, the commenters suggest, the threshold appears to be designed merely to capture a certain percentage of flow. If so, commenters assert this threshold is arbitrary and not based on sound science. Some of these commenters asserted that cooling water intake structure impact data support thresholds exceeding 500 MGD. A few commenters maintained that it is not appropriate to apply a single threshold to all waterbody sizes. Several supported the two MGD threshold. Several commenters also supported higher thresholds, including 5, 10, 25, and 100 MGD. Some commenters maintained that section 316(b) requirements should apply to all cooling water intake structures and that therefore no flow threshold is necessary.

EPA chose the two MGD threshold because this threshold addresses the majority of new facilities and therefore provides the States and Tribes with a national rule that can be easily applied to a majority of permitting decisions they face in order to implement the legal requirements of CWA section 316(b). All cooling water intake flow results in the potential for impingement and entrainment. Thus, all facilities must address section 316(b) requirements in the same fashion. Therefore, where EPA's record demonstrates that the requirements are technically available, economically practicable, and not have unacceptable non-water quality environmental impacts, including energy impacts, the Agency believes that it is appropriate for the new facility rule to address the majority of cooling water intake structure facilities. In doing so, EPA resolves for permit writers what the requirements are for new facilities.

On the basis of data for facilities with cooling water intake structures built in the past 10 years, EPA estimates that 58 percent of the manufacturers, 70 percent of the nonutilities, and 100 percent of the utilities will be regulated under the two MGD threshold. At the two MGD threshold, 62 percent of all in-scope facilities using surface water and 99.7 percent of the total flow will be covered. Estimated total flow is approximately 9 billion gallons per day. EPA did not select a significantly higher threshold, such as 15 or 25 MGD, because these thresholds would exclude most utility, nonutility and manufacturing facilities from regulation. At a threshold of 15 MGD, 32 percent of the manufacturers, 29 percent of the nonutilities, and 50 percent of the utilities would be covered, as would 97.3 percent of the total flow. The total flow covered remains relatively high, because the large flows from a small number of utility facilities dominate the total flow. While at a threshold of 25 MGD, 94.9 percent of the total flow would still be covered, many more facilities would not be covered. Only 18 percent of manufacturers, 17 percent of nonutilities, and 50 percent of utilities would be covered. Thus, 72 percent of

manufacturers, 83 percent of nonutilities, and 50 percent of utilities, withdrawing up to 25 MGD would need to be addressed on a Best Professional Judgement basis. The Agency is concerned about the regulatory uncertainty for regulated new facilities and the burden on State and tribal permit writers to ensure appropriate requirements for these facilities. EPA also believes that the two MGD threshold reduces the burden on States and Tribes responsible for implementing section 316(b) requirements because, as a national threshold, it reduces the burden associated with site-specific determination of appropriate 316(b) limits. The lower threshold may also reduce delays for permit applicants by providing certain national standards.

EPA did not select a 5 or 10 MGD threshold because of the percentage of projected new nonutility and manufacturing facilities that would be excluded from regulation under these thresholds and concern that future trends in intake flow levels would, under these regulatory options, leave most new facilities using cooling water exempt from national regulation and subject to case-by-case determinations by permit agencies. At a threshold of 5 MGD, only 40 percent of nonutility facilities would be covered under this rule. Under a threshold of 10 MGD, 38 percent of manufacturing and 28 percent of nonutility facilities would be covered. EPA did examine the State of Maryland's 10 MGD standard but did not find information that would support the use of this standard on a national basis. In addition, the trend in power generation is toward, on a per facility/per unit of output basis, a general reduction in cooling water intake flow levels over time. Combined-cycle gas turbines require less water per unit of electricity generated than coal-fired or nuclear facilities. For example, a 750 MW combined-cycle facility with evaporative cooling towers is estimated to require approximately 7 to 8 MGD and under a 10 MGD threshold would not be subject to this national rule. The Agency believes that, given the objective of section 316(b), it is undesirable to exclude such a large plant from this rule. As reductions in cooling water intake flow levels occur, the two MGD threshold also ensures that this rule can serve the State, Tribes, and permit applicants by assuring that permits for new facilities comply with 316(b).

EPA does not agree that the intake flow threshold in the applicability portion of this rule must be based on prior determinations of the degree of environmental impact caused by a specific facility or specific cooling water intake structure. Section 316(b) applies to any facility that uses a cooling water intake structure and is a point source subject to standards imposed under CWA section 301 or 306. EPA has included a flow threshold to provide some reasonable limit on the scope of the national requirements imposed under today's rule. The Agency believes those new facilities with withdrawals that are at or below a two MGD threshold will generally be smaller operations that may face issues of economic affordability and are therefore more appropriately addressed on a case-by-case basis using BPJ. Moreover, as discussed in Section III, EPA does not agree that adverse environmental impact associated with cooling water intake structures is solely a population-based phenomenon. Rather, there can be numerous measures of such impacts, including assessments of fish and aquatic organism population impacts. Given the language of section 316(b) and the issues associated with determining adverse impacts, EPA does not view the examples of cooling water impacts discussed in the proposed rule and NODA as limiting the applicability of this rule to new facilities that have the opportunity to employ widely used, economically practicable measures that will, at a minimum, reduce injury to large numbers of fish and aquatic life and may result in benefits at higher levels of ecological structures.

Finally, commenters stated that large facilities that use closed cooling water systems may still require withdrawals of more than 2 MGD. These commenters asserted that it is unfair to subject these facilities to additional regulation after they have reduced their intake flow by 90 percent or more.

EPA agrees that very large facilities that use closed cooling water systems may still require withdrawals of more than two (2) MGD. As discussed elsewhere in this preamble, EPA determined that reducing intake capacity commensurate with use of a closed-cycle recirculating cooling system is not economically practicable for facilities withdrawing between 2 and 10 MGD. However, EPA does not agree that it is unfair to subject these facilities to further requirements necessary to reduce impingement and entrainment. Section 316(b) requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact. While reductions in total intake flow may represent the single most significant improvement for new facilities with cooling water intake structures, large flows withdrawn for make-up (i.e., to replace evaporative loss and blow down) can still cause significant impingement and entrainment. Additional controls on intake velocity, flow relative to the source waterbody, and design and construction technologies proposed by the facility also represent important aspects of a cooling water intake structure that must, under section 316(b), be addressed. As discussed elsewhere in this preamble and in the *Technical Development Document and Economic Analysis*, these additional measures are both widely employed and affordable. EPA does not believe that a determination of "best technology available for minimizing adverse environmental impact" for new facilities can omit these low-cost, effective technologies. Also see Section VIII of this preamble for a discussion that explains the percentage of new facilities already meeting the final rule requirements and the low cost of these requirements.

4. NPDES Permit

The proposed rule would apply only to new facilities that are or will be subject to an NPDES permit. See, proposed 40 CFR 125.81; 65 *FR* 49116. Comments received on this proposed requirement generally focus on the new facilities that withdraw cooling water from waters of the U.S. but do not hold an NPDES permit.

Some commenters asserted that EPA should not use the 316(b) rulemaking to regulate cooling water intake structures that are not owned by the NPDES-permitted facility. Commenters indicated that such an approach was beyond the authority provided by 316(b) and would make the rule unnecessarily complex.

The final rule applies only to new facilities that hold an NPDES permit or are required to obtain a permit. The Agency continues to believe that most new facilities that will be subject to this rule will control the intake structure that supplies them with cooling water and will discharge some combination of their cooling water, wastewater, and stormwater to a water of the U.S. through a point source regulated by an NPDES permit. Under this scenario, the requirements for the cooling water intake structure will be applied in the facility's NPDES permit.

In the event that a new facility's only NPDES permit is a general permit for storm water, EPA anticipates that the Director will write an individual NPDES permit containing requirements for the facility's cooling water intake structure.

Such 316(b) requirements could also be included in the general permit.

*B. Environmental Impact Associated With Cooling Water Intake Structures*

The proposed rule requested comment on the scope and nature of environmental impacts associated with cooling water intakes. Many comments were directed generally toward entrainment and impingement impacts, with some discussion of impacts caused by intake construction activities. The majority of comments, however, concentrated on defining adverse environmental impact and the approaches that were most relevant for characterizing adverse environmental impact, including assessments of population modeling and bioassessment approaches.

1. Entrainment, Impingement, and Construction Impacts

In the proposed rule, EPA requested comment on the types of impacts attributable to cooling water intake structures (65 *FR* 49072). Most of the comments focused on discussion of entrainment and impingement impacts and the impacts associated with construction of new cooling water intake structures.

One commenter suggested that the EPA should have scientific analyses to support the statement that entrainment mortality is high. The commenter also stated that, on the basis of recently conducted entrainment studies, through-plant change in temperature was the controlling factor for entrainment mortality and that entrainment impacts could be minimized through use of a cooling water system designed for high volume, low-velocity flow, which would minimize temperature differential. The commenter also noted that high-volume, low-velocity-flow cooling water systems would be specifically eliminated by the proposed 316(b) regulation.

EPA notes that entrainment studies indicate that through-plant mortality rates of young fish are determined by numerous factors. Different species have different tolerance to passage through a cooling system, and mortality rates may differ among life stages of the same species. A summary of mortality data from five Hudson River power plants found that mortality rates could be substantial.[52] The report cited species-specific mortality rates that varied by life stage for bay anchovy (93 to 100 percent), Atlantic tomcod (0 to 64 percent), herrings (57 to 92 percent), white perch (41 to 55 percent), and striped bass (18 to 55 percent). The study emphasized that the reliability of these estimates was questionable and that various sources of potential bias may have caused the estimated rates to be lower than the actual mortality rates. The Electric Power Research Institute (EPRI) sponsored a recent review of 36 entrainment survival studies, the majority of which were conducted in the 1970s.[53] [54] The summarized mortality rates described by EPRI were in substantial agreement with patterns reported in the Hudson River summary, specifically that anchovies and herrings had the highest mortality rates (greater than 75 percent), and that temperature change seemed to be an important determining factor. Thus, EPA believes scientific studies document that entrainment mortality for some species can be quite high.

EPA recognizes that Track I of the final rule precludes the use of high-volume, flow cooling water systems. However, in today's rule, under Track II, an intake with the capacity needed to support a high-volume, once-through cooling system that is shown through studies to reduce impingement mortality and entrainment for all life stages of fish and shellfish to achieve a level of reduction comparable to the level that would be achieved by applying Track I technology-based performance requirements at a site would meet the requirements of the rule.

Another commenter suggested that many of the more significant impingement episodes occur in conjunction with environmental phenomena such as low dissolved oxygen and rapid temperature declines. According to the commenter, these phenomena cause the death of many fish that are then ultimately collected on intake screens. EPA acknowledges that episodes of low dissolved oxygen and rapid temperature declines can result in fish losses, but does not concur that this is consistently documented as a significant or sole cause of fish impingement mortalities.

Another commenter recommended that EPA require antifouling measures at the construction and operational stages to minimize intake attractiveness to local fish, diving birds, and marine mammals. As stated previously, EPA defers controls for minimizing adverse impacts due to construction of new cooling water intake structures to the authority of existing Federal, State, and Tribal programs established for this purpose. EPA believes it is incumbent upon the individual facilities to implement antifouling measures during operations that are appropriate for the specific characteristics of their waterbody. As an example, antifouling measures for freshwater systems will be different from measures used for ocean intakes. (See Section VI.E.3.a. below for more information on fouling controls).

Finally, one commenter suggested that cooling water intake structures affect many components of an ecosystem, not just individual species. Thus, the regulation should consider indirect effects on predators resulting from losses of prey species and overall ecosystem effects when evaluating environmental impacts. EPA has taken primarily a technology-based approach to this national rule. EPA believes that this rule will reduce impacts to predators by dramatically reducing entrainment and impingement of prey species and will therefore protect ecosystems as a whole. In addition, this rule recognizes that States and Tribes can be more stringent as is consistent with section 510 of the CWA.

EPA also received comments on the documented examples of impingement and entrainment impacts discussed in the proposed rule. Several commenters argued that it was inaccurate for EPA to equate the taking of aquatic organisms with environmental impact because there was little evidence that intakes, new or existing, would cause or were causing adverse impacts. In contrast, other commenters asserted that, given the tremendous quantity of water that utilities withdraw and the large number of organisms impinged and entrained by intakes, it was clear that the cooling process had an adverse impact on aquatic ecosystems. EPA believes that the examples of environmental impact provided in the proposed rule are illustrative of the types of effects associated with cooling water intakes.

Several commenters objected to the use of specific facilities as representative examples of environmental impact. They argued that EPA focused on a few high-profile, high-intake facilities and in some cases used outdated information or misinterpreted results. EPA believes it used the best

[52] Boreman, J., L.W. Barnthouse, D.S. Vaughan, C.P. Goodyear, S.W. Christensen, K.D. Kuman, B.L. Kirk, and W. Van Winkle. 1982. the Impact of Entrainment and Impingement on Fish Populations in the Hudson River Estuary: Volume I, Entrainment Impact Estimates for Six Fish Populations Inhabiting the Hudson River Estuary. Prepared for the U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research by the Oak Ridge National Laboratory. ORNL/NUREG/TM-385/V1.

[53] EPRI. 2000. Review of entrainment survival studies: 1970–2000. Report No. 1000757. Prepared by EA Engineering Science & Technology.

[54] Some of the studies summarized in EPRI (2000) are the same ones considered by Boreman et al. (1982). See EPRI (2000) for complete citations of 36 original studies.

information available for the proposed rule and the final rule. There are few, if any, recent data documenting entrainment or impingement rates at the majority of existing facilities. Many of the available reports are for larger facilities (for which environmental impact concerns were greatest) and contain analyses conducted 20 to 25 years ago. Several of the examples cited in the proposed rule were based on historical data and EPA acknowledges that the data may not reflect current impingement or entrainment rates at the facility, particularly if technologies and other operational measures for reducing entrainment and impingement have been implemented since the original study. However, in most cases updated information was not available. To the extent possible, EPA has supplemented the facility information in the record for this final rule to include smaller facilities and updated information.

Finally, several commenters suggested that there was no need to address construction impacts in the 316(b) rule because there were existing Federal, State, and local provisions designed to minimize the impacts caused by construction activities. Another commenter stated that it was likely that the majority of new generation, once-through cooling facilities will be using existing cooling water intake structures and that it was doubtful that a new once-through facility would be constructed in an area where significant habitat could be disrupted. In contrast, another commenter stated that the regulation should address impacts associated with new cooling water intake structure construction, even if impacts were not recurring.

Under today's rule, EPA will minimize construction impacts by requiring appropriate intake design and construction technologies. EPA recognizes that other Agencies have a prominent role in evaluating and minimizing impacts related to construction activities and acknowledges that existing Federal, State, and Tribal programs include requirements that address many of the environmental impact concerns associated with the construction of new intakes. EPA believes that implementation of appropriate design and construction technologies and existing program requirements will minimize the environmental impacts of construction.

2. Adverse Environmental Impact

The proposed rule discussed six potential definitions for adverse environmental impact: (1) A level of impingement and entrainment that is recurring and nontrivial, perhaps defined as the impingement or entrainment of 1 percent or more of the aquatic organisms in the near-field area as determined in a 1-year study; (2) entrainment or impingement damage as a result of the operation of a specific cooling water intake structure, including a determination of the magnitude of any short-term and long-term adverse impacts; (3) any impingement or entrainment of aquatic organisms; (4) a biocriteria approach based on a comparison of the abundance, diversity, and other important characteristics of the aquatic community at the proposed intake site with similar biological metrics at defined reference sites; (5) evaluation of impacts to protected species, socially, recreationally, or commercially important species, and community integrity (including community structure and function); and (6) impacts likely to interfere with the protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife. The proposed rule also invited comment on whether adverse environmental impact should be defined more broadly to include non-aquatic environmental impacts (e.g., air emissions, noise, introductions of non-indigenous species) associated with technology-based requirements (see Section VI.B.2.e. below). In the NODA, EPA presented another population-based approach proposed by industry for defining adverse environmental impact—"Adverse environmental impact is a reduction in one or more representative indicator species that (1) creates an unacceptable risk to the population's ability to sustain itself, to support reasonably anticipated commercial or recreational harvests, or to perform its normal ecological function, and (2) is attributable to the operation of the cooling water intake"—and invited comment on this definition as well as refinements to three of the definitions discussed in the proposed rule. See, 66 *FR* 28859–28863.

Numerous commenters stated that defining adverse environmental impact was critical to the 316(b) regulation because the program is fundamentally based on minimizing environmental impact. Further, commenters suggested that, without a solid definition of adverse environmental impact, the Agency's ability to interpret, implement, and enforce 316(b)-related actions would be seriously hampered.

EPA recognizes that since enactment of 316(b), scientists, environmentalists, lawmakers, and regulators have disagreed on an exact definition for adverse environmental impact. Further, the many studies conducted to date and arguments put forward on this issue have done little to resolve the current lack of consensus among the concerned parties. Given this background, EPA has determined to address adverse environmental impacts as discussed below.

a. What Constitutes Adverse Environmental Impact Under This Final Rule?

EPA acknowledges that there are multiple types of adverse environmental impact including impingement and entrainment; reductions of threatened, endangered, or other protected species; damage to ecologically critical aquatic organisms, including important elements of the food chain; diminishment of a population's potential compensatory reserve; losses to populations, including reductions of indigenous species populations, commercial fishery stocks, and recreational fisheries; and stresses to overall communities or ecosystems as evidenced by reductions in diversity or other changes in system structure or function.

In the preamble to the proposed rule, EPA discussed several other options for interpreting adverse environmental impact. One option would be to look to section 316(a) of the Clean Water Act for guidance. Section 316(a) addresses requirements for thermal discharge and provides that effluent limitations associated with such discharge should generally not be more stringent than necessary to "assure the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife in and on that body of water." The same language is repeated in section 303(d) with reference to total maximum daily load (TMDL) listing requirements for waters impaired by thermal discharge. These statutory provisions indicate that Congress intended this requirement to be used in evaluating the environmental impacts of thermal discharges. Some have suggested that, since thermal discharges are usually paired with cooling water intake, it may be reasonable to interpret the Clean Water Act to apply this requirement in evaluating adverse environmental impact from cooling water intake structures as well.

Commenters have argued that the CWA compels EPA to determine that the objective of section 316(b) must be linked to the 316(a) goal to ensure protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife. EPA does not agree that the CWA compels EPA to interpret adverse environmental impact

as that term is used in section 316(b) in the Act by reference to the phrase "balanced indigenous population" under section 316(a). Because Congress used different terms in section 316(b) than in section 316(a), EPA does not believe the Agency is required to adopt such an interpretation. When Congress includes particular language in one section of a statute but omits it in another section of the same act, it is generally presumed that Congress acted intentionally and purposely in the disparate inclusion or exclusion. *Bates* v. *U.S.*, 522 U.S. 23 (1997). The usual canon of statutory interpretation is that when Congress uses different language in different sections of a statute, it does so intentionally. *Florida Public Telecommunications Ass'n, Inc.* v. *F.C.C.*, 54 F.3d 857 (D.C. Cir. 1995). Instead, EPA believes, consistent with EPA's ecological risk assessment guidelines, that it is reasonable to interpret adverse environmental impact as including impingement and entrainment, diminishment of compensatory reserve, stresses to the population or ecosystem, harm to threatened or endangered species, and impairment of State or authorized Tribal water quality standards. The Agency has long maintained that adverse environmental impact from cooling water intake structures must be minimized to the fullest extent practicable,[55] even in cases where it can be demonstrated that the requirement applicable under section 316(a) is being met.[56] [57] Thus, the objective of section 316(b) includes population effects but is not limited to those effects. EPA's interpretation of "adverse environmental impact" is discussed in more detail below.

b. Approach to Defining Adverse Environmental Impact

EPA received numerous comments on its proposed rule asserting that the proper endpoint for assessing adverse environmental impact is at the population level, that some of EPA's proposed alternative definitions of adverse environmental impact would essentially protect "one fish," and that EPA's alternative for defining adverse environmental impact as recurring and nontrivial impingement and entrainment was vague or would lead to excessive and costly efforts to protect a very few fish that would not result in ecologically relevant benefits. EPA's record at proposal demonstrated that cooling water intake structures do not kill, impinge, or entrain just "one fish," or even a few aquatic organisms. The NODA published by EPA provides further examples of cooling water intake structures that kill or injure large numbers of aquatic organisms. For example, EPA provided information on aquatic organism conditional mortality rates for the Hudson and Delaware rivers that demonstrated significant mortality due to cooling water intake structures. EPA considered this information, as well as information in Section III on impingement and entrainment survival and impact, as it deliberated options for the final rule and how adverse environmental impact should be defined. Further, EPA considered documents that discussed potential consequences associated with the loss of large numbers of aquatic organisms. These potential consequences included impacts on the stocks of various species, including any loss of compensatory reserve due to the deaths of these organisms, and the overall health of ecosystems. Given all of these considerations, EPA determined that there are multiple types of undesirable and unacceptable adverse environmental impacts, including entrainment and impingement; reductions of threatened, endangered, or other protected species; damage to critical aquatic organisms, including important elements of the food chain; diminishment of a population's compensatory reserve; losses to populations, including reductions of indigenous species populations, commercial fishery stocks, and recreational fisheries; and stresses to overall communities or ecosystems as evidenced by reductions in diversity or other changes in system structure or function.

EPA also invited commenters to submit for consideration additional studies that documented either significant impacts or lack of significant impacts from cooling water intake structures. Several commenters submitted reports on manufacturing and power plant facilities that purported to demonstrate minimal impact from cooling water intake. One commenter submitted three documents for EPA's review. Another commenter submitted information on the Neal Complex facility located on the Missouri River near Sioux City, Iowa. The commenter described a 10-year (1972–82) study that focused on evaluating the operational impacts of the Neal facility, sited on a heavily channelized segment of the Missouri River. The commenter asserted that study results indicated little if any detrimental impact to the Missouri River ecosystem caused by facility operations. EPA reviewed the information summarized by the commenter and finds fault with several of the statements and conclusions cited in the comment. This is discussed further in EPA's response to comments document.

c. Assessment of Population Modeling Approach

Some commenters asserted that impacts on individual organisms or subpopulations are not ecologically relevant and recommended that EPA define adverse environmental impact as follows: "Adverse environmental impact is a reduction in one or more representative indicator species that (1) creates an unacceptable risk to the population's ability to sustain itself, to support reasonably anticipated commercial or recreational harvests, or to perform its normal ecological function, and (2) is attributable to the operation of the cooling water intake structure." Under this approach, EPA would define unacceptable risk by using a variety of methods that fisheries scientists have developed for estimating (1) the level of mortality that can be imposed on a fish population without threatening its capacity to provide "maximum sustainable yield" (MSY) on a long-term basis, as developed under the Magnuson-Stevens Fishery Conservation and Management Act, and (2) the optimum population size for maintaining maximum sustainable yield.

In evaluating such comments, EPA considered the premises underlying MSY and the models used by National Marine Fisheries Service (NMFS) to derive MSY. Because the concept of MSY is based on harvesting adult fish, EPA generally questions whether this approach is directly relevant to egg, larvae, and juvenile losses associated with intakes. EPA also notes that the models used to estimate MSY do not directly incorporate any additional stressors (such as losses from entrainment and impingement) to managed stocks other than fishing pressure. Further, it is important to note that NMFS does not always manage stocks to their calculated MSY. In many cases, particularly if there is a concern over protecting habitat or critical ecosystems, NMFS regulates fisheries based on their "optimum yield," which is less than the MSY. According to the Magnuson-Stevens Fisheries Conservation and Management Act, "the

[55] *In re Brunswick Steam Electric Plant*, Decision of the General Counsel No. 41, June 1, 1976.

[56] *In re Public Service Co. of New Hampshire*, (Seabrook Station Units 1 and 2) (Decision of the Administrator) 10 ERC 1257, 1262 (June 17, 1977).

[57] *In re Central Hudson Gas and Elec. Corp.*, Decision of the General Counsel No. 63, July 29, 1977.

term 'optimum' with respect to the yield from a fishery, means the amount of fish which * * * is prescribed as such on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological function * * *"

EPA also considered the relative long-term success of ongoing fishery management practices implemented by the National Marine Fisheries Service and others. Despite the availability of state-of-the-art fish population models and considerable experience managing fisheries, NMFS recently classified 34 percent of their managed fishery stocks as over-utilized.[58] EPA agrees with fisheries experts and resource managers that there is unavoidable uncertainty associated with managing fish populations.[59] [60] [61] [62] As a recent NMFS advisory panel expressed it, "Uncertainty and indeterminancy are fundamental characteristics of the dynamics of complex adaptive systems. Predicting the behaviors of these systems cannot be done with absolute certainty, regardless of the amount of scientific effort invested."[63] Consistent with its own Guidelines for Ecological Risk Assessment, EPA agrees with the conclusions of the NMFS panel that "Given the high variability associated with ecosystems, managers should be cognizant of the high likelihood for unanticipated outcomes. Management should acknowledge and account for this uncertainty by developing risk-averse management strategies that are flexible and adaptive." As the panel concluded, "The modus operandi for fisheries management should change from the traditional mode of restricting fishing activity only after it has demonstrated an unacceptable impact, to a future mode of only allowing fishing activity that can be reasonably expected to operate without unacceptable impacts." EPA and other fishery scientist support the concept of a precautionary approach,[64] particularly when dealing with complex systems, as described below.

EPA recognizes that the limitations of existing population models, including models used to manage fisheries, may be related to our overall limited understanding of the complexity of aquatic ecosystems and the long-term effects of anthropogenic activities [65] [66]. As proposed in a recent journal article, many of the adverse impacts identified for coastal ecosystems, such as estuarine eutrophication, loss of kelp beds, coral reef die-offs, and introductions of invasive species, were initiated by historical overfishing.[67] Losses or extinctions of large vertebrate predators and filter-feeding bivalves such as oysters caused by overfishing have, over time, resulted in species replacements and significantly limited or ceased interactions between the overfished populations and other coastal community species. Historical overfishing and ecological extinctions precede both modern ecological investigations and the collapse of several marine ecosystems in recent times, "raising the possibility that many more marine ecosystems may be vulnerable to collapse in the near future."[68] Further, because modern ecological studies do not typically consider the long-term historical record, existing fishery resource baselines may be inaccurate, and "Even seemingly gloomy estimates of the global percentage of fish stocks that are overfished are almost certainly far too low."[69] Thus, EPA is concerned that historical overfishing increased the sensitivity of coastal ecosystems to subsequent disturbance, making them more vulnerable to human impact and potential collapse. Based on the long-term record of anthropogenic impacts to coastal ecosystems, their documented degradation, and their potential sensitivity to additional anthropogenic disturbance, as well as the admitted uncertainty associated with managing coastal fishery populations, EPA firmly believes that protective, risk-averse measures are warranted to prevent further declines or collapses of coastal and other aquatic ecosystems. EPA views impingement and entrainment losses to be one of many potential forms of disturbance that should be minimized to avoid further degradation.

Further, it remains unclear whether it is possible or sufficient to use single species population assessment models to assess impacts on multiple species, as is often necessary in evaluating impingement and entrainment by cooling water intake structures. NMFS now recognizes that improvement in fisheries management will require a comprehensive, ecosystem-based approach and recently convened an advisory panel to develop principles and approaches for ecosystem-based fishery management. In its report to Congress, the advisory panel noted that such an approach will "require managers to consider all interactions that a target fish stock has with predators, competitors and prey species; the effects of weather and climate on fisheries biology and ecology; the complex interactions between fishes and their habitat; and the effects of fishing on fish stocks and their habitat."[70] EPA supports the ecosystem-based approach to fisheries management advanced by NMFS and recognizes that this approach will require an in-depth understanding of species interactions. Because the ecosystem-based approach is currently evolving, EPA believes it is unlikely that most existing single species population models can accurately account for multiple-species interactions.

EPA also considered information addressing the issue of compensation—an increase that may potentially occur in survival, growth, or reproduction of a species triggered by reductions in population size [71] [72]—and its application to the section 316(b) rulemaking. In particular, EPA sought comment on a memorandum discussing compensation and the quantity of data required to calculate compensation factors (DCN #2–020C). This document states that the use of compensation factors is typically

[58] National Marine Fisheries Service. 1999. Our living oceans. Report on the status of U.S. living marine resources. U.S. Department of Commerce, NOAA tech. memo. NMFS–F/SO–41.

[59] Hilborn, R., and C.J. Walters. 1992. *Quantitative fisheries stock assessment: choice, dynamics, and uncertainty*. Chapman and Hall.

[60] Hilborn, R., E.K. Pikitch, and R.C. Francis. 1993. Current trends in including risk and uncertainty in stock assessment and harvest decisions. *Canadian Journal of Fisheries and Aquatic Sciences* 50:874–880.

[61] Hutchings, J.A., and R.A. Meyers. 1994. What can be learned from the collapse of a renewable resource? Atlantic cod, Gadus morhus, of Newfoundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences* 51:2126–2146

[62] National Research Council. 1998. *Improving fish stock assessments*. National Academy Press, Washington, D.C.

[63] National Marine Fisheries Service Ecosystem Principles Advisory Panel. 1998. *Ecosystem-based fishery management. A report to Congress*.

[64] Dayton, P.K. 1998. Reversal of the burden of proof in fisheries management. *Science* 279:821–822.

[65] Fogarty, M.J., A.A. Rosenberg, and M.P. Sissenwine. 1992. Fisheries risk assessment: sources of uncertainty. A case study of Georges Bank haddock. *Environ. Sci. Technol.* 26:440–446.

[66] Ludwig, D., R. Hilborn, and C. Walters. 1993. Uncertainty, resource exploitation, and conservation: lessons from history. *Science* 260:17 and 36.

[67] Jackson, J.B.C., M.X. Kirby, W.H. Berger, K.A. Bjorndal, L.W. Botsford, B.J. Bourque, R.H. Bradbury, R. Cooke, J. Erlandson, J.A. Estes, T.P. Hughes, S. Kidwell, C.B. Lange, H.S. Lenihan, J.M. Pandolfi, C.H. Peterson, R.S. Steneck, M.J. Tegner, and R.R. Warner. 2001. *Science* 293(5530):629–638.

[68] Ibid.

[69] Ibid.

[70] NMFS Ecosystem Principles Advisory Panel. 1998. *Ecosystem-based fishery management. A report to Congress*.

[71] Rose, K.A., J.H. Cowan, Jr., K.O. Winemiller, R.A. Myers, and R. Hilborn 2001. In press. Compensatory density-dependence in fish populations: importance, controversy, understanding, and prognosis. In press, *Fish and Fisheries*.

[72] Goodyear, C.P. 1980. Compensation in fish populations. In *Biological monitoring of fish*, ed. C.H. Hocutt and J.R. Stauffer, pp. 253–280. Lexington Books, Lexington, MA.

limited to cases in which fishery managers have extensive data on a fish population and that specific, numerical compensation values generally are not used in the absence of robust data sets (i.e., a minimum of 15–20 years of data suggested). Moreover, fish stocks for which these robust data sets exist are generally the highly exploited commercial and recreational stocks,[73] and few data exist for most nonharvested species. This memorandum also noted that in the absence of sufficient data various proxies are typically used to avoid quantitatively determining compensation.

In general, commenters asserted that compensation is a well-documented property of population regulation and that, despite 30 years of studies, there was no evidence that power plant impacts alone could reduce a population's compensatory reserve. Other comments specific to the memorandum concurred that, in the absence of sufficient data, compensation may be indirectly assessed using spawner-recruit models and that more than 100 marine and estuarine shellfish populations are currently managed by NMFS and other fisheries commissions using these proxies. One commenter provided information pertaining to new scientific studies of compensatory reserve and large databases containing fisheries information that are currently under development. The commenter asserted that use of meta-analysis—defined as the process of combining and assessing findings from several separate research studies that bear upon a common scientific problem—in conjunction with expanded fishery data sets will greatly increase the number of species for which scientists can estimate compensatory reserves. The commenter maintained that more and better estimates of compensatory reserve will be developed by the end of the decade, and requested that EPA take this trend into consideration. In contrast, another commenter asserted that industry abuses compensation theories and density-dependent models to support their contention that killing millions of fish is not ecologically relevant nor does it equate to an adverse environmental impact. The commenter further contended that there was a lack of scientific support for density-dependent models and provided references from peer-reviewed journals that critique and challenge the scientific underpinnings of these models.

EPA believes that a population's potential compensatory ability is affected by all stressors encountered within the population's natural range, including takes attributed to individual or multiple cooling water intake structures. Thus, even if there is little evidence that cooling water intakes *alone* reduce a population's compensatory reserve, EPA is concerned that the multitude of stressors experienced by a species can potentially adversely affect its ability to recover.[74] Moreover, EPA notes that the opposite effect may occur when populations are low, a phenomenon known as "depensation." Depensation refers to decreases in recruitment as stock size declines.[75] Because depensation can lead to further decreases in the abundance of populations that are already seriously depleted, recovery may not be possible even if stressors are removed. In fact, there is some evidence that depensation may be a factor in some recent fisheries collapses.[76] [77] [78]

Because EPA's mission includes ensuring the sustainability of communities and ecosystems, EPA must comprehensively evaluate all potential threats to resources, and work towards eliminating or reducing identified threats. EPA believes that cooling water intakes do pose a threat to some fishery stocks and through this rule is seeking to minimize that threat. EPA also acknowledges that spawner-recruit proxies are currently used by several agencies to manage fishery stocks. However, as indicated in the record, these proxies are used in the absence of robust data sets. EPA does not believe that simply because an approach is currently in place, it constitutes the best approach. Given the uncertainty associated with managing fish stocks and the degree of stock overutilization despite long-term management efforts (see earlier discussion in Section VI.B.2.c.), EPA is concerned about the relative accuracy of these proxies and their overall ability to protect fishery stocks. EPA does not discourage development of new data sets, population models, or other scientific investigations that will improve estimates of compensatory reserve or other parameters that are needed to understand fishery dynamics. In fact, it is EPA's belief that these developments are ongoing due to the acknowledgment—direct or otherwise—that existing data and models are inadequate. Under the consent decree schedule, EPA is required to promulgate today's rule based on its interpretation of current science and EPA agrees with all comments discussed above that there are some weaknesses and potential inaccuracies inherent to existing estimations of compensation. EPA strongly supports additional research efforts and the development of expanded fisheries data sets that can be used to fill information gaps and improve our understanding of the complex relationships associated with aquatic ecosystems, fishery populations, and anthropogenic activities and, ultimately, assist NMFS and other agencies in wisely managing fishery resources. Because fishery resources are so precious, EPA further contends that compensation studies and models currently under development—including the data on which they are based—should be subject to peer review and other measures that will ensure their scientific rigor.

EPA also evaluated information submitted by the Utility Water Act Group (UWAG) and the Electric Power Research Institute (EPRI), both in their comments and in studies provided to the Agency after the comment period. In summary, these comments and documents asserted that entrainment of very large numbers of eggs, larvae, and early juvenile-stage fish does not necessarily meaningfully affect populations of the entrained species and that substantial percentages of the organisms of many species may survive entrainment. Further, these comments and documents asserted or were intended to support the assertion that impingement survival was high for many species and that impingement often impacts low-value, forage species when they are naturally prone to seasonal die-off regardless of cooling water intake structures. One of these comments asserted that EPRI and some

[73] Myers, R.A., J. Bridson, and N.J. Barrowman. 1995. Summary of worldwide stock and recruitment data. *Canadian Technical Reports in Fisheries and Aquatic Science* 2024:1–327.

[74] Hutchings, J.A. and R.A. Myers. 1994. What can be learned from the collapse of a renewable resource? Atlantic cod, *Gadus morhua*, of New Foundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences* 51:2126–2146.

[75] Goodyear, C.P. 1977. Assessing the impact of power plant mortality on the compensatory reserve of fish populations. Pages 186–195 in W. Van Winkle, ed., *Proceedings of the Conference on Assessing the Effects of Power-Plant Induced Mortality on Fish Populations*. Pergamon Press, New York, NY.

[76] Myers, R.A., N.J. Barrowman, J.A. Hutchings, and A.A. Rosenberg. 1995. Populations dynamics of exploited fish stocks at low population levels. *Science* 26:1106–1108.

[77] Hutchings, J.A. and R.A. Myers. 1994. What can be learned from the collapse of a renewable resource? Atlantic cod, *Gadus morhus*, of New Foundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences* 51:2126–2146.

[78] Liermann, M. and R. Hilborn. 1997. Depensation in fish stocks: A hierarchic Bayesian meta-analysis. *Can J. Fish. Aquat. Sci.* 54:1976–1985.

of the best fishery scientists in the world have never identified a site where definitive or conclusive aquatic population or community level impacts have occurred from operation of cooling water intake structures as described by EPA in the proposed rule.

In response to comments that entrainment of very large numbers of eggs, larvae, and other life stages of fish do not meaningfully affect populations of entrained species, EPA believes that there is evidence that some fish stocks have been adversely affected by cooling water intakes. For example, Atlantic Coast States have expressed concern over declines in winter flounder populations and have requested that the Atlantic States Marine Fisheries Commission conduct a study of the cumulative effects of cooling water intakes on winter flounder abundance. In addition, NMFS documented in several fishery management plans that cooling water intake structures are one of the threats that may adversely affect fish stocks and their habitats (DCN# 2–024M, 2–024N, and 2–024O). EPA also is concerned that an extensive data set, encompassing 20 or more years of monitoring data, is usually required to adequately assess whether or not populations are being affected by intakes. These long-term data sets are not currently available for many species, and thus it is very difficult to confidently state that entrainment has a negligible impact on *any* fish population. EPA also notes that the potential compensatory reserve of some fishery stocks can be depleted beyond the point of recovery [79] and that the compensatory reserve of many species entrained or impinged by intakes is unknown. For all of these reasons, EPA believes that the potential for entrainment impacts exists, and that additional scientific data are needed to evaluate entrainment impacts on all affected fish and shellfish populations.

In response to assertions that many organisms survive entrainment, EPA maintains that studies show that through-plant mortality rates of young fishes vary depending on numerous factors. [80] Different species have different tolerance to passage through a cooling system, and mortality rates may differ among life stages of the same species. A summary of mortality data from five Hudson River power plants showed that mortality rates could be substantial.[81] The report cited species-specific mortality rates that varied by life stage for bay anchovy (93 to 100 percent), Atlantic tomcod (0 to 64 percent), herrings (57 to 92 percent), white perch (41 to 55 percent), and striped bass (18 to 55 percent). The study further emphasized that the reliability of these estimates was questionable and that various sources of potential bias may have caused the estimated rates to be *lower* than the actual mortality rates. EPRI sponsored a recent review of 36 entrainment survival studies, the majority of which were conducted in the 1970s. [82] [83] The summarized mortality rates described by EPRI were in substantial agreement with patterns reported in the Hudson river summary, namely that anchovies and herrings had the highest mortality rates (greater than 75 percent), and that thermal regimes seemed to be important determining factors.

Similar to entrainment survival, EPA notes that studies show impingement survival is dependent on species characteristics such as and life history stage, swimming ability, etc.[84] Impingement survival is also dependent on the type of technology in place and the operational aspects of the intake. EPA is aware that in some cases, with appropriate technologies in place, impingement survival may be substantial for some species.[85] EPA is also aware that impingement survival studies suggest that impingement survival is low for some species such as small bay anchovy and Atlantic menhaden during summers in Atlantic Coast estuaries.[86] EPA does not believe that loss of such forage species should be viewed as having limited importance simply because they have minimal or no commercial or recreational value. From a more holistic, ecological perspective, forage species can have great importance in their role as prey for higher trophic levels, including many commercially and recreationally important fish species. In today's rule, EPA seeks to minimize impingement losses for *all* affected species.

d. Biological Assessment Approach

Biological assessments and criteria are recognized as important methods for gathering relevant ecological data for addressing attainment of biological integrity and designated aquatic life uses.[87] EPA invited comment on the following discussion and documents that identified potential constraints on using these methods to determine adverse environmental impact from the operation of cooling water intake structures. First, biological assessment and criteria methods are still being developed for large rivers and the Great Lakes, two large waterbody types where many cooling water intake structures are located. Second, although biological assessment and criteria guidance has been published by EPA for small streams and wadeable rivers, lakes and reservoirs, and estuaries and coastal marine waters, many States and authorized Tribes have yet to apply these criteria in large waterbodies where cooling water intake structures will be located. Most work to date by the States to use these methods was applied to small streams and wadeable rivers where relatively few cooling water intake structures are located. In addition, although bioassessments and criteria are valuable for evaluating the biological condition of a waterbody, in complex situations where multiple stressors are present (e.g., point source discharges, non-point source discharges, harvesting, runoff, hydromodifications, habitat loss, cooling water intake structures, etc.), it is not well understood how to identify all the different stressors affecting the biology in a waterbody and how best to apportion the relative contribution to the biological impairment of the stressors from each source within a watershed. Thus, it is the opinion of EPA that the existing guidance for conducting biological assessments (particularly within large river systems and the Great Lakes) and the quantity of biocriteria data compiled at the State/Tribal level are insufficient at this time to apply a biocriteria approach to

[79] Hutchings, J.S. and R.A. Myers. 1994. What can be learned from the collapse of a renewable resource? Atlantic cod, *Gadus morhua*, of New Foundland and Labrador. *Canadian Journal of Fisheries and Aquatic Sciences* 51:2126–2146.

[80] EPRI. 2000. Review of entrainment survival studies: 1970–2000. Report No. 1000757. Prepared by EA Engineering Science & Technology.

[81] Boreman, J., L.W. Barnthouse, D.S. Vaughan, C.P. Goodyear, S.W. Christensen, K.D. Kumar, B.L. Kirk, and W. Van Winkle. 1982. The impact of entrainment and impingement on fish populations in the Hudson River Estuary: volume I, Entrainment impact estimates for six fish populations inhabiting the Hudson River Estuary. Prepared for the U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research by the Oak Ridge National Laboratory. ORNL/NUREG/TM–385/V1.

[82] Electric Power Research Institute. 2000. *Review of entrainment survival studies: 1970–2000.* No 1000757. Prepared by EA Engineering Science & Technology.

[83] Some of the studies summarized in EPRI (2000) are the same ones considered by Boreman *et al.* (1982). See EPRI (2000) for complete citations of 36 original studies.

[84] EPRI. 2000. Technical evaluation of the utility of intake approach velocity as an indicator of potential adverse environmental impact under Clean Water Act section 316(b). Report No. 100731, EPRI, Palo Alto, CA.

[85] Ibid.

[86] Ibid.

[87] Davis, W.S. and T.P. Simon, eds. 1995. *Biological assessment and criteria: tools for water resource planning & decision making.* Lewis Publishers, Boca Raton, FL.

evaluation of cooling water intakes nationally.

EPRI also questioned the applicability of bioassessments for 316(b) analyses. Specifically, EPRI developed a document that examined the suitability of multimetric bioassessment for regulating cooling water intake structures under section 316(b) of the CWA.[88] In its conclusion, EPRI stated that biocriteria are well suited for assessing community-level effects, but are not designed as indices for measuring population-level effects without additional analyses; that assumptions about the structure and function of ecosystems embedded in the biocriteria approach appear to conflict with current understanding of ecosystems as dynamic, nonequilibrium systems structured on multiple time and space scales; and that issues such as significant uncertainty related to identification of reference conditions remain unresolved, particularly for large, open systems such as estuaries and coastal marine waters.

e. Non-Aquatic Environmental Impacts

EPA invited comment in the proposal on whether adverse environmental impact should be defined broadly to consider non-aquatic adverse environmental impacts in addition to aquatic impacts (65 *FR* 49075). EPA also discussed the water quality and non-water quality impacts of cooling towers (both wet and dry) in the proposal (see 65 *FR* 49075 and 65 *FR* 49081). In the NODA, EPA outlined its methodology for estimating marginal increases in air emissions from electric generating facilities due to the adoption of wet or dry cooling towers (66 *FR* 28867).

Some commenters asserted that EPA failed to consider potential adverse environmental impacts associated with evaporative cooling towers. One commenter stated that evaporative cooling towers carry some potential for localized impact apart from their extraction of cooling water, because they may discharge bacterial slimes, fungi, and a variety of organisms which colonize the tower but are not otherwise native to the local ecosystem. The commenter added that such organisms can be suppressed by the use of biocides that may be discharged with the effluent. In addition, the commenter claimed that evaporative towers may concentrate nutrients such as phosphates and, when brackish or marine water is used, discharge salt spray drift. Additionally, one commenter stated that although there is no express statutory support in section 316(b) for limiting consideration to aquatic impacts (see 33 U.S.C. 1326(b)) they believe that the analysis of such impacts can be appropriate. Further, the commenter encouraged EPA to consider non-aquatic impacts which relate to cooling towers. Other commenters stated that Congress' mandate for environmental impact is broader than the entrainment and impingement impacts upon which EPA has focused in the proposed regulation. The commenters urged EPA to consider the following effects of the cooling tower technology: (1) Increased air emission due to the "energy penalty" exacted by closed-cycle cooling, or dry cooling; (2) noise; (3) visible plumes that (a) are unaesthetic, and (b) contribute to increased fogging and icing on nearby roadways; and (4) salt drift. The commenters added further that of all the technologies associated with cooling condenser water, once-through cooling is the only technology that is not associated with increased air emissions. According to the comments, the other cooling water technologies either directly emit contaminants into the air and/or indirectly result in an increase of fuel use and air emissions due to the loss of electrical generation capacity by the power used to operate these technologies. The comments stated that, in essence, the proposed regulations pre-determine that air and noise impacts are more acceptable than impacts to aquatic resources and water quality. The comments added that the locations least likely to be able to comply with the requirements, like those in urban areas, are also the most likely to have impaired air quality. One commenter maintained that for recirculated systems, cooling tower blowdown must be stored in evaporation ponds or treated prior to discharge, resulting in potential for groundwater impacts and disturbance of terrestrial habitats. Additional commenters stated that there could be unintended air pollution consequences for manufacturers from the 316(b) rule due to adoption of cooling towers. The forest products industry projects an increase in $SO_2$, $NO_X$, PM, and $CO_2$ emissions due to increased energy demand to run their mills. Other commenters stated that EPA must ensure that new cooling water technologies do not increase fossil fuel use by manufacturers.

Conversely, some commenters stated that the primary environmental concern with intake structures should be those focused on the aquatic environment. They added that while non-aquatic concerns are valid and should be considered secondarily, the main effect of these facilities is to the aquatic communities and the decision-making process should reflect this priority. Further, one commenter recommended that the regulation, (and probably more specifically the guidance), allow States, authorized Tribes, permitting authorities, and facility operators to have sufficient flexibility to consider non-aquatic impacts that may result from activities related to the design, construction, location, and operation of an intake structure and other alternative technologies identified as having a harmful effect on air, lands, and other natural resources when making section 316(b) decisions. One commenter claimed that a large array of environmental laws and regulations already exist to address non-water environmental impacts. Some commenters asserted that the potential for localized impact from wet cooling towers is relatively minor given the substantial improvements in entrainment and impingement and the elimination of thermal impacts associated with wet cooling as compared to once-through cooling.

For the final rule, EPA presented estimates of marginal annual increases in air emissions associated with installing recirculating wet cooling towers in lieu of once-through cooling systems. The Agency compared projected emissions under the rule to projected emissions absent the rule. Because EPA projects that, regardless of the outcome of the rule (that is, absent the regulations) a majority of power plants would have recirculating wet cooling towers and a minority would have once-through or dry cooling systems, the number of in-scope facilities contributing to increased air emissions is small. Regardless, EPA estimates that the following annual air emissions increases will occur as consequence of the rule: 2,560 tons of $SO_2$, 1,200 tons of $NO_X$, 485,900 tons of $CO_2$, and 16 pounds of Hg. These increases represent a change of less than 0.02 percent of annual emissions from power plants in the United States. Air emissions for manufacturing facilities projected within the scope of the rule are projected to not increase. This is due to the fact that EPA projects manufacturers to utilize reuse and recycling of cooling water to meet the flow reduction requirements in lieu of recirculating wet cooling towers. For the other regulatory options analyzed for the final rule, EPA presented annual air

[88] EPRI. 2000. Evaluation of biocriteria as a concept, approach, and tool for assessing impacts of impingement and entrainment under :§ 316(b) of the Clean Water Act. Report No. TR-114007, EPRI, Palo Alto, CA.

emissions estimates in Chapter 3 of the *Technical Development Document.*

To a large degree, issues brought forth by commenters regarding non-aquatic impacts of cooling towers were highly site-specific. For instance, in the cases where visible plumes from evaporative cooling towers was a significant issue for the public and other stakeholders on the local level, alternative or additional technologies have been adopted in response to stakeholder sentiment. The two-track regulatory framework adopted by EPA in the final rule allows for this local, site-specific decision-making process. In the case where facilities, or public stakeholders, determine that an alternative technology to a traditional flow reducing type (such as recirculating wet cooling towers or cooling ponds) is necessary, the two-track methodology provides the flexibility for an equivalent aquatic environmental impact minimization to occur without producing a non-aquatic impact.

In general, EPA has concluded that at a national level the primary impacts of this rule will be aquatic in nature, and focus on impingement and entrainment affects. Nevertheless, at a local level, it is possible that air quality impacts, non-impingement and entrainment aquatic effects, or energy impacts could be significant and potentially justify a different approach to regulating cooling water intake structures. Moreover, the cost impact of the rule, under certain local conditions, could be wholly disproportionate to costs anticipated by EPA on a national level. EPA believes that it is prudent to make an alternative regulatory mechanism available to the permitting authority to address such situations, and to be used at the permitting authority's discretion. EPA is sensitive to the large resource burden which such flexibility could place on the permitting authority, if this mechanism were abused by permit applicants. Therefore, EPA is placing the burden of demonstration of the need to pursue such alternative regulatory limits entirely on the permit applicant.

In this final rule for new facilities, where EPA is concerned about certainty and speed of permitting, EPA has selected impingement and entrainment as the metric for performance. EPA has considered the non-impingement and entrainment environmental impacts of the new facility rule and has found them to be acceptable on a national level. EPA is currently developing proposed regulations to establish the best technology available for minimizing adverse environmental impact from intake structures associated with existing facilities. The studies EPA has done of non-impingement and entrainment impacts in the case of new facilities would not govern in that context. Accordingly, the standard and procedures EPA develops for assessing adverse environmental impact from intake structures at existing facilities may well be quite different, and nothing in this rulemaking should preclude EPA from coming to the conclusion that a different approach for regulating cooling water intake structures at existing facilities is warranted.

3. Additional Information Indicating that Impingement and Entrainment May Be a Non-Trivial Stress on a Waterbody

In addition to reviewing the merits of a population approach to assessing adverse environmental impact, EPA considered information suggesting that impingement and entrainment, in combination with other factors, may be a nontrivial stress on a waterbody. EPA recognizes that cooling water intake structures are not the only source of human-induced stress on aquatic communities. These stresses include, but are not limited to, nutrient loadings, toxics loadings, low dissolved oxygen content of waters, sediment loadings, stormwater runoff, and habitat loss. While recognizing that a nexus between a particular stressor and adverse environmental impact may be difficult to establish with certainty, the Agency identified methods for evaluating more generally the stresses on aquatic communities from human-induced perturbations other than fishing. Of particular importance is the recognition that stressors that cause or contribute to the loss of aquatic organisms and habitat may incrementally impact the viability of aquatic resources. EPA examined whether waters meet their designated uses, whether fisheries are in stress, and whether waters would have higher water quality or better support their designated uses if EPA established additional requirements for new cooling water intake structures. EPA considered use of this type of information as one approach for evaluating adverse environmental impact.

EPA prepared a memorandum (Dabolt, T. EPA. April 18, 2001, revised July 2001. Memo to file Re: 316(b) analysis-relationship of location to cooling water intake structures to impaired waters) documenting that 99 percent of existing cooling water intake structures at facilities that completed EPA's section 316(b) industry survey are located within two miles of locations within waterbodies identified as impaired and listed by a State as needing development of a total maximum daily load (TMDL) to restore the waterbody to its designated use. All of the leading sources of waterbody impairment—nutrients, siltation, metals, and pathogens—can affect aquatic life. In the 1998 National Water Quality Inventory, inability to support aquatic life uses was one of the most frequently cited water quality concerns.

EPA recognizes, however, that these data do not establish that cooling water intake structures are the cause of adverse environmental impact in any particular case and that there may be other reasons for the presence of impaired waters near cooling water intake structures, such as the frequent location of facilities with cooling water intake structures near other potential sources of impairment (*e.g.*, industrial point sources, urban stormwater). Nonetheless, this analysis suggests that many cooling water intake structures are sited within or adjacent to impaired waters, and that intakes potentially contribute to existing stress on waterbodies and their resident biota.

EPA also summarized information from a number of sources indicating overutilization of about 34 percent of the fishery stocks whose known status is tracked by and under National Oceanic and Atmospheric Administration's (NOAA) purview (54 out of 160 stock groups) and which rely on tidal rivers, estuaries, and oceans for spawning, nursery, or adult habitat. An additional 45 stocks under NOAA purview are of unknown status (about 22 percent of the fisheries managed by NOAA) because of incomplete assessments. In addition, NOAA documents in a number of their fishery management plans that cooling water intake structures, particularly once-through cooling water systems that withdraw large volumes of water, cause adverse environmental impacts due to significant impingement of juveniles and entrainment of eggs and larvae. EPA believes that stress due to overutilization may be relevant to assessing cumulative impacts of multiple stressors, including cooling water intake structures.

*C. Location*

The proposed rule outlined a framework in which intakes located in certain sections of a waterbody would be subject to varying levels of restrictions. Specifically, intakes located within the broadly defined littoral zone or in especially sensitive waterbodies (estuaries and tidal rivers) would face additional restrictions on intake flows and intake velocity. Intakes located outside these higher priority waters would be subject to decreased levels of regulation. See the proposed rule for a

detailed discussion of the framework set forth. (Section VIII.A.2., pages 49083 to 49085.)

Numerous comments were received on the proposed requirements for location, nearly all of which opposed the proposal. In the most general sense, many commenters agreed with the concept of protecting waters that are more productive. However, most commenters also argued that the proposed approach was scientifically and technically flawed and would be extremely difficult to implement. The comments can be divided into several generic categories: importance of location for an intake, general comments on the use of the littoral zone as a regulatory concept, and specific comments regarding the littoral zone definitions for each waterbody type.

In the NODA, EPA further explored the issue of intake location by soliciting comments on a revised definition of littoral zone and revised requirements for several waterbody types including the Great Lakes, and for waters not designated to support aquatic life use.

Comments on the NODA generally reiterated issues raised in the comments on the proposed rule. Commenters agreed that location is an important factor in assessing the impacts of cooling water intake structure, but that creating a regulatory framework to specifically address locational issues would be extremely difficult.

After reviewing the available data and comments regarding intake location, EPA has elected not to vary requirements for new facilities on the basis of whether a cooling water intake structure is located in one or another broad category of waterbody type or in a broadly defined zone of higher productivity or sensitivity within certain types of waterbody. Instead, EPA has promulgated technology-based performance requirements for new facilities that defines best technology available for minimizing adverse environmental impact in all waterbody types. This prescription for best technology available for minimizing adverse environmental impact recognizes the site-specific nature of biology and other locational factors by allowing the permit applicant in Track I to select and implement certain design and construction technologies after a review of available information on the site. Facilities that choose not to follow the specific technology-based performance requirements in Track I may opt for Track II and, after site-specific study, seek to demonstrate equivalent protection of the aquatic resources in a given waterbody from impingement and entrainment by using alternative technologies or approaches.

While EPA continues to believe that it could have established different requirements based on general information about the productivity of water bodies, EPA decided for the new facility rule that introducing separate requirements for different water bodies was unnecessary in light of the strong record support that the track I requirements are technically available and economically practicable for new facilities and in light of the flexibility provided by Track II where the applicant demonstrates that it can use different technologies to reduce impacts to fish and shellfish to a level comparable to the level that would be achieved if they implemented Track I requirements at their site.

EPA did not vary the performance requirements based on waterbody type because it found problems in defining and implementing a littoral zone approach (as discussed below) and found that reducing impingement mortality and entrainment on fresh water bodies to a comparable level as in estuaries and oceans to be technically feasible and economically practicable.

1. Importance of Intake Location

Several commenters agreed with EPA that location is an important factor in assessing the impact of a cooling water intake structure. One commenter added that location is also critical to the technical feasibility of the facility, because the site characteristics with respect to hydrology, land area available, and other factors can greatly influence the viability of a facility. Other commenters supported the waterbody-specific approach, but in the context that adverse environmental impact is a site-specific or even species-specific phenomenon. Another commenter disagreed with the proposed delineation of waterbody types, stating that adverse impacts can be found at all waterbody types and both in and outside the littoral zone. Therefore, equal protection should be afforded to all waters under the regulation. One commenter opposed the approach involving waterbody types, since defining distinct types is difficult, and noted that a site-specific approach would be more appropriate. Another commenter argued that the effectiveness of intake technologies varies by location, thereby supporting a site-specific approach.

EPA agrees that location is an important factor in addressing cooling water intake structure impacts, and, in Track I, permit applicants must select and implement certain design and construction technologies after considering site-specific conditions. In Track II, permit applicants have complete flexibility to address site-specific conditions, provided they can reduce impacts to fish and shellfish to a level comparable to the level that would be achieved if they implemented Track I requirements at their site.

2. General Comments on the Use of the Littoral Zone Concept

Many commenters made general statements of opposition to the use of the concept of littoral zone as part of the proposed rule, each for a variety of reasons. Most of the comments expressed concern over one or more of the following issues: The proposed definition and approach is too broad and untenable; the conditions used to define the littoral zone can vary greatly on an annual basis; the proposal is poorly supported by the scientific literature; and the proposal is a poor proxy for biological productivity and ignores ecological complexity and site-specific conditions. In general, commenters acknowledged that some areas of a waterbody are more sensitive to cooling water intake structure impacts but disagreed with EPA's approach for defining the concept. For example, the term "area of high impact," proposed in the NODA, represented an improvement over the term "littoral zone," but commenters noted that the proposed term still lacked a clear definition. One commenter further noted that a site-specific approach would allow for a more thorough analysis of a waterbody and account for these sensitive areas. Another commenter argued that the approach was inappropriate, because EPA does not have the authority to establish less restrictive requirements in some waterbodies.

EPA recognizes that most commenters, albeit for a variety of sometimes conflicting reasons, do not support use of a littoral zone or similarly broad concept to specify requirements for best technology available for minimizing adverse environmental impact. EPA instead has adopted a two-track framework in which permit applicants can fully address site-specific factors in proposing what technologies or alternatives they will use to reduce impingement and entrainment to levels readily achievable with use of low-cost, widely used technologies.

3. Specific Comments on the Definition or Applicability of the Littoral Zone

a. Littoral Zone—Oceans

Most commenters opposed the proposed definition and use for oceanic littoral zones. Generally, commenters saw it as too broad, vague, and unsupported by scientific literature, although one commenter did disagree with a reduced level of protection for oceanic waters. Some commenters noted that the entire continental shelf could be interpreted as the littoral zone under the proposed definition. Other commenters disagreed with the usage of salinity as a defining criterion, noting that many environmental factors (e.g., seasonality, tides, weather) can influence the salinity levels and therefore alter the geographic location of the littoral zone. One commenter added that some estuarine waters could possibly be classified as oceanic waters, thus reducing the level of protection required by the regulation. Commenters were also asked to comment on a proposed fixed distance from shore as a definition of the littoral zone. Some commenters did support a fixed distance (from 200 to 500 meters offshore) but most commenters opposed the proposed definition, because of the need to recognize site-specific characteristics, such as biological resources, areas of high productivity, and waterbody size and configuration, at each facility. Many of the same comments opposing the fixed-distance approach are echoed in the general comments about the inadequacy of the littoral zone approach noted above.

For the reasons discussed above, EPA has adopted an alternative regulatory structure and will not in this rule set nationally defined areas within oceans where different requirements apply for best technology available for minimizing adverse environmental impact.

b. Littoral Zone—Freshwater Rivers

Only a few of the comments received addressed freshwater rivers and streams, but those few comments raised concerns over the proposed definition of the littoral zone. One commenter noted that, generally, the flow, turbidity, and seasonality at a site can greatly affect the vegetation and light penetration, thereby affecting the extent of the littoral zone. This commenter also added that riverine intakes are often shoreline intakes and noted that the definition would be difficult to apply to intakes because of hydrologic factors such as meanders and shoreline construction techniques. Another commenter submitted additional data and analysis supporting the concept that freshwater lakes and rivers are less vulnerable to the effects of impingement and entrainment than other types of waterbodies.

Today's final rule adopts a different regulatory framework—a two-track approach—and does not set different requirements for best technology available for minimizing adverse environmental impact for different parts of freshwater rivers. Instead, under Track II, an applicant may conduct site-specific studies and possibly determine that a different cooling water intake structure location within the waterbody would reduce impingement mortality and entrainment to a level of reduction comparable to the level achieved under Track I requirements at a lower cost. If so, the applicant is free to propose an alternative location for its intake in its permit application.

c. Littoral Zone—Lakes and Reservoirs

One commenter noted that site-specific factors must be considered when locating a cooling water intake structure. The commenter argued that it was not necessarily true that intakes located in the littoral zone of lakes or reservoirs impact more species or species having higher economic value compared to intakes sited offshore. The commenter also stated that based on its experience, the dominant species entrained and impinged within lake systems were forage species (e.g., gizzard shad, alewife, smelt) regardless of intake location.

EPA agrees that it is important to consider site-specific factors when identifying the most appropriate location for a cooling water intake structure. As discussed above, under a Track II approach, an applicant may conduct site-specific studies to determine where best to site its intake (inshore or offshore) as long as it can be proven that the chosen location would reduce the level of impingement mortality and entrainment of all stages of fish and shellfish to a level of reduction comparable to the level the facility would achieve under the Track I requirements. However, EPA does not agree that the susceptible life history stages of lake forage species (such as those listed by the commenter) are as likely to be impinged or entrained at an offshore intake as an intake located inshore. Basic life history information for many forage species documents that spawning events and juvenile stages often occur in nearshore lake waters. As an example, young-of-the-year gizzard shad form schools and are usually found close inshore within shallow waters overlying mud bottom (Dames & Moore, 1977). Similarly, although adult alewifes typically inhabit deep, pelagic waters of landlocked lakes, they migrate to harbors and nearshore waters to spawn in spring and early summer.

d. Littoral Zone—Estuaries and Tidal Rivers

Commenters were more divided in their comments on estuaries and tidal rivers. Some commenters generally supported the proposed definition of an estuary and the increased level of protection for these waters. Others noted that the proposed definition greatly oversimplified its ecological function, since not all areas within an estuary are equally productive. Another commenter noted that the proposed rule applied the greatest level of restrictions to the waterbody type with the greatest heterogeneity. Several commenters expressed concern over the use of salinity as a delineation tool, noting the tendency for the 30 ppm gradient to move within the waterbody.

Based on facility size, EPA is setting the same performance-based technology requirements for tidal rivers and estuaries as for all other waterbodies under Track I of the final rule. To the extent that site-specific characteristics of a proposed facility location make the Track I requirements more or less effective at reducing impingement and entrainment, the facility choosing to pursue Track II will have a site-specific goal for evaluating the efficacy of alternative technologies and approaches.

4. Waters Not Designated To Support Aquatic Life Uses

In the NODA, EPA requested comment on the issue of less stringent requirements for facilities located on waterbodies that are not designated to support aquatic life. One commenter supported less stringent requirements than proposed, requesting that facilities located on waters not designated to support aquatic life be exempt from the 316(b) regulations. This commenter also noted that such an exemption would not necessarily be permanent, since States have the authority to reclassify waters to again support aquatic life. Another commenter did not support the proposed approach. A third commenter argued that the CWA does not allow for exemptions from technology-based requirements on the basis of the designated use of the receiving waters. Some commenters submitted specific examples of impaired waterbodies and listed nutrient enrichment as one of the causes of impairment.

Today's final rule does not establish less stringent requirements for waterbodies not designated to support

aquatic life use. However, to the extent that the lack of an aquatic life use would result in Track I requirements achieving limited reductions in impingement and entrainment at a site, a permit applicant willing to conduct site-specific studies under Track II might be able to demonstrate that alternative technologies or approaches would reduce the level of impingement mortality and entrainment to a level of reduction comparable to the level the facility would achieve if it met the Track I requirements at that location. EPA addressed use impairment and the stress that cooling water intake structures may add to impaired waterbodies at VI. B. above.

D. Flow and Volume

Under the proposed rule, EPA proposed limitations on intake flow and volume for new facilities that varied depending on the type of waterbody upon which the facility is to be located. Specifically, intake flows at facilities whose cooling water intake structure withdraws from freshwater lakes and rivers would be limited to the lower of five (5) percent of the source water body mean annual flow or twenty-five (25) percent of the 7Q10. Facilities located on lakes and reservoirs would be limited to intake flows that do not disrupt, alter the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies). Intakes in tidal rivers and estuaries would be limited to no more than one (1) percent of the volume of the water column in the area centered about the opening of the intake, with a diameter defined by the distance of one tidal excursion at the mean low water level. The additional requirement of intake flow commensurate with that of a closed-cycle recirculating cooling water system was proposed for intakes located in either estuaries and tidal rivers or the littoral zone of any waterbody.

EPA requested comment on each proposed limitation by waterbody type, unique situations such as the Great Lakes, and the introduction of more stringent flow requirements for intakes in estuaries, tidal rivers, and littoral zones.

In general, commenters opposed the proposed flow and volume limitations. They argued that EPA did not present a link between intake flows and adverse impact, that the limits are based on questionable grounds, and that EPA lacked the authority to enact such limits, and against specific items in each proposed waterbody limitation.

On the basis of the supporting data presented in the proposed rule and the NODA, Track I and Track II of today's final rule maintain the proposed flow limitations with some changes. EPA believes the record contains ample evidence to support the proposition that reducing flow and capacity reduces impingement and entrainment, one measure of adverse environmental impact, and may reduce stress on higher levels of ecological structure including population and communities. (See, #2–029, 2–013L–R15 and 2–013J). EPA also has determined that a capacity- and location-based limit on withdrawals in certain waterbody types is an achievable requirement that will have little or no impact on the location of cooling water intake structures projected to be built over the next 20 years.

1. Relation of Flow and Capacity to Impact

Several commenters disagreed with EPA's contention that a high intake flow volume necessarily corresponds to higher rates of adverse environmental impact. Commenters pointed to several facilities with relatively high intake volumes that reported no significant loss of aquatic life due to entrainment or impingement. The commenters asserted that, collectively, these cooling systems showed no significant impact on the recovery of impaired aquatic species or on the overall health of the aquatic population. By contrast, some commenters faulted EPA's proportional flow requirements for failing to account for cumulative impacts in waterbodies that have been previously designated as sensitive. In their view, such waters would suffer a disproportionate impact from high intake volumes than would less sensitive waters. Relying heavily on a flow-based requirement would ignore this potentially ecologically harmful effect.

Many commenters also disagreed with the notion that flow-induced entrainment automatically equates to adverse impact. Commenters argued that any intake flow would likely result in some entrainment loss but that this does not substantially harm the biological community of the source water. To support this, commenters provided examples that demonstrate healthy sport and commercial fishing populations in close proximity to large power plants. Citing these examples, commenters argued that EPA's proposed best technology available requirements based on entrainment and impingement are overly restrictive and cost prohibitive. Instead, commenters proposed basing the 316(b) requirements more on the overall health and viability of the surrounding aquatic environment than on rates of entrainment and impingement.

On the other hand, some commenters supported EPA's assertion that volume and impact are directly proportional. One commenter provided statistical evidence from several cooling system studies that demonstrated higher rates of entrainment and impingement when intake volumes were increased.

Several commenters questioned EPA's emphasis on reducing intake flow to minimize impact while ignoring other influential factors, such as life history strategy, distribution throughout the water column, and adaptations to external stresses, among others, that can result in high entrainment and impingement mortality rates. The commenters argued that such factors can often be mitigated by structural design or location modifications without incurring the expense associated with a reduction in the overall volume of water withdrawn. Similarly, other commenters noted that EPA failed to address technologies and design modifications that could achieve the desired effect—reduction in entrainment and impingement losses—while still maintaining a high rate of withdrawal.

EPA believes the record contains ample evidence to support the proposition that reducing flow and capacity reduces impingement and entrainment, one measure of adverse environmental impact, and may reduce stress on higher levels of ecological structure including population and communities. (*See* DCN #2–029 in the record for this rule (compilation of swim speed data), which demonstrates the potential vulnerability of many fish species to impingement. The documents DCN #2–013L–R15 and 2–013J support the proposition that flow is related to entrainment.) The widespread use of capacity-reduction technology at almost all proposed new electric generating facilities and by a substantial number of new manufacturers makes capacity reduction an appropriate component of best technology available for minimizing adverse environmental impact at new facilities. EPA disagrees with commenters that other factors influential to impingement and entrainment have been ignored. Both Track I and Track II of the final rule allow for site-specific evaluations in determining the appropriate technologies to be implemented. For example, the Design and Construction Technology Proposal Plan required in Track I and the Evaluation of Potential

Cooling Water Intake Structure Effects in Track II allow for site specific consideration of factors other than flow to minimize impacts from impingement and entrainment. Cumulative impacts are addressed on a case-by-case basis by each permitting authority.

2. Basis for Flow Proportional Limits

Numerous commenters rejected the justification for the flow requirement proposed by EPA as being too vague and untenable. Specifically, commenters questioned the proposed goal of a "99 percent level of protection" for aquatic communities and how it relates to levels of protectiveness in other water quality-based programs. Many commenters believed both "99 percent" and "level of protection" were vague and called on EPA to provide more explicit definitions in the final rule. Other commenters questioned the gain in overall aquatic health that can be achieved by setting the requirement at such a high level. Several commenters cited other federal programs and publications, such as the *Water Quality Standards Handbook*, in support of their claim that EPA has no precedent on which to base its proposed requirement. Other programs have demonstrated that a lower target protection level is still adequately protective of the viability of the total aquatic environment. Commenters noted that a high standard would increase compliance costs significantly while producing no measurable improvement in the overall health of the source waterbody and called on EPA to better justify its support of the proposed requirement.

While EPA believes this final rule will significantly increase protection for aquatic communities, the Agency has determined that the proportional flow requirements represent limitations on capacity and location that are technically available and economically practicable for the industry as a whole. EPA examined the performance of existing facilities based on data from the section 316(b) industry survey in terms of proportional flow to determine what additional value could be used as a safeguard to protect against impingement and entrainment, especially in smaller waterbodies, where multiple intakes are located on the same waterbody, or in waterbodies where the intake is disproportionately large as compared to the source water body. As discussed in Section V.B.1.c. above, EPA found most existing facilities meet these requirements. EPA expects that new facilities would have even more potential to plan ahead and select locations that meet these requirements. EPA recognizes that some measure of judgment was involved in establishing the specific numeric limits in these requirements and that these requirements are conservative in order to account for multiple intakes affecting a waterbody. In particular, the 1 percent value for estuaries reflects that the area under influence of the intake will move back and forth near the intake and withdrawing 1 percent of the volume of water surrounding the intake twice a day over time would diminish the aquatic life surrounding the intake. The 5 percent value mean annual flow reflects an estimate that this would entrain approximately 5 percent of the river or stream's organisms and a policy judgment that such a degree of entrainment reflects an inappropriately located facility. Nevertheless, because they address important operation situations and appear to be highly achievable for new facilities, EPA believes they are appropriate to this rule.

These requirements are expected to have little or no impact on the location of cooling water intake structures projected to be built over the next 20 years as new facilities have the opportunity to choose sites that meet their specific design and cooling water needs before construction begins.

*E. Velocity*

1. Design Through-Screen Velocity as a Standard Measure

Under the proposed rule, any intake located in a freshwater or tidal river, stream, estuary, or ocean or within or near the littoral zone of a lake or reservoir would have to meet a maximum intake velocity requirement: a design through-screen intake velocity of 0.5 feet per second (ft/s).

EPA requested comment on the appropriateness of design through-screen velocity as a standard measure with 0.5 ft/s as the intake velocity, and the utility and appropriateness of a nationally based velocity requirement for the 316(b) regulations. Comments addressed these topics, as well as a range of other issues: problems with biofouling, issues better addressed through a site-specific approach, applicability to offshore oil and gas facilities, and applicability to existing facilities.

Generally, industry commenters thought the 0.5 ft/s requirement to be overprotective and not supported by the scientific literature. On the other hand, states and public interest groups commenters agreed with this requirement. Commenters also gave examples of several situations in which the velocity requirement would be inappropriate. Comments on the NODA generally reiterated issues raised in the comments on the proposed rule.

Numerous commenters questioned the proposed intake velocity requirement on several grounds. Many of the comments suggested that the proposed requirement is based on limited scientific data and undocumented or unsupported government policies. Commenters generally cited the age of the data used to support the requirement, the small number of scientific studies upon which the requirement is based, and the unclear origins of existing government policies that advocate using the 0.5 ft/s requirement. Other commenters stated that the requirement is very conservative and still may not prevent adverse environmental impact. A number of commenters pointed to other factors that affect impingement and entrainment, such as light, turbidity, temperature, and fish behavior. Other commenters suggested alternative requirements, including 1.0 ft/s, an allowable range of velocity from 0.5 ft/s to 1.0 ft/s, a species-specific velocity requirement dependent on the species composition of nearby waters, and a case-by-case velocity limit. Several other commenters further noted that a number of existing facilities with intake velocities exceeding 0.5 ft/s have been determined to be in compliance with 316(b) or to have minimal impacts to fish populations. Other commenters questioned the record support for determining the safety factor used in deriving the proposed velocity requirement. Some commenters supported the velocity requirement, with one commenter noting that it is well-established as a protective requirement and is consistent with the levels of protection required under other existing regulations.

Several commenters expressed concern over the use of design through-screen velocity as the proposed requirement. Some pointed out that approach velocity has been the accepted standard for measuring velocity and questioned the lack of justification for proposing a different methodology. One commenter noted that a specific measure of velocity may be better suited for the design of a particular intake (e.g., through-screen velocity for a wedgewire screen and sweeping velocity for an angled screen). Another commenter opposed the use of design through-screen velocity, arguing that it is difficult to measure and does not represent the velocity that fish must detect in order to avoid impingement. Others noted that a through-screen velocity of 0.5 ft/s would, by definition,

require an approach velocity of less than 0.5 ft/s. A commenter also questioned the appropriateness of using through-screen velocity, because intake screens can easily become clogged or fouled, having a dramatic effect on velocity and water flows at and through the screen. Other commenters supported the use of design through-screen velocity, noting that it has long been the industry and regulatory standard for measuring intake velocity. Several commenters suggested methods for measuring approach velocity.

Finally, several commenters drew comparisons with existing velocity requirements used by NMFS Northwest Region. Some of these comments requested that the proposed requirement be fully consistent with the existing NMFS requirements. Others noted that the proposed requirements are actually more stringent than the NMFS requirements when compared using a flow vector analysis, contrary to the Agency's statement that the proposed requirements were less stringent than NMFS requirements.

Given the compilation of supporting data presented in the proposed rule and the NODA, Track I of today's final rule maintains the proposed intake velocity requirement of 0.5 ft/s through-screen velocity. The 0.5 ft/s through-screen requirement is well supported by existing literature on fish swim speeds and will also serve as an appropriately protective measure. EPA believes a requirement that protects almost all fish and life stages is particularly appropriate to provide a margin of safety when, as is common, screens become occluded by debris during the operation of a facility and velocity increases through the portions of a screen that remain open. EPA notes that more than 70 percent of the manufacturing facilities and 60 percent of the electricity generating facilities built in the past 15 years have met this requirement and believes the requirement is an appropriate component of best technology available for minimizing adverse environmental impact at new facilities.

As documented by the data collected for the NODA, EPA believes the 0.5 ft/s requirement is scientifically based, technically sound, protective of aquatic resources, and technically available and economically practicable as demonstrated by the fact that it is frequently achieved at recently built facilities. As discussed below, the requirement is well supported by existing literature on fish swim speeds and will also serve as an appropriate protective measure, since the data suggest that a 0.5 ft/s intake velocity would protect 96 percent of the tested fish. EPA notes that if the permit applicant does not want to meet the specific Track I velocity requirement, the applicant can, under Track II, conduct site-specific studies and seek to demonstrate comparable reduction of impingement mortality and entrainment. This may allow facilities to install cooling water intake structures with greater that 0.5 ft/s velocities if they can demonstrate that they would have the same reduction of impingement and entrainment as Track I standards which include the 0.5 ft/s limitation on velocity. Additionally, past permitting decisions were made using the best judgment at the time of the decision. These permitting decisions should not be interpreted to signify best technology available in future decisions.

The NODA presented further data on fish swim speeds. The velocity of water entering a cooling water intake structure exerts a direct physical force against which fish and other organisms must act to avoid impingement and entrainment. An analysis of swim speed data demonstrates that many fish species are potentially unable to escape the intake flow and avoiding being impinged. EPA received or collected data from EPRI (see W–00–03 316(b) Comments 2.11), from a University of Washington study that supports the current National Marine Fisheries Service velocity requirement for intake structures, and from references included in comments from the Riverkeeper (see Turnpenny, 1988, referenced in W–00–03 316(b) Comments 2.06; document found in DCN #2–028B in the record for this rule). These data were compiled into a graph (Swim Speed Data, DCN #2–029 in the record of this rule). The data suggest that a 0.5 ft/s velocity would protect 96 percent of the tested fish.

In developing the intake velocity requirement, EPA assumed a flat screen with the intake flow directly perpendicular to the face of the screen, because this is a typical arrangement for a cooling water intake structure. However, angled screens, such as those described in the NMFS requirements, are used in some intake designs, and EPA does not wish to discourage any intake designs. Under § 125.84(e), the Director may require additional controls (such as the NMFS requirements) to complement the protection afforded by the velocity requirement. EPA also developed the velocity requirement with a highly protective intake velocity in mind, regardless of the intake configuration. As a result, EPA's requirements may be more stringent than existing requirements required by NMFS or other agencies.

EPA recognizes that approach velocity has been a measurement technique for intake velocity in the past. However, many recently constructed facilities have been designed to meet through-screen intake velocity limitations. Additionally, EPA notes that design through-screen velocity will be simpler to measure and therefore be easier to implement on a national level for both regulators and facilities than approach velocity. New facilities can be designed with consideration given to the through-screen velocity requirement, and designs can be altered accordingly. Intake velocity will also be simpler to measure, as facility engineers can simply calculate the intake velocity on the basis of intake flow and the intake screen area, as opposed to the more complex data gathering process involved in measuring approach velocities near an intake screen. EPA also recognizes that the approach velocity will be less than 0.5 ft/s. The intake velocity requirement is intended to be a highly protective requirement. Regardless of the intake structure design or the presence of sufficient detection or avoidance cues, the intake velocity is low enough to protect of a majority of fish species. For these reasons, the final rule maintains the requirement to measure intake velocity on a design through-screen basis.

*2. Appropriateness of a National Velocity Requirement*

Numerous comments were received regarding the appropriateness of a national-scale requirement for intake velocity. Many commenters expressed concern that a national requirement would be an unnecessary burden on facilities. Specifically, some commenters noted that a site-specific framework for the 316(b) rule and velocity requirement would be preferable, as it would best account for site-specific details, some of which may affect the rates of impingement and entrainment. Other commenters questioned using a national requirement; given the variability in environmental conditions and fish swim speeds, these commenters said making a national approach is inappropriate to suitably cover the range of organisms found in a given water body. Some commenters noted that the velocity requirement might preclude the future use or implementation of some highly effective technologies. One commenter noted that several studies have suggested little or no correlation between flow and impingement or entrainment; the commenter argued that, therefore, a relationship between

impingement or entrainment and intake velocity does not exist.

As documented by the data collected for the NODA, the 0.5 ft/s requirement is scientifically based, is protective of aquatic resources with a reasonable margin of safety, and is met by many recently built facilities. EPA believes it is an appropriate component of best technology available for minimizing adverse environmental impact at new facilities. Permit applicants who wish to build a facility using higher intake velocities have the option, under Track II, to conduct site-specific studies and seek to demonstrate that their alternative will reduce impingement mortality and entrainment to a level of reduction comparable to the level the facility would achieved if it met the Track I requirements, including the velocity limit of 0.5 ft/s.

While EPA acknowledges that multiple factors may affect impingement and entrainment at a given intake, EPA believes that there is ample evidence contained in the record to support a correlation between velocity and/or flow and impingement and entrainment. As stated in the preamble to the rule, intake velocity is one of the key factors affecting the impingement of fish and other aquatic biota. The velocity of water entering a cooling water intake structure exerts a direct physical force against which fish and other organisms must act to avoid impingement and entrainment. The compilation of swim speed data (DCN #2–029 in the record of the rule) demonstrates that many fish species are potentially unable to escape the intake flow and avoid being impinged. The record also supports the proposition that flow is related to entrainment.[89]

Finally, EPA chose a national requirement in order to provide a consistent standard for facilitating implementation given the technical availability and economic practicability of the requirement.

3. Other Comments Concerning the Velocity Proposal

a. Biofouling at Intakes

Several commenters submitted that an intake velocity of 0.5 ft/s may lead to increased difficulties with biofouling at facility intakes, especially at offshore oil and gas extraction facilities. Another commenter noted that with an increase in biofouling facilities would need to increase treatment efforts. Frequently, these efforts involve adding chemical treatments to water flows and may have subsequent adverse impacts on water quality. Another management strategy noted by a commenter is to maintain sufficiently high intake velocities to preclude colonization by fouling organisms. One commenter also expressed concern over the implications of biofouling at fine mesh screens and the potential for these protective technologies to become quickly fouled. One commenter supported the velocity requirement, noting that commercially available alloys have been shown to be highly effective in repelling biofouling organisms.

EPA recognizes that maintaining sufficiently high intake velocities is one possible solution for minimizing settlement by biofouling organisms. However, further research by the Agency suggests that this is not the most effective technique. Often, intake velocities are designed to be as low as possible to reduce the impingement and entrainment of aquatic organisms. Additionally, the intake systems of many facilities are unprepared to support such high intake velocities and would possibly require modifications in order to maintain such velocities. An analysis of facility survey data at existing facilities suggested that only 33 (3.4 percent) of 978 surveyed facilities have intake velocities of sufficient magnitude (greater than 5 ft/s) to inhibit biofouling. Fortunately, a variety of viable alternative technologies and management strategies for dealing with biofouling are available. Examples of these options include the use of construction materials that inhibit attachment of organisms, mechancial cleaning, and chemical and/or heat treatments. While no one strategy has been shown to be universally applicable, there are certainly affordable and implementable options. Maintaining a high intake velocity has not been shown to be the most effective way to control biofouling, since other methods have been shown to be more effective at a lower cost, especially in the context of new facilities. A facility that has yet to be constructed can integrate biofouling control technologies into its design and minimize the impacts of biofouling on normal operations.

b. Concerns Better Addressed by a Site-Specific Approach

Several commenters raised other concerns about the proposed velocity requirement, pointing to a variety of issues that they argue could be more easily addressed on a site-specific level. Some commenters noted that intakes located on large or fast-moving waterbodies may have difficulty maintaining the proposed intake velocity. For example, an intake located in a river moving at 3.0 ft/s may be unable to maintain a constant 0.5 ft/s intake velocity because of the ambient flow. As for the biota near the intake, the commenters submitted that these organisms have adapted to a higher-velocity environment and do not necessarily require protection under a velocity requirement. Other commenters noted that the direction of flow near an intake can have a substantial effect on the intake velocity and detection by fish. For example, the intake velocity at an intake subject to tidal movements or a longshore current may be affected. Another commenter expressed concern that the intake velocity is meaningful only if measured where the screen is the first component of the cooling water intake structure encountered by an organism, such as with a wedgewire screen. Intake canals, trash racks, and other cooling water intake structure components pose a threat by potentially entrapping fish that are unable to locate an escape route. One commenter noted that experimental technologies, such as strobe lights, sound, or intake velocities greater than 0.5 ft/s (up to 10 ft/s for some technologies) may not be developed because of the restrictions on intakes. One commenter observed that a reduction in intake velocity may also reduce the amount of cooling water taken in by a facility. The commenter observed that reducing the cooling capacity of the cooling system may adversely affect facility safety and efficiency.

For faster-moving waterbodies and in other situations where a permit applicant may wish to use a higher intake velocity, facilities may opt to follow Track II and seek to demonstrate that reductions in impingement mortality and entrainment would be comparable to the level achieved with the Track I requirements. Given the data EPA has seen on the protective nature of the 0.5 ft/s requirement (see DCN #2–028 in the Docket for the rule), EPA does not foresee a significant issue regarding entrapping fish and will continue in Track I to specify design through-screen velocity as the measure for determining compliance with the velocity requirement. EPA also notes that facilities wishing to employ developmental technologies may follow Track II and demonstrate a comparable level of protection.

For new facilities, EPA does not anticipate that cooling system safety for nuclear-fueled facilities will be an issue

[89] The documents DCN# 2–013L–R15 (Goodyear. 1997. Mathematical Methods to Evaluate Entrainment of Aquatic Organisms by Power Plants) and DCN# 2–013J (EPRI. 1999. Catalog of Assessment Methods for Evaluating the Effects of Power Plant Operations on Aquatic Organisms.) in the record of the rule both support this premise.

because any requirements can be addressed through facility design. New facilities have the opportunity to address and mitigate safety and efficiency issues during the design of the facilities. The fact that 79 percent of power generating plants and 46 percent of manufacturing facilities built within the last five years meet the Track I velocity requirement demonstrates that facilities designed in accordance with this requirement can incorporate any necessary features to ensure proper functioning of the cooling system.

*F. Dry Cooling*

In the proposed rule EPA requested comment on regulatory alternatives based wholly or in part on a zero-intake flow (or nearly zero, extremely low-flow) requirement commensurate with levels achievable through the use of dry cooling systems. See, 65 *FR* 49080–49081. EPA rejected dry cooling as best technology for minimizing adverse environmental impact for the reasons discussed in Section V.C above.

Some commenters, citing several examples, responded that dry cooling systems must be the best technology available for minimizing adverse environmental impact because they reduce intake volume and the killing of aquatic organisms to extremely low levels. These comments claim that dry cooling is an available and demonstrated technology. They focus on several demonstrated cases of dry cooling and discuss its use for a range of fuel sources, ownership categories, climates, and electric generating capacity. The comments claim that dry cooling technology in the United States has been growing rapidly since the early 1980s and represents approximately 27 percent of new capacity since 1985. Additionally, commenters in favor of the dry cooling alternative state, on the basis of recent construction trends, that the best technology available for the New England region is dry cooling systems. The commenters provide examples of 15 steam electric stations currently operating, under construction, or recently approved for construction using dry cooling in New England. These projects range in capacity from 24 MW to 1500 MW, with an average capacity of 480 MW and a total capacity of 7200 MW. Commenters supporting the dry cooling alternative claim that the technology frees the industry user groups from unnecessarily restrictive requirements to site facilities adjacent to or short distances from waterbodies or other sources of cooling water and eliminates discharges (of both thermal pollution and water conditioning chemicals) to these waterbodies. This freedom from water dependency, the comments assert, allows new power plants to locate in close proximity to the end users of electricity, thereby decreasing energy loss due to transmission, and to use alternative sources of water such as treated wastewater effluents, municipal supplies, and groundwater. EPA rejected dry cooling for the reasons discussed at V.C above.

Some commenters asserted that dry cooling systems are not necessary for minimizing adverse environmental impact nor do they qualify as the best technology available. They assert that dry systems are not considered to be a viable, cost-effective design choice unless there are unique circumstances and conditions associated with either the site or the market climate for the project. The comments recommend that adoption of dry cooling systems be left to the permittee's judgment and not be a uniform requirement. The physical space requirements, the commenters assert, severely limit the siting options available to new facilities. They oppose the imposition of dry cooling in southern climates, where, they claim, there is an abundance of high volume surface water available for cooling. Additionally, the commenters claim that dry cooling has not been shown necessary for minimizing adverse environmental impact. They also contest claims made by other commenters on the proposal that dry cooling has been demonstrated for a variety of climates and generating capacities. These commenters counter claims made by other commenters on the proposal that dry cooling is a demonstrated technology for large-size power plants. EPA has rejected dry cooling as best technology available for the reasons discussed at V.C above.

Other commenters discuss dry cooling technologies at manufacturing facilities. The commenters challenge the viability of dry cooling systems in manufacturing facilities that cool process fluids to ambient levels (e.g., below 100 degrees F) or do not condense steam. They claim that the dual use of process and cooling water prevents the application of dry cooling. EPA agrees that dry cooling technologies for manufacturing cooling waters pose engineering feasibility problems. EPA rejects dry cooling as a basis for a national requirement for new manufacturing facilities (as discussed in Section V.C above) but points to several demonstrated cases of dry cooling for cogeneration plants at or adjacent to manufacturing facilities as encouragement for cogenerating plants to consider the technology on a site-specific basis.

The cost of dry cooling systems is discussed in a variety of comments. Generally, all commenters discuss elevated capital and operating and maintenance (O&M) costs in comparison with similar capacity recirculating wet cooling towers. An analysis of modeled new combined-cycle plants in five regions of the United States was submitted with one comment. This analysis estimated that capital and total O&M costs for dry cooling systems exceed those for wet cooling systems by greater than 75 percent, regionally and nationally. Other commenters generically assert that the capital and operating costs of the technology significantly exceed those of recirculating wet cooling towers of comparable capacity. Even commenters in favor of dry cooling as the best technology available acknowledge that the cost of a dry cooling system can be as much as three times that of a comparable wet cooling system. However, these commenters also contest that the cost of the technology is clearly not wholly disproportionate to the environmental benefit gained. These commenters in favor of dry cooling as the best technology available claim that the capital cost and O&M costs of air-cooled structures at combined-cycle electric generating plants represent a small fraction, only 2 to 3 percent (using EPA's proposal cost estimates), of the estimated annual revenues for those facilities. These commenters state that because newer combined-cycle plants need cooling only for the steam portion of their cycle (only about one-third of their total capacity), they can be cooled with a much smaller dry cooling system than a comparably sized, steam-only generating plant. Thus, these commenters claim, the increased cost for dry cooling is considerably smaller than it would have otherwise been for conventional all-steam plants. These commenters add that they believe the costs of installing dry cooling as the best technology available at a fraction of a cent per kilowatt hour, would not be felt or even noticed by consumers. EPA discusses the costs of dry cooling extensively in Chapter 4 of the *Technical Development Document*. EPA agrees with commenters that elevated costs of the technology as compared with other cooling technologies pose a significant implementation problem for new facilities. Specifically, as discussed in Section V.C above, the compliance costs of dry cooling based requirements would result in annualized compliance cost of greater than 4 percent of revenues for all 83 electricity generators,

and of greater than 10% of revenue for 12 of the 83 generators.

The performance of dry cooling systems is addressed in many comments. Some comments point to lower performance than wet cooling systems and greater sensitivity to climatic conditions as being crucial for evaluating the efficacy of the technology. These comments claim that depending on climatic conditions, certain locations in the country will have a higher probability of incurring energy penalties. These commenters cite performance drawbacks to dry cooling systems due to operation at elevated turbine backpressures or reductions in energy production in locations with high daily or seasonal dry-bulb temperatures. One commenter provided results from a modeling exercise simulating energy inefficiency impacts at dry cooling facilities in a variety of climatic conditions. The results from the commenter's analysis showed summer peak performance shortfalls (*i.e.*, peak energy penalties) of greater than 30 percent for dry cooling facilities. Additionally, the commenters estimate that the energy penalty would vary considerably throughout the United States because of climactic conditions. Conversely, some commenters claim that the energy penalty from some dry cooling facilities in some areas is equivalent to that calculated by New York State officials for the Athens Generating Company facility, where they estimated a 1.4 to 1.9 percent reduction in overall plant electrical generating capacity as a consequence of using a dry cooling system versus a hybrid wet'dry system. [90] The commenters add that, in their view, energy conservation measures can more than offset any potential minor loss of efficiency from dry cooling. The commenters claim that the building of modern generating facilities provides significant efficiency gains that dwarf any potential loss due to the cooling system design. These commenters claim that transmission losses exceed the energy penalty associated with the dry cooling system; further, they assert that because dry cooling makes it possible to locate away from major bodies of water and closer to energy users, a facility can be more than compensated for the energy penalty. Finally, the commenters state that a 1 to 2 percent loss for the sake of greater protection of water resources is comparable to other efficiency penalties EPA requires of the electric industry for reductions in $NO_X$ and $SO_2$ emissions. The performance penalties of dry cooling systems play a significant role in EPA's decision to reject dry cooling as the best technology available. See Section V.C above for further discussion.

Hybrid wet and dry cooling systems are addressed in several comments. One commenter contends that the viability of hybrid systems for large-scale cooling operations (e.g., at a power plant with capacity greater than 500 MW) is uncertain. The commenter identifies site-specific performance advantages of hybrid systems over dry cooling, noting that the most common type of hybrid system is designed to eliminate visible plumes from wet cooling towers. These comments additionally claim that hybrid plume abatement systems are not water-conserving systems and that their costs are greater than wet cooling tower systems. EPA considers hybrid cooling systems not to be adequately demonstrated for power plants of the size projected to be within the scope of the rule. As such, EPA has not adopted the technology as a component of the best technology available requirements of today's rule. However, EPA recognizes that there is distinct potential for the use of hybrid cooling systems, especially in cases where plume abatement is concerned.

Some commenters claim that air emissions from electricity generation would increase because of energy penalties from dry cooling systems. These commenters state that an energy penalty creates a need for replacement power, which must be met by even more new generating capacity resulting in an increased potential for environmental impacts (such as increased air emissions). The comments add further that estimating those emissions would project the costs of power production and the mix of generating capacities (e.g., coal-fired, nuclear) available at the time of anticipated demand. Other commenters take the view that increased air emissions due to dry cooling systems are not a concern. EPA is concerned about the degree to which dry cooling-based requirements would increase air emissions associated with electricity generation. In the cases where performance penalties are high (i.e., in hot climates or during hot climatic periods), the increases in air emissions due to the potential adoption of dry cooling-based requirements are of concern to the Agency. This issue is further discussed in Section V.C in the context of EPA's rejection of dry cooling.

For the final rule EPA concludes that dry cooling systems are not the best technology available for minimizing environmental impact. EPA recognizes that dry cooling systems can achieve significant reductions in the impingement and entrainment of aquatic organisms compared with other cooling systems, especially once-through systems. Additionally, EPA acknowledges that the technology has been demonstrated as a viable cooling alternative for certain power plant applications under certain circumstances. EPA notes, however, that few of the plants constructed with the technology have been built with cooling systems of a size comparable to what would be required at several of the planned coal-fired systems EPA projects within the scope of the rule. The dry cooling technology presents flexibility to power plants, especially those of small size, those locating in arid regions, and those with water scarcity issues, or those wishing to avoid NPDES permitting issues. However, the technology presents several clear disadvantages that prohibit its adoption as a minimum national requirement or as a minimum requirement for subcategories of facilities. Although EPA recognizes that the technology—by using extremely low-level or no cooling water intake—reduces impingement and entrainment of organisms to dramatically low levels, EPA interprets the use of the word "minimize" in CWA section 316(b) to give EPA discretion to consider technologies that reduce but do not completely eliminate impingement and entrainment as meeting the requirements of section 316(b) the CWA.

A minimum national requirement based on dry cooling systems would result in annualized compliance cost of greater than 4 percent of revenues for all 83 electricity generators, and of greater than 10% of revenue for 12 of the 83 generators. Because the technology can cause inefficiencies in operation during peak summer periods and in hot climates, adoption as a minimum national requirement would also impose unfair competitive disadvantage for facilities locating in hot climates, more so than a traditional recirculating wet cooling tower or once-through cooling system. For the subcategory of facilities in cool climatic regions of the United States, adoption of a requirement based on dry cooling for these facilities would also impose unfair competitive restrictions. The competitive disadvantages relate primarily to the capital and operating costs of the dry cooling system. Additionally, adoption of requirements based on dry cooling for

[90] State of New York, Department of Environmental conservation. 1999. Initial post hearing brief, Athens Generating Company, L.P. Case no. 97–F–1563.

a subcategory of facilities with a capacity under a particular level or by fuel type would pose similar competitive disadvantages for those facilities. EPA's record demonstrates that dry cooling systems generally cost as much as three times more to install and construct than a comparable wet cooling system. Dry cooling system O&M costs range from less than or comparable to those for wet systems to two or more times higher. In addition, dry systems generally impose an energy penalty as compared with wet cooling systems. EPA estimates the annual average energy penalty to be 3 percent over a recirculating wet cooling tower system.

Further, EPA considers the degree of energy inefficiency associated with dry cooling to be counter to the performance of the best technology available candidate technology. EPA's record shows an annual average energy penalty for dry cooling of approximately 3 percent relative to recirculating wet cooling towers. This energy penalty represents the typical performance of a dry cooling system in northern climates, extended to the rest of the national climates. However, the peak summer performance is expected to decrease significantly in certain hot climates. EPA estimates that, for a newly constructed and designed facility, the peak summer shortfall could exceed the annual penalty by an additional 3 percent. This value could increase significantly as the facility ages; it hinges on regular and thorough maintenance.

EPA concludes that the air emissions increases from power plants due to adoption of a requirement based on dry cooling would be counter to the performance of a best technology available candidate technology. Changes in energy consumption associated with dry cooling would result in changed fuel consumption and therefore could result in greater air emissions from power plants using dry cooling than would occur if the plants used wet cooling. EPA estimates that the average annual air emissions for the power plants in scope of the final rule with a dry cooling alternative for CO, $NO_X$, $SO_2$, and Hg emissions would be greater than if the plants used wet cooling. See Section VI.B.2.e. See Chapter 3 in the *Technical Development Document* for more information on EPA's air emissions analysis.

*G. Implementation-Baseline Biological Characterization*

In the proposed regulations, the Agency proposed that all facilities perform a source water baseline biological characterization to establish an initial baseline for evaluating potential impact from the cooling water intake structure before the start of operation. The study required that information be collected over a 1-year period. This information was needed to determine the kinds, numbers, life stages, and duration of aquatic organisms in the vicinity of the cooling water intake structure. The Director would use the findings of the study to evaluate the efficacy of the location, flow, and velocity requirements and to define the need for design and construction technologies. The regulations would have also required facilities to conduct impingement monitoring over a 24-hour period once per month and entrainment monitoring over a 24-hour period no less than biweekly during the period of peak reproduction and larval abundance. After two years, the permitting agency would be allowed to reduce the frequency of impingement and entrainment monitoring. EPA's July 2000 information collection request estimated costs for the Source Water Baseline Biological Characterization at an average of $32,000. Monitoring was estimated at approximately $38,000 annually for entrainment and $13,000 annually for impingement. The NODA provided updated costs for both the source water baseline characterization and post operational monitoring.

1. Need for the Source Water Baseline Biological Characterization

Numerous commenters from both the States and the industry agreed that the source water baseline biological characterization was reasonable to determine the condition of the aquatic system. Other commenters questioned the need for a 1-year study that would provide information of limited utility because of the variation that natural populations exhibit from year to year. Some commenters were concerned that the baseline year may not be representative of the average characteristics of the organisms and that comparing subsequent monitoring with the baseline may provide erroneous conclusions.

Some commenters expressed their concern that the requirement to perform the baseline biological characterization would delay issuance of an NPDES permit and that the time required to develop the study in cooperation with and with approval from the permitting authority would increase the development time by 3 to 6 months. They estimated that the time to perform the study would be approximately 18 to 21 months. In particular, the electric utility industry stated that the additional time may result in construction delays that would threaten the availability or price structure of electricity in certain areas.

In addition, some commenters stated that there may be no need for a study if highly protective technology such as closed-cycle cooling is proposed to be used by the permittee, especially if the facility is located on a large waterbody.

Some commenters suggested that the studies be required only if alternative requirements were requested and not if the strict technology-based requirements are adopted. One commenter questioned the need for reevaluating the baseline biological characterization for the next permit term.

In response to these comments, EPA has modified the baseline biological characterization requirements in the rule to allow for the use of existing data, both for the initial permit issuance and reissuance. In today's final rule, Track I specifies highly protective technology-based performance requirements and does not require a permit applicant to conduct monitoring prior to submitting an application. The applicant must gather existing information on the site and select design and construction technologies that will minimize impingement and entrainment and maximize impingement survival. Under Track II, the applicant must conduct a considerably more rigorous study if he or she seeks to demonstrate that alternatives to the Track I requirements will reduce the level of impingement mortality and entrainment to a level of reduction comparable to the level the facility would achieve if it met the Track I requirements at a site.

2. Cost of Source Water Baseline Biological Characterization

Numerous commenters stated not only that the proposed sample collection was time consuming but also that the analysis and identification of the samples of aquatic insects and ichthyoplankton were extremely labor intensive. Some commenters suggested that the studies be required only if alternative requirements were requested and not if the strict technology-based requirements were adopted.

Numerous commenters stated that existing qualitative information is already available on aquatic species at many sites located on major waterbodies. At these sites, little additional information would be provided by an additional year of sampling in the vicinity of a proposed cooling water intake structure. These commenters would like the Agency to prepare additional guidance as to when

existing information would be appropriate. Another commenter questioned the acceptability of existing information that is more than 5 years old, because of changes in water quality, species composition, and other variables.

One commenter stated that the study should be tailored to the needs of the site. The commenter stated that some static or controlled environments might require a less rigorous study, while more complex and changing environments might require a more rigorous study to fully characterize the site. Other commenters stated that the requirements in the regulation were ambiguous.

Commenters were concerned that the costs estimated for the proposed rule, at an average of $32,000, were unrealistically low and that a more reasonable estimate might be $100,000. Some commenters stated that the estimate for a proper characterization study would be 10 times the original estimate. One commenter stated that the $32,000 may be low even for a paper study, stating that a simple study with the barest scope of work would cost in excess of $50,000 while impingement and entrainment monitoring would cost approximately $100,000–$150,000 per year.

Some commenters stated that the costs EPA estimated were too low in light of the accuracy that would be needed to determine whether significant adverse environmental impact exists and whether further mitigative measures or technologies must be used and that the characterization will also serve as the benchmark against which future performance is measured. One commenter stated that the accuracy needed would require stratified sampling.

Some commenters stated that the costs presented in the NODA for post-operational monitoring were still too low. They stated that at a minimum multi-species assessments for decisionmaking would cost approximately $50,000.

EPA believes that the post-operational monitoring cost is accurate. This cost was developed to reflect the extent of the monitoring required, which is noticeably less than previous 316(b) monitoring requirements. It is likely that the commenter is referring to these previous monitoring requirements when making comments as to the cost of these efforts. For example, previous studies may have required extensive impingement and entrainment monitoring and detailed taxonomic studies. The post operational monitoring required by this rule is expected to be less burdensome, requiring only monthly surveys for impingement and entrainment and possibly species identification. This level of effort is considerably less than the monitoring conducted under previous section 316(b) studies and is therefore less costly.

3. Impingement and Entrainment Monitoring

Some commenters requested that impingement and entrainment monitoring not be required if the strict technology-based requirements were adopted by a facility. They thought that installing the technology should be adequate to show compliance and to demonstrate that the objectives of section 316(b) had been met. Other commenters suggested that postoperational monitoring be implemented on a site-by-site basis *where there is evidence that* unanticipated potential impacts could occur or where habitat restoration has restored aquatic populations.

EPA disagrees with commenters who advocate no impingement and entrainment monitoring during the permit for permittees who opt to meet the Track I requirements. The Track I requirements for design through-screen velocity and for selecting and installing design and construction technologies that minimize impingement mortality and entrainment require the permittee to install and operate technologies that require periodic maintenance and operation in a prescribed manner. Periodic monitoring is appropriate. The permit director also must determine for each permit renewal whether additional design and construction technologies are necessary, and impingement and entrainment monitoring will provide information needed for this determination. See 125.89(a)(2).

*H. Cost*

1. Consideration of Facility Level Costs

EPA received comments on the proposal regarding its facility level cost estimates for the proposed requirements and a number of the regulatory alternatives. The issues addressed by commenters covered a range of topics, which EPA summarizes below.

Some commenters claim that EPA has not considered or addressed all environmental costs and impacts of the regulatory alternatives. The commenters state that EPA has not considered the operating efficiency losses of wet and dry cooling tower systems. They claim that both auxiliary power requirements and performance penalties may result in reductions in capacity and in the quantity of energy to end-users. The commenters state that replacing this power from other higher-cost sources will result in social costs for which EPA has not accounted. As a result of performance penalties, according to the commenters, the quantity of fuel required to generate the same quantity of energy increases. They add that recirculating cooling towers may result in the following additional environmental impacts, for which EPA has not accounted: visibility impacts from recirculating cooling towers, local climate change from wet cooling tower plumes, wildlife losses (e.g., birds colliding with towers), fish losses due to loss of heated aquatic plumes to over-wintering habitats, increased air emissions from sources replacing lost power, and increased impediments to waterway navigation due to icing in northern regions.

EPA initially responded by providing information in the NODA regarding this subject and outlined its intent to account for some additional costs in the final rule (66 *FR* 28866 and 28867). The cost estimates for the final rule include consideration of performance penalties and other environmental issues highlighted by the commenters. The final rule accounts for the "energy penalty" for facilities that are projected to install recirculating wet cooling tower systems in lieu of once-through cooling systems. EPA estimated marginal performance penalties, the costs to replace the lost power due to these penalties, and the increased air emissions of the penalties. Additionally, visibility impacts from cooling towers, local climate change from wet cooling tower plumes, wildlife losses (*e.g.*, birds colliding with towers), fish losses due to loss of heated aquatic plumes to support over-wintering habitats, and increased impediments to waterway navigation due to icing in northern regions are considered local impacts that can be addressed through the use of Track II or, in some cases, through design modifications of the recirculating wet cooling tower. EPA has provided costs for plume abatement (2 percent of the number of cooling towers) to address cooling tower emissions and considers the other impacts to be negligible and best addressed on a site-specific basis.

Some commenters criticize EPA's approach to estimating capital and operating costs of recirculating wet cooling towers. The commenters claim that EPA has significantly underestimated the costs of a recirculating wet cooling tower by considering only the cost of the cooling tower without the additional cost of other necessary cooling system

equipment such as wiring, foundations, noise attenuation treatment, the cost of construction and other equipment. They claim also that EPA's estimates understate makeup water costs for wet cooling towers. The commenters add that EPA's cost multipliers for recirculating wet cooling towers are questionable and not consistent with a number of engineering texts. With respect to O&M costs, they question EPA's estimates for economies of scale. For dry cooling towers, the commenters object to EPA's methodology of making a direct cost comparison between dry cooling systems and wet cooling systems. They claim that EPA's approach for estimating capital and O&M costs for dry cooling towers is flawed because it relies on cooling water flow as the cost basis. In addition, they state that EPA does not provide cost equations or curves for dry cooling systems. One commenter claims that winterization costs of dry cooling systems were not considered by EPA and that EPA therefore has underestimated the system's costs.

EPA fully documented the bases for recirculating wet cooling tower cost estimates in the NODA (66 *FR* 22866 and 22867). EPA disagrees with many of the comments regarding flaws in estimating capital and operating costs for cooling towers. The *Technical Development Document* and comment response document discuss EPA's costing estimates and consideration of the variety of issues asserted by commenters, such as documentation of equipment costs, foundations, noise attenuation, and the cost of construction. EPA has also considered the comments regarding makeup water costs. The estimates of costs for this rule reflect a realistic and accurate basis for makeup water usage in wet cooling towers. These issues are discussed further in Chapter 2 of the *Technical Development Document*. With respect to EPA's estimates of O&M economies of scale, EPA revised its estimates based on comments received and further analysis. EPA conducted a thorough review of its data and the public comments. Although the comments did not persuasively describe errors in EPA's economies of scale estimates, they did prompt EPA to reconsider the concept. EPA's further research revealed that there are economies of scale associated with certain components of O&M, but that use of economies of scale for total O&M costs would not be appropriate. As such, EPA's estimates for operation and maintenance costs for wet cooling towers have been refined to reflect no economies of scale. See Chapter 2 of the *Technical Development Document* for further discussion.

In the NODA, EPA included further documentation to support its estimates of the costs of dry cooling systems (both for capital and O&M components). Despite the comments received expressing concern over the methodology employed by EPA to estimate the costs, EPA continues to view its empirical models as robust, accurate, and well suited for the purposes of the final rule. EPA acknowledges that basing cost curves for dry cooling systems on cooling flow is unconventional. However, the model is based on empirical data and accurately estimates the costs of dry cooling systems. Regarding the subject of winterization, EPA's costs inherently include this technological aspect as it is an incorporated design feature in modern dry cooling systems upon which the empirical models are correlated. See Chapter 4 of the *Technical Development Document* for further information regarding EPA's costing methodology for dry cooling.

One commenter questions EPA's estimates regarding the "design approach value" used in plant cooling systems. The commenter recommends that EPA adopt an approach value of 8°F instead of 10°F. The commenter claims that EPA has understated the size of the cooling towers with its approach value estimate. EPA provided significant documentation in the NODA regarding its estimates of cooling system design approach values. Specifically, data demonstrate that a 10 degree design approach for a wet cooling tower is acceptable industry practice. Chapter 3 of the *Technical Development Document* discusses this subject further and presents EPA's supporting data.

Comments from manufacturers express concern over potential energy losses due to abandoning the use of waste heat for process water heating. They expressed concern that the proposed rule would discourage the practice of process and cooling water reuse. The commenters assert that if these potential energy loss costs were added to the other costs of the proposed rule, that the total cost could be substantially higher, possibly by several million dollars. Thus, the commenters state, the proposed rule could pose a significant and perhaps insurmountable hurdle for construction of new manufacturing facilities. EPA considered these comments and is adopting a definition of cooling water for the final rule (see § 125.83) that addresses these concerns. At § 125.86(b)(1)(ii), EPA also specifies that the amount of water withdrawn for cooling purposes that is reused or recycled in subsequent industrial processes is equivalent to closed-cycle recirculating cooling water for the purposes of meeting the Track I capacity-reduction, requirements at § 125.84(b)(1). However, the amount of cooling water that is not reused or recycled must be minimized. Therefore, the commenters' concerns that costs could be substantially higher, possibly by several million dollars have been addressed in the final rule.

Further, some commenters claim that EPA has not considered the costs of a sufficient number of regulatory alternatives or alternative technologies. EPA included, in Section VIII of this preamble and the *Economic Analysis* (Chapter 10), cost information on the range of regulatory alternatives considered for the final rule.

One commenter on the NODA described the costs associated with potential delays in permit approvals. The commenter stated that should permitting delays extend the construction period, the associated costs would accumulate at a monthly rate associated with the finance costs associated with down-payments on equipment, the lost income from sales of electricity, and the cost of purchasing replacement power. For regulatory alternatives that have projected permitting delay, EPA has incorporated the commenter's suggestion to the extent possible. For the final rule, EPA is basing the regulatory option on a two-track compliance option that, under the "fast track," has no associated delay in permitting. In addition, EPA has not accounted for cost savings of the rule over the current, resource intensive, case-by-case regulatory approach. In that sense, the final rule overestimates compliance costs.

Another commenter to the NODA provided a case-study example for converting the Indian Point Units 2 and 3 to closed-cycle cooling water systems or dry cooling systems. The results show a small cost impact for closed-cycle cooling water systems and a modest cost impact for dry cooling, according to the commenter. In terms of the cost for producing power, the incremental cost for the installation and use of a closed-cycle cooling water system, according to the commenter's analysis is 0.01 to 0.03 cents per kWh. The commenter's analysis shows incremental costs for the installation and use of a hybrid cooling system between 0.14 and 0.19 cents per kWh and 0.21 to 0.27 cents per kWh for dry cooling. EPA evaluated the case-study analysis presented by the commenter for this retrofit situation and finds the costs

to be relatively applicable (as the costing analysis was based on EPA's proposal cost estimates, EPA notes that some costing methodology revisions are not reflected in the commenter's analysis). EPA disagrees with several cost-related estimates made in the commenter's analysis, and therefore determines that the cost impacts of dry cooling technologies on the price of electricity is somewhat understated. See response to comment document for further discussion of this case-study analysis and EPA's technical review of the study.

2. Need For More Complete Assessment

A number of industry respondents criticized the economic analysis supporting the rule arguing that it has underestimated the cost of the proposal. Several comments noted that the technology cost, along with the baseline biological characterization, has been underestimated. A few comments asserted that EPA has not considered additional alternatives in selecting the preferred option to comply with requirements of the Executive Order 12866. Industry commenters noted that EPA has not selected the best technology available on a cost-benefit basis. Commenters also noted that the environmental cost of the technologies has not been reflected in the *Economic Analysis*. EPA recognizes that it selected best technology available for minimizing adverse environmental impact on the basis of what it determined to be an economically practicable cost for the industry as a whole. EPA did this by considering the cost of the rule as compared with the revenue of a facility, as well as the cost compared to the overall construction costs for a new facility. This approach is analogous to the economic achievability analyses it conducts for other technology-based rules under sections 301 and 306 of the CWA which use very similar language to section 316(b) and to which section 316(b) refers, and is consistent with the legislative history of section 316(b) of the CWA. At the same time, the record does contain analysis of the costs for a number of the regulatory alternatives considered under the rule.

After reviewing these comments, EPA has revised the *Economic Analysis*. As discussed in the NODA, EPA has gathered additional cost information to verify its cost estimates. It has collected additional information on benefit or the efficacy of the technologies used in the costing exercise. EPA has used more recent forecasts to estimate the number of electric generation facilities. The energy penalty associated with certain technology options, which was not included in the economic analysis for the proposal, has been included in the final economic analysis. EPA considered the costs for a number of alternatives to the requirements in today's final rule.

3. Accuracy of the Estimates

A number of commenters questioned the accuracy of the cost estimates. One commenter (Electric Power Supply Association) stated that EPA's estimates of the cost of the rule are based on several critical and arguable assumptions: (1) The rate of new facility development in the coming years, (2) the proportion of new facilities that would employ cooling water intake structures, (3) the costs of adopting one technology versus another, and (4) the cost of scientific and engineering studies. The combined effect of these assumptions, it is claimed, is that EPA underestimated the cost of the rule by as much as one-hundred-fold. Another commenter claimed that the cost of the rule would be more than five times higher than the EPA's estimates. The Utility Water Act Group (UWAG) estimated the cost of installing a cooling tower alone at $6,366.7 million for recirculating wet cooling towers and $11,245.3 million for dry cooling, assuming 100 percent of the combined-cycle facilities would be required to install towers.

EPA considers these estimates to be unreasonable. After careful review of comments received and additional analyses, EPA estimates the annualized compliance cost of the final rule to be $47.7 million. This cost estimate includes a revised forecast for new electric generation capacity, a revised technology baseline for regulated facilities, a revised estimate of the number of regulated manufacturing facilities, and inclusion of costs for a comprehensive demonstration study in Track II. The example costs presented by UWAG were, as described by the commenter, not directly comparable to EPA's cost estimates. The commenter included a significant equipment cost in its analysis—that of the steam condenser—that clearly is not applicable to the incremental costs of this rule, as all new facilities would install a steam condenser regardless of this rule. In addition, several estimates for design variables differ from those used by EPA and significantly bias the capital and operation and maintenance costs upward. EPA analyzes and discusses the UWAG example for costs in the response to comment document.

4. Energy Supply

Some industry respondents, including the Utility Water Act Group, argued that the section 316(b) proposal would be a significant threat to the national energy supply, would prohibit location of new power plants in most places, and would serve as a barrier to entry in the electric generation market. EPA disagrees with these assertions based on the siting impact analysis discussed at Section V.B.2., the relatively low cost of the rule as a proportion of revenues (as discussed in Section VIII), and the energy impact analysis described in Section X.J.

Some of the commenters stated or implied that the cost of the rule would have a significant impact on meeting growth in energy demand. EPA disagrees with this assertion because the compliance cost of the final rule is an insignificant component of not only new facility revenue but also the construction cost of a new plant. Thus, the cost of the rule is too small to affect the electric generation market. The cost of the final rule is so low primarily because 93 percent of the projected new in-scope combined-cycle facilities, which are responsible for most of the new electric generation capacity, have already planned to install recirculating wet cooling towers in the baseline. Therefore, they will incur, in addition to permit application cost, only a cost associated with selecting and implementing a design and construction technology such as a wedgewire screen or a fish return system on a traveling screen. In addition, estimates show that most new in-scope coal facilities also plan to install cooling towers independently of this rule. Thus, the rule requirements will not have any significant effect on the energy supply. Had EPA chosen dry cooling technology as the best technology available for minimizing adverse environmental impact, the energy impact would have been significant (i.e., upwards of 0.51 percent reduction (1,904 MW) of the projected new generating capacity).

Commenters asserted that the requirements of the rule could adversely affect the reliability of the electric power system, potentially increasing the risk of brownouts or blackouts or a curtailment of load provided to a particular user. EPA disagrees with this assertion. While Track I requirements (for facilities with intake flows equal to or greater than10 MGD) to reduce capacity commensurate with the use of a closed-cycle, recirculating cooling system and to select and install design and construction technologies would result in an additional use of electric

power at a power plant not already planning to use these technologies, the magnitude of the electric use compared with total electric supply at the national level is negligible (approximately 0.03 percent (100 MW) of projected new capacity). Only four coal-fired and five combined-cycle plants are projected to install recirculating wet cooling towers because of the rule. Moreover, the magnitude of electricity required in the operation of design and construction technologies, such as a fish return system, is very small. Finally, future facilities are not necessarily required to install cooling towers; under Track II they have an option to conduct site-specific studies and seek to demonstrate that other technologies will reduce impacts to fish and shellfish to a level comparable to the level that would be achieved at their site with the Track I requirements for intake capacity and velocity. Thus, the efficiency issue associated with the recirculating wet cooling towers, raised in some comments, overemphasizes the effect on the power supply at the national level. Similarly, EPA does not believe that other requirements of the rule, such as the velocity limit and proportional flow requirements, will adversely affect efficiency at power plants. The Track I velocity requirements of the rule can be met by design changes including enlarging the opening of the cooling water intake structure and screens without reducing the flow and hence without influencing the cooling efficiency. The proportional flow limits in the rule would also be largely met by power plants without any discernible impact on their efficiency or net energy supply. As discussed in section V.B.1.c. above, EPA found that most existing facilities meet these requirements. The proportional limitation can be met during design by siting on an alternative waterbody or by choosing alternative technologies, for example. Additionally, see Section V.B.1. for a discussion of proportional flow limits.

Commenters expressed concern that the regulatory requirements would result in delays in the construction of the new power plants, thus affecting the power supply and electricity prices. However, under Track I in the final rule, facilities can build a power plant without any required pre-permit monitoring.

Some industry commenters asserted that the requirements of the rule could be a hindrance to cogeneration. EPA disagrees with this conclusion. Contrary to the assertion, Track I in the final rule provides incentives for cogeneration because it considers reuse of cooling water as process water and vice versa as equivalent to recirculation. Thus, a cogeneration facility can reuse cooling water as process water or vice versa and eliminate the need to install a recirculating wet cooling tower to save costs or reduce the size of any tower needed to meet the Track I intake capacity requirement.

5. Forecast for New Utility and Nonutility Electric Generators

Most comments on the forecast of new utility and nonutility electric generators claimed that EPA underestimated the number of new generators in scope of the proposed section 316(b) new facility rule. Commenters cited several reasons for the alleged underestimate: (1) The use of an incomplete, outdated, or biased database as the basis of the estimate; (2) an underestimation of the number of facilities that will operate a CWIS; (3) an underestimation of the size of new facilities; and (4) the use of new capacity forecasts that are based on conservative assumptions regarding anticipated growth in demand for electricity. Two commenters claimed that the underestimation may be five-fold. Commenters also suggested that EPA underestimated the intake flow of regulated (in scope) facilities and the number of new generators that will use a once-through cooling system. One commenter claimed that the proposed section 316(b) new facility rule would cause additional delays in bringing new electricity supply on line.

EPA used the most current and complete data available at the time to develop the projected number of new electric generators. To address the above comments, EPA updated and expanded its research as new data have become available. In support of the final section 316(b) new facility rule, EPA used the February 2001 version of the NEWGen database. Compared to the January 2000 NEWGen database used for proposal, the newer version contains more than twice the number of new projects (941 compared to 466). EPA researched more than three times as many greenfield combined-cycle facilities (320 compared to 94) and obtained cooling water source information on almost four times the number of facilities (199 compared to 56). While EPA recognizes the fast pace of changes in the electricity generation industry, EPA believes that the substantial increase in the number of greenfield electric generators analyzed will address concerns commenters had voiced. In addition, the much larger number of facilities identified as being in scope of the final section 316(b) new facility rule (57 compared to seven) will provide a more robust and representative basis for estimating the characteristics (including size and cooling system type) and costs of new greenfield generators. Finally, EPA is using the Department of Energy's (DOE) updated Annual Energy Outlook 2001 as the basis for its total new capacity forecast. The 2001 Outlook is based on higher economic growth (in the reference case, 3.0 percent) and electricity demand (in the reference case, 1.8 percent) compared to the Annual Energy Outlook 2000 (2.2 percent and 1.4 percent, respectively). It should be noted that, for both the proposed and the final section 316(b) new facility rule, EPA's projection of new electric generators is based on forecasts made by the DOE's Energy Information Administration (EIA), not forecasts made by EPA.

6. Forecast for New Manufacturers

EPA received few comments on the number of new manufacturers estimated for the proposed rule. One main concern was that the proposed regulations could adversely impact offshore and coastal oil and gas drilling operations. At proposal, EPA had not considered or projected impacts on this industrial category. Among other concerns, these commenters stated that: (1) offshore and coastal oil and gas drilling facilities have much more limited technology options for addressing any adverse environmental impact of cooling water intake than land-based facilities; (2) under current regulations (40 CFR 435.11), existing mobile oil and gas extraction facilities are considered new sources when they operate on new development wells and could be required to perform costly retrofits in order to comply with the 0.5 fps velocity requirement if they become subject to the proposed requirements for cooling water intake structures at new facilities; and (3) higher cooling water intake velocities are necessary in marine waters to control biofouling of cooling water intake structures.

EPA also received comments suggesting that certain industry segments should be exempted from the final section 316(b) new facility rule. One commenter claimed that EPA intended to exclude the wood products segment of the forest products industry from the proposed section 316(b) new facility rule because the proposal analysis did not explicitly analyze this segment. This commenter suggested this segment should be exempted because facilities generally use little water. Another commenter claimed that EPA has overestimated the number of new greenfield chemical facilities. This commenter stated that the actual number of new chemical facilities is

very low and that therefore, according to OMB guidelines, regulation of that industry segment is not justified.

In response to these industry comments, EPA will propose and take final action on regulations for new offshore and coastal oil and gas facilities, as defined at 40 CFR 435.10 and 40 CFR 435.40, in the Phase III section 316(b) rule. EPA is deferring regulation of these facilities due to the unique engineering, cost, and economic issues associated with offshore and coastal drilling rigs, ships, and platforms. EPA will not categorically exempt new facilities in those land-based industry segments from the final section 316(b) new facility rule for any of the reasons suggested by commenters. EPA analyzed those industries that are most likely to experience adverse industry-level economic effects, based on their large-volume cooling water use. Any facility that meets the in-scope requirements set forth in § 125.81 will have to comply with the rule, irrespective of the number of in scope facilities in that segment, the industry's general cooling water characteristics, or whether the industry segment was explicitly analyzed in the proposal analysis. Should facilities in these other industrial categories face compliance costs wholly disproportionate to those EPA considered and found to be economically practicable in today's economic analysis, they can seek alternative requirements in accordance with the provisions at § 125.85.

**I. Benefits**

1. Cooling Water Intake Structure Impact Analysis Component of the Benefits Analysis for the Proposed Section 316(b) New Sources Rule

Comments related to EPA's cooling water intake structure impact analysis in Chapter 11 of the new sources EEA were received from two industry commenters. The comments focused on four main topics: (1) Potential population-level consequences of impingement and entrainment, (2) potential compensatory responses of fish populations to mortality of early life stages, (3) potential impingement and entrainment survival, and (4) species and habitats that may be particularly sensitive to cooling water intake structure impacts.

Both commenters argued that EPA should have evaluated the impingement and entrainment numbers presented in Chapter 11 of the EEA in relation to the total population of affected species, and one commenter commissioned a fisheries scientist to conduct such an analysis. EPA believes that a population-level analysis of the data presented in Chapter 11 is inappropriate for several reasons. First, as stated by EPA in its presentation of the data in Chapter 11, the purpose of the data compilation was to provide information on the relative magnitude of impingement and entrainment, not to evaluate potential secondary effects on the affected populations. Thus, EPA did not attempt to assemble the other types of data that the commenter noted would be required to evaluate potential effects of these losses on the populations of affected species. Such data include survival rates of early life stages, growth rates, reproductive rates, population size at the time of impingement and entrainment, and potential carrying capacity of the population in the surrounding waterbody. EPA notes that in most cases the studies that EPA examined did not provide such data.

EPA also notes that the data uncertainties and potential biases associated with the impingement and entrainment data presented in Chapter 11 of the *Economic Analysis* (discussed by EPA in Section 11.2) should be taken into account in any analysis of the data, including evaluation of potential population-level effects. As EPA noted in Chapter 11, there is insufficient information in many of the source documents to determine how impingement and entrainment estimates may have been influenced by choices of which species to study, differences in collection and analytical methods among studies or across years, or changes in a facility over time. EPA is concerned that the consequences of such data uncertainties and biases are even greater for population-level analyses than they are for an analysis of individuals. As EPA noted, the data are not a statistical sample; therefore, "the data should be viewed only as general indicators of the potential range of impingement and entrainment losses." As one of the commenters acknowledges, "EPA's estimates were used primarily to understand the relative proportion of different species impinged and entrained."

Both commenters argued that analyses involving long-term predictions of fish populations must include estimates of potential density-dependence (compensation). Again, EPA wishes to emphasize that the data presented in Chapter 11 were not intended for a population-level analysis and are not suitable for such an evaluation. Thus, the argument that compensation must be considered is irrelevant in the context of EPA's EEA.

One of commenters argued that the annual impingement and entrainment rates summarized by EPA do not equate to harm or losses of organisms, because many organisms survive impingement and entrainment. While some organisms may survive impingement and entrainment, the reliability of estimated entrainment mortality rates has been questioned because of various measurement uncertainties and sources of potential bias. [91] Even if the results of existing studies are accepted, the data indicate that under normal operating conditions entrainment mortality can be quite high for many species. Depending on temperature conditions within the intake and the life stage involved, studies of Hudson River species found that entrainment mortality ranged from 93 to 100 percent for bay anchovy, 0 to 64 percent for Atlantic tomcod, 57 to 92 percent for herrings, 41 to 55 percent for white perch, and 18 to 55 percent for striped bass. [92] A recent industry-sponsored review of 36 entrainment survival studies found that anchovies and herrings have the highest entrainment mortality, generally in excess of 75 percent. [93]

The two commenters disagreed with EPA's conclusion that the littoral zone is a more sensitive area. EPA is no longer including consideration of the littoral zone in its final rule. See discussion in Section VI.C.

One commenter objected that EPA did not provide the original worksheets used by EPA to compile the impingement and entrainment data provided in Chapter 11 of the EEA, arguing that this would have facilitated an independent analysis by making it easier to "quickly identify the studies used." However, EPA notes that all data sources are provided in footnotes to the tables and full citations are provided in the references section at the end of Chapter 11. The methods used to compile and summarize these data are

[91] Boreman, J., L.W. Barnthouse, D.S. Vaughan, C.P. Goodyear, S.W. Christensen, K.D. Kumar, B.L. Kirk, and W. Van Winkle. 1982. The Impact of Entrainment and Impingement on Fish Populations in the Hudson River Estuary: Volume I, Entrainment Impact Estimates for Six Fish Populations Inhabiting the Hudson River Estuary. Prepared for the U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research by the Oak Ridge National Laboratory. ORNL/NUREG/TM–385/VI.

[92] Boreman, J., L.W. Barnthouse, D.S. Vaughan, C.P. Goodyear, S.W. Christensen, K.D. Kumar, B.L. Kirk, and W. Van Winkle. 1982. the Impact of Entrainment and Impingement on Fish Populations in the Hudson River Estuary: Volume I, Entrainment Impact Estimates for Six Fish Populations Inhabiting the Hudson River Estuary. Prepared for the U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research by the Oak Ridge National Laboratory. ORNL/NUREG/TM–385/VI.

[93] Electric Power Research Institute. Review of Entrainment Survival Studies: 1970–2000. Prepared by EA Engineering Science & Technology. December 2000.

provided in Section 11.2 of the chapter, along with a discussion of data uncertainties and potential biases.

Another technical issue raised by this commenter concerned the waterbody classification of two of the facilities in EPA's impingement and entrainment tables. For the waterbody classifications, EPA relied on the industry's 1995 Utility Data Institute database because results from EPA's section 316(b) industry survey were not yet available. This database indicated "river" for the waterbody type on which the intakes of Hudson River facilities are located. EPA agrees with the commenter that this is misleading, since the portion of the Hudson River where the intakes are located is a tidal river. For analysis supporting today's final rule, facility categorization for all facilities is based on the plant's response to the question on waterbody type in the Agency's section 316(b) industry survey administered for the existing facility rule. EPA has revised its data tables to place data from studies on Hudson River facilities under the "estuary and tidal river" classification. Similarly, EPA agrees with the commenter that although the intake of the Monroe plant is on the Raisin River, the facility is more appropriately classified as a Great Lakes facility because of the fish species involved. EPA has therefore revised its tables so that impingement and entrainment data for this facility are now included with data for the Great Lakes. However, as noted above, the final rule does not distinguish among waterbody types, so such classifications do not have a direct effect on the final regulations.

2. Responses to Comments on the Economic Valuation Components of the Benefits Analysis for the Proposed Section 316(b) New Sources Rule

The comments on the new sources benefits analysis (economic component) were all fairly generic in their statements and fairly consistent in their arguments. The main thrust throughout most of the relevant comments was to point out that the Agency had not developed a quantitative benefits analysis and, as such, it had failed to conform to its own guidance and the requirements of Executive Order 12866. Some comments noted that the benefits analysis did not generate relevant quantitative information that could be used to facilitate an informative comparison of benefits and costs, and several comments encouraged EPA to complete its benefits analysis. Industry comments have also repeatedly pointed out that the Agency should perform a site-specific benefits analysis. In addition, several of the comments addressed aspects of how a benefits analysis should be performed. Specifically, comments described (1) what the steps of benefits analysis need to be (identify, quantify, and then value benefits), (2) the use of best practices in applying "benefits transfer" techniques for developing plausible monetary values to apply, and (3) the need to properly consider baseline conditions.

As clearly noted and acknowledged in Chapter 11 of the EEA, "EPA was unable to conduct a detailed, quantitative analysis of the proposed rule because much of the information needed to quantify and value potential reductions in impingement and entrainment at new facilities was unavailable" (EEA, p. 11–1). The chapter then proceeds to detail the types of information that would be required to do the analysis for new sources (the chapter also offers some examples using available data to illustrate potential benefits based on site-specific studies of some existing facilities.)

The comments received are accurate in the sense that they point out what the Agency acknowledges at the outset, namely, that a quantitative benefits analysis was not feasible for the proposed rule for new facilities. The comments received, however, do not offer data or methods that would enable the Agency to overcome these constraints. In fact, a main thrust of industry's comments has been that the Agency is required to do a site-specific benefits analysis, given the site-specific nature of a benefits analysis.

Because the gaps still exist in the types of information required to conduct a more comprehensive benefits analysis, the Agency has been unable to appreciably expand upon the economic portions of its benefits analysis for today's final rule. However, EPA is developing a more comprehensive assessment of benefits for its upcoming rulemaking for existing facilities, because some of the key data limitations can be more readily overcome when baseline conditions for the facilities and the impacted aquatic ecosystems can be identified and studied (these perspectives are not available for new sources with unknown locations).

Finally, EPA notes that the Agency's Guidelines for Preparing Economic Analysis are, as the title states, "guidelines" and not strict requirements. Consistent with these guidelines and standard professional best practices, it is the Agency's intent to develop economic analyses that are as complete and reliable as is feasible for its rulemakings. However, it is neither required nor prudent for EPA to develop empirical estimates of benefits where data limitations or other critical constraints preclude doing so in a credible and reliable manner.

3. Comments on the Relevance and Estimation of Nonuse Values

Two comments were received that questioned the applicability of nonuse benefits to the section 316(b) rulemaking and critiqued EPA's discussion of how such nonuse values might be estimated based on existing literature.

These comments point out that the issue of nonuse values (also known in some literature as "passive use" values) has sometimes been controversial, which the Agency recognizes. Further, the comments accurately note that there are limited methods available for measuring nonuse values, and that the accuracy of these methods can be debated because there are no observable market transactions or other ways to infer values by using the revealed preferences of the American people.

EPA recognizes that challenges associated with the estimation of nonuse values have been widely discussed in the economics literature as well as in the context of regulatory analysis and damage case litigation. However, consistent with the broadly accepted view in the economics profession, the Agency believes that nonuse values are likely to exist and apply for many (if not all) of the beneficial ecological outcomes that stem from EPA regulatory actions, including enhancements to aquatic systems as can be anticipated from the proposed section 316(b) rulemaking. There is no convincing evidence to suggest that nonuse values strictly apply to only a small set of environmental resources or only to irreversible changes in the condition of those resources. Further, even if nonuse values were thought to apply only under limited circumstances, the proposed section 316(b) rule is likely to have beneficial impacts on species and resources of concern (*e.g.*, threatened or endangered fish species) and thereby meet even a narrowly defined applicability test.

EPA agrees with the comments in terms of recognizing that there are no clear preference methods available for estimating nonuse values. Nonetheless, there are a number of stated preference methods that can be and have been successfully applied to develop credible estimates of nonuse values. Research using some of the early applications of the contingent valuation method (CVM, which is one type of stated preference method that has been applied by economists for nonuse value estimation)

indicated that nonuse estimates derived from inadequately designed CVM survey instruments may not be wholly reliable. Nonetheless, the body of research on stated preferences that has evolved over the past several years provides a broadening array of tools and methodological refinements that overcome many of the limitations inherent in some of the earlier applications of contingent valuation methods. EPA believes that well-designed, fully tested, and properly implemented stated preference approaches can provide useful and credible measures of nonuse values.

EPA would like to engage in a large-scale primary research effort to develop and apply state-of-the-art stated preference methods to the issue of estimating nonuse values for the ecological outcomes anticipated from section 316(b) regulatory options. However, the Agency lacks the budgetary resources, time, and appropriate authorities to pursue such research. Accordingly, the EEA discusses the viable alternative approach. Chapter 11 presents two types of benefits transfer approaches that the Agency has relied upon in past regulatory analyses and describes the findings of studies used in these exercises. While no estimates of nonuse benefits are made in the EEA, the discussion provided by the Agency establishes the appropriate concepts, approaches, and caveats that would be associated with the benefits transfer approach that would need to be used if the Agency were to develop such estimates.

*J. Engineering and Economic Analysis Limitations*

Some commenters argued that the industry profiles presented in the proposed rule were inaccurate. One commenter noted that, in particular, the pulp and paper industry has changed substantially since the early 1990's, the time period upon which EPA industry profile assumptions are based.

EPA's economic analysis is based on the forecasts for new facilities. To the extent that forecasts are uncertain, the estimates for costs are uncertain. The economic analysis is based on the 20-year forecast, while the life of the facility is assumed to be 30 years for annualizing costs. Facility life spans could differ from the 30-year life span, and as a result the annualized cost to these facilities could also differ. To estimate the number of new facilities for the chemical sector, EPA assumed, on the basis of comments that the estimate of 50 percent used at proposal was too high, that 25 percent of growth in product demand would be met from the new facilities. However, data were not readily available to verify this assumption. As a sensitivity analysis, EPA also calculated costs by assuming that 37.5 percent of the growth in new capacity in the chemicals sectors would occur at new facilities. In addition, for manufacturing facilities, EPA used the growth rates projected for three to five years to forecast growth over the 20-year time period.

In estimating costs, EPA assumed that new manufacturing facilities that would become operational over the 20-year period would be uniformly distributed over time. Actual growth could differ from this predicted pattern. The economic analysis is based on five major industry groups that account for the vast majority of cooling water withdrawal in the U.S. Some facilities in other industries may withdraw cooling water in excess of 2 MGD and may incur some costs to comply with the requirements of the rule. Such costs are not reflected in the economic analysis because of lack of reliable and readily available data. To the extent that facilities in other industries are affected, EPA believes that the costs and economic impacts would be similar to those considered by EPA and found to be economically practicable.

Numerous commenters argued that the cost estimates in the economic analysis are inaccurate, resulting in the underestimation of the total cost of the rule. Commenters disagreed with the cost analysis for many aspects of the rule, including but not limited to monitoring, operations and maintenance, contingency costs, and capital costs.

To the extent possible, EPA used information on the specific characteristics of planned new plants for which information is available to project the baseline characteristics of facilities affected by the rule.

Some commenters questioned the applicability and appropriateness of the economic analysis in relation to new (greenfield) facilities and existing facilities.

The estimates do not cover substantial modification of existing facilities. These facilities are not covered by the rule; hence, estimates for these facilities are not reflected in this analysis.

*K. EPA Authority*

Numerous commenters raised issues with regard to EPA's authority to implement section 316(b) in the proposed new facility rule. Commenters asserted that EPA's authority is limited to regulating CWISs and that by regulating dynamic flow, EPA is actually placing operational restrictions on the cooling system which in their view, are not part of a CWIS. Further, they argue that Congress did not give EPA authority to decide how much water a facility should withdraw, and thus, EPA may not regulate the gallons per day withdrawn, but must be limited to regulating physical and behavioral barriers located at the interface between the intake structure and the water body and separation and removal processes located between the point of withdrawal and the cooling water pumps. By these definitions, supply pumps and all other elements of the cooling water system are not intake structure technologies. Thus, commenters asserted EPA has no legal authority to require wet cooling or dry cooling.

In response, EPA emphasizes that it is not requiring wet cooling, but that it is establishing performance-based technology requirements on the dynamic flow of the cooling water intake structure that reduce impingement and entrainment at a level that is achieved by using closed-cycle cooling. Section 316(b) authorizes EPA to impose limitations on the location, design, construction and capacity of CWISs. EPA interprets the statute to authorize it to regulate that volume of the flow of water withdrawn through a cooling water intake structure as a means of addressing "capacity." *In re Brunswick Steam Electric Plant,* Decision of the General Counsel No. 41 (June 1, 1976). Such limitations on the volume of flow are consistent with the dictionary definition of "capacity" [94], the legislative history of the Clean Water Act [95], and the 1976 regulations. [96] *Id.* Indeed, as Decision of the General Counsel No. 41 points out, the major environmental impacts of cooling water intake structures are those affecting aquatic organisms living in the volumes of water withdrawn through the intake structure. Therefore, regulation of the volume of the flow of water withdrawn also advances the objectives of section 316(b).

Commenters also stated that EPA's proposed proportional flow withdrawal requirements lack a legal foundation since the references to location and capacity in section 316(b) refer to the CWIS itself, not the whole cooling system, and Congress did not authorize

[94] "Cubic contents; volume; that which can be contained." Random House Dictionary of the English Language, cited in Decision of the General Counsel No. 41.

[95] Legislative History of the Water Pollution Control Act Amendments of 1972, 93d Cong., 1st Sess., at 196–7 (1973).

[96] 40 CFR 402.11(c) (definition of "capacity"), 41 *FR* 17390 (April 26, 1976).

EPA to limit the siting of new facilities that use cooling water. To the extent that new facilities comply with this requirement by employing a wet cooling system or by obtaining water from other sources, EPA believes that this is within EPA's authority to regulate capacity, as stated above. Because the major environmental impacts of cooling water intake structures are those affecting aquatic organisms living in the volumes of water withdrawn through the intake structure, in the limited circumstances where the volume of water withdrawn would exceed the proportional flow requirements and the facility would need to locate elsewhere to meet the requirement, EPA believes this regulation of location also advances the objectives of section 316(b).

Some commenters argued that section 316(b) is no more stringent than section 316(a) and thus section 316(b) compels EPA to interpret "adverse environmental impact" as an impact with a demonstrated impact on a "balanced indigenous population." EPA does not agree that the CWA compels EPA to interpret "adverse environmental impact" as that term is used in section 316(b) in the Act by reference to the phrase "balanced indigenous population" under section 316(a). The CWA is silent with respect to what is meant by "adverse environmental impact" under section 316(b), whereas the CWA specifically mentions "balanced indigenous population" as a variance under section 316(a). The main guiding principles for statutory interpretations were articulated in *Chevron, U.S.A., Inc. v. Natural Resources Defense Council, Inc.*, 467 U.S. 838, 843 (1984). There the court stated, if the statute is silent or ambiguous with respect to the specific issue, the question for the court is whether the agency's answer is based on a permissible construction of the statute. The court need not conclude that the agency construction was the only one it permissibly could have adopted to uphold the construction, or even the reading the court would have reached if the question initially had arisen in a judicial proceeding. Thus, if a statute is ambiguous and an agency's interpretation of the statute is reasonable, a court must defer to the agency. Here, EPA's interpretation of the statute is reasonable and furthers the purposes of the CWA. This interpretation is further supported because Congress used different terms in section 316(b) than it used in section 316(a). Congress did not refer to a "balanced indigenous population" in section 316(b) of the CWA. Where Congress includes particular language in one section of a statute, but omits it in another section of the same act, it is generally presumed that Congress acted intentionally and purposely in the disparate inclusion or exclusion. *Bates v. U.S.*, 522 U.S. 23 (1997). *See also Florida Public Telecommunications Ass'n, Inc. v. F.C.C.*, 54 F.3d 857 (D.C. Cir. 1995). Further, section 316(a) and section 316(b) address two different issues. Section 316(a) addresses the discharge of heated water while section 316(b) address the withdrawal of huge volumes of water. Thus, it is reasonable to view the two different sections of the statute as addressing different environmental problems in different ways. *In re Brunswick Steam Electric Plant*, Decision of the General Counsel No. 41 (June 1, 1976). For purposes of implementing section 316(b) in the new facility rule, EPA thinks it is reasonable to interpret the phrase adverse environmental impacts as including a range of impacts, including impingement and entrainment, diminishment of compensatory reserve, stresses to the population or ecosystem, harm to threatened or endangered species, impairment of state water quality standards, see Section V, above.

Some commenters stated that section 316(b), which focuses on intakes, not discharges, does not authorize EPA to establish a rule authorizing States to set additional cooling water intake structure requirements to meet state water quality standards. EPA addresses this issue in Section V.B. above.

*L. Restoration*

In the proposed rule EPA requested comments on a variety of mandatory, discretionary, and voluntary regulatory approaches involving restoration measures (65 *FR* 49089). Many commenters supported a role for restoration or mitigation. These commenters stated that restoration is a well-accepted concept that should have a voluntary role in section 316(b) determinations and constitutes an appropriate means for sources to reduce the potential for causing adverse environmental impact to below the level of regulatory concern, or reduced regulatory concern. Commenters further stated that restoration should not be mandatory and that EPA lacks authority to require it but should not preclude restoration measures from playing an important role in section 316(b) permitting decisions. These same commenters stated that restoration should not be considered the best technology available for minimizing adverse environmental impact because it is not a technology that addresses the location, design, construction, or capacity of a cooling water intake structure.

Other commenters strongly opposed restoration measures as substitute for direct controls, arguing that they are not the "best technology available for minimizing adverse environmental impact," but the commenters thought restoration measures may have a role in compensating for past harms to the aquatic environment or as an additional consideration above the protections offered by direct controls. Another commenter added that restoration measures, in the context of section 316(b), are generally unworkable and that the only measurable restoration method would be offsetting, in which an applicant would stop use of an older intake facility that does more harm than the proposed one.

Some commenters also stated that restoration should be included in permitting considerations when it is determined that dry cooling is not feasible. In this case, the facility should use a wet closed-cycle recirculating system and restoration should be considered. These commenters also suggested that, if restoration is allowed, there should be consultation with other State and Federal resource agencies to avoid inconsistent approaches. Finally, commenters stated that section 316(b) does not authorize mandatory restoration.

Today's final rule for new facilities includes restoration measures as part of Track II. EPA is not including restoration in Track I because this track is intended to be expeditious and provide certainty for the regulated community and a streamlined review process for the permitting authority. To do this for new facilities, EPA has defined the best technology available for minimizing adverse environmental impact in terms of reduction of impingement and entrainment, an objective measure of environmental performance. By contrast, restoration measures in general require complex and lengthy planning, implementation, and evaluation of the effects of the measures on the populations of aquatic organisms or the ecosystem as a whole.

EPA is including restoration measures in Track II to the extent that the Director determines that the measures taken will maintain the fish and shellfish in the waterbody in a manner that represents performance comparable to that achieved in Track I. Applicants in Track II need not undertake restoration measures, but they may choose to undertake such measures. Thus, to the extent that such measures achieve performance comparable to that

achieved in Track I, it is within EPA's authority to authorize the use of such measures in the place of the Track I requirements. This is similar to the compliance alternative approach EPA took in the effluent guidelines program for Pesticide Chemicals: Formulating, Packaging and Repackaging. There EPA established a numeric limitation but also a set of best management practices that would accomplish the same numeric limitations. See 61 FR 57518, 57521 (Nov. 6, 1997). EPA believes that section 316(b) of the Clean Water Act provides EPA with sufficient authority to authorize the use of voluntary restoration measures in lieu of the specific requirements of Track I where the performance is substantially similar under the principles of *Chevron USA* v. *NRDC*, 467 U.S. 837, 844–45 (1984). Here, Congress is silent concerning the role of restoration technologies in the statute and in the legislative history, either by explicitly authorizing or explicitly precluding their use. EPA also believes that appropriate restoration measures or conservation measures that are undertaken on a voluntary basis by a new facility to meet the requirements of the rule fall within EPA's authority to regulate the "design" of cooling water intake structures. *Bailey* v. *U.S.*, 516 U.S. 137 (1995)(In determining meaning of words used in a statute, court considers not only the bare meaning of the word, but also its placement and purpose in the statutory scheme.)

This interpretation of the statute fits well within the purpose of section 316(b) of the CWA. The purpose of section 316(b) is to minimize adverse environmental impact from cooling water intake structures. Restoration measures that result in the performance comparable to that achieved in Track I further this objective while offering a significant degree of flexibility to both permitting authorities and facilities.

EPA recognizes that restoration measures have been used at existing facilities implementing section 316(b) on a case-by-case, best professional judgment basis as an innovative tool or as a tool to conserve fish or aquatic organisms, compensate for the fish or aquatic organisms killed, or enhance the aquatic habitat harmed or destroyed by the operation of cooling water intake structures. Under Track II, this flexibility will be available to new facilities to the extent that they can demonstrate performance comparable to that achieved in Track I. For example, if a new facility that chooses Track II is on an impaired waterbody, that facility may choose to demonstrate that velocity controls in concert with measures to improve the productivity of the waterbody will result in performance comparable to that achieved in Track I. The additional measures may include such things as reclamation of abandoned mine lands to eliminate or reduce acid mine drainage along a stretch of the waterbody, establishment of riparian buffers or other barriers to reduce runoff of solids and nutrients from agricultural or silvicultural lands, removal of barriers to fish migration, or creation of new habitats to serve as spawning or nursery areas. Another example might be a facility that chooses to demonstrate that flow reductions and less protective velocity controls, in concert with a fish hatchery to restock fish being impinged and entrained with fish that perform a similar function in the community structure, will result in performance comparable to that achieved in Track I.

EPA recognizes that it may not always be possible to establish quantitatively that the reduction in impact on fish and shellfish is comparable using the types of measures discussed above as would be achieved in Track I, due to data and modeling limitations. Despite such limitations, EPA believes that there are situations where a qualitative demonstration of comparable performance can reasonably assure substantially similar performance. EPA is thus providing, in § 125.86, that the Track II Comprehensive Demonstration Study should show that either: (1) The Track II technologies would result in reduction in both impingement mortality and entrainment of all life stages of fish and shellfish of 90 percent or greater of the reduction that would be achieved through Track I (quantitative demonstration) or, (2) if consideration of impacts other than impingement mortality and entrainment is included, the Track II technologies will maintain fish and shellfish in the waterbody at a substantially similar level to that which would be achieved under Track I (quantitative or qualitative demonstration).

EPA does not intend the foregoing discussion or today's rule to be authoritative with respect to any ongoing permit proceedings for existing facilities or previously issued existing facility permits, which should continue to be governed by existing legal authorities. EPA will address the issue of restoration further in Phase II and Phase III.

## VII. Implementation

Under the final rule, section 316(b) requirements would be implemented through the NPDES permit program. These regulations establish application, monitoring, recordkeeping, and reporting requirements for new facilities. The regulations also require the Director to review application materials submitted by each new facility and include the requirements and monitoring and recordkeeping requirements in the permit.

EPA will develop a model permit and permitting guidance to assist Directors in implementing these requirements. In addition, the Agency will develop implementation guidance for owners and operators that will address how to comply with the application requirements, the sampling and monitoring requirements, technology plans, and the recordkeeping and reporting requirements in these regulations.

### *A. When Does the Rule Become Effective?*

This rule becomes effective thirty (30) days from the date of publication. After the effective date of the regulation, new facilities are required to submit the application data for cooling water intake structures required under these regulations.

### *B. What Information Must I Submit to the Director When I Apply for My New or Reissued NPDES Permit?*

The NPDES application process under 40 CFR 122.21 requires that facilities submit information and data 180 days prior to the commencement of a discharge. If you are the owner or operator of a facility that meets the new facility definition, you will be required to submit the information that is required under 40 CFR 122.21 and § 125.86 of today's final rule with your initial permit application and with subsequent applications for permit reissuance. The Director will review the information you provide and will confirm whether your facility is a new facility and establish the appropriate requirements to be applied to the cooling water intake structure(s).

At 40 CFR 122.21, today's rule requires all owners or operators of new facilities to submit three general categories of information when they apply for an NPDES permit. The general categories of information include (1) physical data to characterize the source water body in the vicinity where the cooling water intake structures are located, (2) data to characterize the design and operation of the cooling water intake structures, and (3) existing data (if they are available) to characterize the baseline biological condition of the source waterbody. All applicants must also submit a statement specifying whether they will comply with either Track I or Track II

(§ 125.86(a)(1)), and source waterbody flow information (§§ 125.86(b)(3) or 125.86(c)(1)). If you are a Track I applicant, you must also submit (1) data to show you will meet the Track I flow and velocity requirements and (2) a design and construction technology plan demonstrating that you have selected design and construction technologies necessary to minimize impingement mortality and/or entrainment if you are located where such technologies are necessary. If you are a Track II applicant, you must also submit a comprehensive demonstration study with detailed information on source waterbody and intake structure characteristics, and a verification monitoring plan. Applicants seeking an alternative requirement under § 125.85 must submit data that demonstrate that their compliance costs would be wholly out of proportion to the costs considered by EPA in establishing the requirements of §§ 125.84(a) through (e) or that compliance with the rule would cause significant adverse impacts on local air quality, local water resources or local energy markets.

The following describes the application requirements for all new facilities and the requirements specific to Tracks I and II in more detail.

1. All New Facilities

a. Source Water Physical Data

All new facilities must provide the source water physical data required at 40 CFR 122.21(r)(2) in their permit applications. These data are needed to characterize the facility and evaluate the type of waterbody and species affected by the cooling water intake structure. This information will also be used by the permit writer to evaluate the appropriateness of the design and construction technologies selected by the applicant for use at their site in subsequent permit proceedings. Specific data items that must be submitted include (1) a narrative description and scale drawings showing the physical configuration of all source waterbodies used by the facility, including areal dimensions, depths, salinity and temperature regimes, and other documentation; (2) an identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods used to conduct any physical studies to determine the intake's zone of influence and the results of such studies; and (3) locational maps.

b. Cooling Water Intake Structure Data

All new facilities must submit the cooling water intake structure data required at 40 CFR 122.21(r)(3) to characterize the cooling water intake structure and evaluate the potential for impingement and entrainment of aquatic organisms. Information on the design of the intake structure and its location in the water column will allow the permit writer to evaluate which species or life stages would potentially be subject to impingement and entrainment. A diagram of the facility's water balance would be used to identify the proportion of intake water used for cooling, make-up, and process water. The water balance diagram also provides a picture of the total flow in and out of the facility, allowing the permit writer to evaluate compliance with the Track I flow reduction requirements (if applicable). Specific data on the intake structure include (1) a narrative description of the configuration of each of your cooling water intake structures and where it is located in the waterbody and in the water column; (2) latitude and longitude in degrees, minutes, and seconds for each of your cooling water intake structures; (3) a narrative description of the operation of each of your cooling water intake structures, including design intake flows, daily hours of operation, number of days of the year in operation, and seasonal changes, if applicable; (4) a flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges; (5) engineering drawings of the cooling water intake structure.

c. Source Water Baseline Biological Characterization Data

All new facilities must submit the source water baseline biological characterization data required in 40 CFR 122.21(r)(4) with their permit application. This information will characterize the biological community in the vicinity of the cooling water intake structure as well as the operation of the cooling water intake structures. The Director may use this information in subsequent permit renewal proceedings to determine if the applicant's design and construction technology plan should be revised. This supporting information must include existing data (if available), which may be supplemented with new field studies if the applicant so chooses. The applicant must submit the following specific data (1) a list of the data that are not available and efforts made to identify sources of the data; (2) if available, a list of species (or relevant taxa) in the vicinity of the cooling water intake structure, and identification of the species and life stages that would be most susceptible to impingement and entrainment (including both nekton and meroplankton) (Species identified should include the range of species in the system including the forage base); (3) if available, identification and evaluation of the primary period of reproduction, larval recruitment, and period of peak meroplankton abundance for relevant taxa; (4) if available, information sufficient to provide data representative of the seasonal and daily biological activity in the vicinity of the cooling water intake structure; (5) if available, identification of all threatened or endangered species that might be susceptible to impingement and entrainment at your cooling water intake structures; (6) documentation of any public participation or consultation with Federal or State agencies undertaken in collecting the data; (7) if the above data are supplemented with data collected in actual field studies, a description of all methods and quality assurance procedures for data collection, sampling, and analysis, including a description of the study area; identification of the biological assemblages to be sampled or evaluated (both nekton and meroplankton); and data collection, sampling, and analysis methods. The sampling or data analysis methods used must be appropriate for a quantitative survey and based on a consideration of methods used in other biological studies performed within the same source waterbody. The study area should include, at a minimum, the area of influence of the cooling water intake structure.

d. Source Water Flow Data

All facilities must demonstrate compliance with the source water flow requirements in §§ 125.84(b)(3) and (c)(2). Information to show that a new facility is in compliance with these requirements must be submitted to the Director in accordance with §§ 125.86(b)(3) and (c)(1).

If your facility is located on a freshwater river or stream, you must submit data that supports that you are withdrawing less than five (5) percent of the annual mean flow. The documentation might include either publicly available flow data from a nearby U.S. Geological Survey (USGS) gauging station or actual instream flow monitoring data that the facility has collected itself. The waterbody flow should be compared with the total design flow of all cooling water intake structures at the new facility.

If your cooling water intake structure is withdrawing water from an estuary or a tidal river, you need to calculate the tidal excursion and provide the flow data for your facility and the supporting calculations. The tidal excursion distance can be computed using three different methods ranging from simple to complex. The simple method involves using available tidal velocities that can be obtained from the Tidal Current Tables formerly published by the National Ocean Service of the National Oceanic and Atmospheric Administration (NOAA) and currently printed and distributed by private companies (available at bookstores or marine supply stores). The midrange method involves computing the tidal excursion distance using the Tidal Prism Method.[97] The complex method involves the use of a two-dimensional or three-dimensional hydrodynamic model. The simplest method to use is the following:

(1) Locate the facility on either a NOAA nautical chart or a base map created from the USGS 1:100,000 scale Digital Line Graph (DLG) data available on the USGS website. These DLG Data can be imported into a computer-aided design (CAD) program or geographic information system (GIS). If these tools are unavailable, 1:100,000 scale topographic maps (USGS) can be used.

(2) Obtain maximum flood and ebb velocities (in meters per second) for the waterbody in the area of the cooling water intake structure from NOAA Tidal Current Tables.

(3) Calculate average flood and ebb velocities (in meters per second) over the entire flood or ebb cycle by using the maximum flow and ebb velocities from 2 above.

$$\text{Velocity}_{\text{Average Flood}} = \text{Velocity}_{\text{Maximum Flood}} * {}^{2}/_{\pi} \qquad \text{(Equation 1)}$$

$$\text{Velocity}_{\text{Average Ebb}} = \text{Velocity}_{\text{Maximum Ebb}} * {}^{2}/_{\pi} \qquad \text{(Equation 2)}$$

(4) Calculate the flood and ebb tidal excursion distance using the average flood and ebb velocities from 3 above.

$$\text{Distance}_{\text{Flood Tidal Excursion}} = \text{Velocity}_{\text{Average Flood}} * 6.2103 * 3600\ {}^{s}/_{\text{hr}} \qquad \text{(Equation 3)}$$

$$\text{Distance}_{\text{Ebb Tidal Excursion}} = \text{Velocity}_{\text{Average Ebb}} * 6.2103 * 3600\ {}^{s}/_{\text{hr}} \qquad \text{(Equation 4)}$$

(5) Using the total of the flood and ebb distances from above, define the diameter of a circle that is centered over the opening of the cooling water intake structure.

(6) Define the area of the waterbody that falls within the area of the circle (see Appendix 2 to Preamble). The area of the waterbody, if smaller than the total area of the circle might be determined either by using a planimeter or by digitizing the area of the waterbody using a CAD program or GIS. For cooling water intake structures located offshore in large waterbodies, the area of the waterbody might equal the entire area of the circle (see D in Appendix 3 to Preamble). For cooling water intake structures located flush with the shoreline, the area might be essentially a semicircle (see C in Appendix 3 to Preamble). For cooling water intake structures located in the upper reaches of a tidal river, the area might be some smaller portion of the area of the circle (see A in Appendix 3 to Preamble).

(7) Calculate the average depth of the waterbody area defined in 6 above. Depths can easily be obtained from bathymetric or nautical charts available from NOAA. In many areas, depths are available in digital form.

(8) Calculate a volume by multiplying the area of the waterbody defined in 6 by the average depth from 7. Alternatively, the actual volume can be calculated directly with a GIS system using digital bathymetric data for the defined area.

If your cooling water is withdrawn from a lake or reservoir, you must submit information such as a narrative description of the waterbody thermal stratification and any supporting documentation and engineering calculations to show that your cooling water intake structure meets the requirement not to alter the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies). Typically, this natural thermal stratification will be defined by the thermocline, which may be affected to a certain extent by the withdrawal of cooler water and the discharge of heated water into the system. This information demonstrates to the permit writer that you are maintaining the thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies) such that it maintains appropriate habitat for the biological makeup of the waterbody.

2. Track I Facilities

a. Flow Reduction Information

New facilities larger than 10 MGD that choose Track I must submit the data on flow reduction required in § 125.86(b)(1) with their permit applications. New facilities between 2 and 10 MGD that choose to comply with the Track I requirements at § 125.84(b) must also submit this data. The information required includes a narrative description of the water balance of the closed-cycle recirculating cooling water system for the facility and an

[97] Diana, E., A.Y. Kuo, B.J. Neilson, C.F., Cerco, and P.V. Hyer. 1987. *Tidal prism model manual,* Virginia Institute of Marine Science, Gloucester Point, VA.

engineering demonstration that the intake flows have been minimized to the maximum extent reasonably possible. You should also consider all feasible methods to re-use blowdown in other plant operations. New facilities between 2 and 10 MGD that choose to comply with the Track I requirements at § 125.84(c) must submit data that shows that the facility's total design water intake flow is less than 10 MGD. *See* § 122.21(r)(3)(iii).

b. Velocity Information

New facilities that choose Track I must submit the data on velocity required in § 125.86(b)(2) with their permit applications. The information required includes a narrative description of the design, structure, equipment, and operation used to meet the performance requirement and any engineering calculations used to calculate design through-screen velocity.

c. Design and Construction Technology Plan

If you select Track I, § 125.86(b)(4) and (b)(5) require you to include a Construction Technology Plan in your application that demonstrates that your facility has selected and will implement the design and construction technologies necessary to minimize impingement mortality and/or entrainment when certain conditions exist at the site. If you select Track I and choose to comply with the requirements of § 125.84(c) (which are available to facilities between two and ten MGD) you much install technologies to reduce impingement at some locations and you must install technologies to reduce entrainment at all sites. *See* § 125.84(c)(3) and (4). Examples of such technologies that may be appropriate for your site include, but are not be limited to (1) fish-handling and return systems, (2) wedgewire screens, (3) fine mesh screens, (4) barrier nets, and (5) aquatic filter barrier systems. The Agency recognizes that selection of the specific technology or group of technologies for your site will depend on individual facility and waterbody conditions.

In the application, you need to describe the technology(ies) you will implement at your facility to meet the requirements in § 125.84(b)(4) and (5) or § 125.84(c)(3) and (4), the basis for their selection, and the expected level of performance. During subsequent permit terms, the Director may require you to implement additional or different design and construction technologies if the initial technologies you selected and implemented do not meet the requirement of minimizing impingement mortality and entrainment.

3. Track II Facilities

a. Comprehensive Demonstration Study

If you select Track II, § 125.86(c)(2) requires you to perform and submit to the Director the results of a Comprehensive Demonstration Study, including data and detailed analyses to demonstrate that you will reduce the impacts to fish and shellfish to levels comparable to the level you would achieve were you to implement the Track I requirements at § 125.84(b)(1), and (2). To meet the "comparable level" requirement, you must demonstrate that you have reduced both impingement mortality and entrainment of all life stages of fish and shellfish to 90 percent or greater of the reduction that would be achieved through Track I, or if your demonstration includes consideration of impacts other than impingement mortality and entrainment, that the measures taken will maintain the fish and shellfish in the waterbody at a substantially similar level to that which would be achieved through Track I. Your proposed technologies may specifically include the reuse of spent cooling water as industrial process water and the associated reductions in process water withdrawals from the source waterbody as a means for reducing intake capacity and impingement and entrainment.

The Comprehensive Demonstration Study has four parts:

- A proposal for how information will be collected;
- A Source Water Biological Study;
- An evaluation of potential cooling water intake structure effects; and
- A Verification Monitoring Plan.

These plans and evaluations must be submitted to the Director with the permit application.

Under § 125.86(c)(2)(iii)(B), you may submit data from previous biological studies performed in the vicinity of the proposed or actual intake if the data are no more than 5 years old so that they reasonably represent existing conditions. You must demonstrate that such existing data are fully representative of the current conditions in the vicinity of the intake and provide documentation showing that the data were collected by using established and reliable quality assurance procedures.

Before performing the study you must submit to the Director a plan stating how information will be collected to support the study. This plan must provide (1) a description of the proposed technology(ies) to be evaluated; (2) a list and description of any historical studies characterizing the physical and biological conditions in the vicinity of the proposed or actual intakes and their relevancy to the proposed study; (3) a summary of any public participation or consultation with Federal or State agencies undertaken in development of the plan; and (4) a sampling plan for data that will be collected in actual field studies in the source waterbody that documents all methods and quality assurance procedures for data collection, sampling, and analysis. The study area for such field studies must include, at a minimum, the area of influence of the cooling water intake structure and at least 100 meters beyond. The area of influence is the portion of water subject to the forces of the intake structure such that a particle within the area is likely to be pulled into the intake structure.

You must submit the results of a Source Water Biological Study in accordance with § 125.86(c)(2)(iv)(A). This characterization must include (1) a taxonomic identification and characterization of aquatic biological resources (nekton and meroplankton) to provide a summary of historic and contemporary aquatic biological resources; a determination and description of the target populations of concern (those species and life stages that would be most susceptible to impingement and entrainment); and a description of the abundance and temporal and spatial characterization of the target populations based on the collection of multiple years of data to capture the seasonal and daily biological activity in the vicinity of the cooling water intake structure; (2) an identification of all threatened or endangered species that might be susceptible to impingement and entrainment by the cooling water intake structures; and (3) a description of additional chemical, water quality, and other anthropogenic stresses on the source waterbody. The Director might coordinate a review of your list of threatened or endangered species with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service staff to ensure that potential impacts to threatened or endangered species have been addressed.

The study must evaluate the potential for cooling water intake structure effects in accordance with § 125.86(c)(2)(iv)(A). This evaluation must include (1) a statement of the baseline against which the comparative analyses will be made. The impingement and entrainment baselines must be calculated for the facility by assuming a design of a once-through cooling water system employing a trash rack and traveling

screens; (2) an engineering estimate of the efficacy of proposed technologies in reducing impacts to fish and shellfish to a level comparable to the level that would be achieved by meeting the Track I requirements at the site. To demonstrate that the technologies meet the "comparable level" requirement, the demonstration must show that both impingement and entrainment of all life stages of fish and shellfish have been reduced to 90 percent or greater of the reduction that could be achieved through Track I, or, if impacts other than impingement mortality and entrainment are considered, that the measures taken will maintain the fish and shellfish in the waterbody at a substantially similar level to that which would be achieved through Track I. The efficacy projection must include a site-specific evaluation of technology suitability for reducing impingement and entrainment based on design, location, and operational specification applied to the characterization and a site-specific evaluation of any additional measures based on the physical, chemical, and biological characteristics of the site; and (3) a characterization of impingement and entrainment survival estimates of the proposed alternative technology based on case studies in the vicinity of the cooling water intake structure and/or site-specific technology prototype studies, and a characterization of fish and shellfish propagation and survival based, for example, on case studies documenting the efficacy of any additional measures performed at similar sites.

To demonstrate that you will reduce impingement mortality and entrainment to a level of reduction comparable to the level that you would achieve if you implemented Track I requirements at your site, you will need to develop a conceptual engineering design of a hypothetical recirculating water system for your facility, including the estimated intake flow. The estimated intake flow should take into account an optimized system in which the volume of intake flow/blowdown is minimized to the maximum extent feasible. The conceptual design should also include proposed design and construction technologies that would be used to minimize impingement mortality and entrainment pursuant to § 125.84(b)(4) and (5). Finally, you should estimate the expected level of impingement and entrainment associated with the hypothetical intake structure for all species found in substantial numbers in source waterbody in the vicinity of the intake structure. In estimating entrainment, 100 percent mortality may be assumed to preclude the need to perform entrainment survival studies.

You must then calculate and document the expected level of performance of the proposed alternative technologies for all species found in significant numbers in the source waterbody in the vicinity of the intake structure. Such documentation may consist of pilot-scale testing at the proposed facility, *representative* performance data from *comparable* facilities, or both. In preparing the documentation you should specifically show that the pilot-scale or comparable facility data address the following factors that may affect technology performance:

- Physical and chemical watershed conditions (temperature, freezing and thawing, tidal conditions, wave action, sediment and debris, flow, etc.);
- Biological watershed conditions (individual species, life stages, predator species, seasonality, etc.);
- Engineering feasibility and long-term reliability, and
- Operation and maintenance issues.

Available data suggests that alternative design and construction technologies for cooling water intake structures can achieve the level of reduction in impingement mortality and entrainment required under Track I. Technologies such as fine and wide-mesh wedgewire screens, as well as aquatic filter barrier systems, have been shown to reduce mortality from impingement by up to 99 percent or greater compared with conventional once-through systems. In addition, other types of barrier nets may achieve reductions of 80 to 90 percent, and modified screens and fish return systems, fish diversion systems, and fine mesh traveling screens and fish return systems have achieved reductions in impingement mortality ranging from 60 to 90 percent greater than conventional once-through systems. Similarly, with regard to entrainment, although there is less available full scale performance data, aquatic filter barrier systems, fine mesh wedgewire screens, and fine mesh traveling screens with fish return systems have been shown to achieve 80 to 90 percent greater reduction in mortality from entrainment compared with conventional once-through systems. Several additional factors suggest that these performance levels can be improved upon. First, some of the cooling water intake structure technology performance data reviewed is from the 1970's and 1980's and does not reflect recent developments and innovation (e.g., aquatic filter barrier systems, sound barriers). Second, these conventional barrier and return system technologies have not been optimized on a widespread level to date, as would be encouraged by this rule. Such optimization can be best achieved by new facilities, which can match site conditions to available technologies. Third, EPA believes that many facilities could achieve further reductions (estimated 15–30 percent) in impingement and entrainment by providing for seasonal flow restrictions, variable speed pumps, and other innovative flow reduction alternatives. Finally, new facilities seeking to comply under Track II can choose the specific location of their cooling water intake structures to further optimize the level of reduction in impingement mortality and entrainment (i.e., locate the cooling water intake structure outside of biologically productive or sensitive areas to the extent this would serve to reduce environmental impact). For additional discussion, *see* Section V.B.2.

Finally, new facilities complying under Track II must submit a Verification Monitoring Plan in accordance with § 125.86(c)(2)(iv)(A). The plan must include information on how the facility will conduct a monitoring study to verify the full-scale performance of the proposed technologies and of any additional measures. The plan must describe the frequency of monitoring and the parameters to be monitored. The Director will use the verification monitoring to verify that you are meeting the level of impingement and entrainment expected and that fish and shellfish are being maintained at the level expected. The Director will then determine whether to approve the use of the suite of alternative technologies in subsequent permit issuance. Verification monitoring must start during the first year that the cooling water intake structure begins operation and continue for a sufficient period of time to demonstrate that the facility is reducing impingement mortality and entrainment to a level of reduction comparable to the level the facility would have been achieved by implementing the flow reduction and design velocity requirements of Track I.

4. Data To Support a Request for Alternative Requirements

If, pursuant to § 125.85(a), you request that an alternative requirement less stringent than those specified in § 125.84 be required in your permit, § 125.85(b) places the burden on you to show that your compliance costs are wholly out of proportion to the costs EPA considered during development of

the requirements at issue, or that compliance with the national standard will result in significant adverse impact to local air quality, local water resources, or local energy markets. Compliance costs that EPA considered were subdivided into one-time costs and recurring costs. Examples of one-time costs include capital and permit application costs. Examples of recurring costs include operation and maintenance costs, permit renewal costs, and monitoring, recordkeeping, and reporting costs.

*C. How Will the Director Determine the Appropriate Cooling Water Intake Structure Requirements?*

The Director's first step would be to determine whether the facility is covered by this rule If the answer is yes to all the following questions, the facility must comply with the requirements of this final rule.

(1) Is the facility a "new facility" as defined in § 125.83?

(2) Does the new facility withdraw cooling water from waters of the U.S.; *OR* does the facility obtain cooling water by any sort of contract or arrangement with an independent (supplier or multiple suppliers) of cooling water if the supplier(s) withdraw(s) water from waters of the U.S. and is not a public water system?

(3) Is at least 25 percent of the water withdrawn by the facility used for cooling purposes?

(4) Does the new facility have a design intake flow of greater than 2 million gallons per day (MGD)? [98]

(5) Does the new facility discharge pollutants to waters of the U.S., including storm water-only discharges, such that the facility has or is required to have an NPDES permit?

If these final regulations are applicable to the applicant, the second step would be to determine the locational factors associated with the new facility's cooling water intake structure. The Director would first review the information that the new facility provided to validate the source waterbody type in which the cooling water intake structure is located (freshwater stream or river, lake or reservoir, estuary or tidal river, or ocean). (As discussed above, the applicant would need to identify the source waterbody type in the permit application and provide the appropriate documentation to support the waterbody type classification.) The Director would review the supporting material the applicant provided in the permit application. The Director would also review the engineering drawings and the locational maps the applicant provided, documenting the physical placement of the cooling water intake structure.

For Track I facilities, the Director's next step would be to review the design requirements for intake flow and velocity. For a new facility with an intake flow equal to or greater than 10 MGD that is required to reduce its intake flow to a level commensurate with that which could be attained by a closed-cycle recirculating cooling water system, the Director would review the narrative description of the closed-cycle recirculating cooling water system design and any engineering calculations to ensure that the new facility is complying with the requirement and that the make-up and blowdown flows have been minimized. If the flow reduction requirement is met by reusing or recycling water withdrawn for cooling purposes, the Director must review documentation that the amount of cooling water that is not reused or recycled has been minimized.

The velocity requirement is based on the design through-screen or through-technology velocity as defined in § 125.83. For Track I facilities, the maximum design velocity would always be 0.5 ft/s. To determine whether the new facility meets the maximum design velocity requirement, the Director would review the narrative description of the design, structure, equipment, and operation used to meet the velocity requirement. The Director would also review the design calculations that demonstrate that the maximum design velocity would be met. In reissuing permits, the Director would review velocity monitoring data to confirm that the facility is not exceeding the initial design velocity calculated at the start of commercial service.

Under Track I, the Director would then review the applicant's Design and Construction Technology Plan (if the applicant is located in an area where such technologies are required) and the applicant's Source Water Baseline Biological Characterization data. During each permit renewal, the Director would then review monitoring data, application data, and other supporting information to determine whether the applicant needs to implement additional or different design and construction technologies (see discussion of § 125.89(a)(2) below).

Under Track II, the Director would receive and should review the applicant's proposed plan for preparing the Comprehensive Demonstration Study. When the applicant proposes to rely on existing studies, the Director would assess the data quality and the relevance to the proposed facility. When new biological surveys are proposed, the Director would determine whether they fully characterize the waterbody potentially impacted by impingement and entrainment. Where pilot-scale demonstrations are proposed, the Director would evaluate whether they are generally representative of full-scale operations. After the study is completed, the Director would review the applicant's analysis, specifically to determine whether the proposed alternative technology(ies) will reduce impingement mortality and entrainment to a level of reduction comparable to the level that the facility would achieve if it complied with the Track I requirements for reducing intake capacity and design velocity, or if the proposed measures in conjunction with the proposed technologies will maintain the fish and shellfish in the waterbody at a substantially similar level to that which would be achieved. The Director would also review the facility's Technology Verification Plan for post-operational monitoring to demonstrate that the technologies are performing as predicted.

The proportional flow requirement applicable to all facilities is based on waterbody type. To determine whether the new facility meets the flow requirement, the Director would first verify the new facility's determination of the waterbody flow for the respective waterbody type (e.g., annual mean flow and low flow for freshwater river or stream). The Director would review the source-water flow data the facility provided in the permit application. The Director should consider using available USGS data (for freshwater rivers and streams) to verify the flow data in the permit application. Then the Director would review any supporting documentation and engineering calculations that demonstrate that the new facility would meet the flow requirements. To verify the flow data the new facility provides for an estuary or a tidal river, the Director would review the facility's calculation of the tidal excursion.

The final regulations at § 125.84(e) require compliance with any more stringent requirements relating to the location, design, construction, or capacity of a cooling water intake structure or monitoring requirements at a new facility that a Director deems necessary to comply with any provision of State law, including state water quality standards, including designated

[98] If the answer is no to these flow parameters and yes to all the other questions, the Director would use best professional judgment on a case-by-case basis to establish permit conditions that ensure compliance with section 316(b).

uses, criteria, and antidegradation provisions.

*D. What Will I Be Required to Monitor?*

At § 125.87, today's final rule requires biological monitoring and visual or remote inspections at all facilities. Track I facilities and Track II facilities that rely on specified velocity levels as part of their alternative technology(ies) are also required to monitor screen head loss and velocity.

Both Track I and Track II facilities must conduct biological monitoring for impingement and entrainment to assess the presence, abundance, life stages, and mortality (eggs, larvae, post larvae, juveniles, and adults) of aquatic organisms (fish and shellfish) impinged or entrained during operation of the cooling water intake structure. These data would also be used by the permitting authority in subsequent permit terms to determine whether additional or modified design and construction technologies are reasonably necessary (see discussion of § 125.89(a)(2) in D. below). The facility would be required to conduct impingement and entrainment sampling over a 24-hour period no less than once per month when the cooling water intake structure is in operation and report results to the Director annually. After two years, the Director may approve an applicant's request for less frequent biological monitoring if the facility provides data to support the request showing that less frequent monitoring would still allow for the detection of any seasonal and daily variations in the species and numbers of individuals that are impinged or entrained. The Director should approve a request for reduced frequency in biological monitoring only if the supporting data show that the technologies are consistently performing as projected under all operating and environmental conditions and less frequent monitoring would still allow for the detection of any future performance fluctuations.

Under § 125.87(b), Track I facilities are required to monitor the head loss across the intake screens to obtain a correlation of those values with the design intake velocity (Track I) or other specified velocity (Track II) at minimum ambient source-water surface elevation (according to best professional judgment based on available hydrological data). The maximum head loss across the screen for each cooling water intake structure must be used to determine compliance with the velocity requirement in § 125.84(b)(2) and (c)(1). The data collected by monitoring this parameter would provide the Director with additional information after the design and construction of the cooling water intake structure to demonstrate that the facility is operating and maintaining the cooling water intake structure in a manner such that the velocity requirement continues to be met. The Agency considers this the most appropriate parameter to monitor, because, although the facility might be designed to meet the requirement, proper operation and maintenance is necessary to maintain the open area of the screen and intake structure, ensuring that the design intake velocity is maintained. Head loss can easily be monitored by measuring and comparing the height of the water in front of and behind the screen or other technology. Track I facilities that use devices other than screens would be required to measure the actual velocity at the point of entry through the device. Velocity can be measured with velocity meters placed at the entrance into the device.

Weekly visual or remote inspections are required to provide a mechanism for both the new facility and the Director to ensure that any technologies that have been implemented for minimizing adverse environmental impact are being maintained and operated in a manner that ensures that they function as designed. EPA has promulgated this requirement so that facilities that develop plans and install technologies could not operate them improperly so that adverse environmental impact is not minimized to the extent expected. The Director would determine the actual scope and implementation of the visual inspections based on the types of technologies installed at your facility. For example, inspections could be as simple as observing bypass and other fish handling systems to ensure that debris has not clogged the system and rendered it inoperable.

*E. How Will Compliance Be Determined?*

This rule will be implemented by the Director placing conditions consistent with this rule in NPDES permits. Compliance with permit conditions implementing this rule require the following data and information:

- Data submitted with the NPDES permit application to show that the facility is in compliance with location, design, construction, and capacity requirements (§ 125.86).
- Compliance monitoring data and records, including those for impingement and entrainment monitoring, to show that impingement and entrainment impacts are being minimized (§ 125.87(a)).
- Through-screen or through-technology velocity monitoring data and records to show that the facility is being operated and maintained as designed to continue to meet the velocity requirement (§ 125.87(b)).
- Records from visual or remote inspections to show that technologies installed are being operated properly and function as they were designed (§ 125.87(c)).

Facilities are required to keep records and report the above information in a yearly status report in § 125.88. In addition, Directors may perform their own compliance inspections as deemed appropriate in accordance with 40 CFR 122.41.

*F. What Are the Respective Federal, State, and Tribal Roles?*

Section 316(b) requirements are implemented through NPDES permits. As discussed in Section II.A today's final regulations would amend 40 CFR 123.25(a)(36) to add a requirement that authorized State programs have sufficient legal authority to implement today's requirements (40 CFR part 125, subpart I). Therefore, today's final rule potentially affects authorized State and Tribal NPDES permit programs. Under 40 CFR 123.62(e), any existing approved section 402 permitting program must be revised to be consistent with new program requirements within one year from the date of promulgation, unless the NPDES-authorized State or Tribe must amend or enact a statute to make the required revisions. If a State or Tribe must amend or enact a statute to conform with today's final rule, the revision must be made within two years of promulgation. States and Tribes seeking new EPA authorization to implement the NPDES program must comply with the requirements when authorization is requested.

In addition to updating their programs to be consistent with today's rule, States and Tribes authorized to implement the NPDES program would be required to implement the cooling water intake structure requirements following promulgation of the final regulations. The requirements must be implemented upon permit issuance and reissuance. Duties of an authorized State or Tribe under this regulation include

- Verification of a permit applicant's determination of source waterbody classification and the flow or volume of certain waterbodies at the point of the intake;
- Verification that the intake structure maximum flow rate is less than the maximum allowable as a proportion of waterbody flow for certain waterbody types;

- Verification that a Track I permit applicant's design intake velocity calculations meet applicable regulatory requirements;
- Verification that a Track I permit applicant's intake design and reduction in capacity are commensurate with a level that can be attained by a closed-cycle recirculating cooling water system that has minimized make-up and blowdown flows;
- Verification that a Track II permit applicant's Comprehensive Demonstration Study demonstrates that the proposed alternative technologies will reduce the impacts to fish and shellfish to levels comparable to those the facility would achieve if it met the Track I requirements;
- Development of draft and final NPDES permit conditions for the applicant implementing applicable section 316(b) requirements pursuant to this rule; and
- Ensuring compliance with permit conditions based on section 316(b) requirements.

EPA will implement these requirements where States or Tribes are not authorized to implement the NPDES program.

*G. Are Permits for New Facilities Subject to Requirements Under Other Federal Statutes?*

EPA's NPDES permitting regulations at 40 CFR 122.49 contain a list of Federal laws that might apply to federally issued NPDES permits. These include the Wild and Scenic Rivers Act, 16 U.S.C. 1273 *et seq.*; the National Historic Preservation Act of 1966, 16 U.S.C. 470 *et seq.*; the Endangered Species Act, 16 U.S.C. 1531 *et seq.*; the Coastal Zone Management Act, 16 U.S.C. 1451 *et seq.*; and the National Environmental Policy Act, 42 U.S.C. 4321 *et seq.* See 40 CFR 122.49 for a brief description of each of those laws. In addition, the provisions of the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801 *et seq.*, relating to essential fish habitat might be relevant. Nothing in this final rulemaking authorizes activities that are not in compliance with these or other applicable Federal laws.

*H. Alternative Requirements*

Today's rule establishes national requirements for new facilities. EPA has taken into account all the information that it was able to collect, develop, and solicit regarding the location, design, construction, and capacity of cooling water intake structures at new facilities. EPA concludes that these requirements reflect the best technology available for minimizing adverse environmental impact on a national level. In some cases, however, data that could affect the economic practicability of requirements might not have been available to be considered by EPA during the development of today's rule. Therefore, EPA is including § 125.85 to allow for adjustment of the requirements of § 125.84 in certain limited circumstances.

Section 125.85 would allow the Director, in the permit development process, to set alternative best technology available requirements that are less stringent than the nationally applicable requirements. Under § 125.85(a), any interested person may request that alternative requirements be imposed in the permit. Section 125.85(a) provides that alternative requirements that are less stringent than the requirements of § 125.84 would be approved only if the Administrator determines that compliance with the requirement at issue would result in compliance costs wholly out of proportion to the costs considered during development of the requirement at issue or in significant adverse impacts on local air quality, local water resources or local energy markets; the alternative requirement requested is no less stringent than justified by the wholly out of proportion cost or significant adverse impact; and the alternative requirements will ensure compliance with other applicable provisions of the Clean Water Act and any applicable requirements of State law.

Because new facilities have a great degree of flexibility in their siting, in how their cooling water intake structures are otherwise located, and in the design, construction, and sizing of the structure, cost is the primary factor that would justify the imposition of less stringent requirements as part of the alternative requirements approach. This is because other factors affecting the location, design, construction, and capacity of cooling water intake structures at new facilities can be addressed by modifications that may have cost implications. EPA notes that alternate discharge standards are not allowed in the somewhat analogous case of the new source performance standards that EPA establishes under section 306 of the CWA for the discharge of effluent from new sources in particular industrial categories. However, because EPA is acting under a separate authority in this rule, section 316(b) of the CWA, and because section 316(b) of the CWA is silent concerning this issue, EPA believes it is reasonable to interpret section 316(b) to give EPA discretion to establish alternative requirements for new facility cooling water intake structures. EPA takes this position because this final rule would establish requirements for cooling water intake structures at any type of new facility in any industrial category above the flow threshold.[99] Thus, in some instances it might be possible that the costs of complying with today's final requirements would be wholly out of proportion to the costs EPA considered and determined to be economically practicable. As discussed in the *Economic Analysis* Chapter 7, EPA has analyzed the cost of compliance with today's final requirements for all facilities projected to be built in the reasonably foreseeable future, as well as other types of facilities that might be built at later dates (such as large base-load steam electric generating facilities that do not use combined-cycle technology) and concludes that these compliance costs would be economically practicable for all types of facilities the Agency considered. However, should an individual new facility demonstrate that costs of compliance for a new facility would be wholly out of proportion to the costs EPA considered and determined to be economically practicable, the Director would have authority to adjust best technology available requirements accordingly.

Under § 125.85(a), alternative requirements would not be granted based on a particular facility's ability to pay for technologies that would result in compliance with the requirements of § 125.84. Thus, so long as the costs of compliance are not wholly out of proportion to the costs EPA considered and determined to be economically practicable, the ability of an individual facility to pay in order to attain compliance with the rule would not support the imposition of alternative requirements.

EPA has allowed for alternative requirements where the facility demonstrates, to the satisfaction of the Director, that at a local level, the air quality impacts, non-impingement and entrainment aquatic effects, or energy impacts of complying with the requirements of § 125.84 are significant and justify a different approach to regulating cooling water intake structures.

Section 125.85(a) specifies procedures to be used in the establishment of alternative requirements. The burden is

[99] Except for facilities in the offshore and coastal subcategories of the oil and gas extraction point source category as defined under 40 CFR 435.10 and 40 CFR 435.40.

on the person requesting the alternative requirement to demonstrate that alternative requirements should be imposed and that the appropriate requirements of § 125.85 (a) have been met. The person requesting the alternative requirements should refer to all relevant information, including the support documents for this rulemaking, all associated data collected for use in developing each requirement, and other relevant information that is kept on public file by EPA.

## VIII. Economic Analysis

The total estimated annualized compliance costs of today's final rule is $48 million.[100] This estimate includes incremental costs incurred by new facilities that begin operation between 2001 and 2020. Facilities not already meeting section 316(b) requirements incur several types of costs under today's final rule. One-time costs of the rule include capital technology costs and costs for the initial permit application. Recurring costs include operating and maintenance (O&M) costs, permit renewal costs, and costs for monitoring, record keeping, and reporting. EPA's cost estimates are presented in Chapters 6 and 7 of the *Economic Analysis* and in the *Technical Development Document*.

Today's final rule provides for a two-track approach to comply with the rule's requirements. Facilities that already plan to install a closed-cycle cooling system in the baseline are assumed to choose Track I, the "fast track." These facilities will incur only the costs of installing fish baskets and a fish return system if they would not have already elected to install these technologies independent of the rule. EPA records document that the screens were sized to reduce the velocity. Facilities that do not plan to install a closed-cycle cooling system in the baseline are assumed to choose Track II. These facilities will install alternative technologies of their choice that will reduce impingement mortality and entrainment to a level of reduction comparable to the level the facility would achieve if it met the Track I requirements. The alternative technologies considered in the cost analysis are further discussed in Chapter 5 of the Technical Development Document.

Chapter 2 of the *Technical Development Document* outlines EPA's approach to estimating the facility-level costs associated with this rule. EPA estimated costs for a series of model facilities, based on their cooling system type (once-through or recirculating system), the type of water body from which the intake structure withdraws (freshwater or marine water), and a measure of the facility's size (generating capacity for steam-electric generating capacity plants and design intake flow for manufacturers). Model facility characteristics were derived from specific new facilities predicted to be built based on Resource Data International's NEWGen Database, and from existing facilities based on responses to the section 316(b) industry survey of existing facilities (see discussion below) and U.S. Department of Energy information. EPA estimated compliance costs for the 121 new facilities estimated to begin operation between 2001 and 2020, based on model facility characteristics and the requirements of today's final rule. EPA amortized capital cost estimates over 30 years.[101] EPA projected construction of 121 new facilities over the next 20 years after promulgation of the final rule.

### A. Electric Generation Sector

For the period 2001 through 2020, EPA estimates that 83 new electric generation facilities will be subject to today's final rule.[102] EPA identified these facilities based on three main data sources: (1) The U.S. Department of Energy's *Annual Energy Outlook 2001* (AEO2001); (2) Resource Data International's NEWGen Database (February 2001 version); and (3) the section 316(b) industry survey of existing facilities. Because the facilities are new facilities that have not yet been built, EPA necessarily had to project certain aspects of the facilities. Hence, the facilities are model facilities. For more information on EPA's facility modeling, see Chapter 5 of the *Economic Analysis*.

EPA estimated facility-level costs for the 83 new electric generation facilities found to be within the scope of this rule by comparing each facility's projected baseline characteristics with the incremental requirements of the rule. If a facility already planned to fulfill any of the applicable requirements independent of the rule, the cost estimates did not include any costs for meeting that requirement. For example, EPA estimates that 74 of the 83 proposed new generating facilities already plan to build a recirculating wet cooling tower, so only 9 facilities are assumed to incur costs for complying with the flow reduction requirement at § 124.84(b)(1) of the final rule.

EPA used annual forecasts of new capacity additions from the AEO2001 to predict how many of the 83 new generating facilities will begin operation in each year between 2001 and 2020. EPA then distributed the new facilities estimated to install a cooling tower evenly over the years with projected new facilities. For example, EPA estimates that three of the 14 new in-scope coal-fired facilities are planning to build a once-through system in the baseline. The cost analysis therefore assumes that the 1st, 6th, and 11th coal-fired facility to begin operation will incur costs of a recirculating wet cooling tower. An additional coal facility which plans to have a cooling pond was treated as having a once-through system in the baseline and was also costed with a cooling tower.[103] This facility was assumed to be the 2nd to begin operation. EPA's assumptions on when new Track I coal facilities will begin operation leads to an overestimate of the total costs of this rule because higher cost facilities are over represented among the coal facilities beginning operation early in the 20-year analysis period. Additionally, EPA estimates that five of the 69 new in-scope combined-cycle facilities would install a recirculating wet cooling tower as a result of the rule. The cost analysis therefore assumes that the 1st, 16th, 30th, 44th, and 58th combined-cycle facility to begin operation will incur costs of a recirculating wet cooling tower.

Total annualized costs for the 83 new facility electric generators are estimated to be $34.7 million (using a 7 percent discount rate). The lowest annualized compliance cost for any electric generator is estimated to be

[100] The estimated annualized compliance costs are presented as a single cost to represent the highestpotential implementation costs to industry. For example, although such costs are based on estimates of howmany facilities will choose compliance under Track I and Track II, even facilities estimated to follow TrackII have been assumed to ultimately have to install closed-cycle recirculating cooling water systems.

[101] The amortization period was selected to correspond to the estimated useful life of the technologiesrequired for compliance with this rule. EPA conducted a sensitivity analysis using a 15-yearamortization period (see Chapter 7 of the *Economic Analysis*).

[102] See Section IV.A. above or Chapter 5 of the *Economic Analysis* for underlying estimates and methods used for estimating the cost of the rule.

[103] In some states, a cooling pond is considered a water of the U.S. In these states, a plant with such a cooling system would have to comply with the recirculating requirements of the final section 316(b) New Facility Rule. In those states where a cooling pond is not considered a water of the U.S., a plant would not have to comply with the recirculating requirements of this rule. The costing analysis made the conservative assumption that facilities with a cooling pond would have to comply with the recirculating requirements. These recirculating facilities with cooling ponds were therefore costed as if they had a once-through system in the baseline.

approximately $170,000; the lowest annualized cost per megawatt of generating capacity is estimated to be $153. The highest annualized cost is estimated to be $19.1 million; the highest cost per megawatt of generating capacity is estimated to be $11,640. Sixty-nine facilities are expected to have relatively low annualized compliance costs (below $200,000 per facility), while 8 facilities will have annualized costs exceeding $1 million per facility.[104] The other facilities would have costs between $200,000 and $1 million per facility.

*B. Manufacturing Sector*

For the period 2001 through 2020, EPA projected that 38 new manufacturing facilities will incur costs to comply with today's final rule. All of these facilities are model facilities estimated based on industry growth rates (derived from the U.S. Industry and Trade Outlook 2000 and industry-specific sources, such as Kline's Guide to the Chemical Industry) and responses to the section 316(b) industry survey. Facility-specific operational characteristics of the cooling water intake structures, economic and financial characteristics of the projected new facilities, and waterbody type and other locational information were not available. EPA assumed that the characteristics of new facilities in a given 4-digit SIC code will be similar to the characteristics of existing facilities in that same SIC code. Compliance costs were therefore calculated based on the characteristics of existing facilities by SIC code, source water type, cooling system type, and flow, using data from the section 316(b) industry survey of existing facilities. EPA used the same unit costs and methods as for new electric generators.

Total annualized costs for the 38 new manufacturing facilities are estimated to be $13.0 million. The lowest annualized compliance cost for any facility is approximately $175,000; the highest annualized cost is $1.6 million; the average annualized costs for the remaining 36 manufacturing facilities centers around $494,000 per facility. Five of the manufacturing facilities incur annualized costs less than $200,000 per facility, and one chemicals facility incurs annualized costs exceeding $1 million.

Exhibit 4 provides a summary of the estimated annualized compliance costs for today's final rule.

EXHIBIT 4.—NATIONAL ANNUALIZED COSTS OF COMPLIANCE WITH THE SECTION 316(B) NEW FACILITY REGULATION

[in $2000, millions]

| Industry category | Number of projected new in-scope facilities | Capital and permit application costs | Recurring costs | Total annualized compliance costs |
|---|---|---|---|---|
| Electric Generators: | | | | |
| Combined-Cycle | 69 | $3.7 | $9.6 | $13.3 |
| Coal-Fired | 14 | 4.1 | 17.3 | 21.4 |
| Total Generators | 83 | 7.8 | 26.9 | 34.7 |
| Manufacturing Facilities: | | | | |
| SIC 26 Pulp & paper | 2 | 0.2 | 0.3 | 0.5 |
| SIC 28 Chemicals | 22 | 2.7 | 4.1 | 6.8 |
| SIC 29 Petroleum | 2 | 0.3 | 0.5 | 0.8 |
| SIC 331 Iron & steel | 10 | 1.9 | 2.8 | 4.6 |
| SIC 333/335 Aluminum | 2 | 0.1 | 0.1 | 0.2 |
| Total Manufacturing | 38 | 5.2 | 7.8 | 13.0 |
| All Projected New Facilities | 121 | 12.9 | 34.7 | 47.7 |

*C. Economic Impacts*

The estimated annualized compliance costs would represent a small portion of the estimated revenues for almost all of the new facilities subject to today's rule. Costs as a percentage of baseline revenues would be less than 1 percent for all but nine of the facilities. Of these nine facilities, only 3 would experience costs as a percentage of baseline revenues of 3 percent or more.[105] EPA's discussion of cost impacts is presented in Chapter 7 of the *Economic Analysis*. Impacts at the industry level are expected to be very limited because the projected number and total capacity of the new facilities that are within the scope of today's final rule are generally small compared with the industry as a whole. Because EPA does not expect many facilities to be affected and does not expect the costs of the rule to create a barrier to entry or to create a significant change in productivity, EPA does not expect today's final rule to cause significant changes in industry productivity, competition, prices, output, foreign trade, or employment. The baseline revenues and the modest costs for each facility subject to today's rule are sufficient to preclude any barriers to entry.

EPA therefore expects the final rule to be economically practicable for the industries as a whole. The rule is not expected to result in any significant impact on generation and distribution of electricity, because most of the electric generation facilities are expected to meet most of the rule's requirements in the baseline. Only a small percentage of the total number of facilities in each of the manufacturing sectors will be affected by the final rule. EPA therefore concludes that this rule will not result in a significant impact on industries or the economy.

*D. Cost and Economic Impacts of Other Alternatives*

In addition to today's final rule, EPA estimated the costs and economic impacts of several alternative regulatory options. The first alternative option that EPA considered would be to apply the Track I requirements of today's final rule only to facilities withdrawing from

[104] The higher-cost electric generators are expected to begin operation in the years 2004, 2005 (two facilities), 2007 (two facilities), 2010, 2013, and 2017.

[105] Three coal facilities would have annualized costs between 3.3 percent and 5.2 percent of revenues. Sixelectric generators would have annualized costs greater than 1 but less than 3 percent of revenues.

estuaries, tidal rivers, Great Lakes, and oceans. Under this option, the definition and number of new facilities subject to the rule would not change, but some facilities would incur less stringent compliance requirements. EPA estimates that the total annualized compliance costs for this alternative would be $36.3 million. The second alternative option considered by EPA would impose more stringent compliance requirements on the electric generating segment of the industry. It is based wholly or in part on a zero intake-flow (or nearly zero, extremely low-flow) requirement, commensurate with levels achievable through the use of dry cooling systems. New manufacturing facilities would not be subject to these stricter requirements but would have to comply with the requirements of today's final rule. EPA estimated costs for this alternative by assuming that the dry cooling standard would apply to electric generators on all waters of the U.S. The costs of this option are estimated to be $490.7 million per year.

The first alternative regulatory option considered by EPA would have lower total costs than today's final rule. A regulatory framework based on dry cooling towers for some or all electric generators is the most expensive option. Compared with today's final rule, this option would impose an additional cost of $443 million, or $6,910 per megawatt of generating capacity, on the electric generating sector.

## IX. Potential Benefits Associated With Reducing Impingement and Entrainment

To provide an indication of the potential benefits of adopting best technology for cooling water intake structures, this section presents information from existing sources on impingement and entrainment losses associated with cooling water intake structures and the economic benefits associated with reducing these losses. Benefits of the regulation come from preventing situations such as those discussed below. Examples are drawn from existing sources because the information needed to quantify and value potential reductions in losses at new facilities is not available. The reason the information is unavailable is that the exact location of future facilities is unknown. Also unknown are details of cooling water intake structure characteristics, such as the exact configuration of intake, the species present near an intake, the life stages of the species at the time they are present, and the susceptibility of these species to impingement and entrainment. For some facilities listed in the new NEWGen database, there is some general information about facility locations, but details of intake characteristics and the ecology of the surrounding waterbody are unavailable. For facilities projected into the future, there is no locational information at all. Site-specific information is critical in predicting benefits, because studies at existing facilities demonstrate that benefits are highly variable across facilities and locations. Even similar facilities on the same waterbody can have very different benefits depending on the aquatic ecosystem in the vicinity of the facility and intake-specific characteristics such as location, design, construction, and capacity.

In general, the probability of impingement and entrainment at future cooling water intake structure locations depends on intake and species characteristics that influence the intensity, time, and spatial extent of interactions of aquatic organisms with a facility's cooling water intake structure and the physical, chemical, and biological characteristics of the source waterbody. Flows commensurate with closed-cycle cooling systems (which are one part of the basis for best technology available) withdraw water from a natural waterbody, circulate the water through the condensers, and then send it to a cooling tower or cooling pond before recirculating it back through the condensers. Because cooling water is recirculated, closed-cycle systems generally reduce the water flow from 72 percent to 98 percent, thereby using only 2 percent to 28 percent of the water used by once-through systems. It is generally assumed that this would result in a comparable reduction in impingement mortality and entrainment.

Fish species with free-floating, early life stages are highly susceptible to cooling water intake structure impacts. Such planktonic organisms lack the swimming ability to avoid being drawn into intake flows. Species that spawn in nearshore areas, have planktonic eggs and larvae, and are small as adults experience even greater impacts, because both new recruits and reproducing adults are affected (*e.g.*, bay anchovy in estuaries and oceans). In general, higher impingement and entrainment are observed in estuaries and near coastal waters because of the presence of spawning and nursery areas.

The final regulatory framework also recognizes that for any given species and cooling water intake structure location, the proportion of the sourcewater flow supplied to the cooling water intake structure is a major factor affecting the potential for impingement and entrainment. In general, if the quantity of water withdrawn is large relative to the flow of the source waterbody, water withdrawal would tend to concentrate organisms and increase numbers impinged and entrained. Thus, the final flow requirements seek to reduce impingement and entrainment by limiting the proportion of the waterbody flow that can be withdrawn.

The following five examples from studies at existing facilities offer some indication of the relative magnitude of monetary damages associated with cooling water intake structures. These examples exhibit the magnitude of impingement and entrainment, on a per facility basis, that could be significantly reduced in the future for similar steam electric facilities under this final rule. In the following discussion, the potential benefits of lowering intake flows to a level commensurate with those of a closed-cycle recirculating cooling water system (for the projected 90 percent of facilities not already planning to use such systems) is illustrated by comparisons of once-through and closed-cycle cooling systems (*e.g.*, the Brayton Point and Hudson River facilities). The potential benefits of additional requirements defined by regional permit directors are demonstrated by operational changes implemented to reduce impingement and entrainment (*e.g.*, the Pittsburg and Contra Costa facilities). The Ludington example demonstrates how impingement and entrainment losses of forage species can lead to reductions in economically valuable species. Finally, the potential benefits of implementing additional design and construction technologies to increase survival of organisms impinged or entrained is illustrated by the application of modified intake screens and fish return systems (*e.g.*, the Salem Nuclear Generating Station).

The first example of the potential benefits of minimizing intake flow and associated impingement and entrainment is provided by data for the Brayton Point facility, located on Mt. Hope Bay in Massachusetts. In July 1984, the operation of Unit 4 was changed from closed-cycle cooling and piggyback operation to once-through cooling. Although conversion to once-through cooling increased intake flow by about 41 percent, the facility requested the change because of electrical problems associated with salt contamination from Unit 4's closed-cycle cooling canal equipped with spray modules. The lower losses expected under closed-cycle operation can be estimated by comparing losses before

and after this modification. Based on reports providing predicted [106] or actual [107] losses after the Unit 4 modification, EPA estimates that the average annual reduction in entrainment losses of adult equivalents of catchable fish resulting from closed-cycle operation of a single unit at Brayton Point (reducing the flow of that unit from 1,045 MGD to 703 MGD) would range from 207,254 Atlantic menhaden (Brevoortia tyrannus) [1] and 155,139 winter flounder (Pleuronectes americanus) [2] to 20,198 tautog (Tautoga onitis) [2] and 7,250 weakfish (Cynoscion regalis) [2] per year. Assuming a proportional change in harvest, the lower losses associated with a closed-cycle system would be expected to result in an increase of 330,000 to 2 million pounds per year in commercial landings and 42,000 to 128,000 pounds per year in recreational landings.

The second example of the potential benefits of low intake flow is provided by an analysis of impingement and entrainment losses at five Hudson River power plants. Estimated fishery losses under once-through compared with closed-cycle cooling indicate that an average reduction in intake flow of about 95 percent at the three facilities responsible for the greatest impacts would result in a 30 to 80 percent reduction in fish losses, depending on the species involved.[108] An economic analysis estimated monetary damages under once-through cooling based on the assumption that annual percentage reductions in year-classes of fish result in proportional reductions in fish stocks and harvest rates.[109] A low estimate of damages was based on losses at all five facilities, and a high estimate was based on losses at the three facilities that account for most of the impacts. Damage estimates under once-through cooling ranged from about $1.3 million to $6.1 million annually in 1999 dollars. Over the next 20 years, EPA projects that 9 out of 83 new power plants would be built without recirculating systems in the absence of this rule. Most of the costs projected for the final rule are associated with installing recirculating systems as a result of this final rule.

The third example demonstrates how impingement and entrainment losses of forage species can lead to reductions in economically valued species. A random utility model (RUM) was used to estimate fishery impacts of impingement and entrainment by the Ludington Pumped Storage plant on Lake Michigan.[110] [111] This method estimates changes in demand for beneficial use of the waterbody as a function of changes in catch rates. The Ludington facility is responsible for the loss of about 1 to 3 percent of the total Lake Michigan production of alewife, a forage species that supports valuable trout and salmon fisheries. It was estimated that losses of alewife result in a loss of nearly 6 percent of the angler catch of trout and salmon each year. On the basis of RUM analysis, the study estimated that if Ludington operations ceased, catch rates of trout and salmon species would increase by 3.3 to 13.7 percent annually, amounting to an estimated recreational angling benefit of $0.95 million per year (in 1999 dollars) for these species alone.

The fourth example indicates the potential benefits of technologies that have been required in past section 316(b). Two plants in the San Francisco Bay/Delta, Pittsburg, and Contra Costa in California have made changes to their intake operations to reduce impingement and entrainment of striped bass *Morone saxatilis*). These changes include flow reduction through variable speed pumps. These operational changes have also reduced incidental take of several threatened or endangered fish species, including the delta smelt (*Hypomesus transpacificus*) and several runs of chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*). According to technical reports by the facilities, use of these technologies reduced striped bass losses by 78 to 94 percent, representing an increase in striped bass recreational landings averaging about 100,000 fish each year.[112] [113] [114] [115] [116] A local study estimated that the consumer surplus of an additional striped bass caught by a recreational angler is $8.87 to $13.77.[117] This implies a benefit to the recreational fishery, from reduced impingement and entrainment of striped bass alone, in the range of $887,000 to $1,377,000 annually. The monetary benefit of reduced impingement and entrainment of threatened or endangered species might be substantially greater.

The final example indicates the potential benefits of technologies that can be applied to reduce impingement. In its 1999 permit renewal application, the Salem Nuclear Generating Station in the Delaware Estuary evaluated the potential benefits of dual-flow, fine mesh traveling screens designed to achieve an approach velocity of 0.5 ft/s.[118] Based on the facility's projections of net increases in recreational fisheries that would occur with this technology, EPA estimates that angler consumer surplus would increase by $531,247, to $1,780,104 annually in 1999 dollars. Assuming that nonuse benefits are at least 50 percent of recreational use benefits, nonuse benefits associated with the screens might be expected to amount to up to $890,052 per year.

A more detailed discussion of cooling water intake structure impacts and potential benefits can be found Chapter 11 of the *Economic Analysis* document.

[106] Marine Research, Inc. and New England Power Company. 1981. Final Environmental Impact Report and Sections 316(a) and 316(b) Demonstrations Made in Connection with the Proposed conversion of Generating Unit No. 4 from Closed-Cycle to Once-through Cooling.

[107] New England Power Company and Marine Research Inc. 1995. Brayton Point Station Annual Biological and Hydrological Report, January-December 1994.

[108] Boreman, J. And C.P. Goodyear. 1988. Estimates of entrainment mortality for striped bass and other fish species inhabiting the Hudson River Estuary. *American Fisheries Society Monograph* 4:152–160.

[109] Rowe, R.D., C.M. Lang, L.G. Chestnut, D.A. Latimer, D.A. Rae, S.M. Bernow, and D.E. White. 1995. *The New York Electricity Externality Study, Volume 1.* Empire State Electric Energy Research Corporation.

[110] Jones, C.A., and Y.D. Sung. 1993. *Valuation of Environmental Quality at Michigan Recreational Fishing Sites: Methodological Issues and Policy Applications.* Prepared under EPA Contract No. CR–816247 for the U.S. EPA, Washington, DC.

[111] Pumped storage facilities do not use cooling water and are therefore not subject to this final rule. However, the concept of economic valuation of losses in forage species is transferable to other types of stressors, including cooling water intake structures.

[112] Pacific Gas & Electric Company. 1996. Best Technology Available: 1995 Technical Report for the Contra Costa and Pittsburg Power Plants. Prepared for Central Valley and San Francisco Bay Regional Water Quality Control Boards.

[113] Pacific Gas & Electric Company. 1997. Best Technology Available: 1996 Technical Report for the Contra Costa and Pittsburg Power Plants. Prepared for Central Valley and San Francisco Bay Regional Water Quality Control Boards.

[114] Pacific Gas & Electric Company. 1998. Best Technology Available: 1997 Technical Report for the Contra Costa and Pittsburg Power Plants. Prepared for Central Valley and San Francisco Bay Regional Water Quality Control Boards.

[115] Pacific Gas & Electric Company. 1999. Best Technology Available: 1998 Technical Report for the Contra Costa and Pittsburg Power Plants. Prepared for Central Valley and San Francisco Bay Regional Water Quality Control Boards.

[116] South Energy California. 2000. Best Technology Available: 1999 Technical Report for the Contra Costa and Pittsburg Power Plants. Prepared for Central Valley and San Francisco Bay Regional Water Quality Control Board.

[117] Huppert, D.H. 1989. Measuring the value of fish to anglers: application to central California anadromous species. *Marine Resource Economics* 6:89–107.

[118] Public Service Electric and Gas Company. 1999. Appendix F, 1999 Permit Renewal Application, NJPDES Permit No. NJ0005622.

## X. Regulatory Requirements

### *A. Executive Order 12866: Regulatory Planning and Review*

Under Executive Order 12866, (58 *FR* 51735, October 4, 1993) the Agency must determine whether the regulatory action is "significant" and therefore subject to the Office of Management and Budget (OMB) review and the requirements of the Executive Order. The Order defines a "significant regulatory action" as one that is likely to result in a rule that may:

- Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or Tribal governments or communities;
- Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;
- Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or
- Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

Pursuant to the terms of Executive Order 12866, it has been determined that this final rule is a "significant regulatory action." As such, this action was submitted to OMB for review. Changes made in response to OMB suggestions or recommendations will be documented in the public record.

### *B. Paperwork Reduction Act*

The Office of Management and Budget (OMB) has approved the information collection requirements contained in this rule under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 *et seq.* and has assigned OMB control number 2040–0241. The information collection requirements relate to new electric generation and manufacturing facilities collecting information for baseline biological characterization, monitoring of impingement and entrainment, preparing comprehensive demonstrations, verifying compliance, and preparing yearly reports.

Since the proposal, EPA used updated sources and revised the number of facilities that will be subject to this rule (See Section IV.A.1 of this preamble). These new data sources resulted in an increase in the number of facilities projected as subject to this rule from 98 in the proposed rule analysis to 121 in the final rule. As a result, the cost and burden estimates for today's final rule have increased somewhat.

In the final rule, EPA has revised the requirements of the source water baseline biological characterization to allow the use of existing information, which lowers the cost incurred by new facilities. However, today's rule includes a Comprehensive Demonstration requirement for those facilities choosing Track II. Cost and burden estimates for today's final rule were revised accordingly.

Burden is defined as the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

The total burden of the information collection requirements associated with today's rule is estimated at 121,127 hours. The corresponding estimates of cost other than labor (labor and non-labor costs are included in the total cost of the rule discussed in Section VIII of this preamble) is $5.3 million for 18 facilities and 44 States and one Territory for the first three years after promulgation of the rule. Non-labor costs include activities such as capital costs for remote monitoring devices, laboratory services, photocopying, and the purchase of supplies. The burden and costs are for the information collection, reporting, and recordkeeping requirements for the three-year period beginning with the effective date of today's rule. Additional information collection requirements will occur after this initial three-year period as new facilities continue to be permitted and such requirements will be counted in a subsequent information collection request. EPA does not consider the specific data that would be collected under this final rule to be confidential business information. However, if a respondent does consider this information to be confidential, the respondent may request that such information be treated as confidential. All confidential data will be handled in accordance with 40 CFR 122.7, 40 CFR part 2, and EPA's Security Manual Part III, Chapter 9, dated August 9, 1976.

Compliance with the applicable information collection requirements imposed under this final rule (*see* §§ 122.21(r), 125.86, 125.87, 125.88, and 125.89) is mandatory. Before new facilities can begin operation, they would be required first to perform several data-gathering activities as part of the permit application process. Today's rule would require several distinct types of information collection as part of the NPDES application. In general, the information would be used to identify which of the requirements in today's final rule applies to the new facility, how the new facility would meet those requirements, and whether the new facility's cooling water intake structure reflects the best technology available for minimizing environmental impact. Specific data requirements of today's rule follow:

- Intake structure data, consisting of intake structure design and a facility water balance diagram, to evaluate the potential for impingement and entrainment of aquatic organisms; and
- Information on design and construction technologies implemented to ensure compliance with the applicable requirements set forth in today's rule.

In addition to the information requirements of the permit application, NPDES permits normally specify monitoring and reporting requirements to be met by the permitted entity. New facilities that fall within the scope of this rule would be required to perform biological monitoring of impingement and entrainment, monitoring of the screen or through-screen technology velocity, and visual inspections of the cooling water intake structure and any additional technologies. Additional ambient water quality monitoring may also be required of facilities depending on the specifications of their permits. The facility would be expected to analyze the results from its monitoring efforts and provide these results in an annual status report to the permitting authority. Finally, facilities would be required to maintain records of all submitted documents, supporting materials, and monitoring results for at least three years. (Note that the director may require that records be kept for a longer period to coincide with the life of the NPDES permit.)

All impacted facilities would carry out the specific activities necessary to fulfill the general information collection requirements. The estimated burden includes developing a water balance diagram that can be used to identify the proportion of intake water used for

cooling, make-up, and process water. Some of the facilities (those choosing Track II) would gather performance data to determine the effectiveness of alternative technologies that reduce impingement and entrainment to levels commensurate with reductions achieved through use of recirculating wet cooling towers and document the basis of their determination in a demonstration study. The burden estimates include sampling, assessing the source waterbody, estimating the magnitude of impingement and entrainment, and reporting results in a comprehensive demonstration for certain facilities. The burden also includes conducting a pilot study to show that alternative technologies to be installed are equivalent in performance to the fast track technologies, if data are not publicly available for assessing the performance of certain technologies. Some of the facilities would need to perform additional activities related to velocity and flow reduction requirements. The burden estimates also incorporate the cost of preparing a narrative description of the design, structure, equipment, and operational features required to meet velocity and flow reductions.

In addition to the activities mentioned above, some facilities would need to prepare and submit a plan describing design characteristics of additional technologies to be installed that will reduce impingement and entrainment and maximize survival of aquatic organisms. The estimates for some facilities also incorporate the cost of sampling, analyzing, and reporting the type and number of impinged and entrained organisms; velocity monitoring; and biweekly inspections of installed technologies.

Exhibit 5 presents a summary of the maximum burden estimates for a facility to prepare a permit application and monitor and report on cooling water intake structure operations as required by this rule.

EXHIBIT 5.—MAXIMUM BURDEN AND COSTS PER FACILITY FOR NPDES PERMIT APPLICATION AND MONITORING AND REPORTING ACTIVITIES

| Activities | Burden (hr) | Labor cost | Other direct costs (lump sum)[a] |
|---|---|---|---|
| Start-up activities | 43 | $1,585 | $50 |
| Permit application activities | 146 | 4,598 | 500 |
| Source waterbody flow information | 104 | 3,010 | 100 |
| Source water baseline biological characterization data | 265 | 8,975 | 750 |
| CWIS flow reduction requirements (Track I) | 108 | 3,261 | 400 |
| CWIS velocity requirements (Track I) | 138 | 4,428 | 1,000 |
| Design and construction technology plan (Track I) | 85 | 2,840 | 50 |
| Comprehensive demonstration study plan (Track II)[b] | 383 | 13,563 | 1,000 |
| Source water baseline biological characterization study (Track II) | 5,178 | 274,845 | 13,000 |
| Evaluation of potential CWIS effects (Track II) | 2,577 | 135,141 | 500 |
| Subtotal | 9,027 | 452,246 | 17,350 |
| **Maximum Burden and Costs per Facility for Annual Monitoring and Reporting Activities** | | | |
| Biological monitoring (impingement) | 388 | 20,240 | 650 |
| Biological monitoring (entrainment) | 776 | 41,035 | 4,000 |
| Velocity monitoring | 163 | 4,993 | 100 |
| Visual inspection of installed technology and remote monitoring equipment[c] | 253 | 8,159 | 100 |
| Verification monitoring (Track II)[d] | 122 | 5,146 | 500 |
| Yearly Status report activities | 348 | 13,071 | 750 |
| Subtotal | 2,050 | 92,644 | 6,100 |

[a] Cost of supplies, filing cabinets, photocopying, boat renting, etc.
[b] The Comprehensive Demonstration Study also has contracted service costs associated with it.
[c] Remote monitoring equipment also has capital and O&M costs associated with it
[d] The verification monitoring also has contracted services associated with it.

EPA believes that all 44 States and one territory with NPDES permitting authority will undergo start-up activities in preparation for administering the provisions of the new facility rule. As part of these start-up activities, States and Territories are expected to train junior technical staff to review materials submitted by facilities, and then use these materials to evaluate compliance with the specific conditions of each facility's NPDES permit.

Each State's/Territory's actual burden associated with reviewing submitted materials, writing permits, and tracking compliance depends on the number of new in-scope facilities that will be built in the State/Territory during the ICR approval period. EPA expects that State and Territory technical and clerical staff will spend time gathering, preparing, and submitting the various documents. EPA's burden estimates reflect the general staffing and level of expertise that is typical in States/Territories that administer the NPDES permitting program. EPA considered the time and qualifications necessary to complete various tasks such as reviewing submitted documents and supporting materials, verifying data sources, planning responses, determining specific permit requirements, writing the actual permit, and conferring with facilities and the interested public. Exhibit 6 provides a summary of the burden estimates for States/Territories performing various activities associated with the final rule.

EXHIBIT 6.—ESTIMATING STATE/TERRITORY BURDEN AND COSTS FOR ACTIVITIES

| Activities | Burden (hrs) | Labor cost | Other direct cost |
|---|---|---|---|
| Start-up activities (per state/territory) | 100 | $3,514 | $50 |
| State/territory permit issuance activities (per facility) | 723 | 29,128 | 350 |
| Annual state/territory activities (per facility) | 50 | 1,670 | 50 |

An Agency may not conduct or sponsor, and a person is not required to respond to a collection of information, unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR Chapter 15. EPA is amending the table in 40 CFR part 9 of currently approved ICR control numbers issued by OMB for various regulations to list the information requirements contained in this final rule.

*C. Unfunded Mandates Reform Act*

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law 104–4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and Tribal governments and the private sector. Under section 202 of UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with "Federal mandates" that might result in expenditures to State, local, and Tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective, or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective, or least burdensome alternative if the Administrator publishes with the final rule an explanation why that alternative was not adopted. Before EPA establishes any regulatory requirements that might significantly or uniquely affect small governments, including Tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant intergovernmental mandates, and informing, educating, and advising small governments on compliance with regulatory requirements.

EPA has determined that this rule does not contain a Federal mandate that might result in expenditures of $100 million or more for State, local, and Tribal governments, in the aggregate, or the private sector in any one year. Total annualized compliance and implementation costs are estimated to be $47.9 million. Of the total costs, the private sector accounts for $43.8 million and the government sector (includes direct compliance costs for facilities owned by government entities) accounts for $4.1 million. EPA calculated annualized costs by estimating initial and annual expenditures of facilities and regulatory authorities over the 30-year period (2001–2030), calculating the present value of that stream of expenditures using a 7 percent discount rate. EPA estimates that the highest undiscounted cost incurred by the private sector in any one year is approximately $71.2 million and the highest cost incurred by government sector in any one year is approximately $19.0 million. Thus, today's rule is not subject to the requirements of sections 202 and 205 of UMRA.

EPA has determined that this final rule contains no regulatory requirements that might significantly or uniquely affect small governments. Thus, today's final rule is not subject to the requirements of section 203 of UMRA. A municipality that owns or operates a new electric generation facility is the primary category of small government operations that might be affected by this rule. Existing data indicate that only four government owned facilities will be constructed in the next twenty years. All four are expected to be owned by large governments. Of these, two are expected to be State owned, one is projected to be owned by a municipality and one by a municipality market. In addition, to minimize cost, this final rule excludes facilities that take in less than two (2) million gallons per day. Details and methodologies used for these estimates are included in the *Economic Analysis* document, which is in the docket.

*D. Regulatory Flexibility Act (RFA), as Amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), 5 U.S.C. 601 et seq.*

The RFA generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

Today's rule is intended to minimize the adverse environmental impact from cooling water intake structures and regulates new facilities that use cooling water withdrawn directly from waters of the U.S. The primary impact would be on new steam electric generating facilities (SIC 4911); however, a number of new facilities in other industries likely will also be regulated, including, but not limited to, paper and allied products (primary SIC 26), chemical and allied products (primary SIC 28), petroleum and coal products (primary SIC 29), and primary metals (primary SIC 33).

For the purposes of assessing the impacts of today's rule on small entities, small entity is defined as: (1) A small business according to the Small Business Administration (SBA) size standards; (2) A small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is a not-for-profit enterprise which is independently owned and operated and is not dominant in its field. After considering the economic impacts of today's rule on small entities, I certify that this action will not have a significant economic impact on a substantial number of small entities. This rule is expected to regulate only a small number of facilities owned by small entities, representing a very small percentage of all facilities owned by small entities in their respective industries. EPA has estimated that 11 new facilities owned by small entities would be regulated by this final rule. Of

the 11 new facilities owned by small entities, 8 are steam electric generating facilities and 3 are manufacturing facilities. This rule will not regulate any small governments or small organizations.

1. Electric Generation Sector

EPA has described the process by which prospective new steam electricity generating facilities subject to today's rule were identified in Section IV.A of this preamble and in Chapter 5 of the *Economic Analysis* document. As described in Chapter 8 of that document, EPA then identified those facilities subject to the rule whose owner would be defined as a small business. The analysis used the definitions of small businesses established by the Small Business Administration (SBA). (The SBA defines small businesses based on Standard Industrial Classification (SIC) codes and size standards expressed by the number of employees, annual receipts, or electric output.) The SBA defines a small steam electric generator as a firm whose facilities generate 4 million megawatt-hours output or less. EPA has determined that 8 facilities owned by small businesses in the steam electric generating industry are likely to be regulated by today's rule.

The estimated annualized compliance costs that facilities owned by small entities would likely incur represent between 0.11 and 0.44 percent of estimated facility annual sales revenue. All but one electric generating facilities owned by a small firm incur costs less than 0.3 percent of revenues. The results of this screening analysis indicated very low impacts at the facility level. Consequently, the costs to the parent small entity would be even lower.

The absolute number of small entities potentially subject to this rule is low. This is not unexpected since the total number of facilities subject to this rule is also low, even though the electric power industry is currently experiencing a rapid expansion and transition due to deregulation and new Clean Air Act requirements for emissions controls, and a large number of generating plants are under construction or planned for the early years of the final rule. First, there is a trend toward construction of combined-cycle technologies using natural gas, which use substantially less cooling water than other technologies. Second, there has been a decline in the use of surface water as the source of cooling water. An analysis of new combined-cycle facilities, identified from the NEWGen database shows a trend toward less use of surface cooling water. The analysis showed that 66 percent of the analyzed facilities use alternative sources of cooling water (*e.g.*, grey water, ground water, municipal water, or dry cooling). EPA believes this reflects the increased competition for water, an heightened awareness of the need for water conservation, and increased local opposition to the use of surface water for power generation. Taken together, the trend toward combined-cycle generating technologies, which have small cooling water requirements per unit of output, and the movement away from the use of surface cooling water result in a low projected number of regulated facilities, despite the expected expansion in new generating capacity.

2. Manufacturing Sector

Chapter 5 of the *Economic Analysis* document shows that 38 new manufacturing facilities are expected to incur compliance costs under today's rule. Since EPA's estimate of new manufacturing facilities is based on industry growth forecasts and not on specific planned facilities, actual parent firm information was not available. EPA, therefore, developed profiles of representative new facilities based on the characteristics of existing facilities identified in EPA's Industry Survey of existing facilities.

Using SBA size standards for the firm's SIC Code, only 3 of the 38 new manufacturing facilities are projected to be owned by a small entity. One of the 3 facilities is in the chemicals sector and two are in the metals sector (in both sectors, a small entity is defined as a firm with fewer than 1,000 employees). EPA compared annualized costs to annual sales revenue to assess impacts for manufacturing firms. The test was applied at the facility rather than the firm level, which provides a conservative estimate of the impacts because the ratio of costs to revenues were relatively lower at the firm level than at the individual facility level. The impact analysis showed a negligible impact on small entities: very low effects on facility sales revenue (ranging from 0.04 to 0.08 percent).

EPA has conducted extensive outreach to industry associations and organizations representing small government jurisdictions to identify small-entity manufacturing facilities. Based on the outreach effort and a review of the relevant industry trade literature, EPA concludes that, although the exact number of facilities owned by small entities that would be subject to the rule is difficult to quantify, it is evident that for the foreseeable future few, if any, small entities would be affected. EPA estimates that only 2.9 percent of future facilities in the next twenty years owned by small entities will use cooling water at levels that would bring them within the scope of this regulation.

The small number of small entities subject to this rule in the manufacturing sector is not surprising because the facilities likely to be subject to the rule are large industrial facilities that are not generally owned by small entities. There are many reasons for the limited projected number of in-scope new facilities owned by small entities. Depending on which industry sector is considered, these include industry downsizing; expansion of capacity at existing facilities as a means of meeting increased demand; mergers and acquisitions that reduce the overall number of firms; and addition of a significant number of facilities in at least one industry sector as part of a recently completed expansion cycle so that additional new facilities are not expected for the foreseeable future. The segments of the industries that are the primary users of cooling water are mostly large, capital intensive enterprises with few, if any, small businesses within their ranks.

A final reason why this rule does not have a significant economic impact on a substantial number of small entities is that EPA has established a two (2) MGD flow as the level below which facilities would not be subject to the requirements of the rule. This minimum flow level exempts many facilities using small amounts of water, including facilities owned by small entities, while covering approximately 99 percent of the total cooling water withdrawn from the waters of the U.S. Therefore, EPA concludes that there will be a negligible increase in the number of small facilities in these manufacturing industries subject to today's final rule. Exhibit 7 summarizes the results of small entity analysis.

EXHIBIT 7.—SUMMARY OF RFA/SBREFA ANALYSIS

| Type of facility | Number of facilities owned by small entities | Annual compliance costs/annual sales revenue |
|---|---|---|
| Steam electric generating facilities | 8 | 0.11%–0.44% |
| Manufacturing facilities | 3 | 0.04%–0.08% |
| Total | 11 | 0.04% to 0.44% |

Although this rule will not have a significant economic impact on a substantial number of entities, EPA nonetheless has tried to reduce the impact of this rule on small entities. In particular, EPA does not require that a facility with intake flows equal to or greater than 2 MGD and less than 10 MGD reduce its intake flow to a level commensurate with use of a closed-cycle recirculating cooling system. Instead, these facilities are required to use the less costly design and construction technologies for minimizing entrainment at all locations. See 125.84(c)(4). EPA believes that the requirements of § 125.84(c) are an economically practicable way for these facilities to reduce impingement mortality and entrainment. EPA consulted many times with the Small Business Administration on matters associated with this rule. Upon invitation, EPA met several times with a mix of small businesses interested in this rule.

*E. Executive Order 13132: Federalism*

Executive Order 13132 (64 *FR* 43255, August 10, 1999) requires EPA to develop an accountable process to ensure "meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" is defined in the Executive Order to include regulations that have "substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government."

This final rule does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. Rather, this final rule would result in minimal administrative costs on States that have an authorized NPDES program. The annualized state implementation cost over the 30-year analysis period (2001 to 2030) is approximately $240,000 total for all States per year. Also, based on meetings and subsequent discussions with local government representatives from municipal utilities, EPA believes that the final new facility rule may affect, at most, only two large municipalities that own steam electric generating facilities. The annual impacts on these facilities is not expected to exceed 1,304 burden hours and $36,106 (non-labor costs) per facility.

The national cooling water intake structure requirements would be implemented through permits issued under the NPDES program. Forty-four States and the Virgin Islands are currently authorized pursuant to section 402(b) of the CWA to implement the NPDES program. In States not authorized to implement the NPDES program, EPA issues NPDES permits. Under the CWA, States are not required to become authorized to administer the NPDES program. Rather, such authorization is available to States if they operate their programs in a manner consistent with section 402(b) and applicable regulations. Generally, these provisions require that State NPDES programs include requirements that are as stringent as Federal program requirements. States retain the ability to implement requirements that are broader in scope or more stringent than Federal requirements. (See section 510 of the CWA)

Today's final rule would not have substantial direct effects on States or on local governments because it would not change how EPA and the States and local governments interact or their respective authority or responsibilities for implementing the NPDES program. Today's final rule establishes national requirements for new facilities with cooling water intake structures. NPDES-authorized States that currently do not comply with the final regulations might need to amend their regulations or statutes to ensure that their NPDES programs are consistent with Federal section 316(b) requirements. See 40 CFR 123.62(e). For purposes of this final rule, the relationship and distribution of power and responsibilities between the Federal government and the States and local governments are established under the CWA (e.g., sections 402(b) and 510); nothing in this final rule would alter that. Thus, Executive Order 13132 does not apply to this rule.

Although section 6 of Executive Order 13132 does not apply to this rule, EPA did consult with State governments and representatives of local governments in developing the rule. During the development of the section 316(b) rule for new facilities, EPA conducted several outreach activities through which State and local officials were informed about the proposed rule and they provided information and comments to the Agency.

EPA also held two public meetings in the summer of 1998 to discuss issues related to the section 316(b) rulemaking effort. Representatives from New York and Maryland attended the meetings and provided input to the Agency. The Agency also contacted Pennsylvania and Virginia to exchange information on this issue. In addition, EPA Regions 1, 3, 4, and 9 served as conduits for transmittal of section 316(b) information between the Agency and several States. In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicited comment on the proposed rule from State and local officials. More recently, EPA met with industry, environmental, and State and Federal government representatives, during May, June, and July 2001 to discuss regulatory alternatives for the new facility rule. The States that EPA consulted with or received public comment from, in general, supported the technology-based rule which focused on reducing the impingement mortality and entrainment resulting from cooling water intake structures. In particular, many States endorsed the 2 MGD threshold, capacity reduction, and proportional flow restrictions. A few States wanted more flexibility, whereas others wanted more stringent technology-based performance

standards. EPA believes that it has achieved a balance between these two opposite concerns in establishing the two-track approach.

*F. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*

Executive Order 12898 requires that, to the greatest extent practicable and permitted by law, each Federal agency must make achieving environmental justice part of its mission. Executive Order 12898 provides that each Federal agency must conduct its programs, policies, and activities that substantially affect human health or the environment in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under such programs, policies, and activities because of their race, color, or national origin.

Today's final rule would require that the location, design, construction, and capacity of cooling water intake structures at new facilities reflect the best technology available for minimizing adverse environmental impact. For several reasons, EPA does not expect that this final rule would have an exclusionary effect, deny persons the benefits of the NPDES program, or subject persons to discrimination because of their race, color, or national origin. The final rule applies only to new facilities with cooling water intake structures that withdraw waters of the U.S. As discussed previously, EPA anticipates that this final rule would not affect a large number of new facilities; therefore, any impacts of the final rule would be limited. The final rule does include location criteria that would affect siting decisions made by new facilities, these criteria are intended to prevent deterioration of our nation's aquatic resources. EPA expects that this final rule would preserve the health of aquatic ecosystems located in reasonable proximity to new cooling water intake structures and that all populations, including minority and low-income populations, would benefit from such improved environmental conditions. In addition, because the final rule would help prevent decreases in populations of fish and other aquatic species, it is likely to help maintain the welfare of subsistence and other low-income fishermen or minority low-income populations.

*G. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks*

Executive Order 13045 (62 *FR* 19885, April 23, 1997) applies to any rule that (1) is determined to be "economically significant" as defined under Executive Order 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe might have a disproportionate effect on children. If the regulatory action meets both criteria, the Agency must evaluate the environmental health and safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency. This final rule is not an economically significant rule as defined under Executive Order 12866 and does not concern an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. Therefore, it is not subject to Executive Order 13045.

*H. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments*

Executive Order 13175, entitled "Consultation and Coordination with Indian Tribal Governments" (65 FR 67249, November 6, 2000), requires EPA to develop an accountable process to ensure "meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." "Policies that have tribal implications" is defined in the Executive Order to include regulations that have "substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and the Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes."

This final rule does not have tribal implications. It will not have substantial direct effects on tribal governments, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes, as specified in Executive Order 13175. Given the available data on new facilities and the applicability thresholds in the final rule, EPA estimates that no new facilities subject to this final rule will be owned by tribal governments. This rule does not affect tribes in any way in the foreseeable future. Accordingly, the requirements of Executive Order 13175 do not apply to this rule.

*I. Executive Order 13158: Marine Protected Areas*

Executive Order 13158 (65 FR 34909, May 31, 2000) requires EPA to "expeditiously propose new science-based regulations, as necessary, to ensure appropriate levels of protection for the marine environment." EPA may take action to enhance or expand protection of existing marine protected areas and to establish or recommend, as appropriate, new marine protected areas. The purpose of the Executive Order is to protect the significant natural and cultural resources within the marine environment, which means "those areas of coastal and ocean waters, the Great Lakes and their connecting waters, and submerged lands thereunder, over which the United States exercises jurisdiction, consistent with international law."

Today's final rule implements section 316(b) of the Clean Water Act (CWA) for new facilities that use water withdrawn from rivers, streams, lakes, reservoirs, estuaries, oceans or other waters of the United States (U.S.) for cooling water purposes. The final rule establishes national technology-based performance requirements applicable to the location, design, construction, and capacity of cooling water intake structures at new facilities. The national requirements establish the best technology available for minimizing adverse environmental impact associated with the use of these structures. It also requires the permit applicant to select and implement design and construction technologies to minimize impingement mortality and entrainment.

EPA expects that this final regulation will reduce impingement and entrainment at new facilities. The rule will afford protection of aquatic organisms at individual, population, community, or ecosystem levels of ecological structures. Therefore, EPA expects today's rule will advance the objective of the Executive Order to protect marine areas.

*J. Executive Order 13211 (Energy Effects)*

This rule is not a "significant energy action" as defined in Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355; May 22, 2001) because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

Track I of the final section 316(b) new facility rule requires facilities with an intake flow equal to or greater than 10 MGD to install a recirculating system or other technologies that would reduce

the design intake flow to a level commensurate with that of a recirculating system. For the purposes of this Statement of Energy Effects, EPA believes that facilities that do not already plan to install a recirculating system in the baseline will install a recirculating wet cooling tower to achieve compliance with the rule (9 power plants). Installation of a cooling tower imposes an "energy penalty," consisting of two components: (1) A reduction in unit efficiency due to increased turbine back-pressure; and (2) an increase in auxiliary power requirements to operate the recirculating wet cooling tower. EPA estimates that the installation of 9 recirculating wet cooling towers as a result of this rule (that is, those installed at new power plants that would otherwise not utilize recirculating wet cooling in absence of the rule) would reduce available generating capacity by a maximum of 100 megawatts (MW) nationally. EPA also considered the energy requirements of other compliance technologies, such as rotating screens, but found them insignificant and thus excluded them from this analysis.

EPA estimates that 4 new coal-fired power plants and 5 new combined-cycle power plants will install a recirculating wet cooling tower to comply with the final section 316(b) new facility rule. The estimated generating capacity of the four new coal facilities ranges from 63 MW to 3,564 MW. Each of the five combined-cycle facilities has a generating capacity of 1,031 MW. The estimated mean annual energy penalty is 1.65 percent of the generating capacity for coal-fired facilities and 0.40 percent for combined-cycle facilities. As a result, the installation of recirculating wet cooling towers to comply with the final rule is likely to reduce available energy supply by an average of approximately 74 MW per year over the next 20 years (2001 to 2020). The reduction will reach a maximum of 100 MW in 2017, when all 9 facilities are projected to have begun operation (*see* Section IV.A.1 of this preamble for details on the projected number and cooling water characteristics of new electric generators). These reductions are actually an overestimate due to the fact that some facilities may choose to comply with Track II and implement technologies other than recirculating wet cooling towers.

EPA believes that the estimated reduction in available energy supply as a result of the final section 316(b) rule does not constitute a significant energy effect. During the period covered by EPA's new facility projection, 2001 to 2020, the Energy Information Administration (EIA) forecasts total new capacity additions of 370 gigawatts (GW) (1 GW = 1,000 MW) and an average available generating capability of 921 GW. Compared to the EIA forecasts, the estimated energy effect of the final rule is insignificant, comprising only 0.03 percent of total new capacity (100 MW/370 GW) and 0.008 percent of the average available generating capability (74 MW/921 GW) at new facilities. Chapter 9 of the *Economic Analysis* provides more detail about the estimated energy effect of the final section 316(b) new facility rule. Chapter 3 of the *Technical Development Document* further discusses energy penalty estimation.

*K. National Technology Transfer and Advancement Act*

As noted in the proposed rule, section 12(d) of the National Technology Transfer and Advancement Act (NTTAA) of 1995, Pub L. 104–113, section 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standard bodies. The NTTAA directs EPA to provide Congress, through the Office of Management and Budget (OMB), explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This final rule does not involve technical standards. Therefore, EPA did not consider the use of any voluntary consensus standards.

*L. Plain Language Directive*

Executive Order 12866 requires each agency to write all rules in plain language. EPA has written this final rule in plain language to make the rule easier to understand. EPA specifically solicited comment on how to make this rule easier to understand. EPA received no comments on the plain language of the proposal or NODA.

*M. Congressional Review Act*

The Congressional Review Act, 5 U.S.C. 801 *et seq.*, as added by the Small Business Regulatory Enforcement Fairness Act of 1996, generally provides that before a rule may take effect, the agency promulgating the rule must submit a rule report, which includes a copy of the rule, to each House of the Congress and to the Comptroller General of the United States. EPA will submit a report containing this rule and other required information to the U.S. Senate, the U.S. House of Representatives, and the Comptroller General of the United States prior to publication of the rule in the **Federal Register**. A major rule cannot take effect until 60 days after it is published in the **Federal Register**. This action is not considered a "major rule" as defined by 5 U.S.C. 804(2). This rule will be effective January 17, 2002.

**List of Subjects**

*40 CFR Part 9*

Environmental protection, Reporting and recordkeeping requirements.

*40 CFR Part 122*

Environmental protection, Administrative practice and procedure, Confidential business information, Hazardous substances, Reporting and recordkeeping requirements, Water pollution control.

*40 CFR Part 123*

Environmental protection, Administrative practice and procedure, Confidential business information, Hazardous substances, Indian-lands, Intergovernmental relations, Penalties, Reporting and recordkeeping requirements, Water pollution control.

*40 CFR Part 124*

Environmental protection, Administrative practice and procedure, Air pollution control, Hazardous waste, Indians-lands, Reporting and recordkeeping requirements, Water pollution control, Water supply.

*40 CFR Part 125*

Environmental protection, Reporting and recordkeeping requirements, Waste treatment and disposal, Water pollution control.

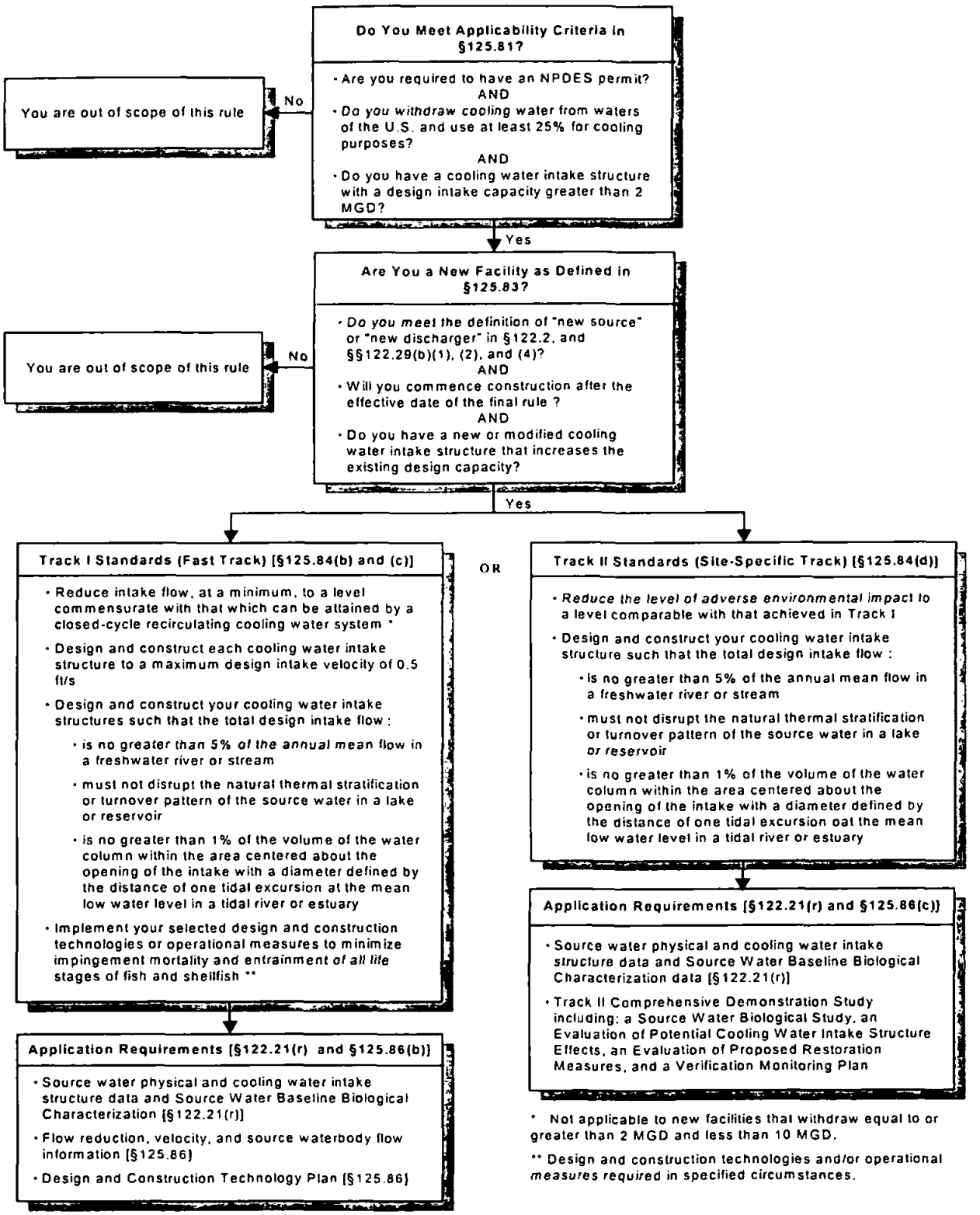
Dated: November 9, 2001.

**Christine Todd Whitman,**

*Administrator.*

BILLING CODE 6560–50–P

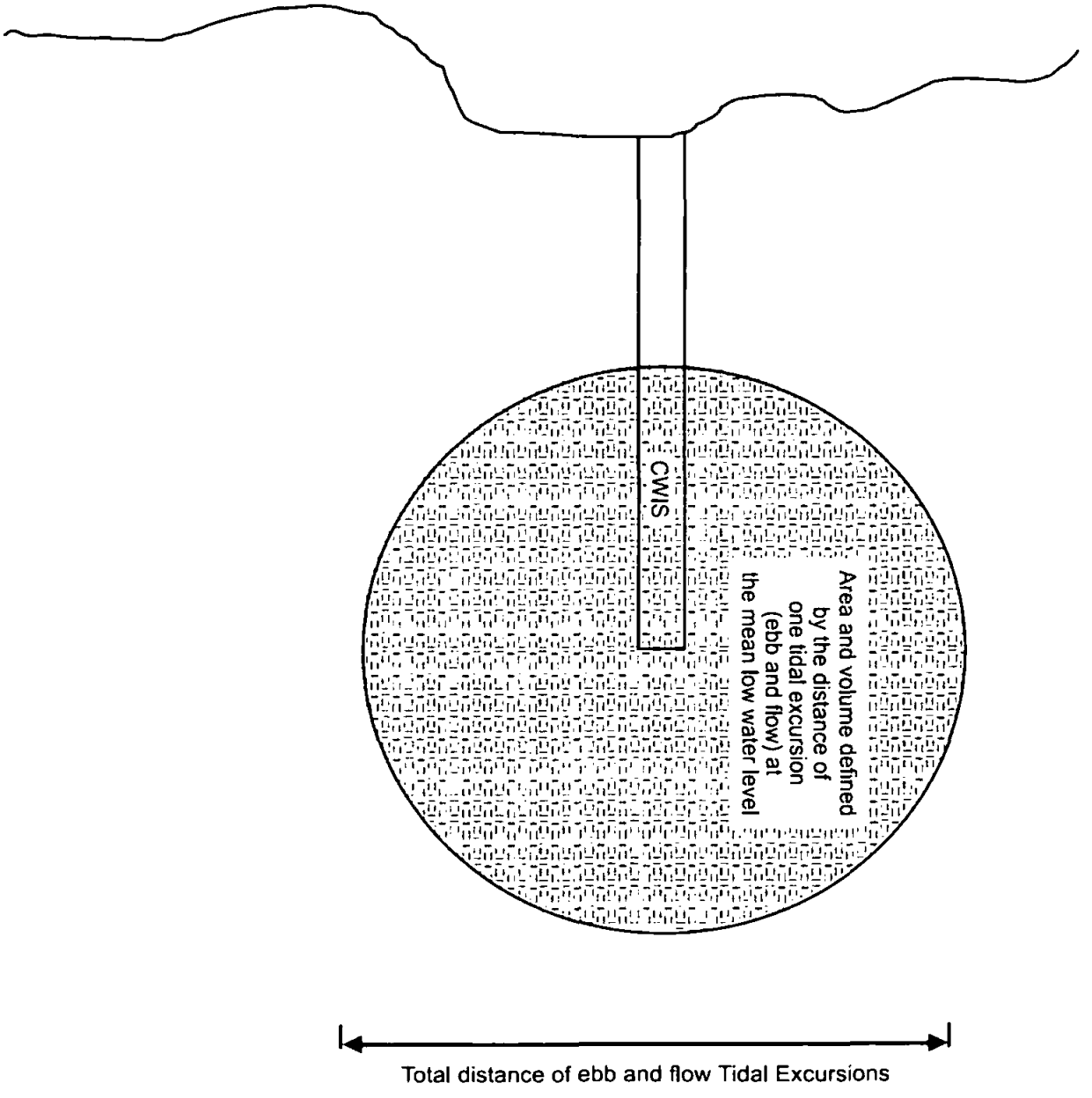
## Appendix 1 to The Preamble—Section 316(b) New Facility Rule Framework



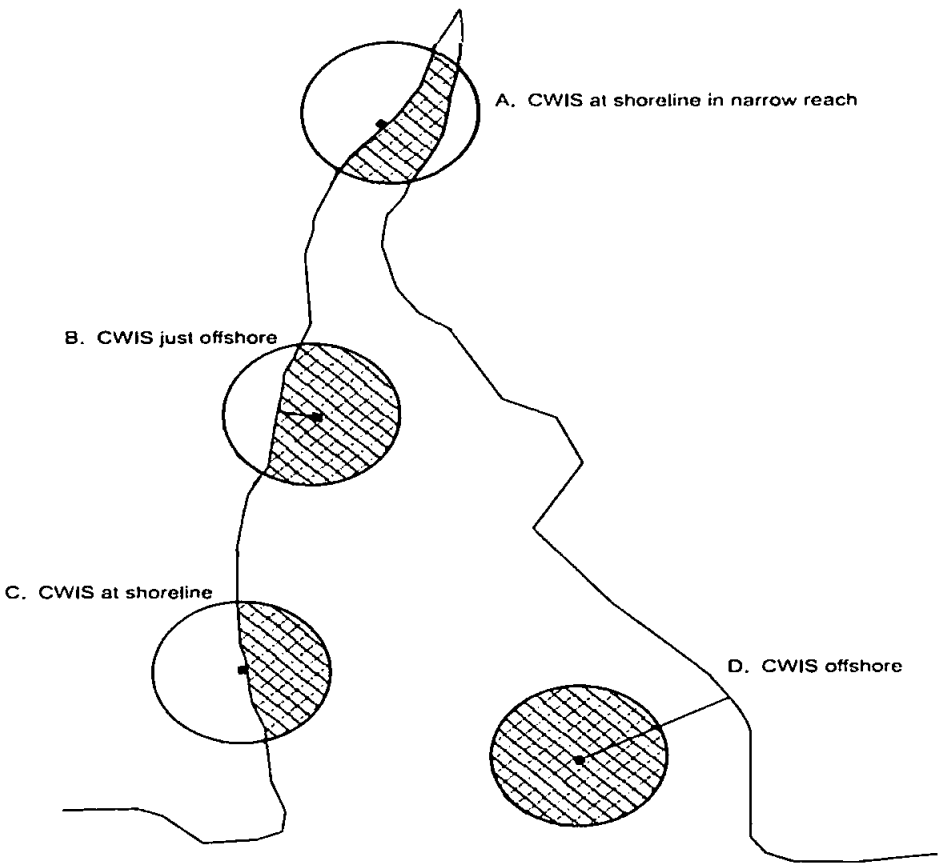

* Not applicable to new facilities that withdraw equal to or greater than 2 MGD and less than 10 MGD.

** Design and construction technologies and/or operational measures required in specified circumstances.

**Appendix 2 to The Preamble—Illustration of Flow Requirement for Estuaries and Tidal Rivers**



**Appendix 3 to The Preamble—Examples of Areas and Volumes Defined in Estuaries or Tidal Rivers By The Tidal Excursion Distance**




CWIS = Cooling Water Intake Structure

BILLING CODE 6560–50–C

For the reasons set forth in the preamble, chapter I of title 40 of the Code of Federal Regulations is amended as follows:

## PART 9—OMB APPROVALS UNDER THE PAPERWORK REDUCTION ACT

1. The authority citation for part 9 continues to read as follows:

**Authority:** 7 U.S.C. 135 *et seq.*, 136–136y; 15 U.S.C. 2001, 2003, 2005, 2006, 2601–2671, 21 U.S.C. 331j, 346a, 348; 31 U.S.C. 9701; 33 U.S.C. 1251 *et seq.*, 1311, 1313d, 1314, 1318, 1321, 1326, 1330, 1342, 1344, 1345 (d) and (e), 1361; E.O. 11735, 38 FR 21243, 3 CFR, 1971–1975 Comp. p. 973; 42 U.S.C. 241, 242b, 243, 246, 300f, 300g, 300g–1, 300g–2, 300g–3, 300g–4, 300g–5, 300g–6, 300j–1, 300j–2, 300j–3, 300j–4, 300j–9, 1857 *et seq.*, 6901–6992k, 7401–7671q, 7542, 9601–9657, 11023, 11048.

2. In § 9.1 the table is amended by adding entries in numerical order under the indicated heading to read as follows:

**§ 9.1 OMB approvals under the Paperwork Reduction Act.**

* * * * *

| 40 CFR citation | OMB Control No. |
|---|---|
| * * * * * | |
| **EPA Administered Permit Programs: The National Pollutant Discharge Elimination System** | |
| * * * * * | |
| 122.21(r) | 2040–0241 |
| * * * * * | |
| **Criteria and Standards for the National Pollutant Discharge Elimination System** | |
| * * * * * | |
| 125.86 | 2040–0241 |
| 125.87 | 2040–0241 |
| 125.88 | 2040–0241 |
| 125.89 | 2040–0241 |
| * * * * * | |

## PART 122—EPA ADMINISTERED PERMIT PROGRAMS: THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

1. The authority citation for part 122 continues to read as follows:

**Authority:** The Clean Water Act, 33 U.S.C. 1251 *et seq.*

2. Section 122.21 is amended by adding a new paragraph (r) to read as follows:

**§ 122.21 Application for a permit (applicable to State programs, see § 123.25)**

* * * * *

(r) *Applications for facilities with cooling water intake structures*—(1) *New facilities with new or modified cooling water intake structures.* New facilities with cooling water intake structures as defined in part 125, subpart I, of this chapter must report the information required under paragraphs (r)(2), (3), and (4) of this section and § 125.86 of this chapter. Requests for alternative requirements under § 125.85 of this chapter must be submitted with your permit application.

(2) *Source water physical data.* These include:

(i) A narrative description and scaled drawings showing the physical configuration of all source water bodies used by your facility, including areal dimensions, depths, salinity and temperature regimes, and other documentation that supports your determination of the water body type where each cooling water intake structure is located;

(ii) Identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods you used to conduct any physical studies to determine your intake's area of influence within the waterbody and the results of such studies; and

(iii) Locational maps.

(3) *Cooling water intake structure data.* These include:

(i) A narrative description of the configuration of each of your cooling water intake structures and where it is located in the water body and in the water column;

(ii) Latitude and longitude in degrees, minutes, and seconds for each of your cooling water intake structures;

(iii) A narrative description of the operation of each of your cooling water intake structures, including design intake flows, daily hours of operation, number of days of the year in operation and seasonal changes, if applicable;

(iv) A flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges; and

(v) Engineering drawings of the cooling water intake structure.

(4) *Source water baseline biological characterization data.* This information is required to characterize the biological community in the vicinity of the cooling water intake structure and to characterize the operation of the cooling water intake structures. The Director may also use this information in subsequent permit renewal proceedings to determine if your Design and Construction Technology Plan as required in § 125.86(b)(4) of this chapter should be revised. This supporting information must include existing data (if they are available). However, you may supplement the data using newly conducted field studies if you choose to do so. The information you submit must include:

(i) A list of the data in paragraphs (r)(4)(ii) through (vi) of this section that are not available and efforts made to identify sources of the data;

(ii) A list of species (or relevant taxa) for all life stages and their relative abundance in the vicinity of the cooling water intake structure;

(iii) Identification of the species and life stages that would be most susceptible to impingement and entrainment. Species evaluated should include the forage base as well as those most important in terms of significance to commercial and recreational fisheries;

(iv) Identification and evaluation of the primary period of reproduction, larval recruitment, and period of peak abundance for relevant taxa;

(v) Data representative of the seasonal and daily activities (e.g., feeding and water column migration) of biological organisms in the vicinity of the cooling water intake structure;

(vi) Identification of all threatened, endangered, and other protected species that might be susceptible to impingement and entrainment at your cooling water intake structures;

(vii) Documentation of any public participation or consultation with Federal or State agencies undertaken in development of the plan; and

(viii) If you supplement the information requested in paragraph (r)(4)(i) of this section with data collected using field studies, supporting documentation for the Source Water Baseline Biological Characterization must include a description of all methods and quality assurance procedures for sampling, and data analysis including a description of the study area; taxonomic identification of sampled and evaluated biological assemblages (including all life stages of fish and shellfish); and sampling and data analysis methods. The sampling and/or data analysis methods you use must be appropriate for a quantitative survey and based on consideration of methods used in other biological studies performed within the same source water body. The study area should include, at a minimum, the area of influence of the cooling water intake structure.

3. Section 122.44 is amended by adding paragraph (b)(3) to read as follows:

**§ 122.44 Establishing limitations, standards, and other permit conditions (applicable to State NPDES programs, see § 123.25).**

* * * * *

(b) * * *

(3) Requirements applicable to cooling water intake structures at new facilities under section 316(b) of the CWA, in accordance with part 125, subpart I, of this chapter.

* * * * *

## PART 123—STATE PROGRAM REQUIREMENTS

1. The authority citation for part 123 continues to read as follows:

**Authority:** The Clean Water Act, 33 U.S.C. 1251 *et seq.*

2. Section 123.25 is amended by revising paragraph (a)(36) to read as follows:

**§ 123.25 Requirements for permitting.**

(a) * * *

(36) Subparts A, B, D, H, and I of part 125 of this chapter;

* * * * *

## PART 124—PROCEDURES FOR DECISIONMAKING

1. The authority citation for part 124 continues to read as follows:

**Authority:** Resource Conservation and Recovery Act, 42 U.S.C. 6901 *et seq.*; Safe Drinking Water Act, 42 U.S.C. 300f *et seq.*; Clean Water Act, 33 U.S.C. 1251 *et seq.*; Clean Air Act, 42 U.S.C. 7401 *et seq.*

2. Section 124.10 is amended by redesignating paragraph (d)(1)(ix) as paragraph (d)(1)(x) and adding a new paragraph (d)(1)(ix) to read as follows:

**§ 124.10 Public notice of permit actions and public comment period.**

* * * * *

(d) * * *

(1) * * *

(ix) Requirements applicable to cooling water intake structures at new facilities under section 316(b) of the CWA, in accordance with part 125, subpart I, of this chapter.

* * * * *

## PART 125—CRITERIA AND STANDARDS FOR THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

1. The authority citation for part 125 continues to read as follows:

**Authority:** The Clean Water Act, 33 U.S.C. 1251 *et seq.*, unless otherwise noted.

2. Remove the existing heading for subpart I and add new subpart I to part 125 to read as follows:

**Subpart I—Requirements Applicable to Cooling Water Intake Structures for New Facilities Under Section 316(b) of the Act**

Sec.

125.80 What are the purpose and scope of this subpart?
125.81 Who is subject to this subpart?
125.82 When must I comply with this subpart?
125.83 What special definitions apply to this subpart?
125.84 As an owner or operator of a new facility, what must I do to comply with this subpart?
125.85 May alternative requirements be authorized?
125.86 As an owner or operator of a new facility, what must I collect and submit when I apply for my new or reissued NPDES permit?
125.87 As an owner or operator of a new facility, must I perform monitoring?
125.88 As an owner or operator of a new facility, must I keep records and report?
125.89 As the Director, what must I do to comply with the requirements of this subpart?

### Subpart I—Requirements Applicable to Cooling Water Intake Structures for New Facilities Under Section 316(b) of the Act

**§ 125.80 What are the purpose and scope of this subpart?**

(a) This subpart establishes requirements that apply to the location, design, construction, and capacity of cooling water intake structures at new facilities. The purpose of these requirements is to establish the best technology available for minimizing adverse environmental impact associated with the use of cooling water intake structures. These requirements are implemented through National Pollutant Discharge Elimination System (NPDES) permits issued under section 402 of the Clean Water Act (CWA).

(b) This subpart implements section 316(b) of the CWA for new facilities. Section 316(b) of the CWA provides that any standard established pursuant to sections 301 or 306 of the CWA and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

(c) New facilities that do not meet the threshold requirements regarding amount of water withdrawn or percentage of water withdrawn for cooling water purposes in § 125.81(a) must meet requirements determined on a case-by-case, best professional judgement (BPJ) basis.

(d) Nothing in this subpart shall be construed to preclude or deny the right of any State or political subdivision of a State or any interstate agency under section 510 of the CWA to adopt or enforce any requirement with respect to control or abatement of pollution that is more stringent than those required by Federal law.

**§ 125.81 Who is subject to this subpart?**

(a) This subpart applies to a new facility if it:

(1) Is a point source that uses or proposes to use a cooling water intake structure;

(2) Has at least one cooling water intake structure that uses at least 25 percent of the water it withdraws for cooling purposes as specified in paragraph (c) of this section; and

(3) Has a design intake flow greater than two (2) million gallons per day (MGD).

(b) Use of a cooling water intake structure includes obtaining cooling water by any sort of contract or arrangement with an independent supplier (or multiple suppliers) of cooling water if the supplier or suppliers withdraw(s) water from waters of the United States. Use of cooling water does not include obtaining cooling water from a public water system or the use of treated effluent that otherwise would be discharged to a water of the U.S. This provision is intended to prevent circumvention of these requirements by creating arrangements to receive cooling water from an entity that is not itself a point source.

(c) The threshold requirement that at least 25 percent of water withdrawn be used for cooling purposes must be measured on an average monthly basis. A new facility meets the 25 percent cooling water threshold if, based on the new facility's design, any monthly average over a year for the percentage of cooling water withdrawn is expected to equal or exceed 25 percent of the total water withdrawn.

(d) This subpart does not apply to facilities that employ cooling water intake structures in the offshore and coastal subcategories of the oil and gas extraction point source category as defined under 40 CFR 435.10 and 40 CFR 435.40.

**§ 125.82 When must I comply with this subpart?**

You must comply with this subpart when an NPDES permit containing requirements consistent with this subpart is issued to you.

**§ 125.83 What special definitions apply to this subpart?**

The following special definitions apply to this subpart:

*Annual mean flow* means the average of daily flows over a calendar year.

Historical data (up to 10 years) must be used where available.

*Closed-cycle recirculating system* means a system designed, using minimized makeup and blowdown flows, to withdraw water from a natural or other water source to support contact and/or noncontact cooling uses within a facility. The water is usually sent to a cooling canal or channel, lake, pond, or tower to allow waste heat to be dissipated to the atmosphere and then is returned to the system. (Some facilities divert the waste heat to other process operations.) New source water (make-up water) is added to the system to replenish losses that have occurred due to blowdown, drift, and evaporation.

*Cooling water* means water used for contact or noncontact cooling, including water used for equipment cooling, evaporative cooling tower makeup, and dilution of effluent heat content. The intended use of the cooling water is to absorb waste heat rejected from the process or processes used, or from auxiliary operations on the facility's premises. Cooling water that is used in a manufacturing process either before or after it is used for cooling is considered process water for the purposes of calculating the percentage of a new facility's intake flow that is used for cooling purposes in § 125.81(c).

*Cooling water intake structure* means the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of the U.S. The cooling water intake structure extends from the point at which water is withdrawn from the surface water source up to, and including, the intake pumps.

*Design intake flow* means the value assigned (during the facility's design) to the total volume of water withdrawn from a source water body over a specific time period.

*Design intake velocity* means the value assigned (during the design of a cooling water intake structure) to the average speed at which intake water passes through the open area of the intake screen (or other device) against which organisms might be impinged or through which they might be entrained.

*Entrainment* means the incorporation of all life stages of fish and shellfish with intake water flow entering and passing through a cooling water intake structure and into a cooling water system.

*Estuary* means a semi-enclosed body of water that has a free connection with open seas and within which the seawater is measurably diluted with fresh water derived from land drainage. The salinity of an estuary exceeds 0.5 parts per thousand (by mass) but is typically less than 30 parts per thousand (by mass).

*Existing facility* means any facility that is not a new facility.

*Freshwater river or stream* means a lotic (free-flowing) system that does not receive significant inflows of water from oceans or bays due to tidal action. For the purposes of this rule, a flow-through reservoir with a retention time of 7 days or less will be considered a freshwater river or stream.

*Hydraulic zone of influence* means that portion of the source waterbody hydraulically affected by the cooling water intake structure withdrawal of water.

*Impingement* means the entrapment of all life stages of fish and shellfish on the outer part of an intake structure or against a screening device during periods of intake water withdrawal.

*Lake* or *reservoir* means any inland body of open water with some minimum surface area free of rooted vegetation and with an average hydraulic retention time of more than 7 days. Lakes or reservoirs might be natural water bodies or impounded streams, usually fresh, surrounded by land or by land and a man-made retainer (e.g., a dam). Lakes or reservoirs might be fed by rivers, streams, springs, and/or local precipitation. Flow-through reservoirs with an average hydraulic retention time of 7 days or less should be considered a freshwater river or stream.

*Maximize* means to increase to the greatest amount, extent, or degree reasonably possible.

*Minimum ambient source water surface elevation* means the elevation of the 7Q10 flow for freshwater streams or rivers; the conservation pool level for lakes or reservoirs; or the mean low tidal water level for estuaries or oceans. The 7Q10 flow is the lowest average 7 consecutive day low flow with an average frequency of one in 10 years determined hydrologically. The conservation pool is the minimum depth of water needed in a reservoir to ensure proper performance of the system relying upon the reservoir. The mean low tidal water level is the average height of the low water over at least 19 years.

*Minimize* means to reduce to the smallest amount, extent, or degree reasonably possible.

*Natural thermal stratification* means the naturally-occurring division of a waterbody into horizontal layers of differing densities as a result of variations in temperature at different depths.

*New facility* means any building, structure, facility, or installation that meets the definition of a "new source" or "new discharger" in 40 CFR 122.2 and 122.29(b)(1), (2), and (4) and is a greenfield or stand-alone facility; commences construction after January 17, 2002; and uses either a newly constructed cooling water intake structure, or an existing cooling water intake structure whose design capacity is increased to accommodate the intake of additional cooling water. New facilities include only "greenfield" and "stand-alone" facilities. A greenfield facility is a facility that is constructed at a site at which no other source is located, or that totally replaces the process or production equipment at an existing facility (*see* 40 CFR 122.29(b)(1)(i) and (ii)). A stand-alone facility is a new, separate facility that is constructed on property where an existing facility is located and whose processes are substantially independent of the existing facility at the same site (*see* 40 CFR 122.29(b)(1)(iii)). New facility does not include new units that are added to a facility for purposes of the same general industrial operation (for example, a new peaking unit at an electrical generating station).

(1) Examples of "new facilities" include, but are not limited to: the following scenarios:

(i) A new facility is constructed on a site that has never been used for industrial or commercial activity. It has a new cooling water intake structure for its own use.

(ii) A facility is demolished and another facility is constructed in its place. The newly-constructed facility uses the original facility's cooling water intake structure, but modifies it to increase the design capacity to accommodate the intake of additional cooling water.

(iii) A facility is constructed on the same property as an existing facility, but is a separate and independent industrial operation. The cooling water intake structure used by the original facility is modified by constructing a new intake bay for the use of the newly constructed facility or is otherwise modified to increase the intake capacity for the new facility.

(2) Examples of facilities that would not be considered a "new facility" include, but are not limited to, the following scenarios:

(i) A facility in commercial or industrial operation is modified and either continues to use its original cooling water intake structure or uses a new or modified cooling water intake structure.

(ii) A facility has an existing intake structure. Another facility (a separate and independent industrial operation),

is constructed on the same property and connects to the facility's cooling water intake structure behind the intake pumps, and the design capacity of the cooling water intake structure has not been increased. This facility would not be considered a "new facility" even if routine maintenance or repairs that do not increase the design capacity were performed on the intake structure.

*Ocean* means marine open coastal waters with a salinity greater than or equal to 30 parts per thousand (by mass).

*Source water* means the water body (waters of the U.S.) from which the cooling water is withdrawn.

*Thermocline* means the middle layer of a thermally stratified lake or reservoir. In this layer, there is a rapid decrease in temperatures.

*Tidal excursion* means the horizontal distance along the estuary or tidal river that a particle moves during one tidal cycle of ebb and flow.

*Tidal river* means the most seaward reach of a river or stream where the salinity is typically less than or equal to 0.5 parts per thousand (by mass) at a time of annual low flow and whose surface elevation responds to the effects of coastal lunar tides.

**§ 125.84 As an owner or operator of a new facility, what must I do to comply with this subpart?**

(a)(1) The owner or operator of a new facility must comply with either:

(i) Track I in paragraph (b) or (c) of this section; or

(ii) Track II in paragraph (d) of this section.

(2) In addition to meeting the requirements in paragraph (b), (c), or (d) of this section, the owner or operator of a new facility may be required to comply with paragraph (e) of this section.

(b) *Track I requirements for new facilities that withdraw equal to or greater than 10 MGD.* You must comply with all of the following requirements:

(1) You must reduce your intake flow, at a minimum, to a level commensurate with that which can be attained by a closed-cycle recirculating cooling water system;

(2) You must design and construct each cooling water intake structure at your facility to a maximum through-screen design intake velocity of 0.5 ft/s;

(3) You must design and construct your cooling water intake structure such that the total design intake flow from all cooling water intake structures at your facility meets the following requirements:

(i) For cooling water intake structures located in a freshwater river or stream, the total design intake flow must be no greater than five (5) percent of the source water annual mean flow;

(ii) For cooling water intake structures located in a lake or reservoir, the total design intake flow must not disrupt the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies);

(iii) For cooling water intake structures located in an estuary or tidal river, the total design intake flow over one tidal cycle of ebb and flow must be no greater than one (1) percent of the volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level;

(4) You must select and implement design and construction technologies or operational measures for minimizing impingement mortality of fish and shellfish if:

(i) There are threatened or endangered or otherwise protected federal, state, or tribal species, or critical habitat for these species, within the hydraulic zone of influence of the cooling water intake structure; or

(ii) There are migratory and/or sport or commercial species of impingement concern to the Director or any fishery management agency(ies), which pass through the hydraulic zone of influence of the cooling water intake structure; or

(iii) It is determined by the Director or any fishery management agency(ies) that the proposed facility, after meeting the technology-based performance requirements in paragraphs (b)(1), (2), and (3) of this section, would still contribute unacceptable stress to the protected species, critical habitat of those species, or species of concern;

(5) You must select and implement design and construction technologies or operational measures for minimizing entrainment of entrainable life stages of fish and shellfish if:

(i) There are threatened or endangered or otherwise protected federal, state, or tribal species, or critical habitat for these species, within the hydraulic zone of influence of the cooling water intake structure; or

(ii) There are or would be undesirable cumulative stressors affecting entrainable life stages of species of concern to the Director or any fishery management agency(ies), and it is determined by the Director or any fishery management agency(ies) that the proposed facility, after meeting the technology-based performance requirements in paragraphs (b)(1), (2), and (3) of this section, would contribute unacceptable stress to these species of concern;

(6) You must submit the application information required in 40 CFR 122.21(r) and § 125.86(b);

(7) You must implement the monitoring requirements specified in § 125.87;

(8) You must implement the record-keeping requirements specified in § 125.88.

(c) *Track I requirements for new facilities that withdraw equal to or greater than 2 MGD and less than 10 MGD and that choose not to comply with paragraph (b) of this section.* You must comply with all the following requirements:

(1) You must design and construct each cooling water intake structure at your facility to a maximum through-screen design intake velocity of 0.5 ft/s;

(2) You must design and construct your cooling water intake structure such that the total design intake flow from all cooling water intake structures at your facility meets the following requirements:

(i) For cooling water intake structures located in a freshwater river or stream, the total design intake flow must be no greater than five (5) percent of the source water annual mean flow;

(ii) For cooling water intake structures located in a lake or reservoir, the total design intake flow must not disrupt the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies);

(iii) For cooling water intake structures located in an estuary or tidal river, the total design intake flow over one tidal cycle of ebb and flow must be no greater than one (1) percent of the volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level;

(3) You must select and implement design and construction technologies or operational measures for minimizing impingement mortality of fish and shellfish if:

(i) There are threatened or endangered or otherwise protected federal, state, or tribal species, or critical habitat for these species, within the hydraulic zone of influence of the cooling water intake structure; or

(ii) There are migratory and/or sport or commercial species of impingement

concern to the Director or any fishery management agency(ies), which pass through the hydraulic zone of influence of the cooling water intake structure; or

(iii) It is determined by the Director or any fishery management agency(ies) that the proposed facility, after meeting the technology-based performance requirements in paragraphs (c)(1) and (2) of this section, would still contribute unacceptable stress to the protected species, critical habitat of those species, or species of concern;

(4) You must select and implement design and construction technologies or operational measures for minimizing entrainment of entrainable life stages of fish and shellfish;

(5) You must submit the application information required in 40 CFR 122.21(r) and § 125.86(b)(2), (3), and (4);

(6) You must implement the monitoring requirements specified in § 125.87;

(7) You must implement the recordkeeping requirements specified in § 125.88.

(d) *Track II.* The owner or operator of a new facility that chooses to comply under Track II must comply with the following requirements:

(1) You must demonstrate to the Director that the technologies employed will reduce the level of adverse environmental impact from your cooling water intake structures to a comparable level to that which you would achieve were you to implement the requirements of paragraphs (b)(1) and (2) of this section.

(i) Except as specified in paragraph (d)(1)(ii) of this section, this demonstration must include a showing that the impacts to fish and shellfish, including important forage and predator species, within the watershed will be comparable to those which would result if you were to implement the requirements of paragraphs (b)(1) and (2) of this section. This showing may include consideration of impacts other than impingement mortality and entrainment, including measures that will result in increases in fish and shellfish, but it must demonstrate comparable performance for species that the Director, in consultation with national, state or tribal fishery management agencies with responsibility for fisheries potentially affected by your cooling water intake structure, identifies as species of concern.

(ii) In cases where air emissions and/or energy impacts that would result from meeting the requirements of paragraphs (b)(1) and (2) of this section would result in significant adverse impacts on local air quality, significant adverse impact on local water resources not addressed under paragraph (d)(1)(i) of this section, or significant adverse impact on local energy markets, you may request alternative requirements under § 125.85.

(2) You must design and construct your cooling water intake structure such that the total design intake flow from all cooling water intake structures at your facility meet the following requirements:

(i) For cooling water intake structures located in a freshwater river or stream, the total design intake flow must be no greater than five (5) percent of the source water annual mean flow;

(ii) For cooling water intake structures located in a lake or reservoir, the total design intake flow must not disrupt the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the *disruption is determined to be* beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies);

(iii) For cooling water intake structures located in an estuary or tidal river, the total design intake flow over one tidal cycle of ebb and flow must be no greater than one (1) percent of the volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level.

(3) You must submit the application information required in 40 CFR 122.21(r) and § 125.86(c).

(4) You must implement the monitoring requirements specified in § 125.87.

(5) You must implement the record-keeping requirements specified in § 125.88.

(e) You must comply with any more stringent requirements relating to the location, design, construction, and capacity of a cooling water intake structure or monitoring requirements at a new facility that the Director deems are reasonably necessary to comply with any provision of state law, including compliance with applicable state water quality standards (including designated uses, criteria, and antidegradation requirements).

**§ 125.85 May alternative requirements be authorized?**

(a) Any interested person may request that alternative requirements less stringent than those specified in § 125.84(a) through (e) be imposed in the permit. The Director may establish alternative requirements less stringent than the requirements of § 125.84(a) through (e) only if:

(1) There is an applicable requirement under § 125.84(a) through (e);

(2) The Director determines that data specific to the facility indicate that compliance with the requirement at issue would result in compliance costs wholly out of proportion to those EPA considered in establishing the requirement at issue or would result in significant adverse impacts on local air quality, significant adverse impacts on local water resources not addressed under § 125.84(d)(1)(i), or significant adverse impacts on local energy markets;

(3) The alternative requirement requested is no less stringent than justified by the wholly out of proportion cost or the significant adverse impacts on local air quality, significant adverse impacts on local water resources not addressed under § 125.84(d)(1)(i), or significant adverse impacts on local *energy markets; and*

(4) The alternative requirement will ensure compliance with other applicable provisions of the Clean Water Act and any applicable requirement of state law.

(b) The burden is on the person requesting the alternative requirement to demonstrate that alternative requirements should be authorized.

**§ 125.86 As an owner or operator of a new facility, what must I collect and submit when I apply for my new or reissued NPDES permit?**

(a)(1) As an owner or operator of a new facility, you must submit to the Director a statement that you intend to comply with either:

(i) The Track I requirements for new facilities that withdraw equal to or greater than 10 MGD in § 125.84(b);

(ii) The Track I requirements for new facilities that withdraw equal to or greater than 2 MGD and less than 10 MGD in § 125.84(c);

(iii) The requirements for Track II in § 125.84 (d).

(2) You must also submit the application information required by 40 CFR 122.21(r) and the information required in either paragraph (b) of this section for Track I or paragraph (c) of this section for Track II when you apply for a new or reissued NPDES permit in accordance with 40 CFR 122.21.

(b) *Track I application requirements.* To demonstrate compliance with Track I requirements in § 125.84(b) or (c), you must collect and submit to the Director the information in paragraphs (b)(1) through (4) of this section.

(1) *Flow reduction information.* If you must comply with the flow reduction requirements in § 125.84(b)(1), you must submit the following information to the

Director to demonstrate that you have reduced your flow to a level commensurate with that which can be attained by a closed-cycle recirculating cooling water system:

(i) A narrative description of your system that has been designed to reduce your intake flow to a level commensurate with that which can be attained by a closed-cycle recirculating cooling water system and any engineering calculations, including documentation demonstrating that your make-up and blowdown flows have been minimized; and

(ii) If the flow reduction requirement is met entirely, or in part, by reusing or recycling water withdrawn for cooling purposes in subsequent industrial processes, you must provide documentation that the amount of cooling water that is not reused or recycled has been minimized.

(2) *Velocity information.* You must submit the following information to the Director to demonstrate that you are complying with the requirement to meet a maximum through-screen design intake velocity of no more than 0.5 ft/s at each cooling water intake structure as required in § 125.84(b)(2) and (c)(1):

(i) A narrative description of the design, structure, equipment, and operation used to meet the velocity requirement; and

(ii) Design calculations showing that the velocity requirement will be met at minimum ambient source water surface elevations (based on best professional judgement using available hydrological data) and maximum head loss across the screens or other device.

(3) *Source waterbody flow information.* You must submit to the Director the following information to demonstrate that your cooling water intake structure meets the flow requirements in § 125.84(b)(3) and (c)(2):

(i) If your cooling water intake structure is located in a freshwater river or stream, you must provide the annual mean flow and any supporting documentation and engineering calculations to show that your cooling water intake structure meets the flow requirements;

(ii) If your cooling water intake structure is located in an estuary or tidal river, you must provide the mean low water tidal excursion distance and any supporting documentation and engineering calculations to show that your cooling water intake structure facility meets the flow requirements; and

(iii) If your cooling water intake structure is located in a lake or reservoir, you must provide a narrative description of the water body thermal stratification, and any supporting documentation and engineering calculations to show that the natural thermal stratification and turnover pattern will not be disrupted by the total design intake flow. In cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish you must provide supporting documentation and include a written concurrence from any fisheries management agency(ies) with responsibility for fisheries potentially affected by your cooling water intake structure(s).

(4) *Design and Construction Technology Plan.* To comply with § 125.84(b)(4) and (5), or (c)(3) and (c)(4), you must submit to the Director the following information in a Design and Construction Technology Plan:

(i) Information to demonstrate whether or not you meet the criteria in § 125.84(b)(4) and (b)(5), or (c)(3) and (c)(4):

(ii) Delineation of the hydraulic zone of influence for your cooling water intake structure;

(iii) New facilities required to install design and construction technologies and/or operational measures must develop a plan explaining the technologies and measures you have selected based on information collected for the Source Water Biological Baseline Characterization required by 40 CFR 122.21(r)(3). (Examples of appropriate technologies include, but are not limited to, wedgewire screens, fine mesh screens, fish handling and return systems, barrier nets, aquatic filter barrier systems, etc. Examples of appropriate operational measures include, but are not limited to, seasonal shutdowns or reductions in flow, continuous operations of screens, etc.) The plan must contain the following information:

(A) A narrative description of the design and operation of the design and construction technologies, including fish-handling and return systems, that you will use to maximize the survival of those species expected to be most susceptible to impingement. Provide species-specific information that demonstrates the efficacy of the technology;

(B) A narrative description of the design and operation of the design and construction technologies that you will use to minimize entrainment of those species expected to be the most susceptible to entrainment. Provide species-specific information that demonstrates the efficacy of the technology; and

(C) Design calculations, drawings, and estimates to support the descriptions provided in paragraphs (b)(4)(iii)(A) and (B) of this section.

(c) *Application requirements for Track II.* If you have chosen to comply with the requirements of Track II in § 125.84(d) you must collect and submit the following information:

(1) *Source waterbody flow information.* You must submit to the Director the following information to demonstrate that your cooling water intake structure meets the source water body requirements in § 125.84(d)(2):

(i) If your cooling water intake structure is located in a freshwater river or stream, you must provide the annual mean flow and any supporting documentation and engineering calculations to show that your cooling water intake structure meets the flow requirements;

(ii) If your cooling water intake structure is located in an estuary or tidal river, you must provide the mean low water tidal excursion distance and any supporting documentation and engineering calculations to show that your cooling water intake structure facility meets the flow requirements; and

(iii) If your cooling water intake structure is located in a lake or reservoir, you must provide a narrative description of the water body thermal stratification, and any supporting documentation and engineering calculations to show that the natural thermal stratification and thermal or turnover pattern will not be disrupted by the total design intake flow. In cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish you must provide supporting documentation and include a written concurrence from any fisheries management agency(ies) with responsibility for fisheries potentially affected by your cooling water intake structure(s).

(2) *Track II Comprehensive Demonstration Study.* You must perform and submit the results of a Comprehensive Demonstration Study (Study). This information is required to characterize the source water baseline in the vicinity of the cooling water intake structure(s), characterize operation of the cooling water intake(s), and to confirm that the technology(ies) proposed and/or implemented at your cooling water intake structure reduce the impacts to fish and shellfish to levels comparable to those you would achieve were you to implement the requirements in § 125.84(b)(1)and (2) of Track I. To meet the "comparable level"

requirement, you must demonstrate that:

(i) You have reduced both impingement mortality and entrainment of all life stages of fish and shellfish to 90 percent or greater of the reduction that would be achieved through § 125.84(b)(1) and (2); or

(ii) If your demonstration includes consideration of impacts other than impingement mortality and entrainment, that the measures taken will maintain the fish and shellfish in the waterbody at a substantially similar level to that which would be achieved through § 125.84(b)(1) and (2); and

(iii) You must develop and submit a plan to the Director containing a proposal for how information will be collected to support the study. The plan must include:

(A) A description of the proposed and/or implemented technology(ies) to be evaluated in the Study;

(B) A list and description of any historical studies characterizing the physical and biological conditions in the vicinity of the proposed or actual intakes and their relevancy to the proposed Study. If you propose to rely on existing source water body data, it must be no more than 5 years old, you must demonstrate that the existing data are sufficient to develop a scientifically valid estimate of potential impingement and entrainment impacts, and provide documentation showing that the data were collected using appropriate quality assurance/quality control procedures;

(C) Any public participation or consultation with Federal or State agencies undertaken in developing the plan; and

(D) A sampling plan for data that will be collected using actual field studies in the source water body. The sampling plan must document all methods and quality assurance procedures for sampling, and data analysis. The sampling and data analysis methods you propose must be appropriate for a quantitative survey and based on consideration of methods used in other studies performed in the source water body. The sampling plan must include a description of the study area (including the area of influence of the cooling water intake structure and at least 100 meters beyond); taxonomic identification of the sampled or evaluated biological assemblages (including all life stages of fish and shellfish); and sampling and data analysis methods; and

(iv) You must submit documentation of the results of the Study to the Director. Documentation of the results of the Study must include:

(A) *Source Water Biological Study.* The Source Water Biological Study must include:

(*1*) A taxonomic identification and characterization of aquatic biological resources including: a summary of historical and contemporary aquatic biological resources; determination and description of the target populations of concern (those species of fish and shellfish and all life stages that are most susceptible to impingement and entrainment); and a description of the abundance and temporal/spatial characterization of the target populations based on the collection of multiple years of data to capture the seasonal and daily activities (e.g., spawning, feeding and water column migration) of all life stages of fish and shellfish found in the vicinity of the cooling water intake structure;

(*2*) An identification of all threatened or endangered species that might be susceptible to impingement and entrainment by the proposed cooling water intake structure(s); and

(*3*) A description of additional chemical, water quality, and other anthropogenic stresses on the source waterbody.

(B) *Evaluation of potential cooling water intake structure effects.* This evaluation will include:

(*1*) Calculations of the reduction in impingement mortality and entrainment of all life stages of fish and shellfish that would need to be achieved by the technologies you have selected to implement to meet requirements under Track II. To do this, you must determine the reduction in impingement mortality and entrainment that would be achieved by implementing the requirements of § 125.84(b)(1) and (2) of Track I at your site.

(*2*) An engineering estimate of efficacy for the proposed and/or implemented technologies used to minimize impingement mortality and entrainment of all life stages of fish and shellfish and maximize survival of impinged life stages of fish and shellfish. You must demonstrate that the technologies reduce impingement mortality and entrainment of all life stages of fish and shellfish to a comparable level to that which you would achieve were you to implement the requirements in § 125.84(b)(1) and (2) of Track I. The efficacy projection must include a site-specific evaluation of technology(ies) suitability for reducing impingement mortality and entrainment based on the results of the Source Water Biological Study in paragraph (c)(2)(iv)(A) of this section. Efficacy estimates may be determined based on case studies that have been conducted in the vicinity of the cooling water intake structure and/or site-specific technology prototype studies.

(C) *Evaluation of proposed restoration measures.* If you propose to use restoration measures to maintain the fish and shellfish as allowed in § 125.84(d)(1)(i), you must provide the following information to the Director:

(*1*) Information and data to show that you have coordinated with the appropriate fishery management agency(ies); and

(*2*) A plan that provides a list of the measures you plan to implement and how you will demonstrate and continue to ensure that your restoration measures will maintain the fish and shellfish in the waterbody to a substantially similar level to that which would be achieved through § 125.84(b)(1) and (2).

(D) *Verification monitoring plan.* You must include in the Study the following:

(*1*) A plan to conduct, at a minimum, two years of monitoring to verify the full-scale performance of the proposed or implemented technologies, operational measures. The verification study must begin at the start of operations of the cooling water intake structure and continue for a sufficient period of time to demonstrate that the facility is reducing the level of impingement and entrainment to the level documented in paragraph (c)(2)(iv)(B) of this section. The plan must describe the frequency of monitoring and the parameters to be monitored. The Director will use the verification monitoring to confirm that you are meeting the level of impingement mortality and entrainment reduction required in § 125.84(d), and that the operation of the technology has been optimized.

(*2*) A plan to conduct monitoring to verify that the restoration measures will maintain the fish and shellfish in the waterbody to a substantially similar level as that which would be achieved through § 125.84(b)(1) and (2).

**§ 125.87 As an owner or operator of a new facility, must I perform monitoring?**

As an owner or operator of a new facility, you will be required to perform monitoring to demonstrate your compliance with the requirements specified in § 125.84.

(a) *Biological monitoring.* You must monitor both impingement and entrainment of the commercial, recreational, and forage base fish and shellfish species identified in either the Source Water Baseline Biological Characterization data required by 40 CFR 122.21(r)(3) or the Comprehensive Demonstration Study required by § 125.86(c)(2), depending on whether

you chose to comply with Track I or Track II. The monitoring methods used must be consistent with those used for the Source Water Baseline Biological Characterization data required in 40 CFR 122.21(r)(3) or the Comprehensive Demonstration Study required by § 125.86(c)(2). You must follow the monitoring frequencies identified below for at least two (2) years after the initial permit issuance. After that time, the Director may approve a request for less frequent sampling in the remaining years of the permit term and when the permit is reissued, if supporting data show that less frequent monitoring would still allow for the detection of any seasonal and daily variations in the species and numbers of individuals that are impinged or entrained.

(1) *Impingement sampling.* You must collect samples to monitor impingement rates (simple enumeration) for each species over a 24-hour period and no less than once per month when the cooling water intake structure is in operation.

(2) *Entrainment sampling.* You must collect samples to monitor entrainment rates (simple enumeration) for each species over a 24-hour period and no less than biweekly during the primary period of reproduction, larval recruitment, and peak abundance identified during the Source Water Baseline Biological Characterization required by 40 CFR 122.21(r)(3) or the Comprehensive Demonstration Study required in § 125.86(c)(2). You must collect samples only when the cooling water intake structure is in operation.

(b) *Velocity monitoring.* If your facility uses surface intake screen systems, you must monitor head loss across the screens and correlate the measured value with the design intake velocity. The head loss across the intake screen must be measured at the minimum ambient source water surface elevation (best professional judgment based on available hydrological data). The maximum head loss across the screen for each cooling water intake structure must be used to determine compliance with the velocity requirement in § 125.84(b)(2) or (c)(1). If your facility uses devices other than surface intake screens, you must monitor velocity at the point of entry through the device. You must monitor head loss or velocity during initial facility startup, and thereafter, at the frequency specified in your NPDES permit, but no less than once per quarter.

(c) *Visual or remote inspections.* You must either conduct visual inspections or employ remote monitoring devices during the period the cooling water intake structure is in operation. You must conduct visual inspections at least weekly to ensure that any design and construction technologies required in § 125.84(b)(4) and (5), or (c)(3) and (4) are maintained and operated to ensure that they will continue to function as designed. Alternatively, you must inspect via remote monitoring devices to ensure that the impingement and entrainment technologies are functioning as designed.

**§ 125.88 As an owner or operator of a new facility, must I keep records and report?**

As an owner or operator of a new facility you are required to keep records and report information and data to the Director as follows:

(a) You must keep records of all the data used to complete the permit application and show compliance with the requirements, any supplemental information developed under § 125.86, and any compliance monitoring data submitted under § 125.87, for a period of at least three (3) years from the date of permit issuance. The Director may require that these records be kept for a longer period.

(b) You must provide the following to the Director in a yearly status report:

(1) Biological monitoring records for each cooling water intake structure as required by § 125.87(a);

(2) Velocity and head loss monitoring records for each cooling water intake structure as required by § 125.87(b); and

(3) Records of visual or remote inspections as required in § 125.87(c).

**§ 125.89 As the Director, what must I do to comply with the requirements of this subpart?**

(a) *Permit application.* As the Director, you must review materials submitted by the applicant under 40 CFR 122.21(r)(3) and § 125.86 at the time of the initial permit application and before each permit renewal or reissuance.

(1) After receiving the initial permit application from the owner or operator of a new facility, the Director must determine applicable standards in § 125.84 to apply to the new facility. In addition, the Director must review materials to determine compliance with the applicable standards.

(2) For each subsequent permit renewal, the Director must review the application materials and monitoring data to determine whether requirements, or additional requirements, for design and construction technologies or operational measures should be included in the permit.

(3) For Track II facilities, the Director may review the information collection proposal plan required by § 125.86(c)(2)(iii). The facility may initiate sampling and data collection activities prior to receiving comment from the Director.

(b) *Permitting requirements.* Section 316(b) requirements are implemented for a facility through an NPDES permit. As the Director, you must determine, based on the information submitted by the new facility in its permit application, the appropriate requirements and conditions to include in the permit based on the track (Track I or Track II) the new facility has chosen to comply with. The following requirements must be included in each permit:

(1) *Cooling water intake structure requirements.* At a minimum, the permit conditions must include the performance standards that implement the requirements of § 125.84(b)(1), (2), (3), (4) and (5); § 125.84(c)(1), (2), (3) and (4); or § 125.84(d)(1) and (2). In determining compliance with proportional flow requirement in §§ 125.84(b)(3)(ii); (c)(2)(ii); and (d)(2)(ii), the director must consider anthropogenic factors (those not considered "natural") unrelated to the new facility's cooling water intake structure that can influence the occurrence and location of a thermocline. These include source water inflows, other water withdrawals, managed water uses, wastewater discharges, and flow/level management practices (e.g., some reservoirs release water from below the surface, close to the deepest areas).

(i) For a facility that chooses Track I, you must review the Design and Construction Technology Plan required in § 125.86(b)(4) to evaluate the suitability and feasibility of the technology proposed to minimize impingement mortality and entrainment of all life stages of fish and shellfish. In the first permit issued, you must put a condition requiring the facility to reduce impingement mortality and entrainment commensurate with the implementation of the technologies in the permit. Under subsequent permits, the Director must review the performance of the technologies implemented and require additional or different design and construction technologies, if needed to minimize impingement mortality and entrainment of all life stages of fish and shellfish. In addition, you must consider whether more stringent conditions are reasonably necessary in accordance with § 125.84(e).

(ii) For a facility that chooses Track II, you must review the information submitted with the Comprehensive

Demonstration Study information required in § 125.86(c)(2), evaluate the suitability of the proposed design and construction technologies and operational measures to determine whether they will reduce both impingement mortality and entrainment of all life stages of fish and shellfish to 90 percent or greater of the reduction that could be achieved through Track I. If you determine that restoration measures are appropriate at the new facility for consideration of impacts other than impingement mortality and entrainment, you must review the Evaluation of Proposed Restoration Measures and evaluate whether the proposed measures will maintain the fish and shellfish in the waterbody at a substantially similar level to that which would be achieved through § 125.84(b)(1) and (2). In addition, you must review the Verification Monitoring Plan in § 125.86(c)(2)(iv)(D) and require that the proposed monitoring begin at the start of operations of the cooling water intake structure and continue for a sufficient period of time to demonstrate that the technologies, operational measures and restoration measures meet the requirements in § 125.84(d)(1). Under subsequent permits, the Director must review the performance of the additional and /or different technologies or measures used and determine that they reduce the level of adverse environmental impact from the cooling water intake structures to a comparable level that the facility would achieve were it to implement the requirements of § 125.84(b)(1) and (2).

(2) *Monitoring conditions.* At a minimum, the permit must require the permittee to perform the monitoring required in § 125.87. You may modify the monitoring program when the permit is reissued and during the term of the permit based on changes in physical or biological conditions in the vicinity of the cooling water intake structure. The Director may require continued monitoring based on the results of the Verification Monitoring Plan in § 125.86(c)(2)(iv)(D).

(3) *Record keeping and reporting.* At a minimum, the permit must require the permittee to report and keep records as required by § 125.88.

[FR Doc. 01–28968 Filed 12–17–01; 8:45 am]

BILLING CODE 6560–50–P

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Federal Register

Friday,
July 9, 2004

Part II

# Environmental Protection Agency

40 CFR Parts 9, 122 et al.
National Pollutant Discharge Elimination System—Final Regulations To Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities; Final Rule

**ENVIRONMENTAL PROTECTION AGENCY**

**40 CFR Parts 9, 122, 123, 124, and 125**

**[FRL-7625-9]**

**RIN 2040-AD62**

## National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Final rule.

**SUMMARY:** Today's final rule implements section 316(b) of the Clean Water Act (CWA) for certain existing power producing facilities that employ a cooling water intake structure and are designed to withdraw 50 million gallons per day (MGD) or more of water from rivers, streams, lakes, reservoirs, estuaries, oceans, or other waters of the United States for cooling purposes. This final rule constitutes Phase II of EPA's section 316(b) regulation development and establishes national requirements, and procedures for implementing those requirements, applicable to the location, design, construction, and capacity of cooling water intake structures at these facilities. The rule applies to existing facilities that, as their primary activity, both generate and transmit electric power or generate electric power but sell it to another entity for transmission. The national requirements, which will be implemented through National Pollutant Discharge Elimination System (NPDES) permits, are based on the best technology available to minimize the adverse environmental impact associated with the use of cooling water intake structures.

Today's final rule establishes performance standards that are projected to reduce impingement mortality by 80 to 95 percent and, if applicable, entrainment by 60 to 90 percent. With the implementation of today's final rule, EPA intends to minimize the adverse environmental impact of cooling water intake structures by reducing the number of aquatic organisms lost as a result of water withdrawals associated with these structures.

**DATES:** This regulation is effective September 7, 2004. For judicial review purposes, this final rule is promulgated as of 1 p.m. Eastern Standard Time (EST) on July 23, 2004, as provided in 40 CFR 23.2.

**ADDRESSES:** The docket for today's final rule is available for public inspection at the Water Docket in the EPA Docket Center, (EPA/DC) EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC.

**FOR FURTHER INFORMATION CONTACT:** For additional technical information contact Martha Segall at (202) 566-1041 or Debra Hart at (202) 566-6379. The e-mail address for the above contacts is *rule.316b@epa.gov*.

**SUPPLEMENTARY INFORMATION:**

### I. General Information

*A. What Entities Are Regulated by This Action?*

This final rule applies to Phase II existing facilities that are point sources; as their primary activity both generate and transmit electric power or generate electric power for sale to another entity for transmission; use or propose to use one or more cooling water intake structures with a total design intake flow of 50 million gallons per day (MGD) or more to withdraw water from waters of the United States; and use 25 percent of water withdrawn exclusively for cooling water purposes. This rule defines "existing facility" as any facility that commenced constructions on or before January 17, 2002, and any modification of, or any addition of a unit at such a facility that does not meet the definition of a new facility at § 125.83.

This rule defines the term "cooling water intake structure" to mean the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of the United States. The cooling water intake structure extends from the point at which water is withdrawn from the surface water source up to, and including, the intake pumps.

| Category | Examples of regulated entities | Standard Industrial Classification (SIC) codes | North American Industry Classification System (NAICS) codes |
|---|---|---|---|
| Federal, State, and Local Government ... | Steam electric generating point source dischargers that employ cooling water intake structures. | 4911 and 493 ..... | 221112, 221113, 221119, 221121, 221122 |
| Industry ..... | Steam electric generating industrial point source dischargers that employ cooling water intake structures (this includes utilities and nonutilities). | 4911 and 493 ..... | 221112, 221113, 221119, 221121, 221122 |

This exhibit is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This exhibit lists the types of entities that EPA is now aware could potentially be regulated by this action. Other types of entities not listed in the exhibit could also be regulated. To determine whether your facility is regulated by this action, you should carefully examine the applicability criteria in § 125.91 of the rule. If you have questions regarding the applicability of this action to a particular entity, consult the person listed for technical information in the preceding **FOR FURTHER INFORMATION CONTACT** section.

*B. How Can I Get Copies of This Document and Other Related Information?*

1. Docket

EPA has established an official public docket for this action under Docket ID No. OW 2002-0049. The official public docket consists of the documents specifically referenced in this action, any public comments received, and other information related to this action. Although a part of the official docket, the public docket does not include information claimed as Confidential Business Information (CBI) or other information the disclosure of which is restricted by statute. The official public docket is the collection of materials that is available for public viewing at the Water Docket in the EPA Docket Center, (EPA/DC) EPA West, Room B102, 1301 Constitution Ave., NW., Washington, DC. The EPA Docket Center Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Water Docket is (202) 566-2426. To view docket materials,

please call ahead to schedule an appointment. Every user is entitled to copy 266 pages per day before incurring a charge. The Docket may charge 15 cents for each page over the 266-page limit plus an administrative fee of $25.00.

2. Electronic Access

You may access this **Federal Register** document electronically through the EPA Internet under the "**Federal Register**" listings at *http://www.epa.gov/fedrgstr/*.

An electronic version of the public docket is available through EPA's electronic public docket and comment system, EPA Dockets. You may use EPA Dockets at *http://www.epa.gov/edocket/* to view public comments, access the index listing of the contents of the official public docket, and to access those documents in the public docket that are available electronically. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the docket facility identified in section I.B.1. Once in the system, select "search," then key in the appropriate docket identification number.

### *C. Supporting Documentation*

The final regulation is supported by three major documents:

1. Economic and Benefits Analysis for the Final Section 316(b) Phase II Existing Facilities Rule (EPA–821–R–04–005), hereafter referred to as the Economic and Benefits Analysis. This document presents the analysis of compliance costs, closures, energy supply effects, and benefits associated with the final rule.

2. Regional Analysis for the Final Section 316(b) Phase II Existing Facilities Rule (EPA–821–R–04–006), hereafter referred to as the Regional Analysis Document or the Regional Study(ies) Document. This document examines cooling water intake structure impacts and regulatory benefits at the regional level.

3. Technical Development Document for the Final Section 316(b) Phase II Existing Facilities Rule (EPA–821–R–04–007), hereafter referred to as the Technical Development Document. This document presents detailed information on the methods used to develop unit costs and describes the set of technologies that may be used to meet the final rule's requirements.

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## II. Scope and Applicability of the Final Rule

This rule applies to owners and operators of existing facilities, as defined in § 125.93 of today's rule that meet all of the following criteria:

- The facility's primary activity is to generate electric power. The facility either transmits the electric power itself, or sells the electric power to another entity for transmission;
- The facility is a point source that uses or proposes to use one or more cooling water intake structures, including a cooling water intake structure operated by an independent supplier that withdraws water from waters of the United States and provides cooling water to the facility by any sort of contract or other arrangement;
- The cooling water intake structure(s) withdraw(s) cooling water from waters of the United States and at least twenty-five (25) percent of the water withdrawn is used exclusively for cooling purposes measured on an average annual basis;
- The facility is a point source; and
- The cooling water intake structures have a total design intake flow of 50

million gallons per day (MGD) or greater.

In the case of a Phase II existing facility that is co-located with a manufacturing facility, only that portion of the cooling water flow that is used by the Phase II facility to generate electricity for sale to another entity will be considered when determining whether the 50 MGD and 25 percent criteria are met. Facilities subject to this final rule are referred to as "Phase II existing facilities." Existing facilities with design flows below the 50 MGD threshold, as well as most existing manufacturing facilities, offshore seafood processors, and offshore and coastal oil and gas extraction facilities are not subject to this rule. Those facilities have different characteristics as compared to the large, power-generating facilities subject to today's rule. If an existing facility is a point source and has or is required to have an NPDES permit, but does not meet the applicability thresholds in today's rule, it is subject to permit conditions implementing section 316(b) of the CWA set by the permit director on a case-by-case basis, using best professional judgment. EPA expects to address at least some of these facilities in a separate rulemaking, referred to as Phase III.

In the preamble to the proposed rule EPA indicated that its intent was to exclude from regulation under the Phase II rule existing facilities whose primary business is manufacturing. See, *e.g.*, 67 FR 17124 (April 9, 2002). At the same time, in § 125.91(a)(3) of the proposed rule, the applicability criteria covered facilities that both generate and transmit electric power, or generate electric power but sell it to another entity for transmission. Numerous commenters indicated concerns that, as proposed, § 125.91(a)(3) would not clearly exclude all existing manufacturing facilities from the Phase II rule since some facilities generate electric power primarily for their own use, but transmit or sell any surplus. Therefore, for the final rule, EPA revised § 125.91 so that it reaches only those existing facilities that generate and transmit or sell electric power as their primary activity. The final rule does not apply to existing manufacturing facilities, including manufacturing facilities that generate power for their own use and transmit any surplus power, or sell it for transmission, provided the primary activity of the facility is not electric power generation.

*A. What Is an "Existing Facility" for Purposes of the Section 316(b) Phase II Rule?*

In today's rule, EPA is defining the term "existing facility" to include any facility that commenced construction as described in 40 CFR 122.29(b)(4) [1] on or before January 17, 2002. EPA established January 17, 2002 as the date for distinguishing new facilities from existing ones because that is the effective date of the Phase I new facility rule. In addition, EPA is defining the term "existing facility" in this rule to include modifications and additions to such facilities, the construction of which commences after January 17, 2002, that do not meet the definition of a new facility at 40 CFR 125.83, the definition used to define the scope of the Phase I rule. That definition states:

"*New facility* means any building, structure, facility, or installation that meets the definition of a 'new source' or 'new discharger' in [other NPDES regulations] and is a greenfield or stand-alone facility; commences construction after January 17, 2002; and uses either a newly constructed cooling water intake structure, or an existing cooling water intake structure whose design capacity is increased to accommodate the intake of additional cooling water. New facilities include only 'greenfield' and 'stand-alone' facilities. A greenfield facility is a facility that is constructed at a site at which no other source is located or that totally replaces the process or production equipment at an existing facility (see 40 CFR 122.29(b)(1)(i) and (ii). A stand-alone facility is a new, separate facility that is constructed on property where an existing facility is located and whose processes are substantially independent of the existing facility at the same site (see 40 CFR 122.29(b)(1)(iii). New facility does not include new units that are added to a facility for purposes of the same general industrial operation (for example, a new peaking unit at an electrical generating station)." [2]

The preamble to the final Phase I rule discusses this definition at 66 FR 65256; 65258–65259; 65285–65287, December 18, 2001.

EPA included in its Phase II proposed rule a freestanding definition of "existing facility." That definition read as follows:

"Existing facility means any facility that commenced construction before January 17, 2002; and

(1) Any modification of such a facility;

(2) Any addition of a unit at such a facility for purposes of the same industrial operation;

(3) Any addition of a unit at such a facility for purposes of a different industrial operation, if the additional unit uses an existing cooling water intake structure and the design capacity of the intake structure is not increased; or

(4) Any facility constructed in place of such a facility, if the newly constructed facility uses an existing cooling water intake structure whose design intake flow is not increased to accommodate the intake of additional cooling water." 67 FR 17221.

Upon further consideration, EPA has decided that it would be clearest to define existing facility primarily by stating that any facility that is not a new facility under 40 CFR 125.83 is an existing facility for purposes of this subpart. Accordingly, the language in this final rule is intended to be clear and consistent with EPA's definition of new facility in the Phase I rule at 40 CFR 125.83. In addition, the definition in today's regulation is also intended to ensure that sources excluded from the definition of new facility in the Phase I rule are captured by the definition of existing facility for the purposes of today's rule. At the same time, EPA believes that the approach taken in

[1] Construction is commenced if the owner or operator has undertaken certain installation and site preparation activities that are part of a continuous on-site construction program, and it includes entering into certain specified binding contractual obligations as one criterion (40 CFR 122.29(b)(4)).

[2] The Phase I rule also listed examples of facilities that would be "new" facilities and facilities that would "not be considered a 'new facility' in two numbered paragraphs. These read as follows:

"(1) Examples of 'new facilities' include, but are not limited to: the following scenarios:

(i) A new facility is constructed on a site that has never been used for industrial or commercial activity. It has a new cooling water intake structure for its own use.

(ii) A facility is demolished and another facility is constructed in its place. The newly-constructed facility uses the original facility's cooling water intake structure, but modifies it to increase the design capacity to accommodate the intake of additional cooling water.

(iii) A facility is constructed on the same property as an existing facility, but is a separate and independent industrial operation. The cooling water intake structure used by the original facility is modified by constructing a new intake bay for the use of the newly constructed facility or is otherwise modified to increase the intake capacity for the new facility.

(2) Examples of facilities that would not be considered a 'new facility' include, but are not limited to, the following scenarios:

(i) A facility in commercial or industrial operation is modified and either continues to use its original cooling water intake structure or uses a new or modified cooling water intake structure.

(ii) A facility has an existing intake structure. Another facility (a separate and independent industrial operation), is constructed on the same property and connects to the facility's cooling water intake structure behind the intake pumps, and the design capacity of the cooling water intake structure has not been increased. This facility would not be considered a 'new facility' even if routine maintenance or repairs that do not increase the design capacity were performed on the intake structure."

today's rule is identical in terms of effect to the approach in the proposed rule. Thus, the approach taken in today's final rule is in no way intended to change the scope of the rule as compared with the proposal as far as the facilities treated as "existing" facilities under the rule. The change is in drafting technique, not in meaning.

The facility encompassed by today's regulation is the point source that uses a cooling water intake structure to generate electric power. This is because the requirements of CWA section 316(b) are implemented through NPDES permits, which are issued only to point source dischargers of pollutants to waters of the United States. A point source generating electric power would be subject to Phase I or Phase II even if the cooling water intake structure it uses is located elsewhere. Similarly, modifications or additions to the cooling water intake structure (or even the total replacement of an existing cooling water intake structure with a new one) does not convert an otherwise unchanged existing facility into a new facility, regardless of the purpose of such changes (*e.g.*, to comply with today's rule or to increase capacity). Rather, the determination as to whether a facility is new or existing focuses on the power-generating point source itself, *i.e.*, whether it is a greenfield facility or a stand-alone facility. This focus on the point source discharger is consistent with section 316(b), which by its express terms applies only to point sources.

Under this rule, an existing power generating facility that uses a cooling water intake structure and repowers by either replacing or modifying an existing generating unit would remain subject to regulation as a Phase II existing facility, unless the existing facility were completely demolished and another facility constructed in its place that used either a new intake structure or the existing structure with an increased design capacity. For example, the following facility modifications or additions would result in a facility being characterized as an existing facility under today's rule:

- An existing power generating facility undergoes a modification of its process short of total replacement of the process and concurrently increases the design capacity of its existing cooling water intake structures;
- An existing power generating facility builds a new process at its site for purposes of the same industrial operation and concurrently increases the design capacity of its existing cooling water intake structures;
- An existing power generating facility completely rebuilds its process but uses the existing cooling water intake structure with no increase in design capacity.

Phase II existing facilities subject to today's rule include point sources that do not presently use, but propose to use, cooling water intake structures and do not meet the definition of new facility at § 125.83. This is appropriate because there may be some cases in which an existing facility historically withdrew its cooling water from a municipal or other source, but then decides to withdraw cooling water from a water of the United States. In these cases, the facility may not previously have met all of the criteria applicable to an existing facility under today's rule (*i.e.*, the facility did not previously withdraw cooling waters from a water of the United States) but may make changes that would place the facility within the scope of today's rule. A comparable situation would be when a facility previously relied on units that do not require cooling water, and then adds or modifies a unit for purposes of the same industrial operation (*i.e.*, power generation) such that cooling water is subsequently required. For example, an existing power generating facility that adds a new generating unit at the same site for purposes of repowering and concurrently increases the design capacity of its existing cooling water intake structure(s), or adds a new intake structure where it did not previously need one, for example when converting a gas turbine to a combined cycle unit, would be considered an existing facility.

In the preamble to the Phase I rule, EPA noted that it had defined "existing facility" in a manner consistent with existing NPDES regulations with a limited exception. EPA noted that it had generally deferred regulation of new sources constructed on a site at which an existing source is located until the Agency had completed analysis of its survey data on existing facilities. 66 FR 65286. Accordingly, the Phase I rule treated almost all changes to existing facilities for purposes of the same industrial operation as existing facilities. These included the addition of new generating units at the same site, even where they required an increase in cooling water intake structure design capacity or the construction of a new cooling water intake structure, as well as the complete demolition of an existing facility and its replacement with a new facility, so long as it did not increase the design capacity of the cooling water intake structure. The only exception was the demolition of an existing facility and its replacement with a new facility accompanied by an increase in design capacity of the cooling water intake structure. As the preamble explained: "The definition of a new facility in the final rule applies to a facility that is repowered only if the existing facility has been demolished and another facility is constructed in its place, and modifies the existing cooling water intake structure to increase the design intake capacity." *Id.*[2a] By contrast, the Phase I rule treated the addition of a new unit for purposes of a different industrial operation as an existing facility only if it used an existing cooling water intake structure whose design intake flow was not increased.

The Phase II proposed rule continued this approach in its definition of "existing facility." It continued to treat all changes to existing facilities for purposes of the same industrial operation as an existing facility unless the change was a complete demolition and replacement of the facility accompanied by an increase in cooling water intake design capacity. It also continued to treat the addition of new units for purposes of a different industrial operation differently, only allowing them to be "existing facilities" if they used an existing cooling water intake structure and did not increase its design intake flow. 67 FR 17221. In putting forth this proposed definition, EPA noted that it had collected data from a variety of sources, including survey data, specifically relating to repowering facilities. *Id.* at 17131–17135. It also made a point of explaining the wide variety of repowering activities that an existing facility could undertake under the proposed rule—anything short of demolition of an existing facility and its replacement with a new facility combined with increasing the design capacity of a cooling water intake structure—while still being regulated as an "existing facility" rather than a "new facility." *Id.* at 17128.

On the basis of the analysis of the survey data and other information in the record, the Agency now has concluded that it should adhere to its provisional

[2a] Because they are part of the same "industrial operation," such units are not "stand-alone" facilities for purposes of the "new facility" definition. As the fifth sentence of the definition of "new facility" explains, they are categorically treated as "existing facilities" regardless of any other considerations unless they completely replace an existing facility and its cooling water design intake capacity is increased. Accordingly, there is thus no need to make a determination whether they are "substantially independent" of the existing facility at the same site under the fourth sentence of the definition in order to determine whether they are "existing" or "new facilities." The fifth sentence alone controls that question.

decision generally giving wide latitude to existing facilities to make changes or additions to their facilities at the same site. In particular, new units that are added to a facility for purposes of the same general industrial operation should be treated as existing facilities because limitations associated with an existing site make it inappropriate to subject such units to new facility requirements. These limitations include space, existing location on a waterbody, location in already congested areas which could affect (if Phase 1 requirements were applied) visibility impairment, highway and airport safety issues, noise abatement issues, salt drift and corrosion problems and additional energy requirements. Moreover, power generation facilities should not be discouraged from making any upgrade, modification, or repowering that would increase energy efficiency or supply out of concern that they would be considered a new facility for purposes of section 316(b). Additional benefits will be realized in terms of reducing industrial sprawl if incremental power generation is not discouraged at existing power generation sites. These considerations counsel in favor of treating new units locating at existing sites as existing rather than new facilities. EPA also noted when it promulgated the Phase I rule (*see* 66 FR 65286) that it is not feasible for the permit authority to judge whether the facility could have been located elsewhere for the purpose of determining whether the facility is subject to the new facility rules. Accordingly, EPA has decided to retain the Phase I definition's provision that a new facility does not include new units that are added to a facility for purposes of the same general industrial operation. As noted above, this decision is fully consistent with the approach to this issue laid out in the proposed Phase II rule.

The final rule definition of "existing facility" is sufficiently broad that it encompasses facilities that will be addressed under the Phase III rule (*e.g.*, existing power generating facilities with design flows below the 50 MGD threshold, certain existing manufacturing facilities, seafood processors, and offshore and coastal oil and gas extraction facilities). EPA notes, however, that these facilities are not covered under this rule because they do not meet the requirements of § 125.91.

*B. What Is "Cooling Water" and What Is a "Cooling Water Intake Structure?"*

Today's rule adopts for Phase II existing facilities the same definition of a "cooling water intake structure" that applies to new facilities. A cooling water intake structure is defined as the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of the United States. Under the definition in today's rule, the cooling water intake structure extends from the point at which water is withdrawn from the surface water source up to, and including, the intake pumps. Today's rule adopts the new facility rule's definition of "cooling water": Water used for contact or noncontact cooling, including water used for equipment cooling, evaporative cooling tower makeup, and dilution of effluent heat content. The definition specifies that the intended use of cooling water is to absorb waste heat rejected from the processes used, or auxiliary operations on the facility's premises. The definition also indicates that water used in a manufacturing process either before or after it is used for cooling is process water for both cooling and non-cooling purposes and would not be considered cooling water for purposes of determining whether 25 percent or more of the flow is cooling water. This clarification is necessary because cooling water intake structures typically bring water into a facility for numerous purposes, including industrial processes; use as circulating water, service water, or evaporative cooling tower makeup water; dilution of effluent heat content; equipment cooling; and air conditioning. EPA notes that this clarification does not change the fact that only the intake water used exclusively for cooling purposes is counted when determining whether the 25 percent threshold in § 125.91(a)(4) is met.

This definition of "cooling water intake structure" differs from the definition provided in the 1977 Draft Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) P.L. 92–500 (U.S. EPA, 1977). The final rule definition clarifies that the cooling water intake structure includes the physical structure that extends from the point at which water is withdrawn from the surface water up to and including the intake pumps. Inclusion of the term "associated constructed waterways" in today's rule is intended to clarify that the definition includes those canals, channels, connecting waterways, and similar structures that may be built or modified to facilitate the withdrawal of cooling water. The explicit inclusion of the intake pumps in the definition reflects the key role pumps play in determining the capacity (*i.e.*, dynamic capacity) of the intake. These pumps, which bring in water, are an essential component of the cooling water intake structure since without them the intake could not work as designed.

*C. Is My Facility Covered if It Withdraws From Waters of the United States?*

The requirements finalized today apply to cooling water intake structures that have the design capacity to withdraw amounts of water equal to or greater than the specified intake flow threshold from "waters of the United States." Waters of the United States include the broad range of surface waters that meet the regulatory definition at 40 CFR 122.2, which includes lakes, ponds, reservoirs, nontidal rivers or streams, tidal rivers, estuaries, fjords, oceans, bays, and coves. These potential sources of cooling water may be adversely affected by impingement and entrainment.

Some facilities discharge heated water to cooling ponds, then withdraw water from the ponds for cooling purposes. EPA recognizes that cooling ponds may, in certain circumstances, constitute part of a closed-cycled cooling system. See, *e.g.*, 40 CFR 125.83. However, EPA does not intend this rule to change the regulatory status of cooling ponds. Cooling ponds are neither categorically included nor categorically excluded from the definition of "waters of the United States" at 40 CFR 122.2. EPA interprets 40 CFR 122.2 to give permit writers discretion to regulate cooling ponds as "waters of the United States" where cooling ponds meet the definition of "waters of the United States." The determination whether a particular cooling pond is or is not a water of the United States is to be made by the permit writer on a case-by-case basis, informed by the principles enunciated in Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers, 531 U.S. 159 (2001). Therefore, facilities that withdraw cooling water from cooling ponds that are waters of the United States and that meet today's other criteria for coverage (including the requirement that the facility has or will be required to obtain an NPDES permit) are subject to today's rule. The EPA and the U.S. Army Corps of Engineers have jointly issued jurisdictional guidance concerning the term "waters of the United States" in light of the Supreme Court's decision in Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, 531 U.S. 159 (2001) (SWANCC). A copy of that guidance was published as an Appendix to an Advanced Notice of Proposed

Rulemaking on the definition of the phrase "waters of the U.S.," see 68 FR 1991 (January 15, 2003), and may be obtained at (*http://www.epa.gov/owow/wetlands/ANPRM-FR.pdf*). Section 125.91(d) also provides, similar to the new facility rule, that facilities that obtain cooling water from a public water system or use treated effluent are not deemed to be using a cooling water intake structure for purposes of this rule.

*D. Is My Facility Covered if It Is a Point Source Discharger?*

Today's rule applies only to facilities that are point sources (*i.e.*, have an NPDES permit or are required to obtain one) because they discharge or might discharge pollutants, including storm water, from a point source to waters of the Unites States. This is the same requirement EPA included in the Phase I new facility rule at 40 CFR 125.81(a)(1). Requirements for complying with section 316(b) will continue to be applied through NPDES permits.

Based on the Agency's review of potential Phase II existing facilities that employ cooling water intake structures, the Agency anticipates that most existing power generating facilities that will be subject to this rule will control the intake structure that supplies them with cooling water, and discharge some combination of their cooling water, wastewater, and storm water to a water of the United States through a point source regulated by an NPDES permit. In this scenario, the requirements for the cooling water intake structure will be specified in the facility's NPDES permit. In the event that a Phase II existing facility's only NPDES permit is a general permit for storm water discharges, the Agency anticipates that the Director would write an individual NPDES permit containing requirements for the facility's cooling water intake structure. Alternatively, requirements applicable to cooling water intake structures could be incorporated into general permits. If requirements are placed into a general permit, they must meet the criteria set out at 40 CFR 122.28.

The Agency also recognizes that some facilities that have or are required to have an NPDES permit might not own and operate the intake structure that supplies their facility with cooling water. For example, electric power-generating facilities operated by separate entities might be located on the same, adjacent, or nearby property(ies); one of these facilities might take in cooling water and then transfer it to other facilities prior to discharge of the cooling water to a water of the United States. Section 125.91(c) of today's rule addresses such a situation. It provides that use of a cooling water intake structure includes obtaining cooling water by any sort of contract or arrangement with one or more independent suppliers of cooling water if the supplier or suppliers withdraw water from waters of the United States but that is not itself a Phase II existing facility. This provision is intended to prevent facilities from circumventing the requirements of today's rule by creating arrangements to receive cooling water from an entity that is not itself a Phase II existing facility.

In addressing facilities that have or are required to have an NPDES permit that do not directly control the intake structure that supplies their facility with cooling water, section 125.91(d) also provides, similar to the new facility rule, that facilities that obtain cooling water from a public water system or use treated effluent are not deemed to be using a cooling water intake structure for purposes of this rule.

As EPA stated in the preamble to the final Phase I rule (66 FR 65256 December 18, 2001), the Agency encourages the Director to closely examine scenarios in which a facility withdraws significant amounts of cooling water from waters of the United States but is not required to obtain an NPDES permit. As appropriate, the Director should apply other legal requirements, such as section 404 or 401 of the Clean Water Act, the Coastal Zone Management Act, the National Environmental Policy Act, the Endangered Species Act, or similar State or Tribal authorities to address adverse environmental impact caused by cooling water intake structures at those facilities.

*E. What Cooling Water Use and Design Intake Flow Thresholds Result in an Existing Facility Being Subject to This Rule?*

This final rule applies to existing facilities that are point sources and use cooling water intake structures that (1) withdraw cooling water from waters of the United States and use at least twenty-five (25) percent of the water withdrawn exclusively for cooling purposes, and (2) have a total design intake capacity of 50 MGD or more measured on an average annual basis (see § 125.91). Today's rule further provides that where a Phase II existing facility is co-located with a manufacturing facility, only that portion of the cooling water intake flow that is used by the Phase II facility to generate electricity for sale to another entity will be considered for purposes of determining whether the 50 MGD and 25 percent criteria have been exceeded.

EPA chose the 50 MGD threshold to focus the rule on the largest existing power generating facilities. EPA estimates that the 50 MGD threshold will subject approximately 543 of 902 (60 percent) existing power generating facilities to this final rule and will address approximately 90 percent of the total flow withdrawn by these facilities. EPA established the 50 MGD threshold because the regulation of existing facilities with flows of 50 MGD or greater in Phase II will address those existing power generating facilities with the greatest potential to cause or contribute to adverse environmental impact. In addition, EPA has limited data on impacts at facilities withdrawing less than 50 MGD. Deferring regulation of such facilities to Phase III provides an additional opportunity for the Agency to collect impingement and entrainment data for these smaller facilities.

Similarly, because Phase II existing facilities typically use far more than 25 percent of the water they withdraw for cooling purposes, EPA established the 25 percent threshold to ensure that nearly all cooling water and the largest existing facilities using cooling water intake structures are addressed by today's requirements. As in the Phase I rule, water used for both cooling and non-cooling purposes does not count towards the 25 percent threshold. Thus, the rule does not discourage the reuse of cooling water as process water or vice versa. Water that serves as cooling water but is either previously or subsequently used as process water is not considered cooling water for purposes of determining the percentage of the water withdrawn that is used for cooling and whether that percentage equals or exceeds 25 percent. Water withdrawn for non-cooling purposes includes water withdrawn for warming by liquified natural gas facilities and water withdrawn for public water systems by desalinization facilities.

## III. Legal Authority, Purpose, and Background of Today's Regulation

*A. Legal Authority*

Today's final rule is issued under the authority of sections 101, 301, 304, 308, 316, 401, 402, 501, and 510 of the Clean Water Act (CWA), 33 U.S.C. 1251, 1311, 1314, 1318, 1326, 1341, 1342, 1361, and 1370. This rule partially fulfills the obligations of the U.S. Environmental Protection Agency (EPA) under a consent decree in *Riverkeeper, Inc.* v. *Leavitt*, No. 93 Civ. 0314, (S.D.N.Y).

*B. Purpose of Today's Regulation*

Section 316(b) of the CWA provides that any standard established pursuant to section 301 or 306 of the CWA and applicable to a point source must require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impact. Today's rule establishes requirements reflecting the best technology available for minimizing adverse environmental impact, applicable to the location, design, construction, and capacity of cooling water intake structures at Phase II existing power generating facilities that have the design capacity to withdraw at least fifty (50) MGD of cooling water from waters of the United States and use at least twenty-five (25) percent of the water they withdraw exclusively for cooling purposes.

*C. Background*

1. The Clean Water Act

The Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), 33 U.S.C. 1251 *et seq.*, seeks to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." 33 U.S.C. 1251(a). The CWA establishes a comprehensive regulatory program, key elements of which are (1) a prohibition on the discharge of pollutants from point sources to waters of the United States, except as authorized by the statute; (2) authority for EPA or authorized States or Tribes to issue National Pollutant Discharge Elimination System (NPDES) permits that regulate the discharge of pollutants; (3) requirements for limitations in NPDES permits based on effluent limitations guidelines and standards and water quality standards.

Today's rule implements section 316(b) of the CWA as it applies to "Phase II existing facilities" as defined in this rule. Section 316(b) addresses the adverse environmental impact caused by the intake of cooling water, not discharges into water. Despite this special focus, the requirements of section 316(b) are closely linked to several of the core elements of the NPDES permit program established under section 402 of the CWA to control discharges of pollutants into navigable waters. For example, while effluent limitations apply to the discharge of pollutants by NPDES-permitted point sources to waters of the United States, section 316(b) applies to facilities subject to NPDES requirements that withdraw water from waters of the United States for cooling and that use a cooling water intake structure to do so.

Section 402 of the CWA provides authority for EPA or an authorized State or Tribe to issue an NPDES permit to any person discharging any pollutant or combination of pollutants from a point source into waters of the United States. Forty-five States and one U.S. territory are authorized under section 402(b) to administer the NPDES permitting program. NPDES permits restrict the types and amounts of pollutants, including heat, that may be discharged from various industrial, commercial, and other sources of wastewater. These permits control the discharge of pollutants primarily by requiring dischargers to meet effluent limitations established pursuant to section 301 or section 306. Effluent limitations may be based on promulgated Federal effluent limitations guidelines, new source performance standards, or the best professional judgment of the permit writer. Limitations based on these guidelines, standards, or best professional judgment are known as technology-based effluent limits. Where technology-based effluent limits are inadequate to ensure attainment of water quality standards applicable to the receiving water, section 301(b)(1)(C) of the Clean Water Act requires permits to include more stringent limits based on applicable water quality standards. NPDES permits also routinely include monitoring and reporting requirements, standard conditions, and special conditions. In addition, NPDES permits contain conditions to implement the requirements of section 316(b). Section 301 of the CWA prohibits the discharge of any pollutant by any person, except in compliance with specified statutory requirements, including section 402.

Section 510 of the Clean Water Act provides, that except as provided in the Clean Water Act, nothing in the Act shall (1) preclude or deny the right of any State or political subdivision thereof to adopt or enforce any requirement respecting control or abatement of pollution; except that if a limitation, prohibition or standard of performance is in effect under the Clean Water Act, such State or political subdivision may not adopt or enforce any other limitation prohibition or standard of performance which is less stringent than the limitation prohibition or standard of performance under the Act. EPA interprets this to reserve for the States authority to implement requirements that are more stringent than the Federal requirements under state law. *PUD No. 1 of Jefferson County. Washington Dep't of Ecology.* 511 U.S. 700, 705 (1994).

Sections 301, 304, and 306 of the CWA require that EPA develop technology-based effluent limitations guidelines and new source performance standards that are used as the basis for technology-based minimum discharge requirements in wastewater discharge permits. EPA issues these effluent limitations guidelines and standards for categories of industrial dischargers based on the pollutants of concern discharged by the industry, the degree of control that can be attained using various levels of pollution control technology, consideration of various economic tests appropriate to each level of control, and other factors identified in sections 304 and 306 of the CWA (such as non-water quality environmental impacts including energy impacts). EPA has promulgated regulations setting effluent limitations guidelines and standards under sections 301, 304, and 306 of the CWA for more than 50 industries. See 40 CFR parts 405 through 471. EPA has established effluent limitations guidelines and standards that apply to most of the industry categories that use cooling water intake structures (*e.g.*, steam electric power generation, iron and steel manufacturing, pulp and paper manufacturing, petroleum refining, and chemical manufacturing).

Section 316(b) states, in full:

> Any standard established pursuant to section 301 or section 306 of [the Clean Water] Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

The phrase "best technology available" in CWA section 316(b) is not defined in the statute, but its meaning can be understood in light of similar phrases used elsewhere in the CWA. See *Riverkeeper v. EPA*, slip op. at 11 (2nd Cir. Feb. 3, 2004) (noting that the cross-reference in CWA section 316(b) to CWA section 306 "is an invitation to look to section 306 for guidance in discerning what factors Congress intended the EPA to consider in determining the 'best technology available' " for new sources).

In sections 301 and 306, Congress directed EPA to set effluent discharge standards for new sources based on the "best available demonstrated control technology" and for existing sources based on the "best available technology economically achievable." For new sources, section 306(b)(1)(B) directs EPA to establish "standards of performance." The phrase "standards of performance" under section 306(a)(1) is defined as being the effluent reduction that is

"achievable through application of the best available demonstrated control technology, processes, operating methods or other alternatives * * *." This is commonly referred to as "best available demonstrated technology" or "BADT." For existing dischargers, section 301(b)(1)(A) requires the establishment of effluent limitations based on "the application of best practicable control technology currently available." This is commonly referred to as "best practicable technology" or "BPT." Further, section 301(b)(2)(A) directs EPA to establish effluent limitations for certain classes of pollutants "which shall require the application of the best available technology economically achievable." This is commonly referred to as "best available technology" or "BAT." Section 301 specifies that both BPT and BAT limitations must reflect determinations made by EPA under Clean Water Act section 304. Under these provisions, the discharge of pollutants from point sources is based not on the impact of the discharge on the receiving waters, but instead upon the capabilities of the equipment or "control technologies" available to control those discharges.

The phrases "best available demonstrated technology"; and "best available technology"—like "best technology available" in CWA section 316(b)—are not defined in the statute. However, section 304 of the CWA specifies factors to be considered in establishing the best practicable control technology currently available, and best available technology.

For best practicable control technology currently available, the CWA directs EPA to consider

> the total cost of application of technology in relation to the effluent reduction benefits to be achieved from such application, and shall also take into account the age of the equipment and facilities involved, the process employed, the engineering aspects of the application of various types of control techniques, process changes, non-water quality environmental impact (including energy requirements), and such other factors as [EPA] deems appropriate.

33 U.S.C. 1314(b)(1)(b).

For "best available technology," the CWA directs EPA to consider:

> the age of equipment and facilities involved, the process employed, the engineering aspects * * * of various types of control techniques, process changes, the cost of achieving such effluent reduction, non-water quality environmental impacts (including energy requirements), and such other factors as [EPA] deems appropriate.

33 U.S.C. 1314(b)(2)(B).

Section 316(b) expressly refers to section 301, and the phrase "best technology available" is very similar to "best technology available" in that section. These facts, coupled with the brevity of section 316(b) itself, prompted EPA to look to section 301 and, ultimately, section 304 for guidance in determining the "best technology available to minimize adverse environmental impact" of cooling water intake structures for existing Phase II facilities.

By the same token, however, there are significant differences between section 316(b) and sections 301 and 304. See *Riverkeeper, Inc.* v. *United States Environmental Protection Agency*, slip op. at 13, (2nd Cir. Feb. 3, 2004) ("not every statutory directive contained [in sections 301 and 306 ] is applicable" to a section 316(b) rulemaking). Section 316(b) requires that cooling water intake structures reflect the best technology available for minimizing adverse environmental impact. In contrast to the effluent limitations provisions, the object of the "best technology available" is explicitly articulated by reference to the receiving water: To minimize adverse environmental impact in the waters from which cooling water is withdrawn. This difference is reflected in EPA's past practices in implementing sections 301, 304, and 316(b). While EPA has established effluent limitations guidelines based on the efficacy of one or more technologies to reduce pollutants in wastewater in relation to cost without necessarily considering the impact on the receiving waters, EPA has previously considered the costs of technologies in relation to the benefits of minimizing adverse environmental impact in establishing 316(b) limits which historically have been done on a case-by case basis. *In Re Public Service Co. of New Hampshire*, 10 ERC 1257 (June 17, 1977); *In Re Public Service Co. of New Hampshire*, 1 EAD 455 (Aug. 4, 1978); *Seacoast Anti-Pollution League* v. *Costle*, 597 F. 2d 306 (1st Cir. 1979).

For this Phase II rulemaking, EPA therefore interprets CWA section 316(b) as authorizing EPA to consider not only technologies but also their effects on and benefits to the water from which the cooling water is withdrawn. Based on these two considerations, EPA has established in today's rule national requirements for facilities to install technology that is technically available, economically practicable, and cost-effective while at the same time authorizing a range of technologies that achieve comparable reductions in adverse environmental impact.

2. Consent Decree

Today's final rule partially fulfills EPA's obligation to comply with a consent decree, as amended. The Second Amended Consent Decree, which is relevant to today's rule, was filed on November 25, 2002, in the United States District Court, Southern District of New York, in *Riverkeeper, Inc.* v. *Leavitt*, No. 93 Civ 0314, a case brought against EPA by a coalition of individuals and environmental groups. The original Consent Decree, filed on October 10, 1995, provided that EPA was to propose regulations implementing section 316(b) by July 2, 1999, and take final action with respect to those regulations by August 13, 2001. Under subsequent interim orders, the Amended Consent Decree filed on November 22, 2000, and the Second Amended Consent Decree, EPA has divided the rulemaking into three phases and is working under new deadlines. As required by the Second Amended Consent Decree, on November 9, 2001, EPA took final action on a rule governing cooling water intake structures used by new facilities (Phase I). 66 FR 65255 (December 18, 2001). The Second Amended Consent Decree requires that EPA take final action by February 16, 2004, with respect to Phase II regulations that are "applicable to, at a minimum: (1) Existing utilities (*i.e.*, facilities that both generate and transmit electric power) that employ a cooling water intake structure, and whose intake flow levels exceed a minimum threshold to be determined by EPA during the Phase II rulemaking process; and (2) existing nonutility power producers (*i.e.*, facilities that generate electric power but sell it to another entity for transmission) that employ a cooling water intake structure, and whose intake flow levels exceed a minimum threshold to be determined by EPA during the Phase II rulemaking process." The consent decree further requires that EPA propose regulations governing cooling water intake structures used, at a minimum, by smaller-flow power plants and facilities in four industrial sectors (pulp and paper making, petroleum and coal products manufacturing, chemical and allied manufacturing, and primary metal manufacturing) by November 1, 2004, and take final action by June 1, 2006 (Phase III).

3. What Other EPA Rulemakings and Guidance Have Addressed Cooling Water Intake Structures?

In April 1976, EPA published a final rule under section 316(b) that addressed cooling water intake structures. 41 FR

17387 (April 26, 1976), see also the proposed rule at 38 FR 34410 (December 13, 1973). The rule added a new § 401.14 to 40 CFR Chapter I that reiterated the requirements of CWA section 316(b). It also added a new part 402, which included three sections: (1) § 402.10 (Applicability), (2) § 402.11 (Specialized definitions), and (3) § 402.12 (Best technology available for cooling water intake structures). Section 402.10 stated that the provisions of part 402 applied to "cooling water intake structures for point sources for which effluent limitations are established pursuant to section 301 or standards of performance are established pursuant to section 306 of the Act." Section 402.11 defined the terms "cooling water intake structure," "location," "design," "construction," "capacity," and "Development Document." Section 402.12 included the following language:

> The information contained in the Development Document shall be considered in determining whether the location, design, construction, and capacity of a cooling water intake structure of a point source subject to standards established under section 301 or 306 reflect the best technology available for minimizing adverse environmental impact.

In 1977, fifty-eight electric utility companies challenged those regulations, arguing that EPA had failed to comply with the requirements of the Administrative Procedure Act (APA) in promulgating the rule. Specifically, the utilities argued that EPA had neither published the Development Document in the **Federal Register** nor properly incorporated the document into the rule by reference. The United States Court of Appeals for the Fourth Circuit agreed and, without reaching the merits of the regulations themselves, remanded the rule. *Appalachian Power Co. v. Train*, 566 F.2d 451 (4th Cir. 1977). EPA later withdrew part 402. 44 FR 32956 (June 7, 1979). The regulation at 40 CFR 401.14, which reiterates the statutory requirement, remains in effect.

Since the Fourth Circuit remanded EPA's section 316(b) regulations in 1977, NPDES permit authorities have made decisions implementing section 316(b) on a case-by-case, site-specific basis. EPA published draft guidance addressing section 316(b) implementation in 1977. See *Draft Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) P.L. 92-500* (U.S. EPA, 1977). This draft guidance described the studies recommended for evaluating the impact of cooling water intake structures on the aquatic environment and recommended a basis for determining the best technology available for minimizing adverse environmental impact. The 1977 section 316(b) draft guidance states, "The environmental-intake interactions in question are highly site-specific and the decision as to best technology available for intake design, location, construction, and capacity must be made on a case-by-case basis." (Section 316(b) Draft Guidance, U.S. EPA, 1977, p. 4). This case-by-case approach was also consistent with the approach described in the 1976 Development Document referenced in the remanded regulation.

The 1977 section 316(b) draft guidance suggested a general process for developing information needed to support section 316(b) decisions and presenting that information to the permitting authority. The process involved the development of a site-specific study of the environmental effects associated with each facility that uses one or more cooling water intake structures, as well as consideration of that study by the permitting authority in determining whether the facility must make any changes for minimizing adverse environmental impact. Where adverse environmental impact is present, the 1977 draft guidance suggested a stepwise approach that considers screening systems, size, location, capacity, and other factors.

Although the draft guidance described the information that should be developed, key factors that should be considered, and a process for supporting section 316(b) determinations, it did not establish uniform technology-based national standards for best technology available for minimizing adverse environmental impact. Rather, the guidance left the decisions on the appropriate location, design, capacity, and construction of cooling water intake structures to the permitting authority. Under this framework, the Director determined whether appropriate studies have been performed, whether a given facility has minimized adverse environmental impact, and what, if any, technologies may be required.

4. Phase I New Facility Rule

On November 9, 2001, EPA took final action on regulations governing cooling water intake structures at new facilities. 66 FR 65255 (December 18, 2001). On December 26, 2002, EPA made minor changes to the Phase I regulations. 67 FR 78947. The final Phase I new facility rule (40 CFR Part 125, Subpart I) establishes requirements applicable to the location, design, construction, and capacity of cooling water intake structures at new facilities that withdraw at least two (2) million gallons per day (MGD) and use at least twenty-five (25) percent of the water they withdraw solely for cooling purposes. In the new facility rule, EPA adopted a two-track approach. Under Track I, for facilities with a design intake flow more than 10 MGD, the intake flow of the cooling water intake structure is restricted, at a minimum, to a level commensurate with that which could be attained by use of a closed-cycle, recirculating cooling system. For facilities with a design intake flow more than 2 MGD, the design through-screen intake velocity is restricted to 0.5 ft/s and the total quantity of intake is restricted to a proportion of the mean annual flow of a freshwater river or stream, or to maintain the natural thermal stratification or turnover patterns (where present) of a lake or reservoir except in cases where the disruption is beneficial, or to a percentage of the tidal excursions of a tidal river or estuary. If certain environmental conditions exist, an applicant with intake capacity greater than 10 MGD must select and implement appropriate design and construction technologies for minimizing impingement mortality and entrainment. (Applicants with 2 to 10 MGD flows are not required to reduce intake flow to a level commensurate with a closed-cycle, recirculating cooling system, but must install technologies for reducing impingement mortality at all locations.) Under Track II, the applicant has the opportunity to demonstrate that impacts to fish and shellfish, including important forage and predator species, within the watershed will be comparable to the reduction in impingement mortality and entrainment it would achieve were it to implement the Track I intake flow and velocity requirements.

With the new facility rule, EPA promulgated national minimum requirements for the design, capacity, and construction of cooling water intake structures at new facilities. EPA believes that the final new facility rule establishes a reasonable framework that creates certainty for permitting of new facilities, while providing significant flexibility to take site-specific factors into account.

5. Proposed Rule for Phase II Existing Facilities

On April 9, 2002, EPA published proposed requirements for cooling water intake structures at Phase II existing facilities to implement section 316(b) of the Clean Water Act. EPA proposed to establish requirements that gave facilities three different compliance options for meeting performance standards that vary based on waterbody

type, the percentage of the source waterbody withdrawn, and the facility capacity utilization rate. 67 FR 17122. EPA received numerous comments and data submissions concerning the proposal.

6. Notice of Data Availability

On Wednesday, March 19, 2003, EPA published a Proposed Rule Notice of Data Availability (NODA). 68 FR 13522. This notice presented a summary of the data EPA had received or collected since proposal, an assessment of the relevance of the data to EPA's analysis, revisions to EPA's estimate of the costs and benefits of the proposed rule, new proposed compliance alternatives, and potential modifications to EPA's proposed regulatory approach. As part of the NODA, EPA also reopened the comment period on the complete contents of the proposed rule.

7. Public Participation

EPA has worked extensively with stakeholders from the industry, public interest groups, State agencies, and other Federal agencies in the development of this final rule. These public participation activities have focused on various section 316(b) issues, including issues relevant to development of the Phase I rule and Phase II rule.

EPA conducted outreach to industry groups, environmental groups, and other government entities in the development, testing, refinement, and completion of the section 316(b) survey, which has been used as a source of data for the Phase II rule. The survey is entitled "Information Collection Request, Detailed Industry Questionnaires: Phase II Cooling Water Intake Structures & Watershed Case Study Short Questionnaire," September 3, 1999. In addition, EPA conducted two public meetings on section 316(b) issues. In June of 1998, in Arlington, Virginia, EPA conducted a public meeting focused on a draft regulatory framework for assessing potential adverse environmental impact from impingement and entrainment. 63 FR 27958 (May 21, 1998). In September of 1998, in Alexandria, Virginia, EPA conducted a public meeting focused on technology, cost, and mitigation issues. 63 FR 40683 (July 30, 1998). In addition, in September of 1998, and April of 1999, EPA staff participated in technical workshops sponsored by the Electric Power Research Institute on issues relating to the definition and assessment of adverse environmental impact. EPA staff have participated in other industry conferences, met upon request on numerous occasions with representatives of industry and environmental groups.

In the months leading up to publication of the proposed Phase I rule, EPA conducted a series of stakeholder meetings to review the draft regulatory framework for the proposed rule and invited stakeholders to provide their recommendations for the Agency's consideration. EPA managers have met with the Utility Water Act Group, Edison Electric Institute, representatives from an individual utility, and with representatives from the petroleum refining, pulp and paper, and iron and steel industries. EPA conducted several meetings with environmental groups attended by representatives from 15 organizations. EPA also met with the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) and, with the assistance of ASIWPCA, conducted a conference call in which representatives from 17 States or interstate organizations participated. After publication of the proposed Phase I rule, EPA continued to meet with stakeholders at their request. Summaries of these meetings are in the docket.

EPA received many comments from industry stakeholders, government agencies, and private citizens on the Phase I proposed rule 65 FR 49059 (August 10, 2000). EPA received additional comments on the Phase I Notice of Data Availability (NODA) 66 FR 28853 (May 25, 2001). These comments informed the development of the Phase II proposal.

In January, 2001, EPA also attended technical workshops organized by the Electric Power Research Institute and the Utilities Water Act Group. These workshops focused on the presentation of key issues associated with different regulatory approaches considered under the Phase I proposed rule and alternatives for addressing section 316(b) requirements.

On May 23, 2001, EPA held a day-long forum to discuss specific issues associated with the development of regulations under section 316(b) of the Clean Water Act. 66 FR 20658 (April 24, 2001). At the meeting, 17 experts from industry, public interest groups, States, and academia reviewed and discussed the Agency's preliminary data on cooling water intake structure technologies that are in place at existing facilities and the costs associated with the use of available technologies for reducing impingement and entrainment. Over 120 people attended the meeting.

In August 21, 2001, EPA staff participated in a technical symposium sponsored by the Electric Power Research Institute in association with the American Fisheries Society on issues relating to the definition and assessment of adverse environmental impact under section 316(b) of the CWA.

During development of the Phase I final rule and Phase II proposed rule, EPA coordinated with the staff from the Nuclear Regulatory Commission (NRC) to ensure that there would not be a conflict with NRC safety requirements. NRC staff reviewed the proposed Phase II rule and did not identify any apparent conflict with nuclear plant safety. NRC licensees would continue to be obligated to meet NRC requirements for design and reliable operation of cooling systems. NRC staff recommended that EPA consider adding language which states that in cases of conflict between an EPA requirement under this rule and an NRC safety requirement, the NRC safety requirement take precedence. EPA added language to address this concern in this final rule.

In a concerted effort to respond to a multitude of questions concerning the data and analyses that EPA developed as part of the Phase II proposal, EPA held a number of conference calls with multiple stakeholders to clarify issues and generally provide additional information. To supplement these verbal discussions, EPA drafted three supporting documents: one that explained the methodology EPA used to calculate entrainment rates; and two others that provided specific examples of how EPA applied this methodology to calculate benefits for the proposed rule. In addition, EPA prepared written responses to all questions submitted by the stakeholders involved in the initial conference calls.

Finally, EPA sponsored a *Symposium on Cooling Water Intake Technologies to Protect Aquatic Organisms*, held on May 6–7, 2003, at the Hilton Crystal City at National Airport in Arlington, Virginia. This symposium brought together professionals from Federal, State, and Tribal regulatory agencies; industry; environmental organizations; engineering consulting firms; science and research organizations; academia; and others concerned with mitigating harm to the aquatic environment by cooling water intake structures. Efficacy and costs of various technologies to mitigate impacts to aquatic organisms from cooling water intake structures, as well as research and other future needs, were discussed.

These coordination efforts and all of the meetings described in this section are documented or summarized in the docket established for this rule.

## IV. Environmental Impacts Associated With Cooling Water Intake Structures

With the implementation of today's final rule, EPA intends to minimize the adverse environmental impacts of cooling water intake structures by minimizing the number of aquatic organisms lost as a result of water withdrawals associated with these structures or through restoration measures that compensate for these losses. In the Phase I new facility rule and proposed Phase II existing facility rule, EPA provided an overview of the magnitude and type of environmental impacts associated with cooling water intake structures, including several illustrative examples of documented environmental impacts at existing facilities (see 65 FR 49071–4; 66 FR 65262–5; and 67 FR 17136–40).

For the same reasons set forth in the preamble to the Phase I rule (66 FR 65256, 65291–65297), EPA has determined that there are multiple types of undesirable and unacceptable environmental impacts that may be associated with Phase II existing facilities, depending on conditions at the individual site. These types of impacts include entrainment and impingement; reductions of threatened and endangered species; damage to critical aquatic organisms, including important elements of the food chain; diminishment of a population's compensatory reserve; losses to populations including reductions of indigenous species populations, commercial fisheries stocks, and recreational fisheries; and stresses to overall communities and ecosystems as evidenced by reductions in diversity or other changes in system structure and function. Similarly, based on the analyses and for the same reasons set forth in the preamble to the new facility rule (66 FR 65256, 65291–65297), EPA has selected reductions in impingement and entrainment as a quick, certain, and consistent metric for determining performance at Phase II existing facilities. Further, EPA considered the non-impingement and entrainment environmental impacts for this rule and found them to be acceptable at a national level. This section describes the environmental impacts associated with cooling water withdrawals and why they are of concern to the Agency.

EPA estimates that facilities under the scope of today's final rule withdraw on average more than 214 billion gallons of cooling water a day from waters of the United States.[2] A report by the U.S. Geological Survey estimates that the use of water by the thermoelectric power industry accounted for 47 percent of all combined fresh and saline withdrawals from waters of the United States in 1995.[3] The withdrawal of such large quantities of cooling water in turn has the potential to affect large quantities of aquatic organisms including phytoplankton (tiny, free-floating photosynthetic organisms suspended in the water column), zooplankton (small aquatic animals, including fish eggs and larvae, that consume phytoplankton and other zooplankton), fish, and shellfish. Aquatic organisms drawn into cooling water intake structures are either impinged on components of the cooling water intake structure or entrained in the cooling water system itself.

Impingement takes place when organisms are trapped against intake screens by the force of the water being drawn through the cooling water intake structure. The velocity of the water withdrawal by the cooling water intake structure may prevent proper gill movement, remove fish scales, and cause other physical harm or death of affected organisms through exhaustion, starvation, asphyxiation, and descaling. Death from impingement ("impingement mortality") can occur immediately or subsequently as an individual succumbs to physical damage upon its return to the waterbody.

Entrainment occurs when organisms are drawn through the cooling water intake structure into the cooling system. Organisms that become entrained are typically relatively small, aquatic organisms, including early life stages of fish and shellfish. Many of these small, fragile organisms serve as prey for larger organisms higher on the food chain which are commercially and recreationally desirable species. As entrained organisms pass through a facility's cooling system they may be subject to mechanical, thermal, and at times, chemical stress. Sources of such stress include physical impacts in the pumps and condenser tubing, pressure changes caused by diversion of the cooling water into the plant or by the hydraulic effects of the condensers, sheer stress, thermal shock in the condenser and discharge tunnel, and chemical toxic effects from antifouling agents such as chlorine. Similar to impingement mortality, death from entrainment can occur immediately or subsequently as the individual succumbs to the damage from the stresses encountered as it passed through the cooling water system once it is discharged back into the waterbody.

The environmental impacts attributable to impingement mortality and entrainment at individual facilities include losses of early life stages of fish and shellfish, reductions in forage species, and decreased recreational and commercial landings. EPA estimates that the current number of fish and shellfish, expressed as age 1 equivalents, that are killed from impingement and entrainment from cooling water intake structures at the facilities covered by this Phase II rule is over 3.4 billion annually. Expressing impingement mortality and entrainment losses as age 1 equivalents is an accepted method for converting losses of all life stages into individuals of an equivalent age and provides a standard metric for comparing losses among species, years, and facilities. The largest losses are in the mid-Atlantic, where EPA estimates 1.7 billion age 1 equivalents are lost annually due to impingement and entrainment.[4] Although the number of age 1 equivalent fish killed by impingement and entrainment is very large, precise quantification of the nature and extent of impacts to populations and ecosystems is difficult. Population dynamics and the physical, chemical, and biological processes of ecosystems are extremely complex. While generally accepted as a simple and transparent method for modeling losses, the proportional methodology that EPA uses to estimate impingement and entrainment nationwide has uncertainties that may result in under or over estimating actual impingement and entrainment rates.

Decreased numbers of aquatic organisms can disrupt aquatic food webs and alter species composition and overall levels of biodiversity. For example, a model that examined the effect of large entrainment losses of forage fish, such as bay anchovy, predicted subsequent reductions in predator populations (including commercially and recreationally important species such as striped bass, weakfish, and blue fish) as high as 25%.[5] This is because forage species, which comprise a majority of

[2] EPA 1999. Detailed Industry Questionnaires: Phase II Cooling Water Intake Structures & Watershed Case Study Short Questionnaire. U.S. Environmental Protection Agency, Office of Wastewater Management, Washington, D.C. OMB Control No. 2040–0213.

[3] Solley, W.B., R.R. Pierce and H.A. Perlman. 1998. Estimated Use of Water in the United States in 1995. U.S. Geological Survey Circular 1200.

[4] For more information, please see Chapter D2: Evaluation of Impingement and Entrainment in the Mid-Atlantic Region in the Section 316(b) Existing Facilities Regional Studies, Part D: Mid-Atlantic.

[5] Summers, J.K. 1989. Simulating the indirect effects of power plant entrainment losses on an estuarine ecosystem. Ecological Modelling, 49: 31–47.

entrainment losses at many facilities, are often a primary food source for predator species.

EPA is also concerned about the potential impacts of cooling water intake structures located in or near habitat areas that support threatened, endangered, or other species of concern (those species that might be in need of conservation actions, but are not currently listed as threatened or endangered under State or Federal law).[6] In the San Francisco Bay-Delta Estuary, California, in the vicinity of the Pittsburg and Contra Costa Power Plants several fish species (*e.g.*, Delta smelt, Sacramento splittail, chinook salmon, and steelhead) are now considered threatened or endangered by State and/or Federal authorities. EPA evaluated facility data on impingement and entrainment rates for these species and estimated that potential losses of special status fish species at the two facilities may average 8,386 age 1 equivalents per year resulting from impingement and 169 age 1 equivalents per year due to entrainment.[7] In another example, EPA is aware that from 1976 to 1994, approximately 3,200 threatened or endangered sea turtles entered enclosed cooling water intake canals at the St. Lucie Nuclear Generating Plant in Florida.[8] The facility developed a capture-and-release program in response to these events. Most of the entrapped turtles were captured and released alive; however, approximately 160 turtles did not survive. An incidental take limit established by NMFS in a 2001 biological opinion for this facility has been set at no more than 1,000 sea turtles captured in the intake, with less than one percent killed or injured as a result of plant operations (only two of those killed or injured may be Kemp's Ridley sea turtles and none may be hawksbill or leatherback sea turtles).[9] Although the extent to which threatened, endangered, and other special status species are taken by cooling water intake structures more generally is yet to be determined, EPA is concerned about potential impacts to such species.

*Examples of Environmental Impacts Caused by Cooling Water Intakes*

1. Hudson River

The power generation facilities on the Hudson River in New York are some of the most extensively studied in the nation. The fish populations in the Hudson River have also been studied extensively to measure the impacts of these power plants. Studies of entrainment at five Hudson River power plants during the 1980s predicted year-class reductions ranging from six percent to 79 percent, depending on the fish species.[10] A Draft Environmental Impact Statement (DEIS) prepared by industry of entrainment at three Hudson River facilities (Roseton, Bowline, and Indian Point) predicted year-class reductions of up to 20 percent for striped bass, 25 percent for bay anchovy, and 43 percent for Atlantic tomcod.[11] The New York State Department of Environmental Conservation (NYSDEC) concluded that any "compensatory responses to this level of power plant mortality could seriously deplete any resilience or compensatory capacity of the species needed to survive unfavorable environmental conditions."[12] In the DEIS, the facilities argue that their operation has not harmed the local aquatic communities, because all observed population changes are attributable to causes other than the operation of the power plants, such as water chestnut growth, zebra mussel invasion, changes in commercial fishing, increases in salinity and improved water quality in the New York Harbor.

In contrast, the Final Environmental Impact Statement (FEIS) prepared by NYSDEC for these three facilities concludes that impacts are associated with the power plants and notes that these impacts are more like habitat degradation than the "selective cropping" of fish that occurs during regulated fishing because the entire community is impacted rather than specific species higher on the food chain.[13] The multiple facilities on the Hudson River act cumulatively on the entire aquatic community. New York State's 2002 section 316(b) report lists the Hudson River downstream from the Federal dam at Troy, New York, as impacted by cooling water use by power plants due to the loss each year of a substantial percentage of annual fish production. The FEIS estimates, from samples collected between 1981 and 1987, that the average annual entrainment losses from these three facilities includes 16.9 million American shad, 303.4 million striped bass, 409.6 million bay anchovy, 468 million white perch, and 826.2 million river herring.[14] In addition, related studies have found a small long-term decline in both species richness and diversity within the resident fish community. A commenter on the DEIS cited further evidence that Atlantic tomcod, Atlantic sturgeon, bluefish, weakfish, rainbow smelt, white perch and white catfish are showing long-term trends of declining abundance of 5 to 8% per annum.[15] Declines in abundances of several species and changes in species composition have raised concerns about the overall health of the community. The FEIS concluded that additional technology was necessary to minimize the adverse environmental impact from these three once-through systems.[16]

The FEIS further concluded that entrainment at these facilities has diminished the forage base for each species so there is less food available for the survivors. This disruption of the food chain compromises the health of the entire aquatic community. The FEIS used, as a simplified hypothetical example, the loss of an individual bay anchovy that would ordinarily serve as prey for a juvenile striped bass. If this individual bay anchovy is killed via entrainment and disintegrated upon

[6] For more information, please see Chapter A12: Threatened & Endangered Species Analysis Methods in the Regional Studies for the Final Section 316(b) Phase II Existing Facilities Rule.

[7] Impingement and entrainment data were obtained from the 2000 Draft Habitat Conservation Plan for the Pittsburg and Contra Costa facilities. Please see EPA's Regional Studies for the Final Section 316(b) Phase II Existing Facilities Rule for detailed information on EPA's evaluation of impingement and entrainment at these facilities.

[8] Florida Power and Light Company. 1995. Assessment of the impacts at the St. Lucie Nuclear Generating Plant on sea turtle species found in the inshore waters of Florida.

[9] Florida Power and Light Company. 2002. Florida Power & Light Company St. Lucie Plant Annual Environmental Operating Report 2002.

[10] Boreman J. and P. Goodyear. 1988. Estimates of entrainment mortality for striped bass and other fish species inhabiting the Hudson River Estuary. *American Fisheries Society Monograph* 4:152–160.

[11] Consolidated Edison Company of New York. 2000. Draft environmental impact statement for the state pollutant discharge elimination system permits for Bowline Point, Indian Point 2 & 3, and Roseton steam electric generating stations.

[12] New York State Department of Environmental Conservation (NYSDEC). 2000. Internal memorandum provided to the USEPA on NYDEC's position on SPDES permit renewals for Roseton, Bowline Point 1 & 2, and Indian Point 2 & 3 generating stations.

[13] New York State Department of Environmental Conservation (NYSDEC). 2003. Final Environmental Impact Statement: Concerning the Applications to Renew NYSPDES Permits for the Roseton 1 & 2, Bowling 1 & 2 and Indian Point 2 & 3 Steam Electric Generating Stations, Orange, Rockland and Westchester Counties.

[14] Ibid.

[15] Henderson, P.A. and R.M. Seaby. 2000. Technical comments on the Draft Environmental Impact Statement for the State Pollution Discharge Elimination System Permit Renewal for Bowline Point 1 & 2, Indian Point 2 & 3, and Roseton 1 & 2 Steam Generating Stations. Pisces Conservation Ltd.

[16] New York State Department of Environmental Conservation (NYSDEC). 2003. Final Environmental Impact Statement: Concerning the Applications to Renew NYSPDES Permits for the Roseton 1 & 2, Bowline 1 & 2 and Indian Point 2 & 3 Steam Electric Generating Stations, Orange, Rockland and Westchester Counties.

passage through a CWIS, it is no longer available as food to a striped bass, but rather it is only useful as food to lower trophic level organisms, such as detritivores (organisms that feed on dead organic material). Further, the bay anchovy would no longer be available to consume phytoplankton, which upsets the distribution of nutrients in the ecosystem.[17]

The Hudson River, like many waterbodies in the nation, has undergone many changes in the past few decades. These changes, which have affected fish populations either positively or negatively, include improvements to water quality as a result of upgrades to sewage treatment plants, invasions by exotic species such as zebra mussels, chemical contamination by toxins such as PCBs and heavy metals, global climate shifts such as increases in annual mean temperatures and higher frequencies of extreme weather events (*e.g.*, the El Niño-Southern Oscillation), and strict management of individual species stocks such as striped bass.[18] In addition, there are dramatic natural changes in fish populations on an annual basis and in the long term due to natural phenomena because the Hudson River, like many waterbodies, is a dynamic system with many fundamental, fluctuating environmental parameters—such as flow, temperature, salinity, dissolved oxygen, nutrients, and disease—that cause natural variation in fish populations each year.[19] The existence of these interacting variables makes it difficult to determine the exact contribution of impingement and entrainment losses on a population's relative health. Nonetheless, as described later in this section, EPA is concerned about the potential for cumulative impacts resulting from multiple facility intakes that collectively impinge and/or entrain aquatic organisms within a specific waterbody.

2. Mount Hope Bay

Environmental impacts were also studied in another recent permit reissuance for the Brayton Point Station in Somerset, Massachusetts, where EPA is the permitting authority. EPA determined that, among other things, the facility's cooling water system had contributed to the collapse of the fishery and inhibited its recovery despite stricter commercial and recreational fishing limits and improved water quality due to sewage treatment upgrades. The facility currently withdraws nearly one billion gallons of water each day and the average annual losses of aquatic organisms due to impingement and entrainment are estimated in the trillions, including 251 million winter flounder, 375 million windowpane flounder, 3.5 billion tautog and 11.8 billion bay anchovy. A dramatic change in the fish populations in Mount Hope Bay is apparent after 1984 with a decline by more than 87 percent, which coincides with a 45 percent increase in cooling water withdrawal from the bay due to the modification of Unit 4 from a closed-cycle recirculating system to a once-through cooling water system and a similar increase in the facility's thermal discharge.[20] [21] The downward trend of finfish abundance in Mount Hope Bay is significantly greater than declines in adjacent Narragansett Bay that is not influenced by the operation of Brayton Point Station.[22] Despite fishing restrictions, fish stocks have not recovered.

3. Southern California Bight

At the San Onofre Nuclear Generating Station (SONGS), in a normal (non-El Niño) year, an estimated 57 tons of fish were killed per year when all units were in operation.[23] The amount lost per year included approximately 350,000 juveniles of white croaker, a popular sport fish; this number represents 33,000 adult equivalents or 3.5 tons of adult fish. In shallow water, densities of queenfish and white croaker decreased 60 percent within one kilometer of SONGS and 35 percent within three kilometers from SONGS as compared to densities prior to facility operations. Densities of local midwater fish decreased 50 to 70 percent within three kilometers of the facility. In contrast, relative abundances of some bottom-dwelling species in the same areas were higher because of the enriched nature of the SONGS discharge, which in turn supported elevated numbers of prey items for bottom-dwelling fish.

4. Missouri River

In contrast to these examples, facilities sited on waterbodies previously impaired by anthropogenic activities such as channelization demonstrate limited entrainment and impingement losses. The Neal Generating Complex facility, located near Sioux City, Iowa, on the Missouri River is coal-fired and utilizes once-through cooling systems. According to a ten-year study conducted from 1972–82, the Missouri River aquatic environment near the Neal complex was previously heavily impacted by channelization and very high flow rates meant to enhance barge traffic and navigation.[24] These anthropogenic changes to the natural river system resulted in significant losses of fish habitat. At this facility, there was found to be little impingement and entrainment by cooling water intakes.

Studies like those described in this section provide only a partial picture of the range of environmental impacts associated with cooling water intake structures. Although numerous studies were conducted to determine the environmental impacts caused by impingement and entrainment at existing facilities, many of them are based on limited data that were collected as long as 25 years ago. EPA's review of available facility impingement and entrainment studies identified a substantial number of serious study design limitations, including data collections for only one to two years or limited to one season and for a subset of the species affected by cooling water intakes; limited taxonomic detail (*i.e.*, many losses not identified to the species level); a general lack of statistical information such as inclusion of variance measures in impingement and entrainment estimates; and the lack of standard methods and metrics for quantifying impingement and entrainment, which limits the potential for evaluating cumulative impacts across multiple facilities. Further, in many cases it is likely that facility operating conditions and/or the state of the waterbody itself has changed since these studies were conducted. Finally, the methods for monitoring impingement and entrainment used in the 1970s and 1980s, when most section 316(b) evaluations were performed, were often inconsistent and incomplete, making quantification of impacts difficult in some cases. Recent advances in environmental assessment techniques

[17] Ibid.

[18] Ibid.

[19] Ibid.

[20] Ibid.

[21] T Gibson, M. 1995 (revised 1996). Comparison of trends in the finfish assemblages of Mt. Hope Bay and Narragansett Bay in relation to operations for the New England Power Brayton Point station. Rhode Island Division of Fish and Wildlife, Marine Fisheries Office.

[22] EPA–New England. 2002. Clean Water Act NPDES Permitting Determinations for Thermal Discharge and Cooling Water Intake from Brayton Point Station in Somerset, MA (NPDES Permit No. MA 0003654). July 22, 2002.

[23] Murdoch, W.W., R.C. Fay, and B.J. Mechalas. 1989. Final Report of the Marine Review Committee to the California Coastal Commission. August 1989, MRC Document No. 89–02.

[24] Tondreau, R., J. Hey and E. Shane, Morningside College. 1982. Missouri River Aquatic Ecology Studies: Ten Year Summary (1972–1982). Prepared for Iowa Public Service Company, Sioux City, Iowa.

provide new and in some cases better tools for monitoring impingement and entrainment and quantifying the current magnitude of the impacts.[25] [26]

EPA is also concerned about the potential for cumulative impacts related to cooling water withdrawal. Cumulative impacts may result from (1) multiple facility intakes impinging and/or entraining aquatic organisms within a specific waterbody, watershed, or along the migratory pathway of specific species; (2) the existence of multiple stressors within a waterbody/watershed, including cooling water intake withdrawals; and (3) long-term occurrences of impingement and/or entrainment losses that may result in the diminishment of the compensatory reserve of a particular fishery stock.

Historically, environmental impacts related to cooling water intake structures have been evaluated on a facility-by-facility basis. These historical evaluations do not consider the potential for a fish or shellfish species to be concomitantly impacted by cooling water intake structures belonging to other facilities that are located within the same waterbody or watershed in which the species resides or along the coastal migratory route of a particular species. The potential cumulative effects of multiple intakes located within a specific waterbody or along a coastal segment are difficult to quantify and are not typically assessed. (One relevant example is provided for the Hudson River; see discussion earlier in this section.) Nonetheless, EPA analyses suggest that almost a quarter of all Phase II existing facilities are located on a waterbody with another Phase II existing facility (DCN 4–4009). Thus, EPA is concerned that although the potential for aquatic species to be affected by cooling water withdrawals from multiple facility intakes is high, this type of cumulative impact is largely unknown and has not adequately been accounted for in evaluating impacts. However, recently the Atlantic States Marine Fisheries Commission (ASMFC) was requested by its member States to investigate the cumulative impacts on commercial fishery stocks, particularly overutilized stocks, attributable to cooling water intakes located in coastal regions of the Atlantic.[27] Specifically, the ASMFC study will evaluate the potential cumulative impacts of multiple intakes on Atlantic menhaden stock [28] which range along most of the U.S. Atlantic coast with a focus on revising existing fishery management models so that they accurately consider and account for fish losses from multiple intake structures. Results from these types of studies, although currently unavailable, will provide significant insight into the degree of impact attributable to intake withdrawals from multiple facilities.

EPA also considered information suggesting that impingement and entrainment, in conjunction with other factors, may be a nontrivial stress on a waterbody. EPA recognizes that cooling water intake structures are not the only source of human-induced stress on aquatic systems. Additional stresses to aquatic systems include, but are not limited to, nutrient, toxics, and sediment loadings; low dissolved oxygen; habitat loss; and stormwater runoff. Although EPA recognizes that a nexus between a particular stressor and adverse environmental impact may be difficult to establish with certainty, EPA believes stressors that cause or contribute to the loss of aquatic organisms and habitat such as those described above, may incrementally impact the viability of aquatic resources. EPA analyses suggest that over 99 percent of all existing facilities with cooling water withdrawal that EPA surveyed in its section 316(b) survey of existing facilities are located within two miles of waters that are identified as impaired by a State or Tribe (see 66 FR 65256, 65297). Thus, the Agency is concerned that to the extent that many of the aquatic organisms subject to the effects of cooling water withdrawals reside in impaired waterbodies, they are potentially more vulnerable to cumulative impacts from an array of physical and chemical anthropogenic stressors.

Finally, EPA believes that an aquatic population's potential compensatory ability—the capacity for a species to increase its survival, growth, or reproduction in response to reductions sustained to its overall population size—may be compromised by impingement and entrainment losses in conjunction with all the other stressors encountered within a population's natural range, as well as impingement and entrainment losses occurring consistently over extended periods of time. As discussed in the Phase I new facility rule (see 66 FR 65294), EPA is concerned that even if there is little evidence that cooling water intakes alone reduce a population's compensatory reserve, the multitude of stressors experienced by a species can potentially adversely affect its ability to recover.[29] Moreover, EPA notes that the opposite effect or "depensation" (decreases in recruitment as stock size declines[30]) may occur if a population's size is reduced beyond a critical threshold. Depensation can lead to further decreases in population abundances that are already seriously depleted and, in some cases, recovery of the population may not be possible even if the stressors are removed. In fact, there is some evidence that depensation may be a factor in some recent fisheries collapses.[31] [32] [33]

Another problem associated with assessing the environmental impact of cooling water intakes is that existing fishery resource baselines may be inaccurate.[34] There is much evidence that the world's fisheries are in general decline,[35] [36] however, many fishery stocks have not been adequately assessed. According to a 2002 study, only 23 percent of U.S. managed fish stocks have been fully assessed and of these, over 40 percent are considered depleted or are being fished beyond sustainable levels.[37] Another study estimated that more than 70 percent of commercial fish stocks are fully

[25] Schmitt, R.J. and C.W. Osenberg. 1996. Detecting Ecological Impacts. Academic Press, San Diego, CA.

[26] EPRI 1999. Catalog of Assessment Methods for Evaluating the Effects of Power Plant Operations on Aquatic Communities. TR–112013, EPRI, Palo Alto, CA.

[27] Personal communication, D. Hart (EPA) and L. Kline (ASMFC), 2001.

[28] Personal communication, D. Hart (EPA) and L. Kline (ASMFC), 2003.

[29] Hutchings, J.A. and R.A. Myers. 1994. What can be learned from the collapse of a renewable resource? Atlantic cod, *Gadus morhus*, of Newfoundland and Labrador. Canadian Journal of Fisheries and Aquatic Sciences 51:2126–2146.

[30] Goodyear, C.P. 1977. Assessing the impact of power plant mortality on the compensatory reserve of fish populations. Pages 186–195 in W. Van Winkle, ed., Proceedings of the Conference on Assessing the Effects of Power Plant Induced Mortality on Fish Populations. Pergamon Press, New York, NY.

[31] Myers, R.A., N.J. Barrowman, J.A. Hutchings, and A.A. Rosenburg. 1995. Population dynamics of exploited fish stocks at low population levels. Science 26:1106–1108.

[32] Hutchings, J.A. and R.A. Myers. 1994. What can be learned from the collapse of a renewable resource? Atlantic cod, *Gadus morhus*, of Newfoundland and Labrador. Canadian Journal of Fisheries and Aquatic Sciences 51:2126–2146.

[33] Liermann, M. and R. Hilborn. 1997. Depensation in fish stocks: A hierarchic Bayesian meta-analysis. Can. J. Fish. Aquatic. Sci. 54:1976–1985.

[34] Watson, R. and D. Pauly. 2001. Systematic distortions in world fisheries catch trends. Nature 414:534–536.

[35] Ibid.

[36] Pew Oceans Commission. 2003. America's Living Oceans: Charting a course for sea change. Summary Report. May 2003. Pew Oceans Commission, Arlington, VA.

[37] U.S. Commission on Ocean Policy. 2002. Developing a National Ocean Policy: Mid-Term Report of the U.S. Commission on Ocean Policy. Washington, DC.

exploited, overfished or collapsed.[38] Another estimated that large predatory fish stocks are only a tenth of what they were 50 years ago.[39] Most studies of fish populations last only a few years, do not encompass the entire life span of the species examined, and do not account for cyclical environmental changes such as ENSO events, and other long term cycles of oceanographic productivity.[40]

Although a clear and detailed picture of the status of all our fishery resources does not exist,[41] it is undisputed that fishermen are struggling to sustain their livelihood despite strict fishery management restrictions which aim to rebuild fish populations. EPA shares the concerns expressed by expert fishery scientists that historical overfishing has increased the sensitivity of aquatic ecosystems to subsequent disturbance, making them more vulnerable to other stressors, including cooling water intake structures.

In conclusion, EPA's mission includes ensuring the sustainability of communities and ecosystems. Thus, EPA must comprehensively evaluate all potential threats to resources and work towards eliminating or reducing identified threats. As discussed in this section, EPA believes that impingement and entrainment losses attributable to cooling water intakes do pose a threat to aquatic organisms and through today's rule is seeking to minimize that threat.

## V. Description of the Final Rule

Clean Water Act section 316(b) requires that any standard established pursuant to section 301 or section 306 of the CWA and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact. Today's final rule establishes national performance requirements for Phase II existing facilities that ensure such facilities fulfill the mandate of section 316(b).

This rule applies to Phase II existing facilities that use or propose to use a cooling water intake structure to withdraw water for cooling purposes from waters of the United States and that have or are required to have a National Pollutant Discharge Elimination System (NPDES) permit issued under section 402 of the CWA. Phase II existing facilities include only those facilities whose primary activity is to generate and transmit electric power and who have a design intake flow of 50 MGD or greater, and that use at least 25 percent of the water withdrawn exclusively for cooling purposes (see § 125.91). Applicability criteria for this rule are discussed in detail in section II of this preamble.

Under this final rule, EPA has established performance standards for the reduction of impingement mortality and, when appropriate, entrainment (see § 125.94). The performance standards consist of ranges of reductions in impingement mortality and/or entrainment (*e.g.*, reduce impingement mortality by 80 to 95 percent and/or entrainment by 60 to 90 percent). These performance standards reflect the best technology available for minimizing adverse environmental impacts determined on a national categorical basis. The type of performance standard applicable to a particular facility (*i.e.*, reductions in impingement only or impingement and entrainment) is based on several factors, including the facility's location (*i.e.*, source waterbody), rate of use (capacity utilization rate), and the proportion of the waterbody withdrawn. Exhibit V–1 summarizes the performance standards based on waterbody type.

In most cases, EPA believes that these performance standards can be met using design and construction technologies or operational measures. However, under the rule, the performance standards also can be met, in whole or in part, by using restoration measures, following consideration of design and construction technologies or operational measures and provided such measures meet restoration requirements (see § 125.94(c)).

As noted earlier in this section, today's rule generally requires that impingement mortality of all life stages of fish and shellfish must be reduced by 80 to 95 percent from the calculation baseline; and for some facilities, entrainment of all life stages of fish and shellfish must be reduced by 60 to 90 percent from the calculation baseline (see § 125.94(b)).

EXHIBIT V–1.—PERFORMANCE STANDARD REQUIREMENTS

| Waterbody type | Capacity utilization rate | Design intake flow | Type of performance standard |
|---|---|---|---|
| Freshwater River or Stream | Less than 15% | N/A [1] | Impingement mortality only. |
| | Equal to or greater than 15%. | 5% or less mean annual flow. | Impingement mortality only. |
| | | Greater than 5% of mean annual flow. | Impingement mortality and entrainment. |
| Tidal river, Estuary or Ocean | Less than 15% | N/A [1] | Impingement mortality only. |
| | Equal to or greater than 15%. | N/A | Impingement mortality and entrainment. |
| Great Lakes | Less than 15% | N/A | Impingement mortality only. |
| | Equal to or greater than 15%. | N/A | Impingement mortality and entrainment. |

[38] Broad, W.J. and A.C. Revkin. 2003. Has the Sea Given Up its Bounty? The New York Times, July 29, 2003.

[39] Myers, R.A. and B. Worm. 2003. Rapid worldwide depletion of predatory fish communities. Nature 423: 280–283.

[40] Jackson, J.B.C., M.X. Kirby, W.H. Berger, K.A. Bjorndal, L.W. Botsford, B.J. Bourque, R.H. Bradbury, R. Cooke, J. Erlandson, J.A. Estes, T.P. Hughes, S. Kidwell, C.B. Lange, H.S. Lenihan, J.M. Pandolfi, C.H. Peterson, R.S. Steneck, M.J. Tegner, and R.R. Warner. 2001. Historical overfishing and the recent collapse of coastal ecosystems. Science 293(5530):629–638.

[41] National Marine Fisheries Service (NMFS). 2002. Annual Report to Congress on the Status of U.S. Fisheries—2001. U.S. Dep. Commerce, NOAA, Natl. Mar. Fish. Serv., Silver Spring, MD, 142 pp.

EXHIBIT V–1.—PERFORMANCE STANDARD REQUIREMENTS—Continued

| Waterbody type | Capacity utilization rate | Design intake flow | Type of performance standard |
|---|---|---|---|
| Lakes or Reservoirs | N/A | Increase in design intake flow must not disrupt thermal stratification except where it does not adversely affect the management of fisheries. | Impingement mortality only. |

[1] Determination of appropriate compliance reductions is not applicable.

This final rule identifies five alternatives a Phase II existing facility may use to achieve compliance with the requirements for best technology available for minimizing adverse environmental impacts associated with cooling water intake structures. Four of these are based on meeting the applicable performance standards and the fifth allows the facility to request a site-specific determination of best technology available for minimizing adverse environmental impacts under certain circumstances. EPA has established these compliance alternatives for meeting the performance standards to provide a significant degree of flexibility to Phase II existing facilities, to ensure that the rule requirements are economically practicable, and to provide the ability for Phase II existing facilities to address unique site-specific factors. Application requirements vary based on the compliance alternative selected and, for some facilities, include development of a Comprehensive Demonstration Study. Application requirements are discussed later in this section. The five compliance alternatives are described in the following paragraphs.

Under § 125.94(a)(1)(i) and (ii), a Phase II existing facility may demonstrate to the Director that it has already reduced its flow commensurate with a closed-cycle recirculating system, or that it has already reduced its design intake velocity to 0.5 ft/s or less. If a facility can demonstrate to the Director that it has reduced, or will reduce, flow commensurate with a closed-cycle recirculating system, the facility is deemed to have met the performance standards to reduce impingement mortality and entrainment (see § 125.94 (a)(1)(i)). Those facilities would not be required to submit a Comprehensive Demonstration Study with their NPDES application. If the facility can demonstrate to the Director that is has reduced, or will reduce maximum through-screen design intake velocity to 0.5 ft/s or less, the facility is deemed to have met the performance standards to reduce impingement mortality only. Facilities that meet the velocity requirements would only need to submit application studies related to determining entrainment reduction, if subject to the performance standards for entrainment.

Under § 125.94(a)(2) and (3), a Phase II existing facility may demonstrate to the Director, either that its current cooling water intake structure configuration meets the applicable performance standards, or that it has selected design and construction technologies, operational measures, and/or restoration measures that, in combination with any existing design and construction technologies, operational measures, and/or restoration measures, meet the specified performance standards in § 125.94(b) and/or the requirements in § 125.94(c).

Under § 125.94(a)(4), a Phase II existing facility may demonstrate to the Director that it has installed and is properly operating and maintaining a rule-specified and approved design and construction technology in accordance with § 125.99(a). Submerged cylindrical wedgewire screen technology is a rule-specified design and construction technology that may be used in instances in which a facility's cooling water intake structure is located in a freshwater river or stream and meets other criteria specified at § 125.99(a).

In addition, under this compliance alternative, a facility or other interested person may submit a request to the Director for approval of a different technology. If the Director approves the technology, it may be used by all facilities with similar site conditions under his or her jurisdiction if allowed under the State's administrative procedures. Requests for approval of a technology must be submitted to the Director and include a detailed description of the technology; a list of design criteria for the technology and site characteristics and conditions that each facility must possess in order to ensure that the technology can consistently meet the appropriate impingement mortality and entrainment performance standards in § 125.94(b); and information and data sufficient to demonstrate that all facilities under the jurisdiction of the Director can meet the relevant impingement mortality and entrainment performance standards in § 125.94(b) if the applicable design criteria and site characteristics and conditions are present at the facility. A Director may only approve an alternative technology following public notice and opportunity for comment on the approval of the technology (§ 125.99(b)).

Under § 125.94(a)(5) (i) or (ii), if the Director determines that a facility's costs of compliance would be significantly greater than the costs considered by the Administrator for a like facility to meet the applicable performance standards, or that the costs of compliance would be significantly greater than the benefits of meeting the applicable performance standards at the facility, the Director must make a site-specific determination of best technology available for minimizing adverse environmental impact. Under this alternative, a facility would either compare its projected costs of compliance using a particular technology or technologies to the costs the Agency considered for a like facility in establishing the applicable performance standards, or compare its projected costs of compliance with the projected benefits at its site of meeting the applicable performance standards of today's rule (see section IX.H). If in either case costs are significantly greater, the technology selected by the Director must achieve an efficacy level that comes as close as practicable to the applicable performance standards without resulting in significantly greater costs.

During the first permit term, a facility that chooses compliance alternatives in § 125.94(a)(2), (3), (4), or (5) may request that compliance with the requirements of this rule be determined based on the implementation of a Technology Installation and Operation Plan indicating how the facility will install and ensure the efficacy, to the extent practicable, of design and construction

technologies and/or operational measures, and/or a Restoration Plan (§ 125.95(b)(5)). The Technology Installation and Operation Plan must be developed and submitted to the Director in accordance with § 125.95(b)(4)(ii). The Restoration Plan must be developed in accordance with § 125.95(b)(5). During subsequent permit terms, if the facility has been in compliance with the construction, operational, maintenance, monitoring, and adaptive management requirements in its TIOP and/or Restoration Plan during the preceding permit term, the facility may request that compliance during subsequent permit terms be based on its remaining in compliance with its TIOP and/or Restoration Plan, revised in accordance with applicable adaptive management requirements if the applicable performance standards are not being met.

Three sets of data are required to be submitted 180 days prior to expiration of a facility's existing permit by all facilities regardless of compliance alternative selected (see § 122.21(r)(2)(3) and (5)). These are:

- Source Water Physical Data: A narrative description and scaled drawings showing the physical configuration of all source waterbodies used by the facility, including areal dimensions, depths, salinity and temperature regimes, and other documentation that supports your determination of the waterbody type where each cooling water intake structure is located; identification and characterization of the source waterbody's hydrological and geomorphological features, as well as the methods used to conduct any physical studies to determine the intake's area of influence and the results of such studies; and locational maps.
- Cooling Water Intake Structure Data: A narrative description of the configuration of each of its facility's cooling water intake structures and where it is located in the waterbody and in the water column; latitude and longitude in degrees, minutes, and seconds for each of its cooling water intake structures; a narrative description of the operation of each of its cooling water intake structures, including design intake flows, daily hours of operation, number of days of the year in operation, and seasonal changes, if applicable; a flow distribution and water balance diagram that includes all sources of water to the facility, recirculating flows, and discharges; and engineering drawings of the cooling water intake structure.
- Cooling Water System Data: A narrative description of the operation of each cooling water system, its relationship to the cooling water intake structures, proportion of the design intake flow that is used in the system, the number of days of the year the system is in operation, and seasonal changes in the operation of the system, if applicable; and engineering calculations and supporting data to support the narrative description.

In addition to the specified data facilities are require to submit, some facilities are also required to conduct a Comprehensive Demonstration Study. Specific requirements for the Comprehensive Demonstration Study vary based on the compliance alternative selected. Exhibit II summarizes the Comprehensive Demonstration Study requirements for each compliance alternative. Specific details of each Comprehensive Demonstration Study component are provided in section IX of this preamble.

EXHIBIT V–2.—SUMMARY OF COMPREHENSIVE DEMONSTRATION STUDY REQUIREMENTS FOR COMPLIANCE ALTERNATIVES

| Compliance alternative (§ 125.94(b)) | Comprehensive demonstration study requirements (§ 125.95(b)) |
|---|---|
| 1—Demonstrate facility has reduced flow commensurate with closed-cycle recirculating system. | None. |
| 1—Demonstrate facility has reduced design intake velocity to ≤ 0.5 ft/s | No requirements relative to impingement mortality reduction. If subject to entrainment performance standard, the facility must only address entrainment in the applicable components of its Comprehensive Demonstration Study, based on the compliance option selected for entrainment reduction. |
| 2—Demonstrate that existing design and construction technologies, operational measures, and/or restoration measures meet the performance standards. | Proposal for Information Collection.<br>Source Waterbody Flow Information.<br>Impingement Mortality and/or Entrainment Characterization Study (as appropriate).<br>Technology and Compliance Assessment Information<br>—Design and Construction Technology Plan<br>—Technology Installation and Operation Plan<br>Restoration Plan (if appropriate).<br>Verification Monitoring Plan. |
| 3—Demonstrate that facility has selected design and construction technologies, operational measures, and/or restoration measures that will, in combination with any existing design and construction technologies, operational measures, and/or restoration measures, meet the performance standards. | Proposal for Information Collection.<br>Source Waterbody Flow Information.<br>Impingement Mortality and/or Entrainment Characterization Study (as appropriate).<br>Technology and Compliance Assessment Information<br>—Design and Construction Technology Plan<br>—Technology Installation and Operation Plan<br>Restoration Plan (if appropriate).<br>Verification Monitoring Plan. |
| 4—Demonstrate that facility has installed and properly operates and maintains an approved technology. | Technology Installation and Operation Plan.<br>Verification Monitoring Plan. |

EXHIBIT V–2.—SUMMARY OF COMPREHENSIVE DEMONSTRATION STUDY REQUIREMENTS FOR COMPLIANCE ALTERNATIVES—Continued

| Compliance alternative (§ 125.94(b)) | Comprehensive demonstration study requirements (§ 125.95(b)) |
|---|---|
| 5—Demonstrate that a site-specific determination of BTA is appropriate | Proposal for Information Collection.<br>Source Waterbody Flow Information.<br>Impingement Mortality and/or Entrainment Characterization Study (as appropriate).<br>Technology Installation and Operation Plan.<br>Restoration Plan (if appropriate).<br>Information to Support Site Specific Determination of BTA including:<br>—Comprehensive Cost Evaluation Study (cost-cost test and cost-benefit test);<br>—Valuation of Monetized Benefits of Reducing IM&E (cost-benefit test only);<br>—Site-Specific Technology Plan (cost-cost test and cost-benefit test);<br>Verification Monitoring Plan. |

The requirements in today's final rule are implemented through NPDES permits issued under section 402 of the CWA. Permit applications submitted after the effective date of the rule must fulfill rule requirements. However, facilities whose existing permit expires before [insert four years after date of publication in the FR], may request a schedule for submission of application materials that is as expeditious as practicable but does not exceed [insert three years and 180 days after date of publication in the FR], to provide sufficient time to perform the required information collection requirements. Phase II existing facilities must comply with this final rule when they become subject to an NPDES permit containing these requirements.

Finally, today's rule preserves each State's right to adopt or enforce more stringent requirements (see § 125.90(d)). It also provides that if a State demonstrates to the Administrator that it has adopted alternative regulatory requirements in its NPDES program that will result in environmental performance within a watershed that is comparable to the reductions of impingement mortality and entrainment that would otherwise be achieved under § 125.94, the Administrator must approve such alternative regulatory requirements (§ 125.90(c)).

## VI. Summary of Most Significant Revisions to the Proposed Rule

### *A. Data Updates*

Based on comments received, additional information made available, and the results of subsequent analyses, EPA revised a number of assumptions that were used in developing the engineering costs, the information collection costs, the economic analyses, and the benefits analyses. These new assumptions are presented below and were used in the analyses in support of this final rule.

1. Number of Phase II Facilities

Since publishing the NODA, EPA continued to verify design flow information for facilities that had been classified as either Phase II (large, existing power production) or Phase III (smaller, power producing or manufacturing) facilities. This verification resulted in the following changes: One facility that was classified as a Phase II facility at proposal was reclassified as being out of scope of the section 316(b) regulation, as it ceased operating. Four facilities that were classified as Phase III facilities at proposal based on projected design intake flow were reclassified as Phase II facilities. As a result, the overall number of Phase II facilities increased from 540 to 543 facilities.[42] For the final rule, all costs, benefits, and economic analyses are based on the updated set of Phase II facilities.

The reason for the change is that the Agency revised the estimated design intake flows for facilities that responded to the short-technical questionnaire EPA used to collect information for this rule. The Agency has now adopted a more robust set of annual flow data (using all the years of data collected for the final rule, rather than only flows for 1998 as reported at proposal). This change altered the calculated design intake flows for the facilities that provided responses to the short-technical questionnaire that EPA used to collect data. Facilities that provided responses to the detailed questionnaire were unaffected, as the Agency collected maximum design intake flows directly through the detailed questionnaire.

2. Technology Costs

Since publishing the NODA, EPA used new information to revise the capital and operation and maintenance (O&M) costs for several compliance technologies, including those used as the primary basis for the final rule. Overall, the cost updates resulted in the following changes: total capital costs decreased by 5 percent and total operation and maintenance costs decrease by 3 percent. These comparisons are based on the raw costs, adjusted to year-2002 dollars, which have not been discounted or annualized.[43] The revised costing assumptions are discussed in detail in section VI.3.

3. Permitting and Monitoring Costs

Since proposal, EPA made several corrections and revisions to its burden and cost estimates for implementing the information collection requirements of today's rule, based on comments received and additional analysis. The following corrections and revisions were made since proposal:

- EPA corrected the hourly rates for the statistician and biological technician labor categories, which were inadvertently transposed at proposal.
- EPA increased the burdens associated with impingement and entrainment monitoring for the Impingement Mortality and Entrainment Characterization Study.

[42] Note that these numbers are unweighted. [As with many surveys, EPA was able to obtain data from most, but not all of the facilities potentially subject to this rule. To estimate the characteristics for those facilities that were not surveyed, EPA assigned a statistically derived sample weight to those facilities for which data were collected.] On a sample-weighted basis, the number of Phase II facilities increased from 551 to 554. The number of Phase II facilities modeled by the Integrated Planning Model (IPM) increased from 531 to 535.

[43] Based on additional research conducted after NODA publication and prior to issuance of the final rule, EPA changed the projected compliance response for some facilities. These changes, together with the increase in the number of in-scope Phase II facilities, contributed to the change in total compliance costs.

• EPA revised the pilot study costs to assume that only a subset of facilities which are projected to install new technologies will perform pilot studies, and to be proportional to the projected capital costs for installing these new technologies in order to comply with the rule. EPA also developed an alternative national cost estimate using slightly different assumptions with regard to pilot study costs (see section XI).

• EPA adjusted the facility-level costs to account for facilities that were projected to demonstrate compliance through the installation of a wedge-wire screen in a freshwater river under the compliance alternative in 125.94(a)(4).

4. Net Installation Downtime for Non-recirculating Cooling Tower Compliance Technologies

In developing the proposal for this rule, the Agency estimated that technologies other than recirculating cooling towers would not require installation downtime for construction. However, the Agency amended this outlook for the NODA and published revised estimates of net construction downtimes for complying facilities installing a subset of technologies analyzed and developed as candidates for best technology available (BTA). Based on comments received on the NODA, the Agency has conducted further research into the construction downtimes that it used in the NODA for certain technologies. For the final regulation analysis, the Agency has adopted minor revisions to the construction downtimes for certain technologies, with the general effect being an increase in the net construction downtimes for a few technologies that the Agency views as candidates for reducing entrainment. (Net downtime was estimated by subtracting 4 weeks from total downtime, based on an assumption that facilities will schedule construction downtime during a 4 week period of normal downtime unrelated to the rule, for example, for routine maintenance.) As such, the Agency projects that a significant number of facilities expected to comply with the entrainment reduction requirements of the rule will have increased downtime costs compared to the NODA and the proposal analyses. The final costs of this rule reflect these changes, which are further discussed in Section X and the Technical Development Document.

*B. Regulatory Approach, Calculation Baseline, and Measuring Compliance*

1. Regulatory Approach

EPA has largely adopted the proposed rule with some restructuring and one significant change: an additional compliance alternative, the approved technology option (§ 125.94(a)(4)) which was discussed in detail in the NODA (68 FR 13539). The restructuring of the rule language now makes the reduction of flow commensurate with a closed-cycle recirculating system a separate compliance alternative, such that the rule now includes five compliance alternatives. In addition, EPA has clarified that facilities may comply with the rule requirement in section 125.94 by successfully implementing the construction, operational, maintenance, monitoring, and adaptive management requirements in a Technology Installation and Operation Plan developed in accordance with § 125.95(b)(4)(ii) and/or a Restoration Plan developed in accordance with § 125.95(b)(5). These plans must be designed and adaptively managed to meet the applicable performance standards in § 125.94(b) and (c). The following discussion describes the regulatory approach of the final rule, as developed through the proposed rule and the NODA.

EPA proposed requirements for the location, design, construction, and capacity of cooling water intakes based on the waterbody type and the volume of water withdrawn by a facility (67 FR 17122). EPA grouped waterbodies into five categories, as in the Phase I regulation—freshwater rivers and streams, lakes and reservoirs, Great Lakes, estuaries and tidal rivers, and oceans. In general, the more sensitive or biologically productive the waterbody, the more stringent were the requirements proposed. The proposed requirements also varied based on the percentage of the source waterbody withdrawn and the capacity utilization rate.

Under the proposed rule, a facility could choose one of three compliance options: (1) Demonstrate that the facility currently meets the specified performance standards, (2) select and implement design and construction technologies, operational measures, or restoration measures that will, in combination with any existing design and construction technologies, operational measures, or restoration measures, meet the specified performance standards, and/or (3) demonstrate that the facility qualifies for a site-specific determination of best technology available, because its costs of compliance are significantly greater than those considered by EPA during the development of the proposed rule or the facility's costs of compliance would be significantly greater than the benefits of compliance with the proposed performance standards at the facility. A facility could also use restoration measures in addition to or in lieu of design and construction technologies and/or operational measures to achieve compliance under any of the compliance options.

In the NODA, EPA sought comment on a proposed fourth compliance option (68 FR 13522, 1359–41). In response to comments expressing concern that the proposed Comprehensive Demonstration Study requirements (at § 125.95(b)) would impose a significant burden on permit applicants, EPA examined an additional, more streamlined compliance option under which a facility could implement certain specified technologies that have been predetermined by EPA or the permitting authority to be highly likely to meet applicable performance standards, in exchange for not having to perform most of the elements of the proposed Comprehensive Demonstration Study.

Two variations were offered in the NODA: (1) EPA would evaluate the effectiveness of specific technologies in achieving an 80 to 95 percent reduction in impingement mortality and a 60 to 90 percent reduction in entrainment and then specify applicability criteria to ensure that the technology would meet the performance standards at facilities satisfying the criteria, or (2) EPA would establish the criteria and a process for States to pre-approve intake structure control technologies as likely to meet the performance standards. For facilities located on freshwater rivers and streams and meeting specified criteria, wedgewire screens would be expected to meet the proposed performance standards. EPA also recognized that these two variations are not mutually exclusive and either or both could be adopted in the final rule.

To a large extent, EPA is adopting the regulatory framework put forth in the proposed rule and supplemented by the NODA. To the three compliance alternatives originally proposed, EPA has added an approved technology alternative discussed in the NODA and included reduction of flow commensurate with closed-cycle cooling as a distinct alternative.

2. Calculation Baseline

Also, in response to comments that the proposed definition for the calculation baseline was overly vague,

EPA published in the NODA a series of additional considerations regarding the calculation baseline and a new definition of it taking these considerations into account (68 FR 13522, 13580–81). The specifications are as follows and the new definition is in today's final rule at § 125.93.

- Baseline cooling water intake structure is located at, and the screen face is parallel to, the shoreline or another depth if this would result in higher baseline impingement mortality and entrainment than the surface. EPA believes it is appropriate to allow credit in reducing impingement mortality from screen configurations that employ angling of the screen face and currents to guide organisms away from the structure before they are impinged.
- Baseline cooling water intake structure opening is located at or near the surface of the source waterbody. EPA believes it is appropriate to allow credit in reducing impingement mortality or entrainment due to placement of the opening in the water column.
- Baseline cooling water intake structure has a traveling screen with the standard 3/8 inch mesh size commonly used to keep condensers free from debris. This allows a more consistent estimation of the organisms that are considered "entrainable" vs. "impingeable" by specifying a standard mesh size that can be related to the size of the organism that may potentially come in contact with the cooling water intake structure.
- Baseline practices, procedures, and structural configurations are those that the facility would maintain in the absence of any structural or operational controls implemented in whole or in part for the purpose of reducing impingement mortality and entrainment. This recognizes and provides credit for any structural or operational controls, including flow or velocity reductions, a facility had adopted that reduce impingement mortality or entrainment.

EPA also requested comment on allowing an "as built" approach under which facilities could choose to use the existing level of impingement mortality and entrainment as the calculation baseline if they did not wish to take credit for the previously adopted measures. This could significantly simplify the monitoring and calculations necessary to determine the baseline.

In the NODA, EPA also discussed an approach to compliance under which facilities would have an "optimization period" during which they would not be required to meet performance standards but, rather, would install, operate and maintain the selected control technologies to minimize impingement mortality and entrainment. EPA suggested several possible durations for this optimization period, and also requested comment on not specifying the duration, but instead leaving it up to the Director. 68 FR 13586 (March 19, 2003).

For the final rule, EPA adopted the NODA definition of calculation baseline with some modifications. More specifically, EPA clarified the calculation baseline to include consideration of intake depth other than at or near the surface in determining the baseline. EPA also adopted the "as built" approach for the calculation baseline, which allows facilities to use current levels of impingement mortality and entrainment as the calculation baseline if the facility is configured similarly to the criteria set up for the calculation baseline.

Finally, EPA clarified how compliance with the requirements in § 125.94 should be determined. In particular, the final rule provides that compliance during the first permit term (and subsequent permit terms if specified conditions are met) may be determined based on compliance with the construction, operational, maintenance, monitoring, and adaptive management requirements in an approved Technology Installation and Operation Plan and/ or an approved Restoration Plan, that has been developed in accordance with specified requirements to meet the applicable performance standards.

3. Measuring Compliance

EPA has clarified how compliance will be measured. At proposal, EPA received comment from the industry that there were uncertainties associated with how compliance with the proposed requirements, particularly the numeric impingement mortality and entrainment performance standards, would be determined. Under the proposed rule and NODA, determining compliance, while obviously dependent on the compliance alternative selected, would, in general, require the development of waterbody characterization data, including key criteria (species, parameters, etc.) to be measured and monitored; a determination of baseline environmental impacts; implementation of cooling water intake technologies (assuming the facility does not already meet applicable performance standards and pursues this alternative); monitoring the selected criteria; and an evaluation of compliance with the applicable numeric impingement mortality and/or entrainment permit standard. The industry stakeholders were concerned that using the performance standard to set enforceable performance requirements would require facilities to collect and analyze greater amounts of data than EPA projected to be able to account for the variability inherent in biological and efficacy data needed to support compliance determinations in spite of overall good technology performance. These stakeholders stated that setting enforceable performance standards would lead to greater administrative burdens and delays when determining numeric standards and monitoring requirements to determine compliance. They were also concerned that establishing numeric standards would stifle innovation because of fears that a technology would not perform as anticipated. These stakeholders suggested that the performance standards in the rule serve as a consistent basis for setting permit conditions and for identifying technologies; installing, operating, and maintaining the chosen technology; performing compliance monitoring; and refining or adjusting operation, maintenance, or other factors in light of initial monitoring.

Today's rule allows facilities to develop and implement a Technology Installation and Operation Plan that would, when used, serve as the primary mechanism upon which compliance with the performance standard requirements of this rule is determined. EPA has established this compliance mechanism because it will ensure that Phase II existing facilities will continually be required to achieve a level of performance that constitutes, for them, best technology available for minimizing adverse environmental impact. For facilities that choose to comply with applicable requirements in whole or in part through the use of restoration measures, the Restoration Plan would serve a similar function. The Restoration Plan is discussed in detail in section IX.

An existing facility that chooses to use a Technology Installation and Operation Plan must (1) select design and construction technologies, operational measures, and/or restoration measures that will meet the performance standards, and (2) prepare a Technology Installation and Operation Plan documenting what, how and when it will install, operate, maintain, monitor, assess, and adaptively manage the design and construction technologies and operational measures to meet the performance standards, including operational parameters and

inspection schedules, etc. Each facility using a Technology Installation Operation Plan must specify key parameters regarding monitoring (*e.g.*, parameters to be monitored, location, and frequency), optimization activities and schedules for undertaking them, ways of assessing efficacy (including adaptive management plan for revising design and construction technologies or operational measures) that ensure that such technologies and measures are effectively implemented, and revised as needed to meet performance standards. This plan must be reviewed and approved by the Director and evaluated for sufficiency and/or revised at each permit term to ensure that the facility is moving expeditiously toward attainment of the applicable performance standards. Once approved, each Phase II existing facility must implement the plan according to its terms. Compliance with the final rule's performance standards during the permit term will be assessed based on the terms of the plan. If a facility does not comply with the plan, the Director has discretion to implement the performance standards or requirements through specifying numeric impingement mortality and entrainment requirements or technology prescription (for the site-specific alternative) in the permit. In addition, a facility that is unable to meet the applicable performance standards using the Technology Installation and Operation Plan approach may request in a subsequent permit that the Director make a site-specific determination of best technology available in accordance with § 125.94(a)(5).

Under these provisions, compliance is determined in terms of whether the facility is implementing, in accordance with the Technology Installation and Operation Plan schedule, the technologies, measures and practices determined by the Director to be the best technologies available for minimizing adverse environmental impact for that facility. The Section 316(b) requirements for the facility are expressed non-numerically, which is analogous to the use of best management practices under other provisions of the CWA. See, *e.g.*, sections 402(a) and 402(p). While EPA has been able to calculate ranges for national performance standards based on model technologies, EPA has insufficient data to determine—as it routinely can do in the context of effluent limitations guidelines and standards—that use of those model technologies will consistently result in achievement of those standards.

The record persuades EPA that there is uncertainty associated with the application and long-term efficacy of these technologies at all facilities under the multitude of different site-specific factors and conditions under which these technologies might have to perform. In addition, even at a single site, there is substantial year-to-year variability in species abundance and composition, as well as other natural and anthropogenic factors, that may affect the performance of a particular technology installed at the facility and it is unclear how this would affect the efficacy of the technology. The Technology Installation and Operation Plan provisions are intended to account for this. For example, meeting numerical reduction standards may not be possible at some sites either because hydrological conditions are not conducive to technological effectiveness, or due to species sensitivity. A Technology Installation and Operation Plan allows a facility, working with the Director, to identify, install, and adaptively manage technologies suited to its particular site conditions. In addition, measuring impingement mortality and entrainment reduction is difficult and would require a substantial amount of multi-year biological data and analysis is burdensome for the facility to develop, is often well beyond the type of information EPA can expect State Directors to be able to develop when monitoring compliance. A Technology Installation and Operation Plan simplifies enforcement: if a facility fails to meet the schedules and other terms of its plan, it is violating its section 316(b) requirements; there is no need to engage in extensive debate about the meaning of complex biological data. This does not mean that biological monitoring and assessment of success in meeting applicable performance standards is not important. If fact, it is critical to the compliance approach adopted in the rule in that it informs facilities and permit authorities when adaptive management, including revisions to the Technology Installation and Operation Plan, are needed to meet the performance standards.

The Technology Installation and Operation Plan provisions also reflect that there is uncertainty about how long it would take a facility to adaptively manage the technology and determine the appropriate operating conditions for the technology to meet the applicable performance requirements. Data and comments available to EPA suggest that it is common for existing facilities to adjust technologies over time in order to achieve optimum performance and, therefore, an adaptive management approach as specified under a plan is appropriate. See documentation at DCN# 1–3019–BE, 4–1830, and 6–5001. EPA understands that adaptive management is going to be necessary for a number of facilities because there are relatively few rigorous evaluations of efficacy under different site and operating conditions. The available studies may also be limited in the numbers and types of species that they have evaluated and they may not show the long term demonstrated effectiveness (and/or consistency of effectiveness) of the technology with the added uncertainties associated with the variability of natural biological systems. By requiring facilities to employ adaptive management principles, EPA assures that the facility will be implementing, on an ongoing basis, the best array of technologies available to them.

As noted above, the Technology Installation and Operation Plan provisions also simplify implementation because they identify the specific compliance requirements needed to meet the performance standard ranges and reduce some of the burden associated with measuring and enforcing compliance with these ranges for both existing facilities and Directors. Directors and facilities may find use of a Technology Installation and Operation Plan preferable because it is less feasible to develop and accurately evaluate biological monitoring data over a relatively short period, as would be required by measuring compliance against a numeric performance standard. Rather, the plan provisions allow implementation to be adaptive, and allow for data development and assessment to proceed in a manner that is appropriate for the facility, technology, and waterbody characteristics.

EPA has the legal authority to express section 316(b) requirements in terms of design criteria, in addition to or in place of enforceable numeric performance standards. EPA employed a design criterion approach in the Phase I rule, when EPA was able to identify a single nationally available and economically practicable technology for the category of new facilities as a whole, in that case closed-cycle recirculating cooling technology. In this rule, EPA was not able to identify a uniform set of technologies that would be available and economically practicable for all existing facilities, but EPA was able to articulate a uniform nationally applicable principle in the form of the performance standards in § 125.94(b), by

which such technologies could be identified by the Director and implemented through the use of a Technology Installation and Operation Plan designed to achieve them. While the technology solution was different in Phase I and Phase II, the legal principle is the same. In addition, EPA has the legal authority to identify section 316(b) requirements as an evolving set of technologies, rather than a single technology array fixed in time. Section 316(b) requires that any technology selected under that section must be the best available to the facility. This term encompasses consideration of effectiveness, costs, non-water quality environmental impacts, feasibility issues and a host of other considerations relevant to existing facilities. See section 304(b)(2)(B). The record indicates that for some facilities, the question of what are *available* technologies and, among those, what is the *best* technology, may change over time. A Technology Installation and Operation Plan is intended to assure that at all times a facility is implementing a technology—or a technology plan—that reflects the best of all technologies consistent with uniform guiding principles in the form of performance standards available to them in light of their site-specific circumstances.

Finally, EPA notes that the way in which performance standards guide technology selection and implementation varies slightly among the five compliance options. For facilities complying with § 125.94(a)(1), the technologies identified are so effective that EPA is confident that any facility employing them will meet the performance standards, so a Technology Installation and Operation Plan and performance monitoring are not required. Because these technologies are not available to all Phase II existing facilities, however, EPA has provided alternative compliance options. For facilities complying in accordance with § 125.94(a)(2), (3), or (4), compliance is generally achieved by implementation of a Technology Installation and Operation Plan designed to meet applicable performance standards. Finally, for facilities that comply in accordance with § 125.94(a)(5) for whom even compliance in accordance with § 125.94(a)(2), (3), or (4) is not available because of significantly higher costs, compliance is achieved by implementation of a Technology Installation and Operation Plan that achieves an efficacy as close as practicable to the applicable performance standards.

4. Site-Specific Requirements

a. Costs Significantly Greater Than Costs Considered by the Administrator

In today's final rule, a facility that demonstrates to the Director that the costs of compliance with the performance standards and/or restoration requirements would be significantly greater than the costs considered by the Administrator for a similar facility, will be given a site-specific determination of best technology available for minimizing adverse environmental impact. The standards of the rule have not changed since proposal, with the exception of one clarification: in the final rule, the alternative site-specific requirements established by the Director must achieve an efficacy that is as close as practicable to the performance standards and/or restoration requirements specified in § 125.94(b) and (c). This was not specified in the proposed rule language. In addition, today's final rule also explains how a facility should calculate costs considered by the Administrator for a similar facility, for comparison with the costs of compliance for the facility. EPA details these steps in § 125.94(a)(5)(i)(A)–(F).

In the proposed rule, submittal requirements for facilities requesting a variance based upon a cost-cost test were identical to those for facilities requesting a variance based on a cost-benefit test. Thus, a facility requesting a site-specific determination based on a cost-cost comparison had to submit three studies: the Cost Evaluation Study, the Valuation of Monetized Benefits of Reducing Impingement and Entrainment, and the Site-Specific Technology Plan. In the final rule, by contrast, a facility must submit only the Cost Evaluation Study and the Site-Specific Technology Plan.

Under the Comprehensive Cost Evaluation Study detailed at proposal, a facility must submit detailed engineering cost estimates to document the costs of implementing the technologies and/or operational measures in the facility's Design and Construction Plan. In the final rule, the facility must provide, in addition to the engineering cost estimates, a demonstration that the costs significantly exceed the benefits of complying with the applicable performance standards. EPA did not make significant changes to the requirements under the Site-Specific Technology Plan.

In summary, the major changes in the cost-cost analysis are as follows:

- In the final rule, EPA has specified how a facility must "calculate costs considered by the Administrator" for comparison with the facility's estimate of the costs of compliance with the final rule,
- Elimination of the requirement to submit a Valuation of Monetized Benefits of Reducing Impingement and Entrainment, and
- Addition of the requirement to demonstrate that the costs significantly exceed the costs considered by the Administrator for a similar facility, under the Cost Evaluation Study.

b. Costs Significantly Greater Than Benefits

In today's final rule, a facility that demonstrates to the Director that the costs of compliance with the performance standards and/or restoration requirements would be significantly greater than the benefits will be given a site-specific determination of best technology available for minimizing adverse environmental impact. The standards of the rule have not changed since proposal, with the exception of one clarification: in the final rule, the alternative site-specific requirements established by the Director must achieve an efficacy that is as close as practicable to the performance standards and/or restoration requirements specified in § 125.94(b) and (c). This was not specified in the proposed rule language.

In the final rule, as in the proposal, a facility requesting a site-specific determination based on a cost-benefit comparison must submit three studies: the Cost Evaluation Study, the Benefits Valuation Study (referred to in proposal as Valuation of Monetized Benefits of Reducing Impingement and Entrainment), and the Site-Specific Technology Plan. The final rule has both added and clarified requirements for the first two components relative to the proposal, but has provided no substantive changes in the requirements for the Site-Specific Technology Plan.

Under the Comprehensive Cost Evaluation Study detailed at proposal, a facility must submit detailed engineering cost estimates to document the costs of implementing the technologies and/or operational measures in the facility's Design and Construction Plan. In the final rule, the facility must provide, in addition to the engineering cost estimates, a demonstration that the costs significantly exceed the benefits of complying with the applicable performance standards.

Additional clarifications are found in the Benefits Valuation Study. In the proposed rule, a facility was required to submit (1) a description of the

methodology used to estimate the benefits' value, (2) the basis for assumptions and quantitative estimates, and (3) an uncertainty analysis. In the final rule, EPA has retained the three submittal requirements. Under the first component, EPA has specified the categories of potential valuation estimates in the final rule, namely commercial, recreational and ecological benefits. EPA has added that a facility should include non-use benefits if applicable. To the second component, EPA has added that the basis may include a determination of entrainment survival if the Director approved such a study. Requirements for the uncertainty analysis remain unchanged from proposal. In the final rule, EPA has added that a facility will be required to submit peer review of the items submitted (upon the Director's request) and a narrative description of non-monetized benefits that would result at the site if the facility was to meet applicable performance standards.

In summary, the major changes in the cost-benefit analysis are as follows:

- Facilities will be required to achieve an efficacy that is "as close as practicable" to performance standards and/ or restoration requirements,
- Facilities will need to specifically demonstrate that costs are significantly greater than the benefits of compliance, and
- Facilities will have additional requirements under the Benefits Valuation Study.

## VII. Basis for the Final Regulation

### *A. Why Is EPA Establishing a Multiple Compliance Alternative Approach for Determining Best Technology Available for Minimizing Adverse Environmental Impact?*

Today's final rule authorizes a Phase II existing facility to choose one of five alternatives for establishing the best technology available for minimizing adverse environmental impacts at the facility. A facility may (1) demonstrate that it has reduced or will reduce its cooling water intake flow commensurate with a closed-cycle, recirculating system, and or that it has reduced, or will reduce, the maximum through-screen design intake velocity to 0.5 ft/ s or less; (2) demonstrate that its existing design and construction technologies, operational measures, and/or restoration measures meet the applicable performance standards and restoration requirements; (3) demonstrate that it has selected design and construction technologies, operational measures, and/or restoration measures that will, in combination with any existing design and construction technologies, operational measures, and/or restoration measures, meet the applicable performance standards and restoration requirements; (4) demonstrate that it will install or has installed and properly operates and maintains an approved design and construction technology; or (5) demonstrate that it has selected, installed, and is properly operating and maintaining, or will install and properly operate and maintain, design and construction technologies, operational measures, and/or restoration measures that the Director has determined to be the best technology available for the facility based on application of a specified cost-to-cost test or a cost-to-benefit test. The basis for each of the five compliance alternatives is explained in section VII.C. of this preamble.

The rule establishes performance standards for the reduction of impingement mortality and entrainment. EPA established these performance standards in part based on a variety of technologies, but the rule does not mandate the use of any specific technology. These performance standards vary by waterbody type (*i.e.*, freshwater river/stream, estuary/tidal river, ocean, Great Lake, or lake/ reservoir) and the capacity utilization rate of the facility. They may be met in whole or in part using restoration measures after demonstrating, among other things, that the facility has evaluated the use of design and construction technologies and operational measures at the site. The basis for the performance standards is explained in section VII.B. of this preamble and the basis for the restoration requirements is explained at section VII.F. of this preamble. For a more detailed description of the rule, see sections V and IX of this preamble. These requirements reflect the best technology available for minimizing adverse environmental impact from cooling water intake structures.

EPA adopted this regulatory scheme because it provides a high degree of flexibility for existing facilities to select the most effective and efficient approach and technologies for minimizing adverse environmental impact associated with their cooling water intake structures. This approach also reflects EPA's judgment that, given the wide range of various factors that affect the environmental impact posed by Phase II existing facilities, different technologies or different combinations of technologies can be used and optimized to achieve the performance standards.

### *B. Why and How Did EPA Establish the Performance Standards at These Levels?*

#### 1. Overview of Performance Standards

The final rule establishes two types of performance standards, one that addresses impingement mortality and one that addresses entrainment. EPA used impingement mortality and entrainment as a metric for performance because these are primary and distinct types of harmful impacts associated with the use of cooling water intake structures (*see also* section IV). Both the impingement mortality and the entrainment performance standards apply to facilities demonstrating compliance under alternatives two, three, and four, described above (§ 125.94(a)(2), (3), and (4)). In addition, the Director's site-specific alternative requirements must be as close as practicable to the applicable performance standards under § 125.94. Performance standards for entrainment do not apply to facilities with low utilization capacity, those with a design intake flow of five percent or less of the mean annual flow of a freshwater river or stream, and those that withdraw cooling water from a lake (other than one of the Great Lakes) or reservoir because such facilities have a low propensity for causing significant entrainment impacts due to limited facility operation, low intake flow, or general waterbody characteristics. The impingement mortality performance standard requires a Phase II existing facility that complies under § 125.94(a)(2), (3), and (4) to reduce impingement mortality of all life stages of fish and shellfish by 80 to 95 percent from the calculation baseline.

Both an entrainment performance standard and an impingement mortality standard apply to facilities with a capacity utilization rate of 15 percent or greater and that withdraw cooling water from a tidal river, estuary, ocean, one of the Great Lakes, as well as facilities that use cooling water from a freshwater river or stream and the design intake flow of the cooling water intake structure is greater than five percent of the mean annual flow because EPA believes that these facilities cause more significant entrainment impacts. The entrainment standard, where applicable, requires a Phase II facility to reduce entrainment of all life stages of fish and shellfish by 60 to 90 percent from the calculation baseline.

#### 2. Basis for Performance Standards

Overall, the performance standards that reflect best technology available under today's final rule are not based on a single technology but, rather, are

based on consideration of a range of technologies that EPA has determined to be commercially available for the industries affected as a whole and have acceptable non-water quality environmental impacts, except for some potential regional energy (reliability) impacts that will be minimized to the extent possible through flexible compliance options. Because the requirements implementing section 316(b) are applied in a variety of settings and to Phase II existing facilities of different types and sizes, no single technology is most effective at all existing facilities, and a range of available technologies has been used to derive the performance standards.

EPA developed the performance standards for impingement mortality reduction based on an analysis of the efficacy of the following technologies: (1) Design and construction technologies such as fine and wide-mesh wedgewire screens, as well as aquatic filter barrier systems, that can reduce mortality from impingement by up to 99 percent or greater compared with conventional once-through systems; (2) barrier nets that may achieve reductions of 80 to 90 percent; and (3) modified screens and fish return systems, fish diversion systems, and fine mesh traveling screens and fish return systems that have achieved reductions in impingement mortality ranging from 60 to 90 percent as compared to conventional once-through systems.

Available performance data for entrainment reduction are not as comprehensive as impingement data. However, aquatic filter barrier systems, fine mesh wedgewire screens, and fine mesh traveling screens with fish return systems have been shown to achieve 80 to 90 percent or greater reduction in entrainment compared with conventional once-through systems. EPA notes that screening to prevent organism entrainment may cause impingement of those organisms instead.

### 3. Discussion of Key Aspects of Performance Standards

The performance standards at § 125.94(b)(1),(2), and (3) are based on the type of waterbody in which the intake structure is located, the volume of water withdrawn by a facility, and the facility capacity utilization rate. Under the final rule, EPA has grouped waterbodies into five categories: (1) Freshwater rivers or streams, (2) lakes or reservoirs, (3) Great Lakes, (4) tidal rivers and estuaries, and (5) oceans. The Agency considers location, one aspect of which is waterbody type, to be an important factor in addressing adverse environmental impact caused by cooling water intake structures. Because different waterbody types have the potential for different adverse environmental impacts, the requirements to minimize adverse environmental impact vary by waterbody type.

The reproductive strategies of tidal river and estuarine species, together with other physical and biological characteristics of those waters, make them more susceptible than other waterbodies to impacts from cooling water intake structures (66 FR 288857–288859; 68 FR 17140). In contrast, many aquatic organisms found in non-tidal freshwater rivers and streams are less susceptible to entrainment due to their demersal (bottom-dwelling) nature and the fact that they do not typically have planktonic (free-floating) egg and larval stages (66 FR 28857; 68 FR 17140). Comments on the proposed Phase II existing facility rule also acknowledge that waterbody type is an important factor in assessing the impacts of cooling water intake structures, although some commenters preferred a site-specific approach, and others maintained that all waters deserve the most rigorous technology. A number of States supported EPA's proposed approach.

Absent entrainment control technologies, entrainment at a particular site is generally proportional to intake flow at that site. As discussed above, EPA believes it is reasonable to vary performance standards by the potential for adverse environmental impact in a waterbody type. EPA is limiting the requirement for entrainment controls in fresh waters to those facilities that withdraw the largest proportion of water from freshwater rivers or streams because they have the potential to impinge and entrain larger numbers of fish and shellfish and therefore have a greater potential to cause adverse environmental impact. EPA is not requiring entrainment reductions in freshwater rivers or streams where facilities withdraw 5 percent or less of the source water annual mean flow because such facilities generally have a low propensity for causing significant entrainment impacts due to the low proportion of intake flow in combination with the characteristics of the waterbody.

There are additional performance standards for facilities withdrawing from a lake (other than one of the Great Lakes) or a reservoir. If such a facility proposes to increase the design intake flow of the cooling water intake structure, the increase in total design intake flow must not disrupt the natural thermal stratification or turnover pattern of the source water except in cases where the disruption does not adversely affect the management of fisheries § 125.94(b)(3)(iii)). The natural thermal stratification or turnover pattern of a lake is a key characteristic that is potentially affected by the intake flow (which can alter temperature and/or mixing of cold and warm water layers) and location of cooling water intake structures within such waterbodies. Cooling water intake structures withdrawing from the Great Lakes are required to reduce fish and shellfish impingement mortality by 80 to 95 percent and to reduce entrainment by 60 to 90 percent. As described in the Phase I proposed rule (65 FR 49086) and NODA (66 FR 28858), EPA believes that the Great Lakes are a unique system that should be protected to a greater extent than other lakes and reservoirs. Similar to oceans, large lakes such as the Great Lakes can possess estuarine-like environments in the lower reaches of tributary streams. For example, within the U.S., a total of 1,370 distinct coastal wetlands fringe the Great Lakes and the channels that connect the lakes. (2–016A Herdendorf, C.E. Great Lakes estuaries. Estuaries, 13(4): 493–503. 1990, pg. 493). The Agency is therefore specifying entrainment controls as well as impingement mortality controls for the Great Lakes. EPA has not applied the entrainment performance standard to lakes other than the Great Lakes because, in general, these waterbodies contain aquatic organisms that tend to be less impacted by entrainment than organisms in estuaries or fresh water rivers or streams.

The performance standards for facilities with cooling water intake structures located in a tidal river or estuary and with a capacity utilization rate of 15 percent or greater are to reduce impingement mortality by 80 to 95 percent and entrainment by 60 to 90 percent for fish and shellfish. As discussed previously, EPA believes estuaries and tidal rivers are more susceptible than other waterbodies to adverse impacts from impingement and entrainment.

The performance standards for facilities with cooling water intake structures located in an ocean are to reduce impingement mortality by 80 to 95 percent and entrainment by 60 to 90 percent for fish and shellfish. EPA is establishing requirements for facilities withdrawing from oceans that are similar to those for tidal rivers and estuaries because the coastal zone of oceans (from which coastal cooling water intake structures withdraw water)

are highly productive areas for fish and shellfish. (*See* the Phase I proposed rule (65 FR 45060) and documents in the record for the Phase I new facility rule (Docket # W–00–03) such as 2–013A through O, 2–019A–R11, 2–019A–R12, 2–019A–R33, 2–019A–R44, 2–020A, 3–0059). EPA is also concerned about the extent to which fishery stocks that rely upon tidal rivers, estuaries and oceans for habitat are overutilized and seeks to minimize the impact that cooling water intake structures may have on these species or forage species on which these fishery stocks may depend. Recent data demonstrate that approximately 78% of the fish stocks managed by the National Oceanic and Atmospheric Administration's National Marine Fishery Service (NMFS) are fully exploited, overfished, or collapsed (America's Living Oceans: Charting a Course for Sea Change, Pew Oceans Commission, June 4, 2003). (*See also* documents 2–019A–R11, 2–019A–R12, 2–019A–R33, 2–019A–R44, 2–020A, 2–024A through O, and 3–0059 through 3–0063 in the record of the Final New Facility Rule (66 FR 65256), Docket # W–00–03).

In accordance with the Phase II rule, facilities that operate with a capacity utilization rate of less than 15 percent are subject to the performance standard for impingement mortality only. EPA is not requiring, in today's rule, that these facilities control entrainment. EPA has several reasons for this. First, EPA has determined that entrainment control technology is not economically practicable in view of the reduced operating levels of these facilities. These facilities also tend to operate most often in mid-winter or late summer, which are times of peak energy demand but periods of generally low abundance of entrainable life stages of fish and shellfish. Finally, the total volume of water withdrawn by these facilities is significantly lower than for facilities operating at or near peak capacity, and as noted above, entrainment at a site is generally proportional to flow, absent entrainment controls. Consequently, EPA determined that it was neither necessary nor cost-effective for these facilities to reduce entrainment where the total volume of water withdrawn and the number of organisms that would be protected from entrainment is likely to be small. EPA is also allowing facilities with multiple, distinct cooling water intakes that are exclusively dedicated to different generating units to determine capacity utilization and applicable performance standards separately for each intake for the same reasons.

As in the Phase I rule, EPA is setting performance standards for minimizing adverse environmental impact based on a relatively easy to measure and certain metric—reduction of impingement mortality and entrainment. Although adverse environmental impact associated with cooling water intake structures can extend beyond impingement and entrainment, EPA has chosen this approach because impingement and entrainment are primary, harmful environmental effects that can be reduced through the use of specific technologies. In addition, where other impacts at the population, community, and ecosystem levels exist, these will also be reduced by reducing impingement and mortality. Using impingement mortality and entrainment as a metric provides certainty about performance standards and streamlines, and thus speeds, the issuance of permits.

EPA is expressing the performance standard in the form of ranges rather than a single performance benchmark because of the uncertainty inherent in predicting the efficacy of any one of these technologies, or a combination of these technologies, across the spectrum of facilities subject to today's rule. The lower end of the range is being established as the percent reduction that EPA, based on the available efficacy data, expects all facilities could eventually achieve if they were to implement and optimize available design and construction technologies and operational measures on which the performance standards are based. (*See* Chapter 4, "Efficacy of Cooling Water Intake Structure Technologies," of the Phase II Existing Facility Technical Development Document, EPA–821–R–04–007, February 2004. Also, *see* EPA's 316(b) technology efficacy database, DCN 6–5000.) The lower end of the range also reflects, in part, higher mortality rates at sites where there may be more fragile species that may not have a high survival rate after coming in contact with fish protection technologies at the cooling water intake structure (*e.g.*, fine mesh screens). The higher end of the range is a percent reduction that available data show many facilities can and have achieved with the available technologies upon which the performance standards are based.

In specifying a range, EPA anticipates that facilities will select the most cost-effective technologies or operational measures to achieve the performance level (within the stated range) based on conditions found at their site, and that Directors will review the facility's application to ensure that appropriate alternatives were considered. Proper selection, operation, and maintenance of these technologies would serve to increase potential efficiencies of the technologies. EPA also expects that some facilities may be able to meet these performance requirements by selecting and implementing a suite (*i.e.*, more than one) of technologies and operational measures and/or, as discussed in this section, by undertaking restoration measures.

Several additional factors support EPA's expectation that the impingement mortality and entrainment reduction reflected in the performance standards can eventually be achieved by all facilities using the design and construction technologies and measures on which the standards were based. First, a significant portion of the available performance data reviewed is from the 1970s and 1980s (when section 316(b) was initially implemented) and does not reflect recent developments, innovations (*e.g.*, aquatic filter barrier systems, sound barriers), or experience using these technologies. These data, developed during early implementation of the CWA, do not fully reflect today's improved understanding of both how the various control technologies work and the various factors that reflect what constitutes and how to measure healthy aquatic conditions. Second, these conventional barrier and return system technologies have not been optimized on a widespread level to date, as would be encouraged by this rule. Available information indicates that facilities that use these cooling water intake structure technologies often achieve better results from the technologies through adjusting which technologies are applied and how they are used. Such optimization, which also benefits from the advances in understanding noted above, would be promoted under this rule as facilities work to achieve the performance standards. Third, EPA believes that some facilities could achieve further reductions (estimated at 15–30 percent) in impingement mortality and entrainment by providing for seasonal flow restrictions, variable speed pumps, systems conversions to closed-cycle, recirculating systems, and other operational measures and innovative flow reduction alternatives. Such operational measures could be used to supplement design and construction technologies where necessary to meet the performance standards. Facilities also could benefit from combining inexpensive technologies as a "suite." For additional discussion, see chapter 4 in the Phase II Existing Facility Technical Development Document.

The calculation baseline used to determine compliance with

performance standards is defined in § 125.93 as an estimate of impingement mortality and entrainment that would occur at a site assuming (1) the cooling water system had been designed as a once-through system; (2) the opening of the cooling water intake structure is located at, and the face of the standard 3/8-inch mesh traveling screen is oriented parallel to, the shoreline near the surface of the source waterbody; and (3) the baseline practices and procedures are those that the facility would maintain in the absence of any operational controls, including flow or velocity reductions, implemented in whole or in part for the purposes of reducing impingement mortality and entrainment. In addition, the facility may choose to use the current level of impingement mortality and entrainment as the calculation baseline. EPA's definition also clarifies the range of available information sources for the baseline. The calculation baseline may be estimated using: historical impingement mortality and entrainment data from the facility or from another facility with comparable design, operational, and environmental conditions; current biological data collected in the waterbody in the vicinity of the facility's cooling water intake structure; or current impingement mortality and entrainment data collected at the facility. Further, a facility may request that the calculation baseline be modified to be based on a location of the opening of the cooling water intake structure at a depth other than at or near the surface if it can demonstrate to the Director that the other depth would correspond to a higher baseline level of impingement mortality and/or entrainment. EPA decided to use this definition because it represents the most common default conditions the Agency could identify to give facilities credit for design and construction technologies, operational measures, and/or restoration measures that they have already implemented to minimize adverse environmental impact, while providing a clear and relatively simple definition. Based on comments received on the Phase II NODA, this calculation baseline definition includes additional criteria that EPA has added to provide clarity to the analysis. (Proposed changes to the calculation baseline were discussed in the Phase II NODA, see 68 FR 13580). In many cases, existing technologies at the site show some reduction in impingement and entrainment when compared to this baseline. In such cases, impingement mortality and entrainment reductions (relative to the calculated baseline) achieved by these existing technologies should be counted toward compliance with the performance standards. In addition, operational measures such as operation of traveling screens, employment of more efficient return systems, and even locational choices should be credited for any corresponding reduction in impingement mortality and entrainment. See section IX of this preamble for a discussion of how the calculation baseline is used to compare facility performance with the rule's performance standards.

### *C. What Is the Basis for the Five Compliance Alternatives That EPA Selected for Establishing Best Technology Available?*

#### 1. Meeting Performance Standards Through Reducing Intake Flow Commensurate With a Closed Cycle Recirculating System or Reduced Design Intake Velocity

Under § 125.94(a)(1)(i), any facility that reduces its flow to a level commensurate with a closed-cycle, recirculating cooling system meets the performance standards in today's rule because such a reduction in flow is deemed to satisfy any applicable impingement mortality and entrainment performance standards for all waterbodies. Facilities that select this compliance alternative either through the use of closed-cycle recirculating system technology at the plant, or by retrofitting their facility, will not be required to further demonstrate that they meet the applicable performance standards. Similarly, under 125.94(a)(1)(ii), any facility that reduces its design intake velocity to 0.5 ft/s or less is deemed to have met the performance standards for impingement mortality and is not required to demonstrate further that it meets the performance standards for impingement mortality.

Available data described in Chapter 3 of the Phase II Existing Facility Technical Development Document suggest that closed-cycle, recirculating cooling systems (e.g., cooling towers or ponds) can reduce mortality from impingement by up to 98 percent and entrainment by up to 98 percent when compared with conventional once-through systems.[44] Although closed-cycle, recirculating cooling is not one of the technologies on which the performance standards are based, use of a closed-cycle, recirculating cooling system would always achieve the performance standards and therefore, facilities that reduce their flow commensurate with closed-cycle, recirculating cooling systems are deemed to have met performance standards. The rule, at § 124.94(a)(1)(i), thus establishes a compliance alternative based on the use of a closed-cycle, recirculating cooling system. While EPA based the requirements of the new facility rule on the performance standards of closed-cycle recirculating systems, EPA has determined that this technology is not economically practicable for many existing Phase II facilities. EPA is nonetheless aware that some existing facilities have installed *this highly effective technology and has* thus provided a streamlined alternative for such facilities.

Additionally, EPA established a compliance alternative that allows facilities to reduce intake velocity to meet the impingement mortality performance standards. As EPA discussed in the proposed rule at 67 FR 17151 and Phase I final rule at 66 FR 65274, intake velocity is one of the key factors that can affect the impingement of fish and other aquatic biota, since in the immediate area of the intake it exerts a direct physical force against which fish and other organisms must act to avoid impingement and entrainment. As discussed in that notice, EPA compiled data from three swim speed studies (University of Washington study, Turnpenny, and EPRI) and these data indicated that a 0.5 ft/s velocity would protect at least 96 percent of the tested fish. As further discussed, EPA also identified federal documents (Boreman, DCN 1–5003–PR; Bell (1990); and National Marine Fisheries Service (NMFS), (1997)), an early swim speed and endurance study performed by Sonnichsen *et al.* (1973), and fish screen velocity criteria that are consistent with this approach.

[44] Reducing the cooling water intake structure's capacity is one of the most effective means of reducing entrainment (and impingement). For the traditional steam electric utility industry, facilities located in freshwater areas that have closed-cycle recirculating cooling water systems can, depending on the quality of the make-up water, reduce water use by 96 to 98 percent from the amount they would use if they had once-through cooling water systems. Steam electric generating facilities that have closed-cycle, recirculating cooling systems using salt water can reduce water usage by 70 to 96 percent when make-up and blowdown flows are minimized. The lower range of water usage would be expected where State water quality standards limit chloride to a maximum increase of 10 percent over background and therefore require a 1.1 cycle of concentration. The higher range should be attainable where cycles of concentration up to 2.0 are used for the design.

2. Meeting Performance Standards Through the Use of Design and Construction Technologies, Operational Measures, and/or Restoration Measures

Under the second and third compliance alternatives (§ 125.94(a)(2) and (3)), a facility may either demonstrate to the Director that the facility's existing design and construction technologies, operational measures, and/or restoration measures already meet the minimum performance standards specified under § 125.94(b) and (c), or that it has selected design and construction technologies, operational measures, and/or restoration measures or some combination thereof that will meet these performance standards.

Available data indicate that, when considered as a suite of technologies, barrier and fish handling technologies are available on a national basis for use by Phase II existing facilities. These technologies exist and are in use at various Phase II facilities and, thus, EPA considers them collectively technologically achievable. In addition, 50 percent of the potentially regulated facilities that do not already have closed-cycle cooling systems have some other technology in place that reduces impingement or entrainment. In turn, a large subset of these facilities (33 percent) also have fish handling or return systems that reduce the mortality of impinged organisms. The fact that these technologies are collectively available means that one or more technologies within the suite is available to each Phase II facility.

EPA finds that the design and construction technologies necessary to meet the requirements are commercially available and economically practicable for existing facilities, because facilities can and have installed many of these technologies years after a facility began operation. Typically, additional design and construction technologies such as fine mesh screens, wedgewire screens, fish handling and return systems, and aquatic filter fabric barrier systems can be installed during a scheduled outage (operational shutdown). Referenced below are examples of facilities that installed these technologies after they initially started operating.

*Lovett Generating Station.* A 495 MW facility (gas-fired steam), Lovett is located in Tomkins Cove, New York, along the Hudson River. The facility first began operations in 1949 and has three generating units with once-through cooling systems. In 1994, Lovett began the testing of an aquatic filter barrier system to reduce entrainment, with a permanent system being installed the following year. Improvements and additions were made to the system in 1997, 1998, and 1999, with some adjustments being accepted as improvements of this vendor's technology for all subsequent installations at other locations.

*Big Bend Power Station.* Situated on Tampa Bay, Big Bend is a 1998 MW (coal-fired steam) facility with four generating units. The facility first began operations in 1970 and added generating units in 1973, 1976, and 1985. Big Bend supplies cooling water to its once-through cooling water systems via two intake structures. When the facility added Unit 4 in 1985, regulators required the facility to install additional intake technologies. A fish handling and return system, as well as a fine-mesh traveling screen (used only during months with potentially high entrainment rates), were installed on the intake structure serving both the new Unit 4 and the existing Unit 3.

*Salem Generating Station.* A 2381 MW facility (nuclear), Salem is located on the Delaware River in Lower Alloways Creek Township, New Jersey. The facility has two generating units, both of which use once-through cooling and began operations in 1977. In 1995, the facility installed modified Ristroph screens and a low-pressure spray wash with a fish return system. The facility also redesigned the fish return troughs to reduce fish trauma.

*Chalk Point Generating Station.* Located on the Patuxent River in Prince George's County, Maryland, Chalk Point has a capacity of 2647 MW (oil-fired steam). The facility has four generating units and uses a combination of once-through and closed-cycle, recirculating cooling systems (two once-through systems serving two generating units and one recirculating system with a tower serving the other two generating units). In 1983, the facility installed a barrier net, followed by a second net in 1985, giving the facility a coarse mesh (1.25") outer net and a fine mesh (.75") inner net. The barrier nets are anchored to a series of pilings at the mouth of the intake canal that supplies the cooling water to the facility and serve to reduce both entrainment and the volume of trash taken in at the facility.

3. Meeting Performance Standards Through Use of an Approved Design and Construction Technology

Under the fourth compliance alternative, a facility can demonstrate that it meets specified conditions and that it has installed and properly operates and maintains a pre-approved technology. EPA is approving one technology at this time: submerged cylindrical wedgewire screen technology to treat the total cooling water intake flow. There are five conditions that must be met in order to use this technology to comply with the rule: (1) The cooling water intake structure is located in a freshwater river or stream; (2) the cooling water intake structure is situated such that sufficient ambient counter currents exist to promote cleaning of the screen face; (3) the through screen design intake velocity is 0.5 ft/s or less; (4) the slot size is appropriate for the size of eggs, larvae, and juveniles of any fish and shellfish to be protected at the site; and (5) the entire main condenser cooling water flow is directed through the technology (small flows totaling less than two MGD for auxiliary plant cooling uses are excluded). Directors are explicitly authorized in § 125.99 to pre-approve other technologies for use at facilities with other specified characteristics within their respective jurisdiction after providing the public with a notice and an opportunity to comment on the request for approval of the technology. The Director's authority to pre-approve other technologies is not limited to technologies for use by facilities located on freshwater rivers and streams.

EPA has adopted this compliance alternative in response to comments that suggested that EPA provide an additional, more streamlined compliance option under which a facility could implement certain specified technologies that are deemed highly protective in exchange for reducing the scope of the Comprehensive Demonstration Study. (*See* 68 FR 13522, 13539; March 19, 2003). EPA evaluated the effectiveness of specific technologies using the impingement mortality and entrainment reduction performance standards as assessment criteria. The technology selected for the approved technology option has a demonstrated ability to reduce impingement mortality by 80 to 95 percent for fish and shellfish and, if required, reduce entrainment by 60 to 90 percent for any stages of fish and shellfish at facilities that meet the conditions specified in section 125.99(a). Thus, the technology has a demonstrated ability to meet the most stringent performance standards that would apply to any facility situated on a freshwater river or stream. (*See* DCN 1–3075, 1–5069, 1–5070, 3–0002, and 4–4002B. *Also see*, DCN 6–5000 and Chapter 3 of the Technical Development Document.) Because cylindrical wedgewire screens are believed to be effective when deployed under the

specified conditions and properly maintained, facilities that select this compliance option are provided substantially streamlined requirements for completing the Comprehensive Demonstration Study. However, facilities selecting this option are still required to prepare a Technology Installation and Operation Plan to monitor the effectiveness of the technology at their site in meeting the performance standards.

4. Site-Specific Determination of Best Technology Available To Minimize Adverse Environmental Impact

A facility may comply with the rule by seeking a site-specific demonstration of the best technology available to minimize adverse environmental impact by demonstrating, to the Director's satisfaction, that its cost of complying with the applicable performance standards would be significantly greater than the costs considered by EPA for a like facility when establishing such performance standards, or that its costs would be significantly greater than the benefits of complying with such performance standards at the facility. (*See* sections 125.94(a)(5)(i) and (ii)). If a facility satisfies one of the two cost tests in § 125.94(a)(5), then the Director must establish site-specific alternative requirements based on design and construction technologies, operational measures, and/or restoration measures that achieve an efficacy that is, in the judgment of the Director, as close as practicable to the applicable performance standards without resulting in costs that are significantly greater than either the costs considered by the Administrator in establishing the applicable performance standards, or the benefits at the facility.

In establishing the performance standards in 125.94(b) and the compliance alternatives in sections 125.94(a)(1)–(4), EPA considered several factors, including efficacy, availability, ease of implementation, indirect effects, the costs that EPA expects all existing facilities to incur (national costs) and the benefits if all existing facilities meet the performance standards (national benefits). This provision for alternative requirements is included in the rule to give facilities flexibility to demonstrate that the best technology available to minimize adverse environmental impact at their particular sites may be less stringent than would otherwise be achieved if the facility selected one of the compliance alternatives in sections 125.94(a)(1)–(4). (For a discussion of EPA's legal authority to authorize compliance with alternative requirements based on this cost-cost comparison, *see* Section VIII. I.).

a. Basis of the Cost-Cost Test

For a number of related reasons, EPA chose to use a comparison of a facility's actual costs to the costs EPA estimated that facility would incur to meet the national performance standards (a "cost-cost test") as a basis for obtaining a site-specific determination of best technology available. EPA's record for this rule shows that, for the category of existing facilities as a whole, today's rule is technically achievable and economically practicable. Although EPA collected more information for this rulemaking than is typical for an effluent limitation guideline rulemaking, detailed information on some factors important to the effectiveness and costs of the technologies, such as debris loading and the presence of navigational channels within the waterbody at which cooling water intakes are sited, was not requested. Moreover, the information EPA used to develop its costs was in some cases limited by the fact that, while EPA sent surveys to all facilities covered under today's rule, only 42% were sent detailed questionnaires. The remaining 58% only received a short technical questionnaire which requested minimal characterization information. Also, EPA may not have elicited information regarding characteristics of a particular facility that, if known would have either significantly changed EPA's national cost estimates or demonstrated that none of the technologies on which the categorical requirements are based are economically achievable by the facility. Similarly, existing facilities have less flexibility than new facilities in selecting the location of their intakes and technologies for minimizing adverse environmental impact, and therefore it may be difficult for some facilities to avoid costs much higher than those EPA considered when establishing the performance standards. The cost-cost site-specific alternative ensures that the overall rule remains economically practicable for facilities subject to today's rule. In short, for certain facilities EPA may not have anticipated some site-specific costs or the costs for retrofit may exceed those EPA considered. Despite EPA's best effort, such costs are difficult to estimate in a national rule. Because of the wide range of available technologies considered and a number of site-specific factors that may significantly affect the cost and practicability of installing particular technologies at particular sites, the site-specific uncertainty in the cost estimates is higher than for an effluent limitations guidelines rulemaking. Thus, EPA may not have anticipated all site-specific costs that a facility could incur. In addition, existing facilities have less flexibility than new facilities in selecting the location of their intakes and technologies for minimizing adverse environmental impact and, therefore, it may be difficult for some facilities to avoid costs much higher than those EPA considered when establishing the performance standards in the rule. For all of these reasons, EPA believes that the cost-cost site-specific compliance alternative is necessary to ensure that the rule is economically practicable for existing Phase II facilities. In order to ensure that this alternative provides only the minimum relaxation of performance standards that is needed to make the rule economically practicable, § 125.94(a)(5)(i) requires that the site-specific requirements achieve an efficacy that is as close as practicable to the applicable performance standards without resulting in costs that are significantly greater than those considered by the Administrator for a like facility when establishing the performance standards.

b. Basis of the Cost-Benefit Test

EPA decided to use a comparison of a facility's costs to the benefits of meeting the performance standards at the facility (a "cost-benefit test") as another basis for obtaining a site-specific determination of BTA to minimize adverse environmental impact. Section 316(b) authorizes consideration of the environmental benefit to be gained by requiring that the location, design, construction, and capacity of cooling water intake structures reflect the best economically practicable technology available for the purpose of minimizing adverse environmental impact. Accordingly, in determining that the technologies on which EPA based the compliance alternatives and performance standards are the best technologies available for existing facilities to minimize adverse environmental impact, EPA considered the national cost of those technologies in comparison to the national benefits—*i.e.*, the reduction in impingement and entrainment that EPA estimated would occur nationally if all existing facilities selected one of the compliance options in sections 125.94(a)(1)–(4). While EPA believes that there is considerable value in promulgating national performance standards under section 316(b) based on what EPA determines, on a national basis, to be the best technology available to minimize adverse environmental impacts, EPA also recognizes that, at

times, determining what is necessary to minimize adverse environmental impacts can necessitate a site-specific inquiry. EPA's comparison of national costs to national benefits may not be applicable to a specific site due to variations in (1) the performance of intake technologies and (2) characteristics of the waterbody in which the intake(s) are sited, including the resident aquatic biota. For example, there may be some facilities where the absolute numbers of fish and shellfish impinged and entrained is so minimal that the cost to achieve the required percentage reductions would be significantly greater than the benefits of achieving the required reductions at that particular site. More specifically, because of the location of the intake, the characteristics of a particular waterbody, or the behavioral patterns of the fish or shellfish in that particular waterbody, there may be little or no impingement mortality or entrainment occurring at the site (see Neal Generating Complex facility example provided in section IV of this preamble). For such a facility, the cost of reducing an already small amount of impingement mortality and entrainment by 80 to 95 percent and 60 to 90 percent, respectively, may be significantly greater than the benefits. In short, it may not be cost-effective and, therefore may be economically impracticable for a facility to achieve percentage reductions when attempting to save a small number of fish or shellfish. Thus, in a waterbody that is already degraded, very few aquatic organisms may be subject to impingement or entrainment, and the costs of retrofitting an existing cooling water intake structure may be significantly greater than the benefits of doing so. By requiring best technology available to minimize adverse environmental impact, section 316(b) invites a consideration of both technology and of environmental conditions, including the potential for adverse impacts, in the receiving waterbody. EPA believes it is a reasonable interpretation of the statute to allow the Director to consider the results of meeting the performance standards in terms of reducing environmental impacts (*i.e.*, the benefits) in cases where the costs of installing the technology are significantly greater than the reduction in environmental impacts would warrant. As with the cost-cost site-specific provision, EPA also wants to ensure that any relaxation of the performance standards be the minimum necessary to ensure that the costs are not significantly greater than the benefits. Section 125.94(a)(5)(i) thus provides that alternative site-specific requirements must achieve an efficacy that is as close as practicable to the applicable performance standards without resulting in costs that are significantly greater than the benefits of meeting the performance standards at the facility.

### *D. How Has EPA Assessed Economic Practicability?*

The legislative history of section 316(b) indicates that the term "best technology available" should be interpreted as "best technology available commercially at an economically practicable cost."[45] This position reflects congressional concern that the application of best technology available should not impose an impracticable and unbearable economic burden. Thus, EPA has conducted extensive analyses of the economic impacts of this final rule, using an integrated energy market model (the IPM[45]). For a complete discussion of this analysis, please refer to section XI.B.1 of this preamble or Chapter B3 of the Economic and Benefits Analysis (EBA) in support of this final rule (DCN 6–0002).

EPA believes that the requirements of this rule reflect the best technology available at an economically practicable cost. EPA examined the effects of the rule's compliance costs on capacity, generation, variable production costs, prices, net income, and other measures, both at the market and facility levels. In addition, the other economic analyses conducted by EPA showed that the costs for this rule are economically practicable.

However, EPA believes that a consideration of the relationship of costs to environmental benefits is an important component of economic practicability. As discussed in section VIII.C of the proposed Phase I rule (65 FR 49094) EPA has long recognized that there should be some reasonable relationship between the cost of cooling water intake structure control technology and the environmental benefits associated with its use. As the preamble to the 1976 final rule implementing section 316(b) stated, neither the statute nor the legislative history requires a formal or informal cost-benefit assessment (41 FR 17387; April 26, 1976).

[45] *See* 118 CONG. REC 33,762 (1972), reprinted in 1 Legislative History of the Water Pollution Control Act Amendments of 1972, at 264 (1973) (Statement of Representative Don H. Clausen).

### *E. What Were the Major Options Considered for the Final Rule and Why Did EPA Reject Them?*

EPA considered a number of options for determining the best technology available to minimize adverse environmental impact at Phase II existing facilities and assessed these options based on overall efficacy, availability, economic practicability, including economic impact and the relationship of costs with benefits, and non-water quality environmental impacts, including energy impacts. Under the options EPA considered, facilities would be allowed to implement restoration measures to meet the performance standards. Similarly, any options considered also would allow facilities to request alternative, less stringent, requirements if the Director had determined that data specific to the facility indicated that compliance with the relevant requirement would result in compliance costs significantly greater than those EPA considered in establishing the applicable requirement, or compliance costs significantly greater than the benefits of complying with the applicable performance standards. The alternative requirements would be no less stringent than justified by the significantly greater cost or the significant adverse impacts on local air quality or local energy markets. EPA also considered several site-specific approaches to establishing best technology available. These include the site-specific sample rule discussed at 67 FR 17159, an alternative based on EPA's 1977 Draft Guidance, and alternatives suggested by the Utility Water Act Group (UWAG) and Public Service Electric and Gas Company (PSEG), respectively (*see* 67 FR 17162). EPA's reasons for not adopting these site specific alternatives are discussed in section VII.E.5 of this preamble. The five major technology options EPA considered but did not select for the final rule are discussed in greater detail in the next section. Finally, the costs and benefits presented below are those developed at proposal because these estimates are most useful for purposes of comparison. Subsequent analyses, such as those presented in the NODA, have resulted in higher cost estimates in general, but did not alter the relative ranking of these options as EPA made determinations regarding the final rule. Rather, these analyses indicated that the costs for options that would have required more extensive retrofitting efforts than the final rule are even higher relative to the costs of the final

rule than they were estimated to be at proposal.

1. Intake Capacity Commensurate With Closed-Cycle, Recirculating Cooling System for All Facilities

EPA considered a regulatory option that would have required Phase II existing facilities with a design intake flow 50 MGD or more to reduce the total design intake flow to a level, at a minimum, commensurate with that which can be attained by a closed-cycle recirculating cooling system using minimized make-up and blowdown flows. In addition, facilities in specified circumstances (*e.g.*, located where additional protection is needed due to concerns regarding threatened, endangered, or protected species or habitat; or regarding migratory, sport or commercial species of concern) would have had to select and implement additional design and construction technologies to minimize impingement mortality and entrainment. This option would not have distinguished between facilities on the basis of the waterbody type from which they withdraw cooling water. Rather, it would have required that the same stringent controls be the nationally applicable minimum for all waterbody types. This is the basic regulatory approach EPA adopted for new facilities at 40 CFR 125.80.

EPA did not select a regulatory scheme based on the use of closed-cycle, recirculating cooling systems at existing facilities based on its generally high costs (due to conversions), the fact that other technologies approach the performance of this option, concerns for energy impacts due to retrofitting existing facilities, and other considerations. Although closed-cycle, recirculating cooling water systems serve as the basis for requirements applied to Phase I new facilities, for Phase II existing facilities, a national requirement to retrofit existing systems is not the most cost-effective approach and at many existing facilities, retrofits may be impossible or not economically practicable. EPA estimates that the total capital costs for individual high-flow plants (*i.e.*, greater than 2 billion gallons per day) to convert to wet towers generally ranged from $130 to $200 million, with annual operating costs in the range of $4 to $20 million (*see* TDD; DCN 6–0004). For purposes of general comparison, EPA estimated that capital and installation costs for cooling towers under the Phase I rule would range from approximately $170,000 to $12.6 million per plant (annualized), depending on flow. At proposal, EPA estimated that the total social cost of compliance for this option for Phase II existing facilities would be approximately $3.5 billion per year.

It is significant to note, however, that EPA's estimates did not fully incorporate costs associated with acquiring land needed for cooling towers and, therefore, these estimates may not fully reflect the costs of the option. For example, based on a survey conducted by one industry commenter, EPA learned that 31 out of 56 plants surveyed said that they would need to acquire additional property to accommodate cooling towers, if required by today's rule. EPA recognizes that this could be a significant cost. EPA also recognizes that there may be impediments, irrespective of costs, to acquiring land for cooling towers. Land upon which to construct cooling towers may be difficult or impossible to obtain, especially in urban areas; some facilities might even turn to displacement of wetlands as a solution. The Agency did not include these potential costs in its analysis for the NODA or proposal. In contrast to new facilities, which can take into account the Phase I requirements when choosing where to situate their structures (including cooling towers), existing facilities have far less flexibility and incur far greater costs. EPA believes that this is a special problem for existing facilities that is relevant to determining whether, as a national categorical matter, closed-cycle cooling is the best technology available for existing facilities for minimizing adverse environmental impacts associated with cooling water intake structures. EPA received retrofit cost estimates from a number of commenters that indicate that such costs could be at least twice those projected by EPA.

Another issue concerns the energy impacts of cooling towers. EPA examined the information it received after publication of the proposed rule and NODA, and agrees that the energy penalty associated with cooling towers, together with other factors, indicates that this technology is not the best technology available for existing facilities for minimizing adverse environmental impacts associated with cooling water intake structures. In reaching this conclusion, EPA relied on energy penalty information provided by the U.S. Department of Energy. EPA worked closely with the U.S. Department of Energy in preparing today's rule because of their expertise in power plant operations and engineering. The U.S. Department of Energy pointed out to EPA that existing fossil-fuel facilities converting from once-through cooling water systems to wet-cooling towers would produce 2.4 percent to 4.0 percent less electricity even while burning the same amount of coal. For at least one nuclear power plant, which provides 78% of the electricity consumed by the State of Vermont, the energy penalty associated with converting to cooling towers was estimated to be 5.3 percent. Expressed differently, DOE estimated that nationally, on average 20 additional 400-MW plants might have to be built to replace the generating capacity lost by replacing once-through cooling systems with wet cooling towers if such towers were required by all Phase II facilities.

This energy penalty leads to other negative consequences. Because this deficit is predicted to occur during the summer months (when energy demand is highest), the net effect would be more consumption of fossil fuel, which in turn increases the emission of sulfur dioxide, $NO_X$, particulate matter, mercury and carbon dioxide. Increasing fuel consumption at existing coal power plants yields the largest increase in air emissions because existing systems are less efficient at producing power (and therefore burn more coal) and because they generally have less air pollution control equipment in place. EPA believes that it is reasonable to consider these non-water quality environmental impacts and the additional costs associated with controlling these increased emissions in making today's decision. EPA further believes that it is authorized to do so because of the links between § 316(b) and sections 301 and 306, which require EPA to consider both the energy impacts and the air pollution impacts of technologies when identifying technologies in the effluent guidelines context. *See* CWA section 304(b)(2)(B) (cross-referenced in § 301); CWA section 306(b)(1)(B) (new source performance standards).

Some commenters also assert that EPA underestimated the down time that the facility would experience as it converts to cooling towers. This, again, is not an impact that would be experienced by new facilities. EPA agrees that such down time can be significant. Indeed, one of the four retrofit case studies EPA developed indicated a down time of 10 months, and EPA believes it is reasonable to infer that many other facilities would experience the same loss.

EPA also agrees with the commenters who assert that the empirical data base of four retrofit cases to which EPA compared cooling tower retrofit costs and engineering characteristics is not representative of the broader population of facilities and could be too narrow a set from which to develop national costs that would be applicable to a wide range

of facilities. Of the four retrofits EPA studied, two were in a single state (South Carolina), none were located along a coast, and only one generated more than 500 MW of electricity. EPA also recognizes that all of these conversions were performed before 1992. While it is true that the vast majority of the new, greenfield utility and non-utility combined cycle plants built in the past 20 years have wet cooling towers, EPA believes that it is significant that so few existing facilities retrofitted to the technology during the same period. The rarity of this technology as a retrofit further indicates that it is not economically practicable for the vast majority of existing facilities.

EPA also considered several additional points made by commenters in rejecting this option. Some commenters asserted that certain facilities with closed-cycle, recirculating cooling systems often need to address the impacts of cooling tower plumes, and subsequent fog and icing in metropolitan areas, and noise abatement. Commenters also asserted that the costs of retrofitting and operating such systems at facilities which do not now have them is disproportionate to the potential benefits derived, particularly given the similarity in the level of protection provided under this option (all facilities required to reduce flow commensurate with a closed-cycle, recirculating system) and the final rule. Finally, they stated that the need for flexibility in a rule pertaining to existing facilities is critical to allow facility owners a range of options to meet the fish protection requirements. EPA does not agree that in all cases the costs of retrofitting a closed-cycle cooling water system is disproportionate to the benefits derived. Nevertheless, EPA recognizes that these concerns have merit for many facilities and that the validity and extent of such concerns often must be assessed on a case-by-case basis.

Each of these factors has a cost and an economic impact that EPA believes is appropriate to consider when evaluating whether cooling towers are the best technology available for existing facilities for minimizing adverse environmental impacts associated with cooling water intake structures. The capital costs estimated by EPA at proposal are already very high; when costs reflecting reasonable changes to EPA's assumptions are added to them, the total capital cost investment and associated economic impact is simply too high at this time for EPA to be able to justify selecting cooling towers as a required technology for all existing Phase II facilities.

EPA further compared the efficacy of closed-cycle, recirculating cooling systems with that estimated for design and construction technologies. Although not identical, the ranges of impingement and entrainment reduction are similar under both options, such that the reductions estimated for the design and construction technologies, particularly when optimized, approach those estimated for closed-cycle, recirculating cooling systems. Therefore, the use of design and construction technologies as the basis for this rule is supported since they can approach closed-cycle, recirculating systems at less cost with fewer implementation problems. EPA considered this similarity in efficacy, along with the economic practicability and availability of each type of technology, in determining that a closed-cycle, recirculating cooling system is not the required technology for all Phase II existing facilities.

2. Intake Capacity Commensurate With Closed-Cycle, Recirculating Cooling Systems Based on Waterbody Type

EPA also considered an alternate technology-based option in which closed-cycle, recirculating cooling systems would have been required for all facilities on certain waterbody types. Under this option, EPA would have grouped waterbodies into the same five categories as in today's rule: (1) Freshwater rivers or streams, (2) lakes or reservoirs, (3) Great Lakes, (4) tidal rivers or estuaries; and (5) oceans. Because oceans, estuaries and tidal rivers contain essential habitat and nursery areas for the vast majority of commercial and recreational important species of shell and finfish, including many species that are subject to intensive fishing pressures, these waterbody types would have required more stringent controls based on the performance of closed-cycle, recirculating cooling systems. EPA discussed the susceptibility of these waters in a Notice of Data Availability (NODA) for the Phase I rule (66 FR 28853, May 25, 2001) and invited comment on documents that may support its judgment that these waters are particularly susceptible to adverse impacts from cooling water intake structures. In addition, the NODA presented information regarding the low susceptibility of non-tidal freshwater rivers and streams to impacts from entrainment from cooling water intake structures.

Under this alternative option, facilities that operate at less than 15 percent capacity utilization would, as in today's final rule, only be required to have impingement control technology. Facilities that have a closed-cycle, recirculating cooling system would have required additional design and construction technologies to increase the survival rate of impinged biota or to further reduce the amount of entrained biota if the intake structure was located within an ocean, tidal river, or estuary where there are fishery resources of concern to permitting authorities or fishery managers.

Facilities with cooling water intake structures located in a freshwater (including rivers and streams, the Great Lakes and other lakes) would have had the same requirements as under today's final rule. If a facility for which closed-cycle recirculating technology was required chose to comply with alternative requirements, then the facility would have had to demonstrate that alternative technologies would reduce impingement and entrainment to levels comparable to those that would be achieved with a closed-loop recirculating system (90% reduction). If such a facility chose to supplement its alternative technologies with restoration measures, it would have had to demonstrate the same or substantially similar level of protection. (For additional discussion see the Phase I final rule 66 FR 65256, at 65315 columns 1 and 2.)

At proposal, EPA estimated that there would be 109[46] facilities located on oceans, estuaries, or tidal rivers that do not have a closed-cycle, recirculating cooling system and would need to reduce intake flow to a level commensurate with that which can be attained by a closed-cycle, recirculating cooling system or upgrade design and construction technology (*e.g.*, screens) in order to meet performance standards for reducing impingement mortality and entrainment.

Although EPA estimated the costs of this option to be less expensive at the national level than an option based on closed-cycle, recirculating cooling systems everywhere, EPA did not select this option based on total social costs estimates of greater than $1 billion per year and its lack of cost-effectiveness, as well as on concerns regarding potential energy impacts. Facilities located on oceans, estuaries, and tidal rivers would incur high capital and operating and maintenance costs for conversions of their cooling water systems. Furthermore, since impacted facilities would be concentrated in coastal regions, EPA is concerned that there is

[46] Sample-weighted.

the potential for short term energy impacts and supply disruptions in these areas if multiple facilities retrofit concurrently or over a relatively short time-frame, as would be required by these regulations.

3. Intake Capacity Commensurate With Closed-Cycle, Recirculating Cooling System Based on Waterbody Type and Proportion of Waterbody Flow

EPA also considered a variation on the above approach that would have required only facilities withdrawing very large amounts of water from an estuary, tidal river, or ocean to reduce their intake capacity to a level commensurate with that which can be attained by a closed-cycle, recirculating cooling system. For example, for facilities with cooling water intake structures located in a tidal river or estuary, if the intake flow is greater than 1 percent of the source water tidal excursion, then the facility would have had to meet standards for reducing impingement mortality and entrainment based on the performance of wet cooling towers. These facilities would instead have had the choice of reducing cooling water intake flow to a level commensurate with wet cooling towers or of using alternative technologies to meet reduction standards based on the performance of wet cooling towers. If a facility on a tidal river or estuary had intake flow equal to or less than 1 percent of the source water tidal excursion, the facility would have only had to meet the same impingement and entrainment performance standards as in the final Phase II rule. These standards were developed based on the performance of technologies such as fine mesh screens and traveling screens with well-designed and operating fish return systems. The more stringent, closed-cycle, recirculating cooling system-based requirements would have also applied to a facility that has a cooling water intake structure located in an ocean with an intake flow greater than 500 MGD.

This option also would impose much higher costs on a subset of facilities than the final rule. Based on an analysis of data collected through the detailed industry questionnaire and the short technical questionnaire, at proposal, EPA estimated there were potentially 109 Phase II existing facilities located on estuaries, tidal rivers, or oceans which would incur capital costs under this option. Of these 109 facilities, EPA estimated that 51 would exceed the applicable flow threshold and be required to meet performance standards for reducing impingement mortality and entrainment based on a reduction in intake flow to a level commensurate with that which can be attained by a closed-cycle recirculating system. Of the 58[47] facilities estimated to fall below the applicable flow threshold, 10 facilities already meet these performance standards and would not require any additional controls, whereas 48[48] facilities would require entrainment or impingement controls, or both. Because this option would only require cooling tower-based performance standards for facilities located on tidal rivers, estuaries or oceans where they withdraw saline or brackish waters, EPA does not believe that this option would raise any significant water quantity issues.

At proposal, EPA estimated the total social cost of compliance for the waterbody/capacity-based option to be approximately $0.97 billion per year. EPA did not select this option because it was not determined to be the most cost-effective approach on a national basis. While the national costs of this option are slightly lower than those of requiring wet cooling towers-based performance standard for all facilities located on oceans, estuaries and tidal rivers, the cost for facilities to meet these standards are still substantial. Although EPA would provide an opportunity to seek alternative requirements to address locally significant air quality or energy impacts, EPA does not believe a framework such as this provides sufficient flexibility to ensure effective implementation and to minimize non-water quality (including energy) impacts. In addition, as noted above for the other cooling tower based options that EPA rejected, facilities can achieve almost the same level of impingement mortality and entrainment reductions using the technologies on which this final rule is based as they can using cooling towers, but at substantially lower cost.

4. Impingement Mortality and Entrainment Controls Everywhere

At proposal, EPA evaluated an option that required impingement mortality and entrainment controls for all facilities. This option did not allow for the development of best technology available on a site-specific basis. This alternative based requirements on the percent of source water withdrawn and, like today's final rule, also restricted disruption of the natural thermal stratification of lakes or reservoirs. It also imposed entrainment performance requirements on Phase II existing facilities located on freshwater rivers or streams, and lakes or reservoirs where EPA has determined in today's final rule that such controls are not necessary. Finally, under this alternative, restoration could be used, but only as a supplement to the use of design and construction technologies or operational measures.

This option established clear performance-based requirements that were based on the use of available technologies to reduce adverse environmental impact. Such an alternative would be consistent with the focus on use of best technology required under section 316(b). However, as indicated above, this option lacks the flexibility of the final rule in applying the necessary and appropriate available technology and therefore would be less effective in addressing the specific cooling water intake structure impacts posed by Phase II facilities in their various environmental settings.

At proposal, total social cost of compliance for this option was estimated at approximately $300 million per year. EPA did not select this option because other options were more cost-effective, in part because this option requires entrainment controls in freshwater rivers, streams, and lakes. The benefits of the final rule are almost the same as those for this option but a lower cost (since lakes and reservoirs, and for design intake flows below 5% in freshwater rivers and streams are the least likely to provide significant benefits).

5. Site-Specific Options as Best Technology Available To Minimize Adverse Environmental Impact

In the proposed rule EPA also considered several site-specific approaches to establishing best technology available. These include the site-specific sample rule discussed at 67 FR 17159, an alternative based on EPA's 1977 Draft Guidance (67 FR 17161), and alternatives suggested by UWAG and PSEG, respectively (*see* 67 FR 17162).

EPA did not adopt any of these site-specific regulatory options for several reasons. None of these site-specific approaches would have established national performance standards for best technology available to minimize adverse environmental impact. EPA believes that such national performance standards promote the consistent application of the best technology available to minimize adverse environmental impact. In addition, based on contact with States (*see* Phase I NODA, 66 FR 28865, Phase II proposal 67 FR 17152–3) and anecdotal

[47] Not sample-weighted.

[48] Not sample-weighted.

information [49] EPA believes that each of these site-specific options would have resulted in higher administrative burdens being imposed on applicants and permit writers relative to the final rule. As EPA has discussed in the preamble to the proposal (*see* 67 FR 17167), these administrative burdens can be associated with the need to determine in each case whether adverse impacts are occurring, the nature and level of any such impacts, and which design and construction technologies constitute the best technology available to minimize adverse environmental impacts, including a consideration of costs and benefits. Further, all of the proposed site-specific options increase the likelihood that each significant cooling water intake permitting issue would become a point of contention between the applicant and permit writer, which EPA's experience indicates slows the permitting process, makes it more resource intensive, and makes it more costly. Finally, because the final rule provides facilities with the option of selecting from five compliance alternatives, including a site-specific compliance alternative, the final rule provides facilities with flexibility comparable to that of a site-specific rule. The site-specific alternative in the final rule provides clear standards for eligibility (the cost-cost and cost-benefit tests), and clear standards on which to base the alternative requirements that they achieve an efficacy as close as practicable to the national performance standards without exceeding the cost-test or benefits-test thresholds. EPA believes that structuring a site-specific compliance alternative in this way will significantly reduce the potential areas of disagreement between permit writer and applicant that are inherent in the other site-specific approaches that it rejected, while still providing facilities with appropriate flexibility. Through the multiple compliance alternatives specified in this rule, EPA has sought to balance the statutory requirements of section 316(b) and the need for reasonable limits on the administrative burden imposed on both applicants and permit writers against the need for existing facilities to have flexibility in implementing the requirements.

[49] For example, a site-specific determination for Brayton Point, Rhode Island, has required resources for greater than two full time equivalents (FTEs) over three years for permitting and support staff, as well as approximately $400,000 in contractor costs to address technical issues and applicant experts. Similarly, development of a permit for Salem has required resources for greater than two full time equivalents (FTEs) over three years for permitting and support staff, as well as approximately $340,000 in contractor costs to address technical issues and applicant experts.

6. Flow Reduction Commensurate With the Level Achieved by Dry Cooling Systems Based on Waterbody Type

EPA conducted a full analysis for the Phase I rule and concluded that dry cooling was not an economically practicable option for new facilities on a national basis. Dry cooling systems use either a natural or a mechanical air draft to transfer heat from condenser tubes to air. In conventional closed-cycle recirculating wet cooling towers, cooling water that has been used to cool the condensers is pumped to the top of a recirculating cooling tower; as the heated water falls, it cools through an evaporative process and warm, moist air rises out of the tower, often creating a vapor plume. Hybrid wet-dry cooling towers employ both a wet section and dry section and reduce or eliminate the visible plumes associated with wet cooling towers.

For the Phase I rule, EPA evaluated zero or nearly zero intake flow regulatory alternatives, based on the use of dry cooling systems. EPA determined that the annual compliance cost to industry for this option would be at least $490 million. EPA based the costs on 121 new facilities having to install dry cooling. For the Phase II proposal, EPA estimated that total social costs for dry cooling based on waterbody type were $2.1 billion per year (or roughly double the costs for wet towers). Thus, this option would be more expensive than dry cooling for new facilities. The cost for Phase II existing facilities to install dry cooling would be significantly higher than the cost for new facilities to do so due to the complexities of retrofitting both the dry cooling equipment and components of the cooling system. At proposal, EPA estimated that 550 Phase II existing facilities would be subject to Phase II regulation. The cost would be significantly higher because existing facilities have less flexibility, thus incurring higher compliance costs (capital and operating) than new facilities. For example, existing facilities might need to upgrade or modify existing turbines, condensers, and/or cooling water conduit systems, which typically imposes greater costs than use of the same technology at a new facility. In addition, retrofitting a dry cooling tower at an existing facility would require shutdown periods during which the facility would lose both production and revenues, and decrease the thermal efficiency of an electric generating facility.

The disparity in costs and operating efficiency of dry cooling systems compared with wet cooling systems is considerable when viewed on a nationwide or regional basis. For example, under a uniform national requirement based on dry cooling, facilities in the southern regions of the United States would be at an unfair competitive disadvantage compared to those in cooler northern climates because dry cooling systems operate more efficiently in colder climates. Even under a regional subcategorization strategy for facilities in cool climatic regions of the United States, adoption of a minimum requirement based on dry cooling would likely impose unfair competitive restrictions for steam electric power generating facilities because of the elevated capital and operating costs associated with dry cooling. Adoption of requirements based on dry cooling for a subcategory of facilities under a particular capacity would pose similar competitive disadvantages for those facilities.

As explained in the preamble to the proposal, EPA does not consider performance standards based on dry cooling a reasonable option for a national requirement, nor for subcategorization under this rule, because the technology of dry cooling carries costs that would potentially cause significant closures for Phase II existing facilities. Dry cooling technology would also have a significant detrimental effect on electricity production by reducing the energy efficiency of steam turbines. Unlike a new facility that can use direct dry cooling, an existing facility that retrofits for dry cooling would most likely use indirect dry cooling which is much less efficient than direct dry cooling. In contrast to direct dry cooling, indirect dry cooling does not operate as an air-cooled condenser. In other words, the steam is not condensed within the structure of the dry cooling tower, but instead indirectly through a heat exchanger. Therefore, the indirect dry cooling system would need to overcome additional heat resistance in the shell of the condenser compared to the direct dry cooling system. Ultimately, the inefficiency (*i.e.*, energy penalty) of indirect dry cooling systems will exceed those of direct dry cooling systems in all cases.

Although the dry cooling option is extremely effective at reducing impingement and entrainment, it is not economically practicable for existing facilities and would cause additional adverse environmental impacts and serious energy impacts. Although dry cooling technology uses extremely low-

level or no cooling water intake, thereby reducing impingement and entrainment of organisms to extremely low levels, section 316(b) does not require that adverse environmental impact be completely eliminated, but that it be minimized using the best technology available. (DOE energy penalty study; DCN 4–2512). EPA does not believe that dry cooling technology is "available" to most Phase II existing facilities.

Although EPA has rejected dry and wet cooling tower technologies as a national minimum requirement, EPA does not intend to restrict the use of these technologies or to dispute that they may be the appropriate cooling technology for some facilities. For example, facilities that are repowering and replacing the entire infrastructure of the facility may find that dry cooling is an acceptable technology in some cases. This technology may be especially appropriate in situations where access to cooling water is limited. Wet cooling tower technology may be suitable where adverse effects of cooling water intakes are severe and where screening systems are impractical, or where thermal discharge impacts pose serious environmental problems. Under Clean Water Act section 510, a State may choose to impose more stringent standards than required by Federal regulations. States may continue to use this authority to require facilities to use dry or wet cooling systems.

*F. What Is the Role of Restoration and Trading Under Today's Final Rule?*

1. What Is the Role of Restoration?

EPA is providing facilities with the option to use restoration for compliance alternatives § 125.94(a)(2), (3), and (5) where the performance of the restoration measures (the production and increase of fish and shellfish in the facility's waterbody or watershed, including maintenance of community structure and function), is substantially similar to that which would have been achieved if the facility reduced impingement mortality and entrainment through the use of design and construction technologies and/or operational measures, to meet the applicable performance standards. (For a complete discussion of the legal analysis supporting restoration, see section VIII of this preamble.) The role of restoration under this rule is to provide additional flexibility to facilities in complying with the rule by eliminating or significantly offsetting the adverse environmental impact caused by the operation of a cooling water intake structure. Restoration measures that increase fish and shellfish in an impacted waterbody or watershed and result in performance substantially similar to that which would otherwise be achieved through reductions in impingement mortality and entrainment further the goal of minimizing adverse environmental impact while offering additional flexibility to both permitting authorities and facilities. Restoration measures may include such activities as removal of barriers to fish migration, reclamation of degraded aquatic organism habitat, or stocking of aquatic organisms. These are still technologies, within the meaning of that term as used in section 316(b) and as such are an appropriate means for meeting technology based performance standards. They are not analogous to water quality based effluent limitations on pollutant discharges because they are not designed to meet water quality standards or dependent on the condition of the receiving waterbody. Rather, they provide an additional means to meet the same performance standards that guide the selection of design and construction technologies and operational measures.

Restoration measures have been used at existing facilities as one of many tools to implement section 316(b) on a case-by-case, best professional judgment basis to compensate for the death and injury of fish and other aquatic organisms caused by the cooling water intake structure. Under today's rule, a Phase II existing facility may utilize restoration either in lieu of or as a supplement to design and construction technologies and/or operational measures. For example, a facility may demonstrate to the Director that velocity controls are the most feasible technology choice for the facility but that, when used on their own, the velocity controls are insufficient to meet the applicable performance standards at § 125.94(b). The facility may then, in conjunction with the use of velocity controls, implement restoration measures to increase the fish and shellfish productivity of the waterbody in order to meet the performance standards at § 125.94(b). Another facility might demonstrate to the Director that restoration measures alone achieve the greatest compliance with the performance standards. A facility may alternatively request a site-specific determination of best technology available under § 125.94(a)(5) and use restoration measures to meet the alternate requirements.

Facilities that propose to use restoration measures must demonstrate to the Director that they evaluated the use of design and construction technologies and operational measures and determined that the use of restoration measures is appropriate because meeting the applicable performance standards or requirements through the use of other technologies is less feasible, less cost-effective, or less environmentally desirable than meeting the standards in whole or in part through the use of restoration measures. Facilities must also demonstrate that the restoration measures they plan to implement, alone, or in combination with design and construction technologies and/or operational measures, will produce ecological benefits (production of fish and shellfish) at a level that is substantially similar to the level that would be achieved through compliance with the applicable impingement mortality and/or entrainment performance standards under § 125.94(b), or alternative site-specific requirements under § 125.94(a)(5). In other words, restoration measures must replace the fish and shellfish lost to impingement mortality and entrainment, either as a substitute or as a supplement to reducing impingement mortality and entrainment through design and control technologies and/or operational measures. While the species makeup of the replacement fish and shellfish may not be exactly the same as that of the impingement mortality and entrainment losses, the Director must make a determination that the net effect is to produce a level of fish and shellfish in the waterbody that is "substantially similar" to that which would result from meeting the performance standards through design and construction technologies and/or operational measures alone. The final rule requires that a facility use an adaptive management method for implementing restoration measures because the performance of restoration projects must be regularly monitored and potentially adjusted to ensure the projects achieve their objectives (see 67 FR 17146–17148 and 68 FR 13542).

The final rule also requires that restoration projects which replace the lost fish and shellfish with a different species mix ("out of kind" restoration) be based on a watershed approach to restoration planning. The boundaries of a "watershed" should be guided by the cataloging unit of the "Hydrologic Unit Map of the United States" (USGS, 1980), although it may be appropriate to use another watershed or waterbody classification system developed at the state or local level if such a system compares favorably in level of detail. For example, in coastal systems that support migratory fish, a coastal

waterbody that transects a number of watersheds may be the most appropriate unit for planning restoration.

2. What Is the Role of Trading in Today's Rule?

In § 125.90(c), today's final rule provides that if a State demonstrates to the Administrator that it has adopted alternative regulatory requirements in its NPDES program that will result in environmental performance within a watershed that is comparable to the reductions of impingement mortality and entrainment that would otherwise be achieved under § 125.94, the Administrator must approve such alternative requirements. A trading program could be a part of these alternative regulatory requirements.

At proposal, EPA sought comment on the potential role of trading in the context of the section 316(b) Phase II rulemaking and possible approaches for developing a trading program. Trading under other EPA programs has been shown to provide opportunities for regulatory compliance at reduced costs. The EPA Office of Water's Water Quality Trading Policy, published in January 2003 [DCN 6–5002], fully supports trading nutrients and sediment and adopts a case-by case approach to evaluating proposals to trade other pollutants.

Trading in the context of section 316(b) raises many complex issues, for example, how to establish appropriate units of trade and how to measure these units effectively given the dynamic nature of the populations of aquatic organisms subject to impingement mortality and entrainment. Should a State choose to propose a trading program under § 125.90(c), EPA will evaluate the State's proposal on a case-by-case basis to ensure the program complies with the regulatory requirement—that it will result in environmental performance within a watershed that is comparable to the reductions of impingement mortality and entrainment that would otherwise be achieved under the requirements established at § 125.94. Some commenters suggested that EPA adopt a trading program that would allow trading between aquatic organisms and pollutant discharges. EPA is concerned that such a program would introduce comparability and implementation challenges that would be difficult to overcome and therefore, EPA does not expect that such a program would work within the framework of today's final rule. In addition, EPA does not believe that it is possible at this time to quantify with adequate certainty the potential effects on ecosystem function, community structure, biodiversity, and genetic diversity of such trades, especially when threatened and/or endangered species are present. Based on the current state of the science in aquatic community ecology and ecological risk assessment, States wishing to develop trading programs within the context of 316(b) would be best off focusing on programs based on metrics of comparability between fish and shellfish gains and losses among trading facilities, rather than the much more complex metrics that would be necessary for comparability among fish and shellfish losses on the one hand, and pollutant reductions on the other.

## VIII. Summary of Major Comments and Responses to the Proposed Rule and Notice of Data Availability (NODA)

### *A. Scope and Applicability*

1. Phase II Existing Facility Definition

Numerous commenters supported limiting the scope of the Phase II rule to existing facilities that generate and transmit electric power, or generate and sell such power to another entity for transmission, but suggested that EPA has not sufficiently limited the rule to only these facilities. Commenters noted that the proposed definition of "Phase II existing facility" does not adequately exempt existing manufacturing facilities that may occasionally transfer power off-site during peak load events. Some commenters suggested that EPA clarify the Phase II rule to specify that it does not apply to facilities whose primary business is not power generation. Some suggested limiting applicability to specified SIC codes (*e.g.*, provided that the rule only applies to facilities in SIC 4911). Examples of facilities identified by commenters that they believe should be excluded from Phase II include manufacturers that produce electricity by co-generation, power generating units that predominantly support a manufacturer, *e.g.*, iron and steel, but also export some power, and facilities that generate power for internal use.

Commenters requested that EPA further clarify when repowering is subject to existing facility requirements. For example, some commenters viewed as inconsistent the fact that the addition of a generating unit at an existing single unit site could increase intake flows by 100% and meet the existing facility definition, while a replacement facility that increases intake flows by a much lesser amount (*e.g.*, 25%) would not meet the existing facility definition. These commenters suggested that EPA consider a facility as an existing facility unless changes to the facility result in new environmental impacts.

In § 125.91(a)(3) of today's rule, an existing facility is subject to this rule if its primary activity is either to generate and transmit electric power, or to generate electric power that it sells to another entity for transmission. This provision was included in the rule in response to comments such as those described previously in this section. EPA believes that this criterion—the primary activity being the generation of electric power—sufficiently clarifies and limits the scope of this rule to existing facilities whose primary business is power generation. As discussed in Section II of this preamble, the final rule does not apply to existing manufacturing facilities, including manufacturing facilities that generate power for their own use and transmit any surplus power, or sell it for transmission, provided the primary activity of the facility is not electric power generation. For example, in the case of a facility that operates its own power generating units and such units predominantly support that facility's manufacturing operation, its primary activity remains manufacturing, even if the facility exports some power. Whether a facility's primary activity is to generate electric power will need to be determined on a case-by-case basis. Section II also makes clear that a manufacturing facility is not covered by this final rule just because it is co-located with another Phase II facility.

EPA considered specifying SIC or NAIC codes to clarify the scope of the rule beyond that proposed in § 125.91(a)(3), but did not do so because it believes the changes in the final rule are sufficient to address many issues raised in comments and because of concerns that SIC and NAIC codes may change over time, which could unintentionally alter the scope of the rule.

With regard to repowering, section II of today's notice discusses the scope of the final rule and specifically discusses the repowering issue. Section II also addresses other Phase I versus Phase II classification issues.

2. Thresholds

Some commenters supported use of the 50 MGD design intake flow threshold and the 25 percent cooling water use criteria in § 125.91(a)(2) and (4), respectively. Some suggested that facilities agreeing to limit their actual intake to less than 50 MGD should be excluded from the rule's requirements or be allowed to request an exemption. Other commenters maintained that permitted or actual flows should be used rather than design flows. Some commenters asked that EPA clarify that,

when applicable, the lesser design value of an intake facility and conveyance structure versus the design volume of intake pumps should be used to determine the 50 MGD threshold for applicability. Alternatively, others asserted that EPA should provide guidance that a facility's design intake flow is not necessarily the flow associated with that of the intake pumps.

Several commenters stated that emergency cooling water and emergency service water intakes should be exempt from the 50 MGD design intake flow threshold. These commenters recommended that EPA distinguish between primary cooling water intakes and emergency service water intakes, for example, at nuclear facilities. They reasoned that emergency service water systems, which can have a large design capacity (*i.e.*, design capacity greater than 50 MGD), generally use an intake that normally operates a nominal amount of time to ensure that the system is in working order. Such back-up systems are required for safety, but under normal conditions do not increase the operational capacity of the facility. Thus, these commenters maintain that rarely used emergency service water should not count towards 50 MGD.

With regard to the criterion that a Phase II existing facility must use at least 25 percent of the water it withdraws exclusively for cooling, some commenters indicated that proposed § 125.91(d), which describes how to measure whether 25 percent of water withdrawn is used for cooling, was ambiguous. Commenters asserted that EPA should not require monthly determinations of applicability of the Phase II rule. One commenter suggested that EPA should assess the 25 percent cooling water use on an annual basis calculated once during permit renewal, since such an approach would provide a high degree of certainty.

As discussed in the proposed rule (67 FR 17129–17130), EPA chose the design intake flow 50 MGD threshold to focus on the largest existing power generating facilities, which the Agency believes are those with the greatest potential to cause or contribute to adverse environmental impact. EPA estimates that the 50 MGD threshold would subject approximately 543 of 902 (60 percent) of existing power generating facilities to this rule and would address 90 percent of the total flow withdrawn by existing steam electric power generating facilities. The 25 percent threshold ensures that nearly all cooling water and the most significant facilities using cooling water intake structures are addressed by these requirements. EPA notes that Phase II existing facilities, which are limited to facilities whose primary activity is power generation, typically use far more than 25 percent of the water they withdraw for cooling. Yet, as in the new facility rule, cooling water that is used in a manufacturing process either before or after it is used for cooling would not count towards calculating the percentage of a facility's intake flow that is used for cooling purposes.

EPA has retained in the final rule the 50 MGD threshold based on design intake flow, rather than actual flow, for several reasons. Design intake flow is a fixed value based on the design of the facility's operating system and the capacity of the circulating and other water intake pumps employed at the facility. This approach provides clarity—the design intake flow does not change, except in those limited circumstances when a facility undergoes major modifications or expansion, whereas actual flows can vary significantly over sometimes short periods of time. EPA believes that an uncertain regulatory status is undesirable because it impedes both compliance by the permittee and regulatory oversight, as well as achievement of the overall environmental objectives. Further, using actual flow may result in the NPDES permit being more intrusive to facility operation than necessary since facility flow would be a permit condition and adjustments to flow would have to be permissible under such conditions and applicable NPDES procedures. It also would require additional monitoring to confirm a facility's status, which imposes additional costs and information collection burdens, and it would require additional compliance monitoring and inspection methods and evaluation criteria, focusing on operational aspects of a facility.

With regard to intake versus pump capacity, EPA notes that under § 125.93 of the final rule, design intake flow means the value assigned (during the cooling water intake structure design) to the total volume of water withdrawn from a source waterbody over a specific time period. Because numerous aspects of a cooling water intake or system can limit a facility's intake flow, and because flow is a critical factor that affects the impacts posed by each facility's cooling water intake structures, EPA has determined that it is more appropriate for the final rule to focus on a facility's total designed volume of water withdrawn over a period of time, rather than to condition applicability of the rule on more specific parameters, such as intake capacity or pump design, which individually do not fully determine total design intake flow.

The final rule does not explicitly exclude emergency cooling water and emergency service water intakes from consideration in determining which facilities are in-scope. Although EPA does not have detailed data on emergency cooling water and emergency intakes, based on other available data EPA does not believe that including consideration of emergency intakes within this rule significantly alters the scope of the rule. EPA's survey of all existing electric utilities and non-utilities indicated that 84 percent of surveyed facilities have an average flow that equals or exceeds 50 MGD. These facilities would by necessity have a design intake flow that also equals or exceeds 50 MGD. Moreover, EPA assumes that this average flow data represent normal operating conditions and does not include emergency cooling water use. Consequently, EPA believes that relatively few facilities are potentially affected by this issue.

Finally, § 125.91(a)(4), which describes how a facility must determine whether it meets the 25 percent cooling water use criterion has been changed in the final rule and provides that the percent of cooling water used be measured on an average annual basis. EPA believes this approach is more appropriate than making this determination on an average monthly basis, primarily because the annual average is an easier measurement to make. Furthermore, because all Phase II existing facilities generate power, most of the water will be used for cooling, rendering monthly evaluation of this value unnecessary. The final rule does not specify how often the facility must measure flow for this annual average. The facility is encouraged to consult the Permit Director to determine what level of data collection is needed.

### *B. Environmental Impact Associated With Cooling Water Intake Structures*

Many comments addressed adverse environmental impact, questioning the definition and quantification of adverse environmental impacts. Several suggested defining adverse environmental impact exclusively at the population, community, or ecosystem levels, and believe that numbers of impinged and entrained organisms should not be a measure of adverse environmental impact. Some commenters argued that, if a facility can prove it does not cause adverse environmental impact at the population level, then it should be exempt from section 316(b) regulations. Commenters

cited numerous studies to illustrate whether cooling water intake structures cause adverse environmental impacts and claimed that where abundance or biomass falls, it was usually the result of some other stressor (overfishing, pollution, etc). These commenters asserted that populations are able to thrive despite high rates of impingement and entrainment because of density-dependence and compensation.

Numerous other commenters disagreed with limiting the definition of adverse environmental impact to the population, community or ecosystem levels, and contended that any measure of impingement and entrainment constitutes adverse environmental impact. They asserted that power plants contribute to fish kills directly by impingement and entrainment, and indirectly by habitat loss. These commenters maintained that the results of population or ecosystem studies are highly subjective, and have no place in determining BTA, as once such impact levels are reached, recovery is often impossible. Regardless of the severity of adverse environmental impact, these commenters argued that section 316(b) requires minimization of adverse environmental impact. They maintained that cooling water intake structures contribute to fishery collapse and vast reductions in fish biomass and abundance that are measurable at the species level. These commenters suggested that actual national impacts due to cooling water intake structures are vastly underestimated due to poor data collection methodologies utilized when the majority of the studies were performed and because studies performed on impinged and entrained organisms overlooked the vast majority of affected species.

In today's final rule, EPA has elected not to define adverse environmental impact. EPA believes that it is reasonable to interpret adverse environmental impact as the loss of aquatic organisms due to impingement and entrainment. For a further discussion of this issue, see Section IV above.

With regard to the relationship between intake flow and adverse environmental impact, some commenters asserted that the relationship of impingement and entrainment to flow is such that catch rates increase non-linearly (exponentially) in relation to the volume of water withdrawn, with entrainment rates being more strongly correlated to flow than impingement. Environmental commenters advocated for flow reduction technologies, such as retrofitting closed-cycle cooling technologies, as the most direct means of reducing fish kills from power plant intakes; they assert that reducing intake by up to 98 to 99 percent would result in a similarly high reduction of impinged and entrained organisms. Other commenters insisted that there is no statistically significant relationship between catch rate and flow, and the mathematical models that evaluate this relationship are inaccurate.

EPA believes the record contains ample evidence to support the proposition that entrainment is related to flow (see DCN 2–013L–R15 and 2–013J) while impingement is related to a combination of flow, intake velocity and fish swim speed (see DCN 2–029). Larger withdrawals of water may result in commensurately greater levels of entrainment. Entrainment impacts of cooling water intake structures are closely linked to the amount of water passing through the intake structure because the eggs and larvae of some aquatic species are free-floating and may be drawn with the flow of cooling water into an intake structure. Swim speeds of affected species as well as intake velocity must be taken into account to predict rates of impingement in relation to flow in order to account for the ability of juvenile and adult lifestages of species to avoid impingement. Due to this relationship, EPA agrees that reducing intake by installing flow reduction technologies will result in a similarly high reduction of impinged and entrained organisms, but EPA believes that other technologies that do not necessarily reduce flow but that do reduce the number of aquatic organisms impinged and entrained will also minimize adverse environmental impact associated with cooling water intake structures. As such, today's rule provides for flexibility in meeting the performance standards.

### *C. Performance Standards*

The performance standards promulgated today are expressed as reductions of impingement and entrainment measured against a calculation baseline. The purpose of a calculation baseline is to properly credit facilities that have installed control technologies prior to the promulgation of the rule. EPA received numerous comments on the performance standards and the calculation baseline.

#### 1. Appropriate Standards

Many commenters discussed the appropriateness of the performance standards. While many commenters acknowledged that the performance range may be attained at some facilities (using certain technologies and in appropriate conditions), several commenters stated that the technical justification for the performance standards was insufficient and may be biased towards higher performing examples of each technology. Many commenters submitted that some technologies will perform at some sites, but that no technology will meet the standards at all sites. Another commenter supported the concept of the performance standards, as long as sufficient flexibility was retained through the use of restoration measures and cost tests. Some commenters suggested allowing permit writers the flexibility to create site-specific performance standards.

EPA has selected performance standards to facilitate a more streamlined permitting process, and to provide consistent national standards. EPA has chosen to express the targets by reference to a percentage reduction in impingement and entrainment because, as discussed above, these losses can easily be traced to cooling water intake structures. Therefore, this is a convenient indicator of the efficacy of controls in reducing environmental impact. As discussed in more detail below, it is also a useful basis against which to consider the efficacy of restoration technologies, which focus on the replacement of fish and shellfish as an alternative means of minimizing adverse environmental impact of intake structures.

Additional documentation has been collected and reviewed by EPA to further support the percent reductions contained in the performance standards. EPA has added this information to the Technology Efficacy database (DCN 6–5000), which EPA has expanded to allow users to query and compare basic data on technology performance and applicability. EPA recognizes that some may disagree with basing the performance standards on the wide range of data available in the database. While many documents do show a level of success in reducing impingement mortality or entrainment, other studies have shown the deployed technology to be unsuccessful or at best inconclusive. EPA does not view the varying degrees of success with regards to a specific technology as indicative that the performance standards cannot be met, but rather as evidence that some technologies work in some applications but not in others.

It is for this reason that performance standards, rather than prescriptive technologies, were chosen. By opting for performance standards instead of requiring the deployment of specified technologies, EPA maintains a desired

flexibility in the implementation of the rule, thus allowing a facility to select measures that are appropriate to the site conditions and facility configuration. EPA believes that there are technologies available (including restoration measures) that can be used to meet the performance standards at the majority of facilities subject to the final Phase II rule. EPA believes that it will likely be the exceptional case where no technology or suite of technologies will be able to achieve the performance standards. This is not to say, however, that the technologies are always economically practicable to implement; there may be situations where the costs are not justified and it is for those situations that EPA has provided for site-specific determinations of best available technology for minimizing adverse environmental impact.

2. Application of the Performance Standards

Commenters generally noted that the application of the performance standards would be very difficult, for a number of site-specific reasons. Several commenters noted that the performance standards are not sufficiently defined to make a full evaluation of their applicability. For example, EPA has not defined the performance standards as being measured using all species or selected species, or by counting individuals versus measuring biomass. Some commenters noted that each of the methods discussed by EPA could have merit at a given facility, and that flexibility would be needed to evaluate compliance at a variety of intake configurations. Another commenter further noted that it is inappropriate for EPA to state that the performance standards are achievable when the standards are undefined. One commenter suggested that EPA has not shown that the performance standards can be met at a reasonable cost. Other commenters stated that reductions may be achievable for only some species of life stages and that this approach may not account for natural fluctuations in population. These commenters claim that implementing a uniform, nationwide performance standard would be exceedingly complex and subject to site-specific factors that could significantly affect the performance of the control technology. Several commenters noted that, for these reasons, EPA should strongly consider a site-specific approach to implement 316(b), including a risk assessment-based approach as suggested by one commenter.

A number of commenters stated that the performance standards would be best implemented as a set of goals or as a best management practice. These commenters contended that in view of the wide variety of environmental conditions at facilities, including natural fluctuations in populations, compliance with a national performance standard will be difficult. They claimed that by using the standards as a goal instead of a condition in the permit, a facility can have greater certainty as to its compliance status. Similarly, several commenters suggested that the permit contain conditions requiring proper technology selection, installation, maintenance, and adjustments instead of requiring compliance with the performance standards.

Commenters were divided over the concept of a range for the performance standards. Some commenters supported the range, arguing that a facility can achieve some reduction within the range and still be compliant, and others were opposed, claiming that a range of performance promotes uncertainty in determining compliance. Some commenters also noted that, by giving a facility a range of performance, EPA is encouraging performance in the lower end of the range and therefore not meeting the definition of "best technology available."

Several commenters noted that consideration of entrainment mortality is important to correctly determine compliance. One commenter also noted that natural events will affect compliance, such as moribund fish being swept into an intake or heavy debris loads following a storm.

As in the Phase I rule, EPA is setting performance standards for minimizing adverse environmental impact based on a conceptually simple and certain metric-reduction of impingement mortality and entrainment. EPA recognizes however, that there are challenges associated with measuring such reduction due to fluctuations in waterbody conditions (species abundance, composition, etc.) over time. While it is relatively straightforward to measure impingement mortality and entrainment reductions relative to past levels, it is more difficult to determine reductions relative to what would have occurred in the absence of control technologies if waterbody conditions change after the technologies are installed. Data provided with the proposed rule (DCN 4–0003) indicate that there is substantial variability over time in the numbers and species mix of impinged and entrained organisms at any given facility. While changes in operational practices and sampling methods account for some of this variability, the data indicate that there may be substantial natural variability in waterbody conditions as well. This natural variability and the changes to species composition over time may affect the ability of these technologies to perform consistently at a certain level. This is one reason why EPA has provided a compliance determination alternative under which facilities comply with the construction, operational, maintenance, monitoring, and adaptive management requirements of a Technology Installation and Operation Plan (or Restoration Plan) designed to meet the performance standards, rather than having to demonstrate quantitatively that they are consistently meeting them, which may be difficult in the face of natural variability. Under this approach, if monitoring data suggest that performance standards are not being met despite full compliance with the terms of the Technology Installation and Operations Plan or the Restoration Plan, the Plan will need to be adjusted to improve performance.

EPA has provided examples of facilities in different areas of the country sited on different waterbody types that are currently meeting or exceeding the performance standards promulgated today. The ability of these facilities to attain similar performance standards suggests that while site-specific factors can influence the performance of a given technology, it is the exceptional situation where no design or construction technology is capable of meeting the performance standards. EPA opted for performance ranges instead of specific compliance thresholds to allow both the permittee and the permitting authority a certain degree of flexibility in meeting the obligations under the final Phase II rule. EPA does not believe that performance ranges promote uncertainty. Instead, EPA has selected performance ranges out of the recognition that precise results may not be able to be replicated in different waterbody types in different areas of the country. EPA disagrees with the comment that it has not shown that the performance standards can be met at a reasonable cost. The cost and economic impact analysis for the final rule supports EPA's determination that the final rule, including the performance standards, are economically practicable at a national level. In addition, the final rule includes a site-specific compliance alternative to address any potential situation where meeting the performance standards, when evaluated on a facility-specific basis, would result in costs that are significantly greater than the costs

considered by EPA, for a like facility in establishing the standards, or that are significantly greater than the benefits of compliance with the applicable performance standards at the facility. Thus, the final rule ensures that the costs of the rule are economically practicable to the extent required by section 316(b).

In developing the final rule, EPA identified and examined a broad range of cooling water intake structure technologies and determined, at a national level, that these technologies support the final performance standards. EPA notes that, although the performance standards address all life stages of fish and shellfish, the Director has significant discretion as to how the performance standards are applied in the permit. For example, the Director may determine that all species must be considered or that only representative species are to be considered. With regard to natural fluctuations in fish and shellfish populations, and the Technology Installation and Operation Plan compliance scheme discussed above addresses the concern that natural fluctuations could impact the level of impingement mortality and entrainment at a given facility over time. Further, the Director is given considerable discretion to determine, based on the facility's Comprehensive Demonstration Study, the appropriate averaging period and precise metric for determining impingement mortality and entrainment reductions. Generally, averaging over longer time periods (*i.e.*, a full five year permit term) can substantially reduce the impact of natural variability on the determination of whether the performance standards are being met.

3. Requirements by Waterbody Type

As stated in section C. 2, different performance standards would apply for facilities located upon different waterbody types. Comments were received both in support of and against basing performance standards in part on waterbody type. Some commenters did not support the withdrawal threshold of 5 percent of the mean annual flow for facilities on freshwater rivers, as the organisms at an intake may not be subject to entrainment or may not be evenly distributed. Some State commenters supported the withdrawal threshold for freshwater rivers, and another suggested correlating the intake flow requirements with the total flow of the waterbody to better protect smaller flow rivers. One State commenter generally opposed all of the proposed thresholds on freshwater rivers as being arbitrary and stated that the regulations would be more effective by considering the impacts to the population within the waterbody. For lakes and reservoirs, one commenter opposed the requirement to not disturb the thermal stratification of the waterbody, stating that the requirement has not been defined in sufficient detail, that EPA has presented no evidence that the disruption is always detrimental, or presented any discussion of technologies that might mitigate any thermal disturbances. Some commenters did not support additional controls on the Great Lakes, stating that the Lakes are not unique and do not require greater protection. Another State commenter suggested that additional requirements be implemented for any impaired waterbody.

EPA considers location to be an important factor in addressing adverse environmental impact and one expressly included in the language of section 316(b). When cooling water is withdrawn from sensitive biological areas, there is a heightened potential for adverse environmental impact, since these areas typically have higher concentrations of impingeable and entrainable aquatic organisms. Therefore, the final rule includes performance standards that vary, in part, by waterbody type. For example, estuaries and tidal rivers have a higher potential for adverse impact because they contain essential habitat and nursery areas for a majority of commercial and recreational species of fish and shellfish. Therefore, EPA believes that these areas warrant a higher level of control that includes both impingement and entrainment controls.

EPA also included performance standards for other waterbody types. Facilities withdrawing greater than 5% of the mean annual flow from freshwater rivers and streams will have additional requirements. As described in the Phase I proposed rule (65 FR 49060) and the Phase II NODA (66 FR 28853), the withdrawal threshold is based on the concept that absent any other controls, withdrawal of a unit volume of water from a waterbody will result in the entrainment of an equivalent unit of aquatic life (such as eggs and larval organisms) suspended in that volume of the water column. Thus, facilities withdrawing greater than 5% of the mean annual flow from freshwater rivers and streams may entrain equal proportions of aquatic organisms. Freshwater rivers and streams are somewhat less susceptible to entrainment than certain other categories of waterbodies and, therefore, the final rule limits the requirement for entrainment control in fresh waters to those facilities that withdraw the largest proportion of water from freshwater rivers or streams. EPA has promulgated special requirements for facilities withdrawing from lakes and reservoirs. Facilities tend to withdraw from the deeper portions of lakes and reservoirs, as these areas hold the coolest water. The rule specifies that the intake flows must not disturb the natural stratification (thermoclines) in the waterbody, as this may disrupt the composition of dissolved oxygen and adversely affect aquatic species. While such disruption is often detrimental, this additional performance standard does not apply where the disruption does not adversely affect the management of fisheries. Intake location, the volume of water withdrawn, and other design technologies can be used to address this requirement. Facilities located on the Great Lakes are also subject to additional requirements because these waterbodies have areas of high productivity and sensitive habitat and in this respect have an ecological significance akin to estuaries.

4. Approved Design and Construction Technology Option

In response to comments on the burden to facilities and permit writers, EPA is including in the final rule an approved design and construction technology option (previously referred to as a "streamlined technology option" or "pre-approved technology option") for facilities in certain locations. Under this option, a facility installing a specified technology would be subject to reduced application requirements, including a reduced Comprehensive Demonstration Study. In addition, the final rule sets forth criteria that State Directors may use to identify and approve additional technologies.

Nearly all commenters supported the concept of an approved design and construction technology option as a positive step in facilitating implementation of section 316(b). Several commenters added that this option should not preclude the use of cost tests, restoration measures or the use of other approaches. One commenter opposed the approved design and construction technology option, arguing that the selection of only one or two technologies oversimplifies the complexity of waterbodies, and that the approach would not be sufficiently protective.

Some commenters agreed that the wedgewire screen should be an effective technology in certain situations and noted that EPA should specify screen slot openings in the approved design

and construction technology option. One of the commenters stated that research on the wedgewire screen suggests that the technology should easily meet the impingement requirements, but that further research may be necessary to confirm the effectiveness for entrainment reductions with varying slot openings.

Some commenters offered suggestions for additional changes to the option, such as developing scientifically sound, peer-reviewed criteria for evaluating pre-approved technologies, identifying the technologies in technical guidance documents as opposed to the regulation, and continuing to allow restoration measures. Some commenters also suggested specifying that any monitoring performed would be informational in nature and not affect the facility's compliance status, or that facilities only be required to "substantially meet" the stated goals. Other commenters suggested expanding the scope of the approved design and construction technology option to include prescribed operational or restoration measures or preapproved technologies for intakes located on man-made cooling reservoirs.

A facility that chooses to comply under the pre-approved technology option should not, in addition, need to employ restoration measures. The intent of the pre-approved technology compliance alternative is to provide a means to reduce the application and information collection requirements for facilities that are able to meet performance standards through a technology that is proven to meet performance standards for impingement mortality and entrainment in most cases. A facility that chooses to comply by meeting the conditions specified at § 125.99(a), therefore, should be able to achieve the performance standards for both impingement mortality and entrainment. Facilities that propose an alternative technology for consideration as a pre-approved technology under § 125.99(b) are encouraged by EPA to propose technologies to the Director for approval that are capable of meeting performance standards for both impingement mortality and entrainment with a high degree of confidence. However, a situation could arise where a pre-approved technology only meets performance standards for impingement mortality or entrainment. In such cases, facilities that choose to comply using an approved design and construction technology that only met a subset of applicable performance standards could either employ other (1) design and construction technologies, operational measures and/or restoration measures or (2) request a site-specific requirements for the remaining performance standards based on either the cost-cost or cost-benefit test.

Some commenters stated that EPA should specify the wedgewire screen slot opening size. EPA disagrees that it should specify a uniform screen slot opening size for all facilities that choose the approved design and construction technology alternative. The rule states in § 125.99(a)(1)(iv) that the screen slot size must be appropriate for the size of eggs, larvae, and juveniles of all fish and shellfish to be protected from entrainment at the site. Because the species to be protected differ among locations, the slot sizes will need to be tailored to the sizes of the various assemblages of species at each site. EPA therefore has determined that the Director should determine the appropriate design criteria, such as wedgewire screen slot opening size, on a case-by-case basis. Since no impingement mortality and entrainment Characterization Study is required under this streamlined option, EPA expects that this determination would be based on available information regarding species and life-stage composition of organisms within the receiving waterbodies. Facilities may wish to assemble available data and propose a screen slot opening size for the Director's consideration.

Some commenters stated that EPA should develop peer-reviewed criteria for evaluating pre-approved technologies other than the wedgewire screen technology described in § 125.99(a). EPA disagrees that it needs to develop specific criteria for evaluating pre-approved technologies. EPA believes that the Director is best equipped to determine the most appropriate technologies for approval in their jurisdictions, since these Directors are most familiar with the site-conditions and intake configurations of the facilities within their jurisdictions, and have physical access to the facilities. Under § 125.99, EPA has set forth a broad framework outlining the types of information that the permitting authority would need to evaluate specific technologies, including design criteria of the proposed technology, site characteristics and conditions necessary to ensure that the technology will meet the performance standards, and data to demonstrate that the facilities in the Director's jurisdiction with the proposed technology and site conditions will be able to meet the performance standards in § 125.94(b). EPA believes that the Directors will be able to evaluate the data and make determinations as to whether the proposed technologies are suitable for use as approved design and construction technologies in their jurisdictions. However, EPA is requiring that the Director take public comment on such determinations prior to finalizing them.

In answer to comments that EPA should not require facilities choosing the approved design and construction compliance alternative to demonstrate through monitoring that they meet the applicable performance standards, EPA disagrees. EPA believes that verification monitoring is very important because, while the pre-approved technologies are designed to meet the performance standards in most cases, the actual efficacy of any technology will be affected by site-specific circumstances and conditions, as well as proper operation and maintenance of the technology. For this reason, EPA believes that it is necessary and appropriate for these facilities to prepare a Technology Installation and Operation Plan that describes how they will operate and maintain the technology and assess success in meeting the performance standards, as well as adaptive management steps they will take if the technology does not perform as expected. They must also propose a Verification Monitoring Plan to describe the monitoring they will perform to support their performance assessment. EPA notes that facilities that select the approved technology alternative have significantly reduced application and information collection requirements relative to facilities that comply under other alternatives.

One commenter stated that the approved design and construction technology alternative will not be sufficiently protective given the complexity of waterbodies. While EPA does not agree with this comment, EPA recognizes that the efficacy of a given technology will be affected by site-specific conditions, such as biological and chemical factors in the waterbody. Because the efficacy of the technology will be affected by such site-specific conditions, EPA has required all facilities that choose to comply using the approved design and construction technology compliance alternative to submit a Technology Installation and Operation Plan and a Verification Monitoring Plan, and to determine if they are meeting the applicable performance standards through monitoring, and adjust their operations accordingly if they are not. EPA believes, based upon extensive research, that the majority of facilities with the appropriate site conditions, and that have installed and properly operated

and maintained submerged cylindrical wedgewire screen technology, should be capable of meeting the performance standards set forth in § 125.94(b). For facilities that fail to meet performance standards through the approved design and technology alternative, the Director may amend the facility's permit to require the use of additional design and construction technologies, operational measures, and/or restoration measures, in order to meet the performance standards, or if appropriate, issue a site-specific determination of BTA.

5. Capacity Utilization Threshold

In the proposed rule, EPA introduced reduced requirements for facilities that are typically not operating year-round and would therefore bear a proportionately higher cost to comply with the rule. EPA proposed that facilities that operate less than 15% of the time (also known as peaking facilities) would only be subject to impingement reductions, regardless of the waterbody type upon which the facility is located.

Generally, commenters supported the concept of reduced requirements for peaking facilities. However, commenters stated that EPA must further refine the definition of peaking facilities and in many cases suggested that EPA adopt the United States Department of Energy's definition of capacity utilization. Aspects of EPA's definition on which commenters requested clarification included how to measure the capacity rate (per intake, per facility, per generating unit, etc.), the time frame for determining historic utilization rates, and the definition of "available" with respect to how to calculate the capacity utilization rate. One commenter further suggested that EPA allow an expanded definition (*i.e.*, a higher capacity utilization rate) for facilities that typically operate in periods of low abundance of entrainable organisms. One commenter further requested that the reduced requirements for peaking facilities be extended to account for future operations at the plant as well. Another commenter expressed concern over the definition of the threshold, as the operational time for the facility could still coincide with periods of high abundances of organisms and therefore still result in significant entrainment. One commenter opposed the threshold, stating it could encourage facilities to reduce electricity production in order to have less stringent requirements and therefore impact energy production, prices, and energy supply nationwide.

State commenters generally supported the concept, but were divided as to the threshold utilization rate; some States preferred a lower threshold and one mentioned that it would prefer a higher threshold. One State did not support the reduced requirements for peaking facilities, noting that the time frame in which the facility operates may be more important than the volume withdrawn. Another State suggested that restoration or mitigation also be required of peaking facilities.

EPA has identified peaking facilities in the final Phase II rule as those facilities that operate at an overall capacity of less than 15 percent. EPA believes that facilities operating below 15% should be subject to less stringent compliance requirements relative to a typical base load facility. The threshold of 15% is based on these facilities' reduced operating levels, low potential for entrainment impacts, and consideration of economic practicability (*see*, 67 FR 17141). To address commenter concerns, EPA has modified the capacity utilization definition to say that the capacity utilization rate applies only to that portion of the facility that generates electricity for transmission or sale using a thermal cycle employing the steam water system as the thermodynamic medium. The Agency has amended the definition of the capacity utilization rate threshold to remove the term "available" from the definition, as requested by comments. Further, the Agency has allowed for calculation of the capacity utilization rate on an intake basis, when the intake is exclusively dedicated to a subset of the plant's generating units, and for determination of the capacity utilization rate based on a binding commitment of future operation below the threshold.

Peaking facilities are typically older, less efficient generating units. Because the cost of operation is higher, peaking facilities are generally employed when generating demand is greatest and economic conditions justify their use. Such usage is typically a fraction of the unit's overall generating capacity and represents significantly less cooling water used when compared to the design intake capacity. This would appear to obviate the need for entrainment controls for the facility.

Most peaking facilities are employed during the highest electrical demand period, typically mid-winter or mid-summer. It is generally accepted that while these seasons can sometimes be associated with a higher abundance of aquatic organisms or spawning events, mid-winter and mid-summer are not typically considered to be critical periods for aquatic communities. Given these operating conditions, generally entrainment controls would appear to be an unnecessary cost for these facilities because the losses, while they occur, would have minimal adverse environmental impact.

*D. Site-Specific Approach*

Past implementation of section 316(b) often followed the draft guidance document published in 1977, which promoted a largely site-specific approach. In this rulemaking, EPA is establishing national performance standards for best technology available for minimizing adverse environmental impacts in connection with cooling water intake structures. Many comments were received regarding a site-specific approach to implementation.

1. Approach

Many commenters favored a site-specific approach in place of national performance standards. Many of the commenters cited a need for flexibility to comply with the regulations, and stated that only a site-specific approach can represent the best framework for addressing site-specific environmental impacts in a cost-effective manner. Commenters also favored an approach that resembles current practices for implementation of 316(b), in which site-specific determinations are made without reference to national performance standards.

Some commenters did not support the concept of a site-specific rule. One commenter stated that it does not fulfill a national standard and allows a more lenient application for some facilities. Another commenter added that a site-specific approach favors industry, as the resources of the regulators and interested public groups to respond to information-intensive site-specific determinations are limited. Some States also expressed concern over a site-specific approach, as it could be less stringent than the present approach, as well as more burdensome. Some other States expressed support for site-specific approaches.

In the final rule, EPA has established national performance requirements for the reduction of impingement mortality and entrainment that reflect best technology available to minimize adverse environmental impact for Phase II existing facilities, and has authorized five different compliance alternatives to achieve those standards, including a site-specific alternative. Thus, the Agency has provided both clear national standards of environmental protection and sufficient flexibility to allow for the selection of cost-efficient approaches to compliance and permit administration. In addition, under certain compliance alternatives, Phase II existing facilities

can use restoration measures, either in lieu of, or in combination with technologies and/or operational measures, when design and construction and/or operational measures alone are less feasible, less cost-effective or less environmentally desirable. This provides additional flexibility to permittees and permitting agencies. Finally, as discussed in Section VII of this preamble, EPA does not agree that all aspects of certain site-specific approaches effectively fulfill the requirements of section 316(b).

2. Existing Programs and Determinations

Several commenters stated that there is already a successful 30-year history of implementing section 316(b). Some commenters noted that many States currently implement 316(b) using a site-specific approach and that these programs should be allowed to continue, including any restoration or enhancement programs the States have established. Others stated that existing BTA determinations (conducted using a site-specific approach) should remain valid.

EPA acknowledges that some States' existing programs and determinations have been successful in reducing adverse environmental impacts to waters of the United States associated with cooling water intake structures. EPA disagrees, however, that all existing BTA determinations should remain valid. Some historical BTA decisions may be based on physical, chemical or biological conditions that are no longer relevant at the site, or reflect BTA technology that is outdated and would not meet the performance standards set forth in today's final rule. However, the final rule provides for EPA approval of alternative State program requirements where such State NPDES requirements will result in environmental performance within a watershed that is comparable to the reductions of impingement mortality and entrainment that would otherwise be achieved under § 125.94. (*see* § 125.90(c)). Thus, this rule provides a reasonable degree of flexibility for States to implement existing effective programs. In § 125.94(e), States are also allowed to establish more stringent BTA requirements if necessary to comply with State, tribal, or other federal law.

*E. Implementation*

1. Calculation Baseline

Numerous commenters indicated that they were unclear as to how to calculate the baseline conditions for impingement mortality and entrainment. Some commenters suggested that the calculation baseline should reflect unrestricted operation at full design capacity year-round to avoid continually changing the baseline, since maintenance and operational schedules change over time. Another commenter added that the baseline definition must specify that data be based upon maximum operation of a given facility, to avoid allowing a facility to withdraw more water than it has been permitted for (based on an averaged flow). Other commenters claimed that the use of a calculation baseline was problematic due to the difficulties of extrapolation between localities and waterbody types. One commenter asserted that the calculation baseline should reflect current local environmental conditions, not historical or hypothetical future conditions and should specify the level of operation that would be maintained in the absence of operational controls implemented for reducing impingement and entrainment.

Many commenters supported an "As Built" alternative approach where a facility would calculate entrainment reduction based on historical measurements before installation of new technology or sampling immediately in front of the new technology and enumerating the organisms of a size that will pass through a standard 3/8-inch screen. Several commenters agreed that the use of historical data would aid in estimating the calculation baseline while others cautioned against the use of historical data that may not be relevant to the current conditions. One commenter disagreed with EPA's statement that the baseline could be estimated by evaluating existing data from a nearby facility; the commenter asserted that site-specific factors determine whether an organism will interact with a cooling water intake structure and/or survive the interaction. Overall, most commenters recommended that EPA allow the Director broad discretion and flexibility in evaluating the calculation baseline due to varying site conditions.

The calculation baseline provides a standard intake configuration by which facilities can determine relative reductions in impingement and entrainment. EPA acknowledges the numerous comments on the proposed definition and has refined the definition to provide more clarity in implementing this concept. For example, the definition in the proposed rule incorporated a shoreline intake structure. In the final rule, the definition has been clarified to specify a 3/8-inch mesh traveling screen at a shoreline intake structure. Based on available data that indicate this is a common intake structure configuration at Phase II existing facilities, EPA designated a 3/8-inch screen as the standard mesh size against which reductions will be calculated. Similarly, the assumption of no impingement or entrainment controls in the definition in the proposed rule has been clarified to describe an intake where the baseline operations do not take into include any procedures or technologies to reduce impingement or entrainment. EPA recognizes that some facilities may have control technologies in place that already reduce impingement or entrainment; the final calculation baseline would allow credit for such reductions. Additionally, EPA further clarified the definition to include the potential data sources that may be used in defining the calculation baseline, such as historical data, data collected at nearby locations, or data collected at the facility. EPA is authorizing the use of existing biological data in determining the calculation baseline to minimize the impacts to facilities, provided that the data are representative of current facility and/or waterbody conditions (as applicable) and were collected using appropriate quality control procedures.

EPA has further clarified the definition to provide that the calculation baseline may be based on an intake structure located at a depth other than a surface intake if the facility can demonstrate that the standard definition (*i.e.*, a shoreline surface intake) would correspond to a higher baseline level of impingement mortality and/or entrainment.

EPA chose not to incorporate operating capacity into the calculation baseline, as the definition is not dependent upon intake flow volumes. EPA has chosen to adopt the "as built" approach: as stated in § 125.93, a facility may choose to use the current level of impingement mortality and entrainment as the calculation baseline.

EPA recognizes that this definition cannot address the variety of intake configurations and other conditions at all facilities and therefore cannot define the calculation baseline in all settings. However, EPA believes that the calculation baseline in the final rule is clear and straightforward to implement, and allows for proactive facilities (*i.e.*, those with control technologies, operational procedures, or restoration measures already in place) to take credit for existing measures.

2. How Will Attainment of the Standards Be Measured?

At the time of the NODA, EPA was evaluating several approaches for

measuring success in meeting performance standards. EPA therefore requested comments on whether performance should be measured based on an assessment of the impacts to all fish and shellfish species ("all-species approach") or to fish and shellfish from only a subset of species determined to be representative of all the species that have the potential to be impinged or entrained ("representative species approach"). These comments are addressed under section 2. a below. Several terms to describe the representative species approach have been used historically. To avoid confusion among the terms "representative indicator species," "representative important species," and "critical aquatic organisms," EPA is adopting the term "representative species" for the purpose of simplicity in this section. EPA also requested comment as to whether enumeration of organisms or biomass should be used as the metric for measuring success in meeting the performance standards. These comments are addressed in section 2. b below. With regard to counting absolute numbers of organisms, EPA also requested comment on the option of counting undifferentiated organisms (*i.e.*, counting without specifying taxonomic identification).

After attempting to select optimal approaches for both the scope and metric to use in determining attainment of the performance standards, EPA has determined site-specific factors such as biological assemblage at the site, intake location, and waterbody type must be factored into decisions regarding how to evaluate attainment. EPA has therefore decided that, in its Verification Monitoring Plan (125.95(b)(7)), the facility must propose, among other things, the parameters to be monitored for determining attainment. The Director will be best suited to review and approve proposed parameters for each facility on a case-by-case basis.

a. Scope of Evaluation: All-Species Consideration vs. Representative Species

Several commenters supported the use of a representative species evaluation, as opposed to the all-species evaluation, as the most practical approach in many cases. Another commenter stated that even with the representative species approach, factors other than simply numeric reduction in impingement mortality and entrainment must be considered when determining attainment. On the other hand, one commenter stated that an "all species" approach could make compliance demonstrations simpler and somewhat less expensive so long as the taxonomic identity of collected organisms is not required. The commenter noted that this would not be appropriate, however, in cases where taxonomic identification is needed, such as where eggs and larval stages are converted to age-1 equivalents.

As part of the representative species inquiry, EPA also requested comment on whether 10 to 15 species might be an appropriate number of representative species to protect all species and ecosystem functions at a facility. One commenter responded, stating that 15 was too large a number. This commenter suggested that a demonstration should focus on the four or five species and add to the list only if there was another species of special concern.

In response to the commenter who suggested that EPA should evaluate factors other than reduction in numbers of organisms impinged or entrained, EPA has selected several means by which to determine compliance with section 316(b) requirements. For facilities that choose to demonstrate compliance with the performance standards, the metric that will be used to evaluate compliance with the performance standards is the facility's reduction of impingement mortality and entrainment through the installation of design and control technologies and/or operational measures. For these facilities, compliance may then be measured against a facility's calculation baseline, which the facility estimates and submits with its permit application package. The calculation baseline is defined at § 125.93. For facilities that choose to use compliance with the terms of a Technology Installation and Operation Plan or Restoration Plan to determine compliance, the degree of success in meeting performance standards is still an important criteria for determining if adaptive management is needed, but it would not be the basis for determining compliance. For facilities that choose to use restoration measures, attainment of performance standards will be based upon whether the production of fish and shellfish from the restoration measures is substantially similar to the level of fish and shellfish the facility would achieve by meeting the applicable impingement and/or entrainment requirements. If a facility has been approved for a site-specific determination of best technology available, the Director will establish alternate requirements accordingly. EPA expects that a variety of factors will be considered in determining the appropriate compliance option for a facility, such as waterbody type, intake location, percentage withdrawal of mean annual flow of rivers or streams, capacity to upset thermal stratification in lakes, a facility's calculation baseline, and the appropriateness of existing or proposed protective technologies or measures.

EPA agrees that a single approach may not be optimal in all cases. The Agency has therefore not prescribed the methods (including a metric) for assessing success in meeting performance standards in today's final rule. Rather, the Director must determine whether a clearly defined all-species approach or representative species approach is appropriate on a case-by case basis, based upon the information and proposed methods presented by the facility. The Director may choose to require evaluation of all species or of certain representative species.

In response to comments regarding EPA's suggested number of representative species, the facility will propose the number of species to monitor, as well as decisions regarding species and life stages to monitor, for review and approval by the Director as part of Verification Monitoring Plan (125.95(b)(7)), Technology Installation and Operation Plan (125.95(b)(4)(ii)), and, if applicable, the Restoration Plan required at 125.95(b)(5). As such, in cases where the representative species approach is applied, the Director may approve the number of representative species proposed by the facility, based upon the specifics of the waterbody from which the facility is withdrawing, the percentage volume of water withdrawn relative to the freshwater river or stream (as applicable), and other factors.

b. Metric: Absolute Counts vs. Biomass

EPA requested comment as to whether species impinged or entrained may be measured by counting the total number of individual fish and shellfish, or by weighing the total wet or dry biomass of the organisms. In response to the use of absolute counts of organisms or biomass (weight) for determining compliance, commenters offered a variety of views. Regarding the use of biomass as a metric, one commenter expressed that measuring either biomass or total undifferentiated numbers of species would be appropriate for cases where restoration was the chosen option, since restoration will never result in one-for-one species compensation. Several commenters pointed out a disadvantage of counting numbers of organisms: early life stages will dominate the numbers and thereby dominate the compliance

determination, even though most of them would have suffered large natural mortality losses even without entrainment. To correct for this, a few commenters suggested identifying the organisms and converting them to an equivalent unit to ensure that each life stage is appropriately weighed. Specifically, one commenter suggested converting to equivalent juveniles, when measuring organisms by biomass, to correct for the fact that the count will be dominated by later larval stages even though the number of these organisms per unit weight will be small compared to eggs and larvae. This commenter continued that this approach would be useful for forage species, since biomass is an appropriate measure of the organisms that serve as a food source for commercial and recreational species.

EPA received many comments regarding the need for flexibility in determining the appropriate metric to use to determine attainment of performance standards. Several commenters asserted that the rule should allow flexibility in the approach and the choice of metric should factor in whether one is assessing impingement mortality, entrainment or both; species and life stages affected, and compliance option.

EPA has decided to give the Director the authority to review and approve methods of determining compliance proposed by the facility as part of the Verification Monitoring Plan. (125.95(b)(7)), Technology Installation and Operation Plan (125.95(b)(4)(ii)), and, if applicable, the Restoration Plan required at 125.95(b)(5). Thus, the facility will propose, and the Director will review and approve, species and life stages of concern. The Director may choose to require evaluation of all species or of certain indicator species; or the Director may elect to verify attainment of performance standards using biomass as a metric. EPA believes that as each situation will be somewhat unique, it should be left to the facility to propose and the Director approve the appropriate unit, biomass or actual counts.

c. Other Means of Determining Attainment of Performance Standards

Several commenters also suggested that EPA should allow for the use of existing data for measuring attainment in lieu of requiring existing facilities to collect and develop new data. Commenters also suggested that if a facility currently implements the best technology available to minimize adverse environmental impact, it should be found in compliance even if the newly promulgated performance standards are not being met. Other commenters expressed that a facility should be considered in compliance even during occurrences of unavoidable episodic impingement and entrainment events. These commenters stated that in such unusual circumstances, the facility should be provided with an exemption from any regulatory actions.

EPA agrees with commenters that under certain circumstances, facilities' historical data may be sufficient to verify that they are meeting performance standards, as long as the historical data is reflective of current operation of the facility and of current biological conditions at the site. For example, under compliance alternative 2, a facility may use historical data to demonstrate that existing design and construction technologies, operational or restoration measures, meet the performance standards. EPA also believes that some historical data may be appropriate for determining the calculation baseline and for characterizing the nature of impingement and entrainment at the site, and therefore has given the Director the discretion to determine whether historical data are applicable to current conditions (see 125.95(b)(1)(ii), 125.95(b)(2)(i), and 125.95(b)(3)(iii)). In addition, a facility that proves, using existing data, that it has reduced its intake capacity commensurate with closed-cycle recirculating systems would be considered to be in compliance, and therefore would not be required to meet the performance standards for either impingement mortality or entrainment.

After the first permit term, facilities may submit a request for reduced information collection activities to their Director. Facilities that are able to demonstrate that conditions at their facility and in the waterbody from which their facility withdraws surface water are substantially unchanged since their previous permit application will qualify for reduced requirements (§ 125.95(a)(3)). In all these cases, historical data are used and required to measure success in meeting performance standards. However, facilities required to submit a Verification Monitoring Plan must still submit verification monitoring data for at least two years following implementation of technologies and/or operational measures.

Other commenters argued that a facility that is implementing permit conditions reflecting a historical determination of the best technology available should be considered in compliance with today's final rule even if the facility is not meeting performance standards. EPA disagrees that a historical determination of the best technology available is appropriate for complying with the requirements set forth by today's rule. Many historical determinations of the best technology available are less protective of aquatic organisms and ecosystems than the standards set by today's rule, and would undermine the national performance standards that EPA has determined reflect the current best technology available for minimizing adverse environmental impact. Furthermore, biological, chemical and physical conditions at the facilities may have changed since the earlier determinations were made, and the best technology available determinations may no longer apply. Many of the historical best technology available determinations are twenty years old or older and may not correspond with current waterbody or operating conditions.

The question whether a facility should be considered in compliance even during occurrences of unavoidable episodic impingement and entrainment events is left to the Director. At the Director's discretion, facilities that are generally in compliance, but that experience an unusual peak of impingement mortality and/or entrainment, may be considered to still be in compliance on the basis of past good performance. Moreover, the inclusion of a compliance determination alternative based on a Technology Installation and Operations Plan in the final rule also addresses these episodic issues.

d. Monitoring

One commenter stated that monitoring frequencies should be established to address the inherent variability in the rates in impingement and entrainment over the seasons of the year. Monthly or biweekly monitoring is probably appropriate in many cases. The same commenter stated that standard statistical procedures could be followed to establish sample sizes needed to establish appropriate levels of precision in the estimates (*e.g.*, 95% confidence intervals within 15–25% of the mean). In contrast, another commenter pointed out that weekly sampling would be necessary to determine compliance, as had been necessary for the Salem facility. Another commenter suggested that the most cost-effective way of conducting studies would be over the periods of peak abundance.

Some commenters stated that facilities should be allowed to cease monitoring following achievement of the performance standards. Some

suggested that facilities meeting performance standards through a closed-cycle cooling system should be exempt from monitoring. Another commenter disagreed with the two-year monitoring requirement altogether.

EPA has determined that a uniform averaging period would not be appropriate; rather, the Director will be best suited to make all such determinations by evaluating these and other factors for each facility on a case-by-case basis. The Director will be able to make determinations regarding averaging periods based upon site-specific factors, such as biological assemblage at the site, annual and diel fluctuations in concentration and populations present, and the selected compliance alternative. EPA disagrees that a facility should cease monitoring once performance standards are achieved, as site-specific conditions at any facility are bound to change with time, affecting a facility's ability to achieve performance standards. EPA agrees that facilities meeting performance standards through flow reductions commensurate with closed-cycle cooling should be exempt from monitoring (see § 125.94(a)(1)(i)). Finally, EPA believes that the two-year monitoring requirement is appropriate so that any site-specific variability in impingement and entrainment rates can be detected.

e. Timing

Some States favored flexibility in implementation including delaying the effective date for permits to be renewed soon after the rule is finalized. Some commenters suggested that the requirements of the rule must be timed so that facilities are not forced into a period of noncompliance because of the time needed to determine, design, and install new intake technology.

One commenter expressed that implementation schedules are too strict. Along the same vein, another commenter suggested that EPA should build flexibility into the implementation schedule so that facilities are not forced into periods of noncompliance.

Commenters generally wanted to see flexibility in the averaging periods (time increments for determining success in meeting the percent reduction or production specified by the performance standards and restoration requirements in § 125.94,) and a way to tailor the sampling schedules to the needs of the site. These commenters indicated that the monitoring should be frequent enough to provide useful information, but not so intensive as to make the program unnecessarily costly or time-consuming. Furthermore, several recommended that a compliance schedule be written into the permits, to allow facilities to install and test new equipment. Several commenters agreed that different facilities might require different amounts of time, as dictated by where they are in the cycle and what their circumstances are.

EPA has provided for time to comply with permitting requirements. A facility whose permit expires more than four years after the date of publication of this final rule must submit the required information 180 days before the expiration of their permit. A facility whose permit expires within four years of the date of publication of this final rule may request that the Permit Director establish a schedule for submission of the permit application. Such submission should be as expeditiously as practicable, but no later than three and one-half years from the date of publication of this final rule. It is expected that the time that facilities need to comply with permitting requirements will be variable, ranging from one year for those not needing to do an impingement mortality and entrainment study to over three years for those needing to collect more than one years worth of impingement and entrainment data.

EPA has also provided that facilities may opt to comply with the Technology Installation and Operations Plan compliance scheme that allows facilities who properly implement the Technology Installation and Operations Plan (or Restoration Plan, as applicable) to be considered in compliance with the requirements of § 125.94. As indicated above, the final rule provides the Director the flexibility to establish an appropriate averaging period to meet the particular situation present in the waterbody within which the facility is located.

3. Entrainment Survival

EPA invited comment on whether to allow Phase II existing facilities to incorporate estimates of entrainment survival when determining compliance with the applicable performance standards. Commenters responded with numerous comments regarding survival with respect to the performance standards as well as comments regarding EPA's assumption of zero percent entrainment survival (100 percent mortality) in the benefits assessment for today's rule.

Some commenters opposing the zero percent survival assumption argued that in the event a facility can demonstrate entrainment survival, it should be awarded credits towards meeting performance standards. EPA disagrees. Today's final rule sets performance standards for reducing entrainment rather than reducing entrainment mortality. EPA chose this approach because EPA does not have sufficient data to establish performance standards based on entrainment survival for the technologies used as the basis for today's rule. If EPA had incorporated entrainment survival into any of its conclusions regarding the appropriate performance standards, then the actual performance standard would most likely have been higher.

Many commenters argued that in many cases organisms survive entrainment and the zero percent survival assumption was too conservative. Some commenters suggested that EPA was biased in its approach to entrainment survival. For example, one commenter stated that EPA was biased as a result of relying heavily on old entrainment survival literature.

Based on its review of all entrainment survival studies available to the Agency, EPA believes that its assumption of zero percent survival in the benefits assessment is justified. The primary issue with regard to the studies EPA reviewed is whether the results can support a defensible estimate of survival substantially different from the value zero percent survival assumed by EPA. The review of the studies has shown that while organisms are alive in some of the discharge samples, the proportion of the organisms that are alive in the samples is highly variable and unpredictable on a national basis. In addition, some studies contain various sources of potential bias that may cause the estimated survival rates to be higher than the actual survival rates. For these reasons, EPA believes the current state of knowledge does not support reliable predictions of entrainment survival that would provide a defensible estimate for entrainment survival above zero at a national level. However, today's final rule does allow facilities to use the results of a well-constructed, sites-specific entrainment survival study, approved by the Director, in their benefits assessments when seeking site-specific entrainment requirements. The permitting authority must review and accept the study before the results may be incorporated into the benefits assessments. In cases where there is uncertainty in the survival rates, permitting authorities may want to specify that benefits be presented as a range that reflects this uncertainty.

4. Comprehensive Demonstration Study (CDS)

a. Requirements and Burden

The majority of commenters expressed two concerns regarding the CDS: (1) it was too burdensome and costly, and the volume of information required was too overwhelming, and (2) several components required clarification. These commenters generally suggested that the costs of such a study were underestimated, and many indicated that the cost estimates for completing the CDS contained misleading or incorrect information. Commenters indicated that the information required for completing the CDS was similar to the data that would be needed for implementing a purely site-specific approach and was therefore overly burdensome. Commenters suggested that EPA require a more simplified demonstration study or waive the requirement for facilities that select one of the approved technologies. Some commenters suggested, in general, that costs could be greatly reduced by streamlining this process, for example, by exempting facilities from certain components based on (1) facilities that have proven that they are not harming the aquatic community, and (2) facilities for which there exists relevant historical data.

Several States anticipated that the majority of their facilities were likely to choose the site-specific compliance alternative, and indicated that a rule that requires cost/benefit analyses for many decisions would be difficult to administer and require significant resources to implement. They claimed that the site-specific performance standards compliance option would impose a substantial review burden and would require specialized expertise. Some States questioned whether existing permitting staff resources over the first 5 years will be sufficient to review material and develop permit requirements.

Many commenters suggested that EPA could lower costs by streamlining the CDS, exempting facilities that are not causing adverse environmental impact or have historical data, and waiving the monitoring components for facilities that have installed approved technologies.

EPA believes that many efficiencies have been added to the rule since the proposal and the NODA to address concerns that the CDS is too burdensome and costly. First, EPA has provided five compliance alternatives to choose from, one of which allows a facility to install an approved design and construction technology with minimal CDS requirements. In addition, facilities with design intake flow commensurate with closed-cycle recirculating systems are exempt entirely from the CDS; facilities may only have to submit partial CDS information if they have reduced their design intake velocity to less than or equal to 0.5 feet per second and are only required to meet requirements as they relate to reductions in entrainment. In addition, requiring an early submission of the Proposal for Information Collection allows the Director to potentially minimize the amount of information required by the facility. Also, by allowing the use of historical data, EPA has minimized costs for many facilities. In the cases where new studies are required, EPA has given the permittee and the Director discretion to set conditions for the studies which will not be overly burdensome. Facilities may also reduce costs incurred through the information collection process in subsequent permit terms by submitting, one year prior to expiration of the existing permit, a request for reduced permit application information based on conditions of their cooling water intake structure and waterbody remaining substantially unchanged since the previous permit issuance.

One commenter expressed concern that historical data should not be allowed in the development of the CDS, as it may not accurately reflect current conditions. EPA believes that some historical data may be appropriate for determining the calculation baseline and for characterizing the nature of impingement and entrainment at the site, and therefore has given the Director the discretion to determine whether historical data are applicable to current conditions. EPA expects to provide guidance to Directors to help them make determinations about historical data submitted by facilities. Historical data will not be used to determine attainment of performance standards; this will be verified through a monitoring program approved by the Director.

b. Timing of Submitting Information

Commenters submitted a variety of opinions about timing. Generally, most favored limiting the submittal of CDS components to a frequency equal to or greater than once every five years (one permitting cycle) to reduce burden. Another commenter argued that there is no reason to mandate timing, and that approval of the Director should not be necessary. Other commenters suggested that a time frame is necessary, and that the information should be submitted with the renewal application for a NPDES permit. Numerous commenters asserted that consultation activities should occur prior to development of the Comprehensive Demonstration Study; that schedules and requirements should be specified in the permit for various data collection, analysis, and application submission activities; implementation schedules are too strict; and monitoring requirements need clarification. Yet another commenter suggested to "start the clock" with the issuance of the renewed permit. Commenters also indicated that anywhere from one year to several years might be necessary to verify success in meeting the performance standards. Several commenters suggested that given the nature of cooling water intake impacts and the proposed requirements, section 316(b) permit and BTA determinations should not be made every five years. Instead, they suggested that one-time determinations should suffice, or that facilities should be allowed to rely on previous section 316(b) demonstrations if conditions remain essentially unchanged. There was also some general confusion as to when the rule would actually become effective.

In response to the comment that EPA should not request submittal of CDS components more frequently than every five years or more, EPA has included a provision whereby a facility may be granted reduced CDS submittal requirements if it can prove that conditions at the facility and in the waterbody have not substantially changed. Facilities will be required to review whether conditions, such as biological, chemical or physical conditions, have substantially changed at each permit renewal cycle. If conditions have changed, facilities will be required to submit all of the relevant CDS components (those that would be affected by the changed conditions when they submit the application for permit renewal.

One commenter stated that the CDS should be a one-time submittal. EPA disagrees that all components of the CDS should only be researched and submitted a single time for the lifetime of the facility, regardless of potential changes in the plant and/or waterbody, because the natural and anthropogenic changes that occur in waterbodies over time may affect a facility's ability to meet performance standards using the current design and construction technologies, operational measures, and/or restoration measures in place.

In response to comments that timing was not clear in previous versions of the rule, EPA agrees, and has clarified timing issues in today's final rule. A

facility whose permit expires more than four years after the date of publication of this final rule must submit the required information 180 days before the expiration of their permit. A facility whose permit expires within four years of the date of publication of this final rule may request that the Permit Director establish a schedule for submission of the permit application, but that such submission should be as expeditiously as practicable, but no later than three and one-half years from the date of publication of this final rule. It is expected that the time that facilities need to comply with permitting requirements will be variable, ranging from one year for those not needing to do an impingement mortality and entrainment study to over three years for those needing to collect more than one years worth of impingement and entrainment data.

Some commenters felt that decisions about the timing of the CDS submittal should be left to the Director. EPA agrees and has provided only that the proposal for information collection should be submitted prior to the start of information collection activities, but that the facility may initiate information collection prior to receiving comment from the Permit Director. All other components of the Comprehensive Demonstration Study must be submitted 180 days prior to permit expiration except as noted above for the first, permit term following promulgation of the rule.

5. State Programs

Many States requested that existing State section 316(b) programs be allowed to be used to meet the requirements of Phase II. One commenter asserted that the Phase II rule should not overturn past State section 316(b) decisions at existing facilities that were made on a site-specific basis and that examined the impacts of the cooling water intake structure in relation to the specific biological community. Several commenters stated that EPA did not sufficiently recognize the work already done by the States in implementing section 316(b). Several commenters do not believe that a State should have to demonstrate that its program is "functionally equivalent" to today's rule (*i.e.*, that its alternative regulatory requirements achieve environmental performance within a watershed that is comparable to the reductions of impingement mortality and entrainment that would otherwise be achieved under § 125.94).

In response to comments about existing State section 316(b) programs, EPA believes that § 125.90(c) in today's rule, by allowing alternative State programs, acknowledges the work already done by States. In response to the comment that a State should not have to prove that its program achieves environmental performance comparable to those that would be achieved under § 125.94, EPA disagrees. While EPA is giving significant flexibility to permitting agencies at the State level to determine how and what each facility must protect and monitor, it believes it is important to set uniform national performance standards.

*F. Restoration*

In the proposed rule EPA requested comments on the use of restoration measures by facilities within scope of the rulemaking (67 FR 17146). EPA received diverse comments. Many commenters supported a role for restoration measures. Several commenters stated that allowing restoration provides additional flexibility to those who must comply with the section 316(b) requirements, and may provide a more cost-effective means of minimizing adverse environmental impact than operational measures or design and construction technologies. Other commenters stated that restoration is a well-accepted concept that should have a voluntary role in section 316(b) determinations and constitutes an appropriate means for reducing the potential for causing adverse environmental impact. Several commenters felt that restoration could provide significant benefits in addition to compensating for impingement and entrainment losses. A number of commenters requested flexibility in the implementation of restoration projects. Some commenters stated that restoration should not be limited to supplementing technology or operational measures, but should instead be allowed as a complete substitute for such measures. However, other commenters stated that restoration measures should only be used once every effort has been made to use technology to avoid impacts.

Commenters further stated that restoration should not be mandatory and that EPA lacks authority under section 316(b) to require it, but also asserted that it should have an important role in section 316(b) permitting decisions. Commenters also stated that restoration should not be considered the best technology available for minimizing adverse environmental impact because it is not a technology that addresses the location, design, construction, or capacity of a cooling water intake structure. However, one commenter argued that past restoration measures should be considered during a regulator's determination of whether or not adverse environmental impact is occurring from a cooling water intake structure.

Other commenters felt restoration should have a limited role or no role in the context of section 316(b). One commenter wrote that restoration measures, in the context of section 316(b), are generally unworkable and that the only measurable restoration method would be offsetting, in which an applicant stops use of an older intake facility that does more harm than the proposed one. One commenter stated that restoration methods must reproduce the ecological value of lost organisms and that they have not seen restoration projects adequately successful in this manner in their region of the country. Many commenters pointed out uncertainties associated with compensating for those organisms impacted by a cooling water intake structure through restoration.

Some commenters suggested that, if restoration is allowed, there should be consultation with other State and Federal resource agencies to avoid inconsistent approaches and to provide useful information on the affected waterbody.

Several commenters remarked on EPA's proposal to include requirements for uncertainty analysis, adaptive management plans, and peer review in the final rule. Some commenters were in favor of the requirements and felt that they would enhance restoration measure certainty and performance. Some commenters were concerned that the requirements would be overly burdensome or would overly restrict the restoration measure options available to permit applicants.

EPA has retained restoration in the final rule and believes that the restoration requirements strike an appropriate balance between the need for flexibility and the need to ensure that restoration measures achieve ecological results that are comparable to other technologies on which the performance standards are based. Facilities that propose to use restoration measures, in whole or in part, must demonstrate to the Director that they have evaluated the use of design and construction technologies and/or operational measures and found them to be less feasible, less cost-effective, or less environmentally desirable than meeting the applicable performance standards in whole or in part through the use of restoration measures. The requirement to look at design and construction technologies and/or

operational measures in order to ensure that facilities give due consideration to the technologies on which the performance standards are based.

Facilities must also demonstrate that the use of restoration measures achieves performance levels that are substantially similar to those that would be achieved under the applicable performance standards. To address concerns regarding the uncertainty of restoration measures, EPA has included, among other things, requirements for uncertainty analysis, adaptive management plans, monitoring, and peer review, if requested by the Director. Finally, EPA does not believe the requirements for restoration measures are overly burdensome or prescriptive as there is a need to ensure that these types of measures achieve the anticipated environmental benefit. Moreover, under the rule, facilities are *provided at least three and one-half* years to submit their restoration plan and complete the required studies.

*G. Costs*

1. Facility-Level Costs

Generally, commenters were split regarding the national costs of the rule. Industry commenters stated that the cost analysis presented in the proposal underestimated the compliance costs in several facets of the analysis, including capital costs of the technology, the site-specific contingencies associated with retrofitting, and facility down time. Several commenters stated that EPA underestimated the costs for the monitoring requirements for both the characterization study in the permit application and for verification monitoring. Other commenters generally stated the opposite, arguing that EPA overestimated the compliance costs, especially for installing cooling towers. Some commenters stated that costs should not be a consideration in section 316(b) determinations.

The Agency significantly revised the approach to developing costs for the NODA. Those revisions incorporated some of the comments on the costing methodology for technologies that reduce impingement and entrainment. EPA's approach to estimating the costs of the requirements of the final rule reflect the NODA comments on the revised methodology, and additional analyses. EPA, however, did not revise its estimates for cooling towers subsequent to the NODA because it decided not to further pursue this regulatory option for the reasons outlined more specifically in Section VII. EPA believes that our costing of cooling tower technology is appropriate as it is based on vendor and engineering firm experience in developing costs for Phase II facilities.

2. Market-Level Impacts

Numerous industry commenters stated that EPA significantly underestimated the impacts to generators, consumers, reliability, and energy supply. EPA disagrees with these commenters. EPA performed an analysis of facility- and market-level impacts (including impacts to generators, consumers, reliability, and energy supply) using the Integrated Planning Model (IPM®), which has been widely used in air quality regulations and in other public policy arenas affecting the electric power generation industry.

One commenter stated that the IPM analysis does not account for the economic impacts of other regulatory programs. EPA disagrees with this assertion. The IPM base case accounts for costs associated with current federal and state air quality requirements, including future implementation of $SO_2$ and $NO_X$ requirements of Title IV of the Clean Air Act and the $NO_X$ SIP call as implemented through a cap and trade program. Because of its relative newness, it does not account for costs associated with the Phase I facility regulations.

One commenter stated that EPA justified the rule by using a cost-to-revenue comparison and that this comparison neither measures profitability nor represents the most efficient economic solution for each facility. As discussed in Section VII. above, the economic practicability of the Phase II regulation is based on the electricity market model analyses using the IPM, not the cost-to-revenue ratio. The cost-to-revenue ratio is only one of several additional measures EPA used to assess the magnitude of compliance costs.

Some commenters stated that EPA did not properly take account of differences between utilities, which own and operate rate-based facilities, and nonutilities, which own and operate competitive generating facilities. EPA disagrees with this comment. EPA believes that in a deregulated market, the distinction between utilities and nonutilities is no longer relevant. While such a distinction may have been important in the past, when only a few unregulated nonutilities competed with regulated utilities, this is no longer the case. The share of Phase II facilities that are owned by unregulated entities has increased from 2 percent in 1997 to 31 percent in 2001. By the time the final rule will take effect, even more Phase II facilities that currently operate under a rate-based system will be operating in a competitive market. Furthermore, EPA does not believe that nonutilities will be differentially impacted compared to utilities, even in the case that deregulation might not have taken effect in all markets by the time this rule is implemented. Competitive pressures, even in regulated environments, will reduce the ability of utilities to pass on costs to their consumers.

Some commenters stated that small or publicly owned facilities may be significantly affected. EPA disagrees with this statement. EPA's SBREFA analysis showed that this rule will not lead to a significant economic impact on a substantial number of small entities (See Section XIII.C below). While municipally owned facilities bear a relatively larger compliance cost per MW of generating capacity than do facilities owned by other types of entities, EPA's analyses show that these costs are not expected to lead to significant economic impacts for these facilities.

Some commenters stated that even a requirement to convert all facilities to closed-cycle cooling would not significantly affect energy supply and that the costs to facilities and consumers is small and in some cases, overstated by EPA's analysis. EPA disagrees with this statement. EPA considered several options that would require some or all facilities to install closed-cycle recirculating systems and rejected them on the basis of economic practicability and technological feasibility. See Section VII.B for more detail on why EPA rejected closed-cycle recirculating systems.

*H. Benefits*

In its analysis for section 316(b) Phase II Proposal, EPA relied on nine case studies to estimate the potential economic benefits of reduced impingement and entrainment. EPA extrapolated facility-specific estimates to other facilities located on the same waterbody type and summed the results for all waterbody types to obtain national estimates. During the comment period on the proposed rule EPA received numerous comments on the valuation approaches applied to evaluate the proposed rule, including commercial and recreational fishing benefits, non-use benefits, benefits to threatened and endangered species (T&E), as well as on the methods used to extrapolate case study results to the national level. EPA tried to address concerns raised by commenters on the proposal in the revised methodology presented in the NODA and the final rule analysis.

1. Benefits Analysis Design

A number of commenters expressed concern about EPA's reliance on a few case studies and the extrapolation method used for estimating benefits at the national level for the proposed rule analysis. The commenters noted that even within the same waterbody type, there are important ecological and socioeconomic differences among different regions of the country. To address this concern, EPA revised the design of its analysis to examine cooling water intake structure impacts at the regional-scale. The estimated benefits were then aggregated across all regions to yield the national benefits estimate. These analytical design changes were presented in the NODA. No major comments were received on EPA's regional benefit approach as described in the NODA.

2. Commercial Fishing Benefits

During the comment period on the proposed rule EPA received a number of comments on the methods used to estimate producer surplus and consumer surplus in the commercial fishing sector. Commenters felt that the methods overestimated benefits. The new methods used by EPA assume that producer surplus is 0% to 40% of gross revenues in the commercial fishing sector. EPA also now assumes that the Phase II rule will not create increases in commercial harvest large enough to impact prices. Thus, no consumer surplus impact is estimated. Commenters on the NODA noted these changes and agreed with them.

3. Recreational Fishing Benefits

A number of comments were received on the recreational fishing benefits estimates EPA included in the proposal, which primarily relied on a benefits transfer approach. Benefit transfer involves adapting research conducted for another purpose in the available literature to address the policy questions in hand. For more detail on the valuation methods used in the final rule analysis, see Chapter A9 of the Regional Analysis document (DCN 6–0003). For three of the nine case studies, this analysis was supplemented by original revealed preference studies. Revealed preference methods use observed behavior to infer users' value for environmental goods and services. Examples of revealed preference methods include travel cost, hedonic pricing, and random utility models (RUM). For more detail on the revealed preference methods used in the final rule analysis, see Chapters A9 and A11 of the Regional Analysis document (DCN 6–0003). Although most commenters agreed that properly executed benefits transfer is an appropriate method for valuing nonmarket goods, they pointed out that original revealed preference studies that provide site-specific recreational fishing benefit estimates provide a superior alternative to benefits transfer. In response to these comments, EPA developed original or used available region-specific recreational angler behavior models, which provide site-specific estimates of willingness-to-pay for improvements in recreational fishing opportunities, to estimate recreational fishing benefits from reduced impingement and entrainment for seven of the eight study regions. Chapter A11 of the Regional Analysis document provides detailed discussion of the methodology used in EPA's RUM analysis (DCN 6–0003). Due to data limitations, EPA used a benefit transfer approach to value recreation fishing benefits from reduced impingement and entrainment in the Inland region.

4. Non-Use Benefits

Numerous comments were received on EPA's proposed non-use benefit estimates. Most commenters agreed that non-use values are difficult to estimate and that EPA's estimates of non-use benefits using the 50% rule was inappropriate because it relies on outdated studies. Commenters, however, disagreed as to whether EPA had vastly overstated or underestimated non-use benefits in the proposed Phase II rule analysis.

Some commenters stated that EPA's approach to estimating non-use benefits of the proposed rule significantly overestimates total benefits and that ecological benefits of the section 316(b) regulation are negligible. Other commenters asserted that EPA's benefits estimates significantly undervalued the total ecological benefits (including use and non-use) of preventing fish kills. These commenters indicated that it would be impossible to claim that the value of the unharvested commercial and recreational and forage species lost to impingement and entrainment was equal to zero. Reasons some commenters gave for the underestimation of total benefits included the following: total losses were underestimated by using outdated monitoring data for periods when population levels (and therefore impingement and entrainment) were much lower than the present; cumulative impacts were not sufficiently considered; recreational and commercial values were underestimated; commercial invertebrate species were ignored; ecological value of forage species was not considered; non-use benefits were underestimated; and secondary economic impacts were not included. Overall these commenters argued that a net benefit underestimation could be corrected by (1) assuming that non-use values were two times the estimated value of recreation, commercial and forage values; and (2) assuming that unharvested fish had a value greater than zero.

In response to public comments regarding the analysis of non-use values in the proposed rule, EPA considered the results of several different approaches to quantifying non-use values. The Agency points out that none of the available methods for estimating either use or non-use values of ecological resources is perfectly accurate; all have shortcomings.

EPA has determined that none of the methods it considered for assessing non-use benefits provided results that were appropriate to include in this final rule, and has thus decided to rely on a qualitative discussion of non-use benefits. The uncertainties and methodological issues raised in the approaches considered could not be resolved in time for inclusion in the rule. EPA continues to evaluate various approaches for evaluating non-use benefits of CWA rules.

5. Habitat Replacement Cost (HRC)

Some commenters argued that the HRC methods are not legitimate valuation methods because they concern costs, not benefits. However, other commenters argued that although HRC analysis is not a benefit's analysis in the strict economic sense it can provide a practical approach to capturing the full range of ecosystem services and, thus, is appropriate for evaluating the benefits of this rule. These commenters further pointed out that "restoration cost is used as a measure of damages under CERCLA for Superfund sites, under the National Marine Sanctuaries Act, and under the oil spill provisions of the Clean Water Act. Use of restoration costs was explicitly upheld in the landmark Ohio vs. Interior court decision of 1989."

EPA has removed the disputed results of the HRC analyses from its benefits estimates for the final rule. For the NODA, EPA revised the HRC analysis presented in the proposed rule (see 67 FR 17191). Instead of the costs of habitat replacement, EPA used estimated willingness-to-pay values for the resource improvements that would be achieved by the habitat replacement/restoration equivalents.

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■ b. In paragraph (a), last sentence, revise "SAF/MIQ" to read "SAF/IEE."
■ c. In paragraph (b), third sentence, revise "HQ USAF/ILEB" to read "HQ USAF/A7CI."
■ d. In paragraph (b), third sentence, revise "SAF/MIQ" to read "SAF/IEE".

**§ 989.36 [Amended]**

■ 17. In § 989.36, make the following technical corrections:
■ a. In first sentence, revise "NEPA" to read "EIAP" at its first occurrence.
■ b. In first sentence, revise "SAF/MIQ" to read "SAF/IEE".

**§ 989.38 [Amended]**

■ 18. In § 989.38, make the following technical corrections:
■ a. In paragraph (b), revise "HQ USAF/ILEB" to read "HQ USAF/A7CI".
■ b. In paragraph (c), revise "HQ USAF/ILEB" to read "HQ USAF/A7CI".
■ c. In paragraph (c), revise "AFCEE/EC" to read "AFCEE/TDB".
■ d. In paragraph (d), revise "HQ USAF/ILEB" to read "HQ USAF/A7CI" in the four places it appears.

**Appendix A to Part 989 [Amended]**

■ 19. In Appendix A, make the following technical corrections:
■ a. In U.S. Government Agency Publications, revise "(DoDD) 4715.1, Environmental Security" to read "DoDD 4715.1E, Environment, Safety, and Occupational Health".
■ b. In U.S. Government Agency Publications, revise "DoDD 5000.1, Defense Acquisition" to read "Department of Defense Directive DoDD 5000.1, The Defense Acquisition System".
■ c. In Abbreviations and Acronyms, Change acronym definition for "AFCEE" from "Air Force Center for Environmental Excellence" to read "Air Force Center for Engineering and the Environment".
■ d. In Abbreviations and Acronyms, revise "AFCEE/EC" to read "AFCEE/TDB". Change acronym definition from "AFCEE Environmental Conservation and Planning Directorate (AFCEE/EC)" to read "AFCEE Technical Directorate, Built Infrastructure Division (AFCEE/TDB)".
■ e. In Abbreviations and Acronyms, revise "AFLSA/JACE" to read "AFLOA/JACE".
■ f. In Abbreviations and Acronyms, revise "AFLSA/JAJT" to read "AFLOA/JAJT".
■ g. In Abbreviations and Acronyms, revise "HQ USAF/ILE" to read "HQ USAF/A7C".
■ h. In Abbreviations and Acronyms, revise "SAF/MI" to read "SAF/IE." Change acronym definition from "Assistant Secretary of the Air Force for Manpower, Reserve Affairs, Installations, and Environment" to "Assistant Secretary of the Air Force for Installations, Environment & Logistics".
■ i. In Abbreviations and Acronyms, revise "SAF/MIQ" to read "SAF/IEE." Change acronym definition from "Assistant Secretary of the Air Force for Manpower, Reserve Affairs, Installations, and Environment" to "Deputy Assistant Secretary of the Air Force for Environment, Safety and Occupational Health (ESOH)".
■ j. In Terms, under "BMPs" revise "40 CFR 1508.22" to read "32 CFR 989.22".

**Appendix B to Part 989 [Amended]**

■ 20. In Appendix B, make the following technical corrections:
■ a. In paragraph A3.1.1, revise "AFLSA/JAJT" to read "AFLOA/JAJT".
■ b. In paragraph A3.1.2, revise "AFLSA/JAJT" to read "AFLOA/JAJT".

**Appendix C to Part 989 [Amended]**

■ 21. In Appendix C, make the following technical corrections:
■ a. In paragraph A3.1.3, last sentence, revise "HQ USAF/ILEVP" to read "HQ USAF/A7CI."
■ b. In paragraph A3.1.3, last sentence, revise "SAF/MIQ" to read "SAF/IEE".
■ c. In paragraph A3.2.2.1, revise "HQ USAF/ILEB" to read "HQ USAF/A7CI".
■ d. In paragraph A3.2.3.3. revise "The name and telephone number of a person to contact for more information" to read "The name, address, and telephone number of the Air Force point of contact".
■ e. In paragraph A3.5.1., revise "AFLSA/JAJT" to read "AFLOA/JAJT".
■ f. In paragraph A3.5.1., revise "military trial judge" to read "hearing officer".
■ g. In paragraph A3.5.1., revise "military trial judge" to read "hearing officer".
■ h. In paragraph A3.8, third to last sentence, revise "SAF/MIQ" to read "SAF/IEE",

**Bao-Anh Trinh,**

*Air Force Federal Register Liaison Officer, Department of the Air Force.*

[FR Doc. E7–13253 Filed 7–6–07; 8:45 am]

BILLING CODE 5001–05–P

## ENVIRONMENTAL PROTECTION AGENCY

### 40 CFR Parts 122 and 125

[EPA–HQ–OW–2002–0049; FRL–8336–9]

RIN 2040–AD62

### National Pollutant Discharge Elimination System—Suspension of Regulations Establishing Requirements for Cooling Water Intake Structures at Phase II Existing Facilities

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Suspension of final rule.

**SUMMARY:** This action suspends the requirements for cooling water intake structures at Phase II existing facilities, pending further rulemaking. The Phase II regulation addressed existing power utilities that use a cooling water intake structure to withdraw cooling water from waters of the United States at a rate of 50 million gallons per day (MGD) or greater.

**DATES:** Effective July 9, 2007, 40 CFR 122.21(r)(1)(ii) and (5), 125.90(a), (c) and (d) and 125.91 through 125.99 in Subpart J are suspended.

**FOR FURTHER INFORMATION CONTACT:** Janet Goodwin at (202) 566–1060, *goodwin.janet@epa.gov* or Deborah Nagle at (202) 564–1185, *nagle.deborah@epa.gov.*

**SUPPLEMENTARY INFORMATION:** This action suspends the Phase II regulations with the exception of 40 CFR 125.90 (b), for cooling water intake structures.

#### I. General Information

*A. Does This Action Apply to Me?*

Entities potentially affected by this action are classified under NAIC 22111.

Affected categories and entities include:

| Category | Examples of regulated entities |
|---|---|
| Electric Utilities ..... | Electric Power Generating Facilities. |
| State governments .. | Department of Environmental Protection. |

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities affected by this action. Other types of entities not listed in the table could also be affected. To determine whether your facility is affected by this action, you should carefully examine the definition in § 125.91. If you have questions regarding the applicability of this action

to a particular entity, consult one of the persons listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

*B. Table of Contents*

I. Legal Authority
II. Background
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## I. Legal Authority

EPA is issuing this suspension of the Phase II rule pursuant to 5 U.S.C. 553(b) and (d), which authorizes administrative agencies to issue administrative suspensions immediately, where good cause justifies the action. Public comment on this suspension is unnecessary, as a decision issued by the U.S. Court of Appeals for the Second Circuit (Second Circuit), *Riverkeeper, Inc.* v. *EPA*, 475 F.3d 83 (2d Cir. 2007), precludes EPA from applying the Phase II rule unless and until EPA takes further action and today's suspension action merely carries out the effect of that decision on the Phase II rule. Additionally, the decision has resulted in uncertainty among the regulated community and permitting agencies about how to proceed with ongoing permitting proceedings given the uncertainty as to the status of the Phase II rule. This suspension provides a clear statement by the Agency that the existing Phase II requirements (with the exception of one provision unaffected by the *Riverkeeper* decision that reaches beyond the Phase II rule, addressed below) are suspended and are not legally applicable.

## II. Background

On February 16, 2004, EPA took final action on regulations governing cooling water intake structures at certain existing power producing facilities under section 316(b) of the Clean Water Act (Phase II rule). 69 FR 41576 (July 9, 2004). The final Phase II rule applies to existing facilities that are point sources that, as their primary activity, both generate and transmit electric power or generate electric power for sale to another entity for transmission; use or propose to use cooling water intake structures with a total design intake flow of 50 MGD or more to withdraw cooling water from waters of the United States; and use at least 25 percent of the water withdrawn exclusively for cooling purposes (see 40 CFR 125.91).

Under the Phase II rule, EPA established performance standards for the reduction of impingement mortality and entrainment (see 40 CFR 125.94). The performance standards consist of ranges of reductions in impingement mortality and/or entrainment. These performance standards were determined to reflect the Best Technology Available (BTA) for minimizing adverse environmental impacts at facilities covered by the Phase II rule.

These regulations were challenged by industry and environmental stakeholders. On judicial review, the Second Circuit decision (*Riverkeeper, Inc.* v. *EPA*, 475 F.3d 83, (2d Cir., 2007)) remanded several provisions of the Phase II rule on various grounds. The provisions remanded to EPA include:

- EPA's determination of the BTA under section 316(b);
- The rule's performance standard ranges;
- The cost-cost and cost-benefit compliance alternatives;
- The Technology Installation and Operation Plan provision;
- The restoration provision; and
- The "independent supplier" provision.

With several significant provisions of the Phase II rule affected by the decision, and with the need to provide timely direction to stakeholders about the continuing application of the Phase II rule, EPA's Assistant Administrator for Water issued a memorandum on March 20, 2007, which announced EPA's intention to suspend the Phase II rule. This memorandum also discussed the anticipated issuance of this **Federal Register** suspension document.

## III. This Action

EPA is suspending § 122.21(r)(1)(ii) and (5), and Part 125 Subpart J with the exception of § 125.90(b). This suspension is appropriate for several reasons.

First, the Second Circuit's decision remanded key provisions of the Phase II requirements, including the determination of BTA and the performance standard ranges. This suspension responds to the Second Circuit's decision, while the Agency considers how to address the remanded issues.[1]

In addition, the decision has a significant impact on the regulated community and permitting agencies. Both groups have sought Agency guidance on how to proceed to establish cooling water intake structure permit requirements for facilities subject to the Phase II rule in light of this decision. These stakeholders support suspending the Phase II requirements until the Agency has considered and resolved the issues raised by the Second Circuit's remand. Permit requirements for cooling water intake structures at Phase II facilities should be established on a case-by-case best professional judgment (BPJ) basis.

Pursuant to 5 U.S.C. 553(b) and (d), EPA has determined for good cause that notice and public comment procedures are unnecessary. As noted, the Second Circuit's decision found key provisions of the Phase II rule to be inconsistent with the Clean Water Act and remanded most of the rule to the Agency. As a result, under the decision, EPA is precluded from applying the rule unless and until it takes further action to address the decision. Thus, today's action simply effectuates the legal status quo and public comment is therefore unnecessary.

Notably, EPA by this action is not suspending 40 CFR 125.90(b). This retains the requirement that permitting authorities develop BPJ controls for existing facility cooling water intake structures that reflect the best technology available for minimizing adverse environmental impact. This provision directs permitting authorities to establish section 316(b) requirements on a BPJ basis for existing facilities not subject to categorical section 316(b) regulations. Establishing requirements in this manner is consistent with the CWA, case law, and the March 20, 2007 memorandum's direction to do so. Phase II facilities are not subject to categorical requirements under Subpart J while this suspension is in effect, and therefore this provision applies in lieu of those requirements. In addition, this provision applies to other types of existing facilities subject to section 316(b) requirements (e.g., existing facilities addressed in EPA's section 316(b) Phase III rule). Moreover, this provision is an analogue to the provision in the 316(b) Phase I new facility rule providing for BPJ permitting where a facility is not subject to categorical requirements under Subpart I. See 40 CFR 125.80(c). Finally, this provision was not addressed, and is therefore not affected, by the Second Circuit's decision in *Riverkeeper*. Retaining it is therefore consistent with the approach EPA took in response to a judicial remand of its original section 316(b) regulations. See 44 FR 32854, 32956/1 (June 7, 1979) (withdrawing remanded regulations, but leaving intact a provision that had not been remanded).

## IV. Statutory and Executive Order Reviews

Under Executive Order 12866 (58 FR 51735, October 4, 1993), this action is not a "significant regulatory action" and is therefore not subject to review under

[1] In the event that the court's decision is overturned after today's action, the Agency will take appropriate action in response.

the Executive Order. This action does not impose any new requirements and does not impose costs or impacts on the regulated industry and thus does not meet the requirements for Executive Order 12866 review. This action is not subject to the Regulatory Flexibility Act (RFA) since this rule is exempt from notice and comment rulemaking requirements for good cause which is explained in section I. Additionally, this rule will not significantly or uniquely affect small governments. EPA has determined that this rule would not contain a Federal mandate that may result in expenditures of $100 million or more for State, local, and tribal governments, in the aggregate, or the private sector in any one year. Thus, this rule is not subject to sections 202, 203, or 205 of the Unfunded Mandates Reform Act of 1999 (Pub. L. 104–4). In addition, the EPA has determined that this action does not have Tribal implications, as specified in Executive Order 13175 (63 FR 67249, November 9, 2000). This action will not have federalism implications, as specified in Executive Order 13132 (64 FR 43255, August 10, 1999) because it does not establish any requirements on State or local governments. This regulation is not subject to Executive Order 13045 because it is not economically significant as defined under Executive Order 12866, and because the Agency does not have reason to believe the environmental health and safety risks addressed by this action present a disproportionate risk to children. This action is not subject to Executive Order 13211, "Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355, May 22, 2001), because it is not a significant regulatory action under Executive Order 12866. This action does not involve technical standards; thus, the requirements of section 12(d) of the National Technology Transfer and Advancement Act of 1995 (15 U.S.C. 272 note) do not apply. This action does not impose any new information collection burden under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). The existing Information Collection requirements in this regulation were approved by the Office of Management and Budget under OMB control number 2040–0257.

**List of Subjects**

*40 CFR Part 122*

Environmental protection, Administrative practice and procedure, Confidential business information, Hazardous substances, Indians-lands, Intergovernmental relations, Penalties, Reporting and recordkeeping requirements, Water pollution control.

*40 CFR Part 125*

Environmental protection, Cooling water intake structure, Reporting and recordkeeping requirements, Waste treatment and disposal, Water pollution control.

Dated: July 2, 2007.

**Stephen L. Johnson,**

*Administrator.*

■ For the reasons set forth in the preamble, EPA is amending 40 CFR parts 122 and 125 as follows:

## PART 122—EPA ADMINISTERED PERMIT PROGRAMS: THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

■ 1. The authority citation for part 122 continues to read as follows:

**Authority:** The Clean Water Act, 33 U.S.C. 1251 *et seq.*

**§ 122.21 [Amended]**

■ 2. Section 122.21 (r)(1)(ii) is suspended.

■ 3. Section 122.21(r)(5) is suspended.

## PART 125—CRITERIA AND STANDARDS FOR THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

■ 4. The authority citation for part 125 continues to read as follows:

**Authority:** Clean Water Act, 33 U.S.C. 1251 *et seq.* unless otherwise noted.

**§ 125.90 [Amended]**

■ 5. Section 125.90(a), (c) and (d) are suspended.

■ 6. Sections 125.91 through 125.99 are suspended.

[FR Doc. E7–13202 Filed 7–6–07; 8:45 am]

BILLING CODE 6560–50–P

## ENVIRONMENTAL PROTECTION AGENCY

### 40 CFR Part 131

**[EPA–HQ–OW–2007–0467; FRL–8337–2]**

**RIN NA2040**

### Withdrawal of Federal Marine Aquatic Life Water Quality Criteria for Toxic Pollutants Applicable to Washington State

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Direct final rule.

**SUMMARY:** EPA is proposing to amend the Federal regulations to withdraw its 1992 federally promulgated marine copper and cyanide chronic aquatic life water quality criteria for Washington State, thereby enabling Washington to implement its current EPA-approved chronic numeric criteria for copper and cyanide that cover all marine waters of the State.

In 1992, EPA promulgated Federal regulations establishing water quality criteria for priority toxic pollutants for 12 States, including Washington, and two Territories that had not fully complied with the Clean Water Act (CWA). These regulations are known as the "National Toxics Rule" or "NTR." On November 18, 1997, Washington adopted revised chronic marine aquatic life criteria for copper and cyanide, the only two marine aquatic life priority toxic pollutants in the NTR applicable to Washington. These revisions included a chronic marine aquatic life water quality criterion for copper for all marine waters and a chronic site-specific cyanide criterion for the Puget Sound. EPA approved these criteria on February 6, 1998. On August 1, 2003, Washington adopted revisions to its water quality standards, including a chronic marine criterion for cyanide for all marine waters except the Puget Sound. EPA approved this criterion on May 23, 2007. Since Washington now has marine copper and cyanide chronic aquatic life criteria effective under the CWA that EPA has approved as protective of Washington's designated uses, EPA is proposing to amend the NTR to withdraw the federally promulgated criteria.

**DATES:** This rule is effective on September 7, 2007 without further notice, unless EPA receives adverse comment by August 8, 2007. If EPA receives such comment, EPA will publish a timely withdrawal in the **Federal Register** informing the public that this rule, or the relevant provisions of this rule, will not take effect.

**ADDRESSES:** Submit your comments, identified by Docket ID No. EPA–HQ–OW–2007–0467, by one of the following methods:

- *www.regulations.gov:* Follow the on-line instructions for submitting comments.
- E-mail: *ow-docket@epa.gov.*
- Mail to either: Water Docket, USEPA, Mailcode: 2822T, 1200 Pennsylvania Ave., NW., Washington, DC 20460 or Becky Lindgren, Washington Marine Aquatic Life NTR Removal, U.S. EPA, Region 10, OWW–131, 1200 Sixth Avenue, Seattle, WA 98101, Attention Docket ID No. EPA–HQ–OW–2007–0467.

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LEXSTAT 40 CFR 125.84

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TITLE 40 -- PROTECTION OF ENVIRONMENT
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PART 125 -- CRITERIA AND STANDARDS FOR THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
SUBPART I -- REQUIREMENTS APPLICABLE TO COOLING WATER INTAKE STRUCTURES FOR NEW FACILITIES UNDER SECTION 316(B) OF THE ACT

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40 CFR 125.84

§ 125.84 As an owner or operator of a new facility, what must I do to comply with this subpart?

(a)(1) The owner or operator of a new facility must comply with either:

(i) Track I in paragraph (b) or (c) of this section; or

(ii) Track II in paragraph (d) of this section.

(2) In addition to meeting the requirements in paragraph (b), (c), or (d) of this section, the owner or operator of a new facility may be required to comply with paragraph (e) of this section.

(b) Track I requirements for new facilities that withdraw equal to or greater than 10 MGD. You must comply with all of the following requirements:

(1) You must reduce your intake flow, at a minimum, to a level commensurate with that which can be attained by a closed-cycle recirculating cooling water system;

(2) You must design and construct each cooling water intake structure at your facility to a maximum through-screen design intake velocity of 0.5 ft/s;

(3) You must design and construct your cooling water intake structure such that the total design intake flow from all cooling water intake structures at your facility meets the following requirements:

(i) For cooling water intake structures located in a freshwater river or stream, the total design intake flow must be no greater than five (5) percent of the source water annual mean flow;

(ii) For cooling water intake structures located in a lake or reservoir, the total design intake flow must not disrupt the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the

disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies);

(iii) For cooling water intake structures located in an estuary or tidal river, the total design intake flow over one tidal cycle of ebb and flow must be no greater than one (1) percent of the volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level;

(4) You must select and implement design and construction technologies or operational measures for minimizing impingement mortality of fish and shellfish if:

(i) There are threatened or endangered or otherwise protected federal, state, or tribal species, or critical habitat for these species, within the hydraulic zone of influence of the cooling water intake structure; or

(ii) Based on information submitted by any fishery management agency(ies) or other relevant information, there are migratory and/or sport or commercial species of impingement concern to the Director that pass through the hydraulic zone of influence of the cooling water intake structure; or

(iii) It is determined by the Director, based on information submitted by any fishery management agency(ies) or other relevant information, that the proposed facility, after meeting the technology-based performance requirements in paragraphs (b)(1), (2), and (3) of this section, would still contribute unacceptable stress to the protected species, critical habitat of those species, or species of concern;

(5) You must select and implement design and construction technologies or operational measures for minimizing entrainment of entrainable life stages of fish and shellfish if:

(i) There are threatened or endangered or otherwise protected federal, state, or tribal species, or critical habitat for these species, within the hydraulic zone of influence of the cooling water intake structure; or

(ii) Based on information submitted by any fishery management agency(ies) or other relevant information, there are or would be undesirable cumulative stressors affecting entrainable life stages of species of concern to the Director and the Director determines that the proposed facility, after meeting the technology-based performance requirements in paragraphs (b)(1), (2), and (3) of this section, would still contribute unacceptable stress to the protected species, critical habitat of those species, or these species of concern;

(6) You must submit the application information required in 40 CFR 122.21(r) and § 125.86(b);

(7) You must implement the monitoring requirements specified in § 125.87;

(8) You must implement the record-keeping requirements specified in § 125.88.

(c) Track I requirements for new facilities that withdraw equal to or greater than 2 MGD and less than 10 MGD and that choose not to comply with paragraph (b) of this section. You must comply with all the following requirements:

(1) You must design and construct each cooling water intake structure at your facility to a maximum through-screen design intake velocity of 0.5 ft/s;

(2) You must design and construct your cooling water intake structure such that the total design intake flow from all cooling water intake structures at your facility meets the following requirements:

(i) For cooling water intake structures located in a freshwater river or stream, the total design intake flow must be no greater than five (5) percent of the source water annual mean flow;

(ii) For cooling water intake structures located in a lake or reservoir, the total design intake flow must not disrupt the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies);

(iii) For cooling water intake structures located in an estuary or tidal river, the total design intake flow over one tidal cycle of ebb and flow must be no greater than one (1) percent of the volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level;

(3) You must select and implement design and construction technologies or operational measures for minimizing impingement mortality of fish and shellfish if:

(i) There are threatened or endangered or otherwise protected federal, state, or tribal species, or critical habitat for these species, within the hydraulic zone of influence of the cooling water intake structure; or

(ii) Based on information submitted by any fishery management agency(ies) or other relevant information, there are migratory and/or sport or commercial species of impingement concern to the Director that pass through the hydraulic zone of influence of the cooling water intake structure; or

(iii) It is determined by the Director, based on information submitted by any fishery management agency(ies) or other relevant information, that the proposed facility, after meeting the technology-based performance requirements in paragraphs (c)(1) and (2) of this section, would still contribute unacceptable stress to the protected species, critical habitat of those species, or species of concern;

(4) You must select and implement design and construction technologies or operational measures for minimizing entrainment of entrainable life stages of fish and shellfish;

(5) You must submit the application information required in 40 CFR 122.21(r) and § 125.86(b)(2), (3), and (4);

(6) You must implement the monitoring requirements specified in § 125.87;

(7) You must implement the recordkeeping requirements specified in § 125.88.

(d) Track II. The owner or operator of a new facility that chooses to comply under Track II must comply with the following requirements:

(1) You must demonstrate to the Director that the technologies employed will reduce the level of adverse environmental impact from your cooling water intake structures to a comparable level to that which you would achieve were you to implement the requirements of paragraphs (b)(1) and (2) of this section. This demonstration must include a showing that the impacts to fish and shellfish, including important forage and predator species, within the watershed will be comparable to those which would result if you were to implement the requirements of paragraphs (b)(1) and (2) of this section.

This showing may include consideration of impacts other than impingement mortality and entrainment, including measures that will result in increases in fish and shellfish, but it must demonstrate comparable performance for species that the Director identifies as species of concern. In identifying such species, the Director may consider information provided by any fishery management agency(ies) along with data and information from other sources.

(2) You must design and construct your cooling water intake structure such that the total design intake flow from all cooling water intake structures at your facility meet the following requirements:

(i) For cooling water intake structures located in a freshwater river or stream, the total design intake flow must be

no greater than five (5) percent of the source water annual mean flow;

(ii) For cooling water intake structures located in a lake or reservoir, the total design intake flow must not disrupt the natural thermal stratification or turnover pattern (where present) of the source water except in cases where the disruption is determined to be beneficial to the management of fisheries for fish and shellfish by any fishery management agency(ies);

(iii) For cooling water intake structures located in an estuary or tidal river, the total design intake flow over one tidal cycle of ebb and flow must be no greater than one (1) percent of the volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level.

(3) You must submit the application information required in 40 CFR 122.21(r) and § 125.86(c).

(4) You must implement the monitoring requirements specified in § 125.87.

(5) You must implement the record-keeping requirements specified in § 125.88.

(e) You must comply with any more stringent requirements relating to the location, design, construction, and capacity of a cooling water intake structure or monitoring requirements at a new facility that the Director deems are reasonably necessary to comply with any provision of state law, including compliance with applicable state water quality standards (including designated uses, criteria, and antidegradation requirements).

**HISTORY:** [66 FR 65256, 65340, Dec. 18, 2001; 67 FR 78948, 78954, Dec. 26, 2002, withdrawn at 68 FR 14164, Mar. 24, 2003; 68 FR 36749, 36754, June 19, 2003]

**AUTHORITY:** AUTHORITY NOTE APPLICABLE TO ENTIRE PART:
The Clean Water Act, 33 U.S.C. 1251 et seq.

**NOTES:** [EFFECTIVE DATE NOTE: 68 FR 36749, 36754, June 19, 2003, amended this section, effective July 21, 2003.]

NOTES APPLICABLE TO ENTIRE CHAPTER:
[PUBLISHER'S NOTE: Nomenclature changes to Chapter I appear at 65 FR 47323, 47324, 47325, Aug. 2, 2000.]
[PUBLISHER'S NOTE: For Federal Register citations concerning Chapter 1 Notice of implementation policy, see: 71 FR 25504, May 1, 2006.]

NOTES TO DECISIONS: COURT AND ADMINISTRATIVE DECISIONS SIGNIFICANTLY DISCUSSING SECTION --
Riverkeeper, Inc. v United States EPA (2004, CA2) 358 F3d 174, 57 Envt Rep Cas 1961, 34 ELR 20017

1778 words

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LEXSTAT 40 CFR 125.94

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40 CFR 125.94

§ 125.94 How will requirements reflecting best technology available for minimizing adverse environmental impact be established for my Phase II existing facility? [This section is suspended. See 72 FR 37107, 37109, July 9, 2007.]

[PUBLISHER'S NOTE: This section was suspended for an indefinite period of time at 72 FR 37107, 37109, July 9, 2007, effective July 9, 2007.]

(a) Compliance alternatives. You must select and implement one of the following five alternatives for establishing best technology available for minimizing adverse environmental impact at your facility:

(1)(i)You may demonstrate to the Director that you have reduced, or will reduce, your flow commensurate with a closed-cycle recirculating system. In this case, you are deemed to have met the applicable performance standards and will not be required to demonstrate further that your facility meets the impingement mortality and entrainment performance standards specified in paragraph (b) of this section. In addition, you are not subject to the requirements in §§ 125.95, 125.96, 125.97, or 125.98. However, you may still be subject to any more stringent requirements established under paragraph (e) of this section; or

(ii) You may demonstrate to the Director that you have reduced, or will reduce, your maximum through-screen design intake velocity to 0.5 ft/s or less. In this case, you are deemed to have met the impingement mortality performance standards and will not be required to demonstrate further that your facility meets the performance standards for impingement mortality specified in paragraph (b) of this section and you are not subject to the requirements in §§ 125.95, 125.96, 125.97, or 125.98 as they apply to impingement mortality. However, you are still subject to any applicable requirements for entrainment reduction and may still be subject to any more stringent requirements established under paragraph (e) of this section.

(2) You may demonstrate to the Director that your existing design and construction technologies, operational measures, and/or restoration measures meet the performance standards specified in paragraph (b) of this section and/or the restoration requirements in paragraph (c) of this section.

(3) You may demonstrate to the Director that you have selected, and will install and properly operate and maintain, design and construction technologies, operational measures, and/or restoration measures that will, in combination with any existing design and construction technologies, operational measures, and/or restoration measures, meet the performance standards specified in paragraph (b) of this section and/or the restoration requirements in paragraph (c) of this section;

(4) You may demonstrate to the Director that you have installed, or will install, and properly operate and maintain an approved design and construction technology in accordance with § 125.99(a) or (b); or

(5) You may demonstrate to the Director that you have selected, installed, and are properly operating and maintaining, or will install and properly operate and maintain design and construction technologies, operational measures, and/or restoration measures that the Director has determined to be the best technology available to minimize adverse environmental impact for your facility in accordance with paragraphs (a)(5)(i) or (ii) of this section.

(i) If the Director determines that data specific to your facility demonstrate that the costs of compliance under alternatives in paragraphs (a)(2) through (4) of this section would be significantly greater than the costs considered by the Administrator for a facility like yours in establishing the applicable performance standards in paragraph (b) of this section, the Director must make a site-specific determination of the best technology available for minimizing adverse environmental impact. This determination must be based on reliable, scientifically valid cost and performance data submitted by you and any other information that the Director deems appropriate. The Director must establish site-specific alternative requirements based on new and/or existing design and construction technologies, operational measures, and/or restoration measures that achieve an efficacy that is, in the judgment of the Director, as close as practicable to the applicable performance standards in paragraph (b) of this section, without resulting in costs that are significantly greater than the costs considered by the Administrator for a facility like yours in establishing the applicable performance standards. The Director's site-specific determination may conclude that design and construction technologies, operational measures, and/or restoration measures in addition to those already in place are not justified because of the significantly greater costs. To calculate the costs considered by the Administrator for a facility like yours in establishing the applicable performance standards you must:

(A) Determine which technology the Administrator modeled as the most appropriate compliance technology for your facility;

(B) Using the Administrator's costing equations, calculate the annualized capital and net operation and maintenance (O&M) costs for a facility with your design intake flow using this technology;

(C) Determine the annualized net revenue loss associated with net construction downtime that the Administrator modeled for your facility to install this technology;

(D) Determine the annualized pilot study costs that the Administrator modeled for your facility to test and optimize this technology;

(E) Sum the cost items in paragraphs (a)(5)(i)(B), (C), and (D) of this section; and

(F) Determine if the performance standards that form the basis of these estimates (i.e., impingement mortality reduction only or impingement mortality and entrainment reduction) are applicable to your facility, and if necessary, adjust the estimates to correspond to the applicable performance standards.

(ii) If the Director determines that data specific to your facility demonstrate that the costs of compliance under alternatives in paragraphs (a)(2) through (4) of this section would be significantly greater than the benefits of complying with the applicable performance standards at your facility, the Director must make a site-specific determination of best technology available for minimizing adverse environmental impact. This determination must be based on reliable, scientifically valid cost and performance data submitted by you and any other information the Director deems

appropriate. The Director must establish site-specific alternative requirements based on new and/or existing design and construction technologies, operational measures, and/or restoration measures that achieve an efficacy that, in the judgment of the Director, is as close as practicable to the applicable performance standards in paragraph (b) of this section without resulting in costs that are significantly greater than the benefits at your facility. The Director's site-specific determination may conclude that design and construction technologies, operational measures, and/or restoration measures in addition to those already in place are not justified because the costs would be significantly greater than the benefits at your facility.

(b) National performance standards. -- (1) Impingement mortality performance standards. If you choose compliance alternatives in paragraphs (a)(2), (a)(3), or (a)(4) of this section, you must reduce impingement mortality for all life stages of fish and shellfish by 80 to 95 percent from the calculation baseline.

(2) Entrainment performance standards. If you choose compliance alternatives in paragraphs (a)(1)(ii), (a)(2), (a)(3), or (a)(4) of this section, you must also reduce entrainment of all life stages of fish and shellfish by 60 to 90 percent from the calculation baseline if:

(i) Your facility has a capacity utilization rate of 15 percent or greater, and

(ii)(A) Your facility uses cooling water withdrawn from a tidal river, estuary, ocean, or one of the Great Lakes; or

(B) Your facility uses cooling water withdrawn from a freshwater river or stream and the design intake flow of your cooling water intake structures is greater than five percent of the mean annual flow.

(3) Additional performance standards for facilities withdrawing from a lake (other than one of the Great Lakes) or a reservoir. If your facility withdraws cooling water from a lake (other than one of the Great Lakes) or a reservoir and you propose to increase the design intake flow of cooling water intake structures it uses, your increased design intake flow must not disrupt the natural thermal stratification or turnover pattern (where present) of the source water, except in cases where the disruption does not adversely affect the management of fisheries. In determining whether any such disruption does not adversely affect the management of fisheries, you must consult with Federal, State, or Tribal fish and wildlife management agencies).

(4) Use of performance standards for site-specific determinations of best technology available. The performance standards in paragraphs (b)(1) through (3) of this section must also be used for determining eligibility for site-specific determinations of best technology available for minimizing adverse environmental impact and establishing site specific requirements that achieve an efficacy as close as practicable to the applicable performance standards without resulting in costs that are significantly greater than those considered by the Administrator for a facility like yours in establishing the performance standards or costs that are significantly greater than the benefits at your facility, pursuant to § 125.94(a)(5).

(c) Requirements for restoration measures. With the approval of the Director, you may implement and adaptively manage restoration measures that produce and result in increases of fish and shellfish in your facility's watershed in place of or as a supplement to installing design and control technologies and/or adopting operational measures that reduce impingement mortality and entrainment. You must demonstrate to the Director that:

(1) You have evaluated the use of design and construction technologies and operational measures for your facility and determined that the use of restoration measures is appropriate because meeting the applicable performance standards or site-specific requirements through the use of design and construction technologies and/or operational measures alone is less feasible, less cost-effective, or less environmentally desirable than meeting the standards or requirements in whole or in part through the use of restoration measures; and

(2) The restoration measures you will implement, alone or in combination with design and construction technologies and/or operational measures, will produce ecological benefits (fish and shellfish), including maintenance

or protection of community structure and function in your facility's waterbody or watershed, at a level that is substantially similar to the level you would achieve by meeting the applicable performance standards under paragraph (b) of this section, or that satisfies alternative site-specific requirements established pursuant to paragraph (a)(5) of this section.

(d)(1) Compliance using a technology installation and operation plan or restoration plan. If you choose one of the compliance alternatives in paragraphs (a)(2), (3), (4), or (5) of this section, you may request that compliance with the requirements of § 125.94(b) during the first permit containing requirements consistent with this subpart be determined based on whether you have complied with the construction, operational, maintenance, monitoring, and adaptive management requirements of a Technology Installation and Operation Plan developed in accordance with § 125.95(b)(4)(ii) (for any design and construction technologies and/or operational measures) and/or a Restoration Plan developed in accordance with § 125.95(b)(5) (for any restoration measures). The Technology Installation and Operation Plan must be designed to meet applicable performance standards in paragraph (b) of this section or alternative site-specific requirements developed pursuant to paragraph (a)(5) of this section. The Restoration Plan must be designed to achieve compliance with the applicable requirements in paragraph (c) of this section.

(2) During subsequent permit terms, if you selected and installed design and construction technologies and/or operational measures and have been in compliance with the construction, operational, maintenance, monitoring, and adaptive management requirements of your Technology Installation and Operation Plan during the preceding permit term, you may request that compliance with the requirements of § 125.94 during the following permit term be determined based on whether you remain in compliance with your Technology Installation and Operation Plan, revised in accordance with your adaptive management plan in § 125.95(b)(4)(ii)(C) if applicable performance standards are not being met. Each request and approval of a Technology Installation and Operation Plan shall be limited to one permit term.

(3) During subsequent permit terms, if you selected and installed restoration measures and have been in compliance with the construction, operational, maintenance, monitoring, and adaptive management requirements in your Restoration Plan during the preceding permit term, you may request that compliance with the requirements of this section during the following permit term be determined based on whether you remain in compliance with your Restoration Plan, revised in accordance with your adaptive management plan in § 125.95(b)(5)(v) if applicable performance standards are not being met. Each request and approval of a Restoration Plan shall be limited to one permit term.

(e) More stringent standards. The Director may establish more stringent requirements as best technology available for minimizing adverse environmental impact if the Director determines that your compliance with the applicable requirements of this section would not meet the requirements of applicable State and Tribal law, or other Federal law.

(f) Nuclear facilities. If you demonstrate to the Director based on consultation with the Nuclear Regulatory Commission that compliance with this subpart would result in a conflict with a safety requirement established by the Commission, the Director must make a site-specific determination of best technology available for minimizing adverse environmental impact that would not result in a conflict with the Nuclear Regulatory Commission's safety requirement.

**HISTORY:** [69 FR 41576, 41685, July 9, 2004; suspended at 72 FR 37107, 37109, July 9, 2007]

**AUTHORITY:** AUTHORITY NOTE APPLICABLE TO ENTIRE PART:
The Clean Water Act, 33 U.S.C. 1251 et seq.

**NOTES:** [EFFECTIVE DATE NOTE: 69 FR 41576, 41685, July 9, 2004, added Subpart J, effective Sept. 7, 2004; 72 FR 37107, 37109, July 9, 2007, suspended this section for an indefinite period of time, effective July 9, 2007.]

NOTES APPLICABLE TO ENTIRE CHAPTER:
[PUBLISHER'S NOTE: Nomenclature changes to Chapter I appear at 65 FR 47323, 47324, 47325, Aug. 2, 2000.]
[PUBLISHER'S NOTE: For Federal Register citations concerning Chapter 1 Notice of implementation policy, see: 71 FR 25504, May 1, 2006.]

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