California Regional Water Quality Control Board
San Diego Region

REVISIONS TO

Tentative Cleanup and Abatement Order No. R9-2011-0001
and Draft Technical Report for the
Shipyard Sediment Site
San Diego Bay

September 15, 2011

STATE OF CALIFORNIA

EDMUND G. BROWN, JR. Governor
MATT RODRIQUEZ, Agency Secretary, California Environmental Protection Agency

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INTRODUCTION

Consistent with the California Regional Water Quality Control Board, San Diego Region (San Diego Water Board) June 8, 2011 Third Amended Order of Proceedings, as amended by the Hearing Outline dated July 12, 2011, revisions to the *Tentative Cleanup and Abatement Order No. R9-2011-0001* (TCAO), to the September 15, 2010 version of *Draft Technical Report for Tentative Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA* (DTR), and to the August 23, 2011 *Response to Comments Report* are contained in this report. These revisions were made by the San Diego Water Board's Cleanup Team in response to comments received on the TCAO and DTR, and in a few cases, on the comments received on the *Draft Environmental Impact Report, Shipyard Sediment Remediation Project, San Diego Bay, California*. Other revisions were made by the Cleanup Team to fix typographical, style, format, and other errors in the three documents.

This Revisions Report is comprised of the pages of the TCAO, DTR, and *Response to Comments Report* that were revised by the Cleanup Team. Revisions are shown in underline/strikeout text. For readability, new tables added to the DTR Appendices are not shown in underline text. Instead a text box in the table indicates that the table is a new addition.

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Daily Load program) is the appropriate regulatory tool to use for correcting the impairment at the Shipyard Sediment Site.

13. **SEDIMENT QUALITY INVESTIGATION.** NASSCO and BAE Systems conducted a detailed sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. Two phases of fieldwork were conducted, Phase I in 2001 and Phase II in 2002. The results of the investigation are provided in the Exponent report *NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003 (Shipyard Report, Exponent 2003*). Unless otherwise explicitly stated, the San Diego Water Board's finding and conclusions in this CAO are based on the data and other technical information contained in the Shipyard Report prepared by NASSCO's and BAE Systems' consultant, Exponent.

    The Shipyard Sediment Site is exempt from the Phase I Sediment Quality Objectives promulgated by the State Water ~~Resources Control~~ Board ~~(State Water Board)~~ because a site assessment (the Shipyard Report) was completed and submitted to the San Diego Water Board on October 15, 2003. See State Water Board, *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality*, II.B.2 (August 25, 2009).

IMPAIRMENT OF AQUATIC LIFE BENEFICIAL USES

14. **AQUATIC LIFE IMPAIRMENT**. Aquatic life beneficial uses designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. Aquatic life beneficial uses include: Estuarine Habitat (EST), Marine Habitat (MAR), and Migration of Aquatic Organisms (MIGR). This finding is based on the considerations described below in this *Impairment of Aquatic Life Beneficial Uses* section of the CAO.

15. **WEIGHT-OF-EVIDENCE APPROACH**. The San Diego Water Board used a weight-of-evidence approach based upon multiple lines of evidence to evaluate the potential risks to aquatic life beneficial uses from pollutants at the Shipyard Sediment Site. The approach focused on measuring and evaluating exposure and adverse effects to the benthic macroinvertebrate community and to fish using data from multiple lines of evidence and best professional judgment. Pollutant exposure and adverse effects to the benthic macroinvertebrate community were evaluated using sediment quality triad measurements, and bioaccumulation analyses, and interstitial water (i.e., pore water) analyses. The San Diego Water Board evaluated pollutant exposure and adverse effects to fish using fish histopathology analyses and analyses of PAH breakdown products in fish bile.

16. **SEDIMENT QUALITY TRIAD MEASURES**. The San Diego Water Board used lines of evidence organized into a sediment quality triad, to evaluate potential risks to the benthic community from pollutants present in the Shipyard Sediment Site. The sediment quality triad provides a "weight-of-evidence" approach to sediment quality assessment by integrating synoptic measures of sediment chemistry, toxicity, and benthic community composition. All three measures provide a framework of complementary evidence for assessing the degree of pollutant-induced degradation in the benthic community.

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23. **TIER I SCREENING LEVEL RISK ASSESSMENT FOR AQUATIC-DEPENDENT WILDLIFE**. The Tier I risk assessment objectives were to determine whether or not Shipyard Sediment Site conditions pose a potential unacceptable risk to aquatic-dependent wildlife receptors of concern and to identify whether a comprehensive, site-specific risk assessment was warranted (i.e., Tier II baseline risk assessment). The receptors of concern selected for the assessment include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). Chemical pollutant concentrations measured in clam tissue derived from laboratory bioaccumulation tests were used to estimate chemical exposure to these receptors of concern. Based on the Tier I screening level risk assessment results, there is a potential risk to all receptors of concern ingesting prey caught at the Shipyard Sediment Site. The chemical pollutants in *Macoma* tissue posing a potential risk include arsenic, copper, lead, zinc, benzo[a]pyrene (BAP), and total PCBs. The results of the Tier I risk assessment indicated that a Tier II baseline comprehensive risk assessment was warranted.

24. **TIER II BASELINE COMPREHENSIVE RISK ASSESSMENT FOR AQUATIC-DEPENDENT WILDLIFE**. The Tier II risk assessment objective was to more conclusively determine whether or not Shipyard Sediment Site conditions pose an unacceptable risk to aquatic-dependent wildlife receptors of concern. The receptors of concern selected for the assessment include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). Based on the Tier I screening level risk assessment results, there is a potential risk to all receptors of concern ingesting prey caught at the Shipyard Sediment Site and so a Tier II assessment was conducted. To focus the risk assessment, prey items were collected within four assessment units at the Shipyard Sediment Site and from a reference area located across the bay from the site. Chemical concentrations measured in fish were used to estimate chemical exposure for the least tern, western grebe, brown pelican, and sea lion and chemical concentrations in benthic mussels and eelgrass were used to estimate chemical pollutant exposure for the surf scoter and green turtle, respectively. Based on the Tier II risk assessment results, ingestion of prey items caught within all four assessment units at the Shipyard Sediment Site poses an increased risk above reference to all receptors of concern (excluding the sea lion). The chemicals in prey tissue posing a risk include BAP, PCBs, copper, lead, mercury, and zinc.

IMPAIRMENT OF HUMAN HEALTH BENEFICIAL USES

25. **HUMAN HEALTH IMPAIRMENT**. Human health beneficial uses for Shellfish Harvesting (SHELL), and Commercial and Sport Fishing (COMM) designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. ~~Human health beneficial uses include: Contact Water Recreation (REC-1), Non-contact Water Recreation (REC-2), Shellfish Harvesting (SHELL), and Commercial and Sport Fishing (COMM).~~ This finding is based on the

considerations described below in this *Impairment of Human Health Beneficial Uses* section of the CAO.

26. **RISK ASSESSMENT APPROACH FOR HUMAN HEALTH**. The San Diego Water Board evaluated potential risks to human health from chemical pollutants present in the sediment at the Shipyard Sediment Site based on a two-tier approach. The Tier I screening level risk assessment was based on tissue data derived from the exposure of the clam *Macoma nasuta* to site sediments for 28 days using ASTM protocols. The Tier II baseline comprehensive risk assessment was based on tissue data derived from resident fish and shellfish caught within and adjacent to the Shipyard Sediment Site. Two types of receptors (i.e., members of the population or individuals at risk) were evaluated:

   a. Recreational Anglers – Persons who eat the fish and/or shellfish they catch recreationally; and

   b. Subsistence Anglers – Persons who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in their diet.

27. **TIER I SCREENING LEVEL RISK ASSESSMENT FOR HUMAN HEALTH**. The Tier I risk assessment objectives were to determine whether or not Shipyard Sediment Site conditions potentially pose an unacceptable risk to human health and to identify if a comprehensive, site-specific risk assessment was warranted (i.e., Tier II baseline risk assessment). The receptors of concern identified for Tier I are recreational anglers and subsistence anglers. Recreational anglers represent those who eat the fish and/or shellfish they catch recreationally and subsistence anglers represent those who fish for food, for economic and/or cultural reasons, and for whom the fish and/or shellfish caught is a major source of protein in the diet. Chemical concentrations measured in *Macoma nasuta* tissue derived from laboratory bioaccumulation tests were used to estimate chemical exposure for these receptors of concern. Based on the Tier I screening level risk assessment results, there is a potential risk greater than that in reference areas to recreational and subsistence anglers ingesting fish and shellfish caught at the Shipyard Sediment Site. The chemicals in *Macoma* tissue posing a potential risk include arsenic, BAP, PCBs, and TBT.

28. **TIER II BASELINE COMPREHENSIVE RISK ASSESSMENT FOR HUMAN HEALTH**. The Tier II risk assessment objective was to more conclusively determine whether Shipyard Sediment Site conditions pose unacceptable cancer and non-cancer health risks to recreational and subsistence anglers. Fish and shellfish were collected within four assessment units at the Shipyard Sediment Site and from two reference areas located across the bay from the Shipyard Site. Chemical concentrations measured in fish fillets and edible shellfish tissue were used to estimate chemical exposure for recreational anglers and chemical concentrations in fish whole bodies and shellfish whole bodies were used to estimate chemical exposure for subsistence anglers. Based on the Tier II risk assessment results, ingestion of fish and shellfish caught within all four assessment units at the Shipyard Sediment Site poses a theoretical increased cancer and non-cancer risk greater than that in reference areas to recreational and subsistence anglers. The chemicals posing theoretical increased cancer risks include inorganic arsenic and PCBs. The chemicals posing theoretical increased non-cancer risks include cadmium, copper, mercury, and PCBs.

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copper, mercury, HPAHs,[2] PCBs, and TBT, and the secondary COCs are arsenic, cadmium, lead, and zinc.

30. **TECHNOLOGICAL FEASIBILITY CONSIDERATIONS**. Although there are complexities and difficulties that would need to be addressed and overcome (e.g. removal and handling of large volume of sediment; obstructions such as piers and ongoing shipyard operations; transportation and disposal of waste), it is technologically feasible to cleanup to the background sediment quality levels utilizing one or more remedial and disposal techniques. Mechanical dredging, subaqueous capping, and natural recovery have been successfully performed at numerous sites, including several in San Diego Bay, and many of these projects have successfully overcome the same types of operational limitations present at the Shipyard Sediment Site, such as piers and other obstructions, ship movements, and limited staging areas. Confined aquatic disposal or near-shore confined disposal facilities have also been employed in San Diego Bay and elsewhere, and may be evaluated as project alternatives for the management of sediment removed from the Shipyard Sediment Site.

31. **ECONOMIC FEASIBILITY CONSIDERATIONS**. Under State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*, determining "economic feasibility" requires an objective balancing of the incremental benefit of attaining further reduction in the concentrations of primary COCs as compared with the incremental cost of achieving those reductions. Resolution No. 92-49 provides that "[e]conomic feasibility does not refer to the dischargers' ability to finance cleanup." When considering appropriate cleanup levels under Resolution No. 92-49, the San Diego Water Board is charged with evaluating "economic feasibility" by estimating the costs to remediate constituents of concern at a site to background and the costs of implementing other alternative remedial levels. An economically feasible alternative cleanup level is one where the incremental cost of further reductions in primary COCs outweighs the incremental benefits.

The San Diego Water Board evaluated a number of criteria to determine risks, costs, and benefits associated with no action, cleanups to background sediment chemistry levels, and alternative cleanup levels greater than background concentrations. The criteria included factors such as total cost, volume of sediment dredged, exposure pathways of receptors to contaminants, short- and long-term effects on beneficial uses (as they fall into the broader categories of aquatic life, aquatic-dependent wildlife, and human health)~~, effects on shipyards and associated economic activities, effects on local businesses and neighborhood quality of life, and effects on recreational, commercial, or industrial uses of aquatic resources~~. The San Diego Water Board then compared these cost criteria against the benefits gained by diminishing exposure to the primary COCs to estimate the incremental benefit gained from reducing exposure based on the incremental costs of doing so. As set

[2] Petroleum hydrocarbons, including TPH, RRO, DRO, and other PAHs were eliminated as primary and secondary COCs for the following reasons. HPAHs, a primary COC, are considered to be the most recalcitrant, bioavailable, and toxic compounds present in the complex mixture of petroleum hydrocarbons. Other measures of petroleum hydrocarbons are generally correlated with HPAHs such that remedial measures to address HPAHs will also address environmental concerns associated with elevated levels of low molecular weight PAHs (LPAHs), total PAHs, TPH, RRO and DRO.

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for Investigation and Cleanup and Abatement of Discharges Under Water Code section 13304; and (5) relevant standards, criteria, and advisories adopted by other state and federal agencies.

37. **CALIFORNIA ENVIRONMENTAL QUALITY ACT**. In many cases, an enforcement action such as this could be exempt from the provisions of the California Environmental Quality Act ("CEQA"; Public Resources Code, section 21000 et seq.), because it would fall within Classes 7, 8, and 21 of the categorical exemptions for projects that have been determined not to have a significant effect on the environment under section 21084 of CEQA.[4] In Resolution No. R9-2010-0115 adopted on September 8, 2010, the San Diego Water Board found that because the tentative CAO presents unusual circumstances and there is a reasonable possibility of a significant effect on the environment due to the unusual circumstances, the tentative CAO is not exempt from CEQA and that an EIR analyzing the potential environmental effects of the tentative CAO should be prepared.

    As the lead agency for the tentative CAO, the San Diego Water Board prepared an EIR that complies with CEQA. The San Diego Water Board has reviewed and considered the information in the EIR.

38. **PUBLIC NOTICE**. The San Diego Water Board has notified all known interested persons and the public of its intent to adopt this CAO, and has provided them with an opportunity to submit written comments and recommendations.

39. **PUBLIC HEARING**. The San Diego Water Board has considered all comments pertaining to this CAO submitted to the San Diego Water Board in writing, or by oral presentations at the public hearing held on [date(s) to be inserted]. Responses to relevant comments have been incorporated into the Technical Report for this CAO. In the event that the San Diego Water Board proposes any changes to the Tentative CAO deemed material by the Dischargers, the Dischargers reserve their right to complete the administrative process delineated in the Final Discovery Plan and Second Amended Order of Proceedings, including the rights to conduct discovery, to cross–examine witnesses, and to submit rebuttal evidence, comments and initial and final briefs, subject to revised deadlines to be set by the San Diego Water Board or its designated Presiding Officer.

40. **TECHNICAL REPORT**. The "*Technical Report for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*" is hereby incorporated as a finding in support of this CAO as if fully set forth here verbatim.

41. **COST RECOVERY.** Pursuant to Water Code section 13304, and consistent with other statutory and regulatory requirements, including but not limited to Water Code section 13365, the San Diego Water Board and the State Water Board are entitled to, and will seek reimbursement for all reasonable costs actually incurred by the San Diego Water Board and the State Water Board to investigate unauthorized discharges of waste and to oversee cleanup of such waste, abatement of the effects thereof, or other remedial action required by this Order.

[4] Title 14 CCR sections 15307, 15308, and 15321

Unreimbursed recoverable costs actually incurred by the San Diego Water Board and the State Water Board for the development and issuance of this Cleanup and Abatement Order fall into three categories as listed and described below.

a. Contracts funded by the State Water Board Cleanup and Abatement Account or other San Diego Water Board contract funds for services in support of the development and issuance of this Cleanup and Abatement Order.

   i. DM Information Services, Inc. produced the electronic administrative record. This work was paid for with Cleanup and Abatement Account funds and San Diego Water Board contract funds in the amount of $[*insert amount*].
   ii. The Department of Fish and Game provided technical consultation services on the fish histopathology and bile studies, and the wildlife risk assessments. This work was paid for with Cleanup and Abatement Account funds in the amount of $[*insert amount*].
   iii. The Office of Environmental Health Hazard Assessment provided technical consultation services on the human health risk assessments. This work was paid for with San Diego Water Board contract funds in the amount of $[*insert amount*].
   iv. LSA provided technical oversight on the Responses to Comments on the Draft EIR, consultation services to complete the CEQA process. This work was paid for with Cleanup and Abatement Account funds in the amount of $[*insert amount*].
   v. SCCWRP provided training and technical consultation services to the Advisory Team on sediment quality triad methods. This work was paid for with Cleanup and Abatement Account funds in the amount of $[*insert amount*].

b. Unreimbursed staff services costs. Due to Site Cleanup Program budget constraints, the San Diego Water Board was unable to bill all of the recoverable staff services costs to the NASSCO and BAE Systems cost recovery accounts. The unreimbursed staff costs total $[*insert amount*].

c. Unpaid invoices billed to NASSCO. NASSCO has not paid the entire amount billed to its cost recovery account. Based on the most current accounting available to the San Diego Water Board, the unpaid balance on the NASSCO cost recovery amount is $[*amount to be determined*] as of [*insert date*].

ORDER DIRECTIVES

IT IS HEREBY ORDERED *that, pursuant to sections 13267 and 13304 of the Water Code, National Steel and Shipbuilding Company; BAE Systems San Diego Ship Repair Inc.; the City of San Diego; Star & Crescent Boat Company; Campbell Industries; San Diego Gas and Electric; the United States Navy; and the San Diego Unified Port District (hereinafter Dischargers), shall comply with the following directives*:

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the United States Navy; and the San Diego Unified Port District (hereinafter Dischargers), shall comply with the following directives:

A. CLEANUP AND ABATE

1. **Illicit Discharges**. The Dischargers shall terminate all illicit discharges, if any, to the Shipyard Sediment Site (see Attachment 1) in violation of waste discharge requirements or other order or prohibition issued by the San Diego Water Board.

2. **Corrective Action**. The Dischargers shall take all corrective actions necessary to remediate the contaminated marine bay sediment at the Shipyard Sediment Site as described below: Corrective action design details shall be included in the Remedial Action Plan required by Directive B.

   a. ***Dredge Remedial Areas***. The sediments in the dredge remedial areas shown on Attachments 3 and 4 shall be dredged. This dredging shall remediate the sediment in the dredge remedial area to the concentrations in the table below for primary COCs, pursuant to confirmatory testing:

Primary COCs	Post-Remedial Dredge Area Concentrations (Background[1])
Copper	121 mg/kg
Mercury	0.57 mg/kg
HPAHs[2]	663 µg/kg
PCBs[3]	84 µg/kg
Tributyltin	22 µg/kg

1. See Finding 29, Table 1.
2. HPAHs = High Molecular Weight Polynuclear Aromatic Hydrocarbons, sum of 6 PAHs: Fluoranthene, Perylene, Benzo(a)anthracene, Chrysene, Benzo(a)pyrene, and Dibenzo(a,h)anthracene.
3. PCBs = Polychlorinated Biphenyls, sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

If the concentration of any primary COC in subsurface sediments (deeper than the upper 5 cm) is above 120 percent of the post-remedial dredge area concentration after completion of initial dredging, then additional sediments shall be dredged by performing an additional "pass" with the equipment.~~If concentrations of primary COCs in subsurface sediments (deeper than the upper 5 cm) are above 120 percent~~

~~of post-remedial dredge area concentrations after completion of initial dredging, then additional sediments shall be dredged by performing an additional "pass" with the equipment.~~ If concentrations of primary COCs in subsurface sediments are below 120 percent of post-remedial dredge area concentrations, then the dredging is sufficient and may stop.

b. ***Under-Pier Remedial Areas***. The sediments in the under pier areas shown on Attachments 3 and 4 and other locations where significant impacts to infrastructure may occur shall be remediated by dredging, sand covering or other means.

c. ***Post Remedial Surface-Area Weighted Average Concentrations.*** The Shipyard Sediment Site as shown in Attachment 2 shall be remediated to attain the following post remedial surface-area weighted average concentrations ("SWACs"):

Primary COCs	Predicted Post-Remedial SWACs
Copper	159 mg/kg
Mercury	0.68 mg/kg
HPAHs[1]	2,451 µg/kg
PCBs[2]	194 µg/kg
Tributyltin	110 µg/kg

1. HPAHs = sum of 10 PAHs: Fluoranthene, Pyrene, Benz[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, indeno[1,2,3-c,d]pyrene, Dibenz[a,h]anthracene, and Benzo[g,h,i]perylene.

2. PCBs = sum of 41 congeners: 18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153, 156, 157, 158, 167, 168, 169, 170, 177, 180, 183, 187, 189, 194, 201, and 206.

3. **MS4 Interim Mitigation Measures**. Immediately after adoption of the CAO, the City of San Diego and the San Diego Unified Port District within the tideland area shall take interim remedial actions, as necessary, to abate or correct the actual or potential effects of releases from the MS4 system that drains to outfall SW4. Interim remedial actions can occur concurrently with any phase of corrective action. Before taking interim remedial actions, the City and the Port District shall notify the San Diego Water Board of the proposed action and shall comply with any requirements that the San Diego Water Board sets.

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remediation, and (v) any potential inconveniences such as excess traffic and noise that may affect the community during the remedial action.

e. *Quality Assurance Project Plan.* A Quality Assurance Project plan (QAPP) shall be included describing the project objectives and organization, functional activities, and quality assurance/quality control protocols as they relate to the remedial action

f. *Sampling and Analysis Plan.* A Sampling and Analysis Plan defining (i) sample and data collection methods to be used for the project, (ii) a description of the media and parameters to be monitored or sampled during the remedial action, and (iii) a description of the analytical methods to be utilized and an appropriate reference for each.

g. *Wastes Generated.* A description of the plans for management, treatment, storage and disposal of all wastes generated by the remedial action.

h. *Pilot Testing.* The results of bench scale or pilot scale studies or other data collected to provide sizing and operations criteria to optimize the remedial design.

i. *Design Criteria Report.* A Design Criteria Report that defines in detail the technical parameters upon which the remedial design will be based. Specifically, the Design Criteria Report shall include the preliminary design assumptions and parameters, including (i) waste characterization; (ii) volume and types of each medium requiring removal or containment; (iii) removal or containment schemes and rates, (iv) required qualities of waste streams (i.e., input and output rates to stockpiles, influent and effluent qualities of any liquid waste streams such as dredge spoil return water, potential air emissions, and so forth): (v) performance standards; (v) compliance with applicable local, State and federal regulations; (vi) technical factors of importance to the design, construction, and implementation of the selected remedy including use of currently accepted environmental control measures, constructability of the design, and use of currently acceptable construction practices and techniques.

j. *Equipment, Services, and Utilities.* A list of any elements or components of the selected remedial action that will require custom fabrication or long lead time for procurement. The list shall state the basis for such need, and the recognized sources of such procurement.

k. *Regulatory Permits and Approvals*. A list of required federal, State and local permits or approvals to conduct the remedial action.

l. *Remediation Monitoring Plan*. A Remediation Monitoring Plan consisting of (i) water quality monitoring, (ii) sediment monitoring, and (iii) disposal monitoring consistent with Section 34.1~~2~~ of the Technical Report. The water quality monitoring must be sufficient to demonstrate that implementation of the selected remedial activities do not result in violations of water quality standards outside the construction area. The sediment monitoring must be sufficient to confirm that the selected remedial activities have achieved target cleanup levels within the remedial footprint

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1. **Year 2 Remedial Goals**

    - Composite site-wide SWACs below the Trigger Concentrations identified in D.1.c.6. above; and

    - Sediment chemistry below SS-MEQ and 60%LAET thresholds; and

    - Toxicity not significantly different from conditions at the reference stations described in Finding 17 and in the *Technical Report. for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and

    - The average of stations sampled shows bioaccumulation levels below the pre-remedial levels.

2. **Year 5 Remedial Goals**

    - Composite site-wide SWACs below the Trigger Concentrations identified in D.1.c.6. above; and

    - Sediment chemistry below SS-MEQ and 60%LAET thresholds; and

    - Toxicity not significantly different from conditions at the reference stations described in Finding 17 and as defined in the *Technical Report for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and

    - The average of stations sampled shows bioaccumulation levels continuing to decrease below the pre-remedial levels and equal to or below the Year 2 post-remedial monitoring sampling event levels.

3. **Confirm remedial goals are maintained at year 10 (if goals were not met in year 5**

    - Composite site-wide SWACs below the Trigger Concentrations identified in D.1.c.6. above; and

    - Sediment chemistry below SS-MEQ and 60%LAET thresholds; and

    - Toxicity not significantly different from conditions at the reference stations described in Finding 17 and defined in the *Technical Report for Cleanup and Abatement Order No. R9-2011-0001 for the Shipyard Sediment Site, San Diego Bay, San Diego, CA*; and

    - The average of stations sampled shows bioaccumulation levels below the pre-remedial levels and equal to or below the Year 5 post-remedial monitoring sampling event levels.

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relating to the progress of work, including, but not limited to, a graphical depiction of the progress of the remedial actions; (4) identify any modifications to the Remedial Action Plan or other work plan(s) that the Dischargers proposed to the San Diego Water Board or that have been approved by San Diego Water Board during the previous quarter; and (5) include information regarding all delays encountered or anticipated that may affect the future schedule for completion of the remedial actions required , and a description of all efforts made to mitigate those delays or anticipated delays. These progress reports shall be submitted to the San Diego Water Board by the (15th) day of March, June, September, and December of each year following the effective date of this CAO. Submission of these progress reports shall continue until submittal of the final Cleanup and Abatement Completion Report verifying completion of the Remedial Action Plan (RAP) for the Shipyard Sediment Site (see Directive C).

F. NO FURTHER ACTION

Upon approval by the San Diego Water Board of the Final Cleanup and Abatement Completion Report (Directive C) and the Post Remedial Monitoring Reports (Directive D.3) remedial actions and monitoring will be complete and compliance with this CAO will be achieved. At that time the San Diego Water Board will inform the Dischargers and other interested persons in writing that, based on available information, no further remedial work is required.

G. PROVISIONS

1. **Cost Recovery**. The Dischargers shall reimburse the State of California for all reasonable costs actually incurred by the San Diego Water Board and State Water Board to investigate, oversee, and monitor cleanup and abatement actions required by this CAO, including the cost to prepare CEQA documents according to billing statements prepared from time to time by the State Water Board. If the Dischargers are enrolled in a reimbursement program managed by the State Water Board for the discharge addressed by this CAO, reimbursement shall be made pursuant to the procedures established in that program.

   Within 60 days of the adoption of this CAO, the Dischargers shall reimburse the State of California in the amount of $[*amount to be determined*] for the unreimbursed costs actually incurred by the San Diego Water Board and State Water Board as described in Finding 41 of this Order.

2. **Waste Management**. The Dischargers shall properly manage, store, treat, and dispose of contaminated ~~soils and ground water~~ marine sediment and associated wastes in accordance with applicable federal, state, and local laws and regulations. The storage, handling, treatment, or disposal of contaminated marine sediment and associated waste shall not create conditions of pollution, contamination or nuisance as defined in Water Code section 13050. The Dischargers shall, as required by the San Diego Water Board, obtain, or apply for coverage under, waste discharge requirements or a conditional waiver of waste discharge requirements for the removal of waste from the immediate place of release and discharge of the waste to (a) land for treatment, storage, or disposal or (b)

DTR Section 04

As outlined above, the City of San Diego MS4 Storm Drain SW4 has discharged pollutants, specifically Aroclor-1254 and 1260, and PAHs, into the BAE Systems leasehold and San Diego Bay at the Shipyard Sediment Site. These facts provide evidence that the City of San Diego MS4 Storm Drain SW4 has discharged and deposited pollutants to the Shipyard Sediment Site, both presently and in the past.

4.7.3 City of San Diego, MS4 Storm Drain SW9 Discharges

As described in Section 4.3.1, the City of San Diego owns and operates an MS4 storm drain identified as SW9 in the Shipyard Report (Exponent, 2003) (see Figure 4-2, above), which conveys urban runoff from source areas upgradient of NASSCO's property and discharges directly within the NASSCO leasehold. Urban runoff discharged into the SW9 storm drain outfall is subject to the NPDES requirements cited in Section 4.6. Although no monitoring data is available for this outfall, it is highly probable that historical and current discharges from this outfall have discharged heavy metals and organics to San Diego Bay at the Shipyard Sediment Site.[56]

A review of maps of the City's storm drain outfalls shows that the City's storm drain SW9 outfall is located in the NASSCO leasehold at the foot of 28th St. near the mouth of Chollas Creek (Exponent, 2003; ENV America, 2004a; City of San Diego, 2004a). SW9 collects flow from 28th Street, and stretches from the I-5 freeway to the bay including parts of Belt Street and Harbor Drive.

Surface sediment data at NASSCO sample station NA22, which is located near the SW9 storm drain outfall shows elevated concentrations of total high-molecular-weight polynuclear aromatic hydrocarbons (Total HPAHs) at 3,600~~u~~µg/kg), Dichlorodiphenyltrichloroethane (DDT) at 29.7µg/kg), and Chlordane at 21.1µg/kg. These pollutant levels are indicators of an urban runoff source (Exponent, 2003) and therefore indicate that historical urban runoff discharges occurred from the City via the SW9 outfall.

As described above, the surface sediment data at NASSCO sample station NA22 provides evidence that the City of San Diego MS4 Storm Drain SW9 conveys the HPAHs, DDT, and Chlordane pollutants into the NASSCO leasehold and San Diego Bay at the Shipyard Sediment Site. The urban runoff characteristics of the sediment pollutants at Station NA22 adjacent to the City of San Diego's MS4 Storm Drain SW9 provide evidence that the City has discharged pollutants to the Shipyard Sediment Site, both presently and in the past. The weight of evidence suggests that there are past and continuing discharges from Storm Drain SW9 that are contributing to the accumulation of pollutant in marine sediment.

[56] See Section 4.3.2 for a description of the most common categories of pollutants found in urban runoff.

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5. Finding 5: Star & Crescent Boat Company

Finding 5 of CAO No. R9-2011-001 ~~S~~states:

The San Diego Water Board alleges, but Star & Crescent Boat Company (hereinafter "Star & Crescent") denies, that Star & Crescent caused or permitted wastes to be discharged or to be deposited where they were discharged into San Diego Bay and created, or threatened to create, a condition of pollution or nuisance. These wastes contained metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc), butyl tin species, PCBs, PCTs, PAHs, and TPH. Between 1914 and 1972, San Diego Marine Construction Company operated a ship repair, alteration, and overhaul facility on what is now the BAE Systems leasehold at the foot of Sampson Street in San Diego. Shipyard operations were conducted at this site over San Diego Bay water or very close to the waterfront. An assortment of waste was generated at the facility, including spent abrasive blast waste, paint, rust, petroleum products, marine growth, sanitary waste and general refuse. In July 1972, San Diego Marine Construction Company sold its shipyard operations to Campbell Industries, and changed its corporate name, effective July 14, 1972, to Star & Crescent Investment Co. On March 19, 1976, Star & Crescent Boat Company was incorporated in California and on April 9, 1976, Star & Crescent Investment Co. (formerly San Diego Marine Construction Company) transferred all of its assets and liabilities to Star & Crescent. Accordingly, Star & Crescent is the corporate successor of and responsible for the conditions of pollution or nuisance caused or permitted by San Diego Marine Construction Company. Based on these considerations, Star & Crescent is referred to as "Discharger(s)" in this CAO.

5.1. Jurisdiction

CWC section 13304 contains the cleanup and abatement authority of the San Diego Water Board. Section 13304(a) provides in relevant part that the San Diego Water Board may issue a cleanup and abatement order to any person "who has discharged or discharges waste into the waters of this state in violation of any waste discharge requirements… ...or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance…."

For the reasons set forth below, the San Diego Water Board has determined that Star & Crescent should be named as dischargers in Cleanup and Abatement Order No. R9-2005-0126 pursuant to CWC section 13304.

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A. Use any relevant evidence, whether direct or circumstantial, including, but not limited to, evidence in the following categories:

1. Documentation of historical or current activities, waste characteristics, chemical use, storage or disposal information, as documented by public records, responses to questionnaires, or other sources of information;

2. Site characteristics and location in relation to other potential sources of a discharge;

3. Hydrologic and hydrogeologic information, such as the difference in upgradient and downgradient water quality;

4. Industry-wide operational practices that historically have led to discharges, such as leakage of pollutants from wastewater collection and conveyance systems, sumps, storage tanks, landfills, and clarifiers;

5. Evidence of poor management of materials or wastes, such as improper storage practices or inability to reconcile inventories;

6. Lack of documentation of responsible management of materials or wastes, such as lack of manifests or lack of documentation of proper disposal;

7. Physical evidence, such as analytical data, soil or pavement staining, distressed vegetation, or unusual odor or appearance;

8. Reports and complaints;

9. Other agencies' records of possible known discharge; and

10. Refusal or failure to respond to San Diego Water Board inquiries.

6.1. Campbell Industries Owned the San Diego Marine Construction Facility From 1972 Through 1979

6.1.1. Leasehold Information

Campbell through ~~it's~~its wholly owned subsidiary San Diego Marine Construction Corporation contributed to the accumulation of pollutants in marine sediment through waste discharges from its shipyard facility located within or adjacent to the current BAE Systems leasehold between 1972 and 1979 (Woodward-Clyde, 1995).

San Diego Marine Construction Company (subsequently Star & Crescent) sold the business and assets of its Marine Division to MCCSD, a wholly owned subsidiary of Campbell Industries in July 1972, as indicated in the minutes of the first meeting of Directors of MCCSD approving that transaction. The purchase did not include the leasehold. San Diego Marine Construction Company surrendered its leasehold to the San Diego Unified Port District (SAR 163149), and the Port District entered into a new lease with MCCSD (SAR 174131).~~San Diego Marine~~

~~Construction Company (subsequently Star & Crescent) sold its leasehold to MCCSD, a wholly owned subsidiary of Campbell Industries in July 1972. MCCSD changed its name to San Diego Marine Construction Corporation in August 1972. A leasehold summary states that San Diego Marine Construction Corporation was issued a lease for the site with an expiration date of November 30, 2018 (SDUPD, 2004).~~ On September 14, 1979, San Diego Marine Construction Corporation surrendered its lease to the Port District, which entered into a new lease with Southwest Marine, Inc., now BAE Systems. On August 24, 1981, San Diego Marine Construction Corporation was merged into Campbell Industries. Campbell ceased all operations on San Diego Bay in October 1999 (SDUPD, 2004).

The stock of Campbell Industries was acquired by Marco Holdings, Inc. ("MARCO"), a Washington corporation, in 1979. Marco Holdings, Inc. is a wholly-owned subsidiary of Marine Construction and Design Company, a Washington Corporation.

On February 19, 2004 the San Diego Water Board issued Investigative Order R9-2004-0026 directing MARCO to submit a historical site assessment report that completely documented all leasehold information and activities in the vicinity of the BAE Systems leasehold that may have affected water quality, including chemical and waste handling and storage activities, discharges, and monitoring data. To date MARCO contends it has been unable to locate any responsive documents.

~~By letter dated March 5, 2004, Mr. H. Allen Fernstrom of MARCO responded to the San Diego Water Board's section 13267 Investigative Order and denied having any records of "operations within or adjacent to the current Southwest Marine leasehold from 1914-79, or any other time." Mr. Fernstrom also stated that they and the "… Campbell Industries subsidiary terminated all California operations in 1999.…" Mr. Fernstrom's response letter, in its entirety, is provided below:~~

> ~~*"Dear Mr. Robertus:*~~
> ~~*Your investigation order to Marine Construction and Design Co. (MARCO) received on February 26, 2004 in connection with the Southwest Marine facility has been directed to my attention. MARCO has undertaken an internal search and has no information pertaining to, and has found no records of, any alleged MARCO and/or Campbell Industries operations within or adjacent to the current Southwest Marine leasehold from 1914-79, or any other time. MARCO has no California operations or offices. The Campbell Industries subsidiary terminated all California operations in 1999 at Eighth Avenue and Harbor Drive. The records we have from California-based operations pertain to the Campbell shipyards site at Eighth and Harbor and CAO95-21."*~~

~~MARCO was not responsive to the directives of the San Diego Water Board's Investigative Order and their lack of responsiveness forms part of the basis for the San Diego Water Board's~~

~~determination that MARCO should be named as a discharger in the Cleanup and Abatement Order.~~[60]

Further investigation by the San Diego Water Board into the ownership of San Diego Marine Construction Corporation found that:

- San Diego Marine Construction Corporation, a California corporation, was the immediate predecessor tenant to BAE Systems at the Shipyard Sediment Site, occupying the premises from July 14, 1972 until August 31, 1979. (See Appendix for Section 6, Tab A);
- San Diego Marine Construction Corporation was a wholly owned subsidiary of Campbell Industries, a California corporation and certain assets of San Diego Marine Construction Corporation were sold to BAE Systems, as stated in a resolution adopted by the directors of Campbell Industries on July 27, 1979. (See Appendix for Section 6, Tab B);
- BAE Systems commenced occupation of the shipyard on September 1, 1979, immediately following San Diego Marine Construction Corporation's surrender of ~~it's~~its leasehold interest to the Port District. (See Appendix for Section 6, Tab C); and
- San Diego Marine Construction Corporation was merged into Campbell on August 24, 1981 (Please see Appendix for Section 6, Tabs D & E) and Campbell Industries remains an active California corporation. (See Appendix for Section 6, Tabs F & G).

Based on these considerations, the San Diego Water Board has determined that Campbell operated within the BAE Systems leasehold from 1972 through 1979.

6.2. Campbell Owned and Operated a Full Service Ship Construction, Modification, Repair, and Maintenance Facility

6.2.1. Facility Description

Campbell was a ship construction and repair facility located at the foot of Sampson Street in the City of San Diego. Ship repair facilities at Campbell included two floating dry docks and three marine railways, which together with cranes, enabled ships to be launched or repaired. The basic purpose of the dry docks was to separate the vessel from the bay to provide access to parts of the ship normally underwater. Piers were used to support berthed vessels undergoing maintenance

~~[60] See Resolution No. 92-49, *Policies and Procedures for the Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*, as summarized in Section 6.2 of this Report. Refusal or failure to respond to San Diego Water Board inquiries is one factor that the San Diego Water Board must consider and use as a basis in determining whether a person shall be required to investigate a discharge under Water Code section 13267, or to clean up waste and abate the effects of a discharge or a threat of a discharge under Water Code section 13304.~~

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The fingerprinting results indicate that the samples collected near the BP and Chevron facilities are composed mainly of pyrogenic sources, thereby excluding the fuels stored at the Chevron and BP Terminals as a possible source of the petroleum hydrocarbons found in bay sediment. One sampling event at sampling station SW24 in August 2002 did show the presence of a petrogenic source, however samples taken before and after this sampling event at the same sampling station did not indicate any petrogenic source product present (Haddad, 2005). BP has not used the pier/wharf near the sampling site since 1978, and therefore, is a highly unlikely source of the PAHs found in the shipyard sediment during this one sampling event.

Creosote impregnated marine pilings have been shown to be a significant source of PAH contamination in San Diego Bay (Chadwick et. al, 1999). At the San Diego Naval Station, the Navy has been mitigating the effects of the creosote pilings by replacing them with plastic ones. There are numerous creosote pilings within the Shipyard Sediment Site. Review of a 1942 aerial photograph show several piers, very likely constructed with creosote pilings, in the vicinity of sampling stations SW20 through SW24, SW27, and SW28 listed in Table 8-2 as having some of the highest reported HPAH concentrations. Many of the old piers at the Shipyard Sediment Site have been removed over the long history of shipyard activities. Pyrogenic PAHs can be released from creosote pilings via leaching or by deterioration from ship and boat contact or during removal.

Based on the information that the San Diego Water Board has reviewed to date, it is likely that most of the PAH contamination present at the Shipyard Sediment Site is of pyrogenic origin and not caused by releases from the ARCO Terminal. Potential sources for the pyrogenic PAHs include vehicle combustion products transported via air deposition and/or storm water runoff, and creosote pilings.

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Sediment PCB levels, specifically Aroclor-1254 and 1260, and sediment PAH levels reported in the MS4 conveyance are also reported in the bay sediment near the storm water outfall as indicated by comparing Tables 9-5 and 9-6. This data provides evidence that discharges from the SDG&E facility have contributed to the pollution in the Shipyard Sediment Site.

9.10. Characterization of Wastewater Pond Operations and Discharge to San Diego Bay

Soil boring samples taken at the locations of the former wastewater ponds found residual metals, PAH, and PCB contamination. The proximity of the ponds to San Diego Bay and evidence that a discharge happened on at least one occasion provide a potential for discharges that contributed pollution to the Shipyard Sediment Site.

SDG&E Landside Tidelands Lease Area Site Assessment Report describes an investigation that ~~was~~ characterized the potential residual contamination that may be present at the location of two former wastewater pond operations (ENV America, 2004a). These ponds reportedly were used to settle solids and separate oil and grease from bilge water collected from the boiler side of the plant before being discharged to the Bay (ENV America, 2004b).

The investigation included the collection and analysis of seven soil borings and ground water samples. Each boring produced three samples (approximate depth of fill material, pond sediment, and soil underlying the pond sediment) and a groundwater sample. The samples were analyzed for one or more of the following TPHs within the gasoline, diesel, and heavy hydrocarbon ranges (TPH-g, TPH-d, and TPH-h), polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals (ENV America, 2004a).

In SDG&E's July 14, 2004, response to the 13267 investigative order, it is clearly stated that "[s]ome water from the pond was discharged to the Bay" (ENV America, 2004b). However, it is not clear whether both ponds discharged or whether only one of the two ponds discharged to the Bay. In any case, discharge to the Bay from either pond is reason for concern based on the investigation results.

Pond A soil contained low concentrations of organic compounds, including TPH-d and TPH-h, and SVOCs. However, none of the soil samples from Pond A was reported to contain detectable VOCs, PCBs, or appreciable metals.

Soil data from Pond B showed the presence of organic and metal analytes. The occurrence of shallow soil contaminants was generally coincident with what was visually identified to be the base of the former ponds. Hydrocarbon soil concentrations typically decreased rapidly with depth, suggesting limited vertical migration. Chromium and benzo [a] anthracene were detected in one sample from Pond B soil at concentrations above U.S. EPA industrial Preliminary Remediation Goals (PRGs) (ENV America, 2004a).

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13. Finding 13: Sediment Quality Investigation

Finding 13 of CAO No. R9-2011-0001 states:

NASSCO and BAE Systems conducted a detailed sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. Two phases of fieldwork were conducted, Phase I in 2001 and Phase II in 2002. The results of the investigation are provided in the Exponent report *NASSCO and Southwest Marine Detailed Sediment Investigation, September 2003 (Shipyard Report*, *Exponent 2003*). Unless otherwise explicitly stated, the San Diego Water Board's finding and conclusions in this CAO are based on the data and other technical information contained in the Shipyard Report prepared by NASSCO's and BAE Systems' consultant, Exponent.

The Shipyard Sediment Site is exempt from the Phase I Sediment Quality Objectives promulgated by the State Water ~~Resources Control~~ Board ~~(State Water Board)~~ because a site assessment (the Shipyard Report) was completed and submitted to the San Diego Water Board on October 15, 2003. See State Water Board, *Water Quality Control Plan for Enclosed Bays and Estuaries – Part 1 Sediment Quality*, II.B.2 (August 25, 2009).

13.1. NASSCO and Southwest Marine Detailed Sediment Investigation

On February 21, 2001, the San Diego Water Board adopted Resolution Nos. 2001-02 and -03 directing the Executive Officer to issue ~~CWC~~ Water Code section 13267 letters to NASSCO and BAE Systems requiring the submission of a site-specific study to develop sediment cleanup levels and identify sediment cleanup alternatives.

On June 1, 2001, the San Diego Water Board Executive Officer directed, under the authority provided in ~~CWC~~ Water Code section 13267, NASSCO and BAE Systems to conduct a site-specific study to develop sediment cleanup levels and identify sediment cleanup alternatives. The study was conducted in accordance with the San Diego Water Board document, *Guidelines for Assessment and Remediation of Contaminated Sediments in San Diego Bay at NASSCO and Southwest Marine Shipyards, June 1, 2001*.

As a first step, NASSCO and BAE Systems developed and submitted to the San Diego Water Board a Work Plan (Exponent, 2001a) and time schedule for performance of a site assessment and development of sediment cleanup levels, sediment cleanup alternatives, and cleanup costs. Following San Diego Water Board concurrence with the work plan NASSCO and BAE Systems conducted the two phase sediment investigation at the Shipyard Sediment Site in San Diego Bay within and adjacent to the NASSCO and BAE Systems leaseholds. The results of the investigation are provided in the Shipyard Report.

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It is important to note that SQGs are not promulgated as regulatory sediment quality criteria or standards in California nor are they intended as cleanup or remediation targets (Buchman, 1999). The SQGs used to classify the Shipyard Sediment Site stations include:

- ERM for metals (Long et al., 1998),
- Consensus midrange effects concentration for PAHs and PCBs (Swartz, 1999; MacDonald et al., 2000), and
- Sediment Quality Guideline Quotient (SQGQ) for chemical mixtures (Fairey et al., 2001).

- **Reference Sediment Quality Conditions** – A key step to evaluating each line-of-evidence comprising the Triad of data is to determine if there are statistically significant differences between a contaminated marine sediment site and reference station sites. To accomplish this it is necessary to specify the appropriate statistical procedure to estimate the level of confidence obtained when differentiating between reference and the contaminated marine sediment site conditions. The statistical procedure used by the San Diego Water Board in the Shipyard Sediment Site investigation to identify stations where conditions are significantly different from the Reference Sediment Quality Conditions consisted of identifying station sample values outside boundaries established by the 95% upper predictive limit reference pool of data for each contaminant of concern. The 95% upper predictive limit allows a one-to-one comparison to be performed between a single Shipyard Sediment Site station and the pool of reference stations used to establish "Reference Sediment Quality Conditions" for the Shipyard Sediment Site (Reference Pool). Although multiple comparisons are made to the Reference Pool prediction limits, the San Diego Water Board made a decision to not correct for multiple comparisons so that the Shipyard Site/Reference comparisons would remain conservative and more protective. Metals characteristics and summary statistics for the Reference Pool are shown in Table 18-2. The 95% upper predictive limit for metals was dependent on the fines content at each station to help identify concentrations of metals that were enriched at the Shipyard Sediment Site (Table 18-3). In general, this means that stations with higher fines content will have a higher 95% upper predictive limit. For example, the 95% upper predictive limit for copper ranged from 85.9 mg/kg for a fines content of 25% to 159.5 mg/kg for a fines content of 75%. Summary statistics and the 95% upper predictive limits for organic contaminants and the SQGQ1 for the Reference Pool are shown in Tables 18-4 and 18-5, respectively.

- **Tributyltin (TBT) Considerations** - TBT is not specifically considered in the sediment chemistry line of evidence (LOE) analysis because 1) it is not incorporated in the combination of chemicals used in the SQGQ1 calculation and 2) there are no published empirical SQGs or consensus MEC values for TBT effects on benthic community health. The SQGQ1 metric, documented in Fairey et. al., (2001) and used in the analysis, is a central tendency indicator of the potential for adverse biological effects from chemical mixtures in a complex sediment matrix. Under the Fairey et. al., (2001) methodology, the SQGQ1 value for a sediment is calculated by dividing concentrations of cadmium, copper, lead, silver, zinc, total chlordane, dieldrin, total PAHs (normalized by sediment organic carbon content), and total PCBs (sum of 18 congeners) in sediment by each chemical's empirical SQG and subsequently averaging the individual quotients. The combination of chemicals used in the SQGQ1 calculation, which does not include TBT, are assumed to be representative of, or the surrogates of, the toxicologically significant chemical mixture regardless of which chemicals were quantified in the sediment chemistry analyses. This is not only a well-accepted, but also a reasonable approach given the seemingly infinite number of chemicals present in marine sediment and for this reason it is not at all uncommon to exclude a specific chemical(s), such as TBT, in the chemistry LOE analysis for determining the likelihood of benthic community impairment.

Table 18-2 Individual Station Characteristics and Summary Statistics for Physical Properties (%) and Metals (mg/kg) in the Reference Pool

Station	% Fines	%TOC	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
CP 2231	41.2	1.0	0.288	7.78	0.025	46.6	71.1	0.364	11.5	40.3	129
CP 2238	69.0	1.0	0.510	7.8	0.133	59.2	71.0	0.262	16.5	28.8	214
CP 2243	30.3	0.6	0.651	5.94	0.143	40.2	56.4	0.332	10.2	30.7	125
CP 2433	38.4	0.5	0.385	5.55	0.288	42.2	43.3	0.251	11.2	23.3	115
CP 2441	82.8	1.8	0.388	8.82	0.411	54.0	78.4	0.238	17.5	26.7	143
SY 2231	45.0	1.3	0.260	8.3	0.100	37.0	82.0	0.430	10.0	42.0	120
SY 2243	28.0	0.5	0.560	4.3	0.120	23.0	47.0	0.250	5.6	21.0	93.0
SY 2433	41.0	0.7	0.390	4.6	0.290	24.0	40.0	0.210	7.4	19.0	92.0
SY 2441	41.0	1.1	0.240	5.4	0.290	22.0	37.0	0.160	9.9	13.0	80.0
2235	45.0	0.6	0.476	6.4	0.095	37.5	58.2	0.239	10.7	21.3	136
2241	18.0	0.5	0.538	4.53	0.088	27.5	59.2	0.213	7.3	26.3	104
2242	31.0	0.7	0.493	4.27	0.096	25.4	42.0	0.300	6.8	17.8	89.8
2243	35.0	0.5	0.504	3.66	0.101	20.8	38.8	0.239	5.1	19.9	81.2
2256	67.0	1.3	1.29	7.47	0.200	54.3	128	0.632	14.3	54.1	197
2257	77.0	1.6	1.25	9.08	0.175	66.7	157	0.511	18.7	64.1	233
2258	71.0	1.4	0.954	7.75	0.161	60.0	143	0.664	16.4	53.0	211
2260	27.0	0.5	0.452	4.06	0.092	23.9	50.8	0.216	7.1	20.4	87.5
2265	13.0	0.4	0.192	2.48	0.069		18.0	0.065	1.5	12.0	43.2
N	18	18	18	18	18	18	18	18	18	18	18
Minimum	13.0	0.4	0.192	2.48	0.025	20.8	18.0	0.065	1.5	12	43.2
Maximum	82.8	1.8	1.29	9.08	0.411	66.7	157	0.664	18.7	64.1	233
Mean	44.5	0.9	0.546	6.01	0.160	39.1	67.8	0.310	10.4	29.6	127.4
Std Dev	20.5	0.4	0.315	1.98	0.100	15.4	38.3	0.158	4.7	15.0	53.4
RSD	46.1%	49.6%	57.8%	33.0%	62.5%	39.4%	56.4%	50.9%	45.5%	50.6%	41.9%
ERM	NA	NA	3.7	70	9.6	370	270	0.71	51.6	218	410

SCCWRP and U.S. Navy, 2005b

5. The 95% upper predictive limits are calculated using the same methodology described in SCCWRP and U.S. Navy, 2005b. The supporting calculations are provided in the Appendix for Section 18.

Table 18-5 Calculated SQGQ1, Summary Statistics and 95% Upper Predictive Limit for the Reference Pool

Station	SQGQ1[1]
CP 2231	0.18
CP 2238	0.20
CP 2243	0.18
CP 2433	0.15
CP 2441	0.19
SY 2231	0.21
SY 2243	0.15
SY 2433	0.13
SY 2441	0.10
2235	0.16
2241	0.16
2242	0.13
2243	0.13
2256	0.33
2257	0.37
2258	0.31
2260	0.14
2265	0.07
N	18
Minimum	0.07
Maximum	0.37
Mean	0.18
Std Dev	0.08
RSD	42%
95% PL[2]	**0.35**

1. SQGQ1 = Sediment Quality Guideline Quotient 1. The SQGQ1 value for a sediment is calculated by dividing concentrations of cadmium, copper, lead, silver, zinc, total chlordane, dieldrin, total PAHs (normalized by sediment organic carbon content), and total PCBs (sum of 18 congeners) in sediment by each chemical's empirical SQG and subsequently averaging the individual quotients. Individual quotients for total chlordane and dieldrin quotients are excluded in the SQGQ1 supporting calculations because these constituents were not included in the list of minimum analytes required to assess exposure at the Shipyard Sediment Site.

2. The 95% upper predictive limit is calculated using the same methodology described in SCCWRP and U.S. Navy, 2005b. The supporting calculations are provided in the Appendix for Section 18.

The relative potential for adverse effects attributable to sediment chemistry is classified as low, moderate, or high based on comparisons made to published sediment quality guidelines where increasing weight is given by the number and magnitude of chemicals exceeding a threshold, similar to the method used by Long et al. (1998). The breakpoints in the ranking levels are established using best professional judgment (BPJ) and followed Long et al. (1998) and Fairey et al., (2001). The San Diego Water Board's decision process for sediment chemistry evaluation is outlined in Figure 18-1 and the supporting calculations are provided in the Appendix for Section 18. The sediment chemistry line-of-evidence results for each Shipyard Sediment Site stations are shown in Table 18-6 and the supporting calculations are provided in the Appendix for Section 18.

The low, moderate, and high ranking benthic community health classification criteria are based on the following two key assumptions (SCCWRP and U.S. Navy, 2005b):

- The assumption is made that no, or a low degree of benthic community degradation is present when the station BRI is Response Level 1 (< RL 2) or is statistically similar to the Reference Condition; and
- A high degree of benthic community degradation at a station is assumed to be present at BRI Response Levels (RLs) greater than 3 or when other indicators also show benthic community structure impacts.

The benthic community structure line of evidence category ranking from the SCCWRP and U.S. Navy (2005b) report are presented below and in Figure 18-3 of this report. The same ranking criteria from the SCCWRP and U.S. Navy (2005b) report are used to evaluate the benthic community indices from the Shipyard Sediment Site investigation.

Low Degree of Benthic Community Degradation: Benthic community degradation at each station is classified as none or a low if the BRI RL is less than 2 and when abundance, number of taxa, and the Shannon-Weiner Diversity Index are all statistically similar to the Reference Condition.

Moderate Degree of Benthic Community Degradation: The benthic community is classified as moderately degraded at stations exhibiting a BRI RL 2 or 3 and is statistically greater degradation than the Reference Condition, or, if any one of the other benthic community metrics is below the 95% PL established by the Reference Condition.

High Degree of Benthic Community Degradation: The benthic community is classified as highly degraded at stations with a BRI greater than RL 3. The benthic community is also classified as highly degraded at stations with BRI RL 2, the results are statistically greater than Reference Condition, and at least one of the other benthic community metrics is below the 95 percent PL established by the Reference Condition.

To determine the likelihood of benthic community impairment (Likely, Possible, or Unlikely), each line of evidence ranking (Low, Moderate, or High) is put into the Weight-of-Evidence Analysis framework described in Section 18 below.

18.5. Weight-of-Evidence Criteria

The ~~classification results for the~~ three line~~s~~ of evidence (LOE) assessments for sediment chemistry, toxicity, and benthic community described in DTR Sections 18.2, 18.3 and 18.4, respectively, ~~comprising the Triad of data are~~ were integrated into an overall weight-of-evidence (WOE) ~~evaluation~~ assessment ~~that focuses on identifying~~ to identify the likelihood that ~~the health of~~ the benthic community is adversely impacted at a given Shipyard Sediment Site station due to the presence of CoPCs in the sediment. This ~~evaluation~~ WOE assessment follows the general principles of the "Sediment Quality Triad Approach" described in a U.S. EPA compendium of "scientifically valid and accepted methods" used to assess sediment quality (U.S. EPA, 1992a). Potential combinations of the rankings for individual LOE were assessed and assigned a relative overall likelihood of benthic community impairment using three categories "Unlikely", "Possible" and "Likely" similar to the WOE approach described in "Sediment Assessment Study for the Mouth of Chollas and Paleta Creek, Phase 1 Final Report, May 2005" (SCCWRP and U.S. Navy, 2005b).

~~Three categories are used to describe the overall likelihood of impairment at each Shipyard Sediment Site station: "Unlikely," "Possible," and "Likely." These categories are assigned to each Shipyard Sediment Site station based on the potential combinations of the low, moderate, and high classifications of impairment for each previously described line-of-evidence in this section. For example, a station with a "High" classification for sediment chemistry, toxicity, and benthic community would indicate that it is "Likely" that the benthic community is adversely impacted. The framework used to interpret the various combinations is shown in Table 18-14 below, and is based on the consideration of four key elements as described in "*Sediment Assessment Study for the Mouth of Chollas and Paleta Creek, Phase 1 Final Report, May 2005*" (SCCWRP and U.S. Navy, 2005b).~~

The WOE framework used to interpret the various combinations is shown in Table 18-14, and is based on the consideration of four key elements:

- Level of confidence or weight given to the individual line of evidence
- Whether the line of evidence indicates there is an effect
- Magnitude or consistency of the effect
- Concurrence among the various lines of evidence.

The three categories of impairment are described below:

Unlikely - A station was classified as "Unlikely" if the individual LOE provided no evidence of biological effects due to elevated CoPCs (relative to the reference condition) at the site. This category was assigned to all stations with a "Low" chemistry LOE ranking, regardless of the presence of biological effects, because there was no evidence that effects were related to site-specific contamination. Similarly, stations having a "Moderate" ranking for chemistry and a "Low" ranking for biological effects were also classified as "Unlikely." The category of "Unlikely" does not mean that there was no impairment, but that the impairment was not clearly linked to site related chemical exposure.

Possible - A station was classified as "Possible" when there was a lack of concurrence among the LOE, which indicates less confidence in the interpretation of the results. This category was assigned to stations with moderate chemistry and a lack of concurrence among the biological effects LOE (i.e., effects present in only one of two LOE). Intermediate chemistry rankings have less certainty for predicting biological effects. The lack of concurrence between the toxicity and benthic community measures indicates a lower degree of confidence that the biological effects observed were due to CoPCs at the site; and that these effects could have been caused by other factors (e.g., physical disturbance or natural variations in sediment characteristics). The category of "Possible" represents situations where impairment was indicated, but there was less confidence in the reliability of the results. Of the three categories listed, stations in this group would be more likely to change their category as a result of natural variability, changes in the composition of the reference stations used for comparison, or to differences in the criteria used to classify each LOE.

Likely - A station was classified as “Likely” if there was a high level of agreement between observed biological effects and elevated CoPCs at the site. Concurrence among the three LOE (i.e., the presence of moderate or high rankings for chemistry, toxicity, and benthic community) always resulted in a classification of likely impairment. This classification was also assigned when the chemistry LOE was “High” and biological effects were present in either the toxicity or benthic community LOE.

For example, a station with a “High” ranking for chemistry, toxicity and benthic community would indicate a “High” likelihood of site-specific aquatic life impairment because each LOE indicates an effect, the magnitude of the effect is consistently high, and there is clear concurrence among the LOE. Alternatively, a station with a “Low” ranking for chemistry, and moderate or high rankings for toxicity and benthic community would indicate unlikely site-specific aquatic life impairment from site CoPCs, because there is no concurrence with site CoPCs. This does not mean that there is no impairment, but that the impairment is not clearly linked to site related chemical exposure.

The WOE framework in Table 18 -14 was used to interpret the MLOE results and is consistent with other published WOE frameworks. The results of the WOE ~~weight of of evidence results~~ assessment for each Shipyard Sediment Site station are presented in Table 18-1 ~~above~~.

DTR Section 25

25. Finding 25: Human Health Impairment

Finding 25 of CAO No. R9-2011-0001 states:

Human health beneficial uses for Shellfish Harvesting (SHELL), and Commercial and Sport Fishing (COMM) designated for San Diego Bay are impaired due to the elevated levels of pollutants present in the marine sediment at the Shipyard Sediment Site. ~~Human health beneficial uses include: Contact Water Recreation (REC-1), Non-contact Water Recreation (REC-2), Shellfish Harvesting (SHELL), and Commercial and Sport Fishing (COMM)~~. This finding is based on the considerations described below in this *Impairment of Human Health Beneficial Uses* section of the CAO.

25.1. Human Health Beneficial Uses

There are four beneficial uses designated in the Basin Plan for San Diego Bay (RWQCB 1994), which must be fully protected in order to provide for the protection of human health:

- **Contact Water Recreation (REC-1) –** Includes uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs;

- **Non-contact Water Recreation (REC-2) –** Includes the uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities;

- **Shellfish Harvesting (SHELL) –** Includes uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters and mussels) for human consumption, commercial, or sport purposes; and

- **Commercial and Sport Fishing (COMM) –** Includes the uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

The concentrations of the pollutants present in the marine sediment within and adjacent to the Shipyard Sediment Site causes or threatens to cause a condition of pollution or contamination that adversely impacts ~~these four~~ two of these beneficial uses, SHELL and COMM, and thereby constitutes a threat to the public health. Information supporting this conclusion is contained in Sections 26 through 28 of this Technical Report.

DTR Section 29

copper, HPAHs, PCBs,[24] and TBT. Correlation coefficients where generated for COC-by-COC comparison to identify the COCs that had strong positive correlations (see Table 29-40). Among the other five COCs, arsenic, cadmium, lead, and zinc exhibited a strong positive correlation with copper, HPAHs, PCBs, and/or TBT, suggesting that areas of the Site exhibiting high concentrations of these COCs also contained high concentrations of the Site-associated COCs. Only mercury was not highly correlated with copper, HPAHs, PCBs and/or TBT.

Table 29-4 Correlation Coefficients (r values) for COC-by-COC Comparisons of Concentrations in Surface Sediment Samples Collected for the Detailed Sediment Investigation)

COC	As	Cd	Cu	Hg	HPAHs	Pb	PCBs	TBT	Zn
As	**1.00**	0.66	**0.92**	0.63	**0.68**	**0.86**	**0.73**	**0.81**	**0.97**
Cd	0.66	**1.00**	0.61	0.42	0.52	0.66	0.64	0.51	**0.71**
Cu	**0.92**	0.61	**1.00**	**0.78**	**0.76**	**0.90**	**0.83**	**0.89**	**0.94**
Hg	0.63	0.42	**0.78**	**1.00**	**0.73**	**0.77**	**0.87**	0.63	0.61
HPAHs	0.68	0.52	**0.76**	**0.73**	**1.00**	**0.84**	**0.87**	**0.80**	0.67
Pb	**0.86**	0.66	**0.90**	**0.77**	**0.84**	**1.00**	**0.92**	**0.87**	**0.89**
PCBs	**0.73**	0.64	**0.83**	**0.87**	**0.87**	**0.92**	**1.00**	**0.79**	**0.75**
TBT	**0.81**	0.51	**0.89**	0.63	**0.80**	**0.87**	**0.79**	**1.00**	**0.85**
Zn	**0.97**	**0.71**	**0.94**	0.61	0.67	**0.89**	**0.75**	**0.85**	**1.00**

Notes: Pearson correlations using ln-transformed data. Correlation is significant if less than -0.433 or greater than 0.433 (correlations > 0.70). Bolded, shaded values indicate a strong correlation between COCs.
Source: Exponent, 2003

The high degree of correlation between Shipyard Sediment Site-associated COCs (copper, TBT, HPAHs, and PCBs) and arsenic, cadmium, ~~and~~ lead, and zinc suggests that alternate cleanup levels for Shipyard Sediment Site-associated COCs would also achieve a high degree of exposure reduction for arsenic, cadmium, ~~and~~ lead, and zinc. However, an alternate cleanup approach based on copper, TBT, HPAHs, and PCBs would not likely address the highest concentrations of mercury due to the lack of correlation between mercury and any of the four

[24] Total PCBs was defined as the sum of 41 congeners.

DTR Section 31

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INTRODUCTION TO DTR SECTION 31 REVISIONS

After the *Response to Comments Report* was released on August 23, 2011, the Cleanup Team discovered a computational error in the spreadsheet that calculated the exposure reductions for the 11 economic feasibility scenarios evaluated in Section 31. The error was corrected and Section 31 was revised accordingly, as shown in the following pages. As requested by Coastkeeper and the Environmental Health Coalition, revised Figure 31-1 now shows percent exposure reduction versus remediation dollars spent for each the 11 scenarios evaluated. The Appendix for Section 31 was also revised to include additional tables showing all of the data and calculations used in the economic feasibility analysis.

31. Finding 31: Economic Feasibility Considerations

Finding 31 of CAO No. R9-2011-0001 states:

Under State Water Board Resolution No. 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304*, determining "economic feasibility" requires an objective balancing of the incremental benefit of attaining further reduction in the concentrations of primary COCs as compared with the incremental cost of achieving those reductions. Resolution No. 92-49 provides that "[e]conomic feasibility does not refer to the dischargers' ability to finance cleanup." When considering appropriate cleanup levels under Resolution No. 92-49, the San Diego Water Board is charged with evaluating "economic feasibility" by estimating the costs to remediate constituents of concern at a site to background and the costs of implementing other alternative remedial levels. An economically feasible alternative cleanup level is one where the incremental cost of further reductions in primary COCs outweighs the incremental benefits.

The San Diego Water Board evaluated a number of criteria to determine risks, costs, and benefits associated with no action, cleanups to background sediment chemistry levels, and alternative cleanup levels greater than background concentrations. The criteria included factors such as total cost, volume of sediment dredged, exposure pathways of receptors to contaminants, short- and long-term effects on beneficial uses (as they fall into the broader categories of aquatic life, aquatic-dependent wildlife, and human health)~~, effects on shipyards and associated economic activities, effects on local businesses and neighborhood quality of life, and effects on recreational, commercial, or industrial uses of aquatic resources~~. The San Diego Water Board then compared these cost criteria against the benefits gained by diminishing exposure to the primary COCs to estimate the incremental benefit gained from reducing exposure based on the incremental costs of doing so. As set forth in detail herein, this comparison revealed that the incremental benefit of cleanup diminishes significantly with additional cost beyond a certain cleanup level, and asymptotically approaches zero as remediation approaches background. Based on these considerations, cleaning up to background sediment chemistry levels is not economically feasible.

31.1. Evaluation of Economic Feasibility of Cleaning Up to Background

Economic feasibility is a term of art under Resolution No. 92-49, and refers to the objective balancing of the incremental benefit of attaining more stringent cleanup levels compared with the incremental cost of achieving those levels. Economic feasibility does not refer to the subjective measurement of the discharger's ability to pay the costs of a cleanup. The benefits of remediation are best expressed as the reduction in exposure of human, aquatic wildlife, and benthic receptors to site-related COCs.

Economic feasibility was assessed by ranking the 65 shipyard sediment stations based on according to the contaminant levels for the five primary COCs found in surficial sediment samples. This process used Triad data and site-specific median effects quotient (SS-MEQ).[25] A series of cumulative cost scenarios was then evaluated by starting with the six most contaminated stations, then adding the six next most contaminated stations, progressing sequentially down the list until the entire Shipyard Sediment Site was included in the scenario (see Appendix for Section 31). For each scenario, the required dredging volume and associated cost of remediation for the set of Thiessen polygons[26] included in the step was estimated. The estimated post-remedial surface-area weighted average concentrations (SWAC) and exposure reduction for the primary COCs was also estimated for each cost scenario. Exposure reduction was defined for this purpose as the reduction in sediment SWAC for the shipyard site, relative to background, where the pre-remedial SWAC is considered zero reduction and background is considered 100 percent reduction. As chemical concentrations are reduced and mass removed, the SWAC for each COC decreases, which is equivalent to an expected exposure reduction for the target receptors. The following equation represents the relationship of exposure reduction to post-remedy SWAC.

$$\mathbf{Exposure\ Reduction} = \mathbf{SWAC}_{\mathbf{current}} - \mathbf{SWAC}_{\mathbf{post\text{-}remedy}}$$

To estimate the relative exposure reduction of a cost scenario, it is appropriate to normalize the exposure reduction to background. For example, current conditions represent 0 percent exposure reduction, whereas as post-remedial SWAC equal to background represents 100 percent exposure reduction. This equation is the calculation of the percent of exposure reduction relative to background.

$$\%\ \text{Exposure Reduction} = \frac{\text{SWAC}_{\text{current}} - \text{SWAC}_{\text{post-remedy}}}{\text{SWAC}_{\text{current}} - \text{Background}} \times 100$$

Subscript “final” changed to “post-remedy”

The following equation is an example of quantifying exposure reduction. This example assumes a current SWAC of 10 ppm for COC1 and a final SWAC of 2 ppm. The background concentration used in this example is 1 ppm for COC1.

$$\frac{10\,\mathbf{ppm} - 2\,\mathbf{ppm}}{\mathbf{10}\,\mathbf{ppm} - 1\,\mathbf{ppm}} \times 100 = 89\%$$

In this example, the exposure reduction relative to background when cleaning up a current SWAC of 10 ppm to a post-remedial SWAC of 2 ppm is 89 percent. An average exposure reduction for each cost scenario was calculated by averaging the percent exposure reduction for each primary COC (copper, mercury, HPAHs, PCBs, and TBT; see Appendix for Section 31).

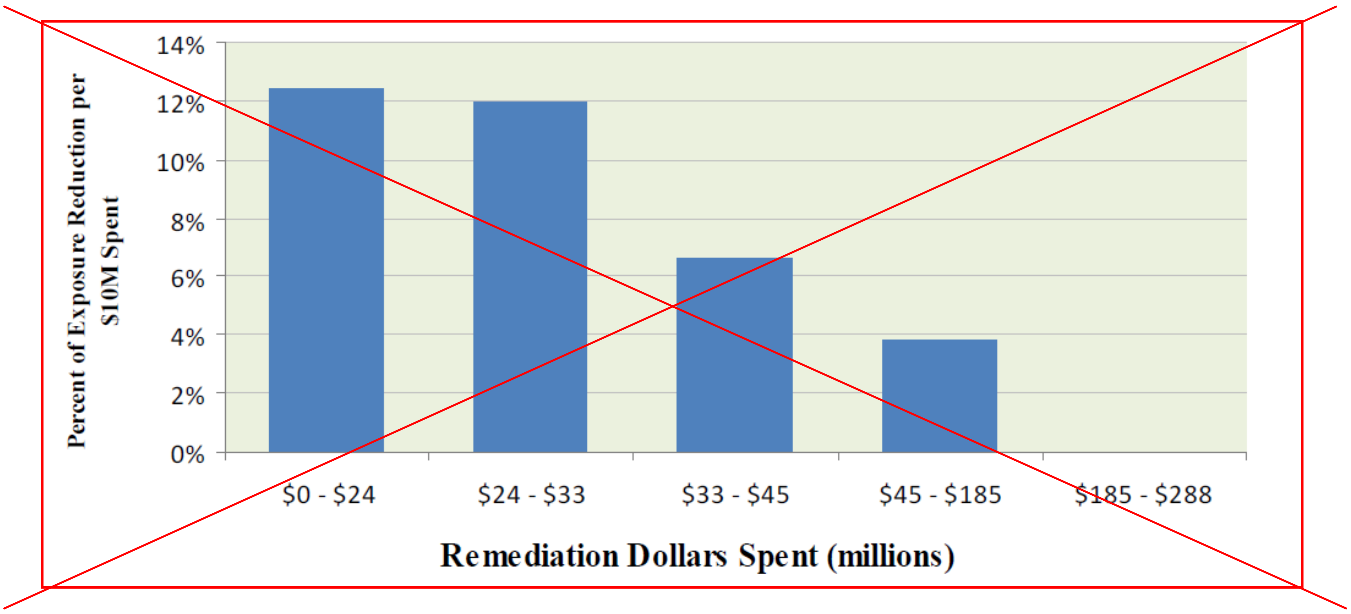
[25] The ranking methodology is discussed in Section 32.2.3. The development and application of the SS-MEQ values is discussed in Section 32.5.2.

[26] To calculate surface-area weighted average concentrations for COCs at the Shipyard Sediment Site, a geospatial technique (Thiessen polygons) was used to represent the area represented by each sediment sample. This methodology is discussed in Section 32.2.

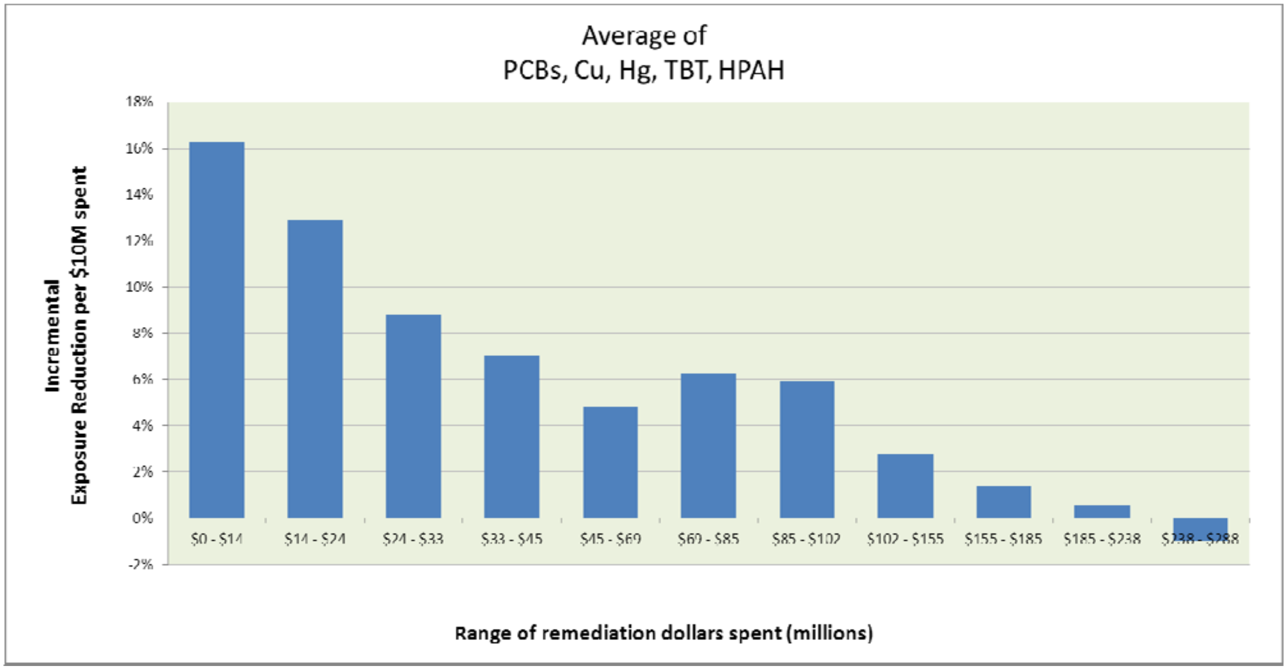
31.2. Comparison of Incremental Cost versus Incremental Benefit

A cost-benefit relationship became readily apparent in the San Diego Water Board's analysis. Initial expenditures return a relatively high exposure reduction benefit, but additional expenditures yield progressively lower returns per dollar spent on remediation. Further expenditures eventually reach a point where exposure reduction benefits become negligible. For additional significant sums of money spent, the environmental condition is not substantially improved. Figure 31-1 illustrates this relationship.

Figure 31-1 Percent Exposure Reduction versus Remediation Dollars Spent



DELETE FIGURE 31-1 AND REPLACE WITH NEW FIGURE 31-1



Note: See Appendix for Section 31 for supporting calculations

The highest net benefit per remedial dollar spent occurs for the first $24~~33~~ million (12~~8~~ polygons), based on the fact that initial exposure reduction is ~~above 12~~16 to 13 percent per $10 million spent. Beyond $24~~33~~ million, however, exposure reduction drops consistently as the cost of remediation increases. Exposure reduction drops ~~below~~to 7 percent or below per $10 million spent after $33 million, and below ~~4 percent~~3 percent after $102~~45~~ million. Based on these incremental costs versus incremental benefit comparisons, cleanup to background sediment quality levels is not economically feasible.

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Using this ranking approach, the highest ranked polygons were sequentially considered for inclusion into the remedial footprint.

Protectiveness of the beneficial uses represented by aquatic-dependent wildlife and human health was assessed via estimation of post-remedial SWAC values of the remedial footprint. Post-remedial SWAC calculations were completed with the assumption that the SWAC inside the footprint would be remediated to background concentrations derived in Section 29 of this Technical Report. In reality, the SWAC within the footprint may be less than background levels; however, background concentrations were assumed to incorporate conservatism in the analysis. Protectiveness was evaluated in terms of degree of exposure reduction and comparison to aquatic –dependent wildlife and human health risk assessments (Sections 32.3 and 32.4, respectively). The predicted post-remedial SWACs are shown in Table 32-3.

Table 32-3 Post-Remedial SWACs for the Shipyard Sediment Site

Primary Contaminant of Concern	Post-Remedial SWACs (site-wide)
Copper	159 mg/kg
Mercury	0.68 mg/kg
HPAHs	2,451 μg/kg
PCBs	194 μg/kg
TBT	110 μg/kg

Note: See Appendix for Section 32 for supporting calculations.

32.3 Alternative Cleanup Levels Protect Aquatic-Dependent Wildlife Beneficial Uses

An assessment of risk to wildlife receptors under projected post-remedial conditions was conducted to confirm that the chemicals identified as wildlife risk drivers in Section 24 ~~the alternative cleanup levels established by economic analysis (Section 31)~~ are adequately protective of aquatic-dependent wildlife beneficial uses. Based on the Tier II risk assessment results, ingestion of prey items caught within all four assessment units at the Shipyard Sediment Site poses an increased risk above reference to all wildlife receptors (excluding the sea lion). The chemicals in prey tissue posing a risk include BAP (surrogate for HPAHs), PCBs, copper, lead, mercury, and zinc. Based on the post-remedial risk assessment results detailed below, post-remedial SWACs for all chemicals identified as wildlife risk drivers are protective of aquatic-dependent wildlife beneficial uses.~~Six aquatic-dependent wildlife receptors were originally selected in the aquatic-dependent wildlife risk assessment (Sections 22 through 24) to evaluate the protection of beneficial uses. The species include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Cheloniamydas agassizii*). No unacceptable risks to sea lion were found for any COPC under pre-remedial conditions, therefore this receptor was excluded from the post-remedial risk evaluation. Potential risk to green turtle was only identified for lead. Lead was not selected as a primary COC, and no alternative cleanup level for~~

~~lead is proposed. However, the proposed remedy will reduce lead levels in surface sediments due to co-occurrence with primary COCs (see Section 29), resulting in mitigation of exposure and risk to wildlife receptors. The proposed remedy is assumed to be protective for lead, as well as the primary COCs, therefore evaluation of post-remedial risk from lead is included here along with the primary COCs.~~

Table 32-5 Current and Post-Remedial SWACs

Zinc Added

Primary COC	Units	Pre-remedy SWAC	Post-remedy SWAC
Copper	mg/kg	187	159
Mercury	mg/kg	0.75	0.68
HPAHs	µg/kg	3,509	2,451
PCBs	µg/kg	308	194
TBT	µg/kg	162	110
Secondary COC	**Units**	**Pre-remedy SWAC**	**Post-remedy SWAC**
Lead	mg/kg	73	66
Zinc	mg/kg	252	221

Note: See Appendix for Section 32 for supporting calculations.

Exposure estimates for each of the receptors were developed using the daily intake equation presented in Section 24. The equation accounts for exposure to COCs that may occur through the ingestion of prey as well as through the incidental ingestion of sediment:

$$\textbf{Daily Intake}_{chemical} = \frac{\left[(CM * IR * FI * AE)_{prey} + (CM * IR * FI * AE)_{sediment}\right]}{BW}$$

Where:

CM	=	post-remedial concentration of the chemical in prey tissue or sediment (mg/kg). Prey tissue concentrations used in this equation were derived using the equation described above, while the sediment concentration was based on the predicted post-remediation SWAC for the COC
IR	=	ingestion rate of prey or sediment (kg/day)
FI	=	fraction of the daily intake of prey or sediment derived from the site (unitless area-use factor)
AE	=	relative gastrointestinal absorption efficiency for the chemical in a given prey or sediment (fraction)
BW	=	body weight of receptor species (kg)

Table 32-6 presents the exposure parameters used for this analysis. The parameters are the same ones used to evaluate current conditions, and are more fully discussed in Section 24.

Table 32-7 Geometric Mean TRVs for Tier II Risk Drivers

Zinc Added

Primary COC	Avian Geometric Mean TRV (mg/kg-day)[1]
Copper	11.0
Mercury	0.084
HPAHs	0.44
PCBs	0.34
TBT[2]	NA
Secondary COC	**Avian Geometric Mean TRV (mg/kg-day)[1]**
Lead[3]	0.35
Zinc	54.4

Note: See Appendix for Section 32 for supporting calculations.

1. Source of TRVs is from Tables 24-7 and 24-8 of Section 24. The benzo[a]pyrene TRV was used as a surrogate for HPAHs.
2. TBT is not a wildlife risk driver and therefore the geometric mean TRV was not calculated.
3. Suitable reptilian TRVs were not found in the literature (Exponent, 2003). Therefore, avian TRVs were used to estimate potential adverse effects to the East Pacific green turtle.

Zinc Added

Table 32-2 Post-Remedy Hazard Quotient (HQ) Results

Receptor of Concern[1]	Copper	Mercury	HPAHs[2]	PCBs	TBT[2]	Lead	Zinc
Brown Pelican	0.059	0.496	NA	0.327	NA	NA	NA
Least Tern	0.100	0.138	NA	0.415	NA	NA	0.309
Western Grebe	0.066	0.073	NA	0.183	NA	NA	NA
Surf Scoter	0.272	0.084	0.265	0.059	NA	NA	NA
Green Turtle	NA	NA	NA	NA	NA	0.245	NA

Note: See Appendix for Section 32 for supporting calculations.

1. TBT is not a wildlife Tier II risk driver and therefore HQs were not calculated. Only surf scoter was identified as a wildlife risk driver in the Tier II ecological risk assessment for HPAH, identified as Benzo[a]pyrene (BAP).

32.4. Alternative Cleanup Levels Protect Human Health Beneficial Uses

Recreational and subsistence fish and lobster consumption scenarios were used to evaluate the post-remedy protectiveness of the alternative cleanup levels with respect to theoretical human health beneficial uses. Measured relationships between sediment concentrations, fish and lobster tissue concentrations, and human health risk were used to estimate post-remedial tissue concentrations from the projected post-remedial SWAC. Both tissue and sediment concentrations associated with human health threshold exposure levels were also calculated for comparison. The details of these calculations are described below.

Post-remedial SWACs should not pose an unreasonable risk to human health if the cancer risks posed by the SWACs should fall within the range of 1 x 10^{-6} to 1 x 10^{-4} and non-cancer risks do not exceed 1.0. For remedial decision making, cancer risks that fall within this range are acceptable pursuant to applicable state and federal regulatory requirements under Title 40 Code of Federal Regulations, Part 300 ~~and OEHHA (2008)~~.

The equations for calculating cancer and non-cancer risk are the same with the exception of the calculation of the exposure. Differences in these exposure calculations (Threshold Exposure Point variable) are described in the Carcinogenic Exposure Equation and the Non-carcinogenic Exposure Equation, below.

Equation for Threshold Exposure Point for Carcinogenic Exposure

$$\mathbf{TEP} = \frac{\mathbf{Risk}}{\mathbf{CSF}}$$

Where:

TEP	=	threshold exposure point (mg/kg-day)
Risk	=	0.00001
CSF	=	oral carcinogenic slope factor (risk/(mg/kg-day))

Equation for Threshold Exposure Point for Non-Carcinogenic Exposure

$$\mathbf{TEP} = RfD$$

Where:

TEP	=	threshold exposure point (mg/kg-day)
RfD	=	oral reference dose (mg/kg-day)

The CSF for PCBs is 2 mg/kg-day resulting in a cancer TEP of 0.000005 mg/kg-day and the RfD and, therefore, non-cancer TEP is 0.00002 mg/kg-day. The mercury and copper RfD (TEP) values used in the assessment are 0.0001 and 0.037 mg/kg-day, respectively.

Equation for Acceptable Tissue Concentrations in Biota

$$C_{TEP} = TEP\left(\frac{BW * AT * CF}{CR * FI * ED}\right)$$

Where:

C_{TEP}	=	tissue concentration at TEP (µg/kg)
TEP	=	threshold exposure point (mg/kg-day)
BW	=	body weight (kg)
AT	=	averaging time (years)
CR	=	consumption rate (kg/day)
FI	=	fraction ingested from the site (unitless)

32.5.2. Analysis for Aquatic Life at Non-Triad Stations

For non-Triad stations only limited data were available to assess potential impacts to aquatic life beneficial uses. This does not indicate a shortcoming of the study, but rather reflects the goal of the data collection at these stations which was primarily to help delineate the nature and extent of contamination. The available data at non-Triad stations generally included surface sediment COC concentrations, and proximate Sediment Profile Image (SPI) analysis of benthic community successional stage. The analysis relied upon these available data and site specific chemical thresholds that were developed from the Triad station in the Shipyard Report (Exponent, 2003). Chemical thresholds included site-specific Lowest Apparent Effects Thresholds (LAETs) for individual COCs, and a Site-Specific Median Effects Quotient (SS-MEQ) to address combined effects of multiple COCs.

The Apparent Effects Threshold (AET) is a tool for identifying concentrations of a pollutant in sediment above which adverse biological effects are always expected. When multiple site-specific effects endpoints are measured, several AET values can be combined to derive a single set of AET values by conservatively applying the lowest of any of the individual AET values for each chemical. This is known as the lowest AET or LAET. The methodology for calculating the site-specific LAETs is described in additional detail in the Shipyard Report (Exponent, 2003). To provide an additional margin of protection, the LAETs derived from the site-specific Triad data were reduced to 60 percent of the calculated value (60%LAETs), and these 60%LAETs were used to assess individual chemicals at the non-Triad stations. The 60%LAET threshold values are shown in Table 32-19. All non-triad stations exceeding the 60% LAET were designated for remediation (Table 32-23).

Table 32-19 60% LAET Values for Primary COCs

Primary COCs	60%LAET Values
Copper	552 mg/kg
Mercury	2.67 mg/kg
HPAH	15.3 mg/kg
PCBs	3,270 µg/kg
TBT	1,110 µg/kg

Note: See Appendix for Section 32 for supporting calculations.

To address potential combined impacts of chemicals, an SS-MEQ was also developed from the Triad data available in the Shipyard Report (Exponent, 2003). The SS-MEQ was derived by calculating the median concentration of individual COCs at 6 of the 30 Triad stations (Table 32-20). These ~~Three of the~~ six ~~included~~ stations were identified as likely impaired under the weight of evidence analysis described in Section 18 of this Technical Report (NA19, NA22, SW04, ~~and~~ SW13, SW22, and SW23). ~~Three possibly-impaired stations with the highest potential for chemically-associated effects (among possibly-impaired stations) were also included in SS-MEQ derivation (NA19, SW22, and SW23). These stations exhibited both “Moderate” toxicity and chemical concentrations just below levels indicative of the “High” LOE category by the Triad sediment chemistry ranking criteria (Table 18-1).~~ The SS-MEQ threshold was then established by conservatively optimizing the performance of the quotient in predicting likely effects or the three most chemically-impaired possible stations (true positives) while minimizing false negatives. The optimal threshold was found to be an SS-MEQ of 0.9. The overall reliability for the available data was ~~73~~70 percent. The term "overall reliability" is defined as the percentage of SS-MEQ predictions that agree with the Triad weight of evidence categories for the stations. The only false negative was at NA22 which had significant evidence of non-COC related impacts from physical disturbance related to ship movements and propeller testing. Performance metrics for this threshold are summarized in Table 32-21.

$$SS \bullet MEQ = \frac{1}{5}\left[\frac{[Cu]}{ME_{Cu}} + \frac{[Hg]}{ME_{Hg}} + \frac{[HPAH]}{ME_{HPAH}} + \frac{[TPCB]}{ME_{TPCB}} + \frac{[TBT]}{ME_{TBT}}\right]$$

For the non-Triad stations, the SS-MEQ threshold of 0.9 was conservatively assumed to be predictive of "Likely" impairment. The SS-MEQ was calculated for all non-Triad stations as where the values in the numerator (e.g. [Cu], [Hg], etc.) are the non-Triad station sediment concentration for that COC, and the values in the denominator (e.g. ME_{Cu}, ME_{Hg}, etc.) are the site-specific median effects levels as shown in Table 32-20. All non-triad stations exceeding the SS-MEQ threshold were designated for remediation (Table 32-23).

Table 32-20 Data from Triad Stations at the Shipyard Sediment Site Used to Develop the SS-MEQ

Station	Sediment COC Concentration				
	Cu mg/kg	Hg mg/kg	HPAH µg/kg	PCB µg/kg	TBT µg/kg
NA19	270	0.78	3,000	990	570
NA22[1]	150	0.38	3,600	180	120
SW04	1,500	1.75	14,000	4,000	3,250
SW13	800	0.86	12,000	490	790
SW22	260	1.1	12,000	900	190
SW23	280	1	11,000	1,000	210
SS-Median	275	0.93	11,500	945	390

Note: See Appendix for Section 32 for supporting calculations.

1. NA22 is not included in the remedial footprint, and is being addressed separately in the TMDL for the mouth of Chollas Creek.

32.7.1. Technological and Economical Feasibility

In prescribing any alternative cleanup levels less stringent than background the San Diego Water Board must apply section 2550.4 of Title 23 of the California Code of Regulations Pursuant to Resolution No. 92-49, the San Diego Water Board may not set alternative cleanup levels for chemicals of concern more stringent than "the lowest concentration that the discharger demonstrates and the San Diego Water Board finds is technologically and economically achievable."[19] This regulation establishes a "ceiling" for proposed concentration limits for chemicals of concern in cleanup and abatement actions.

As demonstrated in Section 31 above, it is not economically feasible to remediate the Shipyard Sediment Site to background sediment-quality levels. Comparing incremental costs of remediation to incremental exposure reduction values, the highest net benefit per remedial dollar spent occurs for the first $24~~33~~ million (12~~8~~ polygons), based on the fact that initial exposure reduction is ~~above 12~~betweeen 16 and 13 percent per $10 million spent. Beyond $24~~33~~ million, however, exposure reduction drops consistently as the cost of remediation increases. ~~Exposure reduction drops below 7 percent per $10 million spent after $33 million, below 4 percent after $45 million, and drops to zero at $185 million~~

Based on this comparison of incremental costs versus incremental benefit, the San Diego Water Board cannot require remediation to background sediment-quality levels because doing so would establish alternative cleanup levels that are not economically feasible and, therefore, are above the "ceiling" permitted by section 2550.4(e).

The total cost of the cleanup is estimated to be $58 million (see Appendix for Section 32).[20] The $58 million estimated cost of the remedial footprint cannot be directly overlaid on the cost scenarios shown in Figure 31-1 because of the differences in methods and assumptions between the economic feasibility analysis and the alternative cleanup levels/remedial footprint analysis. The $58 million estimated cost of cleaning up 23 polygons, however, is likely beyond the initial high exposure reduction per cost scenario represented by cleaning up 12 polygons.~~Cleaning up additional areas beyond the proposed remedial footprint would yield about 4 percent additional exposure reduction per $10 million spent.~~ Accordingly, the alternative cleanup levels established for the Shipyard Sediment Site are the lowest levels that are technologically and economically achievable, consistent with ~~as required under~~ section 2550.4(e).

32.7.2. Maximum Benefit to the People of the State

Resolution No. 92-49 requires that an alternative cleanup level be consistent with maximum benefit to the people of the State of California. When considering an alternative cleanup level under Resolution No. 92-49, a regional water board must consider: "all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic

[19] See Title 23 CCR section 2550.4(e).

[20] The actual cost of cleanup can vary significantly from the estimate due to a number of factors including variability regarding the estimated volume, and dredging subcontractor, transportation, and disposal costs.

DTR Section 33

Each of the polygons excluded from the remedial footprint, as identified Table 33-3, was independently evaluated to determine consistency with the SWAC and SS-MEQ ranking of stations. Table 33-6 identifies the rational for exclusion of these seven polygons from the remedial footprint.

Table 33-6 Rationale for Exclusion of Polygon from Remedial Footprint

Polygon	Rationale for Exclusion
NA07	• Triad station – not "Likely" "Unlikely" impaired • All COCs below 60%LAET values • Low toxicity and low benthic impacts • Technical infeasibility
NA08	• All COCs below 60%LAET and SS-MEQ values • Technical infeasibility
NA23	• All COCs below 60%LAET and SS-MEQ values • Technical infeasibility
NA27	• All COCs below 60%LAET and SS-MEQ values • Technical infeasibility
SW03	• Triad station - Low toxicity and low benthic impacts • All COCs below 60%LAET and SS-MEQ values • Cd not a cleanup driver • Triad analysis – "Unlikely" impaired
SW06	• All COCs below 60%LAET and SS-MEQ values • Triad analysis – not "Likely" "Unlikely" impaired
SW19	• All COCs below 60%LAET and SS-MEQ values • Triad analysis – not "Likely" "Unlikely" impaired

The NA07, NA08, NA23, and NA27 polygons all had technical infeasibility problems associated with dredging. The NA07 polygon is technically infeasible to dredge due to stability concerns about the sheetpile bulkhead on the shoreline and slope near the floating dry dock sump. Any dredging in this area would drastically undermine the slope as well as impacting the sheetpile bulkhead on the east side.

The NA08 polygon is technically infeasible to dredge due to stability concerns about the sheetpile bulkhead on the shoreline and slope near the floating dry dock sump. Any dredging in this area would drastically undermine the slope as well as impacting the sheetpile bulkhead on the east side. The east side of NA08 also supports the structure of the gate at Ways 4. Any dredging in this area would drastically undermine the slope as well as impacting the sheetpile bulkhead on the east side.

The NA23 polygon is technically infeasible to dredge because dredging would affect Pier 12, the tug boat pier, the rip-rap shoreline, as well as undermining the sediment slope for the floating dry dock sump.

DTR Section 34

Sediments are resuspended not only from the dredge bucket, but also by other mechanisms associated with dredging such as spillage, prop wash, and anchor systems. Chemical release can occur when bed sediments are suspended in the water column and increased turbidity can itself degrade acceptable levels of habitat quality for organisms in the water column. Re-deposition may occur near the dredge area or, depending on the environmental conditions and controls, resuspended sediment may be transported to other locations in the water body. Further, sediment dredging activities are planned such that a sufficient volume of contaminated sediment is removed; however, removing all particles of contaminated sediment is neither practical nor feasible.

Sediment monitoring will occur in footprint polygons and will be implemented immediately after the dredging contractor has confirmed that dredge depths within the footprint area have been achieved. Dredge depths are confirmed using multibeam dual frequency sonar coupled to differential Global Positioning System (dGPS) equipment. Confirmation sediment sampling will consist of core sediment sample collection in each footprint polygon. Sediment concentrations in a horizon that represents the first undisturbed depth beneath the dredge depth will be measured. This will be determined based on the accuracy to which the dredge operator can guarantee the depth to which they dredge. Samples will be collected from beneath this elevation using appropriate sampling techniques. Sample cores will be just deep enough to collect sufficient sample for analysis. COCs that will be monitored and compared to background sediment chemistry levels include PCBs, copper, HPAHs, TBT, and mercury. The background sediment chemistry levels can be found in Section 29, Table 29-1.

With respect to determining sediment remediation success, there will be natural variability in the sediment chemistry data collected, which does not represent a true difference from the expected value. Natural variability can be attributed to random error in laboratory instrument outputs, sample collection and handling techniques, grain size distribution variance in sediment samples, or other random non-systematic differences that cannot be measured or specifically accounted for. Furthermore, sediment cannot be dredged at depths of 10 centimeters or less. Therefore, dredging success will be evaluated based on the following decision rules applied to subsurface monitored sediment:

- If the concentration of any primary COC in subsurface sediments (deeper than the upper 5 cm) is above 120 percent of the post-remedial dredge area concentration after completion of initial dredging, then additional sediments shall be dredged by performing an additional "pass" with the equipment.~~If concentrations of COCs in subsurface sediments (deeper than the upper 10 cm) are above 120 percent of background sediment chemistry levels,[22] then additional sediments will be dredged by performing an additional "pass" with the equipment.~~

- If concentrations of COCs in subsurface sediments are below 120 percent of background concentrations, then dredging is sufficient and will stop. A sand cover cap will be placed on the sediment surface, if necessary.

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[22] ~~See Table 29-1 for background concentrations of COCs.~~

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DTR Section 40

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40. References

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DTR

Appendix For

Section 27

Draft Technical Report
for
Tentative Cleanup and Abatement
Order No. R9-2011-0001

APPENDIX FOR SECTION 27

TIER I SCREENING LEVEL RISK ASSESSMENT FOR HUMAN HEALTH

September 15, 2010

SUMMARY OF TIER I HUMAN HEALTH RISK ASSESSMENT RESULTS
(RECREATIONAL ANGLER)

	Arsenic (mg/kg wet)	Arsenic (mg/kg dry)	Cadmium (mg/kg wet)	Cadmium (mg/kg dry)	Chromium (mg/kg wet)	Chromium (mg/kg dry)	Copper (mg/kg wet)	Copper (mg/kg dry)	Mercury (mg/kg wet)	Mercury (mg/kg dry)
NA06										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**	--	No	--	No	--	No	--	No	--
NA11										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**		No	--	No	--	No	--	No	--
NA12										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**		No	--	No	--	No	--	No	--
NA20										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**		No	--	No	--	No	--	No	--
SW04										
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	No	--	No	--	**Yes**	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--
SW08										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--
SW13										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--
SW21										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--
SW28										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--

SUMMARY OF TIER I HUMAN HEALTH RISK ASSESSMENT RESULTS
(RECREATIONAL ANGLER)

	Nickel		Selenium		Silver		Zinc		TBT	
	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(ug/kg wet)	(ug/kg dry)
NA06										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No/Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
NA11										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
NA12										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
NA20										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
SW04										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
SW08										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
SW13										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
SW21										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
SW28										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--

SUMMARY OF TIER I HUMAN HEALTH RISK ASSESSMENT RESULTS
(RECREATIONAL ANGLER)

	Benzo[a]pyrene (ug/kg wet)	Benzo[a]pyrene (ug/kg dry)	Total PCBs (ng/g wet)	Total PCBs (ng/g dry)
NA06				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	Yes	--	Yes
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--
NA11				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	Yes	--	No
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--
NA12				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--
NA20				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	Yes	--	No
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--
SW04				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	Yes	--	Yes
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--
SW08				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	Yes	--	Yes
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--
SW13				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	Yes	--	Yes
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--
SW21				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	Yes	--	Yes
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--
SW28				
~~t-test significantly different~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	Yes	--	Yes
> HH Tissue Residue Guideline(s)	Yes	--	Yes	--

[BLANK SHEET]

SUMMARY OF TIER I HUMAN HEALTH RISK ASSESSMENT RESULTS
(SUBSISTENCE ANGLER)

	Arsenic		Cadmium		Chromium		Copper		Mercury	
	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)
NA06										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**	--	No	--	No	--	No	--	No	--
NA11										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**		No	--	No	--	No	--	No	--
NA12										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**		No	--	No	--	No	--	No	--
NA20										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**		No	--	No	--	No	--	No	--
SW04										
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	No	--	No	--	**Yes**	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--
SW08										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--
SW13										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--
SW21										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--
SW28										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**	**--**	No	--	No	--	No	--	No	--

SUMMARY OF TIER I HUMAN HEALTH RISK ASSESSMENT RESULTS
(SUBSISTENCE ANGLER)

	Nickel		Selenium		Silver		Zinc		TBT	
	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(mg/kg wet)	(mg/kg dry)	(ug/kg wet)	(ug/kg dry)
NA06										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No/Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
NA11										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
NA12										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
NA20										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
SW04										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	**Yes**	**--**
SW08										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	**Yes**	**--**
SW13										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
SW21										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--
SW28										
~~t-test significantly different~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~No~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No	--	No	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	No	--	No	--	No	--	No	--	No	--

SUMMARY OF TIER I HUMAN HEALTH RISK ASSESSMENT RESULTS
(SUBSISTENCE ANGLER)

	Benzo[a]pyrene		Total PCBs	
	(ug/kg wet)	(ug/kg dry)	(ng/g wet)	(ng/g dry)
NA06				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--
NA11				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	No
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--
NA12				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	No	--	No
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--
NA20				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	No
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--
SW04				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--
SW08				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--
SW13				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--
SW21				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--
SW28				
~~t-test significantly different~~	~~**Yes**~~	~~--~~	~~**Yes**~~	~~--~~
> 95% UPL Reference Pool	--	**Yes**	--	**Yes**
> HH Tissue Residue Guideline(s)	**Yes**	--	**Yes**	--

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COMPARISON OF SHIPYARD BIOACCUMULATION STATIONS TO RISK-BASED TISSUE SCREENING LEVELS (RECREATIONAL ANGLER)

	Human Health Tissue Screening Level (ug/kg wet)	Shipyard Stations with *Macoma nasuta* Tissue Data (ug/kg wet)								
		NA06	NA11	NA12	NA20	SW04	SW08	SW13	SW21	SW28
Metals										
Arsenic, inorganic (RfD)	1,000	116.8	119.2	108	112.8	143.2	110.4	113.6	123.2	123.2
Arsenic, inorganic (CSF)	22.22	**116.8**	**119.2**	**108**	**112.8**	**143.2**	**110.4**	**113.6**	**123.2**	**123.2**
Cadmium	3,000	40	40	30	30	40	30	30	40	40
Chromium	10,000	320	270	250	310	480	360	310	390	240
Copper	123,333	2280	1900	1860	1740	4840	3300	3660	2420	2100
Mercury, total (except for Macoma tissue)	300	20	20	20	20	20	20	10	20	20
Nickel	66,667	390	340	330	430	440	340	380	360	390
Selenium	20,000	300	280	300	220	240	200	280	280	250
Silver	16,667	40	50	30	20	30	40	40	50	40
Zinc	1,000,000	19600	16600	16200	17200	28800	15800	19200	19400	19400
Organometallic Compounds										
Tributyltin	1,000	31.6	13.8	14.76	23.6	331	148	124.6	16.4	13
Polycyclic Aromatic Hydrocarbons										
Benzo[a]pyrene	2.78	**27**	**23**	**20**	**38**	**174**	**166**	**105.8**	**138**	**136**
Polychlorinated Biphenyls										
Total PCB Aroclors (CSF)	16.67	**77.8**	**46.8**	**31.8**	**32**	**216**	**160**	**72.2**	**264**	**226**
Total PCB Aroclors (RfD)	66.67	**77.8**	**46.8**	**31.8**	**32**	**216**	**160**	**72.2**	**264**	**226**

NOTE: Tissue concentrations bold faced and shaded are greater than the human health tissue screening levels.

[BLANK SHEET]

COMPARISON OF SHIPYARD BIOACCUMULATION STATIONS TO RISK-BASED TISSUE SCREENING LEVELS (SUBSISTENCE ANGLER)

	Human Health Tissue Screening Level (ug/kg wet)	Shipyard Stations with *Macoma nasuta* Tissue Data (ug/kg wet)								
		NA06	NA11	NA12	NA20	SW04	SW08	SW13	SW21	SW28
Metals										
Arsenic, inorganic (RfD)	130	116.8	119.2	108	112.8	**143.2**	110.4	113.6	123.2	123.2
Arsenic, inorganic (CSF)	2.90	**116.8**	**119.2**	**108**	**112.8**	**143.2**	**110.4**	**113.6**	**123.2**	**123.2**
Cadmium	217	40	40	30	30	40	30	30	40	40
Chromium	1,304	320	270	250	310	480	360	310	390	240
Copper	16,087	2280	1900	1860	1740	4840	3300	3660	2420	2100
Mercury, total (except for Macoma tissue)	43	20	20	20	20	20	20	10	20	20
Nickel	8,696	390	340	330	430	440	340	380	360	390
Selenium	2,174	300	280	300	220	240	200	280	280	250
Silver	2,174	40	50	30	20	30	40	40	50	40
Zinc	130,435	19600	16600	16200	17200	28800	15800	19200	19400	19400
Organometallic Compounds										
Tributyltin	130	31.6	13.8	14.76	23.6	**331**	**148**	124.6	16.4	13
Polycyclic Aromatic Hydrocarbons										
Benzo[a]pyrene	0.36	**27**	**23**	**20**	**38**	**174**	**166**	**105.8**	**138**	**136**
Polychlorinated Biphenyls										
Total PCB Aroclors (CSF)	2.17	**77.8**	**46.8**	**31.8**	**32**	**216**	**160**	**72.2**	**264**	**226**
Total PCB Aroclors (RfD)	8.70	**77.8**	**46.8**	**31.8**	**32**	**216**	**160**	**72.2**	**264**	**226**

NOTE: Tissue concentrations bold faced and shaded are greater than the human health tissue screening levels.

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COMPARISON OF SITE/REFERENCE *MACOMA* TISSUE CONCENTRATIONS

	Total Solids (decimal wet)	Arsenic (mg/kg wet)	Control	Arsenic (mg/kg dry)	Cadmium (mg/kg wet)	Control	Cadmium (mg/kg dry)	Chromium (mg/kg wet)	Control	Chromium (mg/kg dry)	Copper (mg/kg wet)	Control	Copper (mg/kg dry)
NA06	0.147	3	3	20.41	0.032	0.031	0.22	0.33	0.78	2.24	2.3	1.5	15.65
NA06	0.151	2.6	3.1	17.22	0.033	0.045	0.22	0.34	0.25	2.25	2.1	1.2	13.91
NA06	0.128	2.7	2.7	21.09	0.056	0.04	0.44	0.29	0.77	2.27	2.3	0.99	17.97
NA06	0.159	3	2.8	18.87	0.037	0.034	0.23	0.38	0.35	2.39	2.4	1.2	15.09
NA06	0.167	3.3	3.2	19.76	0.051	0.037	0.31	0.25	0.19	1.50	2.3	0.97	13.77
mean	0.1504	2.92	2.96	19.47	0.0418	0.0374	0.28	0.318	0.468	2.13	2.28	1.172	15.28
max	0.167	3.3	3.2	21.09	0.056	0.045	0.4375	0.38	0.78	2.39	2.4	1.5	17.97
~~t-test significantly different~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~		~~--~~	~~--~~
> 95% UPL Reference Pool	--	--	--	No	--	--	No	--	--	No	--	--	No
NA11	0.155	3.2	3	20.65	0.036	0.031	0.23	0.26	0.78	1.68	1.6	1.5	10.32
NA11	0.148	2.6	3.1	17.57	0.028	0.045	0.19	0.23	0.25	1.55	1.8	1.2	12.16
NA11	0.131	2.8	2.7	21.37	0.025	0.04	0.19	0.18	0.77	1.37	1.6	0.99	12.21
NA11	0.155	3.7	2.8	23.87	0.052	0.034	0.34	0.34	0.35	2.19	2.6	1.2	16.77
NA11	0.147	2.6	3.2	17.69	0.054	0.037	0.37	0.36	0.19	2.45	1.9	0.97	12.93
mean	0.1472	2.98	2.96	20.23	0.039	0.0374	0.26	0.274	0.468	1.85	1.9	1.172	12.88
max	0.155	3.7	3.2	23.87	0.054	0.045	0.3673469	0.36	0.78	2.45	2.6	1.5	16.77
~~t-test significantly different~~			~~--~~	~~--~~		~~--~~	~~--~~		~~--~~	~~--~~		~~--~~	~~--~~
> 95% UPL Reference Pool		--	--	No	--	--	No	--	--	No	--	--	No
NA12	0.14	2.8	3	20.00	0.02	0.031	0.14	0.2	0.78	1.43	1.7	1.5	12.14
NA12	0.132	2.6	3.1	19.70	0.036	0.045	0.27	0.26	0.25	1.97	2	1.2	15.15
NA12	0.152	2.6	2.7	17.11	0.031	0.04	0.20	0.26	0.77	1.71	1.5	0.99	9.87
NA12	0.147	2.9	2.8	19.73	0.035	0.034	0.24	0.32	0.35	2.18	1.7	1.2	11.56
NA12	0.142	2.6	3.2	18.31	0.028	0.037	0.20	0.19	0.19	1.34	2.4	0.97	16.90
mean	0.1426	2.7	2.96	18.97	0.03	0.0374	0.21	0.246	0.468	1.72	1.86	1.172	13.13
max	0.152	2.9	3.2	20.00	0.036	0.045	0.2727273	0.32	0.78	2.18	2.4	1.5	16.90
~~t-test significantly different~~			~~--~~	~~--~~		~~--~~	~~--~~		~~--~~	~~--~~		~~--~~	~~--~~
> 95% UPL Reference Pool		--	--	No	--	--	No	--	--	No	--	--	No
NA20	0.162	3	3	18.52	0.029	0.031	0.18	0.25	0.78	1.54	1.7	1.5	10.49
NA20	0.136	2.2	3.1	16.18	0.023	0.045	0.17	0.27	0.25	1.99	1.6	1.2	11.76
NA20	0.158	3.2	2.7	20.25	0.035	0.04	0.22	0.37	0.77	2.34	2	0.99	12.66
NA20	0.158	3.2	2.8	20.25	0.035	0.034	0.22	0.37	0.35	2.34	2	1.2	12.66
NA20	0.147	2.5	3.2	17.01	0.029	0.037	0.20	0.3	0.19	2.04	1.4	0.97	9.52
mean	0.1522	2.82	2.96	18.44	0.0302	0.0374	0.20	0.312	0.468	2.05	1.74	1.172	11.42
max	0.162	3.2	3.2	20.25	0.035	0.045	0.221519	0.37	0.78	2.34	2	1.5	12.66
~~t-test significantly different~~			~~--~~	~~--~~		~~--~~	~~--~~		~~--~~	~~--~~		~~--~~	~~--~~
> 95% UPL Reference Pool		--	--	No	--	--	No	--	--	No	--	--	No
SW04	0.146	3.8	3	26.03	0.043	0.031	0.29	0.76	0.78	5.21	8.1	1.5	55.48
SW04	0.142	3.8	3.1	26.76	0.055	0.045	0.39	0.49	0.25	3.45	5	1.2	35.21
SW04	0.152	3.1	2.7	20.39	0.037	0.04	0.24	0.53	0.77	3.49	4	0.99	26.32
SW04	0.153	3.6	2.8	23.53	0.031	0.034	0.20	0.18	0.35	1.18	2.5	1.2	16.34
SW04	0.149	3.6	3.2	24.16	0.027	0.037	0.18	0.42	0.19	2.82	4.6	0.97	30.87
mean	0.1484	3.58	2.96	24.17	0.0386	0.0374	0.26	0.476	0.468	3.23	4.84	1.172	32.84
max	0.153	3.8	3.2	26.76	0.055	0.045	0.3873239	0.76	0.78	5.21	8.1	1.5	55.48

NOTE: Shaded values indicate undetected at detection limit. Therefore, 1/2 detection limit used in this table.

COMPARISON OF SITE/REFERENCE *MACOMA* TISSUE CONCENTRATIONS

	Total Solids (decimal wet)	Arsenic (mg/kg wet)	Control	Arsenic (mg/kg dry)	Cadmium (mg/kg wet)	Control	Cadmium (mg/kg dry)	Chromium (mg/kg wet)	Control	Chromium (mg/kg dry)	Copper (mg/kg wet)	Control	Copper (mg/kg dry)
~~t-test significantly different~~		~~Yes~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~
> 95% UPL Reference Pool		--	--	**Yes**	--	--	No	--	--	No	--	--	**Yes**
SW08	0.148	2.6	3	17.57	0.022	0.031	0.15	0.33	0.78	2.23	3.2	1.5	21.62
SW08	0.12	2.8	3.1	23.33	0.029	0.045	0.24	0.35	0.25	2.92	3.2	1.2	26.67
SW08	0.148	2.8	2.7	18.92	0.035	0.04	0.24	0.53	0.77	3.58	2.6	0.99	17.57
SW08	0.157	3	2.8	19.11	0.037	0.034	0.24	0.3	0.35	1.91	3.2	1.2	20.38
SW08	0.138	2.6	3.2	18.84	0.03	0.037	0.22	0.31	0.19	2.25	4.3	0.97	31.16
mean	0.1422	2.76	2.96	19.55	0.0306	0.0374	0.22	0.364	0.468	2.58	3.3	1.172	23.48
max	0.157	3	3.2	23.33	0.037	0.045	0.2416667	0.53	0.78	3.58	4.3	1.5	31.16
~~t-test significantly different~~		~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~
> 95% UPL Reference Pool		--	--	No	--	--	No	--	--	No	--	--	**Yes**
SW13	0.12	2.5	3	20.83	0.032	0.031	0.27	0.26	0.78	2.17	2.5	1.5	20.83
SW13	0.158	3.6	3.1	22.78	0.045	0.045	0.28	0.31	0.25	1.96	5.6	1.2	35.44
SW13	0.163	3.1	2.7	19.02	0.031	0.04	0.19	0.3	0.77	1.84	3.1	0.99	19.02
SW13	0.14	2.1	2.8	15.00	0.025	0.034	0.18	0.41	0.35	2.93	4.2	1.2	30.00
SW13	0.151	2.9	3.2	19.21	0.027	0.037	0.18	0.29	0.19	1.92	2.9	0.97	19.21
mean	0.1464	2.84	2.96	19.37	0.032	0.0374	0.22	0.314	0.468	2.16	3.66	1.172	24.90
max	0.163	3.6	3.2	22.78	0.045	0.045	0.2848101	0.41	0.78	2.93	5.6	1.5	35.44
~~t-test significantly different~~		~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~
> 95% UPL Reference Pool		--	--	No	--	--	No	--	--	No	--	--	**Yes**
SW21	0.157	3.1	3	19.75	0.033	0.031	0.21	0.32	0.78	2.04	2.4	1.5	15.29
SW21	0.146	3.1	3.1	21.23	0.037	0.045	0.25	0.32	0.25	2.19	2	1.2	13.70
SW21	0.164	3.7	2.7	22.56	0.053	0.04	0.32	0.35	0.77	2.13	2.4	0.99	14.63
SW21	0.148	2.9	2.8	19.59	0.042	0.034	0.28	0.34	0.35	2.30	2.2	1.2	14.86
SW21	0.128	2.6	3.2	20.31	0.038	0.037	0.30	0.6	0.19	4.69	3.1	0.97	24.22
mean	0.1486	3.08	2.96	20.69	0.0406	0.0374	0.27	0.386	0.468	2.67	2.42	1.172	16.54
max	0.164	3.7	3.2	22.56	0.053	0.045	0.3231707	0.6	0.78	4.69	3.1	1.5	24.22
~~t-test significantly different~~		~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~
> 95% UPL Reference Pool		--	--	No	--	--	No	--	--	No	--	--	No
SW28	0.157	2.8	3	17.83	0.036	0.031	0.23	0.2	0.78	1.27	1.8	1.5	11.46
SW28	0.143	2.7	3.1	18.88	0.028	0.045	0.20	0.18	0.25	1.26	1.6	1.2	11.19
SW28	0.155	3.3	2.7	21.29	0.036	0.04	0.23	0.25	0.77	1.61	2.2	0.99	14.19
SW28	0.163	3.5	2.8	21.47	0.053	0.034	0.33	0.3	0.35	1.84	2.7	1.2	16.56
SW28	0.155	3.1	3.2	20.00	0.034	0.037	0.22	0.27	0.19	1.74	2.2	0.97	14.19
mean	0.1546	3.08	2.96	19.90	0.0374	0.0374	0.24	0.24	0.468	1.55	2.1	1.172	13.52
max	0.163	3.5	3.2	21.47	0.053	0.045	0.3251534	0.3	0.78	1.84	2.7	1.5	16.56
~~t-test significantly different~~		~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~
> 95% UPL Reference Pool		--	--	No	--	--	No	--	--	No	--	--	No

NOTE: Shaded values indicate undetected at detection limit. Therefore, 1/2 detection limit used in this table.

COMPARISON OF SITE/REFERENCE *MACOMA* TISSUE CONCENTRATIONS

	Lead (mg/kg wet)	Control	Lead (mg/kg dry)	Mercury (mg/kg wet)	Control	Mercury (mg/kg dry)	Nickel (mg/kg wet)	Control	Nickel (mg/kg dry)	Selenium (mg/kg wet)	Control	Selenium (mg/kg dry)	Silver (mg/kg wet)	Control
NA06	0.64	0.1	4.35	0.016	0.018	0.109	0.38	0.4	2.59	0.4	0.2	2.72	0.038	0.027
NA06	0.82	0.12	5.43	0.014	0.015	0.093	0.37	0.43	2.45	0.2	0.4	1.32	0.052	0.033
NA06	0.5	0.11	3.91	0.016	0.016	0.125	0.34	0.75	2.66	0.3	0.3	2.34	0.053	0.036
NA06	0.53	0.09	3.33	0.026	0.012	0.164	0.47	0.38	2.96	0.3	0.3	1.89	0.03	0.027
NA06	0.58	0.11	3.47	0.018	0.013	0.108	0.37	0.35	2.22	0.3	0.2	1.80	0.026	0.041
mean	0.614	0.106	4.10	0.018	0.0148	0.120	0.386	0.462	2.57	0.3	0.28	2.01	0.0398	0.0328
max	0.82	0.12	5.43	0.026	0.018	0.164	0.47	0.75	2.96	0.4	0.4	2.72	0.053	0.041
~~t-test significantly different~~		--	--		--	--		--	--		--	--		--
> 95% UPL Reference Pool	--	--	Yes	--	--	No	--	--	No	--	--	No	--	--
NA11	0.37	0.1	2.39	0.012	0.018	0.077	0.39	0.4	2.52	0.3	0.2	1.94	0.051	0.027
NA11	0.28	0.12	1.89	0.014	0.015	0.095	0.27	0.43	1.82	0.2	0.4	1.35	0.041	0.033
NA11	0.3	0.11	2.29	0.017	0.016	0.130	0.28	0.75	2.14	0.3	0.3	2.29	0.042	0.036
NA11	0.53	0.09	3.42	0.018	0.012	0.116	0.39	0.38	2.52	0.4	0.3	2.58	0.072	0.027
NA11	0.48	0.11	3.27	0.016	0.013	0.109	0.36	0.35	2.45	0.2	0.2	1.36	0.037	0.041
mean	0.392	0.106	2.65	0.0154	0.0148	0.105	0.338	0.462	2.29	0.28	0.28	1.90	0.0486	0.0328
max	0.53	0.12	3.42	0.018	0.018	0.130	0.39	0.75	2.52	0.4	0.4	2.58	0.072	0.041
~~t-test significantly different~~		--	--		--	--		--	--		--	--		--
> 95% UPL Reference Pool	--	--	No	--	--	No	--	--	No	--	--	No	--	--
NA12	0.3	0.1	2.14	0.02	0.018	0.143	0.32	0.4	2.29	0.4	0.2	2.86	0.02	0.027
NA12	0.31	0.12	2.35	0.015	0.015	0.114	0.36	0.43	2.73	0.3	0.4	2.27	0.031	0.033
NA12	0.3	0.11	1.97	0.013	0.016	0.086	0.3	0.75	1.97	0.2	0.3	1.32	0.027	0.036
NA12	0.37	0.09	2.52	0.014	0.012	0.095	0.37	0.38	2.52	0.4	0.3	2.72	0.031	0.027
NA12	0.38	0.11	2.68	0.014	0.013	0.099	0.29	0.35	2.04	0.2	0.2	1.41	0.05	0.041
mean	0.332	0.106	2.33	0.0152	0.0148	0.107	0.328	0.462	2.31	0.3	0.28	2.12	0.0318	0.0328
max	0.38	0.12	2.68	0.02	0.018	0.143	0.37	0.75	2.73	0.4	0.4	2.86	0.05	0.041
~~t-test significantly different~~		--	--		--	--		--	--		--	--		--
> 95% UPL Reference Pool	--	--	No	--	--	No	--	--	No	--	--	No	--	--
NA20	0.41	0.1	2.53	0.017	0.018	0.105	0.42	0.4	2.59	0.3	0.2	1.85	0.022	0.027
NA20	0.38	0.12	2.79	0.017	0.015	0.125	0.34	0.43	2.50	0.2	0.4	1.47	0.019	0.033
NA20	0.55	0.11	3.48	0.023	0.016	0.146	0.5	0.75	3.16	0.2	0.3	1.27	0.022	0.036
NA20	0.55	0.09	3.48	0.023	0.012	0.146	0.5	0.38	3.16	0.2	0.3	1.27	0.022	0.027
NA20	0.37	0.11	2.52	0.017	0.013	0.116	0.38	0.35	2.59	0.2	0.2	1.36	0.022	0.041
mean	0.452	0.106	2.96	0.0194	0.0148	0.127	0.428	0.462	2.80	0.22	0.28	1.44	0.0214	0.0328
max	0.55	0.12	3.48	0.023	0.018	0.146	0.5	0.75	3.16	0.3	0.4	1.85	0.022	0.041
~~t-test significantly different~~		--	--		--	--		--	--		--	--		--
> 95% UPL Reference Pool	--	--	No	--	--	No	--	--	No	--	--	No	--	--
SW04	1.9	0.1	13.01	0.023	0.018	0.158	0.48	0.4	3.29	0.3	0.2	2.05	0.058	0.027
SW04	1.7	0.12	11.97	0.021	0.015	0.148	0.63	0.43	4.44	0.2	0.4	1.41	0.029	0.033
SW04	1.3	0.11	8.55	0.022	0.016	0.145	0.35	0.75	2.30	0.2	0.3	1.32	0.034	0.036
SW04	0.7	0.09	4.58	0.016	0.012	0.105	0.37	0.38	2.42	0.2	0.3	1.31	0.028	0.027
SW04	1.1	0.11	7.38	0.019	0.013	0.128	0.38	0.35	2.55	0.3	0.2	2.01	0.024	0.041
mean	1.34	0.106	9.10	0.0202	0.0148	0.136	0.442	0.462	3.00	0.24	0.28	1.62	0.0346	0.0328
max	1.9	0.12	13.01	0.023	0.018	0.158	0.63	0.75	4.44	0.3	0.4	2.05	0.058	0.041

NOTE: Shaded values indicate undetected at detection limit. Therefore, 1/2 detection limit used in this table.

COMPARISON OF SITE/REFERENCE *MACOMA* TISSUE CONCENTRATIONS

	Lead (mg/kg wet)	Control	Lead (mg/kg dry)	Mercury (mg/kg wet)	Control	Mercury (mg/kg dry)	Nickel (mg/kg wet)	Control	Nickel (mg/kg dry)	Selenium (mg/kg wet)	Control	Selenium (mg/kg dry)	Silver (mg/kg wet)	Control
~~t-test significantly different~~	~~Yes~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	--	**Yes**	--	--	No	--	--	No	--	--	No	--	--
SW08	0.8	0.1	5.41	0.026	0.018	0.176	0.29	0.4	1.96	0.2	0.2	1.35	0.016	0.027
SW08	1.4	0.12	11.67	0.015	0.015	0.125	0.29	0.43	2.42	0.1	0.4	0.83	0.034	0.033
SW08	0.6	0.11	4.05	0.018	0.016	0.122	0.43	0.75	2.91	0.3	0.3	2.03	0.019	0.036
SW08	0.66	0.09	4.20	0.017	0.012	0.108	0.37	0.38	2.36	0.2	0.3	1.27	0.041	0.027
SW08	0.75	0.11	5.43	0.017	0.013	0.123	0.3	0.35	2.17	0.2	0.2	1.45	0.067	0.041
mean	0.842	0.106	6.15	0.0186	0.0148	0.131	0.336	0.462	2.36	0.2	0.28	1.39	0.0354	0.0328
max	1.4	0.12	11.67	0.026	0.018	0.176	0.43	0.75	2.91	0.3	0.4	2.03	0.067	0.041
~~t-test significantly different~~	~~Yes~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	--	**Yes**	--	--	No	--	--	No	--	--	No	--	--
SW13	0.35	0.1	2.92	0.013	0.018	0.108	0.35	0.4	2.92	0.2	0.2	1.67	0.043	0.027
SW13	0.4	0.12	2.53	0.014	0.015	0.089	0.44	0.43	2.78	0.5	0.4	3.16	0.077	0.033
SW13	0.43	0.11	2.64	0.018	0.016	0.110	0.41	0.75	2.52	0.3	0.3	1.84	0.028	0.036
SW13	0.35	0.09	2.50	0.013	0.012	0.093	0.34	0.38	2.43	0.2	0.3	1.43	0.027	0.027
SW13	0.33	0.11	2.19	0.016	0.013	0.106	0.34	0.35	2.25	0.2	0.2	1.32	0.038	0.041
mean	0.372	0.106	2.55	0.0148	0.0148	0.101	0.376	0.462	2.58	0.28	0.28	1.88	0.0426	0.0328
max	0.43	0.12	2.92	0.018	0.018	0.110	0.44	0.75	2.92	0.5	0.4	3.16	0.077	0.041
~~t-test significantly different~~	~~Yes~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	--	No	--	--	No	--	--	No	--	--	No	--	--
SW21	0.46	0.1	2.93	0.016	0.018	0.102	0.36	0.4	2.29	0.2	0.2	1.27	0.053	0.027
SW21	0.53	0.12	3.63	0.017	0.015	0.116	0.31	0.43	2.12	0.2	0.4	1.37	0.039	0.033
SW21	0.69	0.11	4.21	0.017	0.016	0.104	0.41	0.75	2.50	0.3	0.3	1.83	0.061	0.036
SW21	0.58	0.09	3.92	0.017	0.012	0.115	0.36	0.38	2.43	0.3	0.3	2.03	0.05	0.027
SW21	0.9	0.11	7.03	0.012	0.013	0.094	0.37	0.35	2.89	0.4	0.2	3.13	0.054	0.041
mean	0.632	0.106	4.34	0.0158	0.0148	0.106	0.362	0.462	2.45	0.28	0.28	1.93	0.0514	0.0328
max	0.9	0.12	7.03	0.017	0.018	0.116	0.41	0.75	2.89	0.4	0.4	3.13	0.061	0.041
~~t-test significantly different~~	~~Yes~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	--	--	**Yes**	--	--	No	--	--	No	--	--	No	--	--
SW28	0.35	0.1	2.23	0.019	0.018	0.121	0.4	0.4	2.55	0.2	0.2	1.27	0.028	0.027
SW28	0.39	0.12	2.73	0.017	0.015	0.119	0.32	0.43	2.24	0.15	0.4	1.05	0.02	0.033
SW28	0.45	0.11	2.90	0.02	0.016	0.129	0.38	0.75	2.45	0.4	0.3	2.58	0.038	0.036
SW28	0.51	0.09	3.13	0.015	0.012	0.092	0.48	0.38	2.94	0.3	0.3	1.84	0.052	0.027
SW28	0.45	0.11	2.90	0.016	0.013	0.103	0.35	0.35	2.26	0.2	0.2	1.29	0.039	0.041
mean	0.43	0.106	2.78	0.0174	0.0148	0.113	0.386	0.462	2.49	0.25	0.28	1.61	0.0354	0.0328
max	0.51	0.12	3.13	0.02	0.018	0.129	0.48	0.75	2.94	0.4	0.4	2.58	0.052	0.041
~~t-test significantly different~~	~~Yes~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	--	--	No	--	--	No	--	--	No	--	--	No	--	--

NOTE: Shaded values indicate undetected at detection limit. Therefore, 1/2 detection limit used in this table.

COMPARISON OF SITE/REFERENCE *MACOMA* TISSUE CONCENTRATIONS

	Silver (mg/kg dry)	Zinc (mg/kg wet)	Control	Zinc (mg/kg dry)	TBT (ug/kg wet)	Control	TBT (ug/kg dry)	Benzo[a]pyrene (ug/kg wet)	Control	Benzo[a]pyrene (ug/kg dry)	Total PCB Congeners (ng/g wet)	Control
NA06	0.259	17	16	115.65	16	0.495	108.84	27	5	183.67	55	0.47
NA06	0.344	18	18	119.21	32	0.5	211.92	26	2.5	172.19	40.1	0.44
NA06	0.414	21	15	164.06	31	0.5	242.19	20	2.5	156.25	20.1	0.54
NA06	0.189	18	14	113.21	38	1.4	238.99	30	5	188.68	69.2	46
NA06	0.156	24	17	143.71	41	0.495	245.51	32	5	191.62	57.9	0.33
mean	0.272	19.6	16	131.17	31.6	0.678	209.49	27	4	178.48	48.46	9.556
max	0.414	24	18	164.06	41	1.4	245.51	32	5	191.62	69.2	46
~~t-test significantly different~~	--		--	--		--	--		--	--		--
> 95% UPL Reference Pool	No	--	--	**Yes**	--	--	**Yes**	--	--	**Yes**	--	--
NA11	0.329	15	16	96.77	15	0.495	96.77	23	5	148.39	26.9	0.47
NA11	0.277	16	18	108.11	11	0.5	74.32	26	2.5	175.68	23.8	0.44
NA11	0.321	14	15	106.87	12	0.5	91.60	19	2.5	145.04	21.6	0.54
NA11	0.465	20	14	129.03	19	1.4	122.58	27	5	174.19	28.1	46
NA11	0.252	18	17	122.45	12	0.495	81.63	20	5	136.05	26.5	0.33
mean	0.329	16.6	16	112.65	13.8	0.678	93.38	23	4	155.87	25.38	9.556
max	0.465	20	18	129.03	19	1.4	122.58	27	5	175.68	28.1	46
~~t-test significantly different~~	--		--	--		--	--		--	--		--
> 95% UPL Reference Pool	No	--	--	**Yes**	--	--	**Yes**	--	--	**Yes**	--	--
NA12	0.143	12	16	85.71	18	0.495	128.57	19	5	135.71	16.1	0.47
NA12	0.235	17	18	128.79	15	0.5	113.64	19	2.5	143.94	15.2	0.44
NA12	0.178	17	15	111.84	13	0.5	85.53	21	2.5	138.16	17.3	0.54
NA12	0.211	17	14	115.65	19	1.4	129.25	23	5	156.46	23.4	46
NA12	0.352	18	17	126.76	8.8	0.495	61.97	18	5	126.76	17.1	0.33
mean	0.224	16.2	16	113.75	14.76	0.678	103.79	20	4	140.21	17.82	9.556
max	0.352	18	18	128.79	19	1.4	129.25	23	5	156.46	23.4	46
~~t-test significantly different~~	--		--	--		--	--		--	--		--
> 95% UPL Reference Pool	No	--	--	**Yes**	--	--	**Yes**	--	--	No	--	--
NA20	0.136	19	16	117.28	22	0.495	135.80	46	5	283.95	24.5	0.47
NA20	0.140	15	18	110.29	26	0.5	191.18	23	2.5	169.12	16.9	0.44
NA20	0.139	18	15	113.92	27	0.5	170.89	35	2.5	221.52	13.2	0.54
NA20	0.139	18	14	113.92	27	1.4	170.89	43	5	272.15	13.2	46
NA20	0.150	16	17	108.84	16	0.495	108.84	43	5	292.52	21.6	0.33
mean	0.141	17.2	16	112.85	23.6	0.678	155.52	38	4	247.85	17.88	9.556
max	0.150	19	18	117.28	27	1.4	191.18	46	5	292.52	24.5	46
~~t-test significantly different~~	--		--	--		--	--		--	--		--
> 95% UPL Reference Pool	No	--	--	**Yes**	--	--	**Yes**	--	--	**Yes**	--	--
SW04	0.397	46	16	315.07	330	0.495	2260.27	170	5	1164.38	195	0.47
SW04	0.204	31	18	218.31	740	0.5	5211.27	170	2.5	1197.18	161	0.44
SW04	0.224	27	15	177.63	420	0.5	2763.16	150	2.5	986.84	15	0.54
SW04	0.183	19	14	124.18	150	1.4	980.39	180	5	1176.47	136	46
SW04	0.161	21	17	140.94	15	0.495	100.67	200	5	1342.28	196	0.33
mean	0.234	28.8	16	195.23	331	0.678	2263.15	174	4	1173.43	140.6	9.556
max	0.397	46	18	315.07	740	1.4	5211.27	200	5	1342.28	196	46

NOTE: Shaded values indicate undetected at detection limit. Therefore, 1/2 detection limit used in this table.

COMPARISON OF SITE/REFERENCE *MACOMA* TISSUE CONCENTRATIONS

	Silver (mg/kg dry)	Zinc (mg/kg wet)	Control	Zinc (mg/kg dry)	TBT (ug/kg wet)	Control	TBT (ug/kg dry)	Benzo[a]pyrene (ug/kg wet)	Control	Benzo[a]pyrene (ug/kg dry)	Total PCB Congeners (ng/g wet)	Control
~~t-test significantly different~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~	~~Need Calc~~	~~--~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	No	--	--	Yes	--	--	Yes	--	--	Yes	--	--
SW08	0.108	15	16	101.35	120	0.495	810.81	170	5	1148.65	103	0.47
SW08	0.283	14	18	116.67	210	0.5	1750.00	140	2.5	1166.67	98.2	0.44
SW08	0.128	17	15	114.86	110	0.5	743.24	180	2.5	1216.22	86.2	0.54
SW08	0.261	19	14	121.02	180	1.4	1146.50	190	5	1210.19	135	46
SW08	0.486	14	17	101.45	120	0.495	869.57	150	5	1086.96	90.1	0.33
mean	0.253	15.8	16	111.07	148	0.678	1064.02	166	4	1165.74	102.5	9.556
max	0.486	19	18	121.02	210	1.4	1750.00	190	5	1216.22	135	46
~~t-test significantly different~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~	~~Need Calc~~	~~--~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	No	--	--	Yes	--	--	Yes	--	--	Yes	--	--
SW13	0.358	17	16	141.67	120	0.495	1000.00	79	5	658.33	22.9	0.47
SW13	0.487	24	18	151.90	140	0.5	886.08	120	2.5	759.49	27.9	0.44
SW13	0.172	25	15	153.37	150	0.5	920.25	100	2.5	613.50	43.2	0.54
SW13	0.193	16	14	114.29	93	1.4	664.29	100	5	714.29	181	46
SW13	0.252	14	17	92.72	120	0.495	794.70	130	5	860.93	35.3	0.33
mean	0.292	19.2	16	130.79	124.6	0.678	853.06	105.8	4	721.31	62.06	9.556
max	0.487	25	18	153.37	150	1.4	1000.00	130	5	860.93	181	46
~~t-test significantly different~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~	~~Need Calc~~	~~--~~	~~--~~	~~No~~	~~--~~
> 95% UPL Reference Pool	No	--	--	Yes	--	--	Yes	--	--	Yes	--	--
SW21	0.338	18	16	114.65	13	0.495	82.80	180	5	1146.50	143	0.47
SW21	0.267	18	18	123.29	14	0.5	95.89	150	2.5	1027.40	175	0.44
SW21	0.372	24	15	146.34	16	0.5	97.56	120	2.5	731.71	170	0.54
SW21	0.338	18	14	121.62	15	1.4	101.35	130	5	878.38	167	46
SW21	0.422	19	17	148.44	24	0.495	187.50	110	5	859.38	106	0.33
mean	0.347	19.4	16	130.87	16.4	0.678	113.02	138	4	928.67	152.2	9.556
max	0.422	24	18	148.44	24	1.4	187.50	180	5	1146.50	175	46
~~t-test significantly different~~	~~--~~	~~Yes~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~	~~Need Calc~~	~~--~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	No	--	--	Yes	--	--	Yes	--	--	Yes	--	--
SW28	0.178	18	16	114.65	15	0.495	95.54	140	5	891.72	127	0.47
SW28	0.140	15	18	104.90	10	0.5	69.93	130	2.5	909.09	120	0.44
SW28	0.245	22	15	141.94	16	0.5	103.23	130	2.5	838.71	136	0.54
SW28	0.319	25	14	153.37	11	1.4	67.48	140	5	858.90	104	46
SW28	0.252	17	17	109.68	13	0.495	83.87	140	5	903.23	121	0.33
mean	0.227	19.4	16	124.91	13	0.678	84.01	136	4	880.33	121.6	9.556
max	0.319	25	18	153.37	16	1.4	103.23	140	5	909.09	136	46
~~t-test significantly different~~	~~--~~	~~No~~	~~--~~	~~--~~	~~Yes~~	~~--~~	~~--~~	~~Need Calc~~	~~--~~	~~--~~	~~Yes~~	~~--~~
> 95% UPL Reference Pool	No	--	--	Yes	--	--	Yes	--	--	Yes	--	--

NOTE: Shaded values indicate undetected at detection limit. Therefore, 1/2 detection limit used in this table.

DTR
Appendix For
Section 31

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ENTIRE TABLE A31-1a ADDED

Scenario	Number of Polygons Dredged*	Cumulative Volume Inside (cy)	Cumulative Volume Outside (cy)	Cumulative Area (sf)	Cumulative Under Pier Areas (sf)
1	6	16,266	8,226	121,907	40,923
2	12	49,660	14,383	302,565	70,030
3	18	81,811	14,383	430,477	115,222
4	24	116,982	24,175	669,166	131,898
5	30	207,058	44,081	1,092,249	139,841
6	36	254,295	51,057	1,434,870	180,359
7	42	288,048	82,215	1,829,641	183,491
8	48	301,962	306,722	2,979,320	210,594
9	54	366,133	349,355	3,700,249	251,828
10	60	464,316	474,903	4,812,792	310,025
11	66	464,316	683,453	6,167,316	313,842

Scenario	Cumulative Shoreline Protection (tons)	Probable Likely Cost
1	5,304	$13,500,000
2	11,278	$24,300,000
3	15,025	$32,900,000
4	20,054	$44,900,000
5	21,600	$69,400,000
6	24,434	$85,200,000
7	26,540	$101,500,000
8	30,924	$155,100,000
9	35,197	$184,800,000
10	45,273	$237,900,000
11	45,817	$288,200,000

Notes:
* Per composite SWAC ranking

DELETE TABLE A31-1
REPLACE WITH TABLE A31-1b

SWAC

Scenario	Construction Seasons Required	PCB	Hg	Cu	TBT	HPAH
1	1	247	0.71	170	136	3086
2	2	208	0.68	160	120	2790
3	2	183	0.67	156	111	2543
4	3	165	0.66	151	101	2306
5	4	149	0.63	141	89	1934
6	5	131	0.60	136	81	1495
7	6	126	0.54	132	77	1382
8	8	109	0.53	116	44	1106
9	10	101	0.52	112	39	962
10	12	89	0.54	112	23	729
11	14	84	0.57	121	22	673

Exposure Reduction

Scenario	Construction Seasons Required	PCB	Hg	Cu	TBT	HPAH	Average
1	1	27.4%	20.3%	25.6%	18.4%	17.9%	21.9%
2	2	44.5%	36.4%	40.3%	30.2%	28.0%	35.9%
3	2	55.6%	42.3%	46.5%	36.4%	36.4%	43.4%
4	3	63.9%	52.3%	54.9%	43.6%	44.4%	51.8%
5	4	70.9%	69.1%	69.1%	52.1%	57.1%	63.7%
6	5	78.9%	81.6%	77.7%	57.9%	72.0%	73.6%
7	6	81.3%	115.9%	82.6%	60.6%	75.9%	83.3%
8	8	89.0%	124.4%	107.1%	84.1%	85.3%	98.0%
9	10	92.6%	125.8%	114.0%	88.2%	90.2%	102.1%
10	12	97.7%	117.4%	113.1%	99.2%	98.1%	105.1%
11	14	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Background	84	0.57	121	22	673	
	Pre-Remedy	308	0.75	187	162	3612	

DELETE TABLE A31-1
REPLACE WITH TABLE A31-1c

Avg. COPC Plot Data

Scenario	Cumulative Exposure Reduction	Incremental Exposure Reduction	Cumulative Cost	Incremental Cost	Cum-ulative Exposure Reduc-tion per $10 million	Inc-remental Exposure Reduc-tion per $10 million	Cost Range
1	21.9%	21.9%	$13,500,000	$13,500,000	16.3%	16.3%	$0 - $14
2	35.9%	13.9%	$24,300,000	$10,800,000	14.8%	12.9%	$14 - $24
3	43.4%	7.6%	$32,900,000	$8,600,000	13.2%	8.8%	$24 - $33
4	51.8%	8.4%	$44,900,000	$12,000,000	11.5%	7.0%	$33 - $45
5	63.7%	11.8%	$69,400,000	$24,500,000	9.2%	4.8%	$45 - $69
6	73.6%	10.0%	$85,200,000	$15,800,000	8.6%	6.3%	$69 - $85
7	83.3%	9.6%	$101,500,000	$16,300,000	8.2%	5.9%	$85 - $102
8	98.0%	14.7%	$155,100,000	$53,600,000	6.3%	2.7%	$102 - $155
9	102.1%	4.2%	$184,800,000	$29,700,000	5.5%	1.4%	$155 - $185
10	105.1%	3.0%	$237,900,000	$53,100,000	4.4%	0.6%	$185 - $238
11	100.0%	-5.1%	$288,200,000	$50,300,000	3.5%	-1.0%	$238 - $288

Item	Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING								
Additional Pre-Design Site Characterization	1	LUMP SUM	150000	200000	250000	150000	200000	250000
Surveys and Engineering Design	1	LUMP SUM	300000	400000	500000	300000	400000	500000
Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR	1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION								
Mobilization(s) and Demobilization(s)	1	CONSTRUCTION SEASONS	200000	250000	300000	200000	250000	300000
Demolition	1	LUMP SUM	150000	250000	350000	150000	250000	350000
DREDGING								
Unconstrained open-water dredging (outside of leasehold area)	8226	CY	6	7	10	49356	57582	82260
Constrained dredging from inner shipyard (within leasehold area)	16266	CY	10	13	18	162660	211458	292788
Dredging Surface/Subsurface Debris	1224.6	CY	70	89	120	85722	108989.4	146952
Engineering Controls (silt curtain, oil boom)	1	CONSTRUCTION SEASONS	25000	28000	32000	25000	28000	32000
Additional Dredging (if needed)	4500	CY	10	13	18	45000	58500	81000
MARINE STRUCTURES								
Placement of Quarry Run Rock for Protection of Marine Structures	5304	TON	25	35	45	132600	185640	238680
SEDIMENT OFFLOADING AND DISPOSAL								
Acquisition or Several-Year Lease of Sediment Offloading Area	1	CONSTRUCTION SEASONS	200000	250000	300000	200000	250000	300000
Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
Rehandling and Dewatering	28992	CY	10	16	25	289920	463872	724800
Transportation and Disposal at Landfill	43488	TON	50	62.5	75	2174400	2718000	3261600
UNDERPIER REMEDIATION								
Purchase and place 3 feet of clean sand/gravel beneath piers and overwater structures	40923	SF	15	20	30	613845	818460	1227690
PLACEMENT OF CLEAN SAND COVER	6772.61111	CY	20	35	40	135452.2222	237041.3889	270904.4444
SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS						5900000	8000000	10400000
BID MANAGEMENT AND SUPPORT	1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT	1	CONSTRUCTION SEASONS	300000	375000	450000	300000	375000	450000
CONTINGENCY	0.3	percent				1865250	2518500	3262500
MONITORING COSTS								
Water Quality Monitoring during construction	7.898211111	week	11000	15000	18000	86880.32222	118473.1667	142167.8
Post-Dredging Confirmational Sampling	7.276359045	samples	4000	6000	8000	29105.43618	43658.15427	58210.87236
Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS								
Eel Grass Habitat Mitigation (if needed)	0.139929982	ACRES	200000	400000	600000	27985.99633	55971.99265	83957.98898
Eel Grass Land Lease Costs (in perpetuity)	0.139929982	ACRES	500000	1000000	1500000	69964.99082	139929.9816	209894.9725
Internal Shipyard Costs	1	LUMP SUM	150000	200000	250000	150000	200000	250000
RWQCB Oversight Costs	8	years	30000	36000	45000	240000	288000	360000
GRAND TOTAL						10000000	13500000	17600000

VOLUME AND AREA LEDGER	TOTAL
Total volume being dredged (CY)	28992
Total volume being dredged (TONS)	43488
Total area of dredging (sq. ft.)	121907
Total area of dredging (acres)	2.798599633

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		16266	add 10%	17892.6
Dredging, open water, cy		8226	add 10%	9048.6
Rock placement, tons		5304		
Clean sand cover, cy		6772.611111		
Underpier sand, sq.ft.		40923		
Time to dredge inner shipyard, days		35.7852	Daily rate (cy)	500
	Weeks	5.9642	Days per week	6
	Months	1.49105		
Time to dredge outer shipyard, days		7.5405	Daily rate (cy)	1200
	Weeks	1.25675	Days per week	6
	Months	0.3141875		
Time to place rock, days		7.072	Daily rate (tons)	750
	Weeks	1.178666667	Days per week	6
	Months	0.294666667		
Time to place clean sand, days		3.386305556	Daily rate (cy)	2000
	Weeks	0.564384259	Days per week	6
	Months	0.141096065		
Time to place underpier sand, days		0.677261111	Daily rate (sf)	10000
	Weeks	0.112876852	Days per week	6
	Months	0.028219213		
	Total weeks of in-water work	9.076877778		
	Total months of in-water work	2.269219444		
	CONSTRUCTION SEASONS	1	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	150000	200000	250000	150000	200000	250000
	Surveys and Engineering Design	1	LUMP SUM	300000	400000	500000	300000	400000	500000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	2	CONSTRUCTION SEASONS	200000	250000	300000	400000	500000	600000
	Demolition	1	LUMP SUM	150000	250000	350000	150000	250000	350000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	14383	CY	6	7	10	86298	100681	143830
	Constrained dredging from inner shipyard (within leasehold area)	49660	CY	10	13	18	496600	645580	893880
	Dredging Surface/Subsurface Debris	3202.15	CY	70	89	120	224150.5	284991.35	384258
	Engineering Controls (silt curtain, oil boom)	2	CONSTRUCTION SEASONS	25000	28000	32000	50000	56000	64000
	Additional Dredging (if needed)	11200	CY	10	13	18	112000	145600	201600
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Structures	11278	TON	25	35	45	281950	394730	507510
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Area	2	CONSTRUCTION SEASONS	200000	250000	300000	400000	500000	600000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	75243	CY	10	16	25	752430	1203888	1881075
	Transportation and Disposal at Landfill	112864.5	TON	50	62.5	75	5643225	7054031.25	8464837.5
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers and overwater structures	70030	SF	15	20	30	1050450	1400600	2100900
PLACEMENT OF CLEAN SAND COVER		16809.16667	CY	20	35	40	336183.3333	588320.8333	672366.6667
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							11600000	15500000	19900000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		2	CONSTRUCTION SEASONS	300000	375000	450000	600000	750000	900000
CONTINGENCY		0.3	percent				3665250	4881000	6247500
MONITORING COSTS									
	Water Quality Monitoring during construction	22.08698611	week	11000	15000	18000	242956.8472	331304.7917	397565.75
	Post-Dredging Confirmational Sampling	18.05943526	samples	4000	6000	8000	72237.74105	108356.6116	144475.4821
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	0.347296832	ACRES	200000	400000	600000	69459.36639	138918.7328	208378.0992
	Eel Grass Land Lease Costs (in perpetuity)	0.347296832	ACRES	500000	1000000	1500000	173648.416	347296.832	520945.2479
	Internal Shipyard Costs	1	LUMP SUM	150000	200000	250000	150000	200000	250000
	RWQCB Oversight Costs	9	years	30000	36000	45000	270000	324000	405000
GRAND TOTAL							18200000	24300000	31400000

VOLUME AND AREA LEDGER		TOTAL
	Total volume being dredged (CY)	75243
	Total volume being dredged (TONS)	112864.5
	Total area of dredging (sq. ft.)	302565
	Total area of dredging (acres)	6.945936639

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		49660	add 10%	54626
Dredging, open water, cy		14383	add 10%	15821.3
Rock placement, tons		11278		
Clean sand cover, cy		16809.16667		
Underpier sand, sq.ft.		70030		
Time to dredge inner shipyard, days		109.252	Daily rate (cy)	500
	Weeks	18.20866667	Days per week	6
	Months	4.552166667		
Time to dredge outer shipyard, days		13.18441667	Daily rate (cy)	1200
	Weeks	2.197402778	Days per week	6
	Months	0.549350694		
Time to place rock, days		15.03733333	Daily rate (tons)	750
	Weeks	2.506222222	Days per week	6
	Months	0.626555556		
Time to place clean sand, days		8.404583333	Daily rate (cy)	2000
	Weeks	1.400763889	Days per week	6
	Months	0.350190972		
Time to place underpier sand, days		1.680916667	Daily rate (sf)	10000
	Weeks	0.280152778	Days per week	6
	Months	0.070038194		
	Total weeks of in-water work	24.59320833		
	Total months of in-water work	6.148302083		
	CONSTRUCTION SEASONS	2	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	210000	275000	348000	210000	275000	348000
	Surveys and Engineering Design	1	LUMP SUM	400000	500000	675000	400000	500000	675000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	2	CONSTRUCTION SEASONS	200000	250000	300000	400000	500000	600000
	Demolition	1	LUMP SUM	300000	400000	500000	300000	400000	500000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	14383	CY	6	7	10	86298	100681	143830
	Constrained dredging from inner shipyard (within leasehold area)	81811	CY	10	13	18	818110	1063543	1472598
	Dredging Surface/Subsurface Debris	4809.7	CY	70	89	120	336679	428063.3	577164
	Engineering Controls (silt curtain, oil boom)	2	CONSTRUCTION SEASONS	25000	28000	32000	50000	56000	64000
	Additional Dredging (if needed)	15900	CY	10	13	18	159000	206700	286200
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Structures	15025	TON	25	35	45	375625	525875	676125
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Area	2	CONSTRUCTION SEASONS	200000	250000	300000	400000	500000	600000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	112094	CY	10	16	25	1120940	1793504	2802350
	Transportation and Disposal at Landfill	168141	TON	50	62.5	75	8407050	10508812.5	12610575
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers and overwater structures	115222	SF	15	20	30	1728330	2304440	3456660
PLACEMENT OF CLEAN SAND COVER		23915.38889	CY	20	35	40	478307.7778	837038.6111	956615.5556
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							16500000	21800000	28100000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		2	CONSTRUCTION SEASONS	300000	375000	450000	600000	750000	900000
CONTINGENCY		0.3	percent				5135250	6771000	8707500
MONITORING COSTS									
	Water Quality Monitoring during construction	34.58630833	week	11000	15000	18000	380449.3917	518794.625	622553.55
	Post-Dredging Confirmational Sampling	25.69421947	samples	4000	6000	8000	102776.8779	154165.3168	205553.7557
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	0.494119605	ACRES	200000	400000	600000	98823.92103	197647.8421	296471.7631
	Eel Grass Land Lease Costs (in perpetuity)	0.494119605	ACRES	500000	1000000	1500000	247059.8026	494119.6051	741179.4077
	Internal Shipyard Costs	1	LUMP SUM	175000	200000	250000	175000	200000	250000
	RWQCB Oversight Costs	9	years	30000	36000	45000	270000	324000	405000
GRAND TOTAL							24900000	32900000	42600000

VOLUME AND AREA LEDGER		TOTAL
	Total volume being dredged (CY)	112094
	Total volume being dredged (TONS)	168141
	Total area of dredging (sq. ft.)	430477
	Total area of dredging (acres)	9.882392103

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		81811	add 10%	89992.1
Dredging, open water, cy		14383	add 10%	15821.3
Rock placement, tons		15025		
Clean sand cover, cy		23915.38889		
Underpier sand, sq.ft.		115222		
Time to dredge inner shipyard, days		179.9842	Daily rate (cy)	500
	Weeks	29.99736667	Days per week	6
	Months	7.499341667		
Time to dredge outer shipyard, days		13.18441667	Daily rate (cy)	1200
	Weeks	2.197402778	Days per week	6
	Months	0.549350694		
Time to place rock, days		20.03333333	Daily rate (tons)	750
	Weeks	3.338888889	Days per week	6
	Months	0.834722222		
Time to place clean sand, days		11.95769444	Daily rate (cy)	2000
	Weeks	1.992949074	Days per week	6
	Months	0.498237269		
Time to place underpier sand, days		2.391538889	Daily rate (sf)	10000
	Weeks	0.398589815	Days per week	6
	Months	0.099647454		
	Total weeks of in-water work	37.92519722		
	Total months of in-water work	9.481299306		
	CONSTRUCTION SEASONS	2	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	210000	275000	348000	210000	275000	348000
	Surveys and Engineering Design	1	LUMP SUM	400000	500000	675000	400000	500000	675000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	3	CONSTRUCTION SEASONS	200000	250000	300000	600000	750000	900000
	Demolition	1	LUMP SUM	300000	400000	500000	300000	400000	500000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	24175	CY	6	7	10	145050	169225	241750
	Constrained dredging from inner shipyard (within leasehold area)	116982	CY	10	13	18	1169820	1520766	2105676
	Dredging Surface/Subsurface Debris	7057.85	CY	70	89	120	494049.5	628148.65	846942
	Engineering Controls (silt curtain, oil boom)	3	CONSTRUCTION SEASONS	25000	28000	32000	75000	84000	96000
	Additional Dredging (if needed)	24800	CY	10	13	18	248000	322400	446400
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Structures	20054	TON	25	35	45	501350	701890	902430
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Area	3	CONSTRUCTION SEASONS	200000	250000	300000	600000	750000	900000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	165957	CY	10	16	25	1659570	2655312	4148925
	Transportation and Disposal at Landfill	248935.5	TON	50	62.5	75	12446775	15558468.75	18670162.5
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers and overwater structures	131898	SF	15	20	30	1978470	2637960	3956940
PLACEMENT OF CLEAN SAND COVER		37175.88889	CY	20	35	40	743517.7778	1301156.111	1487035.556
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							22800000	30100000	38500000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		3	CONSTRUCTION SEASONS	300000	375000	450000	900000	1125000	1350000
CONTINGENCY		0.3	percent				7115250	9373500	11962500
MONITORING COSTS									
	Water Quality Monitoring during construction	50.30439167	week	11000	15000	18000	553348.3083	754565.875	905479.05
	Post-Dredging Confirmational Sampling	39.94103765	samples	4000	6000	8000	159764.1506	239646.2259	319528.3012
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	0.768096878	ACRES	200000	400000	600000	153619.3756	307238.7511	460858.1267
	Eel Grass Land Lease Costs (in perpetuity)	0.768096878	ACRES	500000	1000000	1500000	384048.4389	768096.8779	1152145.317
	Internal Shipyard Costs	1	LUMP SUM	175000	200000	250000	175000	200000	250000
	RWQCB Oversight Costs	10	years	30000	36000	45000	300000	360000	450000
GRAND TOTAL							33900000	44900000	57800000

VOLUME AND AREA LEDGER		**TOTAL**
	Total volume being dredged (CY)	165957
	Total volume being dredged (TONS)	248935.5
	Total area of dredging (sq. ft.)	669166
	Total area of dredging (acres)	15.36193756

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		116982	add 10%	128680.2
Dredging, open water, cy		24175	add 10%	26592.5
Rock placement, tons		20054		
Clean sand cover, cy		37175.88889		
Underpier sand, sq.ft.		131898		
Time to dredge inner shipyard, days		257.3604	Daily rate (cy)	500
	Weeks	42.8934	Days per week	6
	Months	10.72335		
Time to dredge outer shipyard, days		22.16041667	Daily rate (cy)	1200
	Weeks	3.693402778	Days per week	6
	Months	0.923350694		
Time to place rock, days		26.73866667	Daily rate (tons)	750
	Weeks	4.456444444	Days per week	6
	Months	1.114111111		
Time to place clean sand, days		18.58794444	Daily rate (cy)	2000
	Weeks	3.097990741	Days per week	6
	Months	0.774497685		
Time to place underpier sand, days		3.717588889	Daily rate (sf)	10000
	Weeks	0.619598148	Days per week	6
	Months	0.154899537		
	Total weeks of in-water work	54.76083611		
	Total months of in-water work	13.69020903		
	CONSTRUCTION SEASONS	3	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	210000	275000	348000	210000	275000	348000
	Surveys and Engineering Design	1	LUMP SUM	400000	500000	675000	400000	500000	675000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	4	CONSTRUCTION SEASONS	200000	250000	300000	800000	1000000	1200000
	Demolition	1	LUMP SUM	300000	400000	500000	300000	400000	500000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	44081	CY	6	7	10	264486	308567	440810
	Constrained dredging from inner shipyard (within leasehold ar	207058	CY	10	13	18	2070580	2691754	3727044
	Dredging Surface/Subsurface Debris	12556.95	CY	70	89	120	878986.5	1117568.55	1506834
	Engineering Controls (silt curtain, oil boom)	4	CONSTRUCTION SEASONS	25000	28000	32000	100000	112000	128000
	Additional Dredging (if needed)	40500	CY	10	13	18	405000	526500	729000
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Struct	21600	TON	25	35	45	540000	756000	972000
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Are	4	CONSTRUCTION SEASONS	200000	250000	300000	800000	1000000	1200000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	291639	CY	10	16	25	2916390	4666224	7290975
	Transportation and Disposal at Landfill	437458.5	TON	50	62.5	75	21872925	27341156.25	32809387.5
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers ar	139841	SF	15	20	30	2097615	2796820	4195230
PLACEMENT OF CLEAN SAND COVER		60680.5	CY	20	35	40	1213610	2123817.5	2427220
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							36100000	47400000	60500000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		4	CONSTRUCTION SEASONS	300000	375000	450000	1200000	1500000	1800000
CONTINGENCY		0.3	percent				11195250	14676000	18697500
MONITORING COSTS									
	Water Quality Monitoring during construction	88.72391389	week	11000	15000	18000	975963.0528	1330858.708	1597030.45
	Post-Dredging Confirmational Sampling	65.19392562	samples	4000	6000	8000	260775.7025	391163.5537	521551.405
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	1.253729339	ACRES	200000	400000	600000	250745.8678	501491.7355	752237.6033
	Eel Grass Land Lease Costs (in perpetuity)	1.253729339	ACRES	500000	1000000	1500000	626864.6694	1253729.339	1880594.008
	Internal Shipyard Costs	1	LUMP SUM	175000	200000	250000	175000	200000	250000
	RWQCB Oversight Costs	11	years	30000	36000	45000	330000	396000	495000
GRAND TOTAL							52500000	69400000	88900000

VOLUME AND AREA LEDGER		**TOTAL**
	Total volume being dredged (CY)	291639
	Total volume being dredged (TONS)	437458.5
	Total area of dredging (sq. ft.)	1092249
	Total area of dredging (acres)	25.07458678

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		207058	add 10%	227763.8
Dredging, open water, cy		44081	add 10%	48489.1
Rock placement, tons		21600		
Clean sand cover, cy		60680.5		
Underpier sand, sq.ft.		139841		
Time to dredge inner shipyard, days		455.5276	Daily rate (cy)	500
	Weeks	75.92126667	Days per week	6
	Months	18.98031667		
Time to dredge outer shipyard, days		40.40758333	Daily rate (cy)	1200
	Weeks	6.734597222	Days per week	6
	Months	1.683649306		
Time to place rock, days		28.8	Daily rate (tons)	750
	Weeks	4.8	Days per week	6
	Months	1.2		
Time to place clean sand, days		30.34025	Daily rate (cy)	2000
	Weeks	5.056708333	Days per week	6
	Months	1.264177083		
Time to place underpier sand, days		6.06805	Daily rate (sf)	10000
	Weeks	1.011341667	Days per week	6
	Months	0.252835417		
	Total weeks of in-water work	93.52391389		
	Total months of in-water work	23.38097847		
	CONSTRUCTION SEASONS	4	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	300000	400000	500000	300000	400000	500000
	Surveys and Engineering Design	1	LUMP SUM	500000	650000	800000	500000	650000	800000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	5	CONSTRUCTION SEASONS	200000	250000	300000	1000000	1250000	1500000
	Demolition	1	LUMP SUM	400000	500000	600000	400000	500000	600000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	51057	CY	6	7	10	306342	357399	510570
	Constrained dredging from inner shipyard (within leasehold are	254295	CY	10	13	18	2542950	3305835	4577310
	Dredging Surface/Subsurface Debris	15267.6	CY	70	89	120	1068732	1358816.4	1832112
	Engineering Controls (silt curtain, oil boom)	5	CONSTRUCTION SEASONS	25000	28000	32000	125000	140000	160000
	Additional Dredging (if needed)	53100	CY	10	13	18	531000	690300	955800
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Struct	24434	TON	25	35	45	610850	855190	1099530
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Are	5	CONSTRUCTION SEASONS	200000	250000	300000	1000000	1250000	1500000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	358452	CY	10	16	25	3584520	5735232	8961300
	Transportation and Disposal at Landfill	537678	TON	50	62.5	75	26883900	33604875	40325850
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers ar	180359	SF	15	20	30	2705385	3607180	5410770
PLACEMENT OF CLEAN SAND COVER		79715	CY	20	35	40	1594300	2790025	3188600
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							44400000	58300000	74200000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		5	CONSTRUCTION SEASONS	300000	375000	450000	1500000	1875000	2250000
CONTINGENCY		0.3	percent				13775250	18058500	22942500
MONITORING COSTS									
	Water Quality Monitoring during construction	109.013375	week	11000	15000	18000	1199147.125	1635200.625	1962240.75
	Post-Dredging Confirmational Sampling	85.64421488	samples	4000	6000	8000	342576.8595	513865.2893	685153.719
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	1.647004132	ACRES	200000	400000	600000	329400.8264	658801.6529	988202.4793
	Eel Grass Land Lease Costs (in perpetuity)	1.647004132	ACRES	500000	1000000	1500000	823502.0661	1647004.132	2470506.198
	Internal Shipyard Costs	1	LUMP SUM	250000	375000	500000	250000	375000	500000
	RWQCB Oversight Costs	12	years	30000	36000	45000	360000	432000	540000
GRAND TOTAL							64400000	85200000	109000000

VOLUME AND AREA LEDGER		TOTAL
	Total volume being dredged (CY)	358452
	Total volume being dredged (TONS)	537678
	Total area of dredging (sq. ft.)	1434870
	Total area of dredging (acres)	32.94008264

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		254295	add 10%	279724.5
Dredging, open water, cy		51057	add 10%	56162.7
Rock placement, tons		24434		
Clean sand cover, cy		79715		
Underpier sand, sq.ft.		180359		
Time to dredge inner shipyard, days		559.449	Daily rate (cy)	500
	Weeks	93.2415	Days per week	6
	Months	23.310375		
Time to dredge outer shipyard, days		46.80225	Daily rate (cy)	1200
	Weeks	7.800375	Days per week	6
	Months	1.95009375		
Time to place rock, days		32.57866667	Daily rate (tons)	750
	Weeks	5.429777778	Days per week	6
	Months	1.357444444		
Time to place clean sand, days		39.8575	Daily rate (cy)	2000
	Weeks	6.642916667	Days per week	6
	Months	1.660729167		
Time to place underpier sand, days		7.9715	Daily rate (sf)	10000
	Weeks	1.328583333	Days per week	6
	Months	0.332145833		
	Total weeks of in-water work	114.4431528		
	Total months of in-water work	28.61078819		
	CONSTRUCTION SEASONS	5	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	300000	400000	500000	300000	400000	500000
	Surveys and Engineering Design	1	LUMP SUM	500000	650000	800000	500000	650000	800000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	6	CONSTRUCTION SEASONS	200000	250000	300000	1200000	1500000	1800000
	Demolition	1	LUMP SUM	400000	500000	600000	400000	500000	600000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	82215	CY	6	7	10	493290	575505	822150
	Constrained dredging from inner shipyard (within leasehold ar	288048	CY	10	13	18	2880480	3744624	5184864
	Dredging Surface/Subsurface Debris	18513.15	CY	70	89	120	1295920.5	1647670.35	2221578
	Engineering Controls (silt curtain, oil boom)	6	CONSTRUCTION SEASONS	25000	28000	32000	150000	168000	192000
	Additional Dredging (if needed)	67800	CY	10	13	18	678000	881400	1220400
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Struct	26540	TON	25	35	45	663500	928900	1194300
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Are	6	CONSTRUCTION SEASONS	200000	250000	300000	1200000	1500000	1800000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	438063	CY	10	16	25	4380630	7009008	10951575
	Transportation and Disposal at Landfill	657094.5	TON	50	62.5	75	32854725	41068406.25	49282087.5
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers ar	183491	SF	15	20	30	2752365	3669820	5504730
PLACEMENT OF CLEAN SAND COVER		101646.7222	CY	20	35	40	2032934.444	3557635.278	4065868.889
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							53000000	69600000	88400000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		6	CONSTRUCTION SEASONS	300000	375000	450000	1800000	2250000	2700000
CONTINGENCY		0.3	percent				16445250	21561000	27337500
MONITORING COSTS									
	Water Quality Monitoring during construction	128.3428972	week	11000	15000	18000	1411771.869	1925143.458	2310172.15
	Post-Dredging Confirmational Sampling	109.2072222	samples	4000	6000	8000	436828.8889	655243.3333	873657.7778
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	2.100138889	ACRES	200000	400000	600000	420027.7778	840055.5556	1260083.333
	Eel Grass Land Lease Costs (in perpetuity)	2.100138889	ACRES	500000	1000000	1500000	1050069.444	2100138.889	3150208.333
	Internal Shipyard Costs	1	LUMP SUM	250000	375000	500000	250000	375000	500000
	RWQCB Oversight Costs	13	years	30000	36000	45000	390000	468000	585000
GRAND TOTAL							76600000	101500000	129500000

VOLUME AND AREA LEDGER		TOTAL
	Total volume being dredged (CY)	438063
	Total volume being dredged (TONS)	657094.5
	Total area of dredging (sq. ft.)	1829641
	Total area of dredging (acres)	42.00277778

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		288048	add 10%	316852.8
Dredging, open water, cy		82215	add 10%	90436.5
Rock placement, tons		26540		
Clean sand cover, cy		101646.7222		
Underpier sand, sq.ft.		183491		
Time to dredge inner shipyard, days		633.7056	Daily rate (cy)	500
	Weeks	105.6176	Days per week	6
	Months	26.4044		
Time to dredge outer shipyard, days		75.36375	Daily rate (cy)	1200
	Weeks	12.560625	Days per week	6
	Months	3.14015625		
Time to place rock, days		35.38666667	Daily rate (tons)	750
	Weeks	5.897777778	Days per week	6
	Months	1.474444444		
Time to place clean sand, days		50.82336111	Daily rate (cy)	2000
	Weeks	8.470560185	Days per week	6
	Months	2.117640046		
Time to place underpier sand, days		10.16467222	Daily rate (sf)	10000
	Weeks	1.694112037	Days per week	6
	Months	0.423528009		
	Total weeks of in-water work	134.240675		
	Total months of in-water work	33.56016875		
	CONSTRUCTION SEASONS	6	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	300000	400000	500000	300000	400000	500000
	Surveys and Engineering Design	1	LUMP SUM	500000	650000	800000	500000	650000	800000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	8	CONSTRUCTION SEASONS	200000	250000	300000	1600000	2000000	2400000
	Demolition	1	LUMP SUM	400000	500000	600000	400000	500000	600000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	306722	CY	6	7	10	1840332	2147054	3067220
	Constrained dredging from inner shipyard (within leasehold ar	301962	CY	10	13	18	3019620	3925506	5435316
	Dredging Surface/Subsurface Debris	30434.2	CY	70	89	120	2130394	2708643.8	3652104
	Engineering Controls (silt curtain, oil boom)	8	CONSTRUCTION SEASONS	25000	28000	32000	200000	224000	256000
	Additional Dredging (if needed)	110300	CY	10	13	18	1103000	1433900	1985400
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Struct	30924	TON	25	35	45	773100	1082340	1391580
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Are	8	CONSTRUCTION SEASONS	200000	250000	300000	1600000	2000000	2400000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	718984	CY	10	16	25	7189840	11503744	17974600
	Transportation and Disposal at Landfill	1078476	TON	50	62.5	75	53923800	67404750	80885700
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers ar	210594	SF	15	20	30	3158910	4211880	6317820
PLACEMENT OF CLEAN SAND COVER		165517.7778	CY	20	35	40	3310355.556	5793122.222	6620711.111
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							82200000	107800000	136600000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		8	CONSTRUCTION SEASONS	300000	375000	450000	2400000	3000000	3600000
CONTINGENCY		0.3	percent				25385250	33246000	42067500
MONITORING COSTS									
	Water Quality Monitoring during construction	174.1314833	week	11000	15000	18000	1915446.317	2611972.25	3134366.7
	Post-Dredging Confirmational Sampling	177.8290174	samples	4000	6000	8000	711316.0698	1066974.105	1422632.14
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	3.419788797	ACRES	200000	400000	600000	683957.7594	1367915.519	2051873.278
	Eel Grass Land Lease Costs (in perpetuity)	3.419788797	ACRES	500000	1000000	1500000	1709894.399	3419788.797	5129683.196
	Internal Shipyard Costs	1	LUMP SUM	250000	375000	500000	250000	375000	500000
	RWQCB Oversight Costs	15	years	30000	36000	45000	450000	540000	675000
GRAND TOTAL							117100000	155100000	197600000

VOLUME AND AREA LEDGER		TOTAL
	Total volume being dredged (CY)	718984
	Total volume being dredged (TONS)	1078476
	Total area of dredging (sq. ft.)	2979320
	Total area of dredging (acres)	68.39577594

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		301962	add 10%	332158.2
Dredging, open water, cy		306722	add 10%	337394.2
Rock placement, tons		30924		
Clean sand cover, cy		165517.7778		
Underpier sand, sq.ft.		210594		
Time to dredge inner shipyard, days		664.3164	Daily rate (cy)	500
	Weeks	110.7194	Days per week	6
	Months	27.67985		
Time to dredge outer shipyard, days		281.1618333	Daily rate (cy)	1200
	Weeks	46.86030556	Days per week	6
	Months	11.71507639		
Time to place rock, days		41.232	Daily rate (tons)	750
	Weeks	6.872	Days per week	6
	Months	1.718		
Time to place clean sand, days		82.75888889	Daily rate (cy)	2000
	Weeks	13.79314815	Days per week	6
	Months	3.448287037		
Time to place underpier sand, days		16.55177778	Daily rate (sf)	10000
	Weeks	2.75862963	Days per week	6
	Months	0.689657407		
	Total weeks of in-water work	181.0034833		
	Total months of in-water work	45.25087083		
	CONSTRUCTION SEASONS	8	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	400000	500000	600000	400000	500000	600000
	Surveys and Engineering Design	1	LUMP SUM	600000	750000	900000	600000	750000	900000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	10	CONSTRUCTION SEASONS	200000	250000	300000	2000000	2500000	3000000
	Demolition	1	LUMP SUM	500000	650000	800000	500000	650000	800000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	349355	CY	6	7	10	2096130	2445485	3493550
	Constrained dredging from inner shipyard (within leasehold ar	366133	CY	10	13	18	3661330	4759729	6590394
	Dredging Surface/Subsurface Debris	35774.4	CY	70	89	120	2504208	3183921.6	4292928
	Engineering Controls (silt curtain, oil boom)	10	CONSTRUCTION SEASONS	25000	28000	32000	250000	280000	320000
	Additional Dredging (if needed)	137000	CY	10	13	18	1370000	1781000	2466000
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Struct	35197	TON	25	35	45	879925	1231895	1583865
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Are	10	CONSTRUCTION SEASONS	200000	250000	300000	2000000	2500000	3000000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	852488	CY	10	16	25	8524880	13639808	21312200
	Transportation and Disposal at Landfill	1278732	TON	50	62.5	75	63936600	79920750	95904900
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers ar	251828	SF	15	20	30	3777420	5036560	7554840
PLACEMENT OF CLEAN SAND COVER		205569.3889	CY	20	35	40	4111387.778	7194928.611	8222775.556
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							97800000	128200000	162300000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		10	CONSTRUCTION SEASONS	300000	375000	450000	3000000	3750000	4500000
CONTINGENCY		0.3	percent				30245250	39591000	50047500
MONITORING COSTS									
	Water Quality Monitoring during construction	208.1793861	week	11000	15000	18000	2289973.247	3122690.792	3747228.95
	Post-Dredging Confirmational Sampling	220.859674	samples	4000	6000	8000	883438.6961	1325158.044	1766877.392
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	4.247301423	ACRES	200000	400000	600000	849460.2847	1698920.569	2548380.854
	Eel Grass Land Lease Costs (in perpetuity)	4.247301423	ACRES	500000	1000000	1500000	2123650.712	4247301.423	6370952.135
	Internal Shipyard Costs	1	LUMP SUM	300000	500000	700000	300000	500000	700000
	RWQCB Oversight Costs	17	years	30000	36000	45000	510000	612000	765000
GRAND TOTAL							139400000	184800000	235200000

VOLUME AND AREA LEDGER		**TOTAL**
	Total volume being dredged (CY)	852488
	Total volume being dredged (TONS)	1278732
	Total area of dredging (sq. ft.)	3700249
	Total area of dredging (acres)	84.94602847

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		366133	add 10%	402746.3
Dredging, open water, cy		349355	add 10%	384290.5
Rock placement, tons		35197		
Clean sand cover, cy		205569.3889		
Underpier sand, sq.ft.		251828		
Time to dredge inner shipyard, days		805.4926	Daily rate (cy)	500
	Weeks	134.2487667	Days per week	6
	Months	33.56219167		
Time to dredge outer shipyard, days		320.2420833	Daily rate (cy)	1200
	Weeks	53.37368056	Days per week	6
	Months	13.34342014		
Time to place rock, days		46.92933333	Daily rate (tons)	750
	Weeks	7.821555556	Days per week	6
	Months	1.955388889		
Time to place clean sand, days		102.7846944	Daily rate (cy)	2000
	Weeks	17.13078241	Days per week	6
	Months	4.282695602		
Time to place underpier sand, days		20.55693889	Daily rate (sf)	10000
	Weeks	3.426156481	Days per week	6
	Months	0.85653912		
	Total weeks of in-water work	216.0009417		
	Total months of in-water work	54.00023542		
	CONSTRUCTION SEASONS	10	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	400000	500000	600000	400000	500000	600000
	Surveys and Engineering Design	1	LUMP SUM	700000	850000	1000000	700000	850000	1000000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	12	CONSTRUCTION SEASONS	200000	250000	300000	2400000	3000000	3600000
	Demolition	1	LUMP SUM	500000	650000	800000	500000	650000	800000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	474903	CY	6	7	10	2849418	3324321	4749030
	Constrained dredging from inner shipyard (within leasehold are	464316	CY	10	13	18	4643160	6036108	8357688
	Dredging Surface/Subsurface Debris	46960.95	CY	70	89	120	3287266.5	4179524.55	5635314
	Engineering Controls (silt curtain, oil boom)	12	CONSTRUCTION SEASONS	25000	28000	32000	300000	336000	384000
	Additional Dredging (if needed)	178300	CY	10	13	18	1783000	2317900	3209400
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Struct	45273	TON	25	35	45	1131825	1584555	2037285
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Are	12	CONSTRUCTION SEASONS	200000	250000	300000	2400000	3000000	3600000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	1117519	CY	10	16	25	11175190	17880304	27937975
	Transportation and Disposal at Landfill	1676278.5	TON	50	62.5	75	83813925	104767406.3	125720887.5
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers ar	310025	SF	15	20	30	4650375	6200500	9300750
PLACEMENT OF CLEAN SAND COVER		267377.3333	CY	20	35	40	5347546.667	9358206.667	10695093.33
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							126600000	165800000	209900000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		12	CONSTRUCTION SEASONS	300000	375000	450000	3600000	4500000	5400000
CONTINGENCY		0.3	percent				39065250	51096000	64597500
MONITORING COSTS									
	Water Quality Monitoring during construction	269.5415583	week	11000	15000	18000	2964957.142	4043123.375	4851748.05
	Post-Dredging Confirmational Sampling	287.2649036	samples	4000	6000	8000	1149059.614	1723589.421	2298119.229
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	5.524325069	ACRES	200000	400000	600000	1104865.014	2209730.028	3314595.041
	Eel Grass Land Lease Costs (in perpetuity)	5.524325069	ACRES	500000	1000000	1500000	2762162.534	5524325.069	8286487.603
	Internal Shipyard Costs	1	LUMP SUM	400000	600000	800000	400000	600000	800000
	RWQCB Oversight Costs	19	years	30000	36000	45000	570000	684000	855000
GRAND TOTAL							179600000	237900000	302700000

VOLUME AND AREA LEDGER		TOTAL
	Total volume being dredged (CY)	1117519
	Total volume being dredged (TONS)	1676278.5
	Total area of dredging (sq. ft.)	4812792
	Total area of dredging (acres)	110.4865014

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		464316	add 10%	510747.6
Dredging, open water, cy		474903	add 10%	522393.3
Rock placement, tons		45273		
Clean sand cover, cy		267377.3333		
Underpier sand, sq.ft.		310025		
Time to dredge inner shipyard, days		1021.4952	Daily rate (cy)	500
	Weeks	170.2492	Days per week	6
	Months	42.5623		
Time to dredge outer shipyard, days		435.32775	Daily rate (cy)	1200
	Weeks	72.554625	Days per week	6
	Months	18.13865625		
Time to place rock, days		60.364	Daily rate (tons)	750
	Weeks	10.06066667	Days per week	6
	Months	2.515166667		
Time to place clean sand, days		133.6886667	Daily rate (cy)	2000
	Weeks	22.28144444	Days per week	6
	Months	5.570361111		
Time to place underpier sand, days		26.73773333	Daily rate (sf)	10000
	Weeks	4.456288889	Days per week	6
	Months	1.114072222		
	Total weeks of in-water work	279.602225		
	Total months of in-water work	69.90055625		
	CONSTRUCTION SEASONS	12	Months per season	6

Item		Probable Quantity	Unit	Probable Minimum Unit Cost	Probable Likely Unit Cost	Probable Maximum Unit Cost	Probable Minimum Cost	Probable Likely Cost	Probable Maximum Cost
DESIGN AND PERMITTING									
	Additional Pre-Design Site Characterization	1	LUMP SUM	400000	500000	600000	400000	500000	600000
	Surveys and Engineering Design	1	LUMP SUM	800000	1000000	1200000	800000	1000000	1200000
	Permitting	1	LUMP SUM	200000	300000	400000	200000	300000	400000
CEQA EIR		1	LUMP SUM	400000	700000	900000	400000	700000	900000
CONSTRUCTION PREPARATION									
	Mobilization(s) and Demobilization(s)	14	CONSTRUCTION SEASONS	200000	250000	300000	2800000	3500000	4200000
	Demolition	1	LUMP SUM	500000	650000	800000	500000	650000	800000
DREDGING									
	Unconstrained open-water dredging (outside of leasehold area)	683453	CY	6	7	10	4100718	4784171	6834530
	Constrained dredging from inner shipyard (within leasehold ar	464316	CY	10	13	18	4643160	6036108	8357688
	Dredging Surface/Subsurface Debris	57388.45	CY	70	89	120	4017191.5	5107572.05	6886614
	Engineering Controls (silt curtain, oil boom)	14	CONSTRUCTION SEASONS	25000	28000	32000	350000	392000	448000
	Additional Dredging (if needed)	228400	CY	10	13	18	2284000	2969200	4111200
MARINE STRUCTURES									
	Placement of Quarry Run Rock for Protection of Marine Struct	45817	TON	25	35	45	1145425	1603595	2061765
SEDIMENT OFFLOADING AND DISPOSAL									
	Acquisition or Several-Year Lease of Sediment Offloading Are	14	CONSTRUCTION SEASONS	200000	250000	300000	2800000	3500000	4200000
	Preparation of Sediment Offloading Area	1	LUMP SUM	100000	200000	300000	100000	200000	300000
	Rehandling and Dewatering	1376169	CY	10	16	25	13761690	22018704	34404225
	Transportation and Disposal at Landfill	2064253.5	TON	50	62.5	75	103212675	129015843.8	154819012.5
UNDERPIER REMEDIATION									
	Purchase and place 3 feet of clean sand/gravel beneath piers ar	313842	SF	15	20	30	4707630	6276840	9415260
PLACEMENT OF CLEAN SAND COVER		342628.6667	CY	20	35	40	6852573.333	11992003.33	13705146.67
	SW04 Cleanout, BMP Installation, Investigation	1	LUMP SUM	500000	600000	703048	500000	600000	703048
TOTAL DIRECT CONSTRUCTION COSTS							153600000	201100000	254300000
BID MANAGEMENT AND SUPPORT		1	LUMP SUM	17500	20000	25000	17500	20000	25000
CONSTRUCTION MANAGEMENT		14	CONSTRUCTION SEASONS	300000	375000	450000	4200000	5250000	6300000
CONTINGENCY		0.3	percent				47345250	61911000	78187500
MONITORING COSTS									
	Water Quality Monitoring during construction	308.9284972	week	11000	15000	18000	3398213.469	4633927.458	5560712.95
	Post-Dredging Confirmational Sampling	368.1134435	samples	4000	6000	8000	1472453.774	2208680.661	2944907.548
	Long-Term Monitoring of Remediated Areas	30	locations	32000	40000	60000	960000	1200000	1800000
	SW04 Long-Term Monitoring	1	LUMP SUM	400000	500000	595437	400000	500000	595437
OTHER (NON-CONSTRUCTION) COSTS									
	Eel Grass Habitat Mitigation (if needed)	7.079104683	ACRES	200000	400000	600000	1415820.937	2831641.873	4247462.81
	Eel Grass Land Lease Costs (in perpetuity)	7.079104683	ACRES	500000	1000000	1500000	3539552.342	7079104.683	10618657.02
	Internal Shipyard Costs	1	LUMP SUM	500000	750000	1000000	500000	750000	1000000
	RWQCB Oversight Costs	21	years	30000	36000	45000	630000	756000	945000
GRAND TOTAL							217500000	288200000	366500000

VOLUME AND AREA LEDGER		**TOTAL**
	Total volume being dredged (CY)	1376169
	Total volume being dredged (TONS)	2064253.5
	Total area of dredging (sq. ft.)	6167316
	Total area of dredging (acres)	141.5820937

ENTIRE TABLE A31-3 ADDED

ESTIMATION OF CONSTRUCTION DURATION				
Dredging, inner shipyards, cy		464316	add 10%	510747.6
Dredging, open water, cy		683453	add 10%	751798.3
Rock placement, tons		45817		
Clean sand cover, cy		342628.6667		
Underpier sand, sq.ft.		313842		
Time to dredge inner shipyard, days		1021.4952	Daily rate (cy)	500
	Weeks	170.2492	Days per week	6
	Months	42.5623		
Time to dredge outer shipyard, days		626.4985833	Daily rate (cy)	1200
	Weeks	104.4164306	Days per week	6
	Months	26.10410764		
Time to place rock, days		61.08933333	Daily rate (tons)	750
	Weeks	10.18155556	Days per week	6
	Months	2.545388889		
Time to place clean sand, days		171.3143333	Daily rate (cy)	2000
	Weeks	28.55238889	Days per week	6
	Months	7.138097222		
Time to place underpier sand, days		34.26286667	Daily rate (sf)	10000
	Weeks	5.710477778	Days per week	6
	Months	1.427619444		
	Total weeks of in-water work	319.1100528		
	Total months of in-water work	79.77751319		
	CONSTRUCTION SEASONS	14	Months per season	6

ENTIRE TABLE A31-4 ADDED

Econ Feas Scenario	Polygon Rank	Station	Area (ft2)	Station Concentrations PCBs (µg/kg)	Mercury (mg/kg)	Copper (mg/kg)	TBT (µg/kg)
Pre-Remedy							
	1	SW04	22,682	4000	1.75	1500	3250
	2	SW08	16,829	2100	2.25	920	1850
	3	SW02	39,162	5450	4.45	580	167
	4	SW24	21,179	950	1.90	300	165
	5	SW09	24,479	710	0.96	660	910
1	6	SW13	38,257	490	0.86	800	790
	7	NA17	36,471	550	0.85	510	1350
	8	SW01	33,394	1600	1.45	560	450
	9	SW16	17,835	430	0.95	430	1100
	10	SW21	11,896	2400	1.40	260	170
	11	SW28	51,554	2100	0.88	265	150
2	12	NA06	61,035	640	2.35	395	225
	13	SW20	28,175	1600	0.99	290	130
	14	SW05	24,163	1200	0.96	230	170
	15	SW23	30,077	1000	1.00	280	210
	16	SW22	3,762	900	1.10	260	190
	17	SW17	55,898	540	0.98	270	440
3	18	NA19	32,043	990	0.78	270	570

ENTIRE TABLE A31-4 ADDED

Econ Feas Scenario	Polygon Rank	Station	Area (ft2)	Station Concentrations PCBs (µg/kg)	Mercury (mg/kg)	Copper (mg/kg)	TBT (µg/kg)
	19	NA07	30,298	495	1.45	225	110.5
	20	SW14	16,732	400	1.00	280	450
	21	NA15	47,633	340	0.98	250	670
	22	SW10	21,608	610	0.58	160	250
	23	NA23	68,000	510	1.10	350	120
4	24	SW29	62,497	820	0.93	220	190
	25	NA04	72,669	250	1.10	260	300
	26	NA01	99,788	375	1.06	252.5	157
	27	NA27	53,889	210	1.20	390	100
	28	NA16	38,254	590	1.09	252.5	175
	29	SW30	72,231	380	1.10	240	200
5	30	SW27	78,889	200	0.68	210	250
	31	NA03	118,384	370	1.10	220	180
	32	SW25	69,690	350	0.78	230	230.5
	33	SW15	55,766	380	0.90	230	170
	34	SW03	48,811	410	1.20	190	53
	35	SW06	25,751	380	0.75	170	100
6	36	SW18	52,601	440	0.75	220	130

ENTIRE TABLE A31-4 ADDED

Econ Feas Scenario	Polygon Rank	Station	Area (ft2)	Station Concentrations PCBs (µg/kg)	Mercury (mg/kg)	Copper (mg/kg)	TBT (µg/kg)
	37	NA09	29,521	290	1.20	260	120
	38	SW19	214,747	94	2.10	110	37
	39	NA18	40,452	350	0.79	230	210
	40	NA08	20,352	310	0.82	270	110
	41	NA28	54,262	180	0.89	290	90
7	42	SW11	36,689	200	0.75	170	140
	43	NA21	476,122	180	0.51	150	410
	44	SW36	90,730	200	0.75	240	49
	45	NA24	65,314	290	0.88	200	59
	46	SW34	304,572	130	0.75	320	38
	47	NA11	37,813	190	0.85	180	38
8	48	NA02	164,015	210	0.70	170	82
	49	NA05	112,824	180	0.61	170	110
	50	NA13	255,727	170	0.65	185	68
	51	NA22	54,670	180	0.38	150	120
	52	NA10	29,136	160	0.58	160	91
	53	NA12	91,096	150	0.62	150	80
9	54	SW07	40,947	170	0.52	150	44

ENTIRE TABLE A31-4 ADDED

Econ Feas Scenario	Polygon Rank	Station	Area (ft2)	Station Concentrations PCBs (µg/kg)	Mercury (mg/kg)	Copper (mg/kg)	TBT (µg/kg)
	55	NA20	311,465	120	0.24	96	280
	56	NA30	240,838	100	0.71	140	22
	57	SW12	112,942	150	0.53	119.5	36
	58	NA29	202,964	190	0.55	110	58
	59	SW26	86,923	290	0.43	120	49
10	60	NA14	208,687	130	0.55	130	45
	61	SW32	78,477	160	0.51	92	30
	62	SW33	151,872	100	0.53	100	19
	63	NA26	302,544	180	0.48	80	37
	64	NA25	521,664	83	0.42	85	25
	65	NA31	229,185	68	0.35	71	20
11	66	SW31	83,499	66	0.23	54	36
		Total	**6,232,430**				

Notes:

SWAC values in each row result from remediation of all polygons up to and including that row

Areas include all under pier and technically infeasible areas

Chollas Creek mouth TMDL area not included in poygons NA20, NA21, and NA22

Costs and concentration data from July, 2010

ENTIRE TABLE A31-4 ADDED

Econ Feas Scenario	Polygon Rank	Station	Station Concentrations HPAH (µg/kg)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)
Pre-Remedy							
	1	SW04	13000	73.0	1.95	430	3450
	2	SW08	26000	24.0	0.73	225	830
	3	SW02	14000	13.8	3.18	170	585
	4	SW24	58000	10.0	0.33	88	300
	5	SW09	17000	27.0	1.10	220	1200
1	6	SW13	12000	15.0	0.42	93	580
	7	NA17	3900	14.5	0.41	115	620
	8	SW01	10000	13.5	0.71	145	520
	9	SW16	5700	12.0	0.66	97	370
	10	SW21	9700	11.0	0.51	120	330
	11	SW28	20000	14.0	0.32	100	330
2	12	NA06	4400	10.5	0.27	130	335
	13	SW20	11000	14.0	0.41	110	390
	14	SW05	13000	11.0	0.86	120	280
	15	SW23	11000	15.0	0.37	110	330
	16	SW22	12000	13.0	0.35	110	310
	17	SW17	10000	12.0	0.37	93	310
3	18	NA19	3000	14.0	0.37	100	450

ENTIRE TABLE A31-4 ADDED

			Station Concentrations				
Econ Feas Scenario	**Polygon Rank**	**Station**	**HPAH (µg/kg)**	**Arsenic (mg/kg)**	**Cadmium (mg/kg)**	**Lead (mg/kg)**	**Zinc (mg/kg)**
	19	NA07	15850	13.5	0.27	100	255
	20	SW14	8400	10.0	0.31	88	300
	21	NA15	3300	12.0	0.25	83	310
	22	SW10	16000	13.0	0.87	79	360
	23	NA23	3400	12.0	0.26	120	430
4	24	SW29	4600	8.3	0.49	72	230
	25	NA04	3500	12.0	0.27	93	310
	26	NA01	7550	10.2	0.24	84	297.5
	27	NA27	2800	13.0	0.29	110	500
	28	NA16	3700	10.5	0.36	89.75	312.5
	29	SW30	4900	8.9	0.23	72	300
5	30	SW27	12000	10.0	0.27	80	250
	31	NA03	6100	11.0	0.29	94	260
	32	SW25	11000	11.5	0.36	85.5	345
	33	SW15	7700	11.0	0.45	90	290
	34	SW03	6800	11.0	0.70	79	230
	35	SW06	12000	15.0	0.85	81	280
6	36	SW18	8100	11.0	0.33	86	280

ENTIRE TABLE A31-4 ADDED

Econ Feas Scenario	Polygon Rank	Station	Station Concentrations HPAH (µg/kg)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)
	37	NA09	2800	13.0	0.40	97	330
	38	SW19	1100	7.1	0.15	51	150
	39	NA18	2400	14.0	0.36	97	380
	40	NA08	3500	18.0	0.31	96	330
	41	NA28	3400	10.0	0.31	84	390
7	42	SW11	8000	9.6	0.24	74	240
	43	NA21	2100	11.0	0.39	83	250
	44	SW36	4000	9.9	0.21	79	300
	45	NA24	2100	9.6	0.20	88	280
	46	SW34	1400	8.3	0.21	99	310
	47	NA11	2800	9.3	0.28	73	230
8	48	NA02	2800	10.0	0.21	76	240
	49	NA05	2800	9.5	0.17	65	210
	50	NA13	1500	10.8	0.24	75	295
	51	NA22	3600	8.5	0.46	95	230
	52	NA10	1800	6.9	0.22	59	190
	53	NA12	2000	9.5	0.18	59	210
9	54	SW07	3800	8.1	0.19	57	170

ENTIRE TABLE A31-4 ADDED

Econ Feas Scenario	Polygon Rank	Station	HPAH (µg/kg)	Arsenic (mg/kg)	Cadmium (mg/kg)	Lead (mg/kg)	Zinc (mg/kg)
			Station Concentrations				
	55	NA20	2900	6.6	0.44	53	190
	56	NA30	1000	7.5	0.22	59	170
	57	SW12	3000	7.4	0.14	52	160
	58	NA29	1900	6.9	0.14	56	170
	59	SW26	1600	9.0	0.14	58	160
10	60	NA14	1100	9.0	0.25	66	200
	61	SW32	830	9.4	0.06	57	160
	62	SW33	1000	10.0	0.07	58	170
	63	NA26	850	6.2	0.11	41	140
	64	NA25	1100	6.0	0.11	41	130
	65	NA31	530	5.3	0.13	34	110
11	66	SW31	1200	4.0	0.06	21	80
		Total					

ENTIRE TABLE A31-4 ADDED

PCB SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
Pre-Remedy			308		
	1	SW04	294	90,728,000	1,905,288
	2	SW08	288	35,340,900	1,413,636
	3	SW02	255	213,432,900	3,289,608
	4	SW24	252	20,120,050	1,779,036
	5	SW09	249	17,380,090	2,056,236
1	6	SW13	247	18,745,930	3,213,588
	7	NA17	244	20,059,050	3,063,564
	8	SW01	236	53,429,936	2,805,072
	9	SW16	235	7,669,050	1,498,140
	10	SW21	230	28,551,168	999,291
	11	SW28	214	108,263,400	4,330,536
2	12	NA06	208	39,062,400	5,126,940
	13	SW20	201	45,080,000	2,366,700
	14	SW05	197	28,995,600	2,029,692
	15	SW23	193	30,077,000	2,526,468
	16	SW22	192	3,385,602	315,990
	17	SW17	188	30,184,920	4,695,432
3	18	NA19	183	31,722,570	2,691,612

ENTIRE TABLE A31-4 ADDED

PCB SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	19	NA07	181	14,997,277	2,544,993
	20	SW14	181	6,692,772	1,405,482
	21	NA15	179	16,195,220	4,001,172
	22	SW10	177	13,180,880	1,815,072
	23	NA23	172	34,680,000	5,712,000
4	24	SW29	165	51,247,540	5,249,748
	25	NA04	163	18,167,250	6,104,196
	26	NA01	158	37,420,500	8,382,192
	27	NA27	157	11,316,690	4,526,676
	28	NA16	154	22,569,860	3,213,336
	29	SW30	151	27,447,765	6,067,401
5	30	SW27	149	15,777,800	6,626,676
	31	NA03	144	43,802,080	9,944,256
	32	SW25	141	24,391,500	5,853,960
	33	SW15	138	21,191,080	4,684,344
	34	SW03	135	20,012,510	4,100,124
	35	SW06	134	9,785,380	2,163,084
6	36	SW18	131	23,144,440	4,418,484

ENTIRE TABLE A31-4 ADDED

PCB SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	37	NA09	130	8,561,090	2,479,764
	38	SW19	130	20,186,176	18,038,710
	39	NA18	128	14,158,200	3,397,968
	40	NA08	127	6,309,139	1,709,573
	41	NA28	127	9,767,153	4,558,005
7	42	SW11	126	7,337,800	3,081,876
	43	NA21	119	85,701,960	39,994,248
	44	SW36	117	18,146,000	7,621,320
	45	NA24	115	18,941,060	5,486,376
	46	SW34	113	39,594,360	25,584,048
	47	NA11	112	7,184,540	3,176,323
8	48	NA02	109	34,443,150	13,777,260
	49	NA05	107	20,308,320	9,477,216
	50	NA13	103	43,473,607	21,481,076
	51	NA22	102	9,840,600	4,592,280
	52	NA10	102	4,661,755	2,447,421
	53	NA12	101	13,664,400	7,652,064
9	54	SW07	101	6,960,990	3,439,548

ENTIRE TABLE A31-4 ADDED

PCB SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	55	NA20	99	37,375,800	26,163,060
	56	NA30	98	24,083,772	20,230,368
	57	SW12	97	16,941,300	9,487,128
	58	NA29	94	38,563,160	17,048,976
	59	SW26	91	25,207,670	7,301,532
10	60	NA14	89	27,129,365	17,529,743
	61	SW32	88	12,556,291	6,592,053
	62	SW33	88	15,187,214	12,757,260
	63	NA26	83	54,457,846	25,413,662
	64	NA25	83	43,298,100	43,819,764
	65	NA31	84	15,584,608	19,251,574
11	66	SW31	84	5,510,934	7,013,916
		Total			

ENTIRE TABLE A31-4 ADDED

Mercury SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (mg/kg)	Conc x Area	[Bkgd] x Area
Pre-Remedy			0.75		
	1	SW04	0.75	39,694	12,929
	2	SW08	0.75	37,865	9,593
	3	SW02	0.72	174,271	22,322
	4	SW24	0.72	40,240	12,072
	5	SW09	0.72	23,500	13,953
1	6	SW13	0.71	32,901	21,806
	7	NA17	0.71	30,818	20,788
	8	SW01	0.71	48,421	19,034
	9	SW16	0.71	16,943	10,166
	10	SW21	0.70	16,655	6,781
	11	SW28	0.70	45,110	29,386
2	12	NA06	0.68	143,432	34,790
	13	SW20	0.68	27,893	16,060
	14	SW05	0.68	23,196	13,773
	15	SW23	0.68	30,077	17,144
	16	SW22	0.68	4,138	2,144
	17	SW17	0.67	54,780	31,862
3	18	NA19	0.67	24,994	18,265

ENTIRE TABLE A31-4 ADDED

Mercury SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (mg/kg)	Conc x Area	[Bkgd] x Area
	19	NA07	0.67	43,931	17,270
	20	SW14	0.67	16,732	9,537
	21	NA15	0.67	46,680	27,151
	22	SW10	0.67	12,533	12,317
	23	NA23	0.66	74,800	38,760
4	24	SW29	0.66	58,122	35,623
	25	NA04	0.65	79,936	41,421
	26	NA01	0.64	106,025	56,879
	27	NA27	0.64	64,667	30,717
	28	NA16	0.63	41,792	21,805
	29	SW30	0.63	79,454	41,172
5	30	SW27	0.63	53,645	44,967
	31	NA03	0.62	130,222	67,479
	32	SW25	0.61	54,010	39,723
	33	SW15	0.61	50,189	31,787
	34	SW03	0.61	58,573	27,822
	35	SW06	0.60	19,313	14,678
6	36	SW18	0.60	39,451	29,983

ENTIRE TABLE A31-4 ADDED

Mercury SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (mg/kg)	Conc x Area	[Bkgd] x Area
	37	NA09	0.60	35,425	16,827
	38	SW19	0.55	450,968	122,406
	39	NA18	0.55	31,957	23,058
	40	NA08	0.55	16,689	11,601
	41	NA28	0.54	48,293	30,929
7	42	SW11	0.54	27,517	20,913
	43	NA21	0.55	242,822	271,390
	44	SW36	0.54	68,048	51,716
	45	NA24	0.54	57,476	37,229
	46	SW34	0.53	228,429	173,606
	47	NA11	0.53	32,141	21,554
8	48	NA02	0.53	114,811	93,489
	49	NA05	0.53	68,823	64,310
	50	NA13	0.52	164,944	145,764
	51	NA22	0.52	20,775	31,162
	52	NA10	0.52	16,899	16,608
	53	NA12	0.52	56,480	51,925
9	54	SW07	0.52	21,292	23,340

ENTIRE TABLE A31-4 ADDED

Mercury SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (mg/kg)	Conc x Area	[Bkgd] x Area
	55	NA20	0.54	74,752	177,535
	56	NA30	0.53	170,995	137,278
	57	SW12	0.54	59,295	64,377
	58	NA29	0.54	111,630	115,689
	59	SW26	0.54	37,377	49,546
10	60	NA14	0.54	114,778	118,952
	61	SW32	0.54	40,023	44,732
	62	SW33	0.54	80,492	86,567
	63	NA26	0.54	145,221	172,450
	64	NA25	0.56	219,099	297,348
	65	NA31	0.57	80,215	130,636
11	66	SW31	0.57	19,205	47,594
		Total			

ENTIRE TABLE A31-4 ADDED

Copper SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (mg/kg)	Conc x Area	[Bkgd] x Area
Pre-Remedy			187		
	1	SW04	182	34,023,000	2,744,522
	2	SW08	180	15,482,680	2,036,309
	3	SW02	177	22,713,960	4,738,602
	4	SW24	176	6,353,700	2,562,659
	5	SW09	174	16,156,140	2,961,959
1	6	SW13	170	30,605,600	4,629,097
	7	NA17	168	18,600,210	4,412,991
	8	SW01	165	18,700,478	4,040,639
	9	SW16	165	7,669,050	2,158,035
	10	SW21	164	3,093,043	1,439,455
	11	SW28	163	13,661,810	6,238,034
2	12	NA06	160	24,108,825	7,385,235
	13	SW20	160	8,170,750	3,409,175
	14	SW05	159	5,557,490	2,923,723
	15	SW23	158	8,421,560	3,639,317
	16	SW22	158	978,063	455,175
	17	SW17	157	15,092,460	6,763,658
3	18	NA19	156	8,651,610	3,877,203

ENTIRE TABLE A31-4 ADDED

Copper SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (mg/kg)	Conc x Area	[Bkgd] x Area
	19	NA07	156	6,816,944	3,666,001
	20	SW14	155	4,684,940	2,024,564
	21	NA15	154	11,908,250	5,763,593
	22	SW10	154	3,457,280	2,614,568
	23	NA23	152	23,800,000	8,228,000
4	24	SW29	151	13,749,340	7,562,137
	25	NA04	149	18,893,940	8,792,949
	26	NA01	147	25,196,470	12,074,348
	27	NA27	145	21,016,710	6,520,569
	28	NA16	144	9,659,135	4,628,734
	29	SW30	142	17,335,430	8,739,946
5	30	SW27	141	16,566,690	9,545,569
	31	NA03	139	26,044,480	14,324,464
	32	SW25	138	16,028,700	8,432,490
	33	SW15	137	12,826,180	6,747,686
	34	SW03	137	9,274,090	5,906,131
	35	SW06	137	4,377,670	3,115,871
6	36	SW18	136	11,572,220	6,364,721

ENTIRE TABLE A31-4 ADDED

Copper SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (mg/kg)	Conc x Area	[Bkgd] x Area
	37	NA09	135	7,675,460	3,572,041
	38	SW19	135	23,622,121	25,984,333
	39	NA18	135	9,303,960	4,894,692
	40	NA08	134	5,495,056	2,462,599
	41	NA28	133	15,735,968	6,565,697
7	42	SW11	132	6,237,130	4,439,369
	43	NA21	130	71,418,300	57,610,762
	44	SW36	129	21,775,200	10,978,330
	45	NA24	128	13,062,800	7,902,994
	46	SW34	118	97,463,040	36,853,212
	47	NA11	118	6,806,407	4,575,418
8	48	NA02	116	27,882,550	19,845,815
	49	NA05	115	19,180,080	13,651,704
	50	NA13	113	47,309,514	30,942,979
	51	NA22	113	8,200,500	6,615,070
	52	NA10	112	4,661,755	3,525,452
	53	NA12	112	13,664,400	11,022,616
9	54	SW07	112	6,142,050	4,954,587

ENTIRE TABLE A31-4 ADDED

Copper SWACs

Econ Feas Scenario	**Polygon Rank**	**Station**	**SWAC (mg/kg)**	**Conc x Area**	**[Bkgd] x Area**
	55	NA20	113	29,900,640	37,687,265
	56	NA30	112	33,717,281	29,141,364
	57	SW12	112	13,496,569	13,665,982
	58	NA29	113	22,326,040	24,558,644
	59	SW26	113	10,430,760	10,517,683
10	60	NA14	112	27,129,365	25,251,178
	61	SW32	113	7,219,867	9,495,695
	62	SW33	113	15,187,214	18,376,529
	63	NA26	115	24,203,487	36,607,774
	64	NA25	118	44,341,428	63,121,327
	65	NA31	120	16,272,164	27,731,435
11	66	SW31	121	4,508,946	10,103,379
		Total			

ENTIRE TABLE A31-4 ADDED

TBT SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
Pre-Remedy			162		
	1	SW04	151	73,716,500	499,004
	2	SW08	146	31,133,650	370,238
	3	SW02	145	6,540,054	861,564
	4	SW24	144	3,494,535	465,938
	5	SW09	141	22,275,890	538,538
1	6	SW13	136	30,223,030	841,654
	7	NA17	128	49,235,850	802,362
	8	SW01	126	15,027,170	734,662
	9	SW16	123	19,618,500	392,370
	10	SW21	123	2,022,374	261,719
	11	SW28	122	7,733,100	1,134,188
2	12	NA06	120	13,732,875	1,342,770
	13	SW20	119	3,662,750	619,850
	14	SW05	119	4,107,710	531,586
	15	SW23	118	6,316,170	661,694
	16	SW22	118	714,738	82,759
	17	SW17	114	24,595,120	1,229,756
3	18	NA19	111	18,264,510	704,946

ENTIRE TABLE A31-4 ADDED

TBT SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	19	NA07	111	3,347,877	666,546
	20	SW14	109	7,529,369	368,102
	21	NA15	105	31,914,110	1,047,926
	22	SW10	104	5,402,000	475,376
	23	NA23	103	8,160,000	1,496,000
4	24	SW29	101	11,874,430	1,374,934
	25	NA04	98	21,800,700	1,598,718
	26	NA01	96	15,666,716	2,195,336
	27	NA27	95	5,388,900	1,185,558
	28	NA16	94	6,694,450	841,588
	29	SW30	92	14,446,192	1,589,081
5	30	SW27	89	19,722,250	1,735,558
	31	NA03	86	21,309,120	2,604,448
	32	SW25	84	16,063,545	1,533,180
	33	SW15	82	9,480,220	1,226,852
	34	SW03	82	2,586,983	1,073,842
	35	SW06	82	2,575,100	566,522
6	36	SW18	81	6,838,130	1,157,222

ENTIRE TABLE A31-4 ADDED

TBT SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	37	NA09	80	3,542,520	649,462
	38	SW19	80	7,945,622	4,724,424
	39	NA18	79	8,494,920	889,944
	40	NA08	78	2,238,727	447,745
	41	NA28	78	4,883,576	1,193,763
7	42	SW11	77	5,136,460	807,158
	43	NA21	47	195,210,020	10,474,684
	44	SW36	47	4,445,770	1,996,060
	45	NA24	47	3,853,526	1,436,908
	46	SW34	46	11,573,736	6,700,584
	47	NA11	46	1,436,908	831,894
8	48	NA02	44	13,449,230	3,608,330
	49	NA05	43	12,410,640	2,482,128
	50	NA13	41	17,389,443	5,625,996
	51	NA22	40	6,560,400	1,202,740
	52	NA10	40	2,651,373	640,991
	53	NA12	39	7,287,680	2,004,112
9	54	SW07	39	1,801,668	900,834

ENTIRE TABLE A31-4 ADDED

TBT SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	55	NA20	26	87,210,200	6,852,230
	56	NA30	26	5,298,430	5,298,430
	57	SW12	25	4,065,912	2,484,724
	58	NA29	24	11,771,912	4,465,208
	59	SW26	24	4,259,227	1,912,306
10	60	NA14	23	9,390,934	4,591,123
	61	SW32	23	2,354,305	1,726,490
	62	SW33	23	2,885,571	3,341,187
	63	NA26	22	11,194,113	6,655,959
	64	NA25	22	13,041,597	11,476,605
	65	NA31	22	4,583,708	5,042,079
11	66	SW31	22	3,005,964	1,836,978
		Total			

ENTIRE TABLE A31-4 ADDED

HPAH SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
Pre-Remedy			3,612		
	1	SW04	3,567	294,866,000	15,264,986
	2	SW08	3,499	437,554,000	11,325,917
	3	SW02	3,415	548,268,000	26,356,026
	4	SW24	3,220	1,228,382,000	14,253,467
	5	SW09	3,156	416,143,000	16,474,367
1	6	SW13	3,086	459,084,000	25,746,961
	7	NA17	3,068	142,236,900	24,544,983
	8	SW01	3,018	333,937,100	22,473,967
	9	SW16	3,003	101,659,500	12,002,955
	10	SW21	2,986	115,394,304	8,006,223
	11	SW28	2,826	1,031,080,000	34,695,842
2	12	NA06	2,790	268,554,000	41,076,555
	13	SW20	2,743	309,925,000	18,961,775
	14	SW05	2,695	314,119,000	16,261,699
	15	SW23	2,645	330,847,000	20,241,821
	16	SW22	2,638	45,141,360	2,531,678
	17	SW17	2,555	558,980,000	37,619,354
3	18	NA19	2,543	96,129,000	21,564,939

ENTIRE TABLE A31-4 ADDED

HPAH SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	19	NA07	2,469	480,215,851	20,390,238
	20	SW14	2,448	140,548,212	11,260,589
	21	NA15	2,428	157,188,900	32,057,009
	22	SW10	2,375	345,728,000	14,542,184
	23	NA23	2,345	231,200,000	45,764,000
4	24	SW29	2,306	287,486,200	42,060,481
	25	NA04	2,273	254,341,500	48,906,237
	26	NA01	2,163	753,399,400	67,157,324
	27	NA27	2,144	150,889,200	36,267,297
	28	NA16	2,126	141,539,800	25,744,942
	29	SW30	2,077	353,931,704	48,611,436
5	30	SW27	1,934	946,668,000	53,092,297
	31	NA03	1,830	722,142,400	79,672,432
	32	SW25	1,715	766,590,000	46,901,370
	33	SW15	1,652	429,398,200	37,530,518
	34	SW03	1,604	331,914,800	32,849,803
	35	SW06	1,557	309,012,000	17,330,423
6	36	SW18	1,495	426,068,100	35,400,473

ENTIRE TABLE A31-4 ADDED

HPAH SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	37	NA09	1,485	82,658,800	19,867,633
	38	SW19	1,470	236,221,205	144,524,428
	39	NA18	1,459	97,084,800	27,224,196
	40	NA08	1,449	71,232,210	13,696,936
	41	NA28	1,426	184,490,664	36,518,299
7	42	SW11	1,382	293,512,000	24,691,697
	43	NA21	1,273	999,856,200	320,430,106
	44	SW36	1,225	362,920,000	61,061,290
	45	NA24	1,210	137,159,400	43,956,322
	46	SW34	1,175	426,400,800	204,976,956
	47	NA11	1,162	105,877,436	25,448,398
8	48	NA02	1,106	459,242,000	110,382,095
	49	NA05	1,067	315,907,200	75,930,552
	50	NA13	1,033	383,590,650	172,104,338
	51	NA22	1,008	196,812,000	36,792,910
	52	NA10	1,002	52,444,746	19,608,508
	53	NA12	983	182,192,000	61,307,608
9	54	SW07	962	155,598,600	27,557,331

ENTIRE TABLE A31-4 ADDED

HPAH SWACs

Econ Feas Scenario	Polygon Rank	Station	SWAC (µg/kg)	Conc x Area	[Bkgd] x Area
	55	NA20	851	903,248,500	209,615,945
	56	NA30	838	240,837,720	162,083,786
	57	SW12	796	338,826,000	76,009,966
	58	NA29	756	385,631,600	136,594,772
	59	SW26	743	139,076,800	58,499,179
10	60	NA14	729	229,556,162	140,446,634
	61	SW32	727	65,135,761	52,814,900
	62	SW33	719	151,872,140	102,209,950
	63	NA26	711	257,162,052	203,611,836
	64	NA25	675	573,830,246	351,079,778
	65	NA31	680	121,468,267	154,241,781
11	66	SW31	673	100,198,800	56,194,827
		Total			

ENTIRE TABLE A31-5 ADDED

Survey station	Arsenic (mg/kg dry)	Cadmium (mg/kg dry)	Chromium (mg/kg dry)	Copper (mg/kg dry)	Lead (mg/kg dry)
BACKGRND	7.5	0.33	57	121	53
NA01	10.2	0.24	70	253	84 *J*
NA02	10	0.21	67	170	76 *J*
NA03	11	0.29	69	220	94 *J*
NA04	12	0.27	73	260	93 *J*
NA05	9.5	0.17	57	170	65
NA06	11	0.27	62 *J*	395	130
NA07	14	0.27	61	225 *J*	100
NA08	18	0.31	79	270 *J*	96
NA09	13	0.40	75	260 *J*	97
NA10	6.9	0.22	52	160 *J*	59
NA11	9.3	0.28	59	180	73
NA12	9.5	0.18 *U*	54	150	59 *J*
NA13	10.8 *J*	0.24	59	185	75 *J*
NA14	9.0	0.25	56	130 *J*	66
NA15	12	0.25	62	250	83 *J*
NA16	10.5	0.36	70.3 *J*	252.5	89.8
NA17	15	0.41	74 *J*	510	115 *J*
NA18	14	0.36	67	230 *J*	97
NA19	14	0.37	65	270	100 *J*
NA20	6.6	0.44	26	96	53 *J*
NA21	11	0.39	51	150 *J*	83
NA22	8.5	0.46	39	150 *J*	95
NA23	12	0.26	77 *J*	350	120
NA24	9.6	0.20	60 *J*	200	88
NA25	6.0	0.11	33 *J*	85	41
NA26	6.2 *J*	0.11	32	80	41
NA27	13	0.29	100	390	110
NA28	10	0.31	86	290	84
NA29	6.9 *J*	0.14	39	110	56
NA30	7.5 *J*	0.22	37	140	59
NA31	5.3	0.13	29 *J*	71	34
SW01	14	0.71	79	560 *J*	145
SW02	14	3.2	119	580 *J*	170
SW03	11	0.70	52	190 *J*	79
SW04	73 *J*	2.0	88	1,500 *J*	430
SW05	11	0.86	53	230 *J*	120
SW06	15	0.85	56	170 *J*	81
SW07	8.1	0.19	43	150 *J*	57
SW08	24	0.73	83	920 *J*	225
SW09	27	1.1	56	660 *J*	220
SW10	13	0.87	45	160 *J*	79

ENTIRE TABLE A31-5 ADDED

Survey station	Arsenic (mg/kg dry)	Cadmium (mg/kg dry)	Chromium (mg/kg dry)	Copper (mg/kg dry)	Lead (mg/kg dry)
SW11	9.6	0.24	62	170	74
SW12	7.4 *J*	0.14	39	120 *J*	52
SW13	15	0.42	72	800	93
SW14	10	0.31	63	280	88
SW15	11	0.45	67	230	90
SW16	12	0.66	68	430	97
SW17	12	0.37	73	270	93
SW18	11	0.33	74	220	86
SW19	7.1	0.15	42	110 *J*	51
SW20	14	0.41	68	290 *J*	110
SW21	11	0.51	70	260	120
SW22	13	0.35	70	260 *J*	110
SW23	15	0.37	89	280 *J*	110
SW24	10 *J*	0.33	53	300 *J*	88
SW25	12 *J*	0.36	65	230 *J*	86
SW26	9.0	0.14	45	120 *J*	58
SW27	10	0.27	63	210	80
SW28	14 *J*	0.32	66	265	100 *J*
SW29	8.3	0.49	44 *J*	220	72
SW30	8.9	0.23	72	240	72
SW31	4.0 *J*	0.064	18	54	21
SW32	9.4 *J*	0.064	43 *J*	92	57
SW33	10 *J*	0.065	41	100	58
SW34	8.3 *J*	0.21	53	320	99
SW36	9.9	0.21	70 *J*	240 *J*	79

ENTIRE TABLE A31-5 ADDED

Survey station	Mercury (mg/kg dry)	Zinc (mg/kg dry)	Tributyltin (µg/kg dry)	Total PCB Congeners, full dl (ng/g dry)	Total HPAH, full dl (µg/kg dry)
BACKGRND	0.57	192	22	84	673
NA01	1.1 *J*	298	157 *J*	375	7,550
NA02	0.70	240	82	210	2,800
NA03	1.1	260	180	370	6,100
NA04	1.1	310	300	250	3,500
NA05	0.61	210 *J*	110	180	2,800
NA06	2 *J*	335 *J*	225 *J*	640	4,400
NA07	1.5	255 *J*	111	495	15,850
NA08	0.82	330 *J*	110	310	3,500
NA09	1.2	330 *J*	120	290	2,800
NA10	0.58	190 *J*	91	160	1,800
NA11	0.85	230 *J*	38 *J*	190	2,800
NA12	0.62	210	80	150	2,000
NA13	0.65	295	68	170	1,500
NA14	0.55	200 *J*	45	130	1,100
NA15	0.98	310	670	340	3,300
NA16	1.1 *J*	313 *J*	175	590	3,700
NA17	0.85 *J*	620 *J*	1,350	550	3,900
NA18	0.79	380 *J*	210	350	2,400
NA19	0.78	450	570	990	3,000
NA20	0.24	190	280	120	2,900
NA21	0.51	250 *J*	410	180	2,100
NA22	0.38	230 *J*	120	180	3,600
NA23	1.1	430 *J*	120	510	3,400
NA24	0.88 *J*	280 *J*	59	290	2,100
NA25	0.42 *J*	130 *J*	25	83	1,100
NA26	0.48	140	37	180	850
NA27	1.2	500	100	210	2,800
NA28	0.89	390	90	180	3,400
NA29	0.55	170	58	190	1,900
NA30	0.71	170	22	100	1,000
NA31	0.35 *J*	110 *J*	20 *J*	68	530
SW01	1.5 *J*	520 *J*	450	1,600	10,000
SW02	4.5 *J*	585 *J*	167 *J*	5,450	14,000
SW03	1.2	230 *J*	53	410	6,800
SW04	1.8	3,450 *J*	3,250 *J*	4,000	13,000
SW05	0.96	280 *J*	170	1,200	13,000
SW06	0.75	280 *J*	100	380	12,000
SW07	0.52	170 *J*	44	170	3,800
SW08	2.3	830 *J*	1,850 *J*	2,100	26,000
SW09	0.96	1,200 *J*	910	710	17,000
SW10	0.58	360 *J*	250	610	16,000

ENTIRE TABLE A31-5 ADDED

Survey station	Mercury (mg/kg dry)	Zinc (mg/kg dry)	Tributyltin (µg/kg dry)	Total PCB Congeners, full dl (ng/g dry)	Total HPAH, full dl (µg/kg dry)
SW11	0.75	240 *J*	140	200	8,000
SW12	0.53	160 *J*	36	150	3,000
SW13	0.86	580 *J*	790	490	12,000
SW14	1.0	300 *J*	450	400	8,400
SW15	0.90	290 *J*	170	380	7,700
SW16	0.95	370 *J*	1,100	430	5,700
SW17	0.98	310 *J*	440	540	10,000
SW18	0.75	280 *J*	130	440	8,100
SW19	2.1	150 *J*	37	94	1,100
SW20	0.99	390 *J*	130	1,600	11,000
SW21	1.4	330 *J*	170	2,400	9,700
SW22	1.1	310 *J*	190	900	12,000
SW23	1.0	330 *J*	210	1,000	11,000
SW24	1.9	300 *J*	165	950	58,000
SW25	0.78	345 *J*	231 *J*	350	11,000
SW26	0.43	160 *J*	49	290	1,600
SW27	0.68	250 *J*	250	200	12,000
SW28	0.88	330	150 *J*	2,100	20,000
SW29	0.93 *J*	230 *J*	190	820	4,600
SW30	1.1 *J*	300	200	380	4,900
SW31	0.23	80	36 *J*	66	1,200
SW32	0.51 *J*	160 *J*	30	160	830
SW33	0.53	170	19 *J*	100	1,000
SW34	0.75	310	38	130	1,400
SW36	0.75	300 *J*	49	200	4,000

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Appendix For
Section 32

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Table A32-26 Supporting Calculations for Section 32.7.1 Technological and Economical Feasibility

Anchor QEA, L.P.
Cost Estimate for Remedial Footprint
San Diego Shipyards Sediment Site
July 12 ,2010

Item	Probable Quantity	Unit	Unit Cost	Probable Cost	Assumptions
DESIGN AND PERMITTING					
Additional Pre-Design Site Characterization	**1**	LUMP SUM	$348,000	$348,000	
Surveys and Engineering Design	**1**	LUMP SUM	$675,000	$675,000	
Permitting	**1**	LUMP SUM	$400,000	$400,000	See Note 1.
CEQA EIR - if required	**1**	LUMP SUM	$900,000	$900,000	As discussed in Note 1, we do not believe an EIR will be required; however in the event that a EIR is required, we have added in estimated costs for the preparation and submittal of an EIR.
CONSTRUCTION PREPARATION					
Mobilization(s) and Demobilization(s)	**3**	CONSTRUCTION SEASONS	$300,000	$900,000	Estimate assumes work is completed in 3 construction seasons.
Demolition	**1**	LUMP SUM	$500,000	~~$500,000~~ $450,000	~~Includes demolition of dormant BAE pier.~~
DREDGING					
Unconstrained open-water dredging (outside of leasehold area)(12.5% of dredge area)	**17,925**	CY	$10	$179,250	Unit costs are typical for unconstrained dredging outside of shipyard area.
Constrained dredging from inner shipyard (within leasehold area)(87.5% of dredge area)	**125,475**	CY	$18	$2,258,550	Higher cost for dredging within leasehold line, near piers, in areas of ship traffic, etc.
Dredging Surface/Subsurface Debris	**7,170**	CY	$120	$860,400	Unknown quantity. Estimates assume 5% of total dredge volume. Pricing includes landfill disposal.
Engineering Controls (silt curtain, oil boom)	**3**	CONSTRUCTION SEASONS	$32,000	$96,000	Estimate assumes work is completed in 3 construction seasons.
Additional Dredging (as needed for 2nd pass)	**28,100**	CY	$18	$505,800	Two feet of dredging over one-half the remedial area. Same unit costs as for constrained dredging from inner shipyard.
MARINE STRUCTURES					
Placement of Quarry Run Rock for Protection of Marine Structures	**21,887**	TON	$45	$984,915	No structural retrofit of structures is assumed to be necessary. Estimated costs assume setback of dredging from marine structures and revetments, and placement of quarry run blankets or berms to reinstate lateral resistance.
SEDIMENT OFFLOADING AND DISPOSAL					
Acquisition/Lease of Sediment Offloading Area	**3**	CONSTRUCTION SEASONS	$300,000	$900,000	An off-site sediment staging area will be needed in the vicinity of the project area. Location is unknown at this time. Costs assume a three-year construction period.
Preparation of Sediment Offloading Area	**1**	LUMP SUM	$300,000	$300,000	Preparation of sediment handling and dewatering area.
Rehandling and Dewatering	**171,500**	CY	$25	$4,287,500	Assumes stockpiling of sediments prior to transport to landfill and addition of lime or cement admixture to facilitate dewatering.

Table A32-26 Supporting Calculations for Section 32.7.1 Technological and Economical Feasibility, Continued

Item	Probable Quantity	Unit	Unit Cost	Probable Cost	Assumptions
Transportation and Disposal at Landfill	**257,250**	TON	$75	$19,293,750	Assumes disposal at regional hazardous waste landfill outside of San Diego County (Copper Mountain in Nevada).
UNDERPIER REMEDIATION					
Purchase and place 3 feet of clean sand/gravel beneath piers and overwater structures	**103,705**	SF	$30	$3,111,150	Assumes 3 foot thick layer of sand placed only under pier areas in the dredging footprint, quarry run rock assumed to be placed on the setback areas.
PLACEMENT OF CLEAN SAND COVER	**42,211**	CY	$40	$1,688,422	Assumes one half of dredged area receives 1-3 feet of sand.
SW04 cleanout, BMP Installation, Investigation	**1**	LS	$703,048	$703,048	
TOTAL DIRECT CONSTRUCTION COSTS				~~$38,891,785~~ $38,841,785	
BID MANAGEMENT AND SUPPORT	**1**	LUMP SUM	$25,000	$25,000	
CONSTRUCTION MANAGEMENT	**3**	CONSTRUCTION SEASONS	$450,000	$1,350,000	Estimate assumes work is completed in 3 construction seasons.
CONTINGENCY	**30%**	Percent		$12,065,036	Unquantifiable or identifiable unknowns
MONITORING COSTS					
Water Quality Monitoring during construction	**24**	WEEK	$18,000	$432,000	Consistent with project approach per mediation discussions.
Post-Dredging Confirmational Sampling	**45**	SAMPLES	$8,000	$360,000	Consistent with project approach per mediation discussions.
Long-Term Monitoring of Remediated Areas	**30**	LOCATIONS	$60,000	$1,800,000	Consistent with project approach per mediation discussions.
SW04 long term monitoring	**1**	LUMP SUM	$595,437	$595,437	PV for 100 years $20K/year, 5% discount rate
OTHER (NON-CONSTRUCTION) COSTS					
Eel Grass Habitat Mitigation (if needed) Construction and maintenance)	**0.87**	ACRES	$600,000	$522,000	Assumes 5% of dredged acreage will require mitigation
Eel Grass land lease costs in perpetuity (LS)	**0.87**	ACRES	$1,500,000	$1,305,000	
Internal Shipyard Costs	**1**	LUMP SUM	$250,000	$250,000	
RWQCB Oversight Costs	**10**	YEARS	$45,000	$450,000	Duration covers periods of design, construction, and long-term monitoring oversight.
GRAND TOTAL				$58,000,000 ~~$58,100,000~~	

Note 1:
This is inclusive of all requried permits. Required permits will be identified with legal assistance. Implementation of the cleanup program requires resource agency permits and environmental review under state [California Environmental Quality Act (CEQA)] and possibly federal [National Environmental Policy Act (NEPA] guidelines.

Table A32-1

Table A32-5A SWACs and Exposure Calculation

Primary COC	Units	Pre-Remedy SWAC	Post-Remedy SWAC	Background Conc	Exposure Reduction[a]	% Exposure Reduction[b]
Copper	mg/kg	187	159	121	28	42
Mercury	mg/kg	0.75	0.68	0.57	0.07	38.9
HPAH	mg/kg	3.509	2.451	0.663	1.1	37.2
PCB	µg/kg	308	194	84	114	50.9
TBT	µg/kg	na	na	na	na	na
Secondary COC	**Units**	**Pre-Remedy SWAC**	**Post-Remedy SWAC**	**Background Conc**	**Exposure Reduction[a]**	**% Exposure Reduction[b]**
Lead	mg/kg	73	66	53	7	35.0
Zinc	mg/kg	252	221	192	31	51.7

Zinc Added

[a] Exposure reduction = current SWAC minus post-remedy SWAC
[b] Percent exposure reduction relative to background = (current SWAC - final SWAC)/(current SWAC - background) x 100 SWAC - spatially weighted average concentrations

Table A32-5B Average Prey concentration for each aquatic-dependent wildlife receptor *inside NASSCO*

		Average Prey Concentration For Each Receptor				
Primary COC	**Units**	**Brown Pelican**	**Least Tern**	**Western Grebe**	**Surf Scoter**	
Copper	mg/kg	3.9	4.1	4.1	65	
Mercury	mg/kg	0.62	0.088	0.088	0.11	
HPAH[a]	mg/kg	na	na	na	1.58	
PCB	mg/kg	3.763	1.505	1.505	0.6	
TBT	mg/kg	na	na	na	na	
Secondary COC	**Units**					**Green Turtle**
Lead	mg/kg					19
Zinc (outside NASSCO)	mg/kg	na	190	na	na	na

Zinc Added

Source for average detected prey concentrations is Appendix for Section 24
[a] Only surf scoter was identified as a wildlife risk driver in the Tier II ecological risk assessment for HPAH, identified as Benzo[a]pyrene (BAP).

Table A32-5C Average Prey concentration for each aquatic-dependent wildlife receptor *inside SWM*

		Average Prey Concentration For Each Receptor				
Primary COC	**Units**	**Brown Pelican**	**Least Tern**	**Western Grebe**	**Surf Scoter**	
Copper	mg/kg	9	9.9	9.9	48	
Mercury	mg/kg	0.52	0.088	0.088	0.1	
HPAH[a]	mg/kg	na	na	na	4.35	
PCB	mg/kg	4.009	2.273	2.273	0.861	
TBT	mg/kg	na	na	na	na	
Secondary COC	**Units**					**Green Turtle**
Lead	mg/kg					25

Source for average detected prey concentrations is Appendix for Section 24
[a] Only surf scoter was identified as a wildlife risk driver in the Tier II ecological risk assessment for HPAH, identified as Benzo[a]pyrene (BAP).

Table A32-5D Shipyard wide average prey concentration for each aquatic-dependent wildlife receptor and associated BAF

			Average Prey Concentration For Each Receptor[a]			BAF (using pre-remedy SWAC)[b]		
Primary COC	Units	Pre-Remedy SWAC	Brown Pelican, CA Sea lion	Least Tern, Western Grebe	Surf Scoter	Brown Pelican, CA Sea lion	Least Tern, Western Grebe	Surf Scoter
Copper	mg/kg	187	5.99	7.04	56.53	0.0320	0.0376	0.3023
Mercury	mg/kg	0.75	0.57	0.09	0.11	0.75623085	0.1232875	0.1443163
HPAH	mg/kg	3.509	na	na	2.97	na	na	0.8461
PCB	mg/kg	0.308	2.22	1.89	0.57	7.221	6.123	1.862
TBT	mg/kg	na	na	na	na	na	na	na
Secondary COC	**Units**	**Pre-Remedy SWAC**			**Green Turtle**			**Green Turtle**
Lead	mg/kg	73			22.00			0.3014
Zinc	mg/kg	252	na	157.32	na	na	0.62430325	na

Zinc Added

[a] Shipyard wide average concentration = average prey concentration across entire shipyard
b BAF = average chemical level in prey tissue / pre-remedy SWAC
BAF - bioaccumulation factor

Table A32-5E Future prey concentrations for each aquatic-dependent wildlife receptor

			BAF (using pre-remedy SWAC)			New Average Prey Concentration[a]		
Primary COC	Units	Post-Remedy SWAC	Brown Pelican, CA Sea lion	Least Tern, Western Grebe	Surf Scoter	Brown Pelican, CA Sea lion	Least Tern, Western Grebe	Surf Scoter
Copper	mg/kg	159	0.0320	0.0376	0.3023	5.09	5.99	48.07
Mercury	mg/kg	0.68	0.75623085	0.123	0.1443	0.51	0.084	0.098
HPAH	mg/kg	2.451	na	na	0.8461	na	na	2.074
PCB	mg/kg	0.194	7.221	6.123	1.8618	1.40	1.19	0.36
TBT	mg/kg	na	na	na	na	na	na	na
Secondary COC	**Units**	**Post-Remedy SWAC**			**Green Turtle**			**Green Turtle**
Lead	mg/kg	66			0.3014			19.89
Zinc	mg/kg	221	na	0.624	na	na	137.97	na

Zinc Added

[a] Future prey concentration = BAF * post-remedy SWAC
BAF - bioaccumulation factor

Table A32-5F Daily chemical intake

Zinc Added

Zinc Added

Receptor	Body Weight (kg)	Food Ingestion Rate (kg/day	Sediment Ingestion Rate (kg/day dw)	Area Use Factor	Absorption Efficiency	New Average Prey Concentration (mg/kg dw): Copper		Mercury	HPAH	PCB	TBT	Lead	Zinc
Brown Pelican	3.174	0.25	0.005	1	1	5.09		0.51	na	1.40	na	na	na
Least Tern	0.045	0.0053	0.00011	1	1	5.99		0.08	na	1.19	na	na	137.97
Western Grebe	1.2	0.062	0.0031	1	1	5.99		0.08	na	1.19	na	na	na
Surf Scoter	1.05	0.056	0.0028	1	1	48.07		0.10	2.07	0.36	na	na	na
Green Turtle	95	0.35	0.0186	1	1	na		na	na	na	na	19.89	na
Post-Remedy SWAC (mg/kg)						159		0.68	2.5	0.194	na	66	221

Receptor	Daily Chemical Intake (mg/kg)[a]: Copper		Mercury	HPAH	PCB	TBT	Lead	Zinc
Brown Pelican	0.6517		0.0416	na	0.1107	na	na	na
Least Tern	1.0936		0.0115	na	0.1404	na	na	16.7901
Western Grebe	0.7200		0.0061	na	0.0619	na	na	na
Surf Scoter	2.988		0.0070	0.1173	0.0198	na	na	na
Green Turtle	na		na	na	na	na	0.0862	na

Source of exposure parameters is from Section 24

[a] **Daily Intake**$_{chemical}$ = $[(CM * IR * FI * AE)_{prey} + (CM * IR * FI * AE)_{sediment}]/BW$

where:

CM = post-remedial concentration of the chemical in prey tissue or sediment (mg/kg). Prey tissue concentrations used in this equation were derived using the equation in Table 5, while the sediment concentration was based on the predicted post-remediation SWAC for the COC.

IR = ingestion rate of prey or sediment (kg/day)

FI = fraction of the daily intake of prey or sediment derived from the site (unitless area-use factor)

AE = relative gastrointestinal absorption efficiency for the chemical in a given prey or sediment (fraction)

BW = body weight of receptor species (kg)

Zinc Added

Table A32-5G

	Daily Chemical Intake (mg/kg)						
Receptor	**Copper**	**Mercury**	**HPAH**	**PCB**	**TBT**	**Lead**	**Zinc**
Brown Pelican	0.652	0.042	na	0.111	na	na	na
Least Tern	1.094	0.012	na	0.140	na	na	16.790
Western Grebe	0.720	0.0061	na	0.062	na	na	na
Surf Scoter	2.988	0.0070	0.117	0.020	na	na	na
Green Turtle	na	na	na	na	na	0.086	na
Bird Low TRV	2.3	0.039	0.14	0.09	na	0.014	17.2
Bird High TRV	52.3	0.18	1.4	1.27	na	8.75	172
Bird Geometric Mean TRV (mg/kg-day)	10.9677	0.0837854	0.44271887	0.33808283	na	0.35	54.3911758
		HQ (calculation based on geometric mean)[a]					
Receptor	**Copper**	**Mercury**	**HPAH[b]**	**PCB**	**TBT**	**Lead**	**Zinc**
Brown Pelican	0.0594	0.4962	na	0.3273	na	na	na
Least Tern	0.0997	0.1377	na	0.4153	na	na	0.3087
Western Grebe	0.0656	0.0727	na	0.1830	na	na	na
Surf Scoter	0.2724	0.0841	0.2649	0.0585	na	na	na
Green Turtle	na	na	na	na	na	0.2463	na
		HQ (calculation based on low TRV)					
Receptor	**Copper**	**Mercury**	**HPAH**	**PCB**	**TBT**	**Lead**	**Zinc**
Brown Pelican	0.283	1.066	na	1.2295	na	na	na
Least Tern	0.475	0.296	na	1.5599	na	na	0.9762
Western Grebe	0.313	0.156	na	0.6875	na	na	na
Surf Scoter	1.299	0.181	0.838	0.2198	na	na	na
Green Turtle	na	na	na	na	na	6.1573	na
		HQ (calculation based on high TRV)					
Receptor	**Copper**	**Mercury**	**HPAH**	**PCB**	**TBT**	**Lead**	**Zinc**
Brown Pelican	0.0125	0.2310	na	0.0871	na	na	na
Least Tern	0.0209	0.0641	na	0.1105	na	na	0.0976
Western Grebe	0.0138	0.0338	na	0.0487	na	na	na
Surf Scoter	0.0571	0.0392	0.0838	0.0156	na	na	na
Green Turtle	na	na	na	na	na	0.0099	na

Source of TRVs is from Section 24

[a] HQ = daily chemical intake / geometric mean TRV

[b] Only surf scoter was identified as a wildlife risk driver in the Tier II ecological risk assessment for HPAH, identified as Benzo[a]pyrene (BAP).

A yellow cell notes that the HQ value is greater than a HQ threshold value of 1

Zinc Added

Table A32-5H Selected hazard quotient

	HQ[a]						
Receptor	**Copper**	**Mercury**	**HPAH[b]**	**PCB**	**TBT**	**Lead**	**Zinc**
Brown Pelican	0.0594	0.4962	na	0.3273	na	na	na
Least Tern	0.0997	0.1377	na	0.4153	na	na	0.3087
Western Grebe	0.0656	0.0727	na	0.1830	na	na	na
Surf Scoter	0.2724	0.0841	0.2649	0.0585	na	na	na
Green Turtle	na	na	na	na	na	0.2463	na

[a] The selected HQ is based on the geometric mean TRVs

[b] Only surf scoter was identified as a wildlife risk driver in the Tier II ecological risk assessment for HPAH, identified as Benzo[a]pyrene (BAP).

Response To Comments Report

DTR Section 18

concentrations as standalone indicators of sediment toxicity is invalid for definitive assessments of sediment quality, MacDonald's assertion is incorrect.

Response 18.2

The Cleanup Team concurs with BAE Systems rebuttal comments that the use of sediment contaminant concentrations as stand-alone indicators of sediment toxicity is invalid for definitive assessments of sediment quality. The DTR used the sediment quality triad (Triad) to evaluate the potential risks to the benthic community from pollutants present at the Shipyard Sediment Site. The Triad framework is recommended by U.S. EPA (SAR283146 and SAR283124) and is considered to be a standard method for qualitatively assessing the relationship between sediment chemical concentrations and biological effects. The Triad provides a weight-of-evidence approach to sediment quality assessment by integrating synoptic measures of sediment chemistry, toxicity, and benthic community composition. Additionally, the DTR uses site-specific chemical thresholds for evaluating non-Triad stations (i.e., chemistry-only stations). These thresholds consisted of site-specific Lowest Apparent Effects Thresholds (LAETs) for individual COCs and a site-specific Median Effects Quotient (SS-MEQ) to address combined effects of multiple COCs. See Responses 18.4, 33.1 and 34.2 for details on these thresholds.

RESPONSE 18.3

DTR Section: 18, 32.5.2
Comments Submitted By: NASSCO
Comment IDs: 168

Comment

NASSCO'S COMMENT The TCAO and DTR should be corrected to identify the correct number of likely stations (Findings 18, 32). Table 18-1 in Volume II of the DTR, and the sections that follow, correctly summarize the outcome of the DTR Triad analysis. According to this analysis, there are six "likely" stations, two of which are at NASSCO (NA19 and NA22), and four of which are at BAE (SW04, SW13, SW22, and SW23). NA22 is footnoted in Table 18-1 as being excluded from the TCAO.

Response 18.3

There are 6 "likely" stations and not 3 "likely" and 3 "possible." The referenced DTR section ~~35.5.2~~ 32.5.2 will be revised to reflect this change. The revision will be provided on September 15, 2011 consistent with the Third Amended Order of Proceedings.

RESPONSE 18.4

DTR Section: 18
Comments Submitted By: NASSCO, BAE Systems, SDG&E, Coastkeeper and EHC
Comment IDs: 83, 160, 169, 280, 281, 383, 384, 385, 386, 387, 389, 472, 473

Comment

This comment is based on SDGE Comment Letter dated May 26, 2011 Section 1.0 (1.1 to 1.5) and NASSCO and BAE Rebuttal Comments.

Response To Comments Report

DTR Section 24

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24. TCAO Finding 24 and DTR Section 24: Tier II Baseline Comprehensive Risk Assessment for Aquatic-Dependent Wildlife

Finding 24 of CAO No. R9-2011-0001 states:

The Tier II risk assessment objective was to more conclusively determine whether or not Shipyard Sediment Site conditions pose an unacceptable risk to aquatic-dependent wildlife receptors of concern. The receptors of concern selected for the assessment include: California least tern (*Sterna antillarum brownie*), California brown pelican (*Pelecanus occidentalis californicus*), Western grebe (*Aechmophorus occidentalis*), Surf scoter (*Melanitta perspicillata*), California sea lion (*Zalophus californianus*), and East Pacific green turtle (*Chelonia mydas agassizii*). Based on the Tier I screening level risk assessment results, there is a potential risk to all receptors of concern ingesting prey caught at the Shipyard Sediment Site and so a Tier II assessment was conducted. To focus the risk assessment, prey items were collected within four assessment units at the Shipyard Sediment Site and from a reference area located across the bay from the site. Chemical concentrations measured in fish were used to estimate chemical exposure for the least tern, western grebe, brown pelican, and sea lion and chemical concentrations in benthic mussels and eelgrass were used to estimate chemical pollutant exposure for the surf scoter and green turtle, respectively. Based on the Tier II risk assessment results, ingestion of prey items caught within all four assessment units at the Shipyard Sediment Site poses an increased risk above reference to all receptors of concern (excluding the sea lion). The chemicals in prey tissue posing a risk include BAP, PCBs, copper, lead, mercury, and zinc.

RESPONSE 24.1

DTR Section: 24
Comments Submitted By: NASSCO, BAE Systems, SDG&E, Coastkeeper and EHC
Comment IDs: 105, 120, 143, 144, 147, 468, 489
Comment

NASSCO, BAE Systems, and SDG&E commented that the DTR's Tier II risk assessment conducted for aquatic dependent wildlife~~human health~~ was overly conservative, employed unrealistic assumptions, and did not comply with relevant state and federal guidance. The overly conservative and unrealistic assumptions include:

1. **Area Use Factor (Comment ID 105, 120, 144, and 468).** Staff assumed an area use factor ("AUF") of 1.0 for all receptors. This means that Staff assumed that the six receptors of concern—including the California least tern, California brown pelican, Western grebe, Surf scoter, California sea lion, and East Pacific green turtle—all derived 100% of their diet from prey obtained from the Shipyard. DTR, at Section 24.2.2, Table 24-6. This assumption is wholly unrealistic for all six receptors, and significantly magnified the hazard quotient for ever single receptor. Not only are the home ranges of all six species substantially greater than the 43 acre NASSCO Shipyard area, but also it defies belief that any receptor would choose to only forage an active industrial Shipyard where the