Appendix ZZ
Marine Life Mortality Report and Mitigation Calculation

Renewal of NPDES CA0109223
Carlsbad Desalination Project

Poseidon Channelside
5780 Fleet St., Suite 140 Carlsbad, California 92008 Phone: (760) 655-3900 Fax: (760) 655-3901
www.poseidonwater.com

Table of Contents

List of Tables

List of Figures

Appendix ZZ
Carlsbad Desalination Project
Marine Life Mortality Report and Mitigation Calculation

I. Marine Life Mortality Report

The Amendment to the Water Quality Control Plan for Ocean Waters of California Addressing Desalination Facility Intakes, Brine Discharges, and the Incorporation of other Non-substantive Changes (Ocean Plan Amendment) requires that the owner of a desalination facility submit a report to the Regional Water Board estimating the marine life mortality resulting from the construction and operation of the facility after implementation of the required site, design, and technology measures and mitigate for the mortality of all forms of marine life determined in the report. This Appendix ZZ is responsive to this requirement.

A. Intake Mortality – CDP Process Water

Section III.M.2.(e)(1)(a)of the Ocean Plan Amendment provides that for operational mortality related to intakes, the Marine Life Mortality Report shall include a detailed entrainment study conforming to specific requirements. The entrainment impacts associated with the intake of Carlsbad Desalination Project (CDP) process water is presented in this section. The entrainment impacts associated with the intake of flow augmentation water are addressed in the section below which address discharge mortality. The entrainment impacts associated with the intake of water for the fish return system are allocated to the intake and discharge on a flow proportional basis (42% intake and 58% discharge). A complete copy of the entrainment study is included in Report of Waste Discharge (ROWD) Appendix K (Intake/Discharge Entrainment Analysis).

The entrainment impacts presented below were estimated using the Empirical Transport Model (ETM) to determine the spatial area of the source water body and estimate proportional mortality. The Area of Production Foregone (APF) was calculated by multiplying the proportional mortality by area in the source water body using a 95% confidence bound for an assumed 100% mortality of all forms of marine life entrained. Actual entrainment mortality is expected to be lower due to use of fish friendly intake screens and fish friendly flow augmentation pumps.

At a CDP production rate of 60 MGD, the CDP will require 127 MGD of seawater for processing at the desalination facility and 0.42 MGD for fish return flow attributable to CPD process water flow. Therefore, 127.42 MGD, represents the volume of seawater required to support CPD process water requirements, and associated ichtyoplankton, the Discharger has assumed would be subject to 100% mortality. Applying the ETM/APF methodology described in the Ocean Plan, the estimated entrainment impact shown in Table 1 for the intake of CDP process water and 42% of the water required for the operation of the fish return system is 36.12 acres.

Section III.M.2.(e)(1)(a) of the Ocean Plan Amendment provides that the Regional Water Board may apply a one percent reduction to the APF acreage calculated in the Marine Life Mortality Report to Account for the reduction in entrainment of all forma of marine life when using 1.0 mm slot size screen. After accounting for the screen credit allowance, the net total APF for the intake mortality associated with the CDP process water is 35.76 acres.

Table 1
Intake Mortality – CDP Process Water

	CDP	Fish Return	Total	1 mm Screen Credit (1%)	Net Total	ROWD Supporting Documentation
Flow (MGD)	127	0.42	127.42			
Area of Production Foregone Total (Acres)	36.00	0.12	36.12	-0.36	35.76	Appendix K Appendix P

B. Discharge Mortality

The Discharger is proposing to use flow augmentation as an alternative brine discharge technology pursuant to Section III.M.2.d.(2)(d)(ii) of the Ocean Plan Amendment. Section III.M.2.d.(2)(c) that alternative brine discharge technologies may be used if:

> *[A]n owner or operator can demonstrate to the regional water board that the technology provides a comparable level of intake and mortality of all forms of marine life as wastewater dilution if wastewater is available, or multiport diffusers if wastewater is unavailable. The owner or operator must evaluate all of the individual and cumulative effects of the proposed alternative discharge method on the intake and*

mortality of all forms of marine life, including (where applicable): intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the point of discharge.

The Discharger previously demonstrated that wastewater dilution is not feasible (ROWD Appendix RR), so the discussion that follows provides a comparison of all of the individual and cumulative effects of the flow augmentation discharge method on the intake and mortality of all forms of marine life to that of the multiport diffuser. This analysis evaluates intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the point of discharge as applicable for each of the discharge technologies.

1. Flow Augmentation

This section evaluates intake-related entrainment, osmotic stress, turbulence that occurs during water conveyance and mixing, and shearing stress at the point of discharge as applicable for the flow augmentation technology.

a) Intake Related Entrainment Mortality

Section III.M.2.d.(2)(c)(i) of the Ocean Plan Amendment requires the operator use empirical studies or modeling to estimate the intake entrainment impacts of the alternative brine discharge technology using an ETM/APF approach.

At a CDP production rate of 60 MGD, the flow augmentation system is expected to require 171 MGD of seawater for brine dilution purposes and 0.58 MGD for fish return flow attributable to flow augmentation. This additional seawater withdrawal would be used to dilute the brine in the existing discharge channel prior to discharging to the receiving water.

The flow augmentation system would circulate seawater to the existing Encina Power Station (EPS) discharge channel using four low turbulence axial flow or screw centrifugal pumps and an associated conveyance system. The fish-friendly elements of the flow augmentation system are designed to reduce entrainment mortality. The analysis of the shear stress, turbulence, and osmotic stress that is expected to occur in the flow augmentation system indicates the potential for a high rate of survival of all forms of marine life exposed to the cumulative effects of the flow augmentation system (See ROWD Appendix B and Appendix I).

However, for the purposes of demonstrating to the San Diego Regional Water Quality Control Board (Regional Water Board) that the flow augmentation technology provides a comparable level of intake and mortality of all forms of marine life to that of the multiport diffuser, the Discharger has conservatively assumed the worst case outcome -- 100% mortality of all organisms passing through the flow augmentation system. At a CDP production rate of 60 MGD, the flow augmentation system will require 171 MGD of seawater for brine dilution purposes and 0.58 MGD for fish return flow attributable to flow augmentation. Therefore, 171.58 MGD, represents the volume of water, and associated ichtyoplankton, the Discharger has assumed would be subject to 100% mortality. Applying the ETM/APF methodology described in the Ocean Plan, the calculated APF associated with the operation of the flow augmentation system shown in Table 2 is 48.16 acres. After accounting for the screen credit allowance, the net APF for the intake mortality associated with flow augmentation is 47.68 acres.

Table 2
Intake Mortality – Flow Augmentation System

	Flow Augmentation System	Fish Return	Total	1 mm Screen Credit (1%)	Net Total	ROWD Supporting Documentation
Flow (MGD)	171	0.58	171.58			
Area of Production Foregone Total (Acres)	48.00	0.16	48.16	-0.48	47.68	Appendix K Appendix P

b) Brine Mixing Zone Mortality

Section III.M.2.d.(2)(c)(ii) of the Ocean Plan Amendment requires the operator use empirical studies or modeling to estimate of the degradation of all forms of marine life from elevated salinity within the brine mixing zone (BMZ), including osmotic stresses, the size of the impacted area, and the duration that all forms of marine life ae exposed to the toxic conditions. Considerations shall be given to the most sensitive species in the community structure and function.

(1) Benthic Habitat

Parts of the benthic habitat within the BMZ may be exposed to salinity in excess of 35.5 parts per thousand (ppt) for extended periods of time. The discharge mortality assessment conservatively assumes that 100% of the benthic area within the BMZ is exposed to toxic conditions. Based on this assumption, the impacted area within the BMZ is 18.51 acres (ROWD Appendix XX).

(2) Water Column

The hydrodynamic discharge modeling report for the CDP (ROWD Appendix BB) notes that due to the negative buoyancy, the brine discharge flows offshore along the bottom of the BMZ under the force of gravity. Consequently, organisms drifting through the BMZ would not be exposed to excessive shear or turbulence.

Parts of the water column within the BMZ can be exposed to salinity in excess of 35.5 parts per thousand (ppt). CFD and hydrodynamic modeling was conducted to determine the duration of larval exposure to elevated salinity (ROWD Appendix L and Appendix BB). Table 3 presents the matrix of durations based on varying flows at the CDP during average ocean conditions. These exposure durations formed the basis of the biological assays conducted during the salinity tolerance testing discussed below.

In response to the Ocean Plan Amendment requirement to estimate the potential for osmotic stress on marine life, the Discharger contracted with Nautilus Environmental (Nautilus) to estimate the potential effects of varying salinity levels on sensitive larval-stage marine organisms. This study was designed and conducted to support the Discharger's effort to formulate a plan to comply with Ocean Plan Amendment requirements to minimize mortality of marine life. The study design was focused on potential effects due to salinity fluctuations on organisms traveling into the intake from ambient seawater salinity, through the flow augmentation brine dilution system, and then being discharged into the receiving water.

Species and endpoints evaluated for this study included red abalone (Haliotis rufescens) development and purple sea urchin (Strongylocentrotus purpuratus) development. These species were identified as two of the most sensitive to elevated salinity levels relative to other accepted monitoring species in the Ocean Plan, based on previous studies using standard EPA whole effluent toxicity (WET) tests (Philips et al., 2012). Standard EPA WET tests were designed to expose organisms to a given test concentration for the entire duration of the exposure, which is between 48 hours and 7 days, depending on the test protocol.

Table 3
Ichthyoplankton Exposure Durations

Total Discharge Flow Rate	Total Discharge Salinity Level	Time Exposure for Salinity in Discharge Tunnel (Phase I)	Time Exposure for Salinity from Discharge Tunnel to the outside edge of BMZ (Phase 2)	Time Exposure for Salinity from BMZ (35.5 ppt) to Average Ambient Ocean (Phase 3)
184 mgd	44 ppt	2.8 min	30.0 min + Pond[1]	26.7 min
238 mgd	42 ppt	2.2 min	26.9 min +Pond[1]	24.5 min
254 mgd	40 ppt	1.7 min	24.3 min +Pond[1]	22.2 min

1 Residence time in the discharge pond ranges from less than one minute to ten minutes, with a median residence time of 5.5 minutes

Conversely, organisms traveling through the flow augmentation system and through the BMZ would be exposed to salinity fluctuations over considerably shorter durations as determined by the modeling of the CDP's operational characteristics (ROWD Appendix L and Appendix BB).

Because the goal of this study was to determine a scenario that would result in no salinity-induced adverse effects to these organisms as they travel through the brine dilution system, an exposure system was designed to assess several potential scenarios involving differing salinity levels and residence times that were within the plant's operation capabilities. Procedures were established to simulate the salinity fluctuations an organism might experience as it moves through the brine dilution system, encountering elevated salinity as the brine discharge is mixed with dilution water from the flow augmentation system followed by a reduction in salinity to 35.5 ppt as it travels through the discharge system to the edge of the BMZ, and finally a reduction from 35.5 ppt to ambient salinity. The study results showed that organisms exposed to such conditions experienced normal development.

The study was designed to provide an understanding of the potential salinity-induced adverse effects on organisms traveling through all three phases of the brine dilution process (Phase 1 flow augmentation, Phase 2 BMZ, and Phase 3 receiving water beyond the BMZ). In addition to estimating the exposure to elevated salinity in the BMZ for organisms entrained in the flow augmentation system, Phase 2 of the study protocol also provides a conservative approximation of conditions organisms would experience while drifting through the BMZ from the surrounding receiving water.[1] Therefore, the Phase 2 study results can also provide an indication of the potential salinity-induced adverse effects on organisms entering the BMZ from the surrounding receiving water.

A full copy of Nautilus' report is included in ROWD Appendix I. A summary of the study methods and results is provided below.

There were three distinct phases common to each exposure scenario:

> **Phase 1** simulated the initial mixing of brine with seawater from the flow augmentation system. The salinity of the dilution water was raised from ambient seawater (33.5 ppt) by adding 67 ppt brine at a rate calculated to reach 42 ppt salinity within approximately one minute, and then held there for a specified amount of time (1.7 to 2.8 minutes depending on the scenario being tested) to simulate transit time in the discharge conveyance system to the discharge pond.
>
> **Phase 2** simulated the dilution that occurs in the mixing pond and out to the edge of the brine mixing zone. This simulation involved the continuous addition of ambient seawater at a rate calculated to reach 35.5 ppt within a specified period (34 to 39 minutes depending on the scenario being tested).

1 Phase 2 overstates the residence time and salinity exposure for organisms drifting through the BMZ from the surrounding receiving water because it takes into account salinity concentrations and residence time in the discharge pond, discharge channel, and BMZ. Receiving water organisms would only be exposed to salinity concentrations and residence time in the BMZ.

Phase 3 simulated the dilution that occurs beyond the brine mixing zone. This simulation involved the continuous addition of ambient seawater at a rate calculated to reduce the salinity from 35.5 ppt to 33.5 ppt in 30 minutes.

The combined exposure period from the initial brine spike followed by the incremental return to ambient salinity lasted approximately 65 to 75 minutes. The embryos were then incubated in ambient seawater for the remainder of the protocol prescribed testing period (i.e., 48 hours for abalone, 72 hours for urchins). After the grow-out, all embryos were transferred to 30-mL glass shell vials, fixed with a 10% formalin solution buffered in seawater, and 100 embryos were scored per the EPA 1995 protocol guidelines as normal or abnormal. All exposure scenarios were evaluated with red abalone, but purple sea urchins were tested only with Exposure Scenario #1 to provide confirmation of results with a second species. The various exposure scenarios tested, as well as species tested and test dates, are described in Table 4.

Table 4
Exposure Scenarios Brine Dilution Study

Exposure Scenario	Species; Test Date	Phase 1	Phase 2	Phase 3
1	Abalone; 02/06/15 Urchin; 02/17/15	33.5 to 44 ppt in one minute, hold for 2.8 minutes	44 to 35.5 ppt in 39 minutes	35.5 to 33.5 ppt in 30 minutes
2	Abalone; 01/30/15	33.5 to 42 ppt in one minute, hold for 2.2 minutes	42 to 35.5 ppt in 36 minutes	35.5 to 33.5 ppt in 30 minutes
3	Abalone; 01/22/15	33.5 to 40 ppt in one minute, hold for 1.7 minutes	40 to 35.5 ppt in 34 minutes	35.5 to 33.5 ppt in 30 minutes

All three phases are required to assess the effects of elevated salinity on organisms passing through the flow augmentation system, whereas only Phase 2 is required to assess the effects of exposure to salinity greater than 35.5 ppt on organisms drifting through the BMZ from the surrounding receiving water.

In all exposure scenarios, replicates were terminated after each of the phases. There was one statistically significant effect ($p<0.05$) that was detected in Phase 1 of Exposure Scenario #2. However, the effect was small (8.5 percent compared to the Phase 1 control results), and there were no statistically significant effects observed in Phase 2 or 3 of this exposure compared to the controls. Therefore, Nautilus concluded that this finding was not due to the treatment itself.

Although urchins were tested only with Exposure Scenario #1, the similarity of results to those obtained for abalone suggests that the abalone results should be predictive of those obtained with echinoderms.

Results for all species and exposure scenarios are presented in Table 5. Full test results, including all water quality measurements and summary tables, are presented in ROWD Appendix I.

In summary, the brine dilution toxicity study focused on the species that are most sensitive to elevated salinity and concluded that these species experienced no significant toxic effects after being exposed to elevated salinity conditions similar those that would exist during transit through the flow augmentation system to the location offshore where the salinity of the discharge would be match the surrounding seawater. Organisms drifting through the BMZ would experience lower salinity concentrations and lower exposure times than the study design, so it is reasonable to conclude that these organisms would not be exposed to adverse salinity effects while drifting through the BMZ.

POSEIDON WATER

Table 5
Summary of Results for Salinity Exposure Scenarios

Scenario #	Scenario Description	Test date	Species Tested	Mean Normal Development			
				Sample	Phase 1	Phase 2	Phase 3
1	P1: 44 ppt for 2.8 minutes; P2: 39 min.; P3: 30 min.	2/6/15	Abalone Development	Control	83.8	77.7	80.5
				Brine Exposure	76.7*	79.1	78.8
1	P1: 44 ppt for 2.8 min.; P2: 39 min.; P3: 30 min.	2/17/15	Urchin Development	Control	93.7	92.0	89.3
				Brine Exposure	91.3	90.3	91.3
2	P1: 42 ppt for 2.2 min.; P2: 36 min.; P3: 30 min.	1/30/15	Abalone Development	Control	94.0	93.7	94.3
				Brine Exposure	95.7	92.7	91.7
3	P1: 40 ppt for 1.7 min.; P2: 34 min.; P3: 30 min.	1/22/15	Abalone Development	Control[a]	66.0	61.0	67.3
				Brine Exposure	68.5	67.0	60.3

P1, P2, P3 = Phase 1, 2, and 3
* An asterisk indicates a statistically significant decrease compared to the control ($p < 0.05$)
[a] The abalone test Scenario #3 conducted on January 22 did not meet the 80% test acceptability criterion for normal development in the control. None of the three scenarios resulted in statistically significant effects after Phase 3 compared to the control exposure ($p<0.05$).

POSEIDON WATER

c) Cumulative Mortality Flow Augmentation

The cumulative mortality of the flow augmentation system is shown in Table 6. At a CDP production rate of 60 MGD, the flow augmentation system is expected to require 171 MGD of seawater for brine dilution purposes and 0.58 MGD for fish return flow attributable to flow augmentation.

Table 6
Discharge Mortality - Flow Augmentation

Impacted Area	Flow Augmentation	Fish Return	Total Impacted Area (Acres)	1 mm Screen Credit (1%)	Net Impacted Area (Acres)	ROWD Supporting Documentation
Flow Subject to 100% Mortality (MGD)	171	0.58	171.58			
Intake Mortality APF (Acres)	48.00	0.16	48.16	-0.48	47.68	Appendix K Appendix P
BMZ - Adverse Salinity Effects Benthic Habitat (Acres)	NA	NA	18.51	0	18.51	Appendix I Appendix BB Appendix QQ Appendix XX
Total (Acres)			66.67		66.19	

The analysis of the shear stress, turbulence, and osmotic stress that is expected to occur in the flow augmentation system indicates the potential for a high rate of survival of all forms of marine life exposed to the cumulative effects of the flow augmentation system. However, for the purposes of demonstrating that the flow augmentation technology provides a comparable level of intake and mortality of all forms of marine life to that of the multiport diffuser, the Discharger has conservatively assumed 100% mortality of all organisms passing through the flow augmentation system, resulting in an APF of 48.16 acres.

Parts of the benthic habitat within the BMZ may be exposed to salinity in excess of 35.5 parts per thousand (ppt) for extended periods of time. Based on this information, the discharge mortality assessment conservatively assumes that 100% of the benthic area within the BMZ is exposed to toxic conditions. Organisms drifting through the BMZ would not be exposed to significant adverse salinity effects or excessive shear or turbulence. Therefore, the impacted area within the BMZ is limited to 18.51 acres of benthic habitat. The total impacted area associated with brine discharge mortality for the flow augmentation system prior to consideration of the 1% entrainment reduction for the 1 mm screens is 66.67 acres. The net impacted area after accounting for the screen credit is 66.19 acres.

2. Multiport Diffuser

Wastewater is unavailable to dilute the CDP brine discharge (ROWD Appendix RR). Therefore, this section provides an evaluation of the individual and cumulative effects of multiport diffuser on the intake and mortality of all forms of marine life, including shearing stress at the point of discharge, and osmotic stress. The results of this evaluation are summarized below.

a) Shear Stress Mortality

III.M.2.e.(1)(b) of the Ocean Plan Amendment states that the Marine Life Mortality report shall use any acceptable approach approved by the Regional Water Board for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge.

The Discharger used the Empirical Transport Model (ETM) method for evaluating mortality that occurs due to shearing stress resulting from the multiport diffuser. The Regional Water Board requested supporting documentation for this approach that is included in ROWD Appendix WW and summarized below.

The operation of the multiport diffuser results in secondary entrainment of ambient organisms in the receiving water entrained into the diffuser jets. Early life stages of ambient organisms near the operating diffuser will be entrained into the brine plume and a proportion of those organisms will suffer mortality from high levels of shear. The Staff

Report and Substitute Environmental Documentation (Staff Report/SED) states in section 8.6.2.2.1 that "*organisms that are entrained into the brine discharge may experience high levels of shear stress for short durations, which is thought to cause some mortality*." As cited in the Staff Report/SED, modeling results from Foster et al. (2013) found that "*23 percent of the total entrained volume of dilution water may be exposed to lethal turbulence*." Based on this finding, the State Water Resources Control Board (State Water Board) states in section 8.5.1.2 of the Staff Report/SED that "*we assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence*".

Organisms in the ambient water used for dilution are synonymous to the organisms in the ambient water drawn into the intake. In each case, a proportion of those at risk of mortality will be lost. Therefore, a calculation which takes into account the volume of ambient water required to dilute the brine to the target salinity (35.5 ppt) should be used to determine the marine life mortality associated with the diffuser. The basis for this conclusion and the procedure described below for estimating the marine life mortality associated with the multiport diffuser are described in more detail in ROWD Appendix WW.

Section 8.5.1.1 (Intake-related mortality) of the SED provides similar guidance on the use of ETM/APF for calculating the marine life mortality associated with intake flows. The Expert Review Panel (ERP) recommended that ETM/APF (over other modeling approaches) be used to calculate mitigation for a number of reasons. Many components of Section 8.5.1.1 are common to the use of ETM/APF at either the intake or discharge.

The basic dynamics of how flow is drawn into an intake are indistinguishable from how flow is drawn into a diffuser discharge; however, the means by which the ambient flow is withdrawn are different in each case. For intake flows, ambient water is withdrawn; for a diffuser plume, ambient water is drawn in due to the momentum flux of the discharge (Foster et al. 2013). Figure 1 depicts how ambient flow is withdrawn at an intake and into a discharge diffuser.

POSEIDON WATER

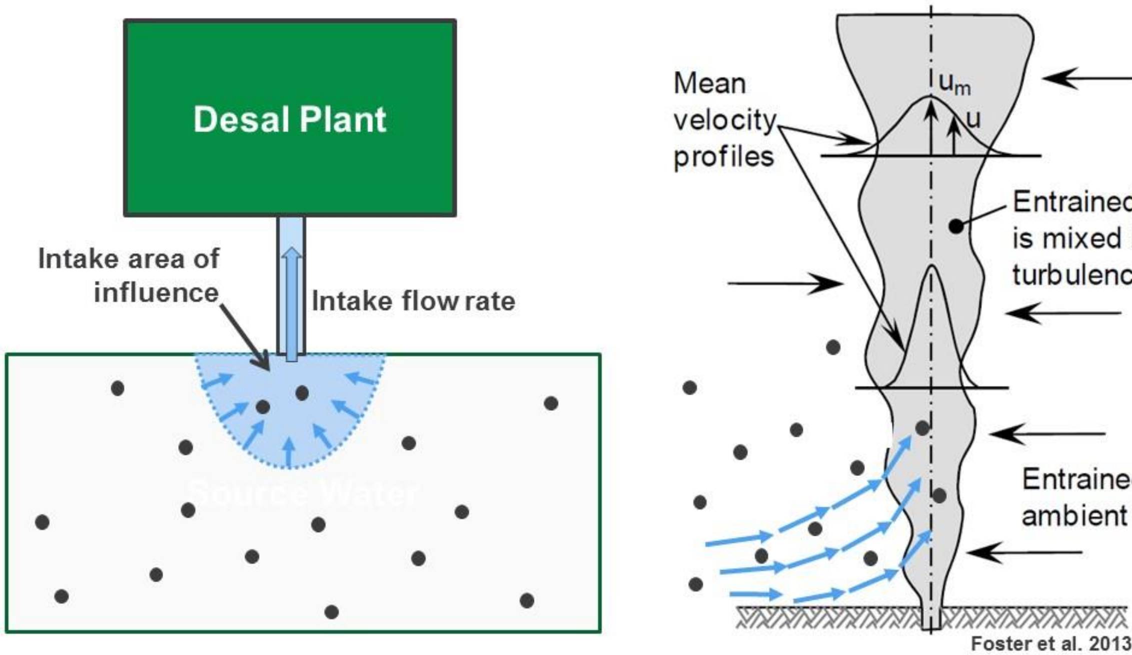

Figure 1. Conceptual schematics of how ambient flow (and passive marine life) is drawn into a) a desalination intake and b) a desalination discharge diffuser. Blue arrows indicate ambient water flow and black dots represent passive marine organisms.

Proportional loss, in each case, represents the number of organisms in the ambient water that are lost due to the operation of the system component. Whether the organisms are lost to entrainment due to intake pumping or to entrainment of dilution flow in brine plume is immaterial; the outcome is the same. Calculating the proportional loss follows the same sequence of steps:

- Delineation of the source water body within which organisms are susceptible to entrainment.
- Calculation of the proportional loss of susceptible organisms to the intake or discharge
- Calculation of the area that could have produced that larvae based on larval age, current speed, and current direction
- Calculation of the acreage required to offset this loss.

The Discharger commissioned MBC Applied Environmental Sciences ("MBC") to evaluate the entrainment effects of each brine discharge alternatives under consideration for the CDP (ROWD Appendix K). MBC evaluated the intake and mortality of each alternative by calculating the APF and comparing these results to determine which discharge alternative will result in the lowest intake and mortality of all forms of marine life. Similar to the prior entrainment assessment of the CDP approved by the Regional Water Board, MBC's analysis relies on Tenera Environmental 2008 EPS Impingement Mortality and Entrainment Characterization Study (ROWD Appendix P) as the primary larval-entrainment data source.

At a production rate of 60 MGD, the CDP will discharge approximately 60 MGD of brine through a 72" outfall pipeline extending approximately 4,000 feet offshore to the multiport diffuser system where four duck-bill diffuser ports would eject the brine into the water column at a high velocity to promote rapid diffusion and dispersion. In order to comply with the Ocean Plan Amendment requirement that the brine is diluted to a salinity of no greater than 2 ppt over natural background salinity, 945 MGD of the surrounding water needs to be entrained in the discharge.[2]

The Ocean Plan Amendment acknowledges that there is no empirical data showing the level of mortality caused by multiport diffusers. Until the Ocean Plan is updated to reflect data that becomes available from the actual operation of multiport diffusers, owners and operators interested in demonstrating that an alternative technology provides a comparable level of intake and mortality of all forms of marine life as multiport diffusers are directed to assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence:

> *[U]ntil additional data is available, we assume that larvae in 23 percent of the total entrained volume of diffuser dilution water are killed by exposure to lethal turbulence. The actual percentage of killed organisms will likely change as more desalination facilities are built and more studies emerge. Future revisions or updates to the Ocean Plan may reflect additional data that becomes available. (*Staff Report/SED at 84)

With the CDP operation at the proposed maximum production of 60 MGD, 23 percent of the total entrained volume of diffuser dilution water exposed to 100% mortality would be 217 MGD. The APF associated with 217 MGD of dilution water exposed to 100% mortality was calculated using the methodology set forth in Ocean Plan Amendment Appendix E. Potential diffuser-induced entrainment estimates were calculated using data from stations near the potential diffuser site 4,000 feet offshore of the CDP. Applying the ETM/APF methodology described in the Ocean Plan, the calculated APF associated with the operation of the multiport diffuser shown in Table 7 is 67.00 acres.

---

2 This volume equals the volume of ambient seawater required to dilute the brine to within 2 ppt of the natural background salinity of 33.5 ppt: ((60 MGD x 67 ppt) + (945 MGD x 33.5 ppt))/(60 MGD + 945 MGD) = 35.5 ppt .

Table 7 Shear Stress Mortality – Multiport Diffuser		
	Multiport Diffuser	**Supporting Documentation**
Flow (MGD)	217	SED §8.6.2.2.1
Area of Production Foregone Total (Acres)	67.00	Appendix K Appendix P Appendix WW

b) Brine Mixing Zone Mortality

Section III.M.2.d.(2)(c)(ii) of the Ocean Plan Amendment requires the operator use empirical studies or modeling to estimate of the degradation of all forms of marine life from elevated salinity within the brine mixing zone (BMZ), including osmotic stresses, the size of the impacted area, and the duration that all forms of marine life are exposed to the toxic conditions. Considerations shall be given to the most sensitive species in the community structure and function.

(1) Benthic Habitat

Parts of the benthic habitat within the BMZ may be exposed to salinity in excess of 35.5 ppt for extended periods of time. Consistent with the approach taken in the analysis of the flow augmentation system, the discharge mortality assessment for the multiport diffuser conservatively assumes that 100% of the benthic area within the BMZ is exposed to toxic conditions.

A discharge pipeline would extend 4,000 feet offshore where it would connect to four diffuser ports spaced 100 feet apart. The diffuser ports would eject the brine into the water column at a high velocity to promote rapid diffusion and dispersion. The BMZ would extend 100 meters (328 ft.) out from each of the four discharge points with the combined area inside the BMZ covering 12.3 acres. Therefore, the impacted area within the BMZ is 12.3 acres.

(2) Water Column

As previously noted, the study of the salinity effects on the most sensitive organisms drifting through the BMZ associated with the flow augmentation system found that there would be no significant adverse effects. The organisms drifting through the BMZ associated with the multiport diffuser may be exposed to somewhat higher salinity concentrations, but the overall exposure time would be shorter due to the rapid entrainment and mixing that occurs within the turbulent plume created by high velocity discharge from the multiport diffuser. As such, it is reasonable to assume that there would be no adverse salinity effects on organisms drifting through the BMZ associated with the multiport diffuser.

c) Combined Mortality Multiport Diffuser

The combined mortality of the multiport diffuser system is shown in Table 8. At a CDP production rate of 60 MGD, the multiport diffuser is expected to require 944 MGD of seawater for brine dilution purposes, 217 MGD of which is subject to 100% entrainment mortality (shear stress), resulting in an APF of 67.00 acres.

Parts of the benthic habitat within the BMZ may be exposed to salinity in excess of 35.5 parts per thousand (ppt) for extended periods of time. Similar to the approach taken with the flow augmentation system, the discharge mortality assessment conservatively assumes that 100% of the benthic area within the BMZ is exposed to toxic conditions. Organisms drifting through the BMZ would not be exposed to significant adverse salinity effects. Therefore, the impacted area within the BMZ is limited to 12.3 acres of benthic habitat. The total impacted area associated with brine discharge mortality associated with the multiport diffuser is 79.30 acres.

POSEIDON WATER

Table 8 Discharge Mortality – Multiport Diffuser		
	Diffuser	**ROWD Supporting Documentation**
Flow Subject to 100% Mortality (MGD)	217	SED §8.6.2.2.1
Diffuser Related Shear Mortality APF (Acres)	67.00	Appendix K Appendix P Appendix WW
BMZ - Adverse Salinity Effects Benthic Habitat (Acres)	12.30	Appendix I
Total (Acres)	79.30	

3. Mortality Comparison Flow Augmentation vs. Multiport Diffuser

Table 9 provides a summary of the comparison of all of the individual and cumulative effects of the flow augmentation discharge method on the intake and mortality of all forms of marine life to that of the multiport diffuser. This analysis evaluated intake-related entrainment, osmotic stress, and shearing stress at the point of discharge as applicable for each of the discharge technologies. The total impacted area associated with brine discharge mortality for the flow augmentation system prior to consideration of the 1% entrainment reduction for the 1 mm screens is 66.67acres. The net impacted area for the flow augmentation system after accounting for the screen credit is 66.19 acres. The total impacted area associated with brine discharge mortality associated with the multiport diffuser is 79.30 acres.

This information supports a conclusion that the flow augmentation brine discharge technology may be used at the CDP pursuant to section III.M.2.d(2)(c) of the Ocean Plan Amendment:

- Wastewater dilution is not available; and
- The flow augmentation system provides a *"comparable level of intake and mortality of all forms of marine life"* as multiport diffusers.

Table 9
Comparison of Discharge Mortality
Flow Augmentation vs. Multiport Diffuser

	Flow Augmentation	Multiport Diffuser
Flow Subject to 100% Mortality (MGD)	171	217
Shear Mortality APF (Acres)	47.68	67.00
BMZ - Adverse Salinity Effects Benthic Habitat (Acres)	18.51	12.30
Total (Acres)	66.19	79.30

C. Fish Return Mortality

Mortality associated with the operation of a modified traveling water screen (TWS) intake is estimated based on the life stages that are exposed to the intake system. The mortality estimates include the following conservative assumptions:

- 100% mortality of eggs and larvae entrained through the flow augmentation system which includes fish-friendly pumps and a flow conveyance hydraulically optimized to minimize injurious shear, turbulence
- Reduced velocities in the intake tunnels under stand-alone operations will allow more fish to escape, though the number of fish that could escape was assumed to be zero for those taxon that could not be estimated because length frequency data were not available.
- 100% mortality of eggs and larvae returned the lagoon through the fish return system which includes fish-friendly organism collection system and a flow conveyance hydraulically optimized to minimize injurious shear, turbulence.

The assumption of 100% mortality of eggs and larvae drawn into the intake has been accounted for in the intake mortality assessment for the CDP source water (Table 1) and the intake mortality assessment for the flow augmentation system (Table 2).

Juvenile and adult organisms that are collected by the modified TWS will experience mortality associated with collection and transport through the fish return system. The estimation of marine life mortality of all forms associated with the collection and transport of juvenile and adult life stages through the fish return system followed five steps:

1. 2004-2005 EPS impingement data (Tenera 2008). This data contained in ROWD Appendix P provides the starting point for the analysis. The total quantity of juvenile and adult organisms potentially at risk is 15.87 lbs/day.

2. Remove freshwater fish from the analysis - freshwater fish were removed from the analysis since they would experience 100% mortality due to osmotic shock regardless of the presence of any intake. The total quantity of seawater juvenile and adult organisms potentially at risk is 15.50 lbs/day.

3. Estimating the number of organisms that will be impinged at the CDP flow. The species that are expected to potentially be collected by the TWS and transported by the fish return system are those that were previously collected in the 2004-2005 impingement sampling conducted at the EPS (Tenera 2008). The sampling data were proportionally reduced based on the reduction in flow rate (299 MGD/657 MGD = 0.455). The relationship between impingement and flow is well-documented in the literature and formed the basis of the U.S. Environmental Protection Agency's 2014 316(b) Rule:

   > *Flow reduction is commonly used to reduce impingement and entrainment. For purposes of this rulemaking, EPA assumes that entrainment and impingement (and associated mortality) at a site are proportional to source water intake volume. Thus, if a facility reduces its intake flow, it similarly reduces the amount of organisms subject to impingement and entrainment.*

   The quantity of seawater juvenile and adult organisms potentially at risk after the proportional reduction to adjust for the CDP flow rate is 7.06 lbs/day.

4. Estimating the number of organisms able to escape from the intake system at the CDP flow. To evaluate the potential for fish to escape from the existing tunnels, a literature search was conducted to quantify fish swim speeds based both in terms of absolute swimming speed and speed relative to body length (a more common

measurement). The generalized swim speeds were then applied to organisms that were collected in the 2004-2005 EPS impingement sampling study (Tenera 2008). Length frequency distributions for the dominant taxa (anchovies, silversides, Shiner Surfperch, Queenfish, Walleye Surfperch, sand basses, Pacific Sardine, Spotfin Croaker, and White Seabass) were used to estimate the absolute swim speeds that organisms may be capable of achieving to determine whether escape from the mean velocity in the tunnels was physiologically possible.

On average, the burst swimming speed for the species reviewed by Videler and Wardle (1991) was 10 body length (BL)/sec. Burst swim speeds were reduced to prolonged/continuous swim speeds by assuming that prolonged/continuous swim speed was 50% of the burst swim speed calculated based on body lengths. This assumption accounts for the fact that escape from the tunnel would require a prolonged/continuous effort against the mean velocity in the tunnels for the proposed project with the discharge channel repurposed as an intake (2.6 ft/sec for Alternative 1 and 1.6 ft/sect for Alternative 15). The quantity of juvenile and adult organisms that are potentially after accounting for the organisms that can conservatively overcome the tunnel velocity associated with Alternatives 1 is 6.19 lbs/day, and for Alternative 15 is 5.61 lbs/day.

5. Estimating the survival of juveniles and adults through the fish return system - Estimating survival through the fish return system was accomplished using available data, where available, and best professional judgment. Species-specific fish return system survival data were available from an investigation conducted to assess survival of organisms through the fish return system at the San Onofre Nuclear Generating Station (SONGS) (Love et al. 1989). Where species-specific data were available from the SONGS study for southern California species, they were used to estimate survival.

   Where species-specific survival data were not available, data from a laboratory study conducted by the Electric Power Research Institute (EPRI 2010) were used. Survival of 85% was used as it represented the midpoint of the range of survival for fish greater than 11 mm in length (substantially smaller than those collected at the EPS in 2004-2005).

Based on the three steps described above, the total mortality associated with the fish return system is estimated to be 0.85 lbs/day (309 lbs/year) for Alternative 1, and 0.78 lbs/day (284 lbs/year) for Alternative 15 based on taxa-specific survival estimates gleaned from previous research and best professional judgment.

The 2009 Flow, Entrainment, and Impingement Minimization Plant approved by the Regional Water Board included an estimate that prior to the adoption of the Ocean Plan Amendment, the CDP stand-alone operations would have resulted in the mortality of 10.36 lbs/day juvenile and adult organisms, which would be offset by 11.3 acres of estuarine habitat restoration (ROWD Appendix P). As noted above, the estimated mortality of juveniles and adults associated with the CDP intake designed and operated in accordance with the Ocean Plan Amendment is 0.85 lbs/day for Alternative 1 and 0.78 lbs/day for Alternative 15. A proportional reduction of the 11.3 acres yields the estuarine habitat mitigation required for the Ocean Plan compliant intake:

Alternative 1 – (11.3 acres) x (0.85 lbs/d)/(10.36 lbs/d) = 0.93 acres

Alternative 15 – (11.3 acres) x (0.78 lbs/d)/(10.36 lbs/d) = 0.85 acres

Table 10 Fish Return System Impacted Area			
System Configuration	2009 Impingement Estimate	Alternative 1	Alternative 15
Estimated Mortality (lbs/day)	10.36	0.85	0.78
Estuarine Habitat Mitigation Required to Offset Impact (acres)	11.3	0.93	0.85

D. Permanent Construction Impacts

The majority of the intake construction will take place onshore within the existing easement from NRG. The only component that will be constructed outside of the NRG easement is the discharge end of the fish return system which will be in the Lagoon. The fish return system pipe will be buried below grade from the screening structure onshore to the Lagoon shoreline. The fish return system pipe will daylight at the shoreline east of the existing EPS intake near the existing dock. The fish return system pipe will be supported by the existing dock pilings; however, if inspection indicates that the dock pilings offer insufficient support, the discharge end of the fish return system will instead be supported with a new pile(s) driven in the Lagoon seafloor. The driven pile(s) would be protected by riprap armoring. The entire area occupied by the fish return system in Agua Hedionda Lagoon would be less than 0.1 acres.

E. Summary of Marine Life Mortality Report

Table 11 provides a summary of the estimated marine life mortality resulting from the construction and operation of the CDP under stand-alone operation with flow augmentation and provides a calculation of the required mitigation. The impacts identified are related to operation of the intake and discharge system and permanent construction impacts associated with the installation of the fish return system in the lagoon. The total impacted area for the flow augmentation system after accounting for the screen credit is 102.98 acres Alternative 1 and 102.90 acres for Alternative 15.

Table 11
Summary of CDP Marine Life Mortality Report

Impact	Impact Assessment Method	Impacted Area (Acres)	
		Alternative 1	Alternative 2
Intake	APF calculated per Appendix E of the Staff Report/SED to the Ocean Plan Amendment using a 95% confidence bound for an assumed 100% mortality of all forms of marine life entrained by 127 MGD CDP process water with an APF of 35.76 acres and 171 MGD flow augmentation with an APF of 47.68 acres after accounting for a 1% credit for 1 mm screening technology.	83.44	83.44
	Potential mortality associated with the operation of the fish return system.	0.93	0.85
Discharge	Area within the BMZ potentially exposed to a salinity in excess of 2 ppt over natural background salinity.	18.51	18.51
Construction	Permanent footprint of the fish return within lagoon	0.10	0.10
	Total	**102.98**	**102.90**

II. Mitigation Calculation

Section III.M.2.e.(2) states that the "*owner or operator shall mitigate for the mortality of all forms of marine life determined in the*" Marine Life Mortality Report. The Discharger is proposing to mitigate for 102.90 acres of impacted area identified in the CDP Marine Life Mortality Report.

A. Marine Life Mitigation Plan

The Marine Life Mitigation Plan (MLMP) was approved by the Regional Water Board pursuant to the Water Code 13142.5(b) determination for the CDP for co-located operations (Order R9-2009-0038). The MLMP sets forth a plan for mitigation and monitoring for impacts due to entrainment from CDP flows of up to 304 MGD through an open intake that is assumed to cause 100% mortality of all forms of marine life.

The MLMP was developed by the Discharger in consultation with multiple resources agencies including the Regional Water Board, and was approved by the California Coastal Commission (Commission) on August 6, 2008. The MLMP was written for stand-alone operation and proposes 55.4 acres of estuarine wetland mitigation. The MLMP provides 1:1 in-kind mitigation for estuarine species and 10:1 out-of-kind mitigation for open ocean species potentially impacted by the CDP.

Subsequent to the Regional Water Board's adoption of Order R9-2009-0038, the Discharger and the Commission agreed to increase the mitigation provide by an additional 11 acres (for a revised total of 66.4 acres) to address the estimated impingement impacts associated with the CPD's stand-alone operations prior to consideration of the proposed improvements to the intake that are required under the Ocean Plan Amendment. The Discharger has entered into a Memorandum of Understanding with the United States Fish and Wildlife Service (USFWS) to restore wetlands in the San Diego National Wildlife Refuge Complex in San Diego Bay. USFWS is currently processing an Environmental Impact Statement (EIS) for the project. Construction is expected to begin in 2019 and be complete in 2020. The MLMP contains mitigation monitoring requirements, and criteria for performance standards. The MLMP also provides for oversight of such monitoring by a scientific advisory panel, Commission and Regional Water Board.

Figure 2: Approved wetland mitigation areas located at the San Diego National Wildlife Refuge Complex in San Diego Bay.

B. Impacted Habitat

There are four types of habitats impacted by the CDP consisting of estuarine habitat, open water habitat, soft bottom habitat, and rock jetty habitat.

C. Mitigation Ratio

Section III.M.2.e.(2)(b)(v) of the Ocean Plan Amendment states that the *"regional water board may permit out-of-kind mitigation for mitigation of open water or soft-bottom species. In-kind mitigation shall be done for all other species whenever feasible."*

The Discharger is proposing out-of-kind mitigation for the soft bottom habitat in the BMZ and the open ocean species impacted by the intake. For out of kind mitigation, Section III.M.2.e.(2)(b)(vi) of the Ocean Plan Amendment provides:

> *For out-of-kind mitigation, an owner or operator shall evaluate the biological productivity of the impacted open water or soft-bottom habitat calculated in the Marine Life Mortality Report and the proposed mitigation habitat. If the mitigation habitat is more biologically productive habitat (e.g., wetlands, estuaries, rocky reefs, kelp beds, eelgrass beds, surfgrass beds) the regional board may apply a mitigation ratio based on the relative biological productivity of the impacted open water or soft-bottom habitat and the mitigation habitat. The mitigation ratio shall not be less than one acre of mitigation habitat for every ten acres of impacted open water or soft bottom habitat.*

A 10:1 mitigation ratio has precedent for past mitigation decision for the CDP and similarly situated projects along the California coast. In 2008, the Commission asked Dr. Raimondi to conduct an assessment of the productivity of the open ocean habitat to that of the wetlands restoration under the MLMP and provide a recommendation for the out-of-kind mitigation ratio. Dr. Raimondi recommended that Commission adopt an out-of-kind mitigation consisting of one acre of estuarine habitat restoration for every ten acres of open ocean habitat impacted ty the CDP. Dr. Raimondi's recommendation (that was subsequently adopted by the Commission) was based on the relative productivity of the open ocean habitat to that of the proposed estuarine wetlands restoration project, the expectation that the estuarine restoration project would produce overall better mitigation that would support a long-recognized need to increase the amount of those habitat types in Southern California, and past precedent with mitigation projects approved by the Commission.

The Discharger conducted a similar assessment of existing habitat value in the BMZ that was used to determine the appropriate mitigation ratio based on the productivity of the existing BMZ habitat as compared to that of the restoration project (ROWD Appendix UU). This assessment found that the soft bottom habitat underlying the BMZ outside the discharge channel is sand. Within the discharge channel, the rocky jetties defining the channel represent higher productivity rocky habitat that warrants a 1:1 mitigation ratio. The sand bottom habitat within the BMZ has a relatively low infaunal diversity and abundance. Table 12 presents a comparison of three key factors for measuring habitat productivity. For each of the parameters, (vegetation production, fish count, and fish productivity) the productivity of the estuarine habitat contemplated under the MLMP is significantly greater than that of the soft bottom area of the BMZ. This information conservatively supports a 10:1 mitigation ratio as appropriate for the soft-bottom sandy habitat impacted by the BMZ (i.e., 10 acres of impacted soft-bottom habitat would be fully mitigated by the restoration of one acre of estuarine habitat).

Table 12
Ratio of Productivity of Estuarine Habitat to Soft Bottom Habitat in BMZ

Natural Resource	Mitigation Ratio
Vegetation (Net prod. g $C/m^2/y$)	>10:1[a]
Fish ($count/m^2$)	650:1 to 9,750:1
Fish Productivity	6:1 to 12:1

a. Since there is no aquatic vegetation present in the BMZ, a true ratio cannot be calculated. However, given the high productivity of the estuarine habitat (1,680 g $C/m^2/y$) compared to no aquatic vegetation in the BMZ, a ratio of 10:1 is extremely conservative.

D. Summary of the Mitigation Calculation

Included below is a summary the expected marine life mortality resulting from the construction and operation of the CDP under stand-alone operation with flow augmentation and a calculation of the required mitigation pursuant to Section III.M.2.e of the Ocean Plan Amendment.

The impacted area identified in the CDP Marine Life Mortality Report is 102.98 acres for Alternative 1 and 102.90 acres for Alternative 15. There are four types of habitats impacted by the CDP: (i) estuarine habitat; (ii) open water habitat; (iii) soft bottom habitat; and (iv) rock jetties jetty. The Discharger is proposing to restore estuarine habitat to satisfy all of the CDP mitigation requirements. The mitigation calculation contemplates 1:1 in-kind mitigation for estuarine species and the rocky jetty habitat, and 10:1 mitigation for open ocean water habitat and soft bottom habitat potentially impacted by the CDP.

The mitigation calculations presented in Table 13 and Table 14 accounts for all of the impacted habitat for Alternatives 1 and 15, respectively. The total mitigation required prior to any adjustment for double counting of mitigation is 67.83 acres for Alternative 1 and 67.75 acres for Alternative 15.

Table 13
Mitigation Calculation Alternative 1

Type of Impact Measured	Impacted Area (Acres)	Impacted Habitat	Impacted Area By Habitat Type (Acres)	Mitigation Ratio	Required Mitigation (Acres)	Mitigation Area Habitat Type
Intake	83.44	Estuarine	62.58	1:1	62.58	Estuarine
		Open Water	20.86	10:1	2.09	Estuarine
Fish Return	0.93	Estuarine	0.93	1:1	0.93	Estuarine
Discharge	18.51	Soft Bottom	18.20	10:1	1.82	Estuarine
		Rock Jetties	0.31	1:1	0.31	Estuarine
Construction	0.10	Estuarine	0.10	1:1	0.10	Estuarine
Total	**102.98**		**102.98**		**67.83**	

POSEIDON WATER

Table 14
Mitigation Calculation Alternative 15

Type of Impact Measured	Impacted Area (Acres)	Impacted Habitat	Impacted Area By Habitat Type (Acres)	Mitigation Ratio	Required Mitigation (Acres)	Mitigation Area Habitat Type
Intake	83.44	Estuarine	62.58	1:1	62.58	Estuarine
		Open Water	20.86	10:1	2.09	Estuarine
Fish Return	0.85	Estuarine	0.14	1:1	0.14	Estuarine
Discharge	18.51	Soft Bottom	18.20	10:1	1.82	Estuarine
		Rock Jetties	0.31	1:1	0.31	Estuarine
Construction	0.10	Estuarine	0.10	1:1	0.10	Estuarine
Total	**102.90**		**102.90**		**67.75**	

III. Mitigation Approvals, Timing, and Performance Security

A. Mitigation Approvals

The Commission and Regional Water Board have taken the following actions related approval and implementation of the MLMP:

- On November 15, 2007, the Commission conditionally approved CDP E-06-013 authorizing the Discharger to construct and operate the CDP. As part of its approval, the Commission imposed Special Condition 8, which required the Discharger to submit for Commission review and approval, a Marine Life Mitigation Plan (MLMP).
- On August 6, 2008, the Commission approved the MLMP.
- On May 13, 2009, the Regional Water Board adopted Order R9-2009-0038 requiring the Discharger to implement and comply with the March 27, 2009 Flow, Entrainment, and Impingement Minimization Plan (Minimization Plan), including the MLMP which is incorporated in the Minimization Plan.
- On January 27, 2011, the Commission approved the Otay River Floodplain Mitigation Site and Preliminary Restoration Plan.

- On March 9, 2011, the Regional Water Board adopted Tentative Resolution No. R9-2011-0028 approving the *Preliminary Wetland Restoration Plan and Selection of the Otay River Floodplain Wetland Mitigation Site to Mitigate for Entrainment and Impingement Impacts of the Carlsbad Desalination Project*. This action was taken pursuant to Finding 43 of Order R9-2009-0038.

The MLMP includes the following provisions that address the Discharger's obligations to construct the mitigation project and ensure performance:

> ***4.2 Wetland Construction Phase***
>
> *Within 6 months of approval of the Phase I restoration plan, subject to the permittee's obtaining the necessary permits, the permittee shall commence the construction phase of the wetland restoration project. The permittee shall be responsible for ensuring that construction is carried out in accordance with the specifications and within the timeframes specified in the approved final restoration plan and shall be responsible for any remedial work or other intervention necessary to comply with final plan requirements.*
>
> ***5.0 Wetland Monitoring, Management and Remediation***
>
> *Monitoring, management (including maintenance), and remediation shall be conducted over the "full operating life" of Poseidon's desalination facility, which shall be 30 years from the date "as-built" plans are submitted pursuant to subsection 4.1(1).*

B. Mitigation Timing

The mitigation would occur along the Otay River Floodplain and the Pond 15 site within the San Diego Bay National Wildlife Refuge (Figure 2), which is managed by USFWS. USFWS is preparing responses to public comments on the draft EIS and expects to issue final Record of Decision approving the EIS in the first half of 2017. The Discharger expects the permitting of the mitigation project to be complete in the first half of 2018 and that the mitigation project construction would be complete in 2020.

As noted in section 5.0 of the MLMP, the Discharger is responsible for monitoring, management, maintenance and remediation of the wetlands (MLMP Obligations) for a period of thirty years from the date the as-built plans are submitted to the Commission. Based on the current schedule, the MLMP Obligations will run from 2020 to 2050.

C. Mitigation Performance Security

The Water Purchase Agreement (WPA) between the Discharger and the San Diego County Water Authority is scheduled to expire on December 23, 2045. If the WPA is not amended or extended, MLMP Obligations are expected to continue for approximately five years beyond the end of the term of the WPA.

The Regional Water Boards indicated that it may require a performance security to ensure MLMP obligations continue to be met after the end of the term of the WPA. The Discharger proposes the following performance security to ensure the MLMP Obligations continue to be met after the WPA term expires:

- One year prior to the end of the term of the WPA, the Discharger shall confirm the number of years remaining on the MLMP Obligations after the WPA is terminated and submit for review and approval by the Regional Water Board the expected cost of the MLMP Obligations for this period.
- Prior to the end of the term of the WPA, the Discharger shall provide (or cause to be provided) the Regional Water Board a non-cancelable mitigation performance security in the amount of the expected cost of the MLMP Obligations for this period.
- The performance security may take one of the forms below:
    - Cash;
    - Non-Cancelable Bond;
    - Irrevocable letter of credit; or
    - Renewable time certificate of deposit.

IV. Productivity Test

The September 4, 2015 ROWD includes a request that the Regional Water Board acknowledge that the Biological Performance Standard is no longer needed because subsequent to the adoption of Order R9-2009-0038, the Discharger agreed to increase the size of the MLMP from 55.4 acres to 66.4 acres to ensure that the project related impingement impacts are fully mitigated. The provision of the additional 11 acres fully offsets the potential impingement impacts associated with the temporary stand-alone operation of the CDP that was the subject of Order R9-2009-0038, thereby eliminating the need for the Biological Performance Standard. Additionally, the destructive nature of the biological performance tests would result in adverse impacts to wetlands habitat and organisms.

The Amended Order R9-2006-0065 included the following Biological Performance Standard:

> *A biological performance standard requiring Poseidon to demonstrate fish productivity (i.e., production of new fish biomass) of 1,715.5 kg/year to be achieved in the wetlands mitigation site(s) created or restored through the MLMP.*
>
> *Impinged Fish Productivity. Commencing four years after construction of the wetlands has been completed, the Discharger shall demonstrate that the wetland site(s) achieve no less than 1,715.5 kg of fish productivity per year (as demonstrated through the monitoring and accounting method set forth in section 6.5 of the Minimization Plan). The Executive Officer shall consider any adjustment to the biological performance standard/fish productivity standard pursuant to section 6.5.2 and any other relevant information in determining whether to adjust the standard of 1,715.5 kg/year for the next permit cycle. The Discharger may seek review of the Executive Officer's determination by appeal to the Regional Board.*
>
> *"The Discharger shall submit a Productivity Monitoring Plan (PMP) concurrently with the Wetland Restoration Plan required by Section 2.0 of the MLMP to the Scientific Advisory Panel (SAP) for review and to the Executive Officer for review and approval. The measurement of productivity shall be conducted in accordance with the methodologies used in Allen, "Seasonal Abundance, Composition, and Productivity . . .," Fishery Bulletin, Vol. 80, No. 4 1982, pages 769-790 (set forth in Attachment 7 of the March 27, 2009 Minimization Plan). Implementation of productivity monitoring in accordance with Allen's methodology shall be for the purpose of determining productivity, defined by Allen as rate of production of biomass per unit of time (measured in grams per unit area per unit time) and shall follow, but need not be limited to, Allen's methodologies as set forth in pages 771-773 and 779-783. Monitoring shall be conducted once per month for a 13-month period beginning four years after completion of construction of the mitigation wetland site(s), and every fifth year thereafter. The Executive Officer, upon consultation with the SAP, may designate a different representative 13-month period. To the extent possible, the 13-month period shall be coordinated with the 12-month period set forth in 1.c(1) below for impingement monitoring. The Discharger may propose modifications to or variations from Allen's productivity methodologies when it submits the PMP or through a subsequent proposed revision to the PMP. Any proposed revisions following initial*

approval of the PMP are also subject to review by the SAP and review and approval by the Executive Officer. If the Executive Officer, after consulting with the SAP, determines that the project is successful in meeting the biological productivity standard, the monitoring program may be waived.

The PMP shall describe the design and proposed implementation of the PMP, including a description of the proposed sampling timing, frequency, locations and methodology and shall describe the fish biomass available to contribute to the fish productivity requirement based on the following accounting:

a. Most Commonly Entrained Lagoon Species: Gobies, Blennies, and Garibaldi;

b. Most Commonly Entrained Ocean Species: White croaker, Spotfin croaker, Queenfish, Northern anchovy, California halibut;

c. All Other Species: All other entrained and non-entrained fish.

The biomass from Lagoon, Ocean, and Other Species shall be deemed available to contribute to the annual fish productivity requirement in the following proportions: 0% (Most Commonly Entrained Lagoon Species); 88% (Most Commonly Entrained Ocean), and 100% (All Other Species).

Available Fish Biomass (i.e., biomass available to contribute to the annual fish productivity requirement) shall be calculated as follows:

Available Fish Biomass = (88% x Biomass of Most Commonly Entrained Ocean Species) + (100% x Biomass of All Other Species)

The PMP shall explain when and how baseline productivity will be assessed and the methods and frequency for evaluating productivity. The SAP will review the proposed PMP and make recommendations on design and implementation to the Executive Officer prior to approval.

The Discharger is requesting that the Regional Water Board acknowledge that the Biological Performance Standard is no longer needed for reasons presented below. A brief history of the CDP permitting process and the development of the Biological Performance Standard are provided to support this request.

- March 18, 2009. Mr. Norby's expert opinion was submitted to the Regional Water Board to address whether the proposed mitigation project would adequately account for both impingement and entrainment impacts of the CDP operating in stand-alone mode (ROWD Appendix P, Attachment 7 - Nordby Biological Consulting - *Mitigation Computation Based on Impingement Assessment*). The mitigation project contemplated at the time would restore 55.4 acres of estuarine wetlands. The primary objective of the 55.4 acre mitigation project is to mitigate for the estimated entrainment associated with CDP's stand-alone operations. Mr. Nordby was asked to render an opinion whether, in addition to mitigating for entrainment, the mitigation project would also offset the CDP's estimated stand-alone impingement mortality. Mr. Norby concluded that the CDP's stand-alone operations have the potential to result in no more than 4.70 kg wet weight of organisms per day, or 1,715.5 kg wet weight per year. This impingement impact would be fully offset by 11.3 acres of proposed 55.4 acre mitigation project while simultaneously achieving the entrainment mitigation required under the MLMP.
- April 29, 2009, Commission staff requested the Discharger agree to provide 11 acres of additional mitigation under the MLMP to address impingement impacts that had not been identified at the time the MLMP was adopted rather than rely on the 55.4 acres of mitigation to address both entrainment and impingement impacts.
- May 6, 2009, the Commission sent a letter to Regional Water Board commenting on the Draft Order R9-2009-0038 in which the Commission expressed an opinion that the acreage in the MLMP is not adequately sized to mitigate for both impingement and entrainment impacts, and that the Commission will require additional review of the project impacts.
- May 13, 2009 the Regional Water Board adopted Order R9-2009-0038 amending Order R9-2006-0065 including the addition of a biological performance standard. The biological performance standard was required in lieu of additional impingement mitigation, and requires the Discharger demonstrate fish productivity of 1,715.5 kg/year is achieved in the 55.4 acre wetlands created or restored through the MLMP.
- September 3, 2009 the Discharger voluntarily agreed to comply with the Commission request to provide 11 additional acres of mitigation, thus bringing the total mitigation required under the CDP to 66.4 acres.

In summary, the Discharger is requesting that the Regional Water Board acknowledge that the Biological Performance Standard is no longer needed because subsequent to the adoption of Order R9-2009-0038, the Discharger agreed to increase the size of the MLMP from 55.4 acres to 66.4 acres to ensure that the project related impingement impacts are fully mitigated independent of the 55.4 acres of mitigation provided for entrainment impacts. The provision of the additional 11 acres of mitigation fully offsets the potential impingement impacts associated with the temporary stand-alone operation of the CDP that was the subject of Order R9-2009-0038, thereby eliminating the need for the Biological Performance Standard.

Additionally, the destructive nature of the biological performance tests would result in adverse impacts to wetlands habitat and organisms. The biological performance tests would impact fish populations and the salt march habitat of the restored site, potentially reducing the Discharger's ability to meet the MLMP performance standards. The SAP voiced concerns that the depletion of fish populations and that hauling nets through the restored wetlands could trample vegetation, detracting from the Discharger's ability to demonstrate fish productivity and canopy development. These impacts are contradictory to the goals of the MLMP.

V. References

Foster, M.S., G.M. Cailliet, J. Callaway, K.M. Vetter, P. Raimondi, and P.J.W. Roberts. 2013. Desalination Plant Entrainment Impacts and Mitigation. Expert Review Panel III. http://www.swrcb.ca.gov/water_issues/programs/ocean/desalination/docs/erp_final.pdf

Philips et al., 2012