POSEIDON WATER

Appendix AAA
Fish Return Discharge
Antidegradation Analysis

Renewal of NPDES CA0109223
Carlsbad Desalination Project

APPENDIX AAA

Claude "Bud" Lewis
Carlsbad Desalination Plant

ANTIDEGRADATION ANALYSIS:

Proposed Fish Return Discharge to Agua Hedionda Lagoon

Renewal of NPDES CA0109223

POSEIDON WATER

April 2017

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List of Abbreviations

AFY	acre-feet per year
APU	Administrative Procedures Update
Basin Plan	*Water Quality Control Plan for the San Diego Basin*
BOD	biochemical oxygen demand
CDP	Claude “Bud” Lewis Carlsbad Desalination Plant
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
COD	chemical oxygen demand
CTR	California Toxics Rule
CWC	*California Water Code*
DDW	State Water Resources Control Board Division of Drinking Water
DEPH	di(2-ethylhexyl phthalate), also known as bis(2-ethylhexyl phthalate)
DO	dissolved oxygen
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
EPS	Encina Power Station
lbs/day	pounds per day
MBAS	methylene blue active substances (surfactants)
ML	minimum level (minimum reporting level)
mgd	million gallons per day
mg/l	milligrams per liter
ml/l	milliliters per liter
mm	millimeters
N	nitrogen
N:P	nitrogen to phosphorus ratio
NPDES	National Pollutant Discharge Elimination System
NTR	National Toxics Rule
Ocean Plan	*Water Quality Control Plan, Ocean Waters of California*
RO	reverse osmosis
RWD	Report of Waste Discharge
RWQCB	Regional Water Quality Control Board, San Diego Region
SDCWA	San Diego County Water Authority
SWRCB	State Water Resources Control Board
TDS	total dissolved solids
TOC	total organic carbon
TSS	total suspended solids
µg/l	micrograms per liter
µm	micrometers
ZID	zone of initial dilution

Executive Summary

Proposed Fish Return Discharge. Poseidon Water (Channelside) LP (Poseidon) proposes to implement a fish return discharge to Agua Hedionda Lagoon (Outfall 002) as part of proposed permanent stand-alone operations for the Claude "Bud" Lewis Carlsbad Desalination Plant (CDP). Under permanent stand-alone operations, 299 million gallons per day (mgd) of inflow from Agua Hedionda Lagoon would be screened using 1 millimeter (mm) traveling screens at a new intake/pumping facility. A low-pressure rinse system would remove organisms and a portion of impinged solids from the screens and deposit them in a fish return trough for discharge back into Agua Hedionda Lagoon. Total fish return flows discharged into the lagoon would be approximately 1 mgd. A subsequent high-pressure rinse system would remove remaining debris from the screens for discharge to the existing effluent pond (Outfall 002), where the debris flow would be blended with CDP filter backwash, bypassed intake flow, and reverse osmosis concentrate prior to discharge to the ocean.

Periodic cleaning of the fish return system would be required to prevent biological growth on the discharge pipe walls from dislodging and discharging into the lagoon. A "pigging" operation is proposed (approximately on an annual basis) to clean the fish return pipe. Prior to initiating the fish return cleaning process, the Regional Water Quality Control Board would be provided with a proposed fish return cleaning plan that identifies cleaning processes and equipment proposed to maximize capture of dislodged solids and minimize the discharge of solids to the lagoon.

Required Antidegradation Analysis. The fish return discharge would represent a new discharge point for the CDP. This study assesses compliance of the proposed fish return discharge with state and federal antidegradation regulations.

Fish Return Benefits. The fish return system will safely return to the lagoon a significant majority of organisms larger than 1 millimeter that reach the CDP intake screens. With the fish return system, total impingement and entrainment losses associated with the permanent stand-alone operations are estimated at 0.85 pounds per day of organisms. Without the fish return option, impingement and entrainment losses are estimated at 5.34 pounds per day.

Hydrodynamic Effects. The fish return discharge point would be located approximately 90 yards northwest from the CDP intake. Typical tidal velocities near this discharge point will allow for escape of mobile organisms, while ensuring sufficient dispersion and flushing of any discharge solids. Due to circulation hydrodynamics of the lagoon, approximately 50 percent of suspended material will be flushed out of the lagoon within six hours, and 98 percent of suspended material will be flushed out of the lagoon within a 2.5-day period.

Antidegradation Conclusions. The following are concluded on the basis of the analyses presented herein:

- The proposed fish return discharge will result in a significant net reduction in mass loads of dissolved and suspended constituents within the southern portion of Agua Hedionda Lagoon.
- The proposed fish return discharge will not result in increased concentrations of dissolved constituents or increased concentrations of small suspended solids less than 1 mm in size.
- Total suspended solids (TSS) concentrations in Agua Hedionda Lagoon are typically low and are comprised of smaller (< 1 mm) suspended solids which will pass through the CDP intake screens and not be concentrated in the fish return discharge.
- During periods of storms, extreme tidal conditions, heavy surf and currents, or heavy winds, the potential exists for elevated concentrations of larger solids (> 1 mm) to become suspended in lagoon waters, including bits of kelp, eelgrass, leaves, twigs, or other bits of organic matter. During such times, TSS concentrations in the fish return discharge may exceed ambient TSS concentrations in the lagoon. No adverse impacts to water quality are projected, however, as the 1 mm screens that will be installed upstream from the fish return system will result in a reduced mass of these larger solids in the lagoon, and discharged material will be rapidly dispersed. No discernible adverse effects on dissolved oxygen, water clarity, or other water quality parameters are projected.
- The proposed fish return discharge will not result in water quality that falls below water quality objectives prescribed in the Basin Plan or state-wide water quality standards imposed by EPA.
- The proposed fish return discharge will not unreasonably affect actual or potential beneficial uses.
- Total economic and social benefits associated with increased marine organism survival provided by the fish return system outweigh economic and social detriments associated with the fish return discharge.
- A fish return discharge to the effluent pond would be slightly less costly, but a fish return discharge to Agua Hedionda Lagoon is preferred because (1) organisms would be returned to the same area from which they were taken from, and (2) organisms would not be exposed to increased salinity levels in the effluent pond.
- The proposed fish return discharge is consistent with providing maximum benefit to the state, in accordance with State Water Resources Control Board antidegradation guidance.
- The proposed fish return discharge (Outfall 002) is consistent with state and federal antidegradation regulations and policies.

1. INTRODUCTION

1.1 PROJECT OVERVIEW

Permit Background. San Diego Regional Water Quality Control Board (RWQCB) Order No. R9-2006-0065[1] (NPDES CA0109223) establishes requirements for the discharge of reverse osmosis (RO) concentrate and pretreatment backwash flows from the Claude "Bud" Lewis Carlsbad Desalination Plant (CDP) into the Pacific Ocean via the Encina Power Station (EPS) effluent channel under:

- co-located operations with EPS, and
- and temporary stand-alone operations when EPS flows are temporarily insufficient to meet CDP needs.[2]

Poseidon Water (Channelside) LP (Poseidon) filed a Report of Waste Discharge (RWD) on March 29, 2011 in application for renewal of NPDES CA0109223. Poseidon submitted an Amended RWD to the RWQCB dated September 4, 2015, and submitted an Addendum to the Amended RWD dated August 16, 2016. Poseidon has subsequently submitted supplemental RWD appendices and supplemental information to the RWQCB in response to SWRCB and RWQCB questions and information requests. The Amended RWD with supplemental information describe measures proposed to:

- transition the CDP from co-located operations with the Encina Power Station (EPS) and temporary stand-alone operations to permanent stand-alone operation following the retirement of the EPS;
- allow for a potential increase in potable water production; and
- comply with the 2015 amendments to the State Water Resources Control Board's (SWQCB) *Water Quality Control Plan, Ocean Waters of California* (Ocean Plan) that require expanded seawater desalination facilities to use the best available site, design, technology, and mitigation measures feasible to minimize the intake and mortality of all forms of marine life pursuant to California Water Code section 13142.5(b).[3]

Proposed Fish Return Discharge. Consistent with the 2015 Ocean Plan Desalination Amendment, Poseidon evaluated alternative intake alternatives for stand-alone operations. On the basis of this analysis, Poseidon concluded that a surface intake of Agua Hedionda Lagoon

1 As amended by RWQCB Order Nos. R9-2009-0038 and R9-2010-0073.

2 Order No. R9-2006-0065, as amended, establishes requirements for the average daily discharge of up to 54 million gallons per day (mgd) of RO concentrate and granular media filtration backwash to the EPS effluent channel. Maximum daily combined RO concentrate and granular media filtration backwash flows of 60.3 mgd are allowed under Order No. R9-2006-0065.

3 On May 6, 2015, the SWRCB adopted an amendment to the *Water Quality Control Plan, Ocean Waters of California* (Ocean Plan) to address effects associated with the construction and operation of seawater desalination facilities (SWRCB, 2015).

water using traveling screens represented the only implementable and feasible intake technology for serving the CDP.[4] As part of the proposed screen intake facility, traveling screens would be employed that include a fish return system. The fish return system would convey organisms rinsed off the screens back into Agua Hedionda Lagoon via a gravity flow channel (Outfall 002). Total flows returned back into the lagoon via the fish return channel are projected at approximately 1 million gallons per day (mgd).

1.2 PURPOSE OF APPENDIX AAA

Antidegradation Conclusions of Order No. R9-2006-0065. Order No. R9-2006-0065 (as amended) concluded that the discharge of CDP RO concentrate and pretreatment backwash water to the Pacific Ocean via the EPS effluent channel will not result in significant degradation of water quality.[5] Order No. R9-2006-0065 further concluded that:

> *The discharge from CDP is not expected to affect the beneficial uses of the receiving water, and the discharge in compliance with this Order is consistent with the antidegradation provisions of 40 CFR 131.12 and State Water Board Resolution No. 68-16.*
>
> *Effluent limitations were not included in this Order for constituents for which reasonable potential to exceed the water quality objective was not indicated following a reasonable potential analysis. The procedures for conducting the reasonable potential analysis are explained elsewhere in this Fact Sheet. For constituents for which effluent limitations were not included, non-regulatory performance goals were included which will indicate the level of discharge at which possible water quality impacts may be significant. With the inclusion of performance goals and the monitoring program for constituents without effluent limitations, the existing water quality is expected to be maintained. For these reasons, the Regional Water Board has determined that an antidegradation analysis is not required to consider the possible impacts resulting from the addition of effluent from the CDP to the EPS discharge channel following a reasonable potential analysis.*[6]

Need for Antidegradation Assessment of Fish Return Discharge. The proposed fish return discharge to Agua Hedionda Lagoon (Outfall 002) represents a new discharge point not currently addressed under Order No. R9-2006-0065 (as amended).

This appendix to Poseidon's RWD assesses water quality effects of the proposed fish return discharge and assesses compliance of the proposed fish return discharge with state and federal antidegradation regulations.

1.3 APPROACH

Federal Antidegradation Regulations. Federal antidegradation regulations are established within Title 40, Section 131.12 of the *Code of Federal Regulations* (40 CFR 131.12). The

4 See Appendices A, II, and SS of Poseidon's amended RWD.

5 See Finding II.K of Order No. R9-2006-0065 as amended, and Section IV.G (page F-44) of Attachment F to Order No. R9-2006-0065.

6 Excerpted from Section IV.G (page F-44) of Attachment F to Order No. R9-2006-0065.

federal antidegradation regulations require states to adopt and implement policies and requirements consistent with the following Tier 1 and Tier 2 antidegradation requirements:

(1) Existing instream water uses [includes marine and ocean waters] *and the level of water quality necessary to protect the existing uses shall be maintained and protected.* (Tier 1 requirement)

(2) Where the quality of the waters exceed [i.e. are better than] *levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.* (Tier 2 requirement)

State Antidegradation Policy. State Water Resources Control Board (SWRCB) Resolution No. 68-16[7] established the following policy that requires maintenance of high quality waters:

> *Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial uses of such water and will not result in water quality less than that prescribed in the policies.*

The SWRCB has interpreted Resolution No. 68-16 as incorporating federal antidegradation regulations.[8] Administrative guidance and procedures governing antidegradation assessment and compliance were issued by the SWRCB in 1990.[9,10] The SWRCB guidance allows the Regional Boards to make a determination of antidegradation compliance without the need for a complete antidegradation analysis if:

1. *A Regional Board determines that the reduction in water quality will be spatially localized or limited with respect to the waterbody; e.g. confined to the mixing zone; or*
2. *A Regional Board determines the reduction in water quality is temporally limited and will not result in any long-term deleterious effects on water quality; e.g. will cease after a storm event, or*
3. *A Regional Board determines that proposed action will produce minor effects which will not result in a significant reduction in water quality; e.g. a POTW has a minor increase in the volume of discharge subject to secondary treatment.*[11]

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7 Resolution 68-16, *Statement of Policy with Respect to Maintaining High Quality Waters in California* was adopted by the SWRCB on October 28, 1968. California's 1968 antidegradation policy predates the creation of the U.S. Environmental Protection Agency, the 1972 federal Clean Water Act, and the implementation of the federal NPDES permit program.

8 See page 2 of "Federal Antidegradation Policy" memorandum issued to the Regional Boards by SWRCB Chief Counsel William Atwater dated October 7, 1987. (SWRCB, 1987.)

9 SWRCB "Administrative Procedures Update, Antidegradation Policy Implementing for NPDES Permitting" (APU 90-004), dated July 2, 1990.

10 SWRCB antidegradation guidance within APU 90-004 incorporates federal guidance issued by EPA Region 9 on June 3, 1987 within *Guidance on Implementing the Antidegradation Provisions of 40 CFR 131.12* (EPA, 1987).

11 See page 3 of APU 90-004 (SWRCB, 1990).

The 1990 SWRCB Administrative Procedures Update (APU 90-004) provides the following guidance relative to whether a complete antidegradation analysis is required to assess conformance with the provisions of Resolution No. 68-16:

> *In general, an antidegradation analysis is needed to support all regulatory actions that, in the Regional Board's judgement, will result in a significant increase in pollutant loadings. The Regional Boards must consider antidegradation effects and conduct an antidegradation analysis when the proposed activity results in:*
>
> 1. *A substantial increase in mass emissions of a pollutant, even if there is no other indication, that the receiving waters are polluted; or*
> 2. *Mortality or significant growth or reproductive impairment of resident species.*
>
> *In particular, an antidegradation finding should be made and, if necessary, an analysis should be conducted when performing the following permit activities:*
>
> 1. *Issuance of a permit for any new discharge, including Section 401 certifications; or*
> 2. *Material and substantial alterations to the permitted facility, such, as relocation of an existing discharge; or*
> 3. *Reissuance or modification of permits which would allow a significant increase in the concentration or mass emission of any pollutant in the discharge.*[12]

Figure 1-1 (page 1-5) summarizes the antidegradation decision making implementation process established within the 1990 SWRCB guidance.[13]

Report Organization. In accordance with the antidegradation implementation guidance presented by the SWRCB, the following approach is used for assessing compliance of the proposed CDP fish return discharge with state and federal antidegradation requirements:

- The proposed fish return discharge is described and the projected effluent quality of the fish return discharge is characterized (Section 2).
- Water quality effects of proposed fish return discharge on Agua Hedionda Lagoon receiving waters are assessed, and a determination is presented as to whether water quality within the lagoon is "lowered" (Section 3).
- Agua Hedionda Lagoon receiving waters are compared with applicable water quality standards and objectives to assess whether water quality is better than necessary to support beneficial uses (Section 4).
- Alternatives to the fish return discharge are identified, and economics of the proposed fish return discharge alternative are evaluated to assess whether lowered water quality is consistent with maximum benefit of the state (Section 5).

Report Preparation. This antidegradation evaluation was prepared for Poseidon Water by Michael R. Welch, Ph.D., P.E., Consulting Engineer.

END OF SECTION 1

12 See page 4 of APU 90-004 (SWRCB, 1990).

13 See Figure 1 on page 7 of APU 90-004 (SWRCB, 1990).

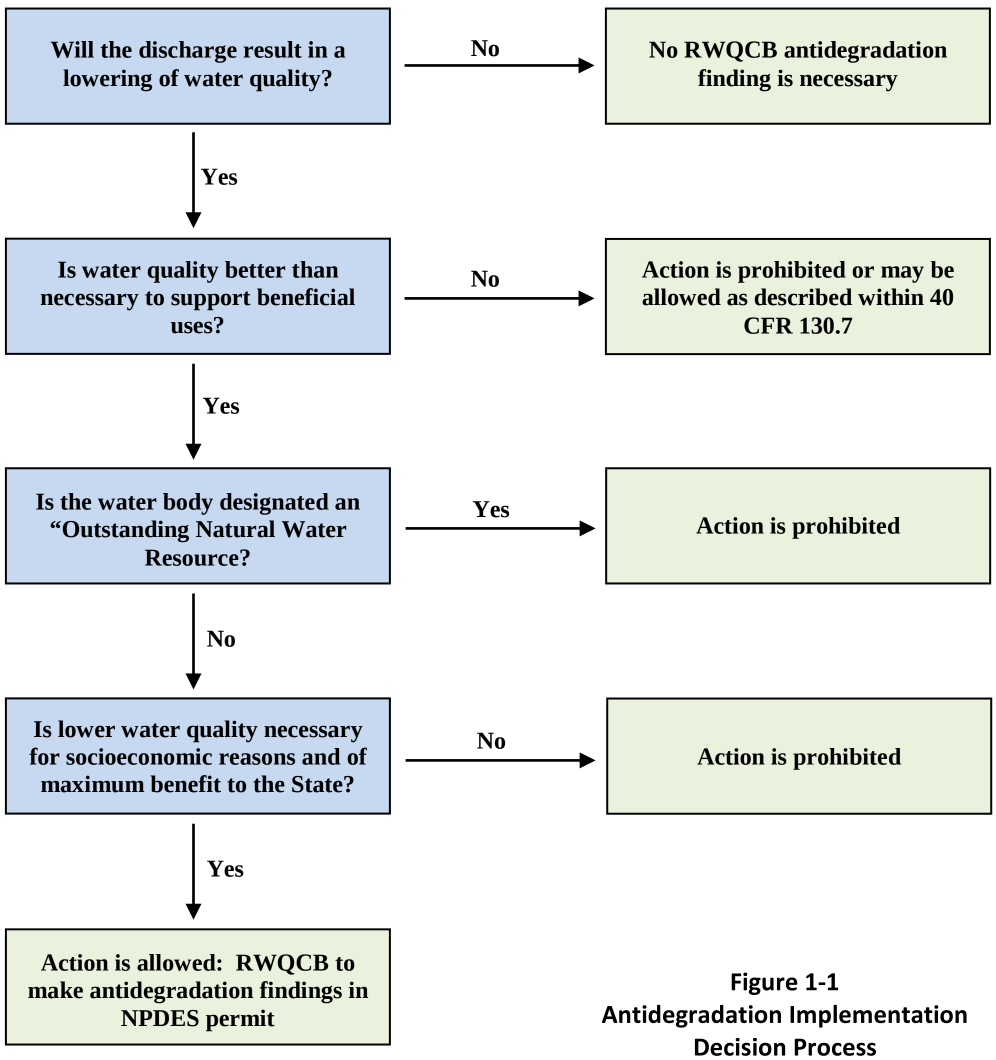

Figure 1-1
Antidegradation Implementation Decision Process

(from SWRCB, 1990)

2. FISH RETURN DISCHARGE

2.1 DESCRIPTION OF DISCHARGE

Proposed Screen and Fish Return System. To assess operational options under permanent stand-alone operations, Poseidon evaluated a wide range of proposed intake sites, technologies, designs, and mitigation strategies to minimize the intake and mortality of marine life.[14] On the basis of this analysis, Poseidon concluded that a surface intake of Agua Hedionda Lagoon water using traveling screens represented the only implementable and feasible technology for serving the CDP.

The proposed intake structure would utilize 1 millimeter (mm) traveling screens designed to ensure that through-screen velocities would not exceed 0.5 feet per second. The traveling screen system (see Figure 2-1 on page 2-2) would feature a two-stage screen rinsing system and a fish return system to transport collected organisms back into Agua Hedionda Lagoon. Virtually all small suspended and colloidal solids in the Agua Hedionda Lagoon intake flow would pass through the 1 mm screen and would be removed by the CDP granular media filtration processes. Solids and organisms larger than 1 mm would be collected in the fish lifting buckets on the rotating screens. As the screen rotates upward, a low-pressure spray would be used to rinse fish and organisms off the screen face into a fish trough. Rinse water and organisms within the fish trough would flow by gravity through a discharge pipe and be returned to Agua Hedionda Lagoon (see Figure 2-2 on page 2-2). The fish return discharge (Outfall 002) would return organisms to the same portion of the lagoon from which they came, but the discharge point would be approximately 90 yards northeast of the intake to minimize the recirculation of organisms back into the intake. Table 2-1 (below) presents general design parameters for the fish return system.

Table 2-1
Fish Return Design Goals[15]

Parameter	Design Value
Pipe Diameter	18 inches
Depth of flow	5.8 inches
Velocity	3.1 feet per second
Slope	0.003
Discharge flow	1 mgd

As the traveling screen continues to rotate, a second powerful high-pressure spray would rinse any remaining impinged solids and debris into a rinse water trough. Solids washed off of the

14 See Appendices A, B, II, SS, YY, and BBB of Poseidon's amended RWD.

15 Design goals to minimize screen fouling and ensure safe return of rinsed fish and organisms to Agua Hedionda Lagoon.

screens would continue to flow by gravity to the EPS discharge pond for blending with the CDP filter backwash and RO concentrate.

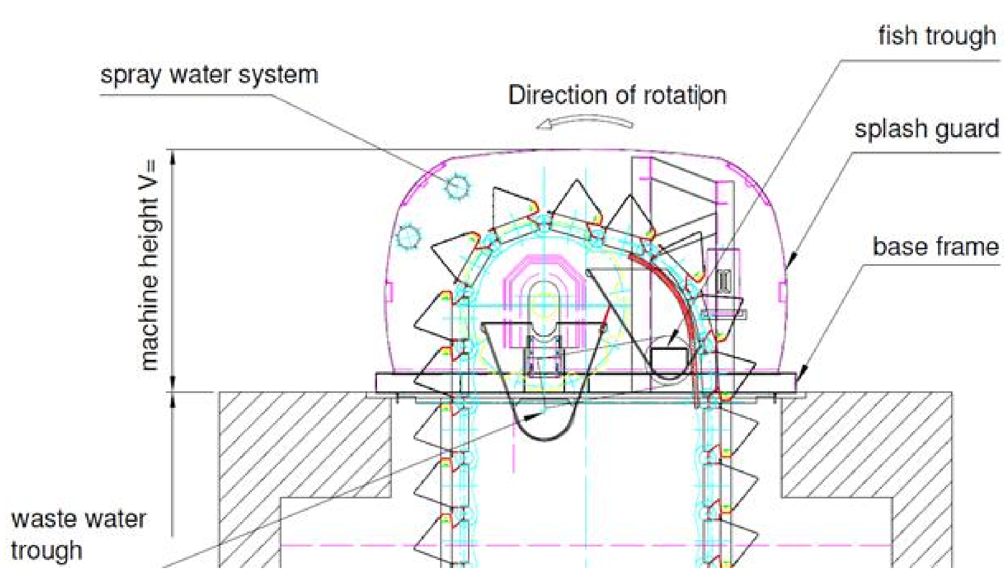

Figure 2-1
Schematic of Proposed CDP Rotating Intake Screens

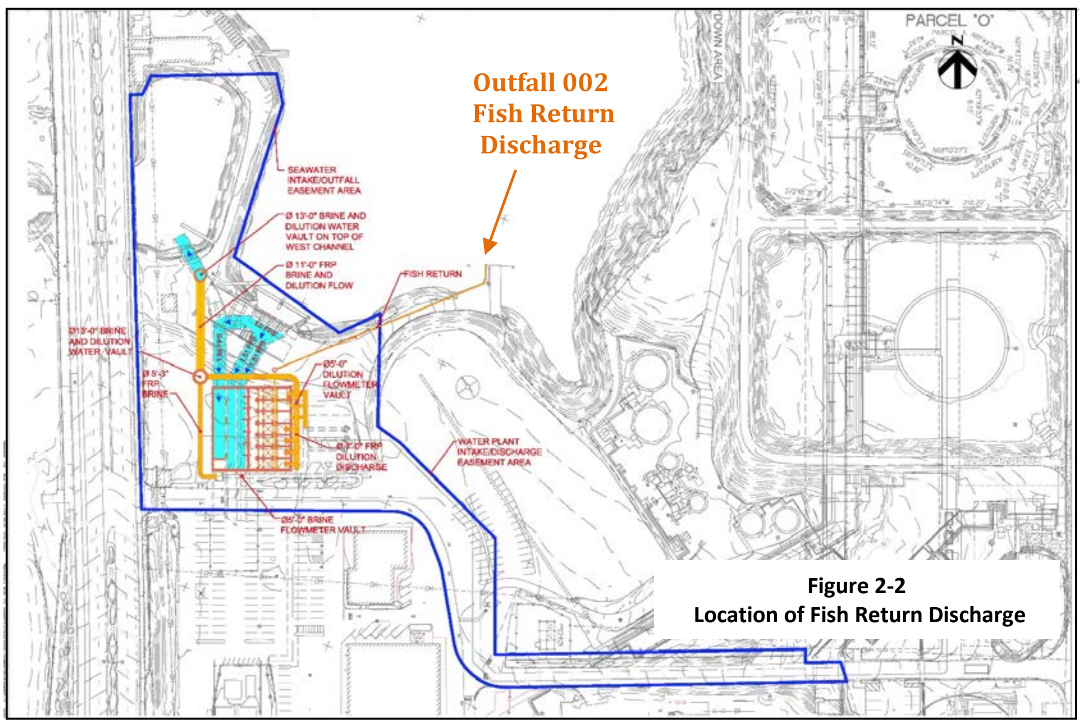

Figure 2-2
Location of Fish Return Discharge

Intake and Discharge Flows. Table 2-2 summarizes intake and discharge flows under permanent stand-alone CDP operations. As shown in Table 2-2, the fish return discharge (Outfall 002) would comprise less than one-half of one percent of the CDP intake flow.

Table 2-2
CDP Intake and Discharge Flows under Permanent Stand-Alone Operations[16]

CDP Flow Component		Flow
Intake Flow	Intake from CDP Lagoon Intake Structure	299 mgd
Disposition of Intake Flow	Potable Water Production	60 mgd
	Outfall 001 Discharge to Pacific Ocean[17,18] • RO Concentrate (60 mgd) • Filter Backwash (7 mgd) • Bypassed intake flows (171 mgd)	238 mgd
	Outfall 002 Discharge to Agua Hedionda Lagoon[19] • Low pressure screen wash & fish return discharge to Agua Hedionda Lagoon	1 mgd

Disposition of Intake Solids Under Permanent Stand-Alone Operations. Table 2-3 (page 2-4) summarizes the disposition of solids in the 299 mgd CDP intake flow. Virtually all dissolved material will pass through the 1 millimeter screens, so the percent of dissolved material in the CDP intake flow that is discharged back into the lagoon (Outfall 002) will be proportional to the ratio of the fish return flow (1 mgd) to the total intake flow (299 mgd), or approximately 0.3 percent.

Suspended material less than 1 mm in size will also pass through the screens. Since screened water will be used as the source of the low-pressure and high-pressure rinse supply, the percent of small suspended solids (<1 mm) returned to the lagoon via the low-pressure fish return process can also be estimated at approximately 0.3 percent (1 mgd divided by 299 mgd). Remaining dissolved and suspended solids that pass through the screens will end up in the discharge pond (Outfall 001) either as solids in the filter backwash or bypass flow.

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16 Conditions under which EPS operations are terminated and the CDP is operated in permanent stand-alone mode. Under such stand-alone conditions, CDP influent flows are withdrawn from the lagoon via a new stand-alone CDP intake system, a portion of the withdrawn flows are directed to CDP for desalination, and remaining withdrawn intake flows are blended back into the CDP RO concentrate and filter backwash streams prior to discharge to the final effluent pond (Monitoring Location M-002).

17 Intake water flows under stand-alone CDP operations that bypass CDP and are directed into the effluent channel (Outfall 001) for blending with CDP RO concentrate and filtration backwash (when backwash is not being recycled to CDP pretreatment). At the discretion of plant operators, filter backwash may instead be recycled to the plant headworks. When backwash flows are being recycled to the CDP pretreatment processes rather than discharged to the ocean, a commensurate increase in the bypass flow rate will be required to ensure that effluent pond salinities are maintained at 42 ppt or less and receiving water salinities 200 meters from the discharge point are less than 2 ppt above ambient. Total CDP intake flows would remain at 299 mgd and total CDP discharge flows would remain at 239 mgd regardless of whether filter backwash is discharged to the ocean or recycled back to the headworks. When filter backwash is recycled to the headworks, 178 mgd of the 299 mgd intake flow would be bypassed. When filter backwash is discharged to the ocean, 171 mgd of the 299 mgd intake flow would be bypassed. Bypassed intake flows also include high pressure rinse water from the permanent stand-alone intake screens.

18 Outfall 001 is the discharge to the Pacific Ocean via the EPS effluent pond and effluent channel.

19 Outfall 002 is the fish return discharge (e.g. low pressure intake screen rinse water) that is discharged back into Agua Hedionda Lagoon.

Debris, suspended materials and organisms greater than 1 mm in size will be impinged on the screens. As noted, the screen rinsing system is designed so that the low-pressure rinse will wash organisms into the fish return trough and the high-pressure wash will deposit debris and heavier large suspended matter into the debris trough for discharge to the effluent pond. Although the screens and return systems is designed to separate organisms and debris to the greatest extent possible, some fish and organisms may end up in the debris return and some suspended solids may be returned back to the lagoon via the fish return system. The quantity of larger solids and debris deposited into the fish return trough will depend on intake water quality and screen operating parameters such as rinse jet pressures, velocities, and angles. It should be possible to tune the rinse system so that 80 percent or more of the impinged screen debris and solids are deposited in the debris trough, and no more than 20 percent of the debris and larger suspended solids are deposited in the fish return trough.

Table 2-3
Projected Disposition of Solids in the CDP Intake
Permanent Stand-Alone Operations

Parameter	Disposition of Solids Mass in the CDP Permanent Stand-Alone Intake	
	Approximate Percent of Intake Mass Returned to the Lagoon in the Fish Return Discharge (Outfall 002)	Approximate Percent of Intake Mass Removed in CDP Treatment or Directed to the Effluent Pond/Ocean Discharge (Outfall 001)
Dissolved solids, ions, and other dissolved constituents	0.3%[20]	99.7%[20]
Small suspended solids (< 1 mm) and small organisms (< 1 mm)	0.3%[21]	99.7%[21]
Larger suspended solids (> 1 mm)	< 20%[22]	> 80%[22]

Water Quality of Intake Flow and Fish Return Discharge. No chemicals or solids are added as part of the screen rinsing process. As a result, the fish return system will contain the same concentration of dissolved constituents as the Agua Hedionda Lagoon intake supply.

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20 All dissolved solids, dissolved ions, and other dissolved constituents will pass through the CDP intake screens. Dissolved constituents in 1 mgd of the 239 mgd intake flow will be returned to Agua Hedionda Lagoon via the fish return discharge (Outfall 002). Almost all dissolved constituents in the other 238 mgd of intake flow will be discharged to the effluent pond (Outfall 001) within the RO concentrate, the filter backwash water, or bypassed intake flow. A tiny fraction of the dissolved constituents will remain in the product water.

21 Almost all suspended material less than 1 millimeter in size will pass through the screens and will be discharged to the effluent pond (Outfall 001) either in the filter backwash or bypassed intake flow. The percent of mass of smaller suspended solids directed to the lagoon is projected by 0.4 percent (1 mgd divided by 239 mgd) of the mass of smaller solids in the CDP intake.

22 Although the fish return system will be designed with separate fish return and debris removal troughs, a portion of the larger debris will be rinsed in to the fish return trough and a portion of the larger organisms will be rinsed into the debris trough and routed to the effluent pond. The exact fraction of impinged organisms and solids that will be rinsed into the fish return trough is not known, and will depend on influent water quality and screen operating parameters such as rinse velocity and angle. The intent of the fish return design is to return a majority of the larger impinged organisms to the lagoon, and to direct a majority of the larger screen debris to the effluent pond. It should prove possible to tune the screen rinse system so that more than 80 percent of the debris and larger solids (> 1 mm) will be rinsed into the debris trough by the high-pressure screen rinse, and less than 20 percent of the debris and larger solids will be rinsed into the fish return trough by the low-pressure rinse.

Concentrations of small suspended solids (< 1 mm) in the fish return discharge are also expected to mirror the quality of the Agua Hedionda Lagoon intake supply, as these small solids will pass through the screens and the screened water will be used in the low-pressure rinse that is returned to the lagoon. The fish return discharge may also contain some larger solids or debris washed off the screens as part of the low-pressure rinse, including bits of kelp, eelgrass, small twigs, leaves or other organic matter. Historic TSS monitoring indicates that the CDP intake flow typically contains low concentrations of TSS and no measurable settleable solids.[23] Although some larger suspended material may be collected in the screens and rinsed into the fish return trough, it is anticipated that the fish return discharge will typically be comprised of the types of smaller solids that are characteristic of the CDP intake supply.[23]

Comprehensive monitoring of the Agua Hedionda Lagoon water has not been performed as part of CDP operations, but extensive monitoring of the CDP intake supply (both under pilot plant operations and full-scale operations) has been conducted over the past 12 years. While past and current CDP intake monitoring reflects water that has been circulated through the EPS, the CDP intake monitoring data may be used to approximate concentrations of both dissolved material and suspended material within the fish return discharge.[24]

Table 2-4 (page 2-6) summarizes the projected quality of the fish return discharge for general physical/chemical constituents. Table 2-5 (page 2-7) summarizes projected concentrations of nutrients and mineral constituents in the fish return discharge. Table 2-6 (page 2-8) summarizes projected concentrations of toxic inorganic constituents in the fish return discharge.

Table 2-7 (page 2-9) summarizes projected concentrations of toxic organic constituents in the fish return discharge. As noted, concentrations of dissolved constituents[25] will be the same in the fish return discharge as in the lagoon intake flow. Other than bis (2-ethylhexyl) phthalate (also known as DEHP[26]), no toxic organic compounds have been detected in the EPS cooling water CDP influent. The extremely low concentrations of DEPH that have been detected in the EPS cooling water (less than 0.1 µg/l) may be due to the use of plastic pipe within portions of the EPS. If so, it is possible that DEPH will not be detectable in the Agua Hedionda Lagoon intake or in the fish return discharge.[27]

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23 TSS concentrations of the CDP intake supply are typically less than 10 mg/l, and contain virtually no settleable or larger solids. See Table 2-4 and footnote #29 on page 2-6. While particle size analyses have not been conducted on the CDP intake flow, the fact that TSS concentrations in the intake supply are consistently low is indicative of the limited potential for larger-sized solids to be present in the CDP intake flow. This is supported by May 2014 monitoring results, in which visual observations of strained CDP influent did not detect any observable solids in influent strainers. This influent strainer monitoring is reported in See Attachment 7 (Sampling Logs) in *Amendment to Pilot Plant Report* (Poseidon Water, 2014). Under typical CDP operating conditions, it is thus projected that smaller solids which pass through the screens will likely comprise a significant portion of the total solids in the fish return discharge.

24 It is possible that small quantities of contaminants such as metals or bis (2-ethylhexyl) phthalate may be added as a result of piping materials used at the EPS, the CDP intake data developed as part of the 1 mgd CDP pilot plant (2003-2009) and subsequent CDP intake monitoring conducted as part of full-scale potable water operations (2016 and beyond) are representative of the quality of the Agua Hedionda Lagoon intake supply that will be used under permanent stand-alone operations.

25 Includes dissolved minerals, dissolved metals, and dissolved nutrients.

26 Bis (2-ethylhexyl) phthalate is also known as di(2-ethylhexyl) phthalate or DEPH.

27 Di-(2-ethylhexyl) phthalate (DEHP) was detected in 6 samples of the CDP influent at a mean concentration of 0.07 µg/l, as reported in Table 4-2 of the *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015). The maximum observed DEHP concentration in the 6 samples was 0.12 µg/l. It is possible that these low concentrations of DEPH are contributed to the CDP intake through the use of plastic piping in the EPS and CDP intake facilities.

Table 2-4
Projected Quality of CDP Intake Supply and Fish Return Discharge
General Physical/Chemical Constituents

General Physical/Chemical Parameters[28]	Units	Outfall 002 Concentration: Fish Return Discharge to Agua Hedionda Lagoon
TSS (total suspended solids)	mg/l	< 30[29]
Settleable Solids	ml/l	< 0.1[30]
BOD (biochemical oxygen demand)	mg/l	< 10[31]
COD (chemical oxygen demand)	mg/l	< 100[31]
TOC (total organic carbon)	mg/l	1.26[32]
Oil and Grease	mg/l	< 1[33]
MBAS (methylene blue active substances)	mg/l	0.125[34]
Chlorine residual, total	mg/l	None[35]
pH	pH Units	7.0– 8.3[36]
Turbidity	NTU	2.8[37]
Color	Units	4[38]
Coliforms, fecal[10]	#/100 ml	61[39]
Temperature (winter)	deg. F	60.3 - 64.1[40]
Temperature (summer)	deg. F	67.8 – 74.9[40]

28 The fish return (Outfall 002) discharge will contain approximately the same concentrations of the above physical/chemical parameters as the Agua Hedionda Lagoon intake water. A "<x" value indicates that the parameter was not detected at a Minimum Level (ML) concentration of "x".

29 TSS concentrations in the CFP influent during pilot testing (41 samples) averaged 4.2 mg/l (see Table 6 of *Amendment to Pilot Plant Report* (Poseidon Water, 2014). Samples collected during storm events in January/February 2007 showed TSS concentrations of 17-22 mg/l in the CDP pilot plant intake. For comparison, Agua Hedionda Lagoon TSS concentrations reported by the Hubbs-Seaworld Research Institute for the period 2001-2009 showed an average TSS concentration of 6.9 mg/l with a standard deviation of 15.5 mg/l, as reported in the RWQCB's *Clean Water Act Sections 305(b) and 303(d) Integrated Report for the San Diego Region* (RWQCB, 2016). TSS in the fish return discharge will include "pass through" solids (solids less than 1 mm in size) that are in the screen rinse water and larger solids and debris (larger than 1 mm) that are rinsed off the screens into the fish return trough by the low-pressure screen rinse. TSS concentrations in the fish return discharge are projected to be less than 30 mg/l under typical operations. During periods of storms, extreme tidal conditions, heavy surf and currents, or heavy winds, the potential exists for elevated concentrations of larger solids (> 1 mm) in the lagoon, including bits of kelp, eelgrass, leaves, twigs, or other bits of organic matter. During such times, TSS concentrations in the fish return discharge may be elevated well above 30 mg/l and exceed ambient TSS concentrations in the ambient lagoon.

30 Settleable solids data on the Agua Hedionda Lagoon intake have not been collected as part of CDP pilot plant testing or operations, but settleable solids were not detected in the CDP effluent discharge (Monitoring Location M-001) in 65 samples collected during 2016. Additionally, settleable solids data have been collected on the north side of the lagoon by the Hubbs-Seaworld Research Institute. As reported by the RWQCB (2016), settleable solids concentrations in the Hubbs-Seaworld intake were less than 0.1 ml/l in all 86 samples collected during samples during 2001-2009.

31 The above BOD and COD data are from February 2003 monitoring of the influent to the 1 mgd CDP pilot plant, as presented in Poseidon's September 2005 NPDES application for CDP co-located and temporary stand-alone operations. The Agua Hedionda Lagoon intake supply and the fish return discharge are projected to have comparable BOD and COD concentrations as the 2003 CDP pilot plant intake supply.

32 Total organic carbon (TOC) concentrations in the CDP influent averaged 1.26 µg/l in 21 CDP pilot plant intake samples collected during 2003-2007, as reported in Table 6 of *Amendment to Pilot Plant Report* (Poseidon Water, 2014). TOC concentrations in the fish return system are projected to be approximately the same as the CDP influent.

33 Oil and grease was not detected in 41 CDP influent samples during 2003-2007 pilot plant testing. See Table 6 of *Amendment to Pilot Plant Report* (Poseidon Water, 2014).

34 Concentrations of MBAS (surfactants) averaged 0.125 mg/l (with a maximum value of 1.5 mg/l) in CDP intake sampling during 2003-2007, as reported in Table 4-3 of the *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015). MBAS concentrations in the fish return discharge are projected to be the same as in the CDP influent.

35 The fish return discharge is not chlorinated.

36 Range of pH concentrations in the CDP intake during pilot plant testing (91 samples) conducted during 2003-2007. See Table 6 of *Amendment to Pilot Plant Report* (Poseidon Water, 2014).

37 As reported, in Table 6 of *Amendment to Pilot Plant Report* (Poseidon Resources, 2016), turbidity in the CDP intake (95 samples) averaged 2.8 NTU during pilot plant testing. Turbidity averaged 3.2 NTU and ranged from 1.3 NTU to 11 NTU in supplemental CDP pilot plant sampling conducted by Montgomery Watson Harza in 2005-2007.

38 Mean value of 2 samples of the CDP influent, as reported in Table 4-2 of the *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015). Maximum value for the 2 samples was 5 color units.

39 Mean value of 13 fecal coliform samples from the outer lagoon, as reported in Table 4-11 of the *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015). The median fecal coliform concentration in the 13 samples was 30 per 100 ml.

40 Winter temperatures are for the period November through April. Summer temperatures are for the period May through October. Listed values represent maximum and minimum monthly temperatures for 2016 at Monitoring Location M-INF. Data for 2016 from Monitoring Location M-INF includes data during both co-located operations and temporary stand-alone operations. As a result, the listed temperatures may represent slight overestimates of temperatures in the Agua Hedionda Lagoon intake supply and in the fish return discharge back into the lagoon.

Table 2-5
Projected Quality of CDP Intake Supply and Fish Return Discharge
Minerals and Nutrients

Mineral and Nutrient Parameters[41]	Concentration (mg/l) Fish Return Discharge to Agua Hedionda Lagoon (Outfall 002)
Total Ammonia (as N)	< 0.1[42]
Nitrate (as N)	0.076[43]
Phosphorus (as P) Total	< 0.07[44]
Boron	4.06[45]
Bromide	60[46]
Fluoride	1.9[47]
Iron	0.108[48]
Manganese	0.005[49]
Sulfate	2642[50]
Sulfide	< 0.1[51]
Sulfite	< 2[51]
Total dissolved solids (TDS)	35,400[52]

2.2 FISH RETURN MASS EMISSIONS

Mass Emissions for Dissolved Constituents. As shown in Table 2-3, only approximately 0.3 percent of the dissolved constituents in the 299 mgd CDP intake will be returned to the lagoon in the fish return discharge under permanent stand-alone operations. The remaining 99.7 percent of the dissolved constituents will (as currently occurs under co-located and temporary stand-alone operating conditions) be discharged to the ocean via the effluent pond (Outfall 001).

41 The fish return (Outfall 002) discharge will contain approximately the same concentrations of the above mineral and nutrient parameters as the Agua Hedionda Lagoon intake water. A "<x" value indicates that the parameter was not detected at a Minimum Level (ML) concentration of "x".

42 Value based on non-detected concentrations of ammonia in the CDP pilot plant intake and effluent in 2003-2004, and non-detected concentrations of ammonia at Monitoring Location M-001 in 2016.

43 Mean value of 6 samples of the CDP influent, as reported in Table 4-2 of the *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015). Maximum nitrate value for the 6 samples was 0.59 mg/l.

44 Based on CDP pilot plant influent sampling by Montgomery Watson Harza during 2008-2009. All 13 samples of the CDP influent for calendar years 2008-2009 collected by Montgomery Watson Harza (2009) showed total phosphorus concentrations of less than 0.07 mg./l.

45 Mean value of 3 samples of the CDP influent, as reported in Table 6 of *Amendment to Pilot Plan Report* (Poseidon Water, 2014). Maximum boron value for the 3 samples was 4.11 mg/l.

46 Mean value of 8 samples of the CDP influent, as reported in Table 6 of *Amendment to Pilot Plant Report* (Poseidon Water, 2014). Maximum bromide value for the 8 samples was 72 mg/l.

47 Mean value of 6 samples of the CDP influent, as reported in Table 4-2 of the *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015). Maximum fluoride value for the 6 samples was 4.4 mg/l.

48 Mean value of 10 samples of the CDP influent, as reported in Table 4-3 of the *Watershed Sanitary Survey*. Maximum iron value for the 10 samples was 0.17 mg/l.

49 Mean value of 10 samples of the CDP influent, as reported in Table 4-3 of the *Watershed Sanitary Survey.* Maximum manganese value for the 10 samples was 11 mg/l.

50 Mean value of 6 samples of the CDP influent, as reported in Table 4-3 of the *Watershed Sanitary Survey*. Maximum sulfate value for the 6 samples was 3314 mg/l.

51 Sulfide and sulfite have not been monitored in the CDP influent or in Agua Hedionda Lagoon, but the concentration in the fish return discharge should be less than concentrations in the combined CDP discharge at Monitoring Location M-001.

52 Mean value of 13 samples of the CDP influent, as reported in Table 4-3 of the *Watershed Sanitary Survey*. Maximum TDS concentration in the 13 samples was 37,500 mg/l.

Table 2-6
Projected Quality of CDP Intake Supply and Fish Return Discharge
Toxic Inorganic Constituents

Toxic Inorganic Constituents[53]	Concentration (µg/l) Fish Return Discharge to Agua Hedionda Lagoon (Outfall 002)	Toxic Inorganic Constituents	Concentration (µg/l) Fish Return Discharge to Agua Hedionda Lagoon (Outfall 002)
Aluminum	193[54]	Mercury	0.031[55]
Antimony	0.097[56]	Molybdenum	< 26[57]
Arsenic	1.5[58]	Nickel	0.325[59]
Barium	7.6[60]	Selenium	0.018[61]
Beryllium	0.02[62]	Silver	0.023[63]
Cadmium	0.02[64]	Thallium	0.009[65]
Chromium III	0.585[66]	Tin	< 2.5[57]
Chromium VI	0.585[66]	Titanium	< 10[57]
Cobalt	< 2.7[57]	Vanadium	2.7[67]
Copper	0.097[68]	Zinc	1.6[69]
Lead	0.1[70]	Cyanide	5[71]

53 The fish return (Outfall 002) discharge will contain approximately the same concentrations of the above toxic inorganic constituents as the Agua Hedionda Lagoon intake water. A "<x" value indicates that the parameter was not detected at a Minimum Level (ML) of "x".

54 Mean value of 11 samples of the CDP influent, as reported in Table 4-2 of the *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015). Maximum aluminum value for the 11 samples was 592 µg/l.

55 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum mercury value for the 10 samples was 0.117 µg/l.

56 Mean value of 11 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum antimony value for the 11 samples was 0.138 µg/l.

57 The constituent was not sampled in Agua Hedionda Lagoon or the CDP influent, but the constituent was not detected in the CDP RO concentrate or filter backwash discharge during pilot plant sampling in February 2003.

58 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum arsenic value for the 10 samples was 2.5 µg/l.

59 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum nickel value for the 10 samples was 0.78 µg/l.

60 Mean value of 5 samples of the CDP intake, as reported in Table 4-2 of the *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015). Maximum barium value for the 5 samples was 41 µg/l.

61 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum selenium value for the 10 samples was 0.07 µg/l.

62 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum beryllium value for the 10 samples was 0.097 µg/l.

63 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum silver value was 0.2 µg/l.

64 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum cadmium value for the 10 samples was 0.116 µg/l.

65 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum thallium value for the 10 samples was 0.02 µg/l.

66 Total chromium was not detected at a concentration in excess of 0.585 µg/l in 10 samples of the CDP influent, as reported in Table 4-2 of the 2015 *Watershed Sanitary Survey* (Poseidon Resources, 2015).

67 Mean value of 3 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum vanadium value for the 3 samples was 4.1 µg/l.

68 Mean value of 10 samples of the CDP intake, as reported in the CDP *Watershed Sanitary Survey*. Maximum copper value was 0.74 µg/l. For comparison, the median copper concentration in 51 Hubbs-Seaworld influent samples (north side of Agua Hedionda Lagoon) was 2.48 µg/l during 2001-2008, as reported in the Fact Sheet to the *2014 Draft Integrated Report (303(d) List/305(b) Report).* (RWQCB, 2016)

69 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum zinc value for the 10 samples was 5 µg/l. For comparison, the median zinc concentration in 26 Hubbs-Seaworld influent samples (north side of Agua Hedionda Lagoon) was 36 µg/l during 2001-2008, as reported by the RWQCB in Fact Sheet to the *2014 Draft Integrated Report (303(d) List/305(b) Report).* (RWQCB, 2016)

70 Mean value of 10 samples of the CDP intake, as reported in the 2015 CDP *Watershed Sanitary Survey*. Maximum lead value was 0.28 µg/l

71 Mean value of 10 samples of the CDP influent, as reported in the CDP *Watershed Sanitary Survey*. Maximum cyanide value was 20 µg/l.

Table 2-7
Projected Quality of CDP Intake Supply and Fish Return Discharge
Toxic Organic Constituents

Toxic Organic Parameters	Concentration (µg/l) Fish Return Discharge to Agua Hedionda Lagoon (Outfall 002)
Volatile Organic Compounds	None detected
Acid Extractable Compounds	None detected
Base Neutral Compounds	
bis(2-ethylhexyl phthalate)	0.07[72]
All other base neutral compounds	None detected
Pesticides and PCBs	None detected
Dioxins/furans	None detected

On a pounds-per-day loading basis, CDP operations will result in a significant net negative mass emissions of dissolved constituents into the lagoon, as significantly more pounds per day of dissolved constituents will be removed from the lagoon than discharged back into the lagoon. Concentrations of dissolved constituents (including dissolved minerals, dissolved metals, dissolved organic compounds) in the fish return discharge, are projected to be virtually identical to ambient Agua Hedionda Lagoon concentrations. As a result, the net negative mass emissions of dissolved constituents in Agua Hedionda Lagoon will not translate to any discernible change in ambient Agua Hedionda Lagoon concentrations for dissolved constituents.

Suspended Solids Mass Emissions. As noted, the low overall TSS concentrations and the absence of settleable solids in the CDP intake indicates that debris (larger solids) will typically be a relatively small component of the overall mass of solids in the CDP intake. For conditions in which lagoon TSS concentrations are low and predominantly comprised of smaller particles, a significant majority of the suspended solids will pass through the CDP intake screens and will be discharged to the effluent pond (Outfall 002), either in the filter backwash or intake bypass flow streams. Scenario 1 of Table 2-8 (see page 2-10) summarizes mass emissions for conditions in which the fish return discharge is almost exclusively comprised of small (< 1 mm) "pass through" suspended solids. Under this scenario, only a small portion of the intake solids will be returned to the lagoon via the fish return discharge (Outfall 002), and TSS concentrations in the fish return discharge will mirror the quality of the ambient lagoon water.

Worst case fish return TSS discharge conditions would occur when the CDP intake contains quantities of larger suspended or floatable solids, a fraction of which will be removed by the low-pressure rinse into the fish return trough.[73]

72 See footnote #27 on page 2-5.

73 As discussed on page 2-4, it should prove possible to tune the screen rinse system so that 80 percent or more of the impinged screen debris and solids are deposited in the debris trough, and no more than 20 percent of the debris and larger suspended solids are deposited in the fish return trough. While a significant majority of debris and larger solids will be discharged to the effluent pond vis the debris trough, TSS concentrations in the fish return system would increase during storm or tide conditions when larger solids or debris are more prevalent in the lagoon.

For example, lagoon TSS concentrations may become elevated during periods of storms, extreme tidal conditions, heavy surf and currents, or heavy winds as a result of bits of dislodged kelp, eelgrass, leaves, twigs, or other bits of organic matter. While the CDP intake screens will be operated to minimize the amount of intake debris that is rinsed into the fish return trough, a portion of any larger impinged solids from the 299 mgd intake flow will be washed into the fish return trough and concentrated in 1 mgd of fish return flow. Scenario 2 presented in Table 2-8 describes conditions in which TSS concentrations in the fish return discharge become elevated. Under these conditions, TSS concentrations in the fish return discharge would exceed ambient lagoon TSS concentrations.

Table 2-8
Suspended Solids Mass Emissions Estimates Under a Wide Range of CDP Permanent Stand-Alone Operating Conditions[74]

Scenario	Example Fish Return TSS Concentration (mg/l)	Solids Mass Emissions (lbs/day)		Percent Reduction in Lagoon Solids Loading Due to CDP Operations
		Solids Mass Withdrawn from the Lagoon in CDP Intake	Solids Mass Discharged Back into the Lagoon in Outfall 002	
Scenario 1: 10 mg/l TSS in CDP intake is comprised almost exclusively of smaller "pass through" suspended solids (< 1 mm) contributed by the screen rinse water itself	10[75]	24,900[76]	80[77]	99.7%[78]
Scenario 2: 50 mg/l TSS in the fish return discharge that is comprised of 10 mg/l small suspended particles (solids < 1 mm) plus 40 mg/l of debris (solids > 1 mm)	50[79]	27,000[80]	420[81]	98.4%[78]

74 Hypothetical scenarios in Table 2-7 are presented for purposes of demonstrating that only a small fraction of solids in the CDP intake supply are returned to the lagoon in the fish return discharge (Outfall 002) through a wide range of potential operating conditions.

75 As documented in Table 2-4 and footnote #29 (page 2-6), TSS concentrations in the CDP intake and Agua Hedionda Lagoon are typically less than 10 mg/l, and settleable solids are less than 0.1 ml/l. Under conditions in which the CDP intake is almost exclusively comprised of smaller solids that pass through the 1 mm screens, and TSS concentrations in the fish return system would mirror concentrations in the ambient lagoon water.

76 Based on 10 mg/l TSS concentration in the CDP intake and an intake flow of 299 mgd. Value rounded to nearest hundred lbs/day.

77 Based on 10 mg/l TSS concentration in the fish return discharge (small "pass through" solids contributed by the rinse water itself) and a discharge flow of 1 mgd. Value rounded to nearest 10 lbs/day.

78 Computed on the basis of the mass of withdrawn solids compared to the mass of solids discharged back into the lagoon.

79 Based on 10 mg/l TSS in the CDP intake that are less than 1 mm in size (which pass through the screens and are contributed by the screen rinse water itself), and an additional 40 mg/l of TSS in the fish return discharge that are larger debris/solids (> 1mm) rinsed off the screens into the fish return trough by the low-pressure screen wash.

80 Includes 24,900 lbs/day contributed by a 299 CDP inflow containing 10 mg/l of smaller solids (< 1 mm) that pass through the screens. Also includes 2300 lbs/day of larger solids/debris, 80 percent of which are diverted to the debris trough by the high-pressure screen wash, and 20 percent (420 lbs/day) of which is rinsed into the fish return trough by the low-pressure screen wash, creating a combined fish return TSS concentration of 50 mg/l (10 mg/l smaller "pass through solids" and 40 mg/l larger impinged solids).

81 Based on 1 mgd fish return discharge and "worst case" 50 mg/l TSS concentration in the fish return discharge (10 mg/l of "pass through" smaller solids (< 1 mm) contributed by the rinse water itself, and 40 mg/l of debris/larger solids washed off the screens into the fish return trough by the low-pressure screen wash. Assumes 80 percent of larger debris/solids are washed into the debris trough by the high-pressure screen rinse, and 20 percent of the larger debris/solids are washed into the fish return trough by the low-pressure screen wash.

Scenario 2 conditions described in Table 2-8 (page 2-10) entail TSS concentrations of 50 mg/l which are largely comprised of debris and solids larger than 1 mm in size.[82] As shown in Table 2-8, Scenario 2 conditions result in a five-fold increase in TSS mass emissions compared to Scenario 1. Both scenarios, however, result in only a small fraction of the intake suspended solids being discharged back into the lagoon. The CDP intake and fish return system thus results in a significant net reduction in the mass emissions of dissolved constituents, suspended solids, and debris over a range of potential operating conditions.

2.3 MAINTENANCE OF FISH RETURN SYSTEM

Mass Emissions for Dissolved Constituents. As documented in Appendices FF and TT, the proposed fish return system will require periodic cleaning to remove biological growth and fouling organisms that accrue on the surface of the fish return trough and pipe. The periodic cleaning (which may be required on an annual or biannual basis) would involve a "pigging" process where a scrubbing device (pig) is forced through the pipe to physically dislodge solids and biological growth that adheres to the pipe walls.

The proposed fish return structure will incorporate a pig launching and retrieval station in order to provide the capability of implementing the periodic fish return cleaning. The pig retrieval system and cleaning process would be designed with a screening basket or similar mechanism to maximize retention of debris and biological material removed through the cleaning process.

Prior to initiating the fish return cleaning process, the RWQCB would be provided with a proposed fish return pipe cleaning plan that identifies cleaning processes and equipment proposed to maximize capture of dislodged solids and minimize the discharge of solids to the lagoon. Special monitoring would be implemented (per anticipated NPDES permit provisions) that would assess solids capture achieved during the cleaning process and confirm that the return flow that enters the lagoon applicable discharge requirements.

END OF SECTION 2

82 Scenario 2 presents mass emissions under conditions of elevated lagoon and fish return concentrations of debris and TSS. As part of Scenario 2, it is assumed that the fish return discharge would contain TSS concentrations of 50 mg/l, comprised of 10 mg/l of "pass through" solids (< 1 mm) contributed by the rinse water itself and 40 mg/l of larger solid debris (> 1mm) that is rinsed off the screens by the low-pressure rinse into the fish return trough.

3. WATER QUALITY EFFECTS

3.1 APPROACH

Definition of "Lowered" Water Quality. The first step in the antidegradation decision process (see Figure 1-1 on page 1-5) is to assess whether or not the proposed fish return discharge results in a "lowering" of water quality. In accordance with guidance published in the SWRCB Administrative Procedures Update (APU 90-004), a "lowering" of water quality is determined to occur if the proposed discharge results in:

- increased concentrations of pollutants in the receiving water,
- increased mass emissions of pollutants in the receiving water, or
- any other water quality-related impacts to beneficial uses, including impairment of growth or reproduction in resident species.

Evaluated Groups of Parameters. To evaluate whether the proposed fish return discharge results in a lowering of water quality in Agua Hedionda Lagoon, potential water quality effects are assessed for a range of water quality parameters, including:

- dissolved minerals, dissolved nutrients, and other dissolved chemicals, including toxic organic and toxic inorganic constituents,
- oil and grease,
- oxygen-demand parameters (BOD/COD) and dissolved oxygen,
- toxicity,
- turbidity and water clarity, and
- suspended solids and debris.

Each above group of pollutants are assessed to determine whether the fish return discharge will result in increased concentrations or mass emission to Agua Hedionda Lagoon, and whether any other known adverse impacts to beneficial uses may occur.

Hydrodynamics of Fish Return Discharge. As shown in Figure 2-2 (page 2-2), the fish return discharge returns some of the extracted lagoon water back into the lagoon at a location approximately 90 yards northeast of the CDP intake. As documented in Appendices F and GG, the western portion of Agua Hedionda Lagoon is well mixed and heavily influenced by tides. As a result of flushing that occurs during each 6-hour tidal cycle, residence times for dissolved or suspended material in this portion of the lagoon are (depending on sedimentation in the lagoon opening) are short. Tidal cycles result in approximately 50 percent of suspended matter being flushed from the lagoon in a 6-hour period, and approximately 98 percent of suspended matter is flushed out of the lagoon within a 2.5-day period.[83] While these tidal influences results in water within the lagoon being well mixed, computer simulations of lagoon mixing demonstrate that velocities in the southeast corner of the basin where velocities are sufficiently low to allow fish to swim away and not be recirculated into the intake area.[84]

As a result of these circulation patterns, suspended or dissolved material in the fish return discharge will not accumulate at the discharge point, but instead be mixed throughout the western portion of Agua Hedionda Lagoon. Within several tidal cycles, discharged suspended and dissolved material will be flushed out into the ocean by tidal currents. As a result of these circulation conditions, mass emission effects of the discharge and intake point may be considered jointly, even though the discharge and intake points are separated by approximately 90 yards.

Lack of Impacts on Lagoon Sediments. As documented in Appendices FF and TT, the fish return system will be designed to minimize sedimentation and the settlement of debris. Additionally, periodic cleaning will be performed in a manner to capture settleable debris, solids, mussels, or other shelled organisms that become attached to the fish return discharge pipe walls. While Appendices FF and TT note the potential for settleable debris, CDP operational monitoring data demonstrate a consistent lack of settleable solids in the CDP intake.[85] Because of the lack of settleable material in the CDP intake, it is projected that the fish return discharge will also contain negligible quantities of settleable material. As a result, no significant sedimentation or sediment build-up is likely to occur in the vicinity of the fish return discharge, and any potential water quality effects will be limited to dissolved or suspended material in the water column or floatable material on the water surface.

3.2 DISSOLVED CONSTITUENTS

Lack of Screening Effects on Dissolved Constituents. As documented in Section 2, dissolved constituents (including dissolved minerals, dissolved nutrients, and dissolved metals, and dissolved toxic organic constituents) will pass through the intake screens. Because 100 percent of the dissolved constituents in the CDP intake will pass through the screens, the screening process will not result in any change in the concentration of dissolved constituents in

83 See RWD Appendix GG. Jenkins and Wasyl (2006) report that, on average, the lagoon exchanges approximately 1700 acre-feet of water with the ocean on a daily basis, and the storage capacity of the western portion of the lagoon averages approximately 3450 acre-feet. Tidal flushing and mean residence times may vary as a result of sedimentation in the lagoon opening, but residence time in the lagoon is not directly impacted by power plant pumping, as reported on page 2-1 of the CDP *Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015).

84 See page 19 of Appendix G.

85 Settleable solids were not detected (< 0.1 milliliters per liter) in all CDP intake samples during 2016. See Table 2-4 and footnote #30 on page 2-6.

the screened water. A small portion of the screened water (approximately 1 mgd) will be used for the low-pressure screen rinse that discharges to the fish return trough for return to Agua Hedionda Lagoon (see Figure 2-2 on page 2-2). Dissolved constituents in this low-pressure screening water be discharged back into the lagoon.

No chemicals are used or added as part of the intake screening process. As a result, concentrations of dissolved constituents in the fish return flow will be identical to concentrations in the CDP intake and concentrations in the ambient Agua Hedionda Lagoon water, including concentrations of:

- dissolved minerals,
- dissolved nutrients, including nitrate, nitrite, ammonia, dissolved organic nitrogen and dissolved phosphate/phosphorus compounds,
- dissolved toxic inorganic constituents, including dissolved metals and cyanide, and
- dissolved toxic organic constituents, including volatile organic compounds, acid-extractable compounds, base neutral compounds, pesticides and herbicides, and dioxins/furans.

The periodic fish return cleaning process is also not projected to affect concentrations of dissolved constituents in the discharge to Agua Hedionda Lagoon.

Net Reduction in Mass Emissions of Dissolved Constituents. As documented in Table 2-3 (page 2-4), only approximately 0.3 percent of the mass of dissolved constituents in the to the CDP intake will be returned back into the lagoon in the fish return discharge.[86] The fish return discharge (which will occur approximately 90 yards northwest of the CDP intake) will thus result in a significant reduction in net mass emissions of dissolved constituents to the lagoon.

Conclusion. The proposed fish return discharge will not result in any discernible lowering of water quality for dissolved minerals, dissolved nutrients, dissolved toxic inorganic constituents, or dissolved toxic organic constituents. Concentrations of such dissolved constituents in the fish return discharge will be the same as the ambient Agua Hedionda Lagoon water, and the CDP intake/fish return process will not result in any adverse impacts related to mass emissions or mass loadings of dissolved constituents.

86 As documented in Section 2, concentrations of dissolved constituents (including dissolved metals, dissolved nutrients, and dissolved organic compounds) will not be affected by the screening, and concentrations of dissolved constituents will be identical between the screen intake supply and screened supply. Approximately 1 mgd of the screened water will be used as low-pressure screen rinse and will be returned to the lagoon, while dissolved material in the remaining 298 mgd of inflow will continue through the CDP process and either end up in the potable supply or be returned to the effluent pond via the filter backwash, RO concentrate, and bypassed intake supply. Approximately 99.7% of the dissolved material in the CDP intake supply (298 mgd divided by 299 mgd) will not be returned to the lagoon.

3.3 OIL AND GREASE

Lack of Screening Contributions to Grease and Oil. Grease and oil concentrations have consistently been non-detectable in the CDP intake.[87] Since grease and oil are not present in the intake flow, proposed CDP stand-alone intake screening operations will not result in any discernible quantities of grease and oil in the fish return discharge. Further, as documented in Appendix FF, silicone-based coatings are proposed for the intake screens.[88] The silicone-based coatings will not contribute any grease or oil compounds to the fish return discharge. As a result of these factors, grease and oil concentrations are projected to be non-detected in the fish return discharge. The fish return discharge will thus not result in any discernible change in Agua Hedionda Lagoon concentrations of grease and oil, and the CDP intake screening process will not affect grease and oil mass emissions.

Conclusion. The proposed fish return discharge will not result in any discernible lowering of water quality in Agua Hedionda Lagoon with respect to grease and oil. The periodic fish return cleaning process is also not projected to affect grease and oil concentrations or mass emissions.

3.4 OXYGEN-DEMANDING PARAMETERS AND DISSOLVED OXYGEN

Ambient Lagoon Dissolved Oxygen. Because of tidal flushing effects, ambient dissolved oxygen (DO) concentrations in the western portion of Agua Hedionda Lagoon mirror those in surface waters of the ocean. Oxygen deficiency and anoxic conditions have never been reported in the lagoon under the current lagoon mouth dredge practices.[89] DO concentration in the CDP intake were monitored as part of pilot plant operations, and DO values in the CDP intake ranged from 7.1 to 7.6 mg/l.[90] Additional monitoring conducted during 2016 (see Appendix DD of this RWD) showed a lagoon DO concentration of 7.6 mg/l.[91]

DO in the Fish Return Discharge. Due to the aeration effects of the CDP screen rinsing operation, DO in the fish return discharge may be slightly elevated compared to the lagoon intake. As a result, concentrations of DO in the fish return discharge are projected to be no lower than those in the highly aerated western portion of Agua Hedionda Lagoon.

Lack of Oxygen-Demand Effects. While BOD concentrations have not been measured in the western portion of Agua Hedionda Lagoon, BOD concentrations in this portion of the lagoon should mirror the low BOD concentrations present in ambient ocean water.

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87 See Table 2-4 on page 2-6.

88 See "Coatings" section of Appendix FF.

89 See Jenkins and Wasyl (2006).

90 See Attachment 7 to *Carlsbad Seawater Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2015).

91 See Table 1 of Appendix DD of this Report of Waste Discharge.

None of the watershed management efforts conducted within the Agua Hedionda watershed have identified oxygen-demanding wastes as an watershed water quality issue.[92] BOD monitoring of storm runoff that enters the eastern portion of Agua Hedionda Lagoon is performed by NPDES stormwater co-permittees, and the mean storm runoff BOD concentrations under wet weather conditions during the period 1997-2007 was reported at 11 mg/l.[93] BOD concentrations in the western portion of Agua Hedionda Lagoon under typical conditions may be concluded as being minimal (on the order of several mg/l).

Any small amount of BOD that is in the ambient lagoon water would predominately be in the form of soluble BOD or BOD associated with small particulate matter that would pass through the screens.[94] As a result, BOD concentrations in the fish return discharge are projected to low, and essentially the same as BOD concentrations in the ambient lagoon water.

While BOD concentrations in the fish return discharge will be low, the BOD test reflects biodegradation that occurs over a five-day period. As documented in Appendix GG, 50 percent of suspended material in the lagoon is typically flushed out within six hours and 98 percent is flushed out in 2.5 days. Any biodegradable material in the lagoon would thus typically be flushed out to the ocean in a time span less than the five-day period of the BOD test. As a result, the BOD test itself represents an overestimate of the effects any oxygen-demanding substances in the lagoon may have on DO concentrations.

Conclusion. The proposed fish return discharge will not result in any lowering of water quality with respect to DO. The fish return discharge will contain concentrations of DO that are at least as high as those in the ambient waters of the Agua Hedionda Lagoon. The fish return discharge will contain low concentrations of oxygen-demanding material, and BOD concentrations in the fish return discharge will mirror those in the ambient lagoon water. Tidal flushing conditions ensures that lagoon DO concentrations will be similar to DO concentrations in the surf zone. Further, the lack of settleable material in the fish return discharge ensures that discharged matter will be flushed out of the lagoon and will not concentrate or accrue in sediments in the discharge zone.

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92 Includes the *Agua Hedionda Watershed Water Quality Analysis and Recommendations Report* (Tetra Tech, 2007), the *Agua Hedionda Watershed Management Plan* (Tetra Tech, 2008), and the *Draft Water Quality Technical Report, Agua Hedionda South Shore Specific Plan* (Geosyntec Consultants, 2015).

93 As reported for the period 1997-2007 in Table 12 of the *Agua Hedionda Watershed Water Quality Analysis and Recommendations Report* (Tetra Tech, 2007).

94 While the screens would collect debris and larger solids less than 1 mm in size and return a portion of this debris to the lagoon in the fish return discharge, much of the larger solids and debris collected on the screens would be in form of twigs, leaves, and other small organic matter. Such larger particles of organic matter would be biodegradable over longer periods of time, but not noticeably degradable over the five-day test span of the BOD test. Additionally, since most screened debris would fall into the debris trough and be discharged to the effluent pond, the CDP intake would result in a net loss of debris from the lagoon. Combined, these factors ensure that larger debris will not result in any adverse dissolved oxygen impacts within the western portion of Agua Hedionda Lagoon.

3.5 TOXICITY

No Change in Concentrations of Toxic Constituents. As noted above, the CDP screening process will not add or utilize any chemicals, and the fish return discharge is projected to contain the same salinity concentration as the ambient Agua Hedionda Lagoon water. To date, no toxic organic constituents (except DEPH) has been present in the EPS effluent (which under co-located operations has served as the CDP intake). The screening/fish return system will not result in any changes in concentrations of salinity, toxic inorganic compounds, or toxic organic compounds.

Conclusion. The proposed fish return discharge will not result in any discernible lowering of water quality in Agua Hedionda Lagoon with respect to acute toxicity, chronic toxicity, or impairment of growth or reproduction in resident species.

The periodic fish return cleaning process is also not projected to affect acute or chronic toxicity in resident species.

3.6 TURBIDITY AND WATER CLARITY

Ambient Lagoon Water Clarity. Turbidity represents a measurement of water clarity, and is caused by dissolved ions, colloidal material, and small suspended particles. Turbidity may be measured by the degree of light scattering that occurs when a beam of light passes through a sample. Since the wavelength of visible light is slightly less than a micrometer (µm), turbidity is highly influenced by colloidal particles and solids significantly less than 1 mm in size.

Turbidity was extensively evaluated as part of CDP planning and design studies, as turbidity can result in shortened filter run times, membrane fouling, and reduced disinfection effectiveness. Comprehensive monitoring of the CDP pilot plant operations indicated an average turbidity of 2.1 NTU in the CDP influent, and the turbidity was less than 5 NTU during 94 percent of the samples.[95] Quarterly intake data collected as part of the CDP watershed sanitary survey showed a mean CDP intake turbidity of 3.1 NTU, with a maximum value of 7 NTU.[96] Turbidity monitoring conducted during times when the lagoon opening was being dredged showed no direct relationship between dredging activities and elevated turbidity.[97]

While turbidity is typically low in the lagoon, turbidity values can increase significantly during storm events. During storm events where significant storm runoff enters Agua Hedionda Lagoon, turbidity values in the lagoon may range from 10 to 30 NTU, and peak values may spike at more than 50 NTU.[98]

95 See page 4-10 and Figure 4-4 of the *Carlsbad Desalination Project Watershed Sanitary Survey* (Palencia Consulting Engineers, 2016.

96 See Table 4-3 of the CDP *Watershed Sanitary Survey*.

97 See page 4-11 of the CDP *Watershed Sanitary Survey*.

98 Turbidity values in the CDP intake exceeded 50 NTU on February 28, 2017, necessitating shutdown of CDP water production operations per provisions of the CDP Water Supply Permit.

The Water Supply Permit issued by the SWRCB Division of Drinking Water (DDW) requires the CDP to be shut down when CDP intake turbidities exceed 30 NTU for more than one hour.[99]

Intake Screening and Lack of Turbidity Effects. Essentially all dissolved, colloidal, and small particles that create turbidity will pass through the CDP screens. As a result, the turbidity of the screened water (which serves as the source of the low-pressure rinse) will be essentially the same as the lagoon water.[100] The fish return discharge is thus not projected to have any direct impact on the turbidity or water clarity in ambient lagoon waters.

The fish return discharge will also not cause any indirect impacts related to water clarity. The fish return discharge will be designed to convey fish and organisms back to the lagoon without exposing the organisms to excessive turbulence. As a result, the fish return discharge is not projected to roil ambient lagoon waters or cause any resuspension of sediments or significant increase in turbidty.[101]

Conclusion. The proposed fish return discharge will not result in any discernible lowering of water quality in Agua Hedionda Lagoon for turbidity or water clarity.

3.7 SUSPENDED SOLIDS AND DEBRIS

Lagoon TSS Concentrations. As documented in Section 2, TSS concentrations in the CFP influent during pilot testing (41 samples) averaged 4.2 mg/l.[102] TSS concentrations in the western portion of the lagoon increased during storm periods as a result of freshwater runoff from the eastern portion of the lagoon. Samples collected during storm events in January/February 2007 showed TSS concentrations of 17-22 mg/l in the CDP pilot plant intake. Similar TSS data have been reported for the north end of western Agua Hedionda Lagoon, where TSS concentrations reported by the Hubbs-Seaworld Research Institute for the period 2001-2009 averaged 6.9 mg/l with a standard deviation of 15.5 mg/l.[103]

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99 A one-hour turbidity limit of 50 NTU was originally established within Plant Operating Requirement No. 18 of *Domestic Water Supply Permit Issued to Poseidon Resources (Channelside) LP for the Carlsbad Desalination Plant, System No. 3710045, Permit No. 05-14-15P-010* (SWRCB Division of Drinking Water, 2015). The SWRCB Division of Drinking Water (DDW) subsequently revised this one-hour turbidity limit to 30 NTU after the storm event of February 27-28, 2017. DDW indicates that it will revisit this turbidity requirement once the CDP has a longer operating history.

100 While some larger solids may be broken into smaller solids by the high-pressure screen rinse which discharges to the debris trough and effluent pond, the low-pressure screen rinse is unlikely to affect turbidity in any discernible way. As a result, the turbidity of the fish return flow is projected to be the same as the ambient lagoon water.

101 Since no direct relationship exists between turbidity and lagoon dredging operations (which cause significant disturbance to lagoon sediments), it may be safely inferred that the fish return discharge will not cause any indirect turbidity impacts related to disturbance of sediments.

102 See Table 6 of *Amendment to Pilot Plant Report* (Poseidon Water, 2014).

103 Data from Hubbs-Seaworld Research Institute performed pursuant to RWQCB Order No. 2001-237 (NPDES CA0109355).

Pass-Through Effects of Smaller Sized TSS. Under permanent stand-alone operations, TSS particles less than 1 mm in size will pass through the CDP intake screens. For such smaller particles, the CDP intake screening process will neither concentrate solids nor change TSS concentrations. TSS concentrations of small suspended particles (< 1 mm) in the fish return discharge will be identical to TSS concentrations in the ambient lagoon water.

Since all such smaller particles will be suspended (no settleable solids), small size TSS particles will not accrue in sediments or be deposited. Instead, discharged TSS will be dispersed into the water column and conveyed out of the lagoon by tidal flushing. Additionally, only a fraction (0.3%) of the mass of smaller solids (< 1 mm) withdrawn in the CDP intake will be returned to the lagoon via the fish return discharge.[104] For these reasons, no lowering of water quality will occur in Agua Hedionda Lagoon with respect to suspended solids smaller than 1 mm.

Debris and Larger Particulates. TSS particles greater than 1 mm in size will be impinged on the CDP intake screens. A low-pressure rinse will deposit fish, organisms, and lighter material into the fish return trough for discharge back into Agua Hedionda Lagoon, while a subsequent high-pressure wash will rinse off remaining debris into a debris trough for discharge to the effluent pond. As noted, is should prove possible to tune the screen rinse system so a significant majority of the screen debris (more than 80 percent) ends up in the debris trough, and a smaller fraction (less than 20 percent) ends up in the fish return trough.

No data are available to describe particle sizes associated with the Agua Hedionda Lagoon TSS. Turbidity data and the lack of settleable solids in the CDP influent (see Table 2-4) suggest that a preponderance of the TSS particles in the CDP influent are less than 1 mm in size. This inference is supported by special CDP operational monitoring data collected during May 2014. As part of this sampling, the CDP influent was strained and visual observations were performed on strainer contents. None of the fourteen samples showed any visibly observable accrual of solids in the strainers.[105] It should be noted that the CDP influent evaluated in this May 2014 sampling had passed through the EPS bar racks and 9.5 mm travelling screens. The lack of visible solids accrual in the CDP influent strainers suggests that under typical operating conditions, very little of the CDP influent TSS is comprised of solids greater than 1 mm but less than 9.5 mm in size.

While this anecdotal evidence suggests that TSS in the CDP influent will be predominantly comprised of smaller size (< 1 mm) particles, larger size particles and debris may occur in the lagoon. During periods of storms, extreme tidal conditions, heavy surf and currents, or heavy winds, concentrations of larger (> 1 mm) suspended matter may become elevated as a result of bits of kelp, eelgrass, leaves, twigs, or other bits of organic matter.

104 See Table 2-8 on page 2-10.

105 The May 2014 CDP monitoring results and visual observations of influent strainers were reported in Attachment 7 (Sampling Logs) in Amendment to Pilot Plant Report (Poseidon Water, 2014).

Any such larger particles in the 299 mgd of CDP inflow would be washed off the screens and concentrated into either the fish return trough or debris trough. As noted, it should be possible to tune screen rinse system so that minimum of 80 percent of debris and larger solids are discharged to the effluent pond via the debris trough. Assuming that up to 20 percent of impinged solids are rinsed into the fish return trough by the low-pressure wash, however, concentrations of large particle TSS and debris in the fish return discharge could exceed concentrations of large particle TSS and debris in the fish return discharge. During times when large particulates comprise a significant fraction of the CDP influent TSS, fish return TSS concentrations could be elevated above 30 mgd and exceed ambient TSS concentrations in the lagoon.

Mass Emissions. Regardless of the particle size distribution of the Agua Hedionda Lagoon supply, the CDP fish return system will result in a significantly greater mass of solids being withdrawn from the lagoon than the mass of solids returned to the lagoon in the fish return discharge. Even under a scenario in which the fish return TSS is dominated by large particulate matter (> 1 mm), only approximately 1.6 percent of the TSS removed from the lagoon would be returned in the fish return discharge. If 100 percent of the influent TSS contained particles less than 1 mm in size, net TSS mass emissions would be 99.7 percent.[106]

Fate of Discharged Solids. Since the CDP influent contains virtually no settleable solids, TSS in the CDP influent will be comprised of fully suspended (or positively buoyant) particulates. As a result, solids impinged on the screens that are rinsed into the fish return trough will also remain in suspension upon discharge. Discharged solids will be dispersed through the water column and carried into the ocean by tidal flushing, and no solids deposition or sediment-related impacts would occur in the vicinity of the fish return discharge.

In the event debris or larger solid particles in the fish return discharge occur at concentrations in excess of ambient Agua Hedionda Lagoon concentrations, concentrations of the solids will quickly be dispersed in the western portion of the lagoon. Since only a fraction of the mass of solids in the CDP intake will be returned to the lagoon by the fish return discharge, the mass of total solids in the lagoon will be reduced by CDP operations. Because of lagoon circulation patterns and tidal flushing (see Appendices F and GG), and ambient TSS concentrations of the lagoon water will continue to be governed by the solids loads in the tidal inflow and in runoff from the upstream watershed. Further, as documented in Appendix GG, 50 percent of suspended material would be flushed from the lagoon within a 6-hour period, and 98 percent of the suspended material would be flushed out within a 2.5-day period. As a result of these factors, the fish return discharge will not result in any increase in overall TSS concentrations in the lagoon.

106 See Scenarios 1 and 2 of Table 2-8 on page 2-10.

Conclusion. The proposed fish return discharge will result in a significant reduction in the mass of larger suspended solids in Agua Hedionda Lagoon, as a significant majority of larger solids (solids > 1 mm) and debris will be rinsed off the screens into the debris trough by the high-pressure wash and will be discharged to the effluent pond. A fraction of the debris and larger solids impinged on the screens, however, will be rinsed off the screens by the low-pressure wash, and will be returned to Agua Hedionda Lagoon in the fish return discharge.

The potential exists, however, for the fish return discharge to periodically contain elevated concentrations of larger suspended solids (solids > 1 mm in size). These elevated concentrations of solids may include bits of kelp, eelgrass, leaves, twigs and other organic matter deposited in lagoon by currents, surf, tides, storm runoff, or winds. Under conditions of elevated concentrations of debris and larger suspended (> 1 mm) solids in the lagoon, TSS concentrations in the fish return discharge can exceed concentrations of TSS in the ambient Agua Hedionda Lagoon receiving water.[107]

Because of the potential for fish return TSS concentrations to periodically exceed TSS concentrations in the ambient Agua Hedionda Lagoon, water quality effects associated with this potential "lowering" of water quality are assessed to determine if beneficial uses are fully supported and if the fish return TSS concentrations are consistent with antidegradation criteria.

END OF SECTION 3

107 While a significant majority of solids captured on the CDP intake screens from the 299 mgd CDP intake flow will be discharged to the debris trough, up to approximately 20 percent may be discharged to the fish return trough. This 20 percent fraction of debris and solids would be concentrated in 1 mgd flow of the fish return discharge. The net result is that the concentration of debris and larger (> 1 mm) particulate matter in the fish return discharge may exceed the concentration of debris and larger size particulate matter in the ambient lagoon, even though CDP operations would significantly reduce the net mass of debris and larger particulate matter in the lagoon.

4. BENEFICIAL USE ASSESSMENT

4.1 CONSISTENCY WITH WATER QUALITY STANDARDS

Designated Beneficial Uses. The *Water Quality Control Plan for the San Diego Basin* (Basin Plan)[108] designates the following beneficial uses of waters of the western portion of Agua Hedionda Lagoon:

- industrial service supply (IND),[109]
- water contact (REC-1) and non-contact (REC-2) recreation,
- commercial and sport fishing (COMM),
- estuarine habitat (EST),
- wildlife habitat (WILD),
- habitat support for rare, threatened or endangered species (RARE),
- marine habitat (MAR),
- aquaculture (AQUA),
- migration of aquatic organisms (MIGR), and
- shellfish harvesting (SHELL).

Applicable Water Quality Standards. Water quality standards to protect these designated beneficial uses include:

- regional water quality standards established in the Basin Plan,
- state water quality standards established in state water quality plans such as the SWRCB *Water Quality Control Plan for Enclosed Bays and Estuaries*[110] and the *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays of California* (Thermal Plan), and
- state water quality standards promulgated by EPA in the California Toxics Rule (CTR),[111] and
- national water quality standards promulgated by EPA.[112]

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108 The current version of the San Diego Region Basin Plan is dated September 8, 1994, but includes amendments which became effective on or before May 17, 2016.

109 Includes the use of Agua Hedionda Lagoon water for industrial activities that do not primarily depend on water quality, including power plant cooling supply. The use of Agua Hedionda Lagoon water as a supply source to the CDP is also covered under this beneficial use designation.

110 The *Water Quality Control Plan for Enclosed Bays and Estuaries, Part 1, Sediment Quality* was approved by the SRWCB in September 16, 2008 and became effective on August 25, 2009.

111 The California Toxics Rule (CTR), as promulgated by EPA on May 18, 2000, within Title 40, Section 131.38 of the *Code of Federal Regulations* (40 CFR 131.38).

Lack of Existing Water Quality Impairment. The fish return discharge (Outfall 002) returns organisms and water that originated from the lagoon back into the lagoon. The quality of the fish return discharge is dependent on the quality of water in Agua Hedionda Lagoon.

Section 305(b) of the federal Clean Water Act (CWA) requires each State to monitor, assess, and submit to EPA a report on the quality of its waters relative to the designated uses of those waters. Section 303(d) of the CWA requires each State to regularly identify surface waters that do not meet applicable water quality standards after technology-based controls have been implemented.

In 2016, the RWQCB issued and approved the *2014 Integrated Report of Federal Clean Water Act Section 305(b) and Section 303(d) List of Water Quality Limited Segments for the San Diego* Region (RWQCB, 2016).[113] The 2014 Integrated 305(b)/303(d) Report assessed all available water quality and sediment data bases for the western portion of Agua Hedionda Lagoon. Based on available data and information, the Integrated 305(b)/303(d) Report concluded that:

- the weight of evidence indicates compliance with all applicable water quality standards, and
- no justification exists for placing any water quality parameter on the CWA 303(d) list within the western portion of Agua Hedionda Lagoon. [114]

Additionally, the 2014 Integrated 305(b)/303(d) Report recommended that Agua Hedionda Lagoon be removed from the 303(d) list as being impaired by sedimentation/siltation, in part, as:

- the lagoon is an engineered system that is artificially kept open and includes settling basins that are expected to require maintenance to remove sediment,
- there is a significant lack of data to support the original sedimentation listing in the 1992 303(d) Water Quality Assessment, and
- the outer lagoon continues to be dredged every 1 to 3 years.[115]

Compliance with Basin Plan Water Quality Objectives. The Basin Plan establishes both numerical and narrative objectives to protect designated beneficial uses. Numerical Basin Plan water quality objectives applicable to coastal lagoons include standards for ammonia, bacteriological indicators, biostimulatory substances, dissolved oxygen, pH, and turbidity. Table 4-1 (page 4-3) summarizes compliance of the proposed fish return discharge with Basin Plan numerical water quality objectives.

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112 Includes the National Toxics Rule (40 CFR 131.36) promulgated by EPA on December 19, 1992. The NTR standards promulgated in 1992 have been incorporated into the CTR criteria tables presented within 40 CFR 131.38.

113 The RWQCB approved the Integrated 305(b)/303(d) Report on October 16, 2016 with the adoption of RWQCB Resolution No. 2016-0196.

114 The 2014 Integrated 305(b)/303(d) Report evaluated available receiving water data through calendar year 2010. Water quality and sediment constituents within evaluated within the 2014 Integrated 305(b)/303(d) Report included total coliform, fecal coliform, enterococcus, ammonia, toxicity, sedimentation/siltation, and toxic organic compounds including volatile organics, acid-extractable compounds, base neutral compounds, and pesticides and PCBs.

115 See Decision ID 43540 within *Draft California 2014 Integrated 303(d) List/305(b) Report, Supporting Information* (RWQCB, 2016).

As shown in Table 4-1, the concentrations in the fish return discharge (and in the ambient Agua Hedionda Lagoon water) are in conformance with the Basin Plan numerical water quality objectives, and designated lagoon beneficial uses should remain protected with respect to each of these parameters.

Table 4-1
Projected Fish Return Discharge Compliance with Numerical Basin Plan Objectives

Parameter Type	Parameter	Fish Return Discharge to Agua Hedionda Lagoon[116] (Outfall 002)	Basin Plan Water Quality Objective
Physical/Chemical	Un-ionized ammonia	< 2 µg/l[117]	25 µg/l[118]
	pH	7.0 – 8.3[119]	7.0 – 9.0[120]
	Turbidity	2.8[119]	See note[121]
	Dissolved oxygen	> 7[122]	5.0[123]
Bacteriological	Fecal coliform	61[119]	200 per 100 ml[124]
Biostimulatory	Total phosphorus	< 70 µg/l[119]	50 – 100 µg/l[125]
	Total nitrogen	< 0.5[126]	See note[127]

116 Projected water quality of Agua Hedionda Lagoon water and the fish return discharge.

117 As shown in Table 2-4 on page 2-6, concentrations of total ammonia in the fish return discharge projected to be less than 0.1 mg/l. At the typical pH range of Agua Hedionda Lagoon waters, un-ionized ammonium comprises less than 2 percent of total ammonia. Concentrations of un-ionized ammonium in the fish return discharge are thus projected to be less than 2 µg/l. For comparison, Agua Hedionda Lagoon concentrations of un-ionized ammonia were consistently less than 1 µg/l in 2001-2008 data reported to the RWQCB by the Hubbs-Seaworld Research Institute (2009).

118 The discharge of wastes shall not cause concentrations of un-ionized ammonia (NH_3) to exceed 0.025 mg/l in coastal lagoons.

119 See Table 2-4 on page 2-6.

120 In bays and estuaries, the pH shall not be depressed below 7.0 nor raised above 9.0 pH units.

121 For lagoon waters with a natural turbidity of 0 – 50 NTU, the turbidity shall not be increased more than 20 percent above the natural turbidity level.

122 DO concentration in the CDP intake were monitored as part of pilot plant operations, and DO values in the CDP intake ranged from 7.1 to 7.6 mg/l.[122] Additional monitoring conducted during 2016 (see Appendix DD of this RWD) showed a lagoon DO concentration of 7.6 mg/l.

123 Dissolved oxygen shall not be less than 5.0 mg/l in waters designated with a Marine Habitat (MAR) beneficial use. The annual mean DO concentration shall not be less than 7 mg/l more than 10 percent of the time.

124 In waters designated for water contact recreation (REC-1), fecal coliform concentrations of not less than five samples during any 30-day period shall not exceed a log mean of 200 per 100 ml, nor shall more than 10 percent of the samples during any 30-day period exceed 400 per 100 ml.

125 Threshold total phosphorus concentrations shall not exceed 0.05 mg/l in any stream where it enters any standing body of water, nor 0.025 mg/l in any standing body of water. To prevent plant nuisances in streams and other flowing waters, the Basin Plan establishes a total phosphorus threshold of 0.1 mg/l. These standards are not to be exceeded more than 10 percent of the time. The Basin Plan does not provide guidance as to whether coastal lagoons subject to significant tidal flushing are "standing" or "flowing" bodies of water.

126 Concentrations of organic nitrogen have not been monitored within the CDP intake, but ammonia and nitrate (see Table 2-4 on page 2-6) have consistently been less than 0.2 mg/l. Total nitrogen monitoring of Agua Hedionda Lagoon water by Hubbs-Seaworld Research Institute (2009) for the period 2001-2009 showed a median total nitrogen concentration of 0.44 mg/l during the period 2001-2009.

127 Analogous threshold values have not been set for total nitrogen, however, natural ratios of nitrogen to phosphorus (N:P) are to be determined and upheld. If data are lacking, a N:P ratio of 10.1 on a weight-to-weight basis shall be used.

The Basin Plan also establishes narrative objectives to protect beneficial uses. Table 4-2 summarizes Basin Plan narrative objectives applicable to the fish return discharge. Table 4-2 also summarizes how the fish return discharge complies with each narrative objective.

Table 4-2
Basin Plan Narrative Objectives Applicable to Agua Hedionda Lagoon

Parameter	Basin Plan Narrative Objective	Fish Return Discharge: Assessment of Compliance
Biostimulation	Concentrations of nitrogen and phosphorus, by themselves or in combination with other nutrients, shall be maintained at levels below those which stimulate algae and emergent plant growth.	The fish return discharge will contain the same concentrations of dissolved nutrients as the ambient lagoon water.[128] The ambient lagoon water complies with existing Basin Plan numerical objectives for nutrients. Mean residence times are limited in the western portion of Agua Hedionda Lagoon due to tidal flushing.[129]
Color	Waters shall be free of coloration that causes nuisance of adversely affects beneficial uses.	The screening operation or fish return discharge will not result in any addition of color or coloration.
Floating Material	Waters shall not contain floating material, including solids, liquids foams, and scum in concentrations which cause nuisance or adversely affect beneficial uses.	Any small particle floating material (< 1 mm in size) will pass through the influent screens and will be returned to the lagoon in the same concentration as the ambient water.[128] The mass of any larger floating particulate matter (e.g. leaves, twigs) discharged to the lagoon will be a small fraction (< 2 percent) of the mass of the floating particulate matter in the CDP intake.[130] Any larger floating particulate matter will be dispersed into the western Agua Hedionda Lagoon and flushed out to the ocean.[131]
Oil and Grease	Waters shall not contain oils, greases, waxes or other materials in concentrations which result in a visible film or coating on the surface of the water or objects in the water, or which cause nuisance or which otherwise adversely affect beneficial uses.	The fish return will contain negligible concentrations of oil and grease.[132]
Sediment	The suspended sediment load and suspended sediment discharge rate of natural surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.	Operational monitoring data demonstrate a consistent lack of settleable solids in the lagoon intake supply. Neither the fish return discharge nor cleaning operations (with appropriate mitigation) will result in the concentration of any settleable material or sediments, or will result in the deposition of solids on the lagoon bottom.[130]
Suspended and Settleable Solids	Waters shall not contain suspended or settleable solids in concentrations of solids that cause nuisance or adversely affect beneficial uses.	Smaller suspended solids (< 1 mm) will pass through the CDP screens, and concentrations of such smaller solids in the fish return discharge will be the same as concentrations in the ambient lagoon.[128] The mass of any larger suspended matter (> 1 mm) discharged to the lagoon will be a small fraction (< 2 percent) of the mass of the suspended material in the CDP intake.[130] Any larger suspended material will be dispersed in the lagoon and flushed to the ocean.[131]
Toxicity	All waters shall be maintained free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in human, plant, animal, or aquatic life.	The screening operation will not add any toxic chemicals, and the fish return discharge will not result in any increase in acute or chronic toxicity over and above the ambient lagoon water.[133]
Transparency	The transparency of waters in lagoons and estuaries shall not be less than 50 percent of the depth, except where lesser transparency is caused by runoff from undisturbed natural areas and dredging projects conducted in conformance with waste discharge requirements issued by the RWQCB.	Turbidity will typically be low in the fish return discharge. Smaller particles and colloids that contribute to turbidity will pass through the screens, and will be discharged back into the lagoon in the same concentrations as the CDP intake flow. Circulation patters in the western Agua Hedionda Lagoon will disperse the fish return discharge.[134]

128 See Section 3.2 on page 3-2.
129 See Table 4-1 on page 4-3.
130 See Section 3.7 on page 3-7.
131 See tidal velocity and dispersion profiles presented in RWD Appendix GG. As documented in Appendix GG, 50 percent of suspended material will be flushed out to the ocean within 6 hours, and 98 percent of suspended material will be flushed to the ocean within 2.5 days.
132 See Section 3.3 on page 3-4.
133 See Section 3.5 on page 3-6.
134 See Section 3.6 on page 3-6.

Compliance with California Toxics Rule Standards. CTR standards[135] include standards promulgated for the protection of aquatic habitat and standards for the protection of public health (consumption of organisms. The CTR standards help support designated Agua Hedionda Lagoon beneficial uses.

Table 4-3 summarizes compliance of the proposed fish return discharge with CTR standards for toxic metals and toxic organic constituents. As shown in the table, projected concentrations of toxic inorganic and organic compounds in the fish return discharge are projected to be significantly less than applicable CTR/NTR standards.

Table 4-3
Projected Fish Return Discharge Compliance with California Toxics Rule Standards

Toxic Inorganic Constituents[136]	Concentration (µg/l) Fish Return Discharge to Agua Hedionda Lagoon[137] (Outfall 002)	CTR Standard for the Protection of Aquatic Habitat		CTR Human Health Standard
		Criteria Maximum Concentration[138] (µg/l)	Criteria Continuous Concentration[139] (µg/l)	Consumption of Organisms (µg/l)
Toxic Metals				
Antimony	0.097	No standard	No standard	4300
Arsenic	1.5	69	36	No standard
Cadmium	0.02	42	9.3	No standard
Chromium VI	0.585	1100	50	No standard
Copper	0.097	4.8	3.1	No standard
Lead	0.1	210	8.1	No standard
Mercury	0.031	1.8	0.94	0.051
Nickel	0.325	74	8.2	4600
Selenium	0.018	290	71	No standard
Silver	0.023	1.9	No standard	No standard
Thallium	0.009	No standard	No standard	6.3
Zinc	1.6	90	81	No standard
Toxic Organic Constituents				
Bis(2-ethylhexyl) phthalate[140]	0.07	No standard	No standard	5.9

135 Includes NTR standards promulgated by EPA in 1992.

136 The fish return (Outfall 002) discharge will contain approximately the same concentrations of the above constituents as the Agua Hedionda Lagoon intake water.

137 Projected water quality of Agua Hedionda Lagoon water and fish return discharge from Table 2-6 on page 2-8.

138 Criteria maximum concentration that causes impacts after acute exposure.

139 Criteria continuous concentration that causes impacts after 4 days of exposure.

140 Bis(2-ethylhexyl) phthalate, also known as di(2-ethylhexyl) phthalate or DEPH, has been detected in trace amounts in the EPS effluent which serves as the CDP influent. It is unknown whether or not DEPH is present in the lagoon in detectable quantities.

4.2 PROTECTION OF BENEFICIAL USES

Conclusions. Concentrations of dissolved constituents and smaller suspended solids (< 1 mm) will pass through the CTP intake screens, and concentrations of these constituents in the fish return discharge (Outfall 002) will be the same as concentrations in the ambient lagoon. Agua Hedionda Lagoon currently complies with applicable water quality standards for the protection of designated lagoon beneficial uses. With implementation of the fish return discharge, the lagoon will continue to comply with all applicable Basin Plan numerical objectives, Basin Plan narrative objectives and CTR water quality standards.

Concentrations of debris and larger suspended solids (< 1 mm), including bits of kelp, eelgrass, leaves, twigs, and other organic matter are typically low in the ambient lagoon waters.[141] During periods of storms, extreme tidal conditions, heavy surf and currents, or heavy winds, however, the potential exists for elevated concentrations of larger suspended solids (> 1 mm) to occur within the lagoon. This suspended material may include bits of kelp, eelgrass, leaves, twigs, or other bits of organic matter.

During such times, TSS concentrations in the fish return discharge may exceed ambient TSS concentrations in the lagoon. No impacts to water quality are projected, however, as the fish return discharge will result in a reduced mass of these larger solids in the lagoon, and discharged material will be rapidly dispersed. Tidal currents will flush 50 percent of discharged suspended solids to the ocean within 6 hours and will flush 98 percent of the discharged solids to the ocean within 2.5 days.[142] No discernible adverse effects on dissolved oxygen, water clarity, or other water quality parameters are projected.[143]

Of the mass of suspended solids withdrawn from the lagoon by the CDP intake, the fish return discharge returns only a small fraction (< 2 percent) of the mass of these suspended solids back into the lagoon. The Basin Plan does not establish a numerical objective for suspended solids, but the fish return discharge will comply with Basin Plan narrative objectives (see Table 4-2 on page 4-4) for floatable materials, suspended solids, and sediments.

Maintenance of High Quality Water. By complying with Basin Plan and CTR water quality standards, the fish return discharge is consistent with maintaining the existing high quality of Agua Hedionda Lagoon water necessary to support beneficial use, and the fish discharge will not unreasonably affect present or anticipated beneficial uses.

141 As described on pages 3-7 and 3-8, monitoring data presented in Attachment 7 to Amended Pilot Plant Report (Poseidon Water, 2014) show that no visible larger solids or debris were visually observed in 14 strained CDP influent samples collected during 2014. The CDP influent had passed through the EPS screens, so any particulates less than 9.6 mm in size that were present in the CDP influent would have been observed.

142 See RWD Appendix GG.

143 See Sections 3, pages 3-2 through 3-10.

Water Body Designation. As noted in Section 1 (see Figure 1-1, Antidegradation Implementation Decision Process), existing high water quality must be maintained in all waters designated as an "Outstanding Natural Resource". Agua Hedionda Lagoon is not designated as an "Outstanding Natural Resource." Additionally, no waters designated as an "Outstanding Natural Resource" exist near the mouth of Agua Hedionda Lagoon.

As a result, if the RWQCB determines that the fish return discharge is deemed to result in a "lowering" of water quality due to periodically higher concentrations of larger particulate matter (> 1 mm) in the fish return discharge compared to the ambient lagoon water, such a lowering of water quality may be allowed subject to demonstrating compliance with "maximum benefit" criteria established within the State's antidegradation policy.

END OF SECTION 4

5. MAXIMUM BENEFIT ASSESSMENT

5.1 ALTERNATIVES TO FISH RETURN DISCHARGE

Purpose of Fish Return Discharge.

Section 13142.5(b) of the *California Water Code* (CWC) requires industrial facilities that utilize seawater to use the best available site, design, technology, and mitigation feasible to minimize the intake and mortality of marine life. The proposed screen washing system and fish return discharge is proposed as part of the overall plan to comply with this requirement.

The purpose of proposed fish return discharge is to provide positive environmental benefit by returning a portion of organisms that enter CDP intake structure back in to the lagoon. The location of the fish return (Outfall 002, see Figure 2-2 on page 2-2) was selected to minimize recirculation of organisms back into the CDP intake structure by:

- providing sufficient separation (approximately 90 yards) between the fish return discharge point and CDP intake structure, and
- discharging organisms into a portion of the lagoon where circulation velocities are sufficiently low to allow organisms free movement away from the CDP intake.

The dual rinse system used to clean the traveling screens is designed to maximize the percent of organisms that are washed into the fish return trough, while minimizing the amount of debris returned to the lagoon. The fish return system will be designed to minimize stress to the organisms in the rinse and fish return systems so that a significant majority of organisms collected in the fish return trough can survive and be safely conveyed back into the lagoon.[144]

To maximize the percent of organisms returned to the lagoon, however, it will not be possible to separate 100 percent of the debris from the organisms. As a result, an adverse side effect of the fish return system is that a fraction of the solid material caught on the CDP 1 millimeter intake screens will be returned to the lagoon along with the organisms.

Environmental Effects of Fish Return Discharge. Of the mass of solids withdrawn from the lagoon, the fish return system will return only approximately 0.3 percent of the dissolved constituents and small solids (< 1 mm) back into the lagoon. Approximately 1.6 percent of the mass of larger suspended solids (> 1 mm) in the CDP intake will be returned are in the lagoon

144 See RWD Appendices EE and TT.

via the fish return discharge.[145] The proposed fish return discharge will thus result in a significant net reduction of dissolved and suspended solids in the lagoon.

Concentrations of dissolved constituents and small suspended solids (< 1 mm) in the fish return discharge will be the same as the ambient lagoon, so no lowering of water quality will occur for such dissolved constituents or small (< 1 mm) suspended solids. Particle size monitoring of the CDP intake has not been performed, but May 2014 visual observation of strained CDP influent revealed no visible solids in the strainers.[146] Anecdotal observations by CDP operators, however, indicate that the lagoon can periodically contain appreciable quantities of larger suspended solids, including:

- pieces of kelp, eel grass, or bits of other submerged vegetation dislodged by currents or ocean conditions, and
- leaves, twigs, and bits of organic material blown or washed in the lagoon.

As discussed in Section 3, when appreciable quantities of larger solids are present in the CDP intake flow, these solids will be impinged on the screens and a fraction of the solids (less than 20 percent) will be returned back into the lagoon. During such conditions, the potential exists for concentrations of larger suspended solids (> 1 mm) in the fish return discharge may exceed the concentrations of solids in the ambient lagoon water. No adverse impacts to beneficial uses will occur as a result of this concentration increase, however, as:

- The fish return discharge (like the CDP intake flow) is not projected to contain any discernible quantity of settleable solids, so no significant settling or deposition of discharged solids is projected to occur near the fish return discharge point.[147]
- The fish return discharge would contain only approximately 1.6 percent of the mass of larger solids (> 1 mm) that are withdrawn from the lagoon in the CDP intake.[145]
- As documented in Appendix GG, tidal fluxes result in relatively rapid dispersion within the western portion of the Agua Hedionda Lagoon, and approximately 50 percent of suspended material is flushed from the lagoon within six hours, and 98 percent is flushed out within 2.5 days.

In summary, the fish return discharge will create positive environmental effects (e.g. return organisms to the lagoon), and the discharge is not projected to result in any discernible effects on beneficial uses or result in any adverse environmental effects. Nonetheless, a maximum benefit analysis of the proposed fish return discharge is warranted because of the potential for concentrations of large suspended solids (> 1 mm) in the fish return discharge to exceed TSS concentrations in the ambient lagoon waters.

145 See Table 2-8 on page 2-10.

146 Monitoring data reported in Attachment 7 to *Amended Pilot Plant Report* (Poseidon Water, 2014).

147 Periodic cleaning of the fish return system using appropriate mitigation will be required to remove any sediment, mussels, shells, or other settleable debris from the walls of the fish return pipe to prevent its being discharged to the lagoon.

5.2 PRIOR ASSESSMENT OF ALTERNATIVES

Categories of Alternatives. Potential alternatives to the fish return discharge are identified as a first step in this maximum benefit analysis. Six general categories of intake/fish return alternatives have been considered, including:

1. Move the fish return discharge point from the lagoon to the effluent pond.
2. Retain the CDP surface intake, but eliminate the fish return system and fish return discharge.
3. Eliminate the CDP surface intake in favor of implementing an alternative intake and discharge technology.
4. Modify or reconfigure the CDP surface intake to reduce overall velocities in the intake channel.
5. Permanently decommission the CDP once the EPS is shut down.
6. Downgrade the CDP potable water production capacity to reduce required inflows.

The feasibility, benefits, and impacts of each of these categories of alternatives have been assessed as part of studies that have:

- assessed compliance with requirements of the California Environmental Quality Act (CEQA),
- assessed compliance with the 2015 Ocean Plan Amendments, and
- supported the RWQCB's analysis of conformance with requirements established in *California Water Code* Section 13142.5(b).

Initial CEQA Analyses. Alternative intake designs evaluated in the original CDP Environmental Impact Report (EIR) included vertical intake wells, horizontal beach wells, and infiltration galleries. Vertical beach wells were concluded as not being feasible. Horizontal beach wells and infiltration galleries were eliminated from consideration due to adverse unmitigable environmental impacts to visual resources and recreation, and significant temporary impacts to biological resources.[148] Because horizontal beach wells, vertical beach wells, and infiltration galleries were deemed unfeasible in the CEQA analysis, these alternatives are not further considered within this antidegradation analysis.

Ocean Plan Intake/Discharge Alternatives. A series of intake/discharge alternatives were evaluated within this RWD as part demonstrating compliance with CWC 13142.5(b) and the 2015 Ocean Plan Amendments.[149] Intake alternatives includes surface screened intake, subsurface intake, offshore wedgewire, lagoon wedgewire, and lagoon traveling screens. These

148 See page 6-6 of the *Carlsbad Precise Development Plan and Desalination Plan Final Environmental Impact Report for the Carlsbad Desalination Project* (City of Carlsbad, 2006).

149 See RWD Appendices B, II, and SS.

intake alternatives were assessed in conjunction with two discharge alternatives: flow augmentation and multiport diffuser.[150] These Table 5-1summarizes the overall feasibility of these alternatives against the feasibility requirement of CWC 13142.5(b). As shown in the table, only Alternative 1 (surface screen intake with flow augmentation) was concluded as being feasible.[151] Because subsurface intake, offshore wedgewire intakes, lagoon wedgewire intakes, multiport diffuser alternatives (see Table 5-1) are concluded as not feasible, these alternatives are not further considered within this antidegradation analysis.

Table 5-1
Feasibility Summary: Intake/Discharge Alternatives

Intake/Discharge Alternative		Projected Annual Cost[152] ($million per year)	Total Impacted Area (acres)[153]	Feasibility Conclusions[154]				
No.	Description			Economically Feasible?	Socially Feasible?	Technically Feasible?	Capable of Being Accomplished in Reasonable Time Period?	Overall Feasibility
1	Proposed Project: Surface screened intake with flow augmentation	$6.9 M[155]	99.8	Yes	Yes	Yes	Yes	Yes
2	Surface screened intake with multiport diffuser	$61.6 M	118.9	No	Yes	Yes	No	No
3	Subsurface intake with flow augmentation	$159 M	87.5	No	No	No	No	No
4	Subsurface intake with multiport diffuser	$94.3 M	114.4	No	No	Yes	No	No
5	Offshore wedgewire screen with flow augmentation	$48.9 M	109.5	No	Yes	Yes	No	No
6	Offshore wedgewire screen with multiport diffuser	$76.0 M	123.1	No	Yes	Yes	No	No
7	Lagoon wedgewire screen with flow augmentation	$ 33.7 M	99.6	No	Yes	Yes	No	No
8	Lagoon wedgewire screen with multiport diffuser	$60.6 M	119.0	No	No	No	No	No
9	Lagoon traveling screen with flow augmentation	$29.7 M	99.9	No	Yes	Yes	No	No
10	Lagoon traveling screen with multiport diffuser	$59.7 M	119.3	No	Yes	Yes	No	No

150 The multiport diffuser would allow for reduced intake flows compared to flow augmentation, resulting in less entrainment and impingement.

151 Per the 2015 Ocean Plan Amendments, feasible for purposes Chapter III.M (Implementation Provisions for Desalination Facilities) is defined as “being capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors.

152 From Table 1 of RWD Appendix II.

153 Sum of area of production foregone, brine mixing zone impacts, and construction impacts. Values from Table 5 of RWD Appendix II.

154 See Table 6 and Sections 4 and 5 of RWD Appendix II.

155 Total capital costs for Alternative 1 (the proposed CDP permanent stand-alone project) are estimated (see RWD Appendix II) at $47.7 million, with an annualized cost of $8.4 million per year. Costs for Alternative 1 were updated in April 2017 at a total capital costs of $48.7 million and an annualized cost of $6.9 million per year.

Ocean Plan Intake/Discharge Alternatives. At the request of the SWRCB, a series of supplemental surface intake and screening alternatives were evaluated within this RWD as part demonstrating compliance with CWC 13142.5(b) and the 2015 Ocean Plan Amendments. Each of these alternatives would retain the need for the fish return discharge, and would not affect overall solids loads discharged in the fish return system. Because of slower velocities through the intake channels, however, the potential exists for a slight increased rate of escape from the intake channels for mobile species, thus reducing marine life loss by a small amount. Table 5-2 summarizes the economic feasibility and benefits of these supplemental surface intake configurations.

Table 5-2
Economic Analysis of Alternative Surface Intake Configurations

Alternative Surface Intake Configuration[156]		Incremental Increase in Annual Cost[157] Compared to Alternative 1 ($million per year)	Reduction in Marine Mortality Compared to Alternative 1[157] (lbs/day)	Unit Cost of Reduced Mortality[157,158] Compared with Alternative 1 ($/lb)
No.	**Description**			
11	Eliminate existing intake channels and draw water into screens installed on what is currently the discharge pond site	$ 6.6 M	0.65	$ 27,800
12	Eliminate existing intake channels and draw water into screens oriented back-to-back on what is now the discharge pond site	$ 6.5 M	0.58	$ 30,700
13	Eliminate existing intake channels and draw water into intake screens oriented in a straight alignment	$ 6.5 M	0.53	$ 33,400
14	Eliminate existing intake channels and draw water into intake screens oriented along a bent alignment	$ 6.7 M	0.53	$ 34,700
15	Repurpose existing effluent channel into a third intake channel with bar racks to feed 7 traveling screens	$ 0.46 M	0.07	$ 18,000
16	Widen the existing intake and bar racks to feed 7 traveling screens	$ 1.75 M	0.00	NA
17	Similar to Alternative 16, plus repurpose existing effluent channel into additional intake channel width to feed 7 traveling screens	$ 2.16 M	0.07	$ 84,500
18	Same as Alternative 17, except a fourth 20-foot-wide intake channel is added to feed 7 traveling screens	$ 3.08 M	0.10	$ 84,400
19	Similar to Alternative 15, except the height of the three intake channels would be raised 10.5 feet to feed 7 traveling screens	$ 1.08 M	0.10	$ 29,500
20	Similar to Alternative 15, but expand the intake channel length to accommodate 11 dual flow traveling screens	$ 2.19 M	0.07	$ 85,800

As shown in Table 5-2, the alternative surface intake configurations provide minimal environmental benefit compared to cost and are concluded as not being economically viable.

156 Each alternative intake configuration utilizes screening rinsing and a fish return system. The mass of solids discharged in the fish return system would be essentially the same among the alternatives surface intake configurations.

157 Information for Alternatives 1 and Alternatives 15-20 are from RWD Appendix BBB. Information for Alternative1 and Alternatives 11-14 are from Appendix CCC. Each alternative would continue the need for the fish return discharge, but by modifying the intake configuration, intake velocities under the alternatives could be reduced compared to Alternative 1, thus enhancing the capability of fish to escape and reducing the mass of organisms that reach the screens.

158 Computed as the ratio of (1) the difference between the projected annual cost of the listed alternative and Alternative 1 and (2) the difference between the net marine life productivity loss between the listed alternative and Alternative 1.

Additionally, compared to Alternative 1, the alternative intake configurations (Alternatives 11-20) will not discernibly affect the fish return discharge point (Options 1 or 2), the fish return discharge flow, the fish return solids concentrations, or the projected receiving water quality. For these reasons, the alternative surface intake configurations are not further considered in this antidegradation analysis.

5.3 SOCIOECONOMIC EVALUATION

Fish Return Discharge Options. Having eliminated non-feasible intake/discharge alternatives from further consideration (see Section 5.2), surface intake with flow augmentation remains as the only viable operational option for the CDP. Under permanent stand-alone operations, the amount of required flow augmentation is established by the need to comply with Ocean Plan receiving water salinity standards. As a result, reduction in the proposed 299 mgd CDP intake flow is not feasible unless either CDP potable water production rates are reduced or if the CDP is shut down.

Infeasibility of Terminating or Reducing CDP Operations. Neither CDP shutdown nor production capacity reduction is economically or socially feasible. Net marine life productivity loss associated with the proposed surface intake screens and fish return system is estimated at approximately 0.85 pounds of organisms per day (lbs/day).[159] Terminating CDP operations to eliminate this loss of 0.85 lbs/day of marine organisms would result in significant social and economic impacts including:

- Loss of important local water resource (approximately 60,000 acre-feet per year) that contributes to approximately 8 percent of SDCWA annual supply and an increase in the region's dependence on imported water from the Colorado River and State Water Project.[160]
- Reduced regional protection against catastrophic aqueduct failure or drought.[161]
- Regional water quality benefits in the millions of dollars associated with reduced salinity levels in the desalination supply compared to imported and other local supplies.[162]

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159 See Appendix BBB of this RWD.

160 See water demands and projected CDP water contributions estimated by the San Diego County Water Authority (SDCWA) in the *2015 Urban Water Management Plan* (SDCWA, 2015).

161 Studies performed by SDCWA as part of the Emergency Storage Project to support the *Emergency Water Storage Project Environmental Impact Statement/Environmental Impact Report* (SDCWA 1996) determined catastrophic interruption of imported water deliveries to the region could result in $87 billion of economic impacts to the San Diego County economy. To help prevent such economic impacts, SDCWA implemented the $1.5 billion Emergency Storage Project which adds 90,000 of regional storage for emergency use. The 60,000 acre-feet per year (AFY) CDP desalination supply would augment this emergency storage during times of catastrophic imported water interruption, and help meet the approximate 500,000 AFY demands of the region during such emergency periods.

162 The Metropolitan Water District *Salinity Management Study* (Metropolitan Water District, 1999) estimated that a 100 mg/l reduction in potable supply TDS concentrations resulted in $95 million per year in economic benefits (in 1999 dollar) over approximately 4 AFY of supply. In current 2017 dollars, this translates to several million dollars of salinity-related water quality benefits in the San Diego Region, as the higher quality CDP water may reduce overall regional average TDS concentrations by an average of 10 to 20 mg/l.

- Loss of approximately 42 full time jobs at the CDP, and the loss of support for more than 500 direct, indirect, and induced jobs resulting in an annual total of $50 million in annual spending to the San Diego County economy.[163]
- Investor and bondholder losses of up to $1 billion.[164]
- Regional economic impacts in the billions of dollars.[165]

Reducing CDP production rates (and hence intake flows) would result in proportional reduction[166] in entrained and impinged organisms, but would similarly entail significant social and economic impacts, including:

- Underutilization of facility capacity.
- Reduction in local water production capacity and a proportional increase in the region's dependence on imported water from the Colorado River and State Water Project.
- Reduced regional protection against catastrophic aqueduct failure or drought proportional to the degree of flow reduction.
- Reduced regional water quality benefits associated with reduced salinity levels in the desalination supply compared to imported and other local supplies.
- Investor and bondholder losses of up to $1 billion if reduced water sales are inadequate to meet revenue bond obligations.
- Regional economic impacts (likely to be in the billions of dollars) proportional to the degree of reduced plant capacity.

No reasonable social or economic rationale exists for shutting down the $1 billion CDP and suffering billions of dollars of economic impacts in order to eliminate the fish return discharge to the lagoon.[167] Further, no economic or social rationale exist for reducing CDP production rates to lessen the mass of solids return back into the lagoon by the fish return discharge. For these reasons, shutting down or reducing the capacity of the CDP is not further considered as part of this antidegradation analysis.

163 Source: Claude "Bud" Lewis Carlsbad Desalination Plant website, located at: carlsbaddesal.com/faqs.

164 Includes default of revenue bonds issued by the California Pollution Control Financing Authority on behalf of SDCWA and the loss of private equity financing.

165 Includes economic losses due to reduced local water supplies, reduced protection against catastrophic aqueduct failure or drought, loss of jobs, losses associated with defaults to investors, loss of local jobs at the CDP, and economic multiplier effects on the local economy associated with each of these factors.

166 Entrainment and impingement of non-mobile organisms would be directly proportional to the amount of CDP intake flow reduction. Additionally, reduced intake flow rates would result in reduced intake velocities which would improve the ability of mobile species to escape from the intake system prior to reaching the screens.

167 The fish return system provides the benefit of reducing marine life loss associated with CDP intake operations, but comes at the "cost" of entailing a discharge of solids back into the lagoon. As noted, although the fish return discharge results in a significant net reduction in TSS mass emissions within the south part of the lagoon, concentrations of larger (> 1 mm) solids in the fish return discharge can be in excess of concentrations in the ambient lagoon. Economic impacts associated with eliminating or reducing mass of solids that are returned back into the lagoon by shutting down (or reducing) CDP operations are not warranted when compared against the "benefits" of eliminating the fish return discharge (e.g., reducing the mass of solids discharged back into the lagoon by the fish return system).

Remaining Feasible Alternatives. Having demonstrated the infeasibility of alternative intake/discharge technologies, the infeasibility of alternative surface intake configurations, and the infeasibility of shutting down the CDP or reducing CDP production rates, remaining options[168] relative to the fish return discharge include:

Option 1: Implement the proposed project (surface intake with flow augmentation) with the proposed fish return discharge.

Option 2: Implement the proposed project (surface intake with flow augmentation) but relocate the fish return discharge to the effluent pond.

Option 3: Eliminate the fish return discharge line and discharge all debris and organisms rinsed off the screens to the debris trough for discharge to the lagoon.

Economic, social, and environmental benefits and impacts are assessed for each of these three alternatives to (1) determine which option provides maximum benefit, and (2) determine if the proposed project is consistent with providing maximum benefit to the state.

Summary of Environmental Consequences. Table 5-3 (page 5-9) summarizes probable environmental consequences of the fish return options. Option 1 (fish return to the lagoon) should provide for a more quiescent release compared to the effluent pond discharge. While directing the fish return discharge to the effluent pond (Option 2) would expose organisms to increased salinity from the RO concentrate, salinities in the discharge pond would be less than 42 parts per thousand. As demonstrated within Appendix I, this level of salinity should not substantially affect the development or survival of marine organisms.

Economic Impacts on Receiving Water Beneficial Uses. Table 5-4 (page 5-10) presents designated beneficial uses, summarizes effects of the two fish return discharge options on the beneficial uses, and assigns an economic value to any identified impacts. As shown in the table, the fish return discharge is not projected to result in any discernible effect on beneficial uses, or create any quantifiable economic impact to these uses.

Impingement, Entrainment, Construction and Maintenance Impacts. In addition to economic costs associated with impacts of the fish return discharge on receiving waters, additional economic costs or benefits costs may be associated with:

- impingement and entrainment effects associated with operation of the CDP intake, screens, and fish return system,
- environmental impacts related to construction or maintenance of the fish return system, and
- costs related to the construction and operation of the fish return system.

168 Eliminating the fish return discharge entirely (e.g. eliminating the low-pressure rinse and eliminating the fish return trough and discharge line) is not considered herein, as no significant cost or operational benefits accrue, and the high-pressure rinse is likely to result in increased mortality to organisms that otherwise might survive the low-pressure rinse.

Table 5-3
Environmental Consequences of Fish Return Options

Alternative	Environmental Consequences Caused by Operation of the Fish Return Discharge[169]
Option 1, Proposed Project: Surface intake with flow augmentation and fish return discharge	• Mass emissions of dissolved constituents and small solids (< 1 mm) to the lagoon will be approximately 0.3 percent of the mass withdrawn from the lagoon by the 299 CDP intake. Remaining mass (99.7%) is discharged to the effluent pond. • Mass emissions of larger suspended solids (> 1 mm) to the lagoon will be approximately 1.6 percent of the mass withdrawn from the lagoon by the 299 mgd CDP intake. The remaining mass (98.6%) of larger (> 1 mm) suspended solids is discharged to the effluent pond. • Concentrations of dissolved constituents and small solids in the fish return discharge to the lagoon will be the same as concentrations in the ambient lagoon waters. • Concentrations of larger suspended solids (> 1 mm) in the fish return discharge may be greater than concentrations in the ambient lagoon water, but discharged solids will be rapidly dispersed from the discharge point and flushed into the ocean by tidal currents. Increased concentrations of larger impinged solids are projected to be greatest during times of storm runoff, high surf, high winds, or extreme tides, as the low TSS concentrations that normally occur in the lagoon may be increased by the presence of bits of kelp, eel grass, leaves, twigs, and other suspended or floating organic matter. • No discernible effects on water clarity or dissolved oxygen are projected to occur. • No discernible impacts will occur to beneficial uses in the lagoon or in the ocean. • The fish return system will not affect concentrations of salinity or dissolved constituents in the CDP discharge to the effluent pond. • The productivity loss is estimated at approximately 0.85 lbs/day of marine organisms due to entrainment and impingement. • Approximately 85 percent of the organisms (> 1 mm) that reach the CDP intake screens will survive the fish return process and be safely returned to the lagoon (via the fish return system) where they came from.
Option 2, Modified Project: Surface intake with flow augmentation and fish return discharge to effluent pond	• Virtually all of the dissolved constituents and suspended solids in the 299 mgd CDP intake will be discharged to the effluent pond. • Virtually 100 percent of the mass of larger (> 1 mm) solids withdrawn from the lagoon will be directed to the effluent pond, either as bypassed flows or in the CDP filter backwash. • Concentrations of both dissolved constituents and suspended solids in the ocean discharge will be higher than ambient solids concentrations in the ambient ocean water. • The fish return system will result in an insignificant reduction in the concentrations of salinity or dissolved constituents in the CDP discharge to the effluent pond. • The effluent pond discharge (Outfall 001) will achieve significant initial dilution within the surf zone and zone of initial dilution (ZID), but turbulence in the discharge system will exceed turbulence in the fish return discharge to the lagoon (Outfall 001). • No impacts to beneficial uses. • Productivity loss is estimated at approximately 0.85 lbs/day of marine organisms due to entrainment and impingement. • Approximately 85 percent of the organisms (> 1 mm) that reach the CDP intake screens are projected to survive to be discharged to the effluent pond.[170] • Surviving organisms discharged to the effluent pond will be exposed to the higher salinities in the RO concentrate prior to discharge to the ocean, but the salinities are not projected to increase mortality or affect the development of organisms.[171]
Option 3, No Fish Return Surface intake with no fish return discharge	• No organisms are assumed to survive in the CDP intake, and the productivity loss is estimated at 5.34 lbs/day of marine organisms due to impingement. • Virtually all of the dissolved constituents and TSS in the 299 mgd CDP intake will be discharged to the effluent pond. • No discernible impacts will occur to beneficial uses in the lagoon or ocean.

169 Excludes construction-related consequences.
170 Mortality attributable to turbulence in the effluent pond or pond discharge is unknown.
171 See page 7 of RWD Appendix EE.

Table 5-4
Estimated Economic Impacts to Receiving Water Beneficial Uses

Beneficial Use	Economic Impact to Receiving Water Caused by Operation of the Fish Return Discharge[172]	
	Option 1 **Fish Return Discharge to Lagoon**	**Option 2** **Fish Return Discharge to Effluent Pond**
Industrial Service Supply (IND)	No impact on the CDP or EPS intake supply. Economic impact: $ 0	No discharge to the lagoon. Economic impact: $ 0
Water Contact (REC-1) and Non-Contact (REC-2) Recreation	No discernible effects on lagoon or ocean water clarity, aesthetics, bacteriological concentrations, or water contact or non-contact recreation use. Economic impact: $ 0	No discharge to the lagoon. No discernible effects on ocean water clarity, aesthetics, bacteriological concentrations, or water contact and non-contact recreation. Economic impact: $ 0
Commercial and Sport Fishing (COMM)	No discernible effects on fishing in the lagoon or ocean. Economic benefit or impact: $ 0	No discharge to the lagoon, and no discernible effects on fishing in the ocean. Economic impact: $ 0
Estuarine Habitat (EST)	No discernible effects on water quality, water clarity or concentrations. More than 98 percent of the suspended solids in the CDP intake will be removed, with less than 2 percent being returned to the lagoon in the fish return discharge. During times when concentrations of larger solids (e.g. bits of kelp, eelgrass, leaves, twigs, and other organic matter) are elevated, concentrations of suspended solids in the fish return discharge will be higher than TSS concentrations in the lagoon. The combination of net reduction in solids mass, dispersion of the fish return discharge, and tidal flushing of solids into the ocean will result in no discernible effects of the fish return discharge on estuarine habitat in the lagoon or ocean habitat. Economic impact: $ 0	No discharge to the lagoon. Economic impact: $ 0
Wildlife Habitat (WILD)	No discernible effect on wildlife or wildlife habitat. Economic impact: $ 0	No discernible effect on wildlife habitat outside the designated Zone of Initial Dilution (ZID). Economic impact: $ 0
Preservation of Rare and Endangered Species (RARE)	No discernible effect on rare or endangered species. Economic impact: $ 0	No discernible effect on rare or endangered species. Economic impact: $ 0
Marine Habitat (MAR)	No discernible effect on marine life outside the ZID. Economic impact: $ 0	No discernible effects on water quality in the ocean outside of the designated ZID. No discernible effect on aquatic habitat in the ocean outside of the ZID. Economic impact: $ 0
Aquaculture (AQUA)	Net mass reduction of suspended solids in the lagoon. No discernible effects on Hubbs-Seaworld aquiculture. Economic impact: $ 0	No discharge to the lagoon. Economic impact: $ 0
Preservation of Areas of Special Biological Significance (BIOL)	Not applicable, as no Areas of Special Biological Significance (ASBS) exist in the lagoon, and no water quality impacts will occur in regional ASBS. Economic impact: $ 0	No discernible water quality effects on any ASBS. Economic impact: $ 0
Migration of Aquatic Organisms MIGR)	No effects on lagoon or ocean hydrodynamics or migration. Economic impact: $ 0	No effects on ocean hydrodynamics or migration. Economic impact: $ 0
Shellfish Harvesting (SHELL)	No discernible effects on lagoon shellfish harvesting. Economic impact: $ 0	No discernible effects on ocean shellfish harvesting. Economic impact: $ 0

172 Economic impacts associated with the discharge of fish return water to the lagoon or to the effluent pond. Excludes construction-related economic impacts. Also excludes economic impacts related to entrainment and impingement of marine life in the CDP intake or fish return system. These costs are computed separately on the following pages.

Benefits of the Fish Return System. Benefits provided by the fish return discharge alternatives include increased survival of organisms within the CDP intake. As documented in Appendix P of this RWD, impingement mortality associated with CDP stand-alone operations when EPS is operating but producing less than 304 mgd of flow was estimated using various methods to range from 3.46 lbs/day to 15.78 lbs/day.[173] The RWQCB in Order No. R9-2009-0038 determined that a reasonable and conservative estimate of the CDP impingement loss under temporary stand-alone CDP operations was 10.36 lbs/day, a value which could be offset by 11.3 acres of estuarine habitat restoration.[174]

The proposed fish return system would result in the survival of a large majority of organisms that reach the CDP intake screens. Total daily impingement loss under stand-alone conditions with operation of the fish return system is estimated at 0.85 lbs/day.[175] Total survival of juvenile and adult fish through the fish return system is estimated at 5.34 lbs/day.[175] This increased 5.34 lbs/day of surviving organisms translates to a proportional mitigation acreage of 5.8 acres.[176] Given that the cost of estuarine or wetlands mitigation acreage in San Diego County is currently approximately $0.5 million per acre, total value associated with the increased survivability can be estimated at $2.9 million.[177] This estimated economic value should be considered conservative, as State regulatory agencies have expressed preference for alternatives that avoid impacts (e.g. reducing marine mortality) over alternatives that create impacts but provide mitigation to offset against the marine mortality impacts.

Construction and Operation Costs. Other costs associated the fish return system include: (1) construction costs, (2) operation/maintenance costs including fish return system cleaning costs, and (3) permitting and compliance monitoring costs. As presented in Appendix BBB, total construction costs of the proposed intake pumping, screening, and fish return system are estimated at $34.7 million.[178] Each individual fish return components are not itemized within the Appendix BBB, but total costs for the fish return system can be roughly estimated at $0.5 million.[179] At a present worth to annual cost factor of 0.08, this capital costs translates to an annual cost of $0.04 million.

173 See page 5-4 of RWD Appendix P. Values in Appendix P are converted from kilograms to pounds per day.

174 See Finding No. 45 of Order No. R9-2009-0038. Value converted from kilograms to pounds per day.

175 Value from page 6 of Appendix CCC of this RWD. This estimated value is based upon 2004-2005 impingement data from EPS, proportionally adjusted to a CDP stand-alone flow of 299 mgd, which yields an estimated 7.06 lbs/day of juvenile and adult fish entering the CDP intake channel. Based on swim speed, it is projected that 6.19 lbs/day of juvenile and adult fish would be at risk under Alternative 1 as not having the ability to outswim intake currents. Of this total, 5.34 lbs/day of juvenile and adult fish are projected to survive the fish return system, with 0.85 lbs/day of fish not surviving.

176 Computed proportionately to the mitigation established under RWQCB Order No. R9-2009-0038. Order No. R9-2009-0038 required 11.3 acres of mitigation to offset impingement losses estimated at 10.36 lbs/day. The value of 5.8 acres is computed as 5.34 lbs/day of increased surviving organisms due to operation of the fish return system, divided by 10.36 lbs/day, multiplied by 11.3 acres.

177 Estimated $500,000 per acre value from a February 12, 2015 KPBS article by Alison St. John entitled "Mitigation Bankers See Profit in Converting Developed Land Back into Natural Habitat".

178 The $34.7 million cost for Alternative 1 that is listed on page 2 of Appendix BBB is expressed in 2017 dollars. Note that the $31.7 million cost listed for Alternative 1 in Appendix X is expressed in 2015 dollars.

179 Breakout costs for each fish return system component are not detailed in Appendices X and BBB, but total capital costs associated with constructing components specific to the fish return system (including the fish return trough, fish return pipe and cleanouts, and fish return

Table 5-5 (below) presents overall estimated annual costs associated with operation of the fish return system. As shown in Table 5-5, total annual costs for the fish return system (annualized capital costs plus operation and maintenance, permitting, and compliance monitoring) are estimated at $0.16 million per year for Option 1, $0.12 million per year for Option 2, and $0.05 million per year for Option 3.

Table 5-5
Estimated Fish Return System Annual Costs

Fish Return System Cost Component[180]	Estimated Annual Cost of Fish Return Facilities/Operations $ million/year		
	Option 1 Fish Return Discharge to Lagoon	Option 2 Fish Return Discharge to Effluent Pond	Option 3 No Fish Return Discharge
Annualized costs to construct fish return facilities[181]	$ 0.05	$ 0.05	$ 0.0
Fish return permitting, monitoring, and compliance reporting[182]	$ 0.08	$ 0.04	$ 0.0
Periodic fish return cleaning, periodic discharge point cleanup	$ 0.03	$ 0.03	$ 0.0
Additional annual mitigation costs[183]	$ 0.0	$ 0.0	$ 0.05
Total Estimated Annual Cost	$ 0.16	$ 0.12	$ 0.05

Construction and Operation Impacts. In addition to fish return system annual operation costs (see Table 5-5 above), other economic impacts will occur that are related to the construction and operation/maintenance of the fish return system.184 The maximum area within Agua Hedionda Lagoon that could be adversely affected by permanent construction or operation-related activities is estimated at less than 0.1 acre.[185] Valuing this impact at $ 0.5 million per acre and converting

discharge structure) are estimated at $0.5 million. These capital costs include 10 percent for design and 15 percent for contingencies. This total capital cost (for equipment and facilities exclusive to the fish return system) represents slightly less than 1.5 percent of the estimated $31.7 million cost of the CDP intake pumping and screening structure.

180 Estimated costs exclusive for operation of the fish return system. Does not include operation and maintenance costs for screens, rinsing, pumping, etc.

181 Based on a total capital cost of $0.5 million for constructing fish return facilities, converted to an annual cost using a present worth to annual cost factor of 0.08.

182 Additional monitoring, compliance reporting and permit-related costs associated with operating the fish return discharge. Assumes lesser degree of required monitoring of the fish return discharge to the effluent pond than to a separate discharge point (Outfall 002) to the lagoon.

183 Not implementing the fish return (Option 3) would require an appropriate degree of additional mitigation (over and above any mitigation required under Options 1 and 2) to make up for decreased organism survival. Capital costs associated with this mitigation are addressed in this analysis (see Table 5-5 on page 5-13) in the form of $2.9 million in mitigation benefits assigned to Options 1 and 2 (as opposed to costs assigned to Option 3). Annual costs for maintaining the additional mitigation habitat required under Option 3 are estimated at $0.05 million per year, and are assigned (see Table 5-5 above) as a cost item under Option 3.

184 These include direct impacts to the lagoon habitat related to construction of the fish return system. Additional impacts related to operation and maintenance could include disturbance impacts associated with periodic cleaning of the fish return system or periodic maintenance of the fish return discharge zone.

185 Maximum impact area for construction- and operation-related impacts is estimated at less than 0.1 acre, as presented on pages 21 and 27 of Appendix ZZ of this RWD.

the capital cost to an annual cost results in an estimated annual impact to the lagoon of $0.004 million.[186]

Maximum Benefit Comparison. Table 5-6 compares economic costs and benefits and detriments associated with operation of the two fish return alternatives. As shown in Table 5-6, fish return system benefits associated with increased survivability of marine organisms outweigh costs and impacts associated with operating the fish return system for both Options 1 and 2. These raw total economic benefits do not include any indirect benefits (which may be significant) associated with the value of the fish return system in demonstrating compliance with the best available technology and mitigation requirements of CWC 13142.5(b).

Table 5-6
Maximum Benefit Comparison of Fish Return Alternatives

Fish Return System Cost Component	Estimated Annual Benefit (+) or Cost (-) $ million/year			Group Enjoying Benefit or Absorbing Impact
	Option 1 Fish Return Discharge to Lagoon	Option 2 Fish Return Discharge to Effluent Pond	Option 3 No Fish Return Discharge	
Total economic impacts to receiving waters (exclusive of entrainment/impingement effects)	$ 0.0	$ 0.0	$ 0.0	Public
Marine organism survivability benefits ($2.9 million mitigation benefit converted to a present worth to annual cost factor of 0.08)[187]	$ 0.23	$ 0.23	$ 0.0	Public
Annual costs exclusive to operation of the fish return system[188]	- $ 0.16	- $ 0.12	- $ 0.05	Water Ratepayers
Construction or operation-related impacts to Agua Hedionda Lagoon (< 0.1 acre impacted)	- $ 0.004	$ 0.0	$ 0.0	Public
Total Estimated Annual Cost (-) or Benefit (+)	$ 0.066	$ 0.11	$ -0.05	Public
Annual Cost Converted to Present Worth[189]	$ 0.83 million	$ 1.4 million	$ -0.6 million	Public

186 Based on a maximum area of less than 0.1 acre that is impacted by the construction of the fish return system or the location of the discharge point (Outfall 002). Annual impact is computed as 0.1 acre impacted multiplied by $500,000 per acre, converted to an annual cost using a present worth to annual costs factor of 0.08.

187 It should be noted that mitigation acreage implemented by Poseidon as part of the Marine Life Minimization Plan (see RWQCB Order No. R9-2009-0038) already offsets impingement losses estimated to occur in the absence of the fish return system. The added survivability provided by the proposed fish return system thus provided an additional environmental benefit over and above required mitigation. Does not include additional value associated with regulatory agency preference for alternatives that do not create impacts (e.g., alternatives that reduce impacts to marine life) over alternatives that create impacts but offer mitigation to offset impacts.

188 Annual costs for Options 1, 2, and 3 are from Table 5-5 on page 5-12.

189 Annual costs ($ million per year) are converted to a present worth value using an annual cost to present worth factor of 12.5. Values rounded to two significant figures.

As also shown in Table 5-6, slightly larger benefits are estimated for Option 2 (fish return discharge to the effluent pond) than Option 1 (fish return discharge back into the lagoon). This difference occurs as a result of slightly higher compliance monitoring costs associated with creating a second regulatory compliance point (Outfall 002). While costs for implementing Option 1 are slightly higher than Option 2, Poseidon has agreed with SWRCB and RWQCB regulators that the Option 1 discharge point offers several unquantifiable benefits including:

- returning organisms back to the same area that they were taken from, and
- avoiding temporarily exposing organisms that have survived in the fish return system to increased salinity levels in the effluent pond.

Maximum Benefit Conclusions. Implementation of either fish return option (Option 1 discharge to Agua Hedionda Lagoon or Option 2 discharge to the effluent pond) is consistent with providing maximum benefit to the state. Both fish return options (Options 1 and 2) provide positive socioeconomic and environmental benefits, while Option 3 (no fish return discharge) results in a net economic detriment. In accordance with preferences expressed by SWRCB and RWQCB regulators, Poseidon proposes to implement the Option 1 fish return discharge to Agua Hedionda Lagoon (Outfall 002).

5.4 ANTIDEGRADATION CONCLUSIONS

The purpose of the proposed fish return discharge is to minimize impingement losses at the proposed CDP surface intake structure. This study has assessed the following factors in evaluating conformance of the proposed fish return discharge with state and federal antidegradation regulations and policies:

- effects on receiving water quality and beneficial uses,
- economic and social costs compared to benefits,
- environmental aspects and consequences of the project, and
- feasible alternatives and control measures.

The following are concluded on the basis of the analyses presented herein:

- The proposed fish return discharge will result in a significant net reduction in mass loads of dissolved and suspended constituents within the southern portion of Agua Hedionda Lagoon.
- Hydrodynamics of the lagoon and lagoon water quality characteristics allow the intake point and discharge point to be considered essentially one and the same with respect to evaluating intake and discharge mass emissions.

- TSS concentrations in Agua Hedionda Lagoon are typically low and are comprised of smaller (< 1 mm) solids which will pass through the CDP intake screens and not be concentrated in the fish return discharge.
- The proposed fish return discharge will not result in increased concentrations of dissolved constituents or increased concentrations of small suspended solids less than 1 mm in size.
- During periods of storms, extreme tidal conditions, heavy surf and currents, or heavy winds, the potential exists for elevated concentrations of larger solids (> 1 mm) in the lagoon (including bits of kelp, eelgrass, leaves, twigs, or other bits of organic matter). During such times, TSS concentrations in the fish return discharge may exceed ambient TSS concentrations in the lagoon. No impacts to water quality are projected, however, as the fish return discharge will result in a reduced mass of these larger solids in the lagoon, and discharged material will be rapidly dispersed. Tidal currents will flush 50 percent of discharged solids to the ocean within 6 hours and 98 percent to the ocean within 2.5 days. No discernible adverse effects on dissolved oxygen, water clarity, or other water quality parameters are projected.
- The proposed fish return discharge will not result in water quality that falls below water quality objectives prescribed in the Basin Plan or state-wide water quality standards imposed by EPA.
- The proposed fish return discharge will not unreasonably affect actual or potential beneficial uses.
- The proposed fish return discharge is consistent with providing maximum benefit to the state, in accordance with antidegradation guidance provided by the SWRCB within APU 90-004.
- The proposed fish return discharge (Outfall 002) is consistent with state and federal antidegradation regulations and policies.

END OF SECTION 5

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