POSEIDON CHANNELSIDE
a Poseidon Water company

FEASIBILITY ASSESSMENT
ALTERNATIVE BRINE DISCHARGE TO ENCINA OCEAN OUTFALL

INTRODUCTION

Poseidon Resources (Channelside) LP (Poseidon) is proposing to modify the intake and discharge at the Claude "Bud" Lewis Carlsbad Desalination Plant (CDP) to convert to "stand-alone" operation following the planned closure of the adjacent Encina Power Station (EPS) in 2017. The intake and discharge modifications will need to comply with the State Water Resources Control Board (SWRCB) *Amendment to the Water Quality Control Plan For Ocean Waters of California Addressing Desalination Facility Intakes, Brine Discharges, and the Incorporation of Other Non-Substantive Changes* (Desalination Amendment) addressing the regulation of desalination facilities.

The Desalination Amendment requires the discharger to assess the feasibility of comingling the brine discharge with effluent from a wastewater. Section M.2.d.(2)(a) of the Desalination Amendment which addresses considerations for brine discharge technology provides that:

> The preferred technology for minimizing intake and mortality of all forms of marine life resulting from brine discharge is to commingle brine with wastewater (e.g., agricultural, municipal, industrial, power plant cooling water, etc.) that would otherwise be discharged to the ocean. The wastewater must provide adequate dilution to ensure salinity of the commingled discharge meets the receiving water limitation for salinity in chapter III.M.3. Nothing in this section shall preclude future recycling of the wastewater.

Poseidon filed an Amended Report of Waste Discharge (ROWD) with the San Diego Water Quality Control Board (San Diego Water Board) that relies on an alternative brine discharge technology described Section M.2.d.(2)(d) of the Desalination Amendment. The San Diego Water Board is currently reviewing Poseidon's ROWD, and has requested Poseidon evaluate the possible use of the Encina Wastewater Authority's (EWA) Encina Ocean Outfall for all or a portion of the brine discharge from the CDP. The purpose of this memo is to address the San Diego Water Board request to determine the feasibility of commingling the CDP brine discharge with the wastewater effluent that is discharged through the Encina Ocean Outfall.

FEASIBILITY ASSESSMENT

For the purposes of chapter III.M., "feasible" was defined as capable of being accomplished in a successful manner within a reasonable period of time, taking into

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account economic, environmental, social and technological factors. In the analysis that follows, each of these criteria are evaluated to arrive at an overall assessment of the feasibility of comingling the discharge from the CDP with treated wastewater from the Encina Water Pollution Control Facility (EWPCF) and discharging the combined flow to the ocean via the Encina Ocean Outfall.

Technical Analysis

The Desalination Amendment requires that the San Diego Water Board shall consider a host of factors in determining feasibility of brine discharge alternatives, including taking into account technical factors. This section provides an analysis of the Encina Ocean Outfall brine dilution potential and an assessment of the facilities required to convey the CDP discharge to the to the Encina Ocean Outfall for blending with the discharge from the EWPCF.

Encina Ocean Outfall Dilution Potential

Section M.2.c.(4) of the Desalination Amendment addresses the acceptable salinity level of outfall discharges and states that:

> Design the outfall so that discharges do not result in dense, negatively-buoyant plumes that result in adverse effects due to elevated salinity or hypoxic conditions occurring outside the brine mixing zone.

Based on this requirement in the Desalination Amendment the commingled CDP brine discharge and Encina Ocean Outfall effluent would need to have a salinity level of 33.5 ppt, which is the ambient ocean salinity level near the CDP, or less (SDCWA 2016). The salinity of the CDP discharge is in the range of 64 to 67 ppt, whereas the salinity of the EWPCF discharge is about 1 ppt. Therefore, in order to avoid a negatively buoyant plume, for every gallon of CDP brine discharged to the EWA outfall there would need to be at least one gallon of EWPCF effluent available for blending.

EWA confirmed that outfall is not able to accept the CDP discharge during large storm events which can last up to two weeks (EWA 2016). Such events significantly increase the quantity of treated wastewater that is processed at the EWPCF, leaving no excess capacity in the outfall for the CDP discharge. As a result of this limitation, comingling the discharge from the CDP with treated wastewater from the EWPCF and discharging the combined flow to the ocean via the Encina Ocean Outfall does not reduce or eliminate the need for the proposed intake/discharge modifications.

During dry weather, the wastewater flow in the Encina Ocean Outfall drops to less than 7 million gallons per day (MGD) for a period of two to three hours each day. This diurnal fluctuation in wastewater flow severely limits the amount of wastewater that is available for mixing with the

CDP discharge. Therefore, the Encina Ocean Outfall is only able to accept about 10% of the CDP discharge unless facilities are provided for equalization of the CDP brine discharge prior to introduction to the outfall.

Capacity of the Encina Ocean Outfall to Receive and Dilute CDP Discharge

The Encina Ocean Outfall is a 1.5-mile long pipe located approximately two miles south of the CDP. The Encina Ocean Outfall is 48 inches in diameter near the shore and expands to 72 inches in diameter near the diffuser discharge end of the outfall. The Encina Ocean Outfall accepts effluent discharge from the Encina Water Pollution Control Facility, Meadowlark Water Reclamation Plant, Shadowridge Water Reclamation Plant, and the Carlsbad Water Reclamation Facility for discharge into the Pacific Ocean. The Encina Ocean Outfall has a design capacity of 75 MGD. However, the National Pollution Discharge Elimination System (NPDES) permit for the outfall limits the dry-weather (May through October) calendar-monthly average flow to 43.3 MGD and the wet-weather (November through April) calendar-monthly average flow to 52.6 MGD (RWQCB 2011).

In 2018, the Encina Wastewater Authority expects to discharge an annual average 20.2 million gallons per day (MGD) of effluent into the Pacific Ocean via the Encina Ocean Outfall (EWA 2016). However, the monthly average discharge flow is expected to vary significantly throughout the year. The discharge to the Encina Ocean Outfall is expected to be as low as 13.8 MGD in the summer when the recycled water demand is at its peak and as high as 29.9 MGD in the winter when the demand for recycled water is low and infiltration of storm water at its peak.

By 2040, the Encina Wastewater Authority expects to treat an annual average 29.7 MGD (minimum month 19.3 MGD and maximum month 35.3 MGD). However, there is a growing interest in recycled water development among the water agencies served by EWA, so it is unclear how much of the treated effluent will actually be available for blending with CDP brine in Encina Ocean Outfall (EWA 2016).

The CDP proposes to discharge up to 67 MGD of RO concentrate and treated filter backwash water with a salinity level of about 65 ppt (SDCWA 2016). Based on the Encina Ocean Outfall design capacity of 75 MGD and the existing effluent of approximately 20.2 MGD that is discharged through the outfall by EWA, there would not be sufficient capacity to commingle all 60 MGD of the CDP's brine discharge in the Encina Ocean Outfall. Furthermore, the amount of brine discharge that the Encina Ocean Outfall could accept from the CDP would be further limited by the NPDES permit limits of 43.3 MGD during dry-weather months and 52.3 MGD during wet-weather months. Based on the expected 2018 average annual effluent flow, the Encina Ocean Outfall would be able to accept approximately 23.1 MGD of the CDP's brine discharge during dry-weather months and up to 32.4 MGD during wet-weather months if the NPDES restrictions were the only controlling factor in determining how much dilution capacity was available.

However, as previously noted, the actual capacity that would be available in the outfall could be significantly higher or lower depending on the future demand for recycled water and wet weather infiltration.

EWA expects to discharge a monthly average 21.2 MGD in 2018 (EWA 2016). The salinity of the discharge from the EWPCF ranges from 0.9 ppt to 1.5 ppt. The CDP proposes to discharge up to 67 MGD with a salinity ranging from 64 ppt to 67 ppt. If 21.2 MGD of EWPCF effluent were commingled with 20.0 MGD of discharge from the CDP (1.1:1 blending ratio), the salinity of the combined discharge would be less than the ambient ocean salinity of 33.5 ppt under when both facilities are operating at the expected maximum salinity levels. Therefore, the combined discharge would consistently comply with the Ocean Plan requirement that commingled brine and wastewater discharges not create a negatively buoyant plume.

The combined discharge flow of 41.2 MGD would be below the 43.3 MGD dry-weather discharge limit in the Encina Ocean Outfall's NPDES permit. However, it has yet to be determined whether the combined discharge would comply with other NPDES permit requirements. Currently the EWA discharges an effluent having positive net buoyancy (1.5 ppt discharge salinity vs. 33.5 ppt ambient seawater salinity). The Encina Ocean Outfall diffuser has been designed to take advantage of the combined action of the turbulent eddies created by the diffuser jets and the net positive of the effluent to entrain the surrounding water mass to meet the NPDES permit initial dilution of requirement of 144 to 1. Blending the CDP discharge with the EWA effluent would reduce the buoyancy and rate of rise of the effluent in the water column, and thereby reduce the entrainment rates and initial dilution of the discharge plume.

The projected average daily dry weather flow of municipal wastewater processed by the EWPCF in 2018 is 21.2 MGD. However, this flow is highly variable throughout the day. The diurnal fluctuations range from a low of 6.2 MGD at 5:00 AM, to a high of 30.0 MGD at 10:00 AM. Therefore, equalization storage will need to be provided for the EWPCF discharge to achieve a constant 1.1:1 blending ratio with 20 MGD of CDP discharge. As shown in Table 1, approximately 3.0 million gallons of equalization storage will need to be constructed on the EWA site to achieve a constant 1.1:1 blending ratio with 20 MGD of CDP discharge. The dry weather discharge flow presented in Table 1 does not take into consideration diversions of secondary effluent for water recycling purposes. As a result, actual flow that would be available for dilution of the CDP discharge may be lower.

Table 1 EWA Ocean Outfall Diurnal Dilution Capacity (2018) Equalization Storage Required for Blending with CDP Discharge								
Hour	EWA Dry Weather Flow (MGD)[1]	CDP Discharge to EWA Outfall (MGD)	Surplus or Deficit Dilution Capacity (MGD)	EWA Dry Weather Flow (GPM)	CDP Discharge to EWA (GPM)	Surplus or Deficit Dilution Capacity (GPM)	Diurnal Dilution Capacity Shortfall (Gallons)	Diurnal Dilution Capacity Excess (Gallons)
12:00 AM	20.9	20.0	0.9	14,513.9	13,888.9	625.0		37,500.0
1:00 AM	15.4	20.0	-4.6	10,694.4	13,888.9	-3,194.4	-191,666.7	
2:00 AM	11.1	20.0	-8.9	7,708.3	13,888.9	-6,180.6	-370,833.3	
3:00 AM	8.5	20.0	-11.5	5,902.8	13,888.9	-7,986.1	-479,166.7	
4:00 AM	6.9	20.0	-13.1	4,791.7	13,888.9	-9,097.2	-545,833.3	
5:00 AM	6.2	20.0	-13.8	4,305.6	13,888.9	-9,583.3	-575,000.0	
6:00 AM	7.0	20.0	-13.0	4,861.1	13,888.9	-9,027.8	-541,666.7	
7:00 AM	12.5	20.0	-7.5	8,680.6	13,888.9	-5,208.3	-312,500.0	
8:00 AM	21.2	20.0	1.2	14,722.2	13,888.9	833.3		50,000.0
9:00 AM	27.5	20.0	7.5	19,097.2	13,888.9	5,208.3		312,500.0
10:00 AM	30.0	20.0	10.0	20,833.3	13,888.9	6,944.4		416,666.7
11:00 AM	29.7	20.0	9.7	20,625.0	13,888.9	6,736.1		404,166.7
12:00 PM	28.7	20.0	8.7	19,930.6	13,888.9	6,041.7		362,500.0
1:00 PM	27.0	20.0	7.0	18,750.0	13,888.9	4,861.1		291,666.7
2:00 PM	25.6	20.0	5.6	17,777.8	13,888.9	3,888.9		233,333.3
3:00PM	24.5	20.0	4.5	17,013.9	13,888.9	3,125.0		187,500.0
4:00PM	23.5	20.0	3.5	16,319.4	13,888.9	2,430.6		145,833.3
5:00PM	23.6	20.0	3.6	16,388.9	13,888.9	2,500.0		150,000.0
6:00PM	24.2	20.0	4.2	16,805.6	13,888.9	2,916.7		175,000.0
7:00PM	25.5	20.0	5.5	17,708.3	13,888.9	3,819.4		229,166.7
8:00PM	27.2	20.0	7.2	18,888.9	13,888.9	5,000.0		300,000.0
9:00PM	28.4	20.0	8.4	19,722.2	13,888.9	5,833.3		350,000.0
10:00PM	28.1	20.0	8.1	19,513.9	13,888.9	5,625.0		337,500.0
11:00PM	25.6	20.0	5.6	17,777.8	13,888.9	3,888.9		233,333.3
						Total	**-3,016,666.7**	**4,216,666.7**

1. Source: EWA 2016. The dry weather discharge flow does not take into consideration diversions of secondary effluent for water recycling purposes. Actual flow that would be available for dilution purposes may be lower.

Wastewater Recycling

State laws and regulations encourage the maximum beneficial use of recycled water. For example, California Water Code Section 131550 provides: "the use of potable domestic water for nonpotable uses is a waste or unreasonable use of the water … if recycled water is available." Section M.2.d.(2)(a) of the Desalination Amendment which addresses considerations for brine discharge technology provides that, "Nothing in this section shall preclude future recycling of the

wastewater." Expanded existing and future wastewater recycling efforts would reduce the ability to dilute the CDP's brine discharge with a sufficient amount of effluent in the Encina Ocean Outfall to achieve a commingled discharge salinity of 33.5 ppt or less, consistent with the requirements in Section M.2.c.(4) of the Desalination Amendment to, "not result in dense, negatively-buoyant plumes."

Existing Wastewater Recycling

There are multiple existing facilities that produce recycled water in the EWA service area. The Carlsbad Water Recycling Facility diverts up to 4 MGD of secondary effluent from the EWPCF that would otherwise be discharged through the Encina Ocean Outfall to produce recycle water that is supplied to the City of Carlsbad for non-potable use (Carlsbad 2016). The Gafner Water Reclamation Facility diverts up to 0.8 MGD of treated effluent from the Encina Water Pollution Control Facility and can produce recycled water that is used for irrigating the La Costa Golf Course. The Meadowlark Water Reclamation Facility diverts up to 3 MGD of untreated wastewater upstream of the EWPCF to produce non-potable recycled water that is used by the City of Carlsbad and Olivenhain Municipal Water District (EWA 2016). The combined effect of the existing water recycling facilities is to reduce the capacity of the EWPCF to dilute the discharge from the CDP from 21.2 MGD to approximately 14 MGD (or less) during the peak irrigation months of the year.

Future Wastewater Recycling

These existing facilities demonstrate a commitment to water recycling and a potential to increase the amount of water recycling in the EWA service area. As these existing facilities expand their water recycling capacity or new water recycling facilities are developed, the availability of effluent in the Encina Ocean Outfall for commingling with the CDP's discharge would further decrease.

The City of Carlsbad is expanding its water recycling by 75 percent. The City Council recently awarded a $7.3 million contract to design and construct an expansion of the Carlsbad water recycling facility from 4 MGD to 7 MGD. The expansion program also includes adding 18 miles of new pipe to the existing 79-mile recycled water distribution system serving the City and building a new 1.5 million-gallon reservoir (City of Carlsbad News Update).

The North County Water Reuse Coalition is studying the potential for a regional recycled water project with a demand of over 10 MGD of new recycled water production within the EWA service area (North County Recycled Water Coalition Regional Recycled Water Project PEIR 2016).

In 2012, EWA completed an Advanced Treatment and Water Use Analysis Report. This report focused on evaluating the feasibility of indirect potable reuse through groundwater recharge as well as direct potable reuse. In addition, the report evaluated non-potable recycled water

production. In August 2016, the EWA Board of Directors approved a contract aimed at identification of potential water recycling projects to maximize the beneficial reuse of the effluent produced at the EWPCF (Minutes EWA August 24, 2016 Board Meeting).

Additionally, legislation was recently proposed in the California state legislature that would have significantly impacted the availability of wastewater flows for the purpose of comingling bring from the CDP. Senate Bill (SB) 163 sought to mandate each wastewater treatment facility that discharges through an ocean outfall to achieve at least 50 percent reuse of the facility's actual annual flow by 2026 and 100 percent by 2036. This legislation, was not into law, but it is one more example of a growing interest in water recycling that raises serious questions regarding the merits of investing upwards of $100 million in facilities to comingle the CDP's discharge with existing wastewater flow as the primary method of disposal. Even though SB 163 was not enacted into law, this bill, coupled with the water recycling initiatives described above, are a clear indication of the level of importance being placed on water recycling throughout the region served by the EWPCF and the state in order to develop new drought-resilient water supplies consistent with the policy goals found in Governor Brown's Water Action Plan and the California Department of Water Resources State Water Plan.

Facilities Required to Convey the CDP discharge to Encina Ocean Outfall

Dedicated Brine Conveyance System

The Encina Ocean Outfall is located approximately two miles south of the CDP. Alternatives for conveyance of the CDP discharge include discharge to the existing wastewater collection system, or construction of a dedicated conveyance system. Discharge to the wastewater collection system is not recommended because it would increase the salinity of all of the water processed at EWPCF to a level that water would no longer be suitable for recycling. Therefore, a dedicated brine conveyance system is the only feasible alternative for conveyance of the CDP discharge to the Encina Ocean Outfall.

For the purposes of this analysis, the dedicated brine conveyance system was sized to deliver up to 24 MGD of CDP discharge from the CDP directly to the Encina Ocean Outfall. The dedicated brine conveyance system would include the following components:

- Brine pump station
- Brine conveyance pipeline
- Brine discharge structure
- Brine outfall connection
- EWPCF flow equalization tank

Brine Pump Station

The Brine Pump Station will be located on the Carlsbad Desalination Plant site, and will differ for each alignment option, as follows:

- Alignment 1: A new brine pump station would be constructed immediately upstream of the connection to the EPS discharge channel.
- Alignment 2: A new brine pump station would be constructed south of the Administration Building and west of the Product Water Tank, with connection to be made at the southernmost point of the brine pipeline prior to it traversing west towards the outfall connection.

Brine Conveyance Pipeline

Open trench construction was maximized where possible to minimize the cost of construction. The method of construction was selected in all areas where there was available space to construct the pipeline and associated appurtenances; traffic control could be maintained; and there were no constraints above ground that would prohibit open trench construction. Trenchless pipeline construction would be used in heavily trafficked intersections that needed to be avoided and areas with existing utilities and services that would prevent open trench construction.

Alignment Options

Carlsbad Boulevard Alignment

- Pump Station
- Carlsbad Boulevard (Southbound)
- Carlsbad Boulevard (Northbound)
- Brine Discharge Chamber
- Outfall Connection

Advantages	Disadvantages
Slightly shorter length (marginal)	Significant traffic issues apparent between the Plant and Palomar Airport Road
No railroad crossings	Greater residential disruption
South of Palomar Airport Road, the construction corridor significantly widens	Tight construction corridor between the Plant and Palomar Airport Road – likely not feasible
Assumed less utilities throughout the entire alignment	Require another easement on EPS property between the existing easement and Carlsbad Boulevard
	Work progress along Carlsbad Boulevard will be very slow
	Outfall connection will require property from EWA and presents constructability issues that will need to be overcome.

Avenida Encinas Alignment

- Pump Station
- NRG Property
- Cross Railroad tracks
- NRG Property
- Avenida Encinas
- Brine Discharge Chamber
- Outfall Connection

Advantages	Disadvantages
Avenida Encinas has a wider construction corridor comparatively	Avenida Encinas has extensive traffic between Cannon Road and Palomar Airport Road
Likely the only feasible option	More permits and easements to obtain, as more landowners and third parties are affected
	1 railroad crossings
	Require either a new easement, or a widening of the existing easements, or both, within NRG's property
	Work progress in Avendia Encinas will likely be slow due to the extensive services in this road.
	Lots of work completed in Avenida Encinas of late. Local city / business area construction fatigue
	Outfall connection will require property from EWA and presents constructability issues that will need to be overcome.

Both alignments present extensive challenges, but the Avenida Encinas alignment appears to be the only viable option. Accordingly, only the Avenida Encinas alignment option will be considered in more detail.

Brine Discharge Structure

A brine discharge structure will be constructed adjacent to the outfall connection. This structure would be designed to dissipate the head from the pumped system and allow the CDP discharge to flow by gravity into the Encina Ocean Outfall.

Outfall Connection

A connection chamber would be constructed on top of the existing outfall pipeline. The outfall connection will require property from EWA, and presents constructability issues that will need to be overcome.

EWPCF Flow Equalization Tank

The projected average daily dry weather flow of municipal wastewater processed by the EWPCF in 2018 is 21.2 MGD. However, this flow is highly variable throughout the day. The diurnal fluctuations range from a low of 6.2 MGD at 5:00 AM, to a high of 30.0 MGD at 10:00 AM.

Therefore, equalization storage will need to be provided for the EWPCF discharge to achieve a constant 1.1:1 blending ratio with 20 MGD of CDP discharge. As shown in Table 1, approximately 3.0 million gallons of equalization storage will need to be constructed on the EWA site to achieve a constant 1.1:1 blending ratio with 20 MGD of CDP discharge.

Economic Analysis

The Desalination Amendment requires that the San Diego Water Board consider a host of factors in determining feasibility of brine discharge alternatives, including economic factors. This section provides an estimate of the capital costs associated with the alternative brine discharge to the Encina Ocean Outfall.

The estimated $75 capital budget for the alternative brine discharge to the Encina Ocean Outfall shown in Table 2 includes: permitting, design, and construction; project management; insurance; taxes; rent; and financing costs. A breakdown of the permitting, design, and construction budget is shown in Table 3.

Potentially significant capital costs associated with acquiring capacity rights in the Encina Ocean Outfall; acquiring property needed from NRG, NCTD, City of Carlsbad, and EWA for construction and operation of the facilities; and any mitigation that would be required as a result of construction and operation of this brine disposal alternative have not been determined.

Annual costs have not been factored into the economic analysis. These include: operation maintenance associated brine pump station, brine conveyance pipeline, equalization tank, outfall connection, and the Encina Ocean Outfall; operating period insurance, taxes, and management; and energy consumption over the lifetime of the facilities.

Table 2
Capital Cost Estimate[1]
Alternative Brine Discharge to the Encina Ocean Outfall

Permitting, Design and Construction	55,760,400
Construction Insurance	2,000,000
Construction Rent	1,200,000
Construction Management	5,000,000
Additional 1 Mo O&M Reserve	559,946
Additional 6 Mo Debt Reserve	2,219,772
Debt Underwriting	612,597
Transactions Costs / Legal	1,494,139
Capitalized Interest	4,975,711
Outstanding Equity Fee	887,518
Total Capital Cost	**$74,710,083**

[1.] Property acquisition costs, mitigation costs, and the capacity charge for access to the Encina Ocean Outfall are potentially significant capital costs that are not included in this estimate.

Table 3 Construction Cost Estimate Alternative Brine Discharge to the Encina Ocean Outfall	
Pump Station	1,800,000
Electrical	400,000
Pipeline Construction	15,220,000
Discharge Structure	800,000
Secondary effluent equalization tank 3.0 MG	15,000,000
Brine Connection	1,200,000
Sub-Total	34,420,000
Engineering, design, permitting, and legal - 20%	6,884,000
Sub-Total	41,304,000
Contingency - 35%	14,456,400
Total Permitting, Design, and Construction Cost	**$ 55,760,400**

Schedule

The Desalination Amendment requires that the San Diego Water Board consider a host of factors in determining feasibility of brine discharge alternatives, including whether the project is capable of being accomplished in a reasonable period of time. This section provides an analysis of the time required for completion of the improvements associated with the alternative brine discharge to the Encina Ocean Outfall.

In terms of time required for project completion, the earliest the improvements associated with the Alternative Brine Discharge to the Encina Ocean Outfall could be ready to go into service is 2023. Permits and other discretionary approvals required for this project would take up to 36 months. Project planning, preliminary design, property acquisition, and infrastructure and right-of-way access agreements is assumed to be completed during this same three-year period. Once the discretionary approvals are complete, the project would proceed to final design, construction, and commissioning which is expected to take approximately 36 months to complete. The total elapsed time for project completion is approximately six years:

- Discretionary Approvals – 36 months
    - Planning
    - Preliminary Design
    - CEQA Compliance
    - Permitting
    - Property Acquisition
    - Outfall Access Agreement
    - Financing
    - Procurement or Design-Build Contractor
- Final Design – 12 months

- Construction / Commissioning – 24 months

Environmental Impact Analysis

The Desalination Amendment requires that the San Diego Water Board consider a host of factors in determining feasibility of brine discharge alternatives, including environmental and social impacts. This section provides an assessment of the potential environmental and social impacts associated with the construction and operation of the alternative brine discharge to the Encina Ocean Outfall.

Construction Impacts

The Encina Ocean Outfall is located approximately two miles south of the CDP. To allow the CDP's saline brine discharge to be commingled with effluent in the Encina Ocean Outfall a pipeline would need to be constructed from the CDP to the Encina Ocean Outfall. Both the CDP and Encina Ocean Outfall are located in proximity to the coastline and near Avenida Encinas. As previously noted, the available pipeline alignments present extensive challenges. The Avenida Encinas alignment appears to be the only viable option. Construction of the two-mile pipeline in Avenida Encinas to allow for commingling of the CDP's brine discharge with the Encina Outfall effluent would result in environmental and social impacts that would need to be appropriately addressed and mitigated, if necessary.

Construction of the pipeline would also result in environmental and social impacts in the area near the pipeline alignment. Depending on the pipeline alignment coastal access along Avenida Encinas could be hindered from lane closures, increased traffic, and impediments caused by the presence of construction equipment and materials. Additionally, temporary visual impacts would also occur from the presence of heavy construction equipment and laydown of construction materials along the pipeline alignment. Traffic along Avenida Encinas would be delayed due tolane closers and alterations during construction of the pipeline. Increased criteria pollutant and greenhouse gas emissions from the use of construction equipment and worker vehicle trips to the construction site would occur as a result of pipeline construction. Other short-term, indirect effects could occur to biological resources such as sensitive coastal vegetation in the vicinity of construction including noise from construction equipment that could adversely affect wildlife and important wildlife activities such as bird breeding; contaminated stormwater runoff from construction sites could impact the water quality of a nearby wetlands or streams if not adequately mitigated; vegetation removal that may be required to clear the construction site or staging area could affect the viability of plant communities, thereby decreasing available habitat; and increased human activity in the area could lead to trampling of vegetation or disruption of wildlife behavior.

Operational Impacts

Diffuser Entrainment

The Desalination Amendment requires that the intake and mortality of marine life be minimized. Typically, "entrainment" refers to early life stages of marine organisms that are small enough to pass through the fine-mesh screening provided at the seawater intake structure. In the Substitute Environmental Documentation (SED), the SWRCB also defines another type of entrainment which occurs at the brine discharge location:

> In addition to mortality that occurs at screened surface intakes, marine life mortality may occur where desalination brine waste is discharged. The mortality occurs as a result of exposure to toxic concentrations of brine, anoxic or hypoxic conditions, or shearing stress from turbulent mixing where brines are discharged.

Entrainment mortality in the diffuser is determined by two factors: 1) the discharge velocity and the shear environment it produces and 2) the volume of water entrained to provide the needed dilution. As such, it is important to note, as stated in the SED, that:

> The actual risk of shearing-related mortality will vary depending on the design aspects of a diffuser array and the production capacity and efficiency of a facility. The shearing mortality will be related to the velocity at which the effluent is discharged. Modeling and additional studies may need to be done in order to estimate shearing related mortality from diluted brine discharge systems. In some instances, the diluted discharged may be passively discharged; however, if there is any turbulent mixing, an owner or operator will need to estimate the mortality associated with brine discharge."

Additional information would be required to determine if the diffuser discharge velocity for the combined EWA and CDP effluent would create an injurious, high-shear environment. In the absence of additional design information, the entrainment impact associated with the addition of the brine can be simply estimated as the proportion of the brine that is routed to the Encina Ocean Outfall. This calculation is allowed based on the following excerpt from the SED:

> For commingled discharges, there may be shearing that occurs as the result of the wastewater being discharged through diffusers. Historically, a wastewater treatment plant has not been required to mitigate for this shearing related mortality. It is not the intention of the Desalination Amendment to make the wastewater treatment plants mitigate for the shearing related mortality from their existing effluent volume. However, if an owner or operator of a desalination facility plans to commingle their brine with a wastewater treatment plant, they will need to estimate the shearing mortality from the addition of the brine. For example, if a

wastewater treatment plant discharged 250 MGD of treated effluent and a desalination facility is planning on adding 50 MGD to the effluent, the owner or operator of the desalination facility would be responsible for estimating and mitigating for shearing mortality from the added 50 MGD.

Therefore, if a particular percentage of the brine were routed to the Encina Ocean Outfall, then that same percentage of the diffuser-related entrainment mortality would need to be accounted for and mitigated.

Diffuser Performance

Performance of the existing Encina Ocean Outfall diffuser will be affected by the addition of brine from the CDP. Treated wastewater effluent is positively buoyant (less dense) relative to seawater. Brine effluent from the seawater reverse osmosis (SWRO) process is negatively buoyant (denser) relative to seawater. When brine is comingled with the wastewater effluent, the combined flow will increase in density (neutrally buoyant rather than positively buoyant). The magnitude by which buoyancy will decrease is dependent on the volume of brine flow that will be comingled with the wastewater effluent.

Since the design of diffuser ports is specific to the effluent being discharged, understanding the ultimate buoyancy of the mixed effluent is important. The Encina Ocean Outfall diffuser was designed for the positively buoyant effluent it produces, which means that the inclination of the diffuser ports is likely lower than would be designed for an effluent with a lower density. Therefore, modification of the Encina Ocean Outfall diffusers may be required to achieve the optimal dilution and dispersion of the comingled effluent.

The combined discharge flow of 41.2 MGD would be below the 43.3 MGD dry-weather discharge limit in the Encina Ocean Outfall's NPDES permit. However, it has yet to be determined whether the combined discharge would comply with other NPDES permit requirements. Currently the EWA discharges an effluent having positive net buoyancy (1.5 ppt discharge salinity vs. 33.5 ppt ambient seawater salinity). The Encina Ocean Outfall diffuser has been designed to take advantage of the combined action of the turbulent eddies created by the diffuser jets and the net positive of the effluent to entrain the surrounding water mass to meet the NPDES permit initial dilution of requirement of 144 to 1. Blending the CDP discharge with the EWA effluent would reduce the buoyancy and rate of rise of the effluent in the water column, and thereby reduce the entrainment rates and initial dilution of the discharge plume.

Social Impact Analysis

Institutional Arrangements

Complex interagency agreements would need to be put in place to allow a non-member of EWA to acquire access to the Encina Ocean Outfall.

CONCLUSION

The Desalination Amendment requires that the San Diego Water Board consider a host of factors in determining feasibility of brine discharge alternatives, including whether the alternative is capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social and technological factors. The feasibility assessment of the alternative brine discharge to the Encina Ocean Outfall evaluated each of these criteria to arrive at an overall assessment of the feasibility of comingling the discharge from the CDP with EWPCF discharge to the Encina Ocean Outfall.

The conclusion of this assessment is that the alternative brine discharge to the Encina Ocean Outfall is infeasible. The growing interest in water recycling in the EWA services area makes it unlikely that EWA would be willing to make a long-term commitment to dedicate a meaningful quantity of secondary effluent for brine dilution purposes. Furthermore, complex interagency agreements would need to be put in place to allow a non-member of EWA to acquire access to the Encina Ocean Outfall. Absent a willingness to enter into such agreements, it would be difficult to justify capital investment of upwards of $100 million for the alternative brine discharge to the Encina Ocean Outfall that does not reduce or eliminate the need for duplicative bine discharge capacity that must be constructed at the CDP.

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