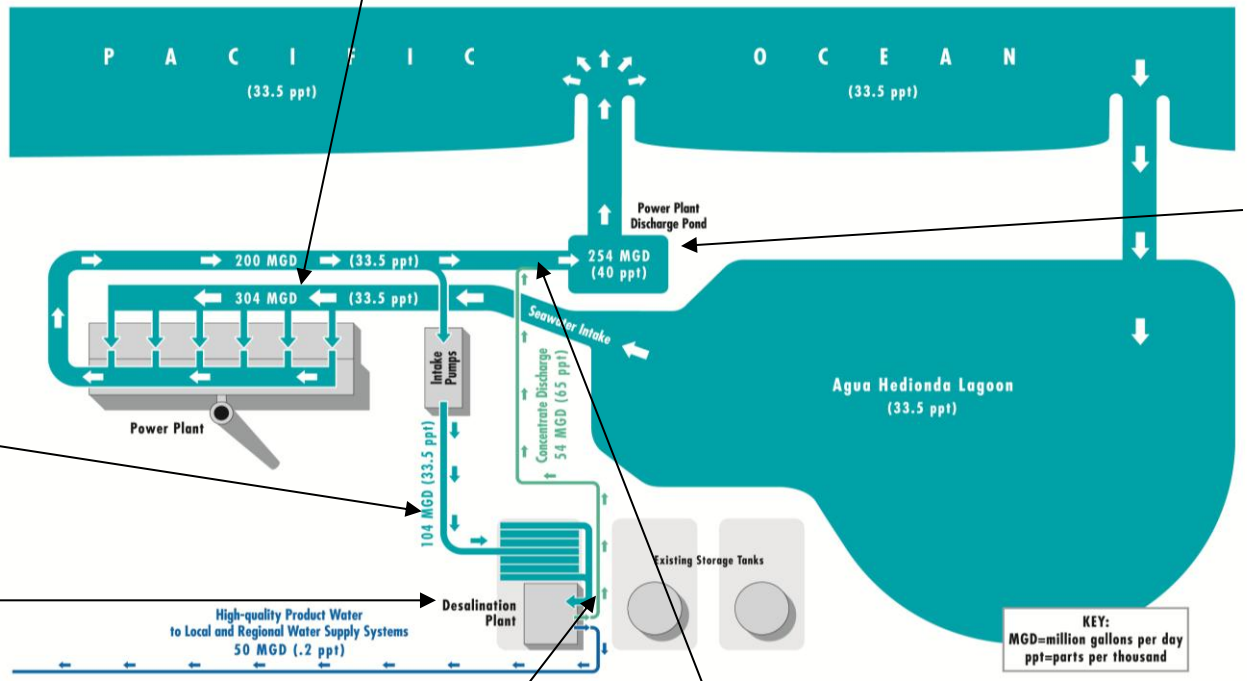
Figure 1

Brine Discharge Flow Schematic (San Diego RWQCB Order No. R9-09-0038)

1 Under the desalination Project's minimum flow requirement of 304 MGD of seawater enters the power plant intake facilities and after screening is pumped through the plant's condensers to the discharge channel.

7 The Regional Water Quality Control Board found that the 40 ppt salinity concentration will not violate Ocean Plan acute or chronic toxicity standards. Receiving water salinity concentrations outside the zone of initial dilution (1,000' radius from the end of the discharge channel) will approach ambient conditions, and salinity concentrations within the zone of initial dilution will be 40 ppt or less.



2 The Carlsbad desalination plant intake structure is connected to the end of this discharge canal and under minimum flow requirements would divert 104 MGD of the 304 MGD of cooling water for production of fresh water.

6 The Regional Water Quality Control Board found that the survival or reproduction of marine organisms would not be significantly affected at salinity concentrations of 40 ppt or less. To ensure that marine organisms are not harmed by the desalination plant discharge, the RWQCB issued a discharge permit for the project that limits average day effluent salinity concentrations in the discharge pond to 40 ppt.

3 50 MGD of the diverted cooling seawater would be converted to fresh drinking water via reverse osmosis membrane separation.

4 The remaining 54 MGD would have salinity approximately two times higher than that of the ocean water (65 ppt vs. 33.5 ppt).

5 This seawater concentrate would be returned to the power plant discharge canal downstream of the point of intake for blending with the remaining cooling water prior to conveyance to the Pacific Ocean.

Figure 2

Ocean Outfall/Diffuser System

Figure 3

POSEIDON RESOURCES

DESALINATION PROJECT FLOW SCHEMATIC

Without Power Plant

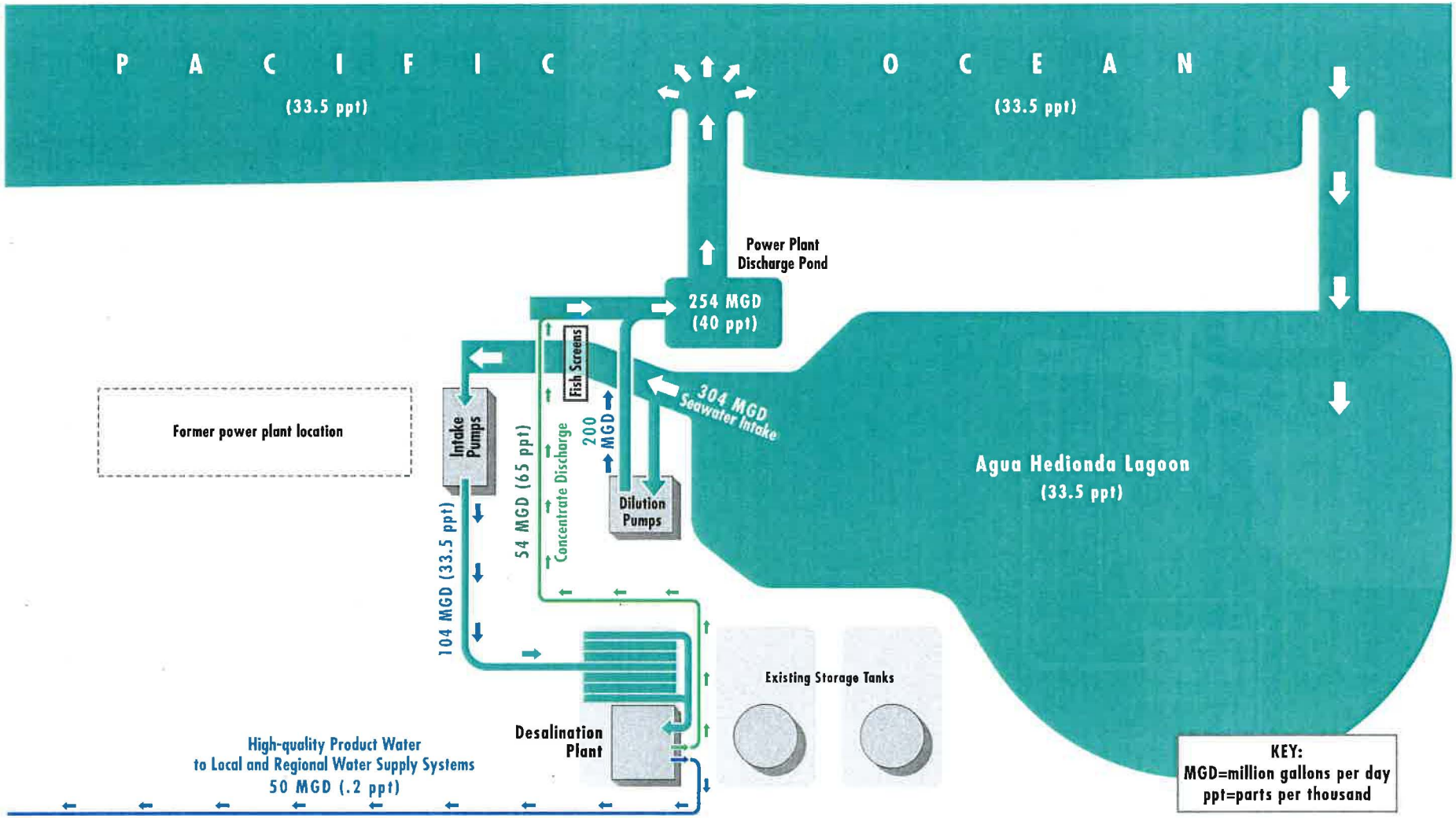


Figure 4

Attachment 1

Comparison of Environmental Impacts of Brine Discharge Alternatives

	Carlsbad Desalination Project Permitted Operating Conditions (co-located with Encina Power Plant)	**Carlsbad Desalination Potential Operating Conditions (following retirement of Encina Power Plant)**	**Staff's Proposed Ocean Plan Amendments**
Brine discharge salinity (ppt)	40.0	40.0	67.0
Receiving water salinity (ppt)	33.5	33.5	33.5
Salinity reduction requirement and discharge technology	Reduce salinity from 67 ppt to sublethal level of 40 ppt prior to discharge through in-plant dilution. Remainder of dilution achieved through natural mixing via low velocity (1 to 3 feet per second) discharge into high energy surf zone seaward of the point of discharge. Zone of initial dilution (the "ZID") extends 1,000 feet from end of the discharge channel. *See* Attachment 1.	Similar to permitted operating conditions *See* Attachment 2.	Mechanical mixing achieved through pressurized diffuser used to reduce full strength brine salinity to from 67 ppt to 35.5 ppt through high velocity (20 to 30 feet per second) turbulent mixing in receiving water. ZID extends 100 meters from the point of discharge. *See* Figure 2.
Initial dilution	5:1 prior to discharge and 15:1 in the ZID.	5:1 prior to discharge and 15:1 in the ZID.	20:1 in the ZID
Habitat present in the vicinity of the discharge	Sandy bottom	Sandy bottom	Sand and rock with kelp forest immediately down coast from the discharge.
Volume of seawater exposed to entrainment impacts to achieve required salinity level	204 MGD of seawater is pumped through the Encina Power Station once-through cooling water system for in-plant dilution to achieve 5:1 dilution. Impacts associated with pumping this water through the once-through cooling system has been	204 MGD of seawater is transferred from the Encina Power Plant intake to the discharge channel using low impact pumps (screw pump, Kaplan turbine, or vacuum pump) to achieve 5:1 dilution. These pumps transfer the water without turbulence,	Up to 950 MGD of seawater is entrained in the turbulent/high-velocity mixing zone created by the diffuser to achieve 20:1 dilution. Turbulence velocities as low as 7 feet per second have been demonstrated to cause entrainment mortality to

Figure 4

	documented to result in mortality of ninety-five percent of the entrained organisms. *See* Attachment 1.	thereby minimizing impacts to entrained organisms. *See* Attachment 2.	planktonic eggs and larvae. Diffuser discharge velocity is approximately 20 to 30 feet per second. The organisms in the seawater drawn in the turbulent mixing zone are exposed to entrainment mortality. *See* attached Figure 8.1 from the Brine Plane Report for a graphic representation of diffuser caused entrainment.
Organisms in entrained water	Due to the intake location in Agua Hedionda Lagoon, ninety-five percent of the larval organisms entrained are lagoon based species that have saturated Agua Hedionda Lagoon (e.g., gobies and blennies makeup over 80% of the entrained fish larvae). Less than 0.5% of the entrained organisms are recreationally or commercially important species; no threatened or endangered species were identified.	Same as permitted operating conditions.	Due to the diffuser location off shore and its proximity to the Carlsbad kelp bed, the diffuser would entrain significantly greater numbers of commercially and recreationally important fish and invertebrates than the lagoon based intake. Additionally, the higher level of dilution (20:1 vs. 5:1) would result nearly a five-fold increase in entrainment.
Receiving water exposed to lethal level of brine concentration?	No. The brine is reduced to sublethal levels (40 ppt) prior to discharge.	No. The brine is reduced to sublethal levels (40 ppt) prior to discharge.	Yes. The marine organisms entrained in the discharge plume are exposed to lethal levels of salinity up to 67 ppt.
Potential for increased turbidity and sediment flux down coast from the discharge to create a long-term negative effect on kelp reproduction in the nearby Carlsbad kelp	No. Low velocity, laminar flow discharge will not result in an increase in turbidity in the receiving water.	No. Low velocity, laminar flow discharge will not result in an increase in turbidity in the receiving water.	Yes. High velocity discharge coupled with a turbulent mixing zone will stir up bottom sediment, resulting in the formation of a turbid plume drifting down coast to the Carlsbad kelp bed. Similar experience with diffuser technology at the San Onofre Nuclear Generating Station had a

Figure 4

bed?			long-term negative effect on kelp reproduction in the nearby San Onofre kelp bed, with significant losses of kelp plants, the failure of adult recruitment of new kelp plants, and a dramatic decline in the fish and shellfish that had depended on the now damaged or destroyed kelp forest for habitat, cover and food.
Other environmental impacts	None	None	Impacts associated with construction of a new ocean outfall and diffuser extending one mile offshore. Increased energy consumption.