APPENDIX F

29 June 2001

To: Mr. Alan Ashimine
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From: David Vilas
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MBC Applied Environmental Sciences

RE: Existing Conditions for the Proposed Poseidon Desalinization Plant at Huntington Beach, California

DESCRIPTION OF THE OFFSHORE AREA

Location

The proposed location of Poseidon Orange County Desalination facility is at or adjacent to the AES Huntington Beach L.L.C. generating station, located on the coast in Huntington Beach, Orange County, California. The described area includes approximately one square kilometer (km) of ocean to the north and south of the intake and discharge conduits of the AES Huntington Beach L.L.C. generating station. The physiography, climate, and general oceanography of the Southern California Bight all contribute to the general character of the study area. Any effects of discharges on coastal waters are influenced by the complex interactions of these factors as well as by the nature of the biota present. All these factors have natural long- and short-term cycles as well as aperiodic components. Winds, tides, and currents are particularly important since they determine, to the greatest extent, the actual fate of any effluent.

Physiography

The general orientation of the coastline between Point Conception and the Mexican border is northwest to southeast. The continental margin has been slowly emerging (on a geologic time scale), resulting in a predominantly cliffed coastline, broken by coastal plains in the Oxnard-Ventura, Los Angeles, and San Diego areas. Drainage of the coastal region is by many relatively small streams which normally flow only during rain storms. However, only a small part of the storm runoff ever reaches the ocean, most being impounded by dams and diverted for other uses.

Water circulation and oceanographic characteristics of the coastal region are strongly influenced by the eight offshore islands (Figure 1). The mainland shelf is narrow, ranging in width from less than two to more than 18 km, averaging about 7 km. Seaward of the mainland shelf is an irregular and geologically complex region known as the continental borderland. The borderland is composed of basins and ridges which extend from near the surface to depths of more than 2,400 m.

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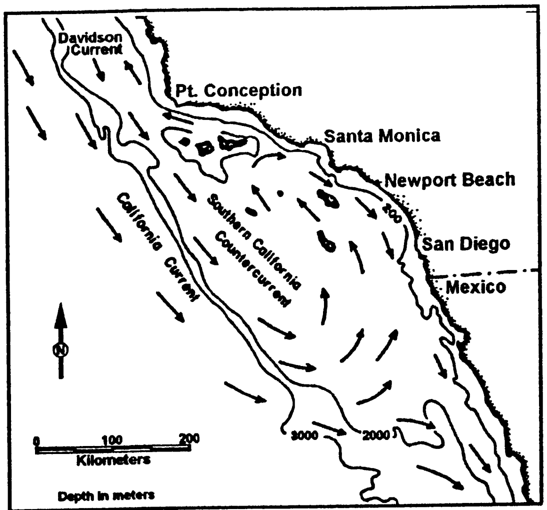

Figure 1. Surface circulation in the Southern California Bight (from Jones 1971). AES Huntington Beach L.L.C. generating station NPDES, 2000.

Much of the City of Huntington Beach is located on the flood plain drained by the Santa Ana River, which empties into the ocean approximately 2.4 km downcoast from the project site. The mean annual flow from the Santa Ana River (computed for a 30-year period) is 28 x 10^6 m^3/year; however, it is intermittent and only substantial during storms. The current annual flow rate is much less than the 30-year average, due to the presence of 42 dams in the drainage area, most of which were constructed during that time span.

The coast near the AES Huntington Beach L.L.C. generating station is fronted by a broad, sandy beach and is backed by lowlands. The sea floor directly offshore is relatively smooth, with isobaths following the coastline. The average seaward slope of the bottom is approximately 0.34°, representing a drop of about 3.0 m per 500 m of horizontal distance. Approximately 5.6 km southeast of the generating station; however, is the Newport Submarine Canyon, where the 50-ft (15-m) isobath is within 300 m of the shoreline.

Sediments in the nearshore area grade from fine to medium sand nearshore to sandy silt at a distance of about 1,600 m from shore (EQA/MBC 1973). The beach sands are normally transported southeastward by littoral currents which are generated by incoming waves and modified by bottom topography.

Climate

Southern California lies in a climatic regime broadly defined as Mediterranean, which is characterized by short, mild winters and warm, dry summers. Long-term annual precipitation near the coast averages about 46 centimeters (cm), of which 90% occurs between November and April. Sea breezes are caused by differential heating between land and sea. During the summer, these breezes combine with the prevailing winds that blow out of the northwest to produce strong onshore winds. They typically start around noon and may continue through late afternoon, with speeds reaching 40 km per hour. In late fall and winter, a reverse pressure system frequently develops, causing coastal offshore winds from the southeast from November through February, typically between 1300 and 2000 hours (hr). Monthly mean air temperatures along the coast range from 8.3°C in winter to 20.6°C in summer, with the minimum dropping slightly below freezing and maximum reaching above 37°C.

Currents

Water in the north Pacific Ocean is driven eastward by prevailing westerly winds until it impinges on the western coast of North America, where it divides and flows both north and south. The southern component is the California Current, a diffuse southeastward flowing water mass. No true western boundary of this current exists, but more than 90% of the southeastward transport is within 725 km of the California coast. South of Point Conception, the current diverges. One branch turns northward and flows inshore through the Channel Islands, forming the inner edge of the Southern California Countercurrent. Surface speed in the counter current averages between 5 and 10 cm/s. The flow pattern is complicated by small eddies within the Channel Island region and it fluctuates seasonally, being more developed in summer and autumn and weak or occasionally absent in winter and spring. The general pattern of surface water circulation off southern California is shown in Figure 1.

Currents in the nearshore area are affected by many factors, including wind, weather, tide, local topography, density structure, and offshore oceanic currents. The latter, which are superimposed on the tidal motion, usually have a strong diurnal component in response to local wind patterns. Therefore, short-term observations of currents near the coast often vary in both direction and speed as a result of combined wind-induced and tidal motions.

Tides

Tides along the California coast are mixed semi-diurnal, with two unequal highs and two unequal lows during each 25-hr period. In the eastern North Pacific Ocean, the tide wave rotates in a counterclockwise direction. As a result, flood tide currents flow upcoast and ebb tide currents flow downcoast.

Upwelling

Northwesterly winds are predominantly responsible for the large scale upwelling noted along the California coast. From about February to October, these winds induce offshore movement (Ekman transport) of surface water, resulting in the upward movement of deeper ocean waters near the coast. This upwelled water is colder, more saline, lower in oxygen, and higher in nutrient concentrations than surface waters. The phenomenon alters the physical properties of the surface waters, while the nutrients enhance biological productivity.

RECEIVING WATER CHARACTERISTICS

Temperature

Natural water temperatures fluctuate throughout the year in response to seasonal and diurnal variations in currents as well as meteorological conditions such as wind, air temperature, relative humidity, cloud cover, ocean waves, and turbulence.

Natural temperature is defined by the California State Water Resources Control Board as "the temperature of the receiving water at locations, depths, and times which represent conditions unaffected by any elevated temperature waste discharge." Previous studies have shown that natural surface temperatures may vary several degrees in a single day depending on time of day and year, as well as meteorological and oceanographic conditions.

Diurnally, natural surface water temperatures generally vary 1 to 2°C in summer and 0.3 to 1°C in winter (EQA/MBC 1973). Factors contributing to rapid daytime warming of the sea surface are weak winds, clear skies, and warm air temperatures. Factors that reduce diurnal temperature ranges are overcast skies, moderate air temperatures, and vertical mixing of the surface waters by winds and waves.

A sharp difference between surface and bottom water temperatures is called a thermocline, a steep temperature gradient between adjacent water layers of more uniform temperatures. In natural waters, a thermocline is formed when absorption of solar radiation penetrating the sea surface develops a stable stratification, separating the surface layer from the subsurface layer. Artificial thermoclines are found in elevated temperature fields which result when heated water overlies the cooler receiving water. Reasonably sharp natural thermoclines have been reported in nearshore waters off Huntington Beach at a depth of 12 to 15 m during the summer months, but they are typically absent during the winter (Allan Hancock Foundation 1965).

Salinity

Salinity (a measure of the concentration of dissolved salts) in coastal environments is affected by the introduction of freshwater from land runoff and direct rainfall and by evaporation. Salinities in the area are fairly uniform and normally range from 33.0 to 34.0 parts per thousand (ppt) (Allan Hancock Foundation 1965).

Density

Seawater density varies inversely with temperature and directly with salinity at a given pressure. Water temperature is the major factor influencing density stratification in southern California since salinity is relatively uniform. As a result, density gradients are most pronounced when spring and summer thermoclines are present.

Dissolved Oxygen

Dissolved oxygen (DO) is used by aquatic plants and animals in respiration; it is replenished by gaseous exchange with the atmosphere and as a product of photosynthesis. Concentrations in the study area range from approximately 5 to 13 milligrams per liter (mg/l) (Allan Hancock Foundation 1965); the large values probably result from increased photosynthetic activity and the lower values from mixing of surface waters with oxygen-poor subsurface waters.

Hydrogen Ion Concentration

The hydrogen ion concentration (pH) in surface waters off southern California varies narrowly around a mean of approximately 8.0 and decreases slightly with depth. No meaningful correlation with other water quality parameters has been identified.

BIOLOGICAL RESOURCES

Benthic Macrofauna

Surveys of the macrofaunal assemblages on and in the sandy subtidal area offshore of the AES Huntington Beach L.L.C. generating station indicate that a core group of species persists in the area, although interannual variation is evident (MBC 1975-2000).

Five taxa, three polychaete annelids (*Diopatra*, *Owenia*, and Maldanidae) hermit crabs (Paguridea), and Pacific sand dollars (*Dendraster excentricus*) form the core group of the macrofaunal assemblage on and in the sandy subtidal area offshore of Huntington Beach, together accounting for almost 90% of the abundance observed since 1975 (MBC 1975-2000).

A long-term mean of 33 macrofaunal species were found during the 26 annual surveys, with a range from 21 species in 1975 and 1980 to 54 species in 1984 (MBC 1975-2000). Variation is also evident from differences in abundance and density noted between years, with an average abundance of 61.3 individuals/m^2 and a large standard deviation of 38.3 individuals/m^2 over the 26 annual surveys.

Temporal fluctuations in abundance and diversity of some macrofaunal species are the norm for the shallow water communities on the mainland shelf of southern California (Jones 1969). Variation in abundance from year to year is probably due to a combination of environmental oceanographic perturbations, such as changes in water temperature, or storms which cause differences in water movement that affects the substrate and the resulting sediment characteristics. Significant sediment grain size changes result in favorable or unfavorable resource partitioning for a particular species (Oliver et al. 1980). These physical factors, combined with biological factors such as predation and prey availability, temporarily favor or hinder successful recruitment. Sediment differences effectively exclude some species while enhancing opportunities for others (Brenchley 1981). Storm runoff in wet years brings sediment down the nearby Santa Ana River and impacts the sediment composition and, subsequently, the macrofauna at the downcoast stations. A review of the data taken at the discharge station (sampled until 1994) shows that slightly fewer species and individuals have been present at the discharge station than the average for all stations, suggesting the macrofauna had been negatively affected by the discharge. However, when a statistical analysis was performed on the first 17 years of data, results indicated that, despite a slight depression in species density and richness, differences in either parameter among the stations were not statistically significant (MBC 1991).

Fish

Although there has been variability in fish abundance since 1978 offshore of the AES Huntington Beach L.L.C. generating station, interannual comparison of relative abundance shows that composition of the fish community in the study area has remained fairly consistent over time (MBC 1976-2000). Based on the species ranks of trawl-caught fish from multiyear surveys, there is a recurring group of pelagic and demersal species that are generally captured in high numbers offshore of Huntington Beach. Until 1999, northern anchovy (*Engraulis mordax*), queenfish (*Seriphus politus*), and white croaker (*Genyonemus lineatus*)had been found in all surveys conducted since 1976, and to date have been the three most abundant species in 18 of the 25 trawl surveys. In 1999, however, only one white croaker was captured, and queenfish and northern anchovy were absent from trawl catches. Instead, California lizardfish (*Synodus lucioceps*) and speckled sanddab (*Citharichthys stigmaeus*) were the most abundant fish species, and the total number of trawl-caught fish (82 individuals) represented the fewest individuals collected in trawl surveys since 1976. In 2000, northern anchovy, queenfish, and white croaker again dominated the trawl catch, and fish abundance was similar to that prior to 1999.

The persistence of the top ranking fish species through time indicates a stable assemblage typical of the near-shore, soft-bottom ichthyofauna in the Southern California Bight. Interannual fluctuations in abundance are most likely related to such factors as recruitment success, competition, predation, and large-scale oceanographic/climatological processes (e.g., El Niño and La Niña events). In 1999, effects from equatorial La Niña conditions extended northward, resulting in colder than normal water temperatures in the study area (NOAA 1999). This is likely the reason the historically abundant nearshore schooling fish (northern anchovy, queenfish, and white croaker) were virtually absent from the study area. Less-than-average numbers of these species were also noted in trawl surveys in studies off Seal Beach and Oxnard in 1999 (MBC 2000).

Since 1976, the three most abundant fish species, northern anchovy, white croaker and queenfish, have accounted for more than 95% of total abundance (MBC 2000), with individuals of these species species found in all three regions of the study area (upcoast, discharge, and downcoast)., Northern anchovy, the most abundant fish species, was collected during 24 of the 25 annual surveys. Uneven distribution and occasional large catches of this species in the sampling area is typical of this active, schooling species (Allen and DeMartini 1983, Love et al. 1986, Mearns 1979). White croaker, which ranked second in overall total abundance, was was one of only two species collected during every annual survey (the other, California halibut, *Paralichthys californicus*, was caught in moderate to low numbers). White croaker live close to shore and are common over sandy areas near the bottom at depths less than 25 m (Hobson and Chess 1976, Allen 1982, Allen and DeMartini 1983, Love et al. 1984). Queenfish, the third most common species, is very abundant over soft substrate, such as that present offshore of Huntington Beach (Allen 1982, Allen 1985). This nocturnal species schools during the day and feeds at night, and is often found with white croaker (Love 1996). Queenfish are mid-water feeders, feeding primarily on zooplankton (Love 1996). Abundance and distribution of the three most common species reflects their patterns of utilization of the existing habitat and is typical of the nearshore sandy habitat of southern California.

COASTAL WETLANDS

South of the proposed project site are the Huntington Beach wetlands. The wetlands occupy a 131 acre, 1.5 mile long area along the coast, bordered by the Pacific Coast Highway to the southwest, and the Talbert and Santa Ana River Flood Control Channels to the north and southeast (MEC 1991). The wetlands are divided into two major components. To the southeast, the 17-acre Talbert Marsh opens to the ocean through a 100 ft-wide entrance adjacent to the mouth of the Santa Ana River. The Talbert Marsh is a recovering wetland area reintroduced to tidal influence on 17 February 1989 (Reish and Massey 1990).

The second component of the Huntington Beach wetlands, separated from the Talbert Marsh by Brookhurst Street, includes 89 privately owned acres immediately adjacent to the proposed project site. This acreage does not have tidal access, and water sources are limited to rainfall, urban runoff, and groundwater seepage (MEC1991). Salinities are extremely high in the soils and seasonal ponds, water quality of the brackish water marsh is poor, and the area in general is considered degraded (Coats and Josselyn 1990, CDFG 1982, cited in MEC 1991). Other acreage of the Huntington Beach wetlands includes almost 20 acres of open water channel of the Talbert Flood Control System.

The privately owned acreage of the Huntington Beach wetlands is primarily a seasonally flooded estuarine intertidal habitat dominated by pickleweed, along with other plant species that can tolerate high soil salinities and seasonal saturation and drought, such as saltgrass and alkali heath (MEC 1991). Many areas of the wetland are heavily disturbed and unvegetated. The back dune habitat along the Pacific Coast Highway supports a moderate number of species including introduced plant species. The dunes have been replanted with native plant species. The site functions as a seasonal wetland for some wildlife, while seasonal ponding in former tidal sloughs supports limited fish and invertebrate use.

Belding's savannah sparrow (*Passerculus sandwichensis beldingi*, state-listed as endangered), may use the pickleweed of the Huntington Beach wetlands for breeding, nesting and feeding habitat (MEC 1991). Breeding pairs have been found in the wetlands between Magnolia and Brookhurst Streets. Belding's savannah sparrow is nonmigratory, living all year in the coastal salt marshes along the southern California coast (Thelander and Crabtree 1994). These birds are associated with upper intertidal marsh areas, above all but the highest tides.

California least tern (*Sterna antillarum browni*, state- and federally-listed as endangered), are known to fly over the Huntington Beach wetlands, and to feed in the open water of the Talbert Channel (MEC 1991). Least terns forage on small shallow-water fish such as anchovys and topsmelt (Thelander and Crabtree 1994). In order to provide abundant food for their chicks, California least terns breed in loose colonies along the coast near areas of seasonally abundant small fish, such as estuaries, river mouths and shallows. Nests are shallow depressions in sandy open areas with little vegetation. Nests and chicks are highly vulnerable to predation from native and introduced predators. A protected 7.9-acre California least tern breeding area is located on the Huntington State Beach between the Talbert Marsh opening and the mouth of the Santa Ana river. Typically 200 to 300 nesting pairs of California least terns utilize this breeding site each year (Keane 2001, pers. com.).

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PERSONAL COMMUNICATIONS

Keane, K. 2001. Keane

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FEB 1 2002

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29 January 2002

MBC

To: Mr. Alan Ashimine
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From: David Vilas
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RE: Effects of a Concentrated Seawater Discharge on the Marine Environment of Huntington Beach, California.

Background

Poseidon Resources Corporation (Poseidon) plans to construct and operate a reverse osmosis (RO) desalination plant in the city of Huntington Beach, adjacent to the AES L.L.C. Huntington Beach generating station (AES Huntington Beach). Up to 50 million gallons per day (mgd) of high-quality water treated to drinking water standards will be produced by the RO plant to supplement the water supply of Orange County. Source water for the desalination plant will be seawater drawn from AES Huntington Beach's existing once-through cooling water circulation system. During the RO process, up to 50 mgd of by-product water, with a salinity about twice that of seawater, will be generated. This concentrated seawater will be released back into the AES Huntington Beach cooling water circulation system where it will mix and be discharged with the circulating cooling water. Hydrodynamic modeling of source water (Jenkins and Wasyl 2001, 2002) and a sanitary survey of the watershed (Archibald and Wallberg 2002) have identified sources and reviewed the safety of the source water supplied to the RO facility. From these studies it is possible to assess likely impacts of RO plant operations on the marine environment in the vicinity of Huntington Beach. Assessments presented in the following text are based on the assumptions that the models are accurate in predicting localized salinities and that salinity of the discharge is the limiting constituent of the RO plant discharge upon the health of the marine community.

Operations

AES Huntington Beach utilizes a once-through cooling water system which intakes and discharges seawater from offshore of the Huntington Beach facility. The offshore intake is located approximately 2,300 ft from the mean high tide line (Jenkins and Wasyl 2001). An intake tower, located at a depth of 34 ft, draws water from approximately 16 ft above the ocean floor into the cooling water system. The intake tower is equipped with a velocity cap to reduce entrainment of fish (Weight 1958). Inside the power plant the seawater is screened to remove incidental trash and debris and circulated through the condensers, which cool and condense spent steam for recirculation as boiler feed water. Two circulating pumps serve each of the four generating units (two units are currently operational). A maximum of 507 mgd of seawater will circulate through the plant when all four units are operational and generating electricity. Passage through the condensers typically heats the seawater about 10° C above ambient. The heated seawater, with the intermittent addition of a small amount of permitted in-plant wastes, is then discharged offshore through a structure similar to the intake tower, but without a velocity cap, about 800 ft inshore of the intake in about 28 ft of water. Because the discharge structure lacks a velocity cap, the discharge stream produces a vertical jet of water which broaches the sea surface as an observable "boil," and promotes mixing with the surrounding water.

During maximum operation, the Poseidon RO plant will draw approximately 100 mgd of heated seawater from the AES Huntington Beach circulating water system after the water has passed through the condensers, but prior to the addition of any in-plant wastes. This water will pass through additional pretreatment filters and then be conveyed to the RO plant. The RO process yields about 45% to 50% recovery of fresh water. For each 100 mgd of seawater drawn from the generating station, approximately 50 mgd of fresh water and 50 mgd of concentrated seawater by-product will be produced. The fresh water will be further treated to achieve drinking water standards and used to supplement Orange County's water supply. The concentrated seawater by-product will have a salinity approximately twice that of seawater. The by-product water, along with filter backwash water, will be released back into, and subsequently diluted by, the remaining cooling water discharge stream.

As a guideline for increased interest in desalination technologies, the California Coastal Commission produced a report to provide background technical and policy information on desalination in California (CCC 1993). Included are descriptions of desalination technologies, status of desalination in California up to 1993, and regulatory issues that pertain to the siting, construction and operation of desalination plants. The siting and design of the proposed Poseidon RO plant incorporates several of the suggestions from the report, including plant construction in an industrialized area, utilization of an area previously developed, siting near a power plant, energy recovery, and most importantly for the marine environment, sharing existing intakes and discharges and diluting by-product water by combining it with an existing discharge.

The use of existing intakes and discharges eliminates the need for new construction and associated environmental impacts. Another advantage of teaming with AES Huntington Beach is that even nominal generating station operations will provide all the seawater the Poseidon RO plant will require without causing additional marine impacts from the construction and operation of an intake system.

Physical Effects

Mixing of the RO by-product water with power plant cooling water will reduce the salinity of the by-product water prior to discharge. In-pipe salinity of the combined RO by-product and cooling water will depend upon the level of operation at AES Huntington Beach. With a 50 mgd RO plant production and no additional in-plant discharges, salinity of the combined discharge with only one of the four generating units in operation would be about 55.4 parts per thousand (ppt) (about 60% higher than the local mean of 33.5 ppt for seawater). With all four generating units operational, the salinity of the combined discharge would be about 37.2 ppt, near the upper range of natural variability of ocean salinities (Jenkins and Wasyl 2001).

Following ocean discharge, the combined effluent will mix rapidly with oceanic water. The orientation of the outfall structure produces a vertical discharge stream which broaches the sea surface as an observable "boil," and promotes mixing. The denser, high-salinity water will subsequently sink to the bottom, then spread outward from the base of the outfall tower, further mixing with the surrounding water. With a maximum discharge salinity of 55.4 ppt (one unit generating electricity), and no additional mixing from natural causes such as wind or wave action (worst case scenario), the highest salinity in the core of the discharge jet is predicted to be 55.0 ppt at mid-depth and 50.1 ppt at the surface (Jenkins and Wasyl 2001). The highest salinity on the ocean floor will be 48.3 ppt at the base of the outfall tower, decreasing with distance from the tower. A maximum of 15.6 acres of ocean floor (benthic area) and 18.3 acres of the water (pelagic area) around the discharge are expected to be exposed to water with a salinity 10% higher than the ambient seawater during the worst case scenario. At the same time, 263 acres of benthic area and 151 acres of pelagic area will be exposed to a salinity increase of 1% above ambient. A minimum dilution of 32 to 1 of the RO by-product water is predicted at the shoreline. These effects are acute and not expected to last for an extended period. Composited for one month, the worst case scenario has a less than 1% chance of occurring.

For nominal power plant operation (two units generating), typical environmental conditions and RO plant production of 50 mgd (average case scenario), the salinity at mid-depth in the discharge jet is predicted to be about 42 ppt, dropping to 38.3 ppt on the sea surface and 37.6 ppt on the ocean floor at the base of the discharge (Jenkins and Wasyl 2001). During average case conditions a maximum of 6.5 acres of benthic area and 8.3 acres of pelagic area is expected to be exposed to water with a salinity 10% higher than ambient seawater, while 172 acres of benthic area and 130 acres of pelagic area will be exposed to a salinity increase of 1% above ambient. Minimum dilution of the RO by-product water at the shoreline is predicted to be 190 to 1. Average case conditions are expected to occur 50% of the time the RO plant is operating. As more generating units are operated, salinity of the combined discharge will continue to decrease and a smaller area of the surrounding environment will be exposed to elevated salinities.

Biological Effects

The AES Huntington Beach discharge is located in a sandy bottom, open coast area. There are no giant kelp, surf grass or eel grass beds in the area.

Pelagic organisms are those which live in the water column. Pelagic organisms include mobile species such as adult fish and large invertebrate species such as shrimp, and planktonic species such as phytoplankton, zooplankton, and ichthyoplankton (fish eggs and larval fish), which float with the tide and currents.

The pelagic area potentially exposed to a 10% increase in salinity as a result of the RO plant discharge is relatively small, even in the worst case model. A 10% anomaly is within the normal variability of seawater salinity and would be tolerated by most fish species. Salinities predicted for the discharge jet during the worst case scenario are potentially fatal to fish species. Mobile species have the ability to avoid areas that they cannot tolerate and, since sharp salinity gradients may act as barriers to the movements of fish (Holliday 1971, cited in Reynolds 1973), should avoid higher salinity areas. Fish have been observed feeding in the discharge streams of southern California generating stations including the AES Huntington Beach discharge (Curtis 2002, pers. comm.). This opportunistic behavior is likely to be reduced or completely discontinued following the addition of the concentrated seawater discharge, but this will affect a small number of individuals. No significant impact to local fish populations as a result of the addition of the concentrated seawater by-product is expected.

Planktonic species have limited mobility and these species tend to occur in great numbers. Marine planktonic organisms have similar salinity tolerances to local fish species. However, plankton entrained in the discharge stream are likely to be killed, as much by the turbulence and temperature of the discharge (which would occur even without the RO plant by-product input) as by the salinity increase. No significant increase in plankton loss is expected from the addition of the by-product water to the discharge stream. Effects of elevated salinities on the pelagic communities near the discharge are expected to be minimal.

The benthic area potentially exposed to a 10% increase in salinity as a result of the RO plant discharge is relatively small in relation to the soft-bottom habitat offshore of Huntington Beach. The benthic community near the discharge structure is dominated by soft-bottom infaunal invertebrate species with limited mobility. Macrofaunal species are the larger members of the benthic community more easily identified in the field and are commonly used to assess the benthic community. Infaunal and other benthic species common offshore of Huntington Beach will have salinity tolerances similar to those of other marine species in the area and should be able to endure salinity increases of up to 10%. Pomory (2000), when reviewing potential effects for a RO plant in Florida, pointed out that for most marine organisms, lower salinities are more detrimental than higher salinities, as long as the upper limit does not exceed 40 ppt. During worst case conditions, however, salinities at the base of the discharge tower are expected to exceed 48 ppt, and even during average conditions the salinity of the water at ocean floor immediately around the discharge will be about 38 ppt, higher than local normal oceanic variation.

In times of stress infaunal species can withdraw into the sediments, where the interstitial water is only gradually exchanged with overlaying water. Still, the benthic species at the base of the intake tower will probably be replaced by species which are more tolerant of high salinities. There is also likely to be a general trend of replacement of infaunal species in the area of the 10% salinity anomaly footprint with species which are common to areas of fluctuating salinity such as bays, estuaries and river mouths. While species common to the open coast can tolerate salinity fluctuations to some degree, in the open coast these fluctuations are gradual, while operations of either the Poseidon RO plant or AES Huntington Beach may cause rapid changes in local salinity which estuarine species are better adapted to tolerate. Local benthic community diversity is likely to be depressed as a result of the RO plant operations. However, these estuarine species will be functionally similar to the existing community. Still, temporal fluctuations in abundance and diversity of benthic species are the norm for the shallow water communities on the mainland shelf of southern California (Jones 1969). Replacement species are most likely to be infaunal species common to local estuaries and bays. The area of this replacement will be relatively small and localized.

Approximately 2 km downcoast of the discharge structure, a protected 7.9-acre California least tern nesting area is located on the Huntington State Beach between the Talbert Marsh opening and the mouth of the Santa Ana River. The addition of the by-product water will have little if any impact on the least tern colony. This area is well outside the modeled area of elevated salinities (Jenkins and Wasyl 2001). Even if this were not the case, least terns nest above the high tide level, so they would not be directly impacted by water of varying salinities, and their prey species are mobile, surface-schooling fish species which will avoid water that they can not tolerate. California least terns will not be affected as a result of RO plant operations. Similarly, other bird and marine mammal species are unlikely to affected by the addition of the RO plant by-product water to the discharge.

While the mouth of Talbert Marsh is outside of the area of elevated salinities, Huntington Beach wetlands, separated from the Talbert Marsh by Brookhurst Street, is immediately adjacent to the proposed Poseidon RO plant site. The Huntington Beach wetlands does not have tidal access, although the wetlands border a channel of the Talbert Flood Control System. Water sources to this area are limited to rainfall, urban runoff, and groundwater seepage (MEC1991). Salinities are extremely high in the soils and seasonal ponds, water quality of the brackish water marsh is poor, and the area in general is considered degraded (Coats and Josselyn 1990; CDFG 1982, cited in MEC 1991). This privately owned acreage is primarily a seasonally flooded estuarine habitat dominated by pickleweed, along with other plant species that can tolerate high soil salinities and seasonal saturation and drought such as saltgrass and alkali heath. Many areas of the wetland are heavily disturbed and unvegetated. The site functions as a seasonal wetland for some wildlife, while seasonal ponding in former tidal sloughs supports limited fish and invertebrate use.

A spill at the Poseidon RO plant of either product or by-product water is likely to have a negligible effect on Huntington wetlands or the Talbert Flood Control System. Soils of wetlands are already flooded by freshwater during the rainy season, forming standing pools. Product water spills will do the same. Soils are already hypersaline, so spills of by-product water will contribute little to the salinity of soils. Spills into the local Talbert Channel are also likely to have minimal impact. The channel already has multiple year-round fresh water inputs, so product water spills will have no impact. By-product water spills will be diluted by these fresh water inputs, although if the channel is mostly oceanic at the time of a spill, salinities may be overly elevated. Species likely to be found in the channel, such as topsmelt, can tolerate wide variations in salinity.

Mitigation

There are no perceived impacts to the marine environment from the construction of the Poseidon RO plant. Adherence to regulatory requirements and control methods during construction should reduce the likelihood of any environmental impacts.

Operations of the Poseidon RO plant resulting in the discharge of a concentrated seawater by-product may lead to a localized replacement of benthic species in the area of the existing discharge tower. The replacement community is likely to be less diverse but more tolerant of variable salinity than the existing community. No additional impacts to the marine environment are anticipated as a result of discharge of the RO plant by-product water. To ensure that the beneficial uses of the receiving water is maintained, Poseidon will obtain and comply with a National Pollutant Discharge Elimination System (NPDES) permit for the concentrated seawater by-product discharge (Archibald and Wallberg, 2002). The NPDES permit requirements will be determined by the Santa Ana Regional Water Quality Control Board.

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