5.1 Hydrology and Water Quality

5.1.1 Introduction

This section describes the existing hydrology and water quality of the project area and surrounding areas, and evaluates whether the development of the proposed desalination plant and related facilities would result in adverse effects to hydrology and water quality. Specifically, the evaluation focuses on whether the proposed project would violate water quality standards or waste discharge requirements, alter existing drainage pattern of the site or area, contribute to or create runoff, degrade water quality, or expose people or structures to significant risk due to flooding or inundation. Effects to marine water quality through the discharge of brine generated during the desalination process are included in the evaluation.

The description of the existing setting and evaluation of impacts is based in part on review of the data presented in **Appendix D, scwd[2] Final Seawater Reverse Osmosis Desalination Pilot Test Program Report & Appendices** (Pilot Test Program Report), **Appendix E, Proposed scwd[2] Desalination Project Watershed Sanitary Survey** (Watershed Sanitary Survey), **Appendix J, Dilution Analysis for Brine Disposal** (Dilution Analysis) and **Appendix L, scwd[2] Seawater Desalination Plant – Preliminary Design: Volume 1 – Report & Volume 2 – Drawings** (Desalination Plant Preliminary Design Report). Additional information in this section related to environmental setting, regulatory framework, and the analysis of impacts and mitigation measures is derived from Section 5.1, Hydrology and Water Quality, of the *Integrated Water Plan Program Environmental Impact Report* (IWP Program EIR) (City, 2005a), as well as from other references cited in this section[1].

Public and agency comments related to hydrology and water quality were received during the public scoping period in response to the Notice of Preparation, and are summarized below.

- Address the proposed project's effects on surface water, including compliance with stormwater regulations.
- Evaluate the proposed project's effect on groundwater.
- Evaluate the effects of climate change on the proposed project, including impacts to groundwater levels, tsunami and coastal flooding, and coastal erosion.
- Evaluate product water quality in relation to drinking-water standards, including disinfection byproducts (DBPs).

[1] Referenced documents in this EIR are available for review at the City of Santa Cruz Water Department offices at 212 Locust Street, Suite D, Santa Cruz, California 95060, Monday through Thursday 8:00 a.m. to Noon and 1:00 p.m. to 5:00 p.m, except holidays. Likewise, these documents are available for review at the Soquel Creek Water District offices at 5180 Soquel Drive, Soquel, CA 95073, Monday through Friday 8:00 a.m. to Noon and 1:00 p.m. to 5:00 p.m, except holidays.

- Describe the brine chemical characteristics, discharge patterns, and potential impacts to receiving water quality.
- Include the Dilution Analysis for Brine Disposal study as an appendix.

To the extent that issues identified in public comments involve potentially significant effects on the environment according to the California Environmental Quality Act (CEQA), and/or are raised by responsible and trustee agencies, they are identified and addressed in this EIR. For a complete list of public comments received during the public scoping period, refer to **Appendix A, Scoping Report City of Santa Cruz and Soquel Creek Water District (scwd^2) Regional Seawater Desalination Project**.

5.1.2 Environmental Setting

The proposed desalination project and its various components would be located in the City of Santa Cruz (City), unincorporated Santa Cruz County (County), City of Capitola (Capitola), and offshore in Monterey Bay. The regional and project area setting for the onshore and offshore components of the project related to hydrology and water quality is provided in the sections below.

Regional Setting

Climate

The Santa Cruz area is on the coast of California, and has a temperate coastal climate. Summers tend to be warm and dry, but foggy; and winters are mild and rainy. Average annual precipitation is approximately 30 inches, with the majority of the precipitation falling between November and March. The average maximum temperature varies between approximately 60 degrees Fahrenheit (°F) in December and January, to approximately 75°F in August and September. **Table 5.1-1, Summary of Climatological Data for Santa Cruz,** summarizes the climatological data for the region.

Table 5.1-1. Summary of Climatological Data for Santa Cruz, CA

	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Maximum Temperature (°Fahrenheit)	68.5	59.8	62.2	64.2	67.4	70.5	73.5	74.1	75	75.8	72.7	65.8	60.4
Average Precipitation (Inches)	30.66	6.56	5.49	4.34	2.14	0.66	0.2	0.08	0.09	0.34	1.27	3.86	5.63

Source: Western Regional Climate Center, 2011. Climate Data for Santa Cruz, California (047916).
Period of Record: 07/01/1948 to 12/31/2005.

Watersheds and Water Bodies

The entire project area is in the Big Basin Hydrologic Unit, as defined by the Central Coast Regional Water Quality Control Board (RWQCB), and includes portions of the San Lorenzo and Aptos Creek Hydrologic subareas.

The City is divided into five sub-watersheds that make up the San Lorenzo Hydrologic subarea. Of those five watersheds, the Arroyo Seco, Neary Lagoon, and Arana Creek watersheds overlap with the project area, and are further described below. Moore Creek and San Lorenzo River watersheds do not overlap with the project area and are not described. Additional watersheds in the project area further east in the unincorporated County and Capitola include the Rodeo Gulch, Soquel Creek, and Porter Gulch watersheds.

Some of the creeks in the above watersheds have culverted sections, but they are mostly open channels (i.e., not enclosed in a culvert or pipe). Conditions of riparian corridors and water quality in each of the watersheds vary depending on the creek's location, and proximity and characteristics of adjacent development. Specific information about each of the relevant watersheds and water bodies in the immediate project area, listed from west to east, is provided below. Water bodies are shown on **Figure 5.1-1, Surface Water Bodies**.

Information pertaining to the water quality in each water body in the watersheds is summarized in **Table 5.1-2, Surface Water Bodies in the Project Area.** Beneficial uses[2] of water bodies are identified by the RWQCB in its Basin Plan. When a water body exceeds the Basin Plan water quality objectives (WQOs), it is placed on the Clean Water Act (CWA) Section 303(d) list as "impaired" waters, and a Total Maximum Daily Load (TMDL[3]) must be established with the goal of restoring the beneficial use(s) of the water body. The Basin Plan is further described in **Section 5.1.3, Regulatory Framework**.

Arroyo Seco Watershed and West Side Creeks

A portion of the West Side of the City is drained by the Arroyo Seco Watershed and several other small creeks. The watershed is comprised primarily of residential, commercial, and industrial uses with limited open space. Arroyo Seco is a small seasonal creek that crosses Meder Street south of University Terrace Park. Through the park, the creek is bounded by a riparian buffer of mixed non-native woodland, and native oak woodland and riparian scrub. The drainage is culverted under Highway 1 and emerges south of the highway.

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[2] Aquatic resources provide many different benefits. Beneficial uses are those resources, services, and/or qualities of aquatic systems that are to be maintained, and are the ultimate goals of protection and achieving high water quality.

[3] The TMDL is the maximum amount of a pollutant that a water body can receive and still meet the water quality standards. In general, a TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources.

Near Area A, where the alternative desalination plant sites are located, Arroyo Seco was realigned and restored, and runs to the east of the plant sites. The restored area includes riparian and oak plantings on either side of the restored channel. The drainage continues south under Delaware Avenue where it traverses next to Derby Park, going underground until its outfall to Monterey Bay, at West Cliff Drive.

Natural Bridges Creek is a small, seasonal creek that appears to originate at a culvert downslope of Delaware Avenue, just east of its intersection with Natural Bridges Drive and south of the alternative plant site locations. It is an intermittent creek that runs through Natural Bridges State Beach into Monterey Bay (City, 2008a). The alternative desalination plant sites drain to Natural Bridges Creek.

Bethany Creek is a small seasonal creek that is daylighted only briefly between Delaware Avenue and West Cliff Drive as it flows through Bethany Curve Greenbelt. It drains into Monterey Bay near the intersection of West Cliff Drive and Woodrow Avenue (City, 2008a).

As indicated in **Table 5.1-2**, none of the drainages described above have been recognized as having beneficial uses, nor have they been listed as impaired.

Neary Lagoon Watershed

The Neary Lagoon Watershed is on the eastern edge of the Westside Watershed, and is comprised of several creeks, all of which feed into Neary Lagoon before entering Monterey Bay at Cowells Beach. A large part of the watershed drains the UCSC campus via Bay and Laurel creeks, with residential and commercial use accounting for the remaining portion. Bay and Laurel creeks are not considered to be in the project area. During the dry season, water in Neary Lagoon is diverted to the wastewater treatment plant on Bay Street to the southwest of the lagoon. Excess stormwater flows in Neary Lagoon overflow to Cowells Beach via a lagoon outlet and weir, outlet channel, pump station, and beach outlet.

Beneficial uses of Neary Lagoon, as shown in **Table 5.1-2**, include recreation and habitat for rare, threatened, or endangered species. It is not impaired according to the Section 303(d) list.

Arana Creek Watershed

The Arana Creek Watershed forms the City's eastern border and is partially situated in the unincorporated portion of the County known as Live Oak. The watershed consists of mixed residential and open-space land uses, as well as limited commercial use. Arana Creek is natural, with a riparian corridor along most of its reach. The upper watershed is mostly residential. The lower watershed is dominated by the City-owned Arana Creek greenbelt property, where Arana Creek broadens out into a wetland area (Arana Wetland) before entering the Santa Cruz Harbor. Upstream of the greenbelt property, the watershed crosses under Capitola Road and Soquel Avenue, near Harbor High School (City, 2008a).

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Figure 5.1-1
Surface Water Bodies

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Table 5.1-2. Surface Water Bodies in the Project Area

Water Body (Watershed)	Project Component(s) in Immediate Vicinity	Beneficial Use(s)	303(d) Listed Pollutant(s)	Pollutant Source(s)	TMDL Status
Inland Surface Water					
Natural Bridges Creek (Local Drainage)	Plant Sites, Intake Transfer Piping, Brine Piping	None	Not listed as impaired	Not listed as impaired	Not listed as impaired
Arroyo Seco (Arroyo Seco Watershed)	Plant Sites, Intake Transfer Piping, Brine Piping	None	Not listed as impaired	Not listed as impaired	Not listed as impaired
Bethany Creek (Local Drainage)	Intake Pump Station (Intake Site SI-4)	None	Not listed as impaired	Not listed as impaired	Not listed as impaired
Neary Lagoon (Neary Lagoon Watershed)	GWR, REC1, REC2, WILD, WARM, SPWN, RARE, COMM	Not listed as impaired	Not listed as impaired	Not listed as impaired	Not listed as impaired
Arana Creek (Arana Creek Watershed)	Intertie System Improvements (Conveyance between DeLaveaga Tanks and McGregor Pump Station)	MUN, GWR, REC1, REC2, WILD, COLD, MIGR, SPWN, RARE, FRESH, COMM	Chlorpyrifos	Other urban runoff, unknown NPS	Expected completion January 1, 2021 for all pollutants listed
			E. coli	Unknown	
			Fecal coliform	Unknown	
Soquel Creek (Soquel Creek Watershed)	Intertie System Improvements (Conveyance between DeLaveaga Tanks and McGregor Pump Station)	MUN, AGR, IND, GWR, REC1, REC2, WILD, COLD, MIGR, SPWN, BIOL, FRESH, COMM	Enterococcus	Collection system failure, natural sources, transient encampments, urban runoff/storm sewers	Approved November 17, 2010 for *Enterococcus*, *E. coli*, and fecal coliform
			E. coli	Collection system failure, natural sources, onsite wastewater systems (septic tanks), transient encampments, urban runoff/storm sewers	
			Fecal coliform	Collection system failure, natural sources, onsite wastewater systems (septic tanks), transient encampments, urban runoff/storm sewers	
			Turbidity	Unknown	Expected completion January 1, 2021

Table 5.1-2. Surface Water Bodies in the Project Area

Water Body (Watershed)	Project Component(s) in Immediate Vicinity	Beneficial Use(s)	303(d) Listed Pollutant(s)	Pollutant Source(s)	TMDL Status
Nobel Gulch (Soquel Creek Watershed)	Intertie System Improvements (Conveyance between DeLaveaga Tanks and McGregor Pump Station)	None	E. coli	Unknown	Approved November 17, 2010
Rodeo Gulch (Rodeo Gulch Watershed)	Intertie System Improvements (Conveyance between DeLaveaga Tanks and McGregor Pump Station)	MUN, AGR, IND, GWR, REC1, REC2, WILD, COLD, SPWN, FRESH, COMM	pH	Unknown	Expected completion January 1, 2021 for both pollutants listed
			Turbidity	Unknown	
Porter Gulch (Porter Gulch Watershed)	Intertie System Improvements (McGregor Pump Station Upgrade)	None	Enterococcus	Unknown	Expected completion January 1, 2021 for both pollutants listed
			E. coli	Unknown	
Coastal Water					
Pacific Ocean (Point Año Nuevo to Soquel Point)	Intakes (all intake locations)	IND, REC1, REC2, NAV, COMM, RARE, MAR, SHELL	Dieldrin	Other	Expected completion January 1, 2021

Sources: RWQCB, 2011. Water Quality Control Plan for the Central Coast Region (Basin Plan); SWRCB, 2011a.

Acronyms:
- E. coli = *Escherichia coli*
- NPS = nonpoint source
- TMDL = total maximum daily load

Beneficial Use Definitions:
- AGR = agricultural supply
- BIOL = preservation of biological habitat of special significance
- COLD = cold freshwater habitat
- COMM = commercial and sport fishing
- EST = estuarine habitat
- FRESH = freshwater replenishment
- GWR = groundwater recharge
- IND = industrial service supply
- MAR = marine habitat
- MIGR = migration of aquatic organisms
- MUN = municipal and domestic supply
- NAV = navigation
- RARE = rare, threatened, or endangered species
- REC1 = water contact recreation
- REC2 = no-contact water recreation
- SHELL = shellfish harvesting
- SPWN = spawning, reproduction, and/or early development
- WARM = warm freshwater habitat
- WILD = wildlife habitat

As shown in **Table 5.1-2,** Arana Creek has a variety of beneficial uses, including water supply, recreation, fishing, and habitat for rare, threatened, or endangered species. Arana Creek was placed on the Section 303(d) list for being impaired by chlorpyrifos, *E. coli*, and fecal coliform due to urban runoff.

Soquel Creek Watershed

Occupying most of Capitola, the Soquel Creek Watershed is the second-largest watershed in the project area. Soquel Creek flows through unincorporated portions of the County in its upper watershed, and the center of Capitola as it approaches the ocean. The creek is an open channel throughout its entire length as it flows through open space, residential, and commercial zones. Soquel Creek terminates at Capitola City Beach. Nobel (also called Noble) Gulch is a small tributary that flows into Soquel Creek from the east. Nobel Gulch originates near Fairway Drive and Bay Heights Drive and flows south under Highway 1 through Capitola to Soquel Creek.

As shown in **Table 5.1-2**, beneficial uses of Soquel Creek include water supply, recreation, and wildlife habitat. According to the Section 303(d) list, Soquel Creek is impaired by *Enterococcus*, *E. coli*, fecal coliform, and turbidity due to collection system failures, transient encampments, urban runoff, and natural sources. No beneficial uses have been identified for Nobel Gulch, but it is listed as impaired by *E. coli* (see **Table 5.1-2**).

Rodeo Gulch Watershed

The Rodeo Gulch Watershed flows through the unincorporated area of Live Oak between the City and Capitola. The watershed consists primarily of open space in the upper watershed, and residential use in the lower reaches. Rodeo Gulch is daylighted for most of its length, and flows into Corcoran Lagoon, before terminating at the Pacific Ocean. Corcoran Lagoon is not considered part of the project area.

Rodeo Gulch supports beneficial uses, including water supply, recreation, and wildlife habitat. It is included on the Section 303(d) list as being impaired by pH and turbidity due to unknown sources of pollution.

Porter Gulch Watershed

The Porter Gulch Watershed is east of the Soquel Creek Watershed. Porter Gulch flows through New Brighton State Beach, just south of the project area, before meeting the Pacific Ocean. No beneficial uses have been identified for Porter Gulch, but it is listed as being impaired by *Enterococcus* and *E. coli*, due to unknown sources of pollution (see **Table 5.1-2**).

Regional Flooding Conditions

As described in the *City of Santa Cruz General Plan 2030 Final EIR* (General Plan 2030 Final EIR), the City has worked to improve the flood capacity of the San Lorenzo River levees over the past twenty years (City, 2012a). Significant flood improvements along the river were completed in 2000 as part of the U.S. Army Corps of Engineers' San Lorenzo River Flood Control and Environmental Restoration Project. This project raised the river levees and rehabilitated the three downtown bridges (over the San Lorenzo River) to increase flood flow capacity. Despite recent flood control projects and improved flood rating in much of the downtown and Beach Area, the risk of flooding is still a concern to the City. While the levee project has resulted in a more flood-resistant downtown, floods may still occur (City, 2012a).

Figure 5.1-2, Flood Insurance Zones, shows the Federal Emergency Management Agency (FEMA) floodplains for the major watersheds in the project area. The identified FEMA flood zones are along the coast, and in narrow bands along the major streams that intersect the project area (i.e., Arana Creek, Rodeo Gulch, and Soquel Creek). The exception is the San Lorenzo River, which shows a large section of downtown Santa Cruz in an A99 zone. An A99 zone is an area protected from the 1 percent chance flood (i.e., 100-year flood) by a federal Flood Protection system under construction. The effective date of the FEMA map is 2006.

FEMA re-designated much of the downtown and Beach Area from A-11 to the A-99 Flood Zone designation in recognition of the significant flood improvements resulting from completion of the San Lorenzo River Flood Control and Environmental Restoration Project. Under the A-99 designation, new buildings and improvements are no longer mandated to meet FEMA flood construction requirements and flood insurance premiums are significantly reduced (City, 2012a).

Regional Groundwater Basins

The "Soquel-Aptos" groundwater area, which underlies the mid-County region, comprises the Soquel Valley, Santa Cruz Purisima Formation, West Santa Cruz Terrace, and Pajaro Valley groundwater basins, as shown on **Figure 5.1-3, Regional Groundwater Basins**. The Purisima Formation (Purisima) is the primary water-bearing unit in the West Santa Cruz Terrace and Santa Cruz Purisima Formation basins; and the Purisima and Aromas Red Sands Formation (Aromas) are the primary water-bearing units in the Soquel Valley and Pajaro Valley basins (CDWR, 2004a; CDWR, 2004b; CDWR, 2004c; CDWR, 2006).

Both the City's and the District's UWMPs describe the groundwater resources of the Soquel-Aptos area. The Purisima is a collection of distinct geologic units composed of sandstone interbedded with layers of siltstone and claystone. These units vary in thickness and hydrogeologic characteristics. The formation is relatively shallow under the City's water service area, but dips southeast, becoming deeper and thicker towards Capitola and Aptos, and outcrops at the cliffs along Monterey Bay shoreline. Recharge is thought to occur from deep percolation of rainfall in the upper watersheds and along streambeds of Branciforte Creek, Arana Creek, Rodeo Gulch, and Soquel Creek. This aquifer serves as a mutual groundwater resource for the City, the District, the Central Water District (CWD), several small water systems, and hundreds of private wells (District, 2011a; City, 2011a).

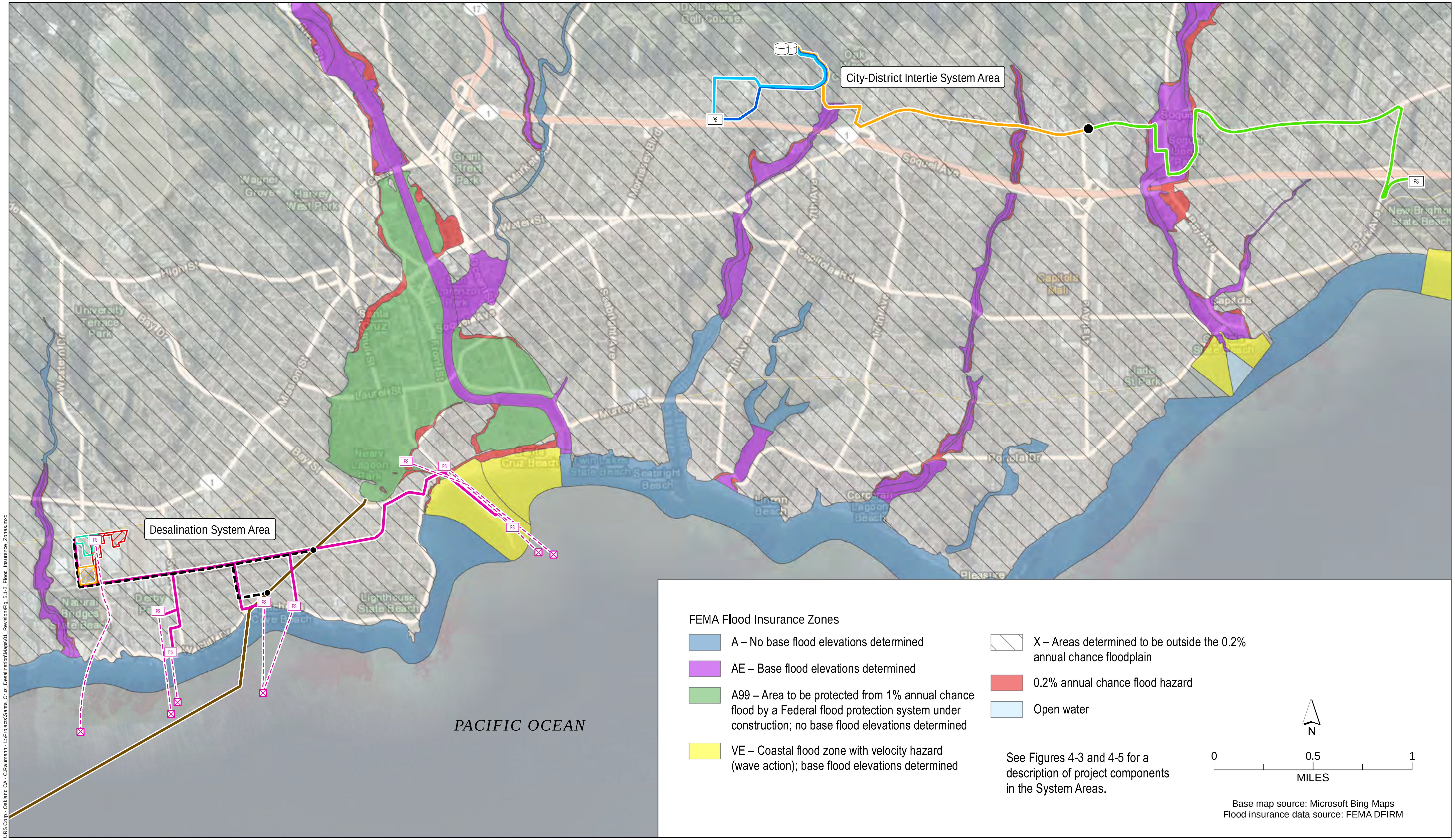

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Figure 5.1-2
Flood Insurance Zones

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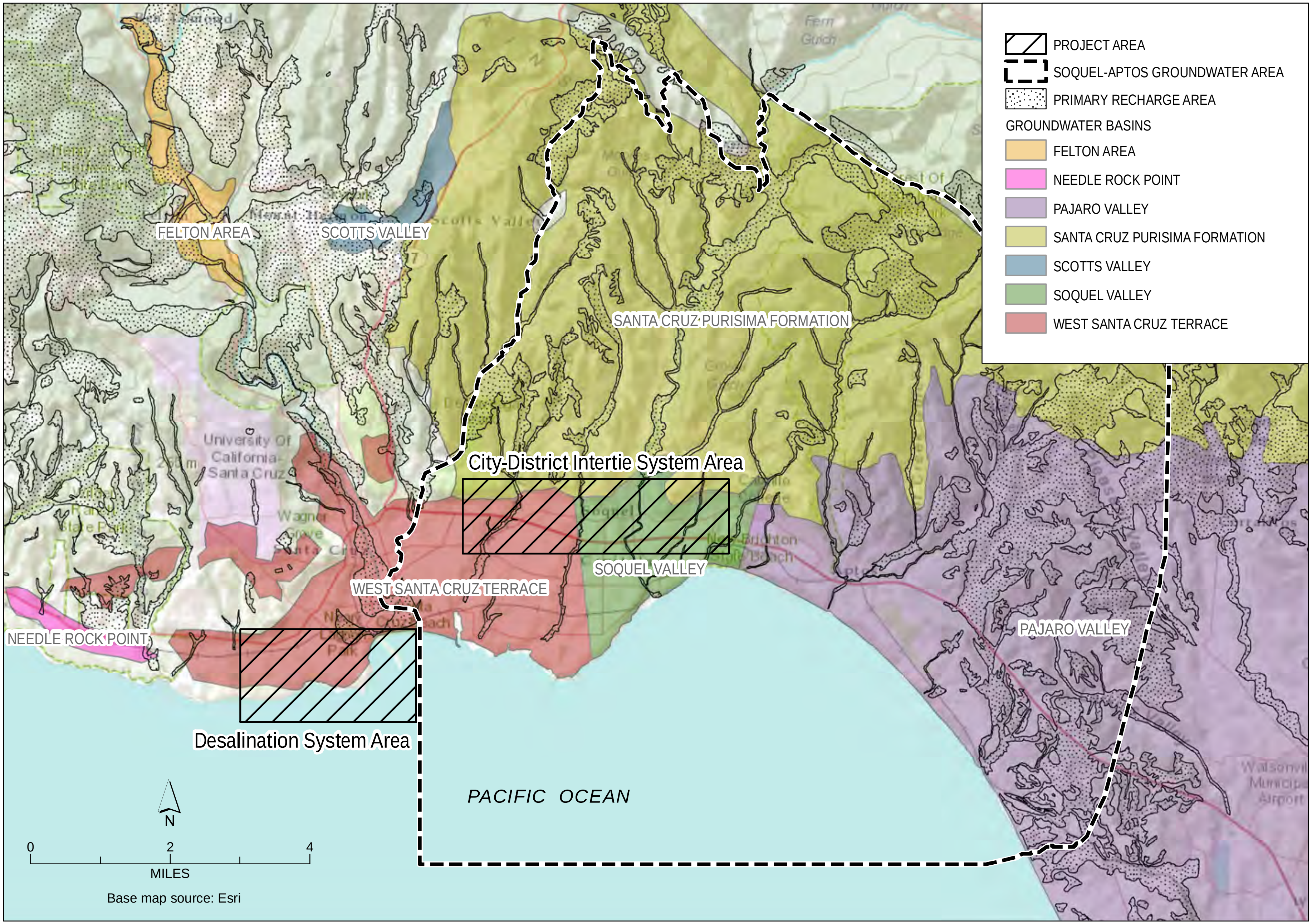

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Figure 5.1-3
Regional Groundwater Basins

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The Aromas aquifer mainly serves the communities of Seascape, Rio Del Mar, and La Selva Beach in the District's service area. The Aromas is a 400-foot-thick aquifer divided into two units. The uppermost unit is about 225 feet thick, and the lowermost unit is about 175 feet thick. The Aromas aquifer is composed of interbedded layers of silt and clay, and it overlies the Purisima in portions of the District's service area.

The entire production of Santa Cruz's Live Oak well field is derived from groundwater contained in the Purisima, and accounts for approximately 4 percent of the City's water supply (City, 2011a). The District relies entirely on groundwater from the Soquel-Aptos area, with approximately two-thirds of their supply coming from the Purisima, and one-third coming from the Aromas (District, 2011a).

Marine Setting

The proposed brine discharge point and the alternative seawater intake sites are in or immediately adjacent to the Monterey Bay National Marine Sanctuary (MBNMS), which encompasses 6,094 square miles of the Pacific Ocean and 276 miles of shoreline from the Farallon Islands in the north to Morro Bay in the south. The brine would be discharged via the existing City Wastewater Treatment Facility (WWTF) outfall approximately 1 mile from the shore at a depth of approximately 110 feet. A number of seawater intake locations are being considered (see **Figure 4-2, Proposed Desalination Plant Sites and Related Facilities**), and are generally within ½ mile from shore, where depths are shallower. Characteristics of the marine environment that are relevant to the analysis in this section are further described below.

Circulation

Water circulation and oceanography in the MBNMS are driven by the California Current System, which mixes cool, lower-salinity subarctic water with warm, saltier equatorial water. The proportion of the two water types in Monterey Bay changes depending on the strength of the various components of the Current System (MBNMS, 2011). The predominant ocean-water current direction in the project area is to the west, and there are three distinct oceanographic seasons for Monterey Bay, as noted in **Appendix G, City of Santa Cruz Water Department and Soquel Creek Water District scwd[2] Desalination Program Open Ocean Intake Effects Study** (Open Ocean Intake Effects Study):

1. Upwelling[4] Period (typically February to July), when surface waters cool;
2. Oceanic or California Current Period (typically August to October), characterized by wind relaxation, which allows previously upwelled water to sink and be replaced by warm oceanic waters from offshore; and

[4] Upwelling is the offshore transport of surface waters usually resulting from steady northwesterly/westerly winds, causing deep, colder, nutrient-rich water to rise to the surface (Appendix G).

3. Davidson Current Period (typically November to January), characterized by winter storm conditions, downwelling in Monterey Bay, and lower currents in the nearshore.

Waves and tides introduce turbulence, particularly in nearshore areas. Tides at Santa Cruz are mixed semi-diurnal, with an average range between mean high and mean low tides of 3.50 feet (see **Appendix G**); and 5.3 feet between mean higher high and mean lower low tides. Rivers and streams discharge freshwater to the nearshore environment, particularly during storm events, but have very little impact on circulation patterns (see **Appendix G**).

The ocean is often stratified; that is, the density is not constant, but varies with depth. The surface of the ocean can be warmer and possibly less salty than the bottom water, which tends to be colder and saltier. Project area temperature and salinity information is shown in **Table 5.1-3, Summer/Fall and Winter Ambient Temperature and Salinity**, and is based on data collected in February 1976 and September of 1977 that represent worst-case drought conditions and related minimal freshwater inflows (see **Appendix J**). These data show that thermal stratification occurs during the summer/fall. In winter, there is little to no temperature gradient in ambient coastal waters with depth.

Table 5.1-3. Summer/Fall and Winter Ambient Temperature and Salinity

Depth from Surface (feet)	Summer/Fall Profile		Winter Profile	
	Temperature (ºC)	Salinity (ppt)	Temperature (ºC)	Salinity (ppt)
0	14.87	33.69	12.48	33.76
13	14.13	33.70	12.47	33.77
26	13.70	33.73	12.44	33.78
39	12.70	33.76	12.38	33.78
53	12.52	33.78	12.31	33.78
66	12.32	33.78	12.18	33.78
79	12.16	33.81	11.98	33.79
92	12.07	33.80	11.79	33.77
105	11.94	33.80	11.56	33.79

Source: Appendix J, Dilution Analysis for Brine Disposal via Ocean Outfall.
Acronyms:
ºC = degrees Celsius ppt = parts per thousand

Data on the salinity and temperature elsewhere in Monterey Bay were obtained from the National Oceanic and Atmospheric Administration's (NOAA) National Oceanographic Data Center database for the period from 1960 to 2010 (NOAA, 2013). Data obtained from the NOAA station, located at the southern end of Monterey Bay near Seaside, indicates that: the surface temperatures varied from 50 degrees Fahrenheit (ºF) (10 degrees Celsius [ºC]) to 61ºF (16ºC); at a 100-foot depth, the minimum temperature was as low as 47ºF (8.4ºC); and salinity was fairly constant throughout the year. These data also indicate that stratification occurs during the spring and summer months in Monterey Bay, as demonstrated by the data shown in **Table 5.1-3**.

Marine Water Quality

As described in **Table 5.1-2**, the beneficial uses of the Pacific Ocean and coastal waters in and near the project area include recreation, navigation, fishing, and preservation and enhancement of habitat for rare, threatened, or endangered species. The information provided in this table for the "Pacific Ocean" addresses the geographic range between Point Año Nuevo on the north and Soquel Point on the south, which includes the northern tip of Monterey Bay, near the project area. This portion of the Pacific Ocean is included on the CWA Section 303(d) list for being impaired with dieldrin.

Dieldrin is an insecticide that was widely used from 1950 to 1974 to control insects in agricultural crops, but has been banned in the United States since 1985 (USEPA, 2012). Dieldrin is a persistent organic compound that attaches to organic matter, sediments, and other particulates. Because of this, it bioconcentrates and biomagnifies through terrestrial and aquatic food chains. Resident mussels in this area have been found to contain levels of dieldrin that are higher than the Office of Environmental Health Hazard Assessment (OEHHA) screening value for the protection of human health from the consumption of fish and shellfish. Its concentration in water is typically very low (SWRCB, 2012a).

Monitoring for physical, inorganic, organic, and microbial constituents was conducted from February 2008 to February 2010 to characterize existing (or source) water quality, as part of the Pilot Test Program Report (**Appendix D**) and Watershed Sanitary Survey (**Appendix E**). Samples were collected at multiple depths near the abandoned WWTF outfall about 2,000 feet off West Cliff Drive; near the pilot plant location approximately 15 feet offshore from UCSC's Long Marine Laboratory; and near the end of Santa Cruz Municipal Wharf (**Figure 5.1-4, Water Quality Sampling Locations**).

Water quality data collected from these locations are representative of the source water quality from the various alternative intake locations that could provide sea water to the proposed desalination plant. Additionally, dilution of stormwater runoff from San Lorenzo River and Soquel Creek, the main sources for transporting urban runoff to the nearshore ocean environment, was also modeled.

The Watershed Sanitary Survey found Monterey Bay to be a high-quality source of water, with most inorganic and organic contaminants at concentrations below primary and secondary drinking water standards. The exceptions are turbidity and fecal indicator bacteria, which were slightly elevated during storm events, one (of fourteen) perchlorate sample, gross beta particle radioactivity (naturally occurring in seawater), and salts and sulfate, all of which would be removed by the desalination process. Summary data from the monitoring program are presented in **Appendix Q, Water Quality Data.** These source water data are incorporated in the marine water quality analysis contained in **Section 5.1.4, Impacts and Mitigation Measures**. For the full list of monitored constituents, see the Watershed Sanitary Survey (**Appendix E**).

The Watershed Sanitary Survey identifies bacteria as the primary constituent of concern in stormwater runoff. The hydrodynamic modeling conducted in the Watershed Sanitary Survey predicts that stormwater runoff does not significantly affect marine water quality at or near the proposed intake location. The study predicted stormwater dilution factors at the depth of the proposed intake to be 1,050 to 1 under maximum runoff conditions, and with ocean conditions most likely to transport discharges from the San Lorenzo River and Soquel Creek toward the proposed intake. Other modeling runs predicted a dilution factor in excess of 3,000 to 1. Monitoring conducted at the proposed intake location showed that fecal indicator bacteria at the proposed intake were only slightly elevated.

The Watershed Sanitary Survey also included an evaluation of algal blooms and toxicity. Algal blooms occur frequently in the northeastern area of Monterey Bay near Santa Cruz. Most algal toxins are present in the cells of algae, rather than dissolved in the water.

Additional sampling of marine waters in the project vicinity is conducted by the Central Coast Long-term Environmental Assessment Network (CCLEAN) Regional Monitoring Program. Marine stations in the project vicinity monitored through the CCLEAN program include two ambient sites in Monterey Bay, and seven 30-foot-depth contour stations down-current (west) of the WWTF outfall. The ambient sites are monitored twice per year for organic pollutants, perfluorinated compounds, nutrients, bacteria, and general physical parameters. The 30-foot contour stations are monitored monthly for total and fecal coliform and *Enterococcus*. The network also includes WWTF effluent from Santa Cruz, Watsonville, Monterey, Carmel, and associated receiving-water stations.

The 2009-2010 CCLEAN Annual Report (CCLEAN, 2011) indicated that estimated loads of most persistent organic pollutants are much greater from rivers than from wastewater. There have been no bacterial impairments to the water contact recreation beneficial use associated with discharges from any of the CCLEAN WWTFs. There was only one sample at the far field receiving water monitoring station adjacent to the Santa Cruz WWTF discharge that exceeded the Ocean Plan *Enterococcus* single-sample objective for water contact recreation, and this is not considered an impairment of the beneficial use.

Regional Tsunami Inundation

Information about tsunami inundation was provided in the City's General Plan 2030 Final EIR and in Appendix F of that EIR (City, 2012a). Information from these documents is summarized below. Tsunamis are ocean waves generated when uplift or down-dropping movement occurs over a broad area of the ocean floor. Ocean floor displacement may occur due to movement on submarine faults during large earthquakes, submarine landslides, or violent volcanic eruptions.

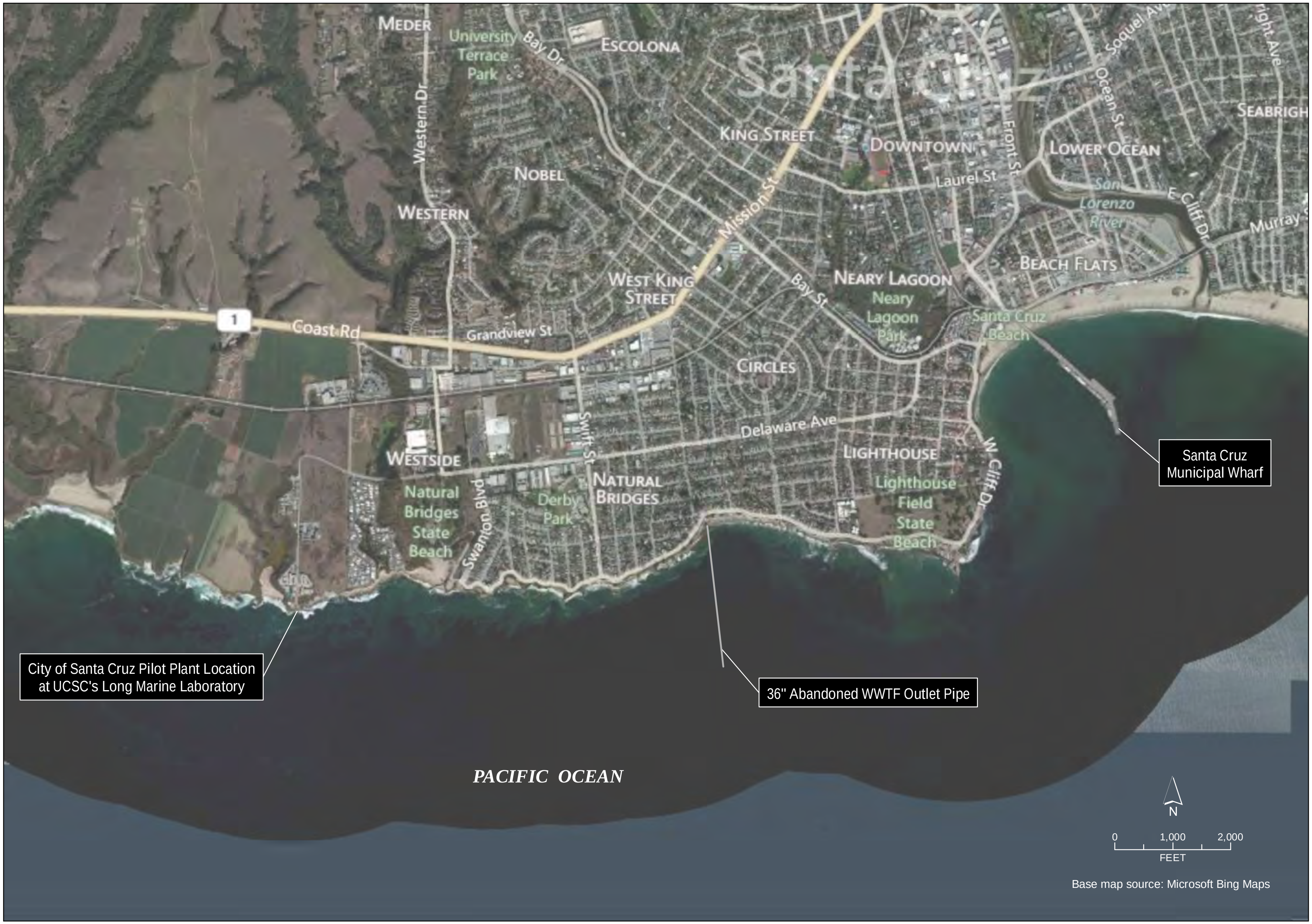

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Figure 5.1-4
Water Quality Sampling Locations

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California is at risk from both local and distant-source tsunamis, and tsunamis are a potential hazard to the City. There has been minimal damage and loss of life in Santa Cruz during recorded history. However, a tsunami generated by a 9.0 magnitude earthquake in Japan in March 2011 reached Santa Cruz and caused substantial damage to the Santa Cruz Small Craft Harbor.

Tsunamis can be generated locally, by movement on an offshore fault or by landsliding along the banks of the Monterey submarine canyon. The San Gregorio fault and Monterey Bay fault zone are both considered active, and capable of large earthquakes. However, these faults are not likely to produce large vertical offsets of the sea floor, and therefore are probably not likely to generate significant tsunamis. Submarine landslides in the Monterey submarine canyon, however, are a more likely local source of tsunamis. Many large landslides have been mapped along the flanks of the canyon. A model of a landslide-generated tsunami in Monterey Bay predicted about 23 feet of runup along the Monterey Bay coastline. A particular hazard with a locally generated tsunami is that there is little warning time before the wave impacts the shoreline; a landslide-generated tsunami in Monterey Bay could strike the coastline in as little as 10 minutes from the time it was generated.

Figure 5.1-5, Tsunami Inundation Area, shows the regional tsunami inundation zone, as obtained from the Santa Cruz Quadrangle of the Tsunami Inundation Map for Emergency Planning (California Emergency Management Agency et al, 2009). The largest area of inland inundation is in downtown Santa Cruz, as a result of backwater in San Lorenzo River, Neary Lagoon, and Woods Lagoon. The map is based on very conservative assumptions, and suggests that several of the pump station locations, even those on the coastal bluffs, might be inundated during an extreme event.

Sea-Level Rise

The Sea-Level Rise Task Force of the Coastal and Ocean Working Group of the California Climate Action Team (CO-CAT) has developed interim guidelines for sea-level rise (CO-CAT, 2010). According to the guidelines, 16 inches in sea-level rise (above year 2000 levels) should be planned for by the year 2050, and up to 55 inches by the year 2100. This approach is consistent with the California Ocean Protection Council's (COPC) resolution on sea-level rise (COPC, 2011).

Regional Wastewater Treatment and Disposal Characteristics

The City of Santa Cruz operates a regional WWTF that provides service to approximately 130,000 people in the cities of Santa Cruz and Capitola, and portions of unincorporated Santa Cruz County. The service areas beyond the City of Santa Cruz include: (1) the Santa Cruz County Sanitation District, which includes the Live Oak, Capitola, Soquel, and Aptos areas; and (2) Community Service Areas 10 and 57, which include a portion of the Graham Hill Road corridor. Municipal wastewater generated within the City limits is delivered to the WWTF via 160 miles of wastewater mains and 21 pumping stations (City, 2011a). Additionally, the Santa

Cruz County Sanitation District collects wastewater through a system of approximately 200 miles of wastewater mains and 34 pumping stations for treatment at the City's WWTF (City, 2011a).

The WWTF is next to Neary Lagoon, just inland from the City's Main Beach. The WWTF is designed to provide secondary treatment and to treat an average dry-weather flow of 17 million gallons per day (mgd), and a peak wet-weather flow of 81 mgd. Treated effluent is discharged to the Pacific Ocean via a 10,000+ foot outfall/diffuser system that terminates approximately 1 mile offshore at a depth of 110 feet. Santa Cruz operates the WWTF under a current National Pollutant Discharge Elimination System (NPDES) permit, renewed in 2010 by the RWQCB (Order No. R3-2010-0043, NPDES No. CA 0048194). See **Section 5.1.3** for a description of the RWQCB permit process; and Santa Cruz's NPDES permit conditions, which are summarized below to characterize the existing effluent discharge water quality.

WWTF Flows

Currently, the average daily dry weather flow at the Santa Cruz WWTF is about 9.9 mgd, with a peak wet-weather flow on the order of 65.0 mgd. The minimum daily flow between 2006 and 2010 averaged 8.7 mgd. Of the total average daily flow, the City contributes approximately 5.3 mgd, and the Santa Cruz County Sanitation District contributes about 4.5 mgd (City, 2011a). Approximately 0.15 to 0.2 mgd of treated water is retained for various uses at the treatment plant.

In addition to sewered wastewater collection from the City and County areas, the City of Scotts Valley discharges approximately 1.0 mgd of treated municipal wastewater through the City of Santa Cruz's ocean outfall. Scotts Valley treats its wastewater separately at its own treatment facility under a separate NPDES permit (CA 0048828, Order No. 97-12), but makes joint use of the Santa Cruz ocean outfall facility. The Santa Cruz WWTF also has a dedicated septage-receiving facility that receives approximately 7.0 million gallons of septage per year (or approximately 19 thousand gallons per day) from septic systems in the unsewered areas of Santa Cruz County. Average daily discharge from the outfall from all sources combined is about 11.5 to 12.5 mgd during the dry season (City, 2011a).

Treated Wastewater Effluent Characteristics and Quality

Water quality requirements for the City's effluent discharge are established in the City's NPDES permit (Order No. R3-2010-0043). Recent (2005-2010) effluent quality data monitored at the WWTF indicate that the City's effluent complies with NPDES permit concentration limitations (See **Appendix Q**). The WWTF monitoring data are incorporated in the marine water quality analysis contained in **Section 5.1.4, Impacts and Mitigation Measures** (see **Table 5.1-10)**

URS City of Santa Cruz and Soquel Creek Water District
scwd² Regional Seawater Desalination Project

Figure 5.1-5
Tsunami Inundation Area

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The treated wastewater is discharged into the Pacific Ocean through the existing outfall/diffuser system. According to the City's NPDES permit, the diffuser provides a minimum initial dilution of 139:1 (parts seawater to effluent) so that effluent leaving the diffuser system effectively mixes with ocean water. Water-quality–based effluent limitations established in the NPDES permit are based on this ratio. The temperature of the existing effluent, estimated to range from 63.7ºF (17.6ºC) in winter to 78.1ºF (25.5ºC) in summer, is warmer than the ambient seawater, which ranges from 47.3ºF (8.4ºC) to 61.4ºF (16.2ºC).

Any discharge into the ocean would rise towards the surface, sink towards the bottom, or stay at the same level, depending upon the density difference between the effluent and the ambient water. Discharges where the effluent is less dense than the ambient water are considered positively buoyant and would rise once discharged. Discharges where the effluent is denser than the ambient water are considered negatively buoyant and would sink once discharged. Discharges where the effluent has the same density as the ambient water are neutrally buoyant and would neither sink nor rise. Under existing conditions, the WWTF plant effluent is made up of freshwater so it is less dense than ocean water, and will always rise to the surface. Specifically, the salinity of wastewater effluent is about 0.5 part per thousand (ppt), compared to seawater, which ranges between about 32 to over 34 ppt. The temperature and salinity differences between the effluent and seawater contribute to the mixing and dilution of the effluent, as the warmer, less-dense effluent rises through the colder, denser ocean water.

Drinking Water Quality

City customers receive water from four locales: the North Coast sources, the San Lorenzo River, Loch Lomond Reservoir, and the Live Oak Wells (City, 2011a). District customers receive water from 15 operating wells pumping from two underground aquifers, the Purisima and the Aromas, as previously described (District, 2011a). In accordance with federal and state requirements, the City and the District regularly monitor their domestic water supply. Water quality test results are compiled in an annual report and distributed to the public. The 2010 Consumer Confidence Reports for both the City and the District indicate that both water supplies are of high quality, and met all regulatory drinking water standards (see **Appendix Q**). Drinking water standards are described further in **Section 5.1.3**.

Project Area Setting

This section describes the surface water hydrology and water quality in and around the project area, and refers to the various sites and alignments where the project components would be located. See **Section 4, Project Description** for a full description of the proposed project. The various components of the project are also shown on the figures provided in this section.

Seawater Intake and Brine Conveyance Sites

The alignment of the raw water transfer pipelines and brine discharge pipeline along Delaware Avenue would cross over the culverted alignment of Arroyo Seco (see **Figure 5.1-1**). The brine pipeline and raw-water transfer pipeline alignments could cross over the culverted alignment of Bethany Creek along Delaware Avenue, depending on the discharge point and intake site selected. For intake sites near the Municipal Wharf (SI- 9 and SI-17), the raw-water transfer pipeline alignment would continue westward, approaching the southern end of Neary Lagoon at Bay Street, but would not cross Neary Lagoon. For SI-18, the raw water transfer pipeline would cross under the Neary Lagoon storm drain that directs excess stormwater flows to Cowells Beach.

The outlet of Bethany Creek is next to the intersection of Woodrow Avenue and West Cliff Drive, immediately adjacent to the intake pump station site for SI-4. The intake pump station site for SI-18 is just southeast of Neary Lagoon. A short segment of the lagoon outlet channel is along the southern edge of SI-18.

As shown on **Figure 5.1-2**, the intake pump station site associated with SI-17 at the end of the Municipal Wharf, is in an area designated as a VE zone. A VE zone is defined as an area subject to a 1 percent annual chance of flooding, with the additional risk of being exposed to wave action.

The intake pump station site associated with SI-18 is on property owned by the Santa Cruz County Regional Transportation Commission, and leased by the City just southeast of Neary Lagoon, and is within an A99 zone. As stated, an A99 zone is an area to be protected from 1 percent annual chance of flood by a federal flood protection system under construction; no base flood elevations determined. The A99 zone does not require that the project be elevated above the 100-year base flood elevation or any other special flood protection requirements, as indicated previously.

As shown on **Figure 5.1-5**, the intake pump station locations associated with SI-4, SI-5, SI-9, SI-17, and SI-18 are in the tsunami inundation area; whereas SI-14 and SI-16 are setback from the coast and are not in the tsunami inundation area, and SI-7 is just outside of this area. The intake pump station for SI-17, located offshore, adjacent to the existing Municipal Wharf, would be designed to account for wave heights, storm surge, water levels, scouring and erosion, maximum and minimum tides, and currents associated with a 100-year storm event and factoring in anticipated water levels due to sea level rise and global warming over the life of the structure. None of the other intake pump station locations would be exposed to sea-level rise over the 75-year life of the project, based on the CO-CAT interim guidelines for sea-level rise.

Desalination Plant Sites

Plant Site A-1

Natural Bridges Creek is approximately 1,200 feet south of Plant Site A-1, and Arroyo Seco is approximately the same distance east of this site. As shown on **Figure 5.1-6, Storm Drain System**, stormwater intake drains are south of Area A, where Natural Bridges Drive intersects with Delaware Avenue.

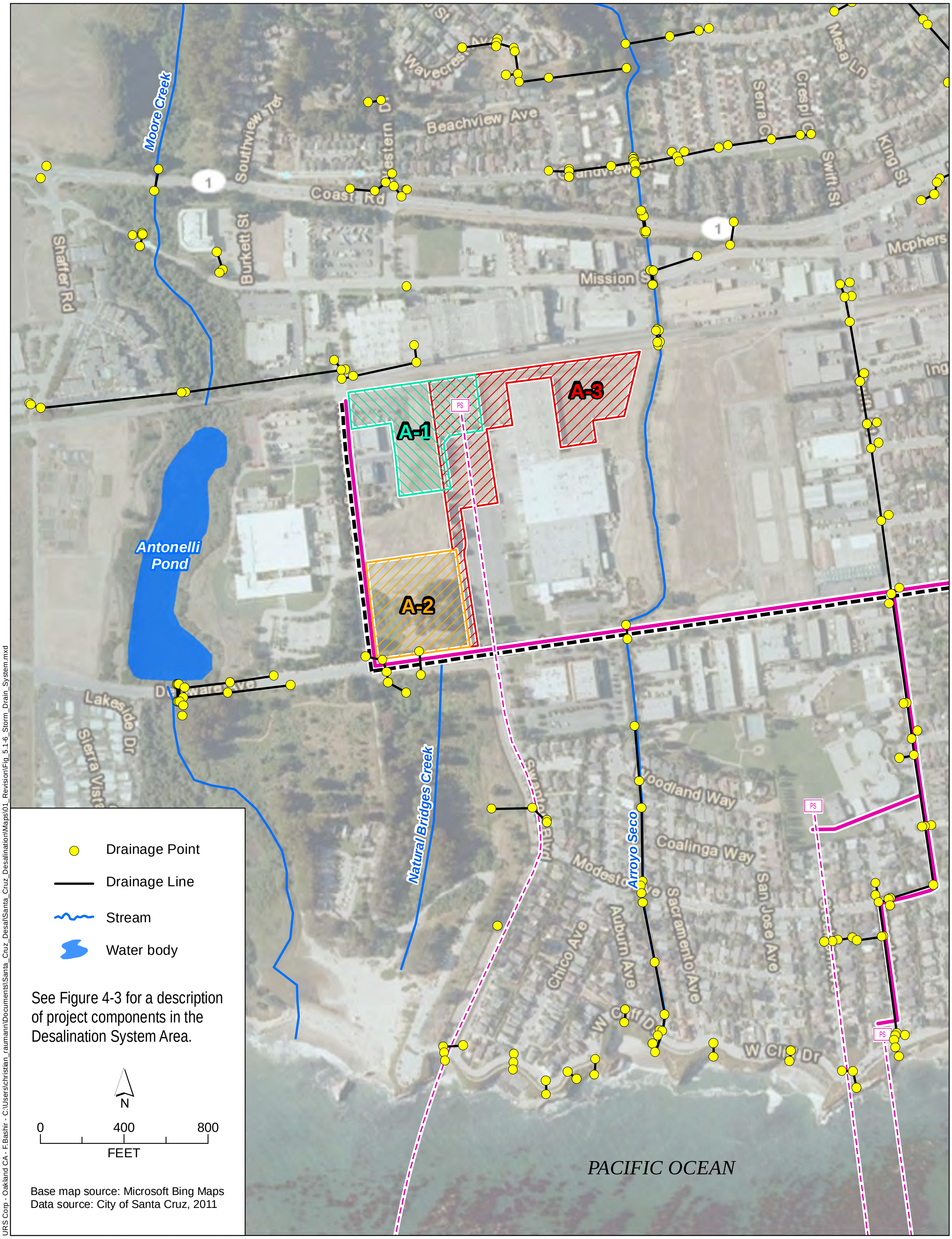

Figure 5.1-6
Storm Drain System

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These drains connect to Natural Bridges Creek at Natural Bridges State Beach. Due to the topography of Plant Site A-1, runoff is expected to flow south overland and enter these intake drains. Natural Bridges Creek originates south of Plant Site A-1 at Delaware Avenue, and flows south to Monterey Bay. Additionally, Plant Site A-1 is not in a groundwater recharge area as shown on **Figure 5.1-3,** or in a water supply watershed, as mapped by the County of Santa Cruz (Santa Cruz LAFCO, 2005).

Plant Site A-1 does not lie within the 100-year floodplain as identified by FEMA. The site is in an area determined to be outside of the 0.2 percent annual-chance floodplain (Zone X), according to Flood Insurance Rate Map for Santa Cruz County, California (Map Number 06087C0333D, effective date March 2, 2006). **Figure 5.1-2**, shows the floodplain information for the project area.

Although the coastal portion of the City is in a tsunami inundation zone, Plant Site A-1 is not in this zone. As shown on **Figure 5.1-5**, the tsunami run-up in the project vicinity extends inland from the coast at Natural Bridges State Beach into Antonelli Pond, but does not inundate across Natural Bridges Drive, which separates the Pond and the proposed location of the plant site. Additionally, this location would not be exposed to sea-level rise over the 75-year life of the project, based on the CO-CAT interim guidelines for sea-level rise (COPC, 2010) described under Regional Setting.

Plant Site A-2

Natural Bridges Creek is approximately 100 feet south of Plant Site A-2, and Arroyo Seco is approximately 1,000 feet east of Plant Site A-2. As shown on **Figure 5.1-6,** stormwater intake drains are at the southwestern end of Area A, where Natural Bridges Drive intersects with Delaware Avenue. These drains connect to Natural Bridges Creek at Natural Bridges State Beach. Due to the topography of Plant Site A-2, runoff is expected to enter these intake drains. Natural Bridges Creek originates immediately south of Plant Site A-2 and Delaware Avenue, and flows south to Monterey Bay.

Like Plant Site A-1, Plant Site A-2 is not in a groundwater recharge area, as shown on **Figure 5.1-3**; or in a water supply watershed, as mapped by the County of Santa Cruz. Plant Site A-2 is also not in the FEMA 100-year floodplain or in the tsunami inundation area (see **Figures 5.1-2 and 5.1-5**). This location also would not be exposed to sea-level rise over the 75-year life of the project, based on the CO-CAT interim guidelines for sea-level rise.

Plant Site A-3

Natural Bridges Creek is approximately 1,200 feet southwest of Plant Site A-3, and Arroyo Seco is approximately 100 feet east of this site. Two stormwater intake drains are on Plant Site A-3 that serve the existing Harmony Foods building and grounds. Due to the topography of the site, it is expected that these intake drains flow towards the southwestern corner of Area A and into Natural Bridges Creek at Natural Bridges State Beach.

Like Plant Sites A-1 and A-2, Plant Site A-3 is not in a groundwater recharge area, as shown on **Figure 5.1-3**, or in a water supply watershed, as mapped by the County of Santa Cruz. Plant Site A-3 is also not in the FEMA 100-year floodplain or in the tsunami inundation area (see **Figure 5.1-2** and **Figure 5.1-5**). This location also would not be exposed to sea-level rise over the 75-year life of the project, based on the CO-CAT interim guidelines for sea-level rise.

Potable Water Distribution System

The alignment for the proposed intertie pipeline system to connect the City and the District water supply systems would cross three streams, including Arana Creek, Rodeo Gulch, and Soquel Creek. The two transmission main alignment design options from the Morrissey pump station to the DeLaveaga water tanks would require crossing culverted reaches of the Arana Creek system. The transmission main alignment from the DeLaveaga water tanks to the intertie location would cross Arana Creek at the Brookwood Drive crossing and Rodeo Gulch on the existing Soquel Drive Bridge. The transmission main alignment from the intertie location to the McGregor pump station upgrade site would cross Soquel Creek at the existing bridges at Porter Street and Main Street in Soquel. The transmission main alignment would continue along Soquel Drive, which crosses Nobel Gulch. The McGregor Drive pump station upgrade site is within 500 feet north of and drains to Porter Gulch.

As shown on **Figures 5.1-2 and 5.1-5**, none of the sites for the surface components (e.g., pump stations) of the intertie system are in flood zones or tsunami inundation areas. The intertie pipeline corridor does cross the AE[5] flood zones associated with Arana Creek, Rodeo Gulch and Soquel Creek. Additionally, these locations would not be exposed to sea-level rise over the 75-year life of the project, based on the CO-CAT interim guidelines for sea-level rise.

Potential Energy Projects

The site for the potential solar photovoltaic (PV) panels would be at the desalination plant, which is described above. The site for the potential micro-hydro system would be the basement of the Graham Hill Water Treatment Plant (GHWTP). Given that the micro-hydro system would involve only interior improvements within an existing building and no ground-disturbing activities, hydrological resources and water quality conditions at and near the GHWTP are not described herein.

5 Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are determined for this flood zone (FEMA, 2013).

5.1.3 Regulatory Framework

The proposed project would be subject to applicable regulations pertaining to marine and surface water quality, drinking water quality, and flooding. Regulations pertaining to hydrology and water quality in the project area that are relevant to the analysis of project impacts are detailed below. See also **Section 5.4, Land Use, Planning, and Recreation** for evaluation of potential conflicts with relevant land use plans, policies, and regulations of agencies that have jurisdiction over the proposed project. For example, the California Coastal Act and the National Marine Sanctuaries Act, along with relevant local general plans, are addressed in **Section 5.4**.

Marine and Surface Water Quality

Ocean Plan

The State Water Resources Control Board (SWRCB) adopted the *Water Quality Control Plan for Ocean Waters of California* (Ocean Plan) in 1972 to provide control for the discharge of waste to ocean waters, and ensure the protection of beneficial uses of ocean waters. The plan was last amended in 2009 (SWRCB, 2009a). **Table 5.1-4, Ocean Plan Water Quality Objectives for Protection of Marine Aquatic Life**, shows numerical water quality objectives established in the Ocean Plan for protection of marine aquatic life.

The plan also establishes water quality objectives for 20 non-carcinogenic and 42 carcinogenic constituents for the protection of human health. In addition, the plan sets forth objectives for bacterial, physical, chemical, and biological characteristics for ocean waters. Compliance is determined from samples collected in the waste field where initial dilution is completed. In cases where there is conflict between limitations set forth in the Ocean Plan and those set forth in other federal or state legislation, the more stringent limitations apply. Ocean Plan narrative objectives relevant to the proposed project include:

- Natural light shall not be significantly reduced at any point outside the zone of initial dilution[6] as the result of the discharge of waste.
- Waste discharged to the ocean must be essentially free of substances that would accumulate to toxic levels in marine waters, sediments, or biota.

[6] The "zone of initial dilution" is the area around the diffuser where initial dilution occurs. Initial dilution is defined in the Santa Cruz Waste Water Treatment Plant NPDES permit as the process that results in the rapid and irreversible turbulent mixing of wastewater with ocean water around the point of discharge. For a submerged buoyant discharge the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting wastewater ceases to rise (or fall) in the water column and first begins to spread horizontally. For non-buoyant discharges, turbulent mixing results primarily from the momentum of discharge. Initial dilution, in these cases, is considered to be completed when the momentum-induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge.

- The pH shall not be changed at any time more than 0.2 unit from that which occurs naturally.
- The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed to the point that benthic communities are degraded.

Table 5.1-4. Ocean Plan Water Quality Objectives for Protection of Marine Aquatic Life

Constituent	Unit	Limiting Concentrations		
		6-Month Median	Daily Maximum	Instantaneous Maximum
Arsenic	µg/L	8	32	80
Cadmium	µg/L	1	4	10
Hexavalent Chromium	µg/L	2	8	20
Copper	µg/L	3	12	30
Lead	µg/L	2	8	20
Mercury	µg/L	0.04	0.16	0.4
Nickel	µg/L	5	20	50
Selenium	µg/L	15	60	150
Silver	µg/L	0.7	2.8	7
Zinc	µg/L	20	80	200
Cyanide	µg/L	1	4	10
Total Chlorine Residual	µg/L	2	8	60
Ammonia (as N)	µg/L	600	2400	6000
Acute Toxicity	TUa	N/A	0.3	N/A
Chronic Toxicity	TUc	N/A	1	N/A
Phenolic Compounds (Nonchlorinated)	µg/L	30	120	300
Chlorinated Phenolics	µg/L	1	4	10
Endosulfan	µg/L	0.009	0.018	0.027
Endrin	µg/L	0.002	0.004	0.006
Hexacyclohexane	µg/L	0.004	0.008	0.0012

Source: SWRCB, 2009a. Water Quality Control Plan for Ocean Waters of California (Ocean Plan).
Acronyms:
µg/L = micrograms per liter
N/A = not applicable
N = nitrogen
TUa = toxicity unit acute
TUc = toxicity unit chronic

The SWRCB is developing an amendment to the Ocean Plan that would address issues associated with desalination facilities and the disposal of brine discharges (SWRCB, 2011b). Currently, the RWQCBs regulate brine discharges from these types of facilities through the issuance of NPDES permits that contain conditions protective of aquatic life. However, the Ocean Plan does not yet have an objective for elevated salinity levels in the ocean, nor does it describe how brine discharges are to be regulated and controlled.

Water quality issues for seawater desalinations discharges are currently regulated by the individual RWQCBs that have permitting authority over the projects. The amendment is envisioned to have the following components: (1) a "narrative" objective for salinity; (2) provisions to minimize impacts to marine life from desalination plant intakes; and (3) implementation provisions. The SWRCB anticipates that the Ocean Plan amendment will be completed by late 2013.

Thermal Plan

The *Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California* (Thermal Plan), adopted by the SWRCB in 1972 and amended in 1975, establishes water quality objectives for existing and new discharges in California coastal waters, interstate waters, enclosed bays, and estuaries (SWRCB, 1975). Elevated temperature wastes are required to comply with limitations necessary to assure protection of the beneficial uses. The existing NPDES permit for the City's WWTF meets the Thermal Plan standards.

Basin Plan

The Porter-Cologne Water Quality Control Act (Division 7 of the California Water Code) authorizes the SWRCB to provide comprehensive protection for California's waters through water allocation and water quality protection. The SWRCB implements the requirements of CWA Section 303 that water quality standards be set for certain waters by adopting water quality control plans, or basin plans, under the Porter-Cologne Act.

Basin plans serve as the legal, technical, and programmatic basis of water quality regulation for a region. In addition, the Porter-Cologne Act established the responsibilities and authorities of the nine RWQCBs, which include preparing basin plans, identifying water quality objectives, and issuing NPDES permits and Waste Discharge Requirements (WDRs) (see further discussion below). Water quality objectives are defined as limits or levels of water quality constituents and characteristics established for reasonable protection of beneficial uses or prevention of nuisance.

- The project area lies in the Central Coast Hydrologic Region. The RWQCB's *Water Quality Control Plan* (Basin Plan), last updated in 2011, identifies the existing and potential beneficial uses of surface and groundwater in the region, as well as WQOs and implementation measures throughout the basin (RWQCB, 2011). The Basin Plan includes WQOs for inland surface waters, enclosed bays, and estuaries, which differ depending on the identified beneficial use of the water body. **Tables 5.1-5a** and **5.1-5b** list WQOs that apply to freshwater and marine inland surface waters, enclosed bays, and estuaries potentially affected by the proposed project. See **Table 5.1-2** for a list of the beneficial uses identified for each of the water bodies in the project area.

- The Basin Plan defers to the Ocean and Thermal Plans (see **Table 5.1-4**) for the Pacific Ocean (including Monterey Bay) WQOs (see below), with the exception of dissolved oxygen and pH, in which case the WQOs in **Tables 5.1-5a, Basin Plan General Water Quality Objectives** and **5.1-5b, Basin Plan General Water Quality Objectives for Aquatic Life** apply.

Table 5.1-5a. Basin Plan General Water Quality Objectives

Constituent	Unit	Water Quality Objectives
Color	units	15
pH[1]	--	6.5 - 8.3
Dissolved Oxygen	mg/L	5.0
Unionized ammonia (NH_3)	mg/L	0.025
Methylene Blue Activated Substances	mg/L	0.2
Phenols	mg/L	0.1
Polychlorinated biphenyls	µg/L	0.3
Phthalate Esters	µg/L	0.002
Phenol	µg/L	1
Fecal Coliform[2]	MPN/100 ml, mean	200 (2000)
	MPN/100 ml, max	400 (2000)

Source: RWQCB, 2011. Water Quality Control Plan for the Central Coast Region (Basin Plan).
Notes:
1. For waters with the beneficial use of non-contact or water-contact recreation. For waters without beneficial uses specified, the pH objective is 7.0 - 8.5.
2. The first objective applies to areas with water-contact recreation, and the second objective applies to areas with non-contact recreation.
Acronyms:
mg/L = milligrams per liter
ml = milliliters
MPN = most probable number
µg/L = micrograms per liter

Table 5.1-5b. Basin Plan Water Quality Objectives for Aquatic Life

Constituent	Unit	Water Quality Objectives				
		Cold Freshwater Habitat (COLD)	Warm Freshwater Habitat (WARM)	Marine Habitat (MAR)	Fish Spawning (SPWN)	Shellfish Harvesting (SHELL)
Temperature	°F	increase of 5	increase of 5	--	--	--
pH	--	7.0 - 8.5	7.0 - 8.5	7.0 - 8.5	--	--
Dissolved Oxygen	mg/L	7.0	5.0	7.0	7.0	--
Cadmium[1]	µg/L	4 (30)	4 (30)	0.2	0.4 (3)	--
Chromium	µg/L	50	50	50	--	10
Copper[1]	µg/L	10 (30)	10 (30)	10	--	--
Lead	µg/L	30	30	10	--	--
Mercury[2]	µg/L	0.2	0.2	0.1	--	--
Nickel[1]	µg/L	100 (400)	100 (400)	2	--	--
Zinc[1,3]	µg/L	4 (200)	4 (200)	20	--	--

Source: RWQCB, 2011. Water Quality Control Plan for the Central Coast Region (Basin Plan).
Notes:
1. For Inland Surface Waters, Enclosed Bays, and Estuaries. Where a second value is shown in parentheses, the first objective applies in soft water (< 100 mg/l calcium carbonate [$CaCO_3$]); the second objective in parentheses applies in hard water (> 100 mg/l $CaCO_3$).
2. Total mercury values should not exceed 0.05 micrograms per liter (µg/l) as an average value.
3. Nickel objectives pertain to nickel salts (not pure metallic nickel).
Acronyms:
°F = degrees Fahrenheit
mg/L = milligrams per liter
µg/L = micrograms per liter

Clean Water Act and NPDES Permits

The CWA is the primary surface water protection legislation in the nation. The CWA employs a variety of regulatory and non-regulatory tools to restore and maintain the chemical, physical, and biological integrity of surface waters. Tools include establishing water quality standards, issuing permits, monitoring discharges, and managing polluted runoff.

The proposed project is subject to regulations governing discharge from point sources and “wet weather point sources,” such as urban storm sewer systems and construction sites, as defined in Sections 1311–1330 of the CWA. The proposed project would be subject to a number of permits, including a NPDES WWTF Discharge Permit or amendment to the City’s existing NPDES permit, a permit issued under the City’s Phase II Small Municipal Separate Storm Sewer Systems (MS4) NPDES General Permit, a NPDES Construction General Permit, and a Section 401/404 permit. These are described in further detail below.

CWA Section 402

Section 402 of the CWA states that discharge of pollutants to waters of the U.S. is unlawful unless the discharge is in compliance with the NPDES program. A number of different NPDES permits would apply to the proposed project, as described below.

WWTF Discharge Permit. The discharge of brine through the existing City of Santa Cruz wastewater outfall would require a modification of the existing NPDES permit for the wastewater outfall. The discharge would be required to comply with limitations in the Ocean Plan (**Table 5.1-4**) beyond the zone of initial dilution.

Discharges from the City of Santa Cruz WWTF are regulated by the *NPDES Waste Discharge Requirements for the City of Santa Cruz Wastewater Treatment Plant* (WWTF Discharge Permit) (Order No. R3-2010-43, NPDES No. CA 0048194), issued by the Central Coast RWQCB (RWQCB, 2010). The permit mandates a removal efficiency for total organic carbon, 5-day biochemical oxygen demand, and total suspended solids (TSS) of not less than 85 percent, and sets effluent limitations for metals, chlorine residual, ammonia, toxicity, phenolic compounds, and other constituents for the protection of marine aquatic life. Eighteen non-carcinogenic and 42 carcinogenic chemicals are also regulated for protection of human health. Effluent limitations apply to discharges measured in the outfall pipe prior to mixing with ambient water.

The constituents listed with effluent limitations in the permit are consistent with Ocean Plan water quality objectives recognizing the initial dilution of treated effluent at the point of discharge of 139:1 (seawater to effluent). Effluent limitations are typically a factor of 139 above the Ocean Plan water quality objectives. WWTF effluent limitations are included in **Appendix Q**.

In addition, the permit states that effluent shall be essentially free of materials and substances that:

- Float or become floatable upon discharge;
- Form sediments that degrade benthic communities or other aquatic life;
- Accumulate to toxic levels in marine waters, sediment, or biota;
- Decrease the natural light to benthic communities and other marine life; and
- Result in aesthetically undesirable discoloration of the ocean surface.

The NPDES permit also sets receiving water limitations such that the discharge shall not cause certain water quality objectives to be violated upon completion of initial dilution. The receiving water limitations address physical and chemical characteristics of the receiving water, including temperature, dissolved oxygen, pH, nutrients, organic material, and dissolved sulfide, as well as biological characteristics, including prohibitions on "degradation" to vertebrate, invertebrate, and plant communities, alteration of the natural taste, odor, and color of marine resources used for human consumption, and the bioaccumulation to toxic levels of organic material in marine resources used for human consumption.

Under the findings of the permit, the outfall diffuser configuration is documented as achieving a minimum initial dilution of 139:1 (parts seawater to effluent) such that effluent leaving the diffuser system effectively mixes with ocean water.

A detailed monitoring and reporting program is required under the NPDES permit to analyze short-term and long-term effects of the discharge on receiving waters, sediments, biota, and beneficial uses of the receiving water, and to assess compliance with the NPDES permit and the Ocean Plan. The NPDES permit also requires that notification be made of any new industrial users that discharge to the wastewater treatment facilities or the outfall.

Phase II Small MS4 General Permit. Municipalities with urbanized areas and municipalities with a population size greater than 10,000 people, and density greater than 1,000 persons per square mile are subject to the *NPDES Waste Discharge Requirements for Storm Water Discharges from Municipal Separate Storm Sewer Systems* (MS4 General Permit) (Order No. 2003-0005-DWQ, NPDES No. CAS000004) (SWRCB, 2003). To obtain coverage under the MS4 General Permit from the SWRCB, a municipality must develop a Storm Water Management Program (SWMP) that would achieve the following goals:

- Develop and implement an SWMP that describes Best Management Practices (BMPs), measurable goals, and timetables for implementation of six required programs covering public education and participation, illicit discharge detection and elimination, construction and post-construction stormwater management, and pollution prevention for municipal operations.
- Reduce its discharge of pollutants to the Maximum Extent Practicable.
- Annually report on the progress of SWMP implementation.

The County and Capitola have developed a joint SWMP and are covered under MS4 General Permit (County and Capitola, 2010). The City has also developed a SWMP and is covered under the MS4 General Permit (City, 2010b). The existing MS4 General Permit is currently being renewed as the 2012 Draft Phase II Small MS4 General Permit, which is scheduled for adoption in early 2013 (SWRCB, 2013a).

The City of Santa Cruz SWMP is based on the requirements and guidelines of the MS4 General Permit, and is designed to reduce the discharge of pollutants in urban runoff to the maximum extent practicable and to protect water quality. In addition to the six required control programs referred to in the bullet list above, the City's SWMP also includes programs for industrial and commercial facilities. The programs include urban runoff control policies, outreach and education efforts, site visits, and the implementation of BMPs. Mandatory BMPs have been selected and developed by the City and are described in the City's BMP Manual, which is appended to the SWMP. The City's Stormwater and Urban Runoff Pollution Control regulations

(Municipal Code Chapter 16.19) require the implementation of the mandatory BMPs provided in the City's BMP Manual. BMPs that are relevant to the proposed project include the following requirements:

- Low-Impact Development (LID) design measures intended to mimic the pre-project site hydrology and protect water quality must be incorporated during the site planning and design process. LID methods disperse and infiltrate runoff from impervious surfaces through: (1) conservation of natural areas; (2) reduction of pavement and use of pervious pavements [impervious/pervious ratio should not exceed 2 to 1]; (3) detaining and retaining runoff; (4) use of vegetated buffers, depressed landscape areas, rain gardens, and bio-retention areas in the drainage design; and (5) directing runoff from roof downspouts and paved areas to landscape BMPs. A "Storm Water and LID Assessment" checklist must be submitted with the City Grading Permit application.
- Peak stormwater runoff discharge rates and sediment loading shall not exceed the estimated pre-development rate. Structural devices, such as sediment basins or swales, may be required to meet this goal.
- All structural or treatment control BMPs shall incorporate either a volumetric or flow-based treatment control design standard, or both, to mitigate stormwater runoff. This design standard is typically based on the 85th percentile 24-hour runoff event.
- Stormwater pollutants of concern (e.g., oil and grease, sediment, metals, pesticides) must be minimized to the fullest extent practicable through the implementation of LID features or treatment control BMPs.
- Commercial and industrial projects must implement additional requirements related to loading docks, repair/maintenance bays, vehicle/equipment wash areas, chemical/material/waste storage, leak and spill cleanup, pavement cleaning, employee training, and other requirements.
- Project construction activities where grading exceeds 50 cubic yards must obtain a Grading Permit from the City. The permit application must include an erosion control plan and construction BMPs. Projects equal to or larger than 1 acre must also comply with the Statewide Construction General Permit, described below.
- The City's existing stormwater regulations will be revised effective September 2013, as discussed in **Appendix M, Santa Cruz Seawater Desalination Facility, Technical Memorandum on New Storm Water Regulations for the Central Coast Regional of the Regional Water Quality Board** (New Storm Water Regulations Technical Memorandum). The new regulations will require that projects in this area with over 22,500 square feet of impervious surfacing infiltrate runoff from the 95th percentile 24-hour rainfall event on site, including peak flow management for 2-year and 10-year storm events. If onsite conditions limit the ability to fully infiltrate the runoff at this rate, projects will have to ensure treatment of the runoff from the 85th percentile 24-hour rainfall event.

Construction General Permit. Construction activities on 1 acre or more are subject to the permitting requirements of the *NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities* (Construction General Permit) (Order No. 2009-0009-DWQ, NPDES No. CAS000002) (SWRCB, 2009b). Given the area subject to construction activities, one or more stormwater pollution prevention plans (SWPPPs) would be required for the proposed project.

The SWRCB established the Construction General Permit program to regulate stormwater discharges from construction sites. The Construction General Permit implements a risk-based permitting approach, and specifies minimum BMP requirements, and stormwater monitoring, and reporting requirements based on a project's risk level. The Construction General Permit establishes three project risk levels that are based on site erosion and receiving-water risk factors. Risk Levels 1, 2, and 3 correspond to low-, medium-, and high-risk levels for a project. Risk Level 2 and Level 3 projects are subject to compliance with Numeric Action Levels for pH and turbidity. Exceedance of Numeric Action Levels will require mandatory follow-up, including additional BMPs and/or corrective action. Most projects are categorized as Risk Level 2.

The Construction General Permit requires preparation and implementation of an SWPPP, which would provide BMPs to minimize potential short-term increases in transport of sediment and other pollutants caused by construction. Typical BMPs include installing silt fences, fiber rolls, storm-drain inlet protection, or other measures to minimize soil erosion and sedimentation; limiting fueling and/or use of hazardous materials to designated areas; developing spill prevention and emergency response plans to handle potential fuel or other spills; limiting construction to certain times of the year; and implementing post-construction standards. Monitoring and reporting requirements are also described in the SWPPP.

CWA Section 401/404

Under Section 404 of the CWA, disposal of dredge and fill material into waters of the U.S. requires a permit. The permitting agency is the U.S. Army Corps of Engineers (USACE). Under Section 404(b)(1) Guidelines, an application must include an evaluation of the impacts on the affected resources. Construction of the seawater intake would require a Section 404 permit due to the likely need to dredge or move sediment on the ocean floor around the intake structure. Section 401 requires a water quality certification from the RWQCB for issuance of a 404 permit. Because the proposed project would require a Section 404 permit, it would also require 401 certification. Section 401/404 permitting may also be required for the Arana Creek crossing at Brookwood Drive.

Drinking Water Standards and Requirements

Under the federal Safe Drinking Water Act, the U.S. Environmental Protection Agency (USEPA) sets national standards for drinking water to protect public health. The California Department of Public Health (CDPH) enforces national drinking water standards within the State. California's Safe Drinking Water Act authorizes CDPH to promulgate regulations relating to drinking water quality and the operation of public water systems that are a part of Title 22 of the California Code of Regulations (CCR). The CDPH is responsible for ensuring that all public water systems are operated in compliance with drinking water regulations.

Current drinking water regulations include both primary and secondary standards, which are listed in Title 22 of the CCR. The primary standards define maximum contaminant levels (MCLs) and maximum residual disinfectant levels (MRDLs) that cannot be exceeded by any public water system. All standards except turbidity are applicable at the point of delivery. Compliance with primary MCLs and MRDLs is mandatory, because these standards are based on potential health effects on water users. For some regulations, treatment techniques were established in lieu of an MCL to control unacceptable levels of contaminants in drinking water. Secondary standards, or secondary MCLs, are parameters that may adversely affect the aesthetic quality of drinking water, such as taste and odor. Secondary MCLs are not federally enforceable, although CDPH reserves the right to enforce the standards as warranted. Water systems are required to monitor for primary and secondary MCLs and MRDLs, and notify their consumers when they have violated drinking water standards.

The drinking water standards that apply to the proposed project include those listed below. Primary and secondary MCLs are listed in **Table 5.1-13, Product Water Quality**, under the discussion of Impact 5.1-7 in **Section 5.1.4, Impacts and Mitigation**.

- Microbial contaminants, such as viruses, bacteria, and protozoa that may come from discharges of treated and untreated sewage from humans, livestock, and wildlife;
- Inorganic contaminants, such as metals and salts that can be naturally occurring, or result from urban stormwater runoff, industrial discharges, mining, or farming;
- Disinfection byproducts, such as total trihalomethanes (TTHM) and the five haloacetic acids (HAA5) that can form in water through disinfectants used to control microbial pathogens[7];
- Synthetic organic contaminants, such as pesticides and herbicides that may come from agriculture and urban stormwater runoff;
- Volatile organic chemical contaminants from industrial processes and petroleum production, gas stations, urban stormwater runoff, agriculture, and septic systems;
- Radioactive contaminants that may come from naturally occurring sources or be the result of oil and gas production and mining activities.

7 The U.S. EPA's Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBP Rule) is one part of the Microbial and Disinfection Byproducts Rules, which are a set of interrelated regulations that address risks from microbial pathogens and disinfectants/disinfection byproducts (DBPs) (USEPA, 2011b).

New classes of chemicals, such as pharmaceuticals and personal care products (PPCPs), currently used pesticides, and industrial chemicals are collectively referred to as chemicals of emerging concern. This diverse group of relatively unmonitored chemicals has been found to occur at trace levels in wastewater discharges, ambient receiving waters, and drinking water supplies, but many of them are so new that standardized measurement methods and toxicological data for interpreting their potential human or ecosystem health effects are unavailable. This lack of basic information and technology to efficiently measure chemicals of emerging concern hampers the state's ability to assess their potential risks and develop regulatory protocols; therefore, they are generally not regulated under Title 22 (SWRCB, 2010).

National Flood Insurance Program

FEMA is responsible for determining flood elevations and floodplain boundaries, and distributing FIRMs, which are used in the National Flood Insurance Program (NFIP). FIRMs identify the locations of special flood hazard areas, including the 100-year and 500-year floodplain. Federal regulations governing development in Zone A (100-year) floodplain are set forth in Title 44, Part 60 of the Code of Federal Regulations (CFR), which enables FEMA to require municipalities that participate in the NFIP to adopt certain flood hazard reduction standards for construction and development in floodplains. In Santa Cruz County, the NFIP program is overseen by the County Planning Department's Floodplain Management Program.

5.1.4 Impacts and Mitigation Measures

This section contains the evaluation of potential environmental impacts associated with the proposed project related to hydrology and water quality. The section identifies the standards of significance used in evaluating the impacts, the methods used in conducting the analysis, and a detailed evaluation of impacts for the proposed project, and any potential future expansion.

Standards of Significance

Based on CEQA Guidelines Section 15065; Appendix G of the CEQA Guidelines; applicable agency plans, policies, and/or guidelines; and agency and professional standards; the proposed project would cause a significant impact related to hydrology and water quality if it would:

Water Quality

1a. Violate any water quality standards or waste discharge requirements, including those listed below, or otherwise substantially degrade water quality;

- Ocean Plan water quality objectives for protection of marine aquatic life (see **Table 5.1-4**)
- Basin Plan water quality objectives (see **Table 5.1-5a** and **Table 5.1-5b**)
- NPDES WWTF effluent limits (see **Appendix Q** and **Table 5.1-10**)

- Drinking water standards (see **Table 5.1-12**).

Groundwater

1b. Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level.

Drainage

1c. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.

1d. Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.

1e. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

1f. Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

Flooding and Inundation

1g. Result in construction of habitable structures within a 100-year floodplain as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, which would expose people or structures to a significant risk of loss, injury or death due to flooding.

1h. Locate structures within a 100-year flood hazard area that would impede or redirect flood flows.

1i. Expose people or structures to a significant risk of loss, injury or death involving flooding, as a result of the failure of a levee or dam or coastal flooding due to sea-level rise; and/or

1j. Expose people or structures to a significant risk of loss, injury or death as a result of inundation by seiche, tsunami, or mudflow.

Analysis Methodology

The above standards of significance are assessed in this section as the basis for determining the significance of impacts related to hydrology and water quality. If necessary, mitigation measures are proposed to reduce impacts to acceptable levels. The approach to the analysis of marine water quality related to the discharge of brine from the proposed project is further described below.

The analysis of marine water quality effects provided in this section is based on review and evaluation of Dilution Analysis (**Appendix J**). To evaluate marine water quality effects, two factors are reviewed. The first factor involves determining whether the dilution requirements of the City's existing WWTF NPDES permit, as well as ambient salinity of receiving waters, could be maintained with the addition of brine to the WWTF outfall. The second factor involves determining whether estimated effluent/brine mixture concentrations would exceed: (1) other WWTF permit limits (see **Appendix Q** and **Table 5.1-10**); (2) Basin Plan water quality objectives for marine habitat (see **Table 5.1-5a** and **Table 5.1-5b**); and/or (3) Ocean Plan water quality objectives (see **Table 5.1-4**). The methodology used in the Dilution Analysis is further described below.

As described in **Section 4**, the brine resulting from the treatment process would be combined with the existing WWTF effluent, via a new pipeline connection between the desalination plant and the existing WWTF outfall. The Dilution Analysis (**Appendix J**) evaluated whether a combined discharge could still achieve the minimum initial dilution ratio (MIDR) of 139:1 (seawater to effluent) required by the City's NPDES permit. The analysis also evaluated how to ensure that the combined discharge would not exceed the salinity of ambient seawater.

Higher dilution rates are achieved as effluent becomes more buoyant relative to ambient seawater. Consequently, the salinity and temperature of the brine, the WWTF effluent, the brine/effluent blend, and the ambient seawater were estimated, to assess the likely buoyancy of the combined discharge. Density stratification in the ambient water due to seasonal changes can affect dilution. Based on data from 1976 and 1977 that represent worst-case drought conditions and related minimal freshwater inflows, thermal stratification with depth during summer/fall can reduce dilution by preventing upward momentum of an otherwise buoyant plume, decreasing mixing of the plume with the ambient water compared to that when the receiving water is less stratified. In the winter, ambient coastal waters are essentially isothermal, which means there is very little temperature gradient and salinity gradient with depth. Given these differences, **Appendix J** evaluates two ambient-water seasonal scenarios—summer/fall and winter—based on the 1976 and 1977 data noted above and shown in **Table 5.1-3**.

A Windows-based mixing zone modeling application (VISUAL PLUMES) was used to estimate the MIDR. Dilution model inputs included flow rate through each outfall diffuser section (estimated using Brown and Caldwell's proprietary diffuser hydraulics program DIFF$$), diffuser section characteristics, temperature and salinity of the composite effluent, and temperature and salinity of the ambient water. Key assumptions made in the modeling include:

- Complete mixing of brine and effluent would occur prior to discharge into the outfall diffuser via the use of an injection nozzle at the outfall connection point, which is part of the project (see **Section 4**).
- Rejection rate of brine from reverse osmosis would be 55 percent (45 percent recovery).

- The City would open all ports on the diffuser (some are now covered over). Red Valves© would be retrofitted over all existing outfall ports, which is part of the project (see **Section 4**).
- WWTF effluent salinity was conservatively assumed to be 0.5 ppt.
- No change in brine temperature would occur through the desalination process; therefore, brine temperature was assumed to be equal to ambient seawater temperature at the depth from which seawater is drawn into the intake system (approximately 40 feet). The diffuser discharges at depths of 90 to 110 feet, where seawater is always slightly cooler and saltier. Effluent temperature is projected to be higher than brine temperature throughout the year. Therefore, the brine/effluent mixture would always be warmer than ambient seawater, when discharged.
- The average daily effluent flow from the WWTF would continue to be 9.8 mgd under low-flow conditions. The minimum daily future dry weather flow would not drop below this level; for example, possible reductions in effluent flow associated with improved water efficiency in potable water use would be offset by growth in the number of connections.

The results of the Dilution Analysis noted above are considered in the analysis of marine water quality related to brine disposal provided in Impact 5.1-3, below.

Impacts and Mitigation

This section provides a detailed evaluation of hydrology and water quality impacts for all project components and related component alternatives, where relevant. The evaluation addresses impacts related to construction of the onshore components (standard 1a), construction and maintenance for the offshore components (standard 1a); brine discharge (standard 1a); groundwater (standard 1b); drainage (standards 1c, 1d, 1e, and 1f); flooding (standards 1g, 1h, 1i, and 1j); and product water quality (standard 1a).

The impacts to hydrology and water quality are summarized in **Table 5.1-6, Summary of Potential Hydrology and Water Quality Impacts**, and are categorized as either "not applicable," "no impact," "less than significant impact," "less than significant impact with mitigation," or "significant and unavoidable impact." Although not required by CEQA, "beneficial impacts" are also provided where they relate to the project objectives identified for the proposed project (see **Section 4**).

The detailed analysis of hydrology and water quality impacts and mitigation measures follows this table. Potential project-related water quality and temperature effects on marine life are addressed in **Section 5.2, Marine Biology**. Impacts related to wetlands and creek habitats is contained in **Section 5.3 Terrestrial Biology**.

Table 5.1-6. Summary of Potential Hydrology and Water Quality Impacts

Impacts	LEVEL OF SIGNIFICANCE													
	Seawater Intake Site Alternatives								Plant Site Alternatives			Other Components	Project Overall	Possible Future Expansion
	SI-4	SI-5	SI-7	SI-9	SI-14	SI-16	SI-17	SI-18	A-1	A-2	A-3			
5.1-1: Construction Water Quality – Onshore Components	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTS
5.1-2: Construction and Maintenance Water Quality – Offshore Components	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	LTSM	--	--	--	--	LTSM	LTSM
5.1-3: Brine Discharge	--	--	--	--	--	--	--	--	--	--	--	--	LTS	LTS
5.1-4: Groundwater	--	--	--	--	--	--	--	--	--	--	--	--	B	--
5.1-5: Drainage	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTSM	LTSM	LTSM	LTS	LTSM	LTS
5.1-6: Flooding and Inundation	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS	LTS
5.1-7: Water Supply Quality	--	--	--	--	--	--	--	--	LTS	LTS	LTS	--	LTS	LTS

Acronyms:
SU = Significant and Unavoidable Impact
LTSM = Less Than Significant Impact With Mitigation
LTS = Less Than Significant Impact
NI = No Impact
-- = Not applicable
B = Beneficial Impact

CONSTRUCTION WATER QUALITY – ONSHORE COMPONENTS

Impact 5.1-1:	If not properly controlled, construction activities associated with the onshore components of the proposed project could substantially degrade surface water quality due to the release of sediments and contaminants.
Significance before Mitigation:	Potentially significant
Mitigation Measures:	See Mitigation Measures 5.1-1a and 5.1-1b
Significance after Mitigation:	Less than significant

Proposed Project

General Construction Activities

As indicated in **Section 5.1.2, Environmental Setting**, there are a number of creeks in the immediate project area. During storm events, runoff from onshore construction areas could drain directly to one or more of these water bodies, and eventually to Monterey Bay (see **Table 5.1-7, Drainage Characteristics near Onshore Project Components**). Construction activities, including vegetation removal, grading, excavation, trenching, and backfilling, have the potential to affect surface water quality, if not properly controlled.

Table 5.1-7. Drainage Characteristics Near Onshore Project Components

Onshore Project Component	Nearby Drainages	Construction Site Drainage Destination
Seawater Intake Pump Stations		
Intake Pump Station SI-4	Bethany Creek	Bethany Creek
Intake Pump Station SI-18	Neary Lagoon	Neary Lagoon outlet channel
Other Intake Pump Stations	None	Storm drains in paved public rights-of-way
Plant Sites		
Plant Sites	Natural Bridges Creek, Arroyo Seco	Natural Bridges Creek
Conveyances		
Intake Transfer Piping	Bethany Creek, Arroyo Seco, Natural Bridges Creek	Storm drains in paved public rights-of-way
Brine Piping	Bethany Creek, Arroyo Seco, Natural Bridges Creek	Storm drains in paved public rights-of-way
Intertie System Improvements	Arana Creek, Rodeo Gulch, Soquel Creek, Nobel Gulch, Porter Gulch	Storm drains in paved public rights-of-way Portions of corridor drain directly to Arana Creek McGregor pump station site drains to Porter Gulch

Specifically, the construction of the proposed desalination plant would involve these ground-disturbing activities on 5 to 8 acres of land, depending on the location alternative selected (see **Table 5.1-8, Area Subject to Ground-Disturbing Activities**). Overall, ground-disturbing construction activities related to all components of the project would result in up to 17 acres of disturbed soils being temporarily exposed to the erosive forces of wind, rain, and stormwater runoff, depending on which component alternative is pursued, which could result in the release of sediment into nearby water bodies that drain to Monterey Bay. In addition to the release of sediment, contamination of stormwater runoff with typical chemicals used during construction such as fuels, oils, lead solder, solvents, and glues could occur through the daily use, transportation, and storage of these materials, if not properly controlled. Conveyance of sediment and other pollutants from the construction sites to receiving waters could occur by direct overland flow and/or via the storm drain system. This impact is considered to be potentially significant.

Table 5.1-8. Area Subject to Ground-Disturbing Activities

Onshore Project Component	Land Area Subject to Ground Disturbance (acres)	Ground-Disturbing Construction Techniques
Seawater Intake Pump Stations		
All Onshore Sites[1]	0.2	Vegetation removal, grading, excavation, trenching, backfilling, tunneling
Plant Sites		
A-1	5.0	Vegetation removal, grading, excavation, trenching, and backfilling
A-2	5.0	Vegetation removal, grading, excavation, trenching, and backfilling
A-3	8.0	Vegetation removal, grading, excavation, trenching, and backfilling
Conveyances		
Raw Water Transfer Piping	2.6 (SI-9, SI-17, SI-18) 1.2 (SI-4, SI-5, SI-7, SI-16)	Pavement demolition, trenching, backfilling, repaving
Brine Piping	1.1	Pavement demolition, trenching, backfilling, repaving
City-District Intertie Piping	5.5	Pavement demolition, trenching, backfilling, repaving. Tunneling also being considered at the Arana Creek crossing at Brookwood Drive.

Notes:
1. The construction footprint subject to ground-disturbing activities applies to all onshore intake pump station locations. The pump station site for SI-17 would be offshore, adjacent to the Municipal Wharf, and is not considered above.

As one of the project environmental design features, the City and District shall prepare and submit an erosion control plan/BMPs by a licensed engineer for the portion of the project located in the City of Santa Cruz, concurrent with the grading permit application submittal, because the project would disturb over 50 cubic yards of grading, and therefore would be subject to Municipal Code Chapter 18.45, Excavation and Grading Regulations. The erosion control plan shall include the City's mandatory BMPs as detailed in the latest BMP Manual, published by the City's Public Works Department. BMPs shall be maintained in full force and effect for the duration of the project, under Municipal Code Chapter 16.19, Stormwater and Urban Runoff Pollution Control. The erosion control plan is further described below under environmental design features.

Potential construction-phase water quality impacts would also be controlled through the preparation and implementation of a SWPPP in accordance with NPDES permitting requirements, (see Mitigation Measure 5.1-1a). An SWPPP would be required for the entire project, not just the portion in the City. The SWPPP details the construction-phase erosion and sediment control BMPs and the housekeeping measures for control of contaminants other than sediment, similar to the BMPs that would be included in the erosion control plan required by the City. The SWPPP also sets forth a BMP monitoring and maintenance schedule, and identifies the responsible entities during the construction and post-construction phases. If monitoring results indicate that the discharge is outside the range of the pH Numeric Action Level or above the turbidity Numeric Action Level, a construction site and run-on evaluation will be conducted to determine the source of the pollutant and the nature of the corrective actions needed to bring the discharge within the NALs. The implementation of the SWPPP would avoid or mitigate runoff pollutants at the construction sites to the "maximum extent practicable." The impact related to construction-phase water quality degradation would be less than significant with mitigation.

Arana Creek Crossing

The majority of new piping for raw water, brine, and water delivery would be constructed within paved public rights-of-way, and therefore would not result in construction activities within drainages. One exception would be for a segment of the proposed intertie that would require crossing Arana Creek at Brookwood Drive. Due to the conditions of the existing bridge on Brookwood Drive, construction of the pipeline within the bridge structure would not be feasible. Two options for crossing the creek are presented in **Section 4** (see **Figure 4-13, Arana Creek Crossing Construction Options**), both of which may be subject to CWA Section 401/404 permitting.

The first option would involve open-cut trenching methods. This method would cut a trench across the stream channel, but within the Brookwood Drive bridge structure in order to install the new water pipeline. Conventional methods would be used to temporarily isolate the excavation work area and divert and bypass the stream flow until the section of pipeline crossing is completed and flow can be returned to the creek. This approach would have the potential for releasing sediment and contaminants into the creek, if not properly controlled. However, Mitigation Measure 5.1-1a requiring the implementation of the SWPPP would avoid or mitigate runoff pollutants at the creek crossing to the "maximum extent practicable." With the implementation of this mitigation measure, the impact related to construction-phase water quality degradation at this creek crossing would be reduced to less than significant.

The second option would involve horizontal directional drilling or microtunneling under the creekbed to install the pipeline. The construction procedure for installing a pipeline with trenchless methods (e.g., microtunneling, horizontal directional drilling) requires the use of special lubricating drilling fluids. Drilling fluids are generally a naturally based product: bentonite clay and water. Although this option would avoid directly trenching in the creek, potential exists for the release of drilling fluids through a fracture in the earth, which could have water quality effects if discharged into the creek. Mitigation Measure 5.1-1b would require: (1) the preparation and implementation of a drilling-fluids management plan that would include a pre-construction geologic study to determine soil types, ground conditions, and appropriate construction procedures; (2) isolating the work area with siltation fencing; (3) maintaining materials and equipment on site for the cleanup of any leak; (4) continually monitoring the work site during tunneling to detect leaks; and (5) procedures to follow if a leak occurs. With the implementation of this mitigation measure, any temporary water quality impacts associated with the potential for the release of drilling fluids during tunneling under the creek would be reduced to less than significant.

Please refer to **Section 5.3, Terrestrial Biological Resources**, for additional information about construction effects in drainages.

Potential Future Expansion

If expansion of the proposed plant and related facilities were pursued in the future, the majority of the additional equipment would be installed in existing structures at the plant, and at the intake pump station. Some additional ground-disturbing activities would be involved in the construction of additional brine storage structure(s) and dissolved air floatation (DAF) basin(s) at the plant, but would not occur elsewhere in the project area.

Potential construction-phase water quality impacts would be controlled below the level of significance through preparation of an erosion control plan/BMPs, in accordance with the City's Municipal Code Chapter 18.45, Excavation and Grading Regulations. The area of additional ground disturbance from potential future expansion (approximately 0.3 acre) would not be sufficient for NPDES permitting requirements to be applicable. Therefore, construction-phase water quality impacts would be less than significant.

Environmental Design Features

The environmental design feature (**Section 4**, **Table 4-12**) of the proposed project related to construction-phase erosion control includes the following:

- The City and District will prepare and submit an erosion control plan/BMPs by a licensed engineer for the portion of the project located in the City of Santa Cruz, concurrent with the grading permit application submittal, because the project would disturb over 50 cubic yards of grading, and therefore would be subject to Municipal Code Chapter 18.45, Excavation and Grading Regulations. The erosion control plan will include the City's mandatory BMPs as detailed in the latest BMP Manual, published by the City's Public Works Department. BMPs will be maintained in full force and effect for the duration of the project, under Municipal Code Chapter 16.19, Stormwater and Urban Runoff

Pollution Control. The erosion control plan will include, but not be limited to, the following measures:

- Conduct grading operations in phases to reduce the amount of disturbed areas and exposed soil at any one time.
- Clearing, excavation, and grading will not be conducted during rainy weather unless specifically approved as part of the grading permit, and all rainy season grading will be conducted in accordance with Municipal Code Section 18.45.040.
- Delineate clearing limits, setbacks, sensitive or critical areas, trees, drainage courses, and buffer zones to prevent excessive or unnecessary disturbances and exposure prior to or during construction.
- Construct access roads and entrances to minimize the tracking of soil, mud, or hazardous materials into the roadway or drains. Install shaker roads and/or washdown facilities for construction vehicles on construction sites greater than 1 acre.
- Implement erosion, sediment, and runoff control measures prior to initiating construction and throughout the construction period to prevent a net increase of sediment load in stormwater discharge relative to preconstruction levels. Control measures could include installation of filter fabric, erosion control blankets, geotextiles, mulching, seeding, and vegetation planting on exposed soils; provisions for stockpiling of topsoil or other materials removed during construction; protection of storm drain inlets; and proper installation, inspection, maintenance, and repair of erosion control measures.
- Implement good housekeeping measures at the construction site related to the use and storage of construction equipment and vehicles, paints and other hazardous materials, site cleanup and sweeping, and waste management.

Mitigation Measures

Mitigation Measure 5.1-1a

This mitigation measure applies to all project components involving ground disturbance. The City and District shall prepare a Notice of Intent (NOI) to be submitted to the Central Coast RWQCB, which indicates the intent to comply with the Statewide NPDES General Construction Permit (Order No. 2009-0009-DWQ) prior to construction being initiated. Prior to submittal of the NOI, the City and the District shall prepare an SWPPP to comply with the Statewide NPDES General Construction Permit.

The SWPPP shall identify BMPs to prevent or reduce pollution into surface waters, including Monterey Bay. BMPs shall include—but shall not be limited to—construction or installation of sediment retention or erosion control structures such as hay bales, coconut fiber rolls, geofabric, sand bags, and water filters over storm drains; reseeding of exposed soils; stockpiling of topsoil removed during construction; wetting of dry and dusty surfaces to prevent fugitive dust emissions; and clear water diversions to protect channels during trenching/pipeline installation. The SWPPP shall also establish good housekeeping measures such as construction vehicle storage and maintenance, handling procedures for hazardous materials, and waste management BMPs. Additional required components of the SWPPP shall include run-on and runoff control measures; inspection, maintenance, and repair of BMPs; and periodic reporting to show compliance with the NPDES Construction General Permit.

Depending on the Risk Level assessed to the project discharges, the City and District shall ensure that project construction complies with Numeric Action Levels for pH and turbidity, which is required for Risk Level 2 and 3 projects. Risk Level 2 and 3 projects also require development of Rain Event Action Plans by qualified individuals, and water quality sampling of non-stormwater discharges and stormwater runoff during qualifying rain events. Exceedance of the Numeric Action Levels shall require mandatory follow-up, including additional evaluation, BMPs, and/or corrective action. Corrective actions will be implemented to bring the discharge to within the Numeric Action Levels. The City and the District shall ensure that a copy of the SWPPP is available at each construction site at all times, and shall be implemented and amended as necessary to ensure compliance with the NPDES Construction General Permit.

Mitigation Measure 5.1-1b

This mitigation measure applies to the City-District intertie and the Arana Creek crossing at Brookwood Drive if trenchless construction is used. Prior to construction, a drilling-fluids management and response plan shall be prepared to address the potential for fluid releases. The plan shall include—but not be limited to—the following measures and actions:

- Conducting a pre-construction geologic study to examine the work area to determine soil types, ground conditions, and appropriate construction procedures.
- Isolating the work area with siltation fencing so that any fluid leaks are contained within a controlled area.
- Maintaining materials and equipment on site to allow for the cleanup of any leak that may occur.
- Constantly monitoring the work site by having inspector(s) maintain constant radio contact with equipment operators.
- If a fluid leak does occur, the contractor shall stop work immediately and assess the nature of the leak. Remedial actions shall be implemented and may include spot cleanup with adsorbent materials, or sub-containment of a localized area for the duration of the work.
- Once construction is complete, the site shall be restored to existing conditions.

The City and District shall include the requirement for a drilling fluids management and response plan in construction specifications and bid document for the City-District intertie, and shall ensure its implementation during construction.

CONSTRUCTION AND MAINTENANCE WATER QUALITY – OFFSHORE COMPONENTS

Impact 5.1-2:	If not properly controlled, construction and maintenance activities associated with the offshore components of the proposed project could substantially degrade marine water quality due to the release of sediments and contaminants.
Significance before Mitigation:	Potentially significant
Mitigation Measures:	See Mitigation Measures 5.1-2a and 5.1-2b
Significance after Mitigation:	Less than significant

Proposed Project

Construction

A portion of the seawater intake system, including the intake structure and intake pipelines, would be located in Monterey Bay. Potential marine water quality effects during construction could be caused by the potential inadvertent release of drilling fluids during tunneling for the intake pipeline, and disturbance of sediments on the seafloor during the installation of the seawater intake structure. These potential effects are further described below.

Inadvertent Release of Drilling Fluids during Tunneling. Installing the intake pipeline would involve tunneling from the intake pump station out under the seafloor. The construction procedure for tunneling requires the use of special lubricating drilling fluids made of bentonite clay and water, as described above for the Arana Creek crossing. During the tunneling process, there is some potential that an inadvertent release of drilling fluids could occur through a fracture in the ocean floor, which could have localized water quality effects if discharged into Monterey Bay. Mitigation Measure 5.1-2a would require the preparation and implementation of a drilling-fluids management plan specifically for the marine environment that would include a pre-construction geologic study to identify soil and bedrock types and conditions on the ocean floor; maintaining materials and equipment on site, and/or on the off-shore barge for the cleanup of any leak; inspectors/divers to continually monitor the work site during tunneling to detect leaks; and procedures to follow if a leak occurs. With the implementation of this mitigation, any temporary water quality impacts associated with the potential for the release of drilling fluids during tunneling under the seafloor would be less than significant.

Disturbance of Bottom Sediments. Disturbance of bottom sediments during construction has the potential to temporarily affect water quality near and down-current of the construction site. At the intake alternative sites along West Cliff Drive (SI-4, SI-5, SI-7, SI-14, and SI-16), tunneling underground would be done from land to the intake structure location. At the intake, sandy sediments would be dredged to expose the bedrock above the intake. The bedrock would be excavated to the terminus of the dual-intake tunnels. The size of the rock excavation would be approximately 10 feet wide by about 25 feet long, sloping up from the tunnel to the ocean floor. The depths of the excavation would be about 15 to 20 feet into the bedrock. Each prefabricated intake screen assembly would be lowered to the bottom, moored, and connected to an intake tunnel. The activities would be conducted from a barge or work platform, using cranes to lower the structure. Active work on the ocean floor to expose the intake pipeline and connect the intake structure would last approximately 3 months and could result in an increase in turbidity in the vicinity of the construction site.

At intake alternative sites near the Municipal Wharf (SI-9, SI-17, and SI-18), located in sandy habitats, tunneling underground would be done to a point just past the surf zone. An approximately 4,800-foot-long trench would be dredged using a clamshell bucket, from the terminus of the tunnel to the intake. The dredged material would be side cast and used to cover the intake pipelines once in place. It is possible that this segment of pipe could also be laid on the ocean floor and anchored, as opposed to dredged and buried. As for the western intake sites, the activities for intake sites near the Wharf would be conducted from a barge or work platform, using cranes to lower the structure. The presence of sandy bottom sediments limits the duration and magnitude of turbidity generated during these activities, because sediments would quickly fall out of the water column. On the east side, active work on the ocean floor to dredge and install the pipeline out beyond the surf zone and connect it to the intake structure would last approximately 9 months for SI-9 and SI-18 or approximately 15 months for SI-17, and could result in an increase in turbidity in the vicinity of the construction site.

Potential water quality impacts associated with the disturbance of bottom sediments during construction of the intake pipeline and structure would be minimized by implementing sediment control BMPs contained in Mitigation Measure 5.1-2b. Mitigation Measure 5.1-2b would require: (1) the use of closed-bucket dredging systems to minimize the release of sediments during dredging; (2) isolating the construction zone with the use of a turbidity curtain, which would contain sediments within the construction zone; and (3) work scheduling to avoid or closely monitor construction activities during high swell periods. All of these measures would minimize the release of suspended sediments into Monterey Bay during activities that disturb bottom sediments. The project would also conduct water quality monitoring inside and outside the construction zone, if required by the RWQCB CWA Section 401 Water Quality Certification. The 401 Water Quality Certifications would be required along with the CWA Section 404 permit that would be required for the fill of Waters of the U.S., as described in detail in **Section 5.2, Marine Biological Resources**. If increased turbidity is detected, the certification may require a specific time of attenuation, or further isolation of the work area with additional turbidity screens. The ambient turbidity background level of Monterey Bay is expected to be high, and the contribution of turbidity from the seawater intake construction activities would likely be difficult to detect. Nonetheless, Mitigation Measure 5.1-2b would reduce any temporary water quality impacts to less than significant.

Intake Maintenance

Maintenance of the intake pipeline could introduce turbidity and other constituents to surface waters and the marine environment. The raw water intake pipeline and screens would be routinely inspected by divers and/or video surveillance for damage, cracks, biogrowth, corrosion, and so forth. If necessary, the equipment would be repaired or cleaned.

The interior of the intake and transfer pipelines would be cleaned with a process called pigging. This cleaning method employs an interior scrubbing device called a "pig," which would be inserted into the pipelines at the intake pump station and launched with water pressure through the pipelines toward the intake structure screens—which would be removed prior to the activity. The pig has an abrasive coating that scrubs the pipeline walls, removing any natural buildup of ocean sediments, mineral deposits, and biogrowth. Materials removed from the pipeline interior are pushed ahead of the pig and released at the end of the pipe. The discharge would likely cause turbidity for a short duration. Larger materials would settle out of the water column, and smaller sediments would disperse via ocean currents. Screen cleaning would either be conducted manually in situ by divers, or on a barge after temporary removal. Neither of the screen-cleaning methods or pigging would have a significant impact on water quality, because any increases in turbidity would not violate the narrative Ocean Plan water quality objectives that apply to discharges, because: (1) any material discharged would be essentially free of substances that would accumulate to toxic levels in marine waters, sediments, or biota; and (2) the deposition of inert solids would not be changed such that benthic communities are degraded. Therefore, temporary water quality impacts due to intake maintenance would be less than significant.

Potential Future Expansion

Any expansion of the seawater intake system would involve adding two wedgewire screen assemblies of the same or similar design as the proposed project. The pre-cast concrete slab installed with the proposed project that would serve as the base of the intake screen assembly would accommodate the additional screens. Therefore, construction would consist only of attaching the additional screens to the concrete slab already in place. No substantial bottom disturbance would be expected to occur with this installation. Mitigation Measure 5.1-2b would ensure that the marine water quality impacts associated with construction of these future project elements would be less than significant.

If expansion of the proposed plant and related facilities were pursued in the future, the operation and maintenance activities associated with the seawater intake would not change. Although additional screen assemblies would be installed, the characteristics, frequency, and magnitude of the operations and maintenance activities would be similar. The impacts would continue to be less than significant.

Mitigation Measures

Mitigation Measure 5.1-2a

This mitigation measure applies to the use of trenchless construction for the installation of the seawater intake pipeline. Prior to construction, a drilling-fluids management and response plan specifically for the marine environment shall be prepared to address the potential for fluid releases. The plan shall include—but not be limited to—the following measures and actions:

- Conducting a pre-construction geologic study to examine the work area to determine soil types, ground conditions, and appropriate construction procedures.
- Maintaining materials and equipment on site and/or on the off-shore barge to allow for the cleanup of any leak that may occur.
- Constantly monitoring the work site through inspector(s)/divers evaluating the tunneling operation to determine the presence of any leaks, and maintaining constant radio contact with equipment operators.
- If a fluid leak does occur, the contractor shall stop work immediately and assess the nature of the leak. Remedial actions shall be implemented, and may include spot cleanup with adsorbent materials or sub-containment of a localized area for the duration of the work.

The City and District shall include the requirement for a drilling fluids management and response plan for the marine environment in construction specifications and bid document for the seawater intake system, and shall ensure its implementation during construction.

Mitigation Measure 5.1-2b

This mitigation measure applies to the seawater intake structure and intake pipeline project components. Contractors shall implement specific measures that reduce sediment disturbance during underwater construction that results in disturbance of the ocean floor. Where dredging is conducted, a closed "environmental" bucket dredging system with a lid to reduce turbidity (or equivalent) shall be employed. Turbidity screens shall be used during the rock excavation work at SI-4, SI-5, SI-7, SI-14, and SI-16, as appropriate, due to the presence of kelp forests nearby.

Water quality monitoring inside and outside the construction zone shall be performed to detect increased turbidity levels, if required by the RWQCB CWA 401 Water Quality Certification. If increased turbidity is detected, the certification may require a specific time of attenuation or further isolation of the work area with additional turbidity screens.

In addition, work shall be stopped, or monitored carefully, during periods of high swell (such as for the period from October 15 through February 15 due to the high incidence of large swells), and work shall be avoided during extreme high tides, or during other periods of extreme tidal fluctuations such as during full and new moons.

BRINE DISCHARGE IMPACTS

Impact 5.1-3:	The brine discharge from operation of the proposed project via the existing WWTF ocean outfall would not violate water quality objectives in the Ocean Plan and Basin Plan, or effluent-mixing limitations and other effluent limits in the WWTF NPDES permit.
Significance:	Less than significant
Mitigation Measures:	None required

Proposed Project

MIDR and Salinity

As described in **Section 4** and summarized above in the Analysis Methodology section, the brine resulting from the treatment process would be combined with the existing WWTF effluent and discharged via the existing WWTF outfall. The Dilution Analysis (**Appendix J**) evaluated whether a combined discharge could still achieve the MIDR of 139:1 (seawater to effluent), required by the City's NPDES permit for the WWTF effluent discharge. The analysis also evaluated how to ensure that the combined discharge would not exceed the average ambient salinity of receiving waters.

Dilution of discharges is a function of several variables, including outfall and diffuser characteristics, effluent density, effluent flow rate, and the density, velocity, and depth of ambient water. Density is a function of temperature and salinity.

Under existing conditions, the WWTF plant effluent is made up of freshwater, so it is less dense than ocean water and will always rise to the surface, which facilitates dilution. Conversely, the brine from the desalination plant would be denser than ocean water, and therefore would sink to the bottom if discharged to the ocean without being combined with the WWTF effluent, which limits dilution. With the combined discharge associated with the proposed project, the combined effluent would consist of a mixture of brine and freshwater, so it may be positively, negatively, or neutrally buoyant, depending upon the ratio of the two discharges. If WWTF flows were to be less than the brine flow (which is not proposed), the discharge plume would sink or stay near the bottom. **Table 5.1-9, Brine and WWTF Effluent Water Quality**, provides the temperature and salinity of brine and WWTF effluent. **Table 5.1-3** in **Section 5.1.2** provides the temperature and salinity of the ambient ocean in the project area during summer/fall and winter. Given the differences in summer/fall and winter conditions, two ambient water seasonal scenarios—summer/fall, and winter—were evaluated in the Dilution Analysis.

Table 5.1-9. Brine and WWTF Effluent Water Quality

Condition	Brine		WWTF Effluent	
	Temperature (°C)	Salinity (ppt)	Temperature (°C)	Salinity (ppt)
Winter	12.3	61.4	18.0	0.5
Summer/Fall	12.8	61.4	23.0	0.5

Source: Appendix J, Dilution Analysis for Brine Disposal via Ocean Outfall.
Acronyms:
°C = degrees Celsius
ppt = parts per thousand
WWTF = wastewater treatment facility

The results of the Dilution Analysis indicate that the addition of brine from the proposed desalination plant to the WWTF effluent in the outfall would have an effect on the MIDR achieved at the outfall diffuser. With no brine discharged from the proposed project, MIDR ranged from 400:1 to 600:1 at WWTF flow rates ranging from 4 to 15 mgd. However, as the ratio of brine to WWTF effluent increased, MIDR dropped. With the proposed desalination plant running at full capacity (2.5 mgd) for both the summer/fall and winter conditions, a minimum WWTF effluent flow of 2.1 mgd was determined to be required to maintain a MIDR of 139:1.

The results indicate that brine storage would be necessary when hourly WWTF flows drop to levels that would decrease the MIDR to below the allowed permit limit. As indicated in **Section 4**, brine storage would be constructed as part of the proposed project; and the sizing of this storage, anticipated to be approximately 600,000 gallons, would be confirmed during final design of the project. Brine storage would be required during low WWTF effluent periods, which occur typically during the night and early morning hours. The minimum effluent WWTF flows required for brine disposal would depend on the capacity of plant operations at any given time. Therefore, the blending ratio of brine flow from the plant to WWTF effluent flow and brine disposal would be automatically controlled to meet the MIDR of the existing NPDES permit. Assuming that the blending ratio and brine disposal are controlled in the manner described above, there would be adequate WWTF effluent available in the outfall pipe to ensure that the combined effluent never exceeds average ambient receiving water salinity.

The Dilution Analysis demonstrates that it would be feasible to design and operate the plant to maintain the existing MIDR permit requirement, and that the combined effluent would not exceed the average ambient salinity of receiving waters. **Section 4** (**Table 4-12, Environmental Design, Construction, and Operational Features,** and as summarized below) requires adequately-sized brine storage, new valves over existing WWTF outfall diffuser ports to spread effluent flow, and automatic control of the blending ratio to meet the dilution requirements of the existing NPDES permit and to ensure that the combined effluent would not exceed existing salinity of the ambient receiving water. Given the above, the combined discharge would not exceed the dilution requirements of the NPDES permit for the WWTF. Further, as ambient salinity would not increase, the proposed project would adhere to the recommended MBNMS

Guidelines related to salinity (i.e., would not result in salinity that is 10 percent above ambient salinity) (see **Section 5.1.3**).

Water Quality of Combined Discharge

Using the dilution values calculated in the Dilution Analysis, concentrations for various constituents other than salinity were estimated at the edge of the zone of initial dilution, the area around the diffuser where initial dilution occurs. This is the location where compliance with the WWTF NPDES permit is determined.

The flow rate for the effluent/brine mixture was assumed to be the combined flow rates for brine, based on plant operation at 2.5 mgd and a WWTF effluent flow rate of 2.1 mgd. A dilution factor of 186, which was calculated in the Dilution Analysis, was used to estimate conditions at the edge of the zone of initial dilution. The water quality of the brine was based on source water quality data collected during the Watershed Sanitary Survey (**Appendix E**) and the Pilot Test Program Report (**Appendix D**); and on a desalination recovery rate of 45 percent. (The desalination process concentrates source water but does not add constituents to the brine.) WWTF effluent water quality was based on water quality data for the City's WWTF effluent. This information is provided in **Appendix Q**.

Estimated effluent/brine mixture concentrations were then compared to the City's WWTF permit limits (see **Appendix Q** and **Table 5.1-10**), Basin Plan water quality objectives for marine habitat (see **Table 5.1-5a** and **Table 5.1-5b**), and the Ocean Plan water quality objectives (typically, the 6-month median limiting concentration) (**Table 5.1-4**). **Table 5.1-10, Predicted Concentrations of Constituents in the Combined Effluent Compared to Relevant Water Quality Objectives**, provides this comparison for constituents with data available for both brine and WWTF effluent. Several constituents were monitored as part of the Watershed Sanitary Survey that are not monitored by the WWTF. As a result, these constituents are not included in the detailed calculations shown in **Table 5.1-10**.

The project would implement environmental design features—described above and summarized below—that would cause the brine salinity to be diluted back to ambient salinity in the WWTF outfall pipe under worst-case conditions. Constituents that only occur in the source water (i.e., are not present in the WWTF effluent) would also be diluted back to near ambient concentrations in the outfall pipe. Those constituents that are in both the source water and the WWTF effluent would have concentrations in the outfall pipe between the brine and WWTF concentrations.

Table 5.1-10 shows the predicted concentrations in the combined discharge from the diffuser at the edge of the zone of initial dilution would not violate the WWTF's NPDES effluent limits, the RWQCB Basin Plan WQOs for marine habitat, and the Ocean Plan WQOs for marine aquatic life.

Impact Summary

Given that the combined discharge would not exceed the dilution requirements of the NPDES permit, and would not violate the WWTF's NPDES effluent limits, the RWQCB Basin Plan WQOs for marine habitat, and the Ocean Plan WQOs for marine aquatic life, the marine water quality impact associated with the discharge of brine would be less than significant.

Potential Future Expansion

If expansion of the proposed plant and related facilities were pursued in the future, the discharge of brine would continue to be operated in accordance with the environmental design features summarized below and described in detail in **Section 4**. As long as the brine discharge rate is limited in this way, the marine water quality impact would be less than significant, as described above for the proposed project.

Environmental Design Features

The environmental design features (**Section 4**, **Table 4-12**) of the proposed project related to brine discharge include the following:

- Brine from the desalination plant will be blended with WWTF effluent.
- Automatic control of blending ratio of brine flow to WWTF effluent flow will be provided to meet minimum initial dilution requirement of the existing NPDES permit and to ensure that the combined effluent would not exceed the salinity of ambient ocean water.
- On-site storage of brine will be provided such that the rate of disposal can be controlled.
- New valves over existing ports on the WWTF outfall diffuser will be installed to spread effluent flow.

Mitigation Measures

None required.

GROUNDWATER IMPACTS

Impact 5.1-4:	The proposed project would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge. The project would allow the District to reduce its groundwater pumping and meet its target groundwater recovery pumping goal, which would allow for the recovery of the basin over time.
Significance:	Beneficial
Mitigation Measures:	None required

Proposed Project

As discussed in **Section 5.1.2**, the Purisima Formation is the primary source of groundwater in the region, and supplies the entire production of the City's Live Oak well field and the majority of the District's service area. Recharge is thought to occur from deep percolation of rainfall along the foothills of the Santa Cruz Mountains in the upper watersheds and along streambeds of Branciforte Creek, Arana Creek, Rodeo Gulch, and Soquel Creek.

Although new impervious surfaces at the desalination plant and the seawater intake pump station would result with the proposed project, which could reduce infiltration, these sites would not be located in groundwater recharge areas, as indicated in **Section 5.1.2**. The proposed project would include bioretention basins that would provide stormwater infiltration to partially offset any possible losses to groundwater resources resulting from the construction of new impervious surfaces. The use of permeable pavement would also be considered during final design as a means to increase infiltration on site. Additionally, the proposed project would not use groundwater for water supply, so it would not cause any decrease in groundwater levels in the project area.

As described in detail in **Section 3, Project Background**, the District currently derives all of its water supplies from the Purisima and the Aromas aquifers. According to numerous hydrogeologic studies, coastal groundwater levels are below elevations that protect the Soquel-Aptos area from seawater intrusion (protective elevations). This potential for seawater intrusion results from both historical extractions of too much groundwater from the basin, and extraction wells being too close to the coast. The operation of the proposed project would provide the District with potable water via the proposed City-District intertie system, and associated pipeline and pump station improvements. With the supplemental water supply from the proposed project, the District could reduce groundwater pumping in the Soquel-Aptos area to meet its recovery pumping goal of 2,900 acre-feet per year, which is the estimated amount of pumping needed over at least 20 years to achieve basin recovery. Therefore, the operation of the proposed project would have a beneficial effect on regional groundwater resources.

Table 5.1-10. Predicted Concentrations of Constituents in the Combined WWTF and Desalination Plant Effluent Compared to Relevant Water Quality Objectives

Constituent	Units	Source Water Concentration[3]		WWTF Effluent Concentration[4]		Estimated Brine Concentration (45% Recovery Rate)		Concentration at Edge of the Zone of Initial Dilution[6]		NPDES WWTF Effluent Limit	Basin Plan Marine WQO	Ocean Plan WQOs[5]
		Median	Maximum	Median	Maximum	Median	Maximum	Median	Maximum			
Aluminum	µg/L	23	110	< 50	< 50	< 41.8	< 200	< 23.1	< 110	--	--	--
Antimony	µg/L	0.028	0.15	< 0.5	< 0.5	< 0.05	< 0.27	< 0.029	< 0.15	1.7E+05	--	--
Arsenic	µg/L	0.89	1.4	1.65	2	1.62	2.55	0.89	1.40	--	--	8
Barium	µg/L	< 20	9.1	17.7	34	36.4	16.5	20.0	9.18	--	--	--
Beryllium	µg/L	< 0.01	ND	< 0.5	< 0.5	< 0.02	< --	< 0.011	< --	4.6	--	--
Boron	µg/L	4400	5000	328	350	8000	9091	4403	5003	--	--	--
Cadmium	µg/L	0.047	0.077	< 10	< 10	< 0.09	< 0.14	< 0.069	< 0.10	140	0.2	1
Chromium	mg/L	0.19	0.45	24	50	0.35	0.82	0.24	0.56	280	50	2
Copper	µg/L	0.14	0.41	< 10	67	< 0.25	0.75	< 0.16	0.56	--	10	3
Iron	µg/L	8	25	132	146	14.5	45.5	8.29	25.3	--	--	--
Lead	µg/L	0.034	0.12	< 20	30	< 0.06	0.22	< 0.08	0.19	280	10	2
Manganese	mg/L	0.0011	0.002	--	--	0.0020	0.0036	--	--	--	--	--
Mercury	µg/L	0.0041	0.0074	0.016	0.042	0.0075	0.013	0.0041	0.0075	5.0	0.1	0.04
Nickel	µg/L	0.34	0.65	3.1	< 20	0.62	< 1.18	0.35	< 0.69	--	2	5
Selenium	µg/L	< 0.05	0.06	< 0.6	0.8	< 0.091	0.11	< 0.051	0.062	2,100	--	15
Silver	µg/L	< 0.025	ND	< 3	< 4	< 0.045	< --	< 0.032	< --	98	--	0.7
Thallium	µg/L	< 0.025	0.015	< 0.5	< 0.5	< 0.045	< 0.027	< 0.026	< 0.016	280	--	--
Vanadium	µg/L	1.6	1.9	0.95	1.2	2.9	3.5	1.603	1.903	--	--	--
Zinc	µg/L	0.28	2.7	24	74	0.51	4.91	0.280	2.70	--	--	20

Notes:
1. Minimum wastewater flow rate of 2.1 mgd was assumed, which is when all the brine from a 2.5-mgd plant operating a full capacity can be discharged. Brine discharge of 2.5 mgd assumed. Selected constituents are those where both WWTF and brine water quality data were available.
2. Dilution at the diffuser of 186, Winter Scenario was assumed. From Appendix J, Dilution Analysis for Brine Disposal via Ocean Outfall.
3. From Appendix E, Proposed scwd^2 Desalination Project Watershed Sanitary Survey.
4. Compiled from City, 2005a; City, 2006; City, 2007b; City, 2008b; City, 2010b; City, 2011e.
5. 6-month median WQO for the protection of marine aquatic life.
6. **BOLD** indicates exceeds a WQO.

Acronyms:
µg/L = micrograms per liter
mg/L = milligrams per liter
mgd = million gallons per day
ND = not detected
NPDES = National Pollutant Discharge Elimination System
WQOs = water quality objectives
WWTF = wastewater treatment facility

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Potential Future Expansion

Any potential future expansion would not result in groundwater impacts, because any increases in impervious paving at the proposed desalination plant would not impact a groundwater recharge area. The District's 2010 UWMP and 2012 IRP Update do not contemplate expansion of the proposed desalination project or the need for water from an expanded plant. Therefore, an expanded project would not be expected to have a similar beneficial effect on groundwater resources.

Mitigation Measures

None required.

DRAINAGE IMPACTS	
Impact 5.1-5:	The proposed desalination plant would not: (1) alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river; or (2) exceed the capacity of existing or planned stormwater drainage systems. However, the proposed desalination plant could increase the rate, amount, or quality of surface runoff in a manner that would result in substantial erosion or siltation on- or off-site, or provide substantial additional sources of polluted runoff.
Significance before Mitigation:	Potentially significant
Mitigation Measures:	See Mitigation Measure 5.1-5
Significance after Mitigation:	Less than significant with mitigation

Proposed Project

Drainage

Seawater Intake Pump Station. All of the onshore seawater intake pump station sites, except SI-9, would result in an increase in impervious surfacing. The proposed seawater intake pump station would also be required to meet the City's stormwater requirements, which could involve the use of site design to reduce runoff rates, such as porous pavement and/or bio-retention areas.

Desalination Plant. The proposed desalination plant would be constructed on one of three alternative desalination plant sites that are immediately adjacent to areas currently used for light industrial or commercial activity. The area containing the proposed sites for the desalination plant is bounded by Natural Bridges Drive on the west, the railroad on the north, Arroyo Seco drainage on the east, and Delaware Avenue to the south. All of these sites currently drain to Natural Bridges Creek through a 24-inch culvert under Delaware Avenue.

As described in **Section 4** and **Appendix L**, stormwater handling at the three alternative plant sites would follow the City of Santa Cruz requirements for LID. The stormwater LID requirements are specified in the current City's Storm Water BMP Manual, which is part of the City's Storm Water Management Plan (City, 2010b). The BMPs are mandatory under Municipal Code Section 16.19.130. Pending revisions to the City's requirements are further described below under Water Quality. Based on these requirements, stormwater handling requirements were developed for each of the alternative plant sites, as further described below.

The stormwater handling requirements for the three plant site alternatives were calculated based on the 25-year storm event and a safety factor of 1.25. Peak stormwater runoff rates from the desalination plant site shall not exceed the estimated pre-development rate for this peak storm event, per the City's requirements. Each site would allow for runoff from impervious roofs, structures, and roadways to first travel through vegetated swales, then to bio-retention and detention areas to allow for as much infiltration of runoff as possible. These stormwater features would be designed to provide detention of peak discharges, as well as filtration of runoff for control of water quality (see Water Quality, below). Excess stormwater flows that are not infiltrated on site would leave Area A though a 24-inch storm drain under Delaware Avenue to Natural Bridges Creek, and eventually into Natural Bridges State Beach Lagoon and Monterey Bay.

The stormwater requirements for the proposed project are summarized in **Table 5.1-11, Stormwater Handling Requirements at Plant Site Alternatives**, and additional figures and data are provided in **Appendix L**.

Table 5.1-11. Stormwater Handling Requirements for Plant Site Alternatives

Plant Site Alternatives	Project Area (sf)	25-Year Storm Event Flow Rate (cf/sec)		Minimum Required Bioswale Areas (sf)	Required 25-Year Storm Event Detention Volume (cf)	Required Water Quality Treatment Volume (cf)
		Pre-Development	Post-Development (Design)			
A-1	191,300	3.84	12.44	6,100	7,000	18,025
A-2	174,500	3.51	11.34	5,600	6,400	16,442
A-3	290,611	5.84	18.89	9,300	10,600	27,382

Source: Appendix L, scwd[2] Seawater Desalination Plant – Phase 1 Preliminary Design: Volume 1 - Report.
Acronyms:
sf = square feet
cf = cubic feet
cf/sec = cubic feet per second

The site plans for the desalination plant shown in **Section 4** (**Figure 4-7** through **Figure 4-10**) also include conceptual stormwater management plans based on the requirements provided in **Table 5.1-11**. The plans include the drainage pathways on each of the sites, and provide preliminary details of required stormwater and flood control BMPs. These plans would be refined during final design.

With the installation of detention facilities sized to meet the required 25-year storm event detention volume shown in **Table 5.1-11**, peak stormwater runoff rates from the desalination plant site would not exceed the estimated pre-development rate for this peak storm event, per the City's requirements. The detention volume would range from approximately 6,400 cubic feet to 10,600 cubic feet, depending on the plant site alternative selected. Because the proposed desalination plant would not increase the rate of runoff, it would not result in downstream flooding, nor would it exceed the capacity or cause flooding of the existing downstream 24-inch culvert under Delaware Avenue. Therefore, drainage impacts of the desalination plant component of the project would be less than significant.

City-District Intertie Pump Station Upgrades. The Morrissey pump station upgrades would not result in new impervious surfacing as the structure would be built on the footprint of the existing pump station. However, this pump station would also be required to meet the City's stormwater requirements, as described above for the seawater intake pump station. Upgrades at the McGregor and Aptos pump stations would not involve new building construction or impervious surfacing. Therefore, drainage impacts of the City-District Intertie would be less than significant.

Potential Energy Projects. The potential solar PV panels would be installed at the desalination plant, which is evaluated above. The potential micro-hydro system would be installed in the basement of the GHWTP, and would involve only interior improvements, with no ground-disturbing activities. Therefore, it would not have the potential to cause drainage impacts. There would be no impact.

Water Quality

Seawater Intake Pump Station. All of the onshore seawater intake pump station sites, except SI-9, would result in an increase in impervious surfacing. The proposed seawater intake pump station could also be required to meet the City's stormwater requirements, which would likely involve the use of site design to provide for infiltration and treatment, such as porous pavement and/or bio-retention areas.

Desalination Plant. Erosion and sedimentation are typically of greatest potential concern during the project-construction phase, and an SWPPP would be developed and appropriately implemented to reduce erosion and siltation during construction under Mitigation Measure 5.1-1a. After the project has been built and the landscaping and BMPs have been installed, as described above, erosion and sedimentation from the developed site should be minimal.

Once construction of the desalination plant is complete, typical urban runoff contaminants might include trace metals, oil and grease, and sediment from pavement runoff; nutrients and pesticides from landscape maintenance; and litter. Many of these constituents are probably already found in runoff from the alternative desalination plant sites as a result of their location in an urban area, and presence of impervious surfaces on and adjacent to these sites. Stormwater runoff currently drains to receiving waters, with little to no treatment. Because the site drains to Natural Bridges Creek and Monterey Bay, these pollutants may affect water quality in these aquatic habitats.

The conceptual stormwater management plans describe post-construction water quality control measures for the desalination plant site alternatives (Plant Sites A-1, A-2, and A-3). These plans describe and locate BMPs designed to treat stormwater runoff from the desalination plant for water quality. The proposed BMPs are vegetated basins that would treat stormwater through a combination of vegetative uptake, chemical treatment, adsorption, and infiltration. They are currently sized to temporarily store the volume of runoff from impervious surfaces from the 85th percentile 24-hour rainfall event per the method described in the City of Santa Cruz SWMP (City, 2010b). The proposed BMPs temporarily store this volume to a depth of 1 foot, and release it over a 48-hour period.

The City's existing stormwater regulations will be revised effective September 2013. The new regulations will require that projects with over 22,500 square feet of impervious surfacing, such as the proposed desalination plant, infiltrate runoff from the 95th percentile 24-hour rainfall event on site, including peak flow management for 2-year and 10-year storm events. If onsite conditions limit the ability to fully infiltrate the runoff at this rate, projects will have to ensure treatment of the runoff from the 85th percentile 24-hour rainfall event, and the treatment may include an underdrain with an orifice to ensure that a minimum 48 hours of extended detention is provided for the treatment volume.

Appendix M (New Storm Water Regulations Technical Memorandum) was prepared by Bowman & Williams to evaluate the implications of the new regulations on the stormwater design and specifications for the proposed project. Based on this evaluation, it is assumed that additional bioretention area above and beyond that recommended in the Desalination Plant Preliminary Design Report (**Appendix L**) and described in **Table 5.1-11** would be required to meet the new regulations. If additional area is not available at the plant sites under consideration, the implementation of an underdrain system would be required. An underdrain would consist of perforated pipes under the bioretention areas to drain out the collected runoff. The use of pervious pavement would also be considered to reduce the amount of additional bioretention areas needed. During final design, Mitigation Measure 5.1-5 requires that more-detailed site investigations, involving soil percolation tests and other design-level studies, be performed as the basis for developing the final revised stormwater management plan for the proposed desalination plant, in compliance with the new regulations.

The proposed treatment BMPs would prevent the project from contributing a substantial amount of polluted runoff. Therefore, with the implementation of the above mitigation measure the impact of the desalination plant on water quality due to stormwater runoff would be reduced to less than significant.

City-District Intertie Pump Station Upgrades. The Morrissey pump station upgrades would not result in new impervious surfacing as the structure would be built on the footprint of the existing pump station. However, this pump station would also be required to meet the City's stormwater requirements, as described above for the seawater intake pump station. Upgrades at the McGregor and Aptos pump stations would not involve new building construction or impervious surfacing. Therefore, water quality impacts of the City-District Intertie would be less than significant.

Potential Energy Projects. The potential solar PV panels would be installed at the desalination plant, which is evaluated above. The potential micro-hydro system that would be installed in the basement of the GHWTP would involve only interior improvements and no ground-disturbing activities. Therefore, it would not have the potential to cause water quality impacts. There would be no impact.

Potential Future Expansion

If expansion of the proposed plant and related facilities were pursued in the future, the majority of the additional equipment would be installed in existing structures at the plant, and at the intake pump station. Some additional facilities would be constructed at the desalination plant, including brine storage structure(s) and DAF basin(s), but would not occur elsewhere in the project area. These new facilities would result in additional area of impervious surfacing of approximately 10,500 to 15,500 square feet, depending on which plant site is chosen. Therefore, additional BMPs would likely be required to account for this additional square footage of impervious surfacing and associated runoff. The nature and extent of these BMPs would be determined during subsequent environmental review conducted for such an expansion and would be based on stormwater requirements in place at the time. Assuming the design of additional stormwater BMPs would meet future requirements for such facilities, the drainage impact would be less than significant.

Environmental Design Features

The environmental design features (**Table 4-12**) of the proposed project related to stormwater handling at the plant site include the following:

- Stormwater handling at the plant site will follow the City of Santa Cruz requirements for Low Impact Development, as specified in the City's BMP Manual, and per pending revisions effective September 2013.
- Swales and smaller bio-retention/detention basins will be distributed throughout the sites, rather than concentrating stormwater in one area.

- The drainage facilities will handle a 25-year storm event with a safety factor of 1.25.
- Peak stormwater runoff rates and sediment loading from the desalination plant site will not exceed the estimated pre-development rate for this peak storm event.

Mitigation Measures

Mitigation Measure 5.1-5

This measure applies to the proposed desalination plant. The City and District shall revise the stormwater management plan for the selected desalination plant site to ensure that it complies with the City's pending stormwater regulations. To accomplish this and to provide for additional bioretention area expected to be needed; soil percolation tests will be conducted on the selected plant site to determine the site-specific soil percolation characteristics, and whether runoff from the 95th percentile 24-hour rainfall event can be infiltrated on site. If onsite conditions limit the ability to fully infiltrate the runoff at this rate, the desalination plant portion of the project will have to provide treatment of the runoff from the 85th percentile 24-hour rainfall event. To provide for this treatment, an underdrain with an orifice can be used to ensure that a minimum 48 hours of extended detention is provided for the water quality treatment volume. The use of pervious pavement shall be considered as a mechanism for maximizing infiltration.

FLOODING AND INUNDATION IMPACTS

Impact 5.1-6:	The proposed project would not place structures within a 100-year flood-hazard area that would impede or redirect flood flows, or otherwise expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam or inundation by seiche, tsunami, mudflow, or sea-level rise.
Significance:	Less than significant
Mitigation Measures:	None required

Proposed Project

Flood Hazards

None of the project facilities would be located in a FEMA-designated hazard area, with the exception of the pump station proposed for the end of the Municipal Wharf (SI-17), the pump station proposed south of Depot Park (SI-18), and small portions of the underground pipelines within the City-District intertie system (see **Figure 5.1-2**).

The Municipal Wharf is in an area designated as a VE Zone, which is subject to a 1 percent annual chance of flooding, with the additional risk of being exposed to wave action. The

1 percent annual chance of flooding at the Municipal Wharf is due to high water levels in the ocean, and storm-induced waves. The construction of the pump station on the Municipal Wharf would not interfere with or exacerbate the high-tide levels or wave heights, and therefore would not impede or redirect flood flows. Further, because the pump station would be unmanned, a pump station in this location would not expose people to flood hazards. However, NFIP guidance may require that the pump station be flood-proofed to protect sensitive equipment from damage during large storms.

The SI-18 pump station is located on land adjacent to the Neary Lagoon outlet channel. The site is located in a large section of downtown Santa Cruz that is in an A99 zone, which is an area to be protected from 1 percent annual chance flood by a federal flood protection system under construction, for which no base flood elevations have been determined. While the City has worked to improve the flood capacity of the San Lorenzo River levees over the past twenty years, which has resulted in a more flood-resistant downtown, floods may still occur. Under the A99 Zone designation, new buildings and improvements are not required to meet FEMA flood construction requirements and flood insurance premiums are significantly reduced. It is assumed that the pump station building would be constructed to appropriate building standards, if it is to be constructed above ground. However, regardless of whether the pump station is above or below ground, it could experience minor damage if flooding were to occur. Although the structure would be water-resistant, flooding of the wet well could take place in a flood event, which could result in minor damage. Because the desalination plant and associated intake system would not be considered a critical facility, it could be taken off line temporarily in the event of an emergency, and then brought back on line after any needed repairs have been completed[8]. Because the pump station would be unmanned, a pump station in this location would not expose people to flood hazards.

The A99 Zone containing the SI-18 site is an overflow area from the San Lorenzo River, not an area that conveys flood flows. While the details of the pump station design have not yet been determined, it will likely consist of some above ground facilities (e.g., building, pipes) that could potentially interfere with flood flows. However, because the site is not in an area of flood conveyance and the new levees constructed on the San Lorenzo River will reduce flooding in this area, the construction of the pump station should not cause any change in flooding as shown on the FEMA flood maps. The SI-18 site is mostly vacant; however it has an industrial character due to the use of the site for storage, and likely has a low permeability. Therefore, new impervious surfacing associated with construction should not result in a large increase in runoff that could contribute to flooding. In addition, the water level in Neary Lagoon and the Neary

8 It is anticipated that periodic, short-term interruptions in project operations would be acceptable given that: (1) the proposed project would provide a supplemental water supply to reduce District pumping in the Soquel-Aptos area to allow coastal groundwater levels to recover and to help the City meet its water needs during drought periods; and (2) the existing primary water supplies and existing treated water storage in the distribution systems of both the City and District service areas would be available to serve customers during such a short-term interruption.

Lagoon outlet channel (the water body adjacent to the pump station site) is controlled by a weir and a forced main storm drain, therefore any small increase in runoff from the pump station site would have minimal impacts to water levels in the Neary Lagoon outlet channel.

The intertie pipeline corridor does cross the AE flood zones associated with Arana Creek, Rodeo Gulch and Soquel Creek. However, the pipeline would cross under Arana Creek and be constructed within the bridge structures over Rodeo Gulch and Soquel Creek. Therefore, these components of the project would not place structures within flood-hazard areas or otherwise expose people or structures to significant risks involving flooding.

The project components would not expose people or structures to a significant risk from flooding as a result of the failure of a levee or dam. The components would not be at risk of inundation from a seiche or mudflow. Overall, impacts related to flooding hazards would be less than significant, as the proposed project would not expose people or structures to significant risks involving flooding.

Tsunami

The proposed intake pump station alternative locations along the coast (SI-4, SI-5, SI-7, SI-9, SI-17, and SI-18) are either in the projected tsunami inundation area or immediately adjacent to the inundation area (see **Figure 5.1-5**). If one of the coastal sites is selected, the pump station could experience minor damage due to inundation if a tsunami were to occur. Although the structure would be water-resistant, flooding of the pump station wet well could occur during a tsunami, which could result in minor damage. Because the desalination plant and associated intake system would not be considered a critical facility, it could be taken off line in the event of an emergency, and then brought back on line after any needed repairs have been completed.[8]

While future sea-level rise would likely increase the size of the tsunami inundation area, it is not anticipated that additional project components would be subject to tsunami inundation in the future. The calculated sea-level rise over the life of the project (using the CO-CAT guidelines as discussed below) is approximately 4 feet over the next 75 years. Plant Sites A-1 and A-3 are approximately 60 to 75 feet above sea level, while Plant Site A-2 is approximately 45 to 65 feet above sea level. Intake pump stations SI-14 and SI-16 are approximately 75 and 50 feet above sea level respectively. These components are therefore unlikely to be subject to future inundation from tsunami.

Impacts related to tsunami inundation would be less than significant, as the proposed project would not expose people or structures to significant risk of inundation.

Sea-Level Rise

The existing ground elevation near the alternative desalination plants is approximately 45 to 75 feet above sea level, and would not be affected by future sea-level rise, as indicated above. According to the CO-CAT guidelines, 16 inches in sea-level rise (above year 2000 levels) should be planned for by the year 2050, and up to 55 inches by the year 2100 (COPC, 2011). Using this information, the calculated sea-level rise within the 75-year design-life of the project (starting from 2016, the earliest year of project operation) would be approximately 48 inches (4 feet) above 2000 levels.

The onshore intake pump station sites range in elevation from approximately 20 to 70 feet above mean sea level, and therefore are not at risk of inundation from sea-level rise. The top surface of the SI-17 pump station and surrounding new decking would be constructed approximately 20 feet above current sea level (level with the existing wharf surface), and the pump station would extend approximately 10 to 15 feet below the surface of the decking. The pump station wet well would extend from the pump station down to the ocean floor. As indicated in the environmental design feature below, the intake pump station and associated wet well at SI-17 would be designed to account for wave heights, storm surge, water levels, scouring and erosion, maximum and minimum tides, and currents associated with a 100-year storm event and factoring in anticipated water levels due to sea level rise and global warming over the life of the structure (approximately 4 feet of sea-level rise is anticipated over the 75 year life of the project). Therefore, the impact related to sea-level rise would be less than significant.

Potential Future Expansions

If expansion of the proposed plant and related facilities were pursued in the future, there would be no additional impacts related to flooding or inundation, because no changes would be made to structures within areas subject to flooding or inundation (e.g., the intake pump station), and no additional structures would be constructed in areas subject to flooding or inundation. Therefore, the impact related to flooding and inundation would be less than significant.

Environmental Design Features

The environmental design feature (**Table 4-12**) of the proposed project related to the design storm includes the following:

- Any project facilities (intakes, intake structures, and pipelines) subject to coastal wave action will be designed to account for wave heights, storm surge, water levels, scouring and erosion, maximum and minimum tides, and currents associated with a 100-year storm event and factoring in anticipated water levels due to sea level rise and global warming over the life of the structures. Design standards may be subject to modification based on regulatory requirements and policies of permitting agencies.

Mitigation Measures

None required.

WATER SUPPLY QUALITY IMPACTS

Impact 5.1-7:	Introduction of a new water supply source would not affect the water quality of the domestic water supply.
Significance:	Less than significant
Mitigation Measures:	None required

Proposed Project

Product Water Quality

Raw water from Monterey Bay would be pretreated prior to going through the seawater reverse osmosis (SWRO) desalination treatment system. Pretreatment would consist of chemical coagulation, microfiltration/ultrafiltration (MF/UF), and dechlorination under normal water quality conditions. When storm events, moderate algae blooms, or red tide events occur, the pretreatment process would also include DAF units to reduce particulate and organic loading to the MF/UF membranes, and reduce potential fouling of the SWRO membranes. These pretreatment processes would remove essentially all solids and many dissolved substances from the seawater prior to SWRO desalination treatment.

Product water quality from the SWRO desalination treatment is of high quality and is expected to meet all California and federal drinking water quality MCLs, as is the case for potable water from both the City and the District (see **Appendix Q**). Testing of product water from the Pilot Test Program Report demonstrated that the proposed desalination project will meet all regulatory drinking water standards and be effective in removing emerging contaminants and algal toxins (see **Appendix D**). A study undertaken as part of the Pilot Test Program Report (**Appendix D**) included simulations of algal toxin and large red tide events. The study concluded that a large red tide event would negligibly impact the operation of the desalination system, and that that there is very little risk of contamination of the reverse osmosis product water during harmful algal bloom events.

Table 5.1-12, Product Water Quality, shows the product water quality for general water quality parameters, salinity parameters, and inorganic constituents compared to regulatory limits (i.e., primary and secondary MCLs) and or other guidance levels (e.g., Action Level, Public Health Goal). Trace organics and indicators of microbial contaminants were also measured in the Pilot Test Program Report, but none were detected. Detected radioactive constituents were at levels below reporting limits, minimum detection limits, and/or the primary MCLs. The potential impact of introducing a new water supply source would be less than significant, because drinking water standards would not be exceeded.

Table 5.1-12. Product Water Quality

Constituent	Unit	Product Water Concentration		Drinking Water Standard/Goals		
		Median	Maximum	Primary MCL[1]	Secondary MCL[1]	Other Guidance
General Parameters						
pH	pH units	6.2	6.6	--	6.5 – 8.5	
Total Alkalinity	mg/L as $CaCO_3$	3.5	7.2	--	--	
Total Hardness	mg/L as $CaCO_3$	5.5	14	--	--	
Color	color units	<3	<3	--	15	--
Odor	TON	<1	<1	--	3	--
TSS	mg/L	<0.11	<0.1	--	--	--
Turbidity	NTU	<0.05	<0.05	5	5	0.1[3]
Salinity Parameters						
TDS	mg/L	160	280	--	500	
Specific Conductance	µS/cm	275	500	--	900	--
Chloride	mg/L	90	150	--	250	
Sodium	mg/L	48	68	--	--	30 – 60[4]
Sulfate	mg/L	<1	<1	--	250	--
Boron[2]	mg/L	0.9	1.2			1[5]
Bromide	mg/L	0.4	0.8			
Inorganic Constituents						
Aluminum	µg/L	<3	<3	1,000	200	600[6]
Antimony	µg/L	<0.005	<0.005	6.0	--	20[6], 0.7[7]
Arsenic	µg/L	<0.005	<0.005	10	--	0.004[6]
Asbestos	MFL	<0.2	<0.2	7.0	--	7[6]
Barium	µg/L	<0.2	<0.2	1,000	--	2,000[6]
Beryllium	µg/L	<0.005	<0.005	4.0	--	1[6]
Cadmium	µg/L	<0.005	<0.005	5.0	--	0.04[6]
Calcium	mg/L	0.3	0.4	--	--	--
Chromium	µg/L	0.06	0.10	50	--	--
Hexavalent Chromium	µg/L	<0.005	0.007	--	--	0.02[6]
Copper	µg/L	<0.005	<0.005	1,300[8]	1,000	300[6]
Cyanide	µg/L	<20	<20	150	--	150[6]
Fluoride	µg/L	0.02	0.03	2,000	2,000	1,000[6]
Iron	µg/L	0.7	1.2	--	300	--

Table 5.1-12. Product Water Quality

Constituent	Unit	Product Water Concentration		Drinking Water Standard/Goals		
		Median	Maximum	Primary MCL[1]	Secondary MCL[1]	Other Guidance
Lead	μg/L	<0.005	<0.005	15[8]	--	0.2[6]
Mercury	μg/L	<0.005	<0.005	2.0	--	1.2[6]
Magnesium	mg/L	1.0	1.2	--	--	--
Manganese	μg/L	0.04	0.06	--	50	500[5]
Nickel	μg/L	0.01	0.03	100	--	12[6]
Nitrate	mg/L as N	0.03	0.05	10	--	10[6]
Nitrite	mg/L as N	<0.2	<0.2	1	--	1[6]
Perchlorate	μg/L	<1.0	<1.0	6.0	--	6[6], 1[7]
Potassium	mg/L	2.2	3.0	--	--	--
Selenium	μg/L	<0.005	<0.005	50	--	30[6]
Silver	μg/L	<0.005	<0.005	--	100	--
Thallium	μg/L	<0.005	<0.005	2.0	--	0.1[6]
Vanadium	μg/L	<0.005	<0.005	--	--	50[5]
Zinc	μg/L	0.3	0.9	--	5000	--

Sources: Appendix D, scwd[2] Final Seawater Reverse Osmosis Desalination Plant Pilot Test Program Report; CDPH, 2010. Drinking Water Notification Levels and Response Levels: An Overview; OEHHA, 2011. All Public Health Goals; USEPA, 2011a. 2011 Edition of the Drinking Water Standards and Health Advisories.

Notes:

1. Most stringent MCL between federal (USEPA) and state (California Department of Public Health [CDPH]) is shown.
2. Although median concentrations of boron meet the CDPH notification level, the maximum concentration is slightly higher. The Pilot Test Program Report included a Boron Evaluation Investigation to research alternatives to improve boron rejection. It was determined that high boron rejection SWRO membranes would enable the resulting product water to meet the boron goal. Consequently, high boron rejection SWRO membranes are included in the project description.
3. General turbidity goal recommended by reverse osmosis membrane manufacturers for open ocean intake source water (Appendix D).
4. USEPA Drinking Water Advisory Level for taste and odor threshold (USEPA, 2011a).
5. CDPH Notification Level (NL) (CDPH, 2010).
6. OEHHA Public Health Goal (PHG) (OEHHA, 2011).
7. OEHHA Draft P (OEHHA, 2011).
8. Action Level (AL). Exceedance of AL in over 10 percent of homes tested triggers treatment for corrosion control.

Acronyms:

'--' = no information
'<' = less than
AL = Action Level
$CaCO_3$ = calcium carbonate
CDPH = County Department of Public Health
MCL = maximum contaminant level
MFL = million fibers per liter
mg/L = milligrams per liter
μg/L = micrograms per liter
μS/cm = microsiemens per centimeter
NTU = nephelometric turbidity units
OEHHA = Office of Environmental Health Hazard Assessment
SWRO = seawater reverse osmosis
TDS = total dissolved solids
TON = threshold odor number
TSS = total suspended solids

Disinfection Byproducts

Many water systems treat their water with a chemical disinfectant to inactivate pathogens that can cause disease. The public health benefits of common disinfection practices are significant and well-recognized; however, disinfection may pose its own risk. Although disinfectants are effective at controlling many harmful microorganisms, they can react with organic and inorganic matter in surface waters and form DBPs, some of which pose long-term health risks when present above certain levels. One of the most complex questions facing water supply professionals is how to reduce risks from disinfectants and DBPs, while providing adequate protection against microbial contaminants.

As described above in **Section 5.1.3**, the USEPA sets national standards for drinking water, and the CDPH has primacy in enforcing USEPA regulations in California. Public water systems are required to monitor and report their levels of various constituents. The USEPA Stage 2 DBP Rule limits exposure to DBPs, specifically TTHM and HAA5, by requiring compliance monitoring.

Similar to more traditional surface water sources, DBPs can be an issue with seawater because seawater contains bromide. The treatment process that removes the salt—SWRO in the case of the proposed project—removes much, but not all, of the bromide. During chlorination, bromide is oxidized to bromine, which can in turn form brominated TTHM and HAA5 when organic precursors are present. See **Section 5.1.3** for definitions and descriptions of these substances.

The Pilot Test Program Report (**Appendix D**) included a DBP Formation Investigation to assess the concentrations of TTHM and HAA5 formed in the product water after chlorination, and to assess if blending the product water with treated water from the Graham Hill Water Treatment Plant would increase TTHM and HAA5 concentrations in the distribution system. The results of the investigation indicated that: (1) SWRO membranes be selected and specified to achieve a bromide goal of 0.5 milligram per liter (mg/l) or less to minimize the impact of bromide on DBP formation; (2) the average chlorine residual of the SWRO permeate (product water) should not exceed that of the distribution system; and (3) water age and blending ratios should be monitored to further ensure no exceedance. As indicated in **Section 4, Table 4-12,** and summarized below, the project includes high boron rejection SWRO membranes that would achieve item #1 above. The compliance monitoring described above and required of all public water systems would achieve items #2 and #3. Therefore, impacts related to exposure to DBPs as a result of the introduction of product water from the proposed project into the distribution system would be less than significant.

Potential Future Expansions

If expansion of the proposed plant and related facilities were pursued in the future, the quality of the product water from an expanded plant would not change. The impact would remain less than significant.

Environmental Design Features

The environmental design feature (**Table 4-12**) of the proposed project related to product water quality includes the following:

- Each SWRO membrane skid or unit will be configured with a hybrid arrangement of high-boron-rejection SWRO membranes and low-energy-consumption SWRO membranes. This hybrid arrangement will provide the optimum balance of boron removal to meet treatment objectives, while minimizing system energy requirements.

Mitigation Measures

None required.