3.3 Water Quality and Sediment

This section of the Environmental Impact Report (EIR) describes the existing water quality within the Eden Landing Phase 2 project area at southern Eden Landing and analyzes whether implementation of the project would cause a substantial adverse effect on water quality. Given that many of the water quality constituents of concern are found in and exchange with sediment, sediment distribution and composition is described here as well. The information presented is based on a review of existing water and sediment quality within the area, and other pertinent federal, state, and local regulations, which are presented in Section 3.3.2, Regulatory Setting. Section 3.3.1, Physical Setting, is included to establish the origin and environmental context of the resources. Using this information as context, an analysis of the water quality-related environmental impacts of the project is presented for each alternative in Section 3.3.3, Environmental Impacts and Mitigation Measures. The program-level mitigation measures described in Chapter 2, Alternatives, would be implemented as part of the project. Therefore, this section only includes additional, project-level mitigation measures as needed.

3.3.1 Physical Setting

Methodology

The development of the baseline conditions, significance criteria, and impact analysis in this section is commensurate to and reliant on the analysis conducted in the 2007 South Bay Salt Pond (SBSP) Restoration Project Final Environmental Impact Statement/Report (2007 Final EIS/R), which was both a programmatic EIS/R and a project-level Phase 1 EIS/R. Information regarding water quality in the San Francisco Bay (or Bay) and the Eden Landing Phase 2 project area was primarily based on data collected by the San Francisco Estuary Institute (SFEI) Regional Monitoring Program (RMP), the California Department of Fish and Wildlife (CDFW), the Alameda County Water District (ACWD), the Alameda County Flood Control and Water Conservation District (ACFCWCD), as well as the Adaptive Management Plan (AMP) special studies and other special studies conducted for the SBSP Restoration Project.

Regional Setting

Surface Water and Sediment Quality

The former salt ponds at Eden Landing are at the interface between the urban environment and the South Bay. The regional setting includes the South Bay, the SBSP Restoration project area, the Eden Landing pond complex, and upland watershed areas. Water quality conditions for mercury and other metals, legacy pollutants, and general water quality conditions (e.g., dissolved oxygen) are discussed in this section. Regional water and sediment quality are also discussed in comparison to water and sediment quality guidelines, criteria, and objectives established by the San Francisco Bay Regional Water Quality Control Board (RWQCB).

Mercury. Mercury occurs naturally in the Bay environment and has been introduced as a contaminant in various chemical forms from a variety of anthropogenic sources. Ambient levels of mercury in Bay sediments are elevated above naturally occurring background levels. Although mercury often resides in forms that are not hazardous, it can be transformed through natural processes into toxic methylmercury.

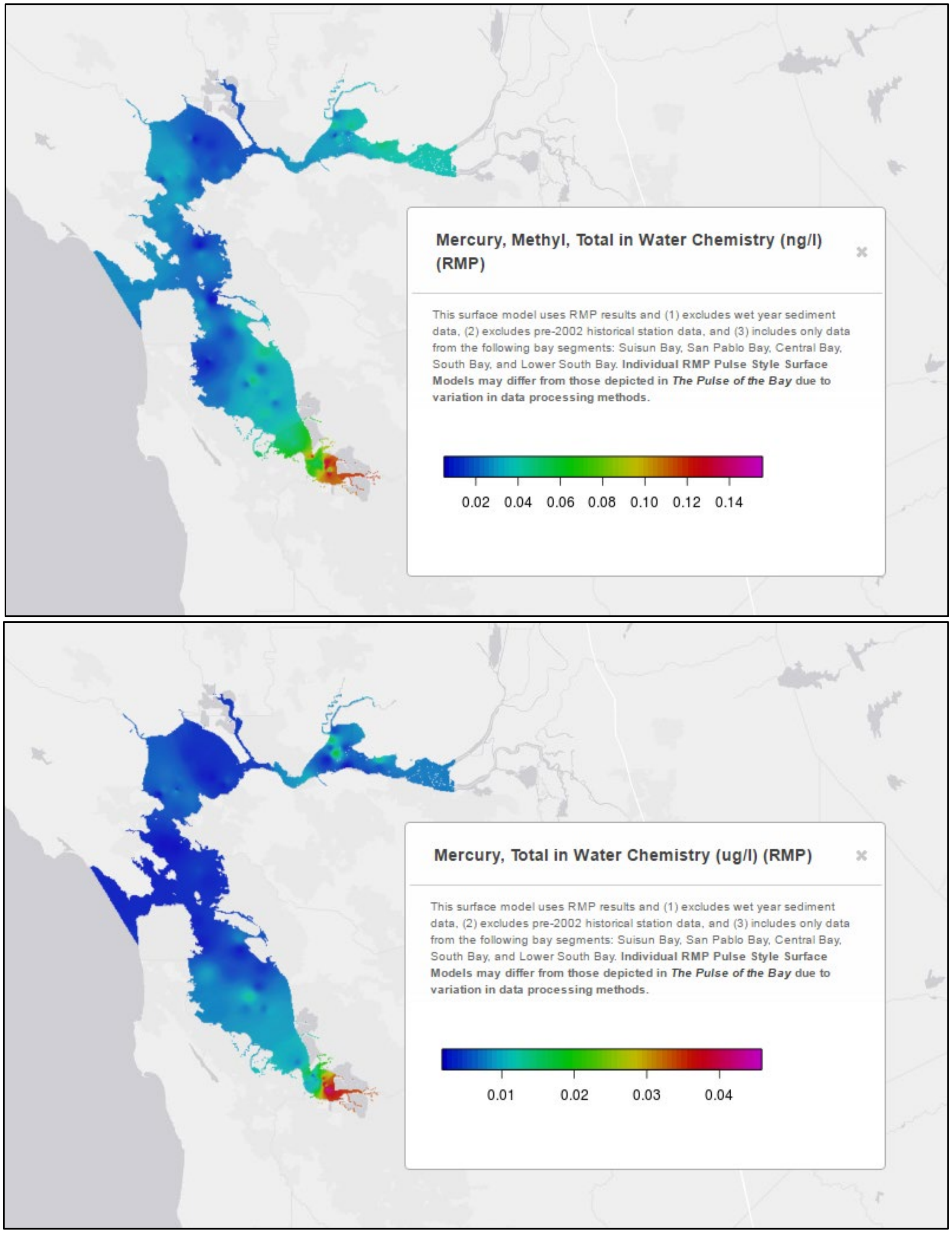
The primary concern with mercury contamination in the Bay is the accumulation of methylmercury in organisms, particularly at the top of aquatic food webs. Methylmercury typically represents only about 1 percent of the total of all forms of mercury in water or sediment, but it is the form that is readily accumulated in the food web and poses a toxicological threat to exposed species (SFEI 2012). Elevated methylmercury levels in fish can result in mercury exposure in humans who consume contaminated fish. Elevated levels of methylmercury can also adversely affect the health and fitness of fish and birds.

Methylmercury is produced in aquatic ecosystems through the methylation of inorganic mercury by microorganisms. Methylmercury has a complex cycle, influenced by many processes that vary in space and time. The rate of methylation is a function of an array of variables, including mercury levels, mercury speciation, oxidation reduction potential, microbial activity, sulfate levels, salinity, pH, dissolved oxygen, dissolved organic carbon, turbidity, solar radiation, and vegetation type. Although the interaction of these variables is not fully understood, wetlands are known to be significant sites of microbial methylation and potentially important sources of methylmercury to aquatic food webs (Benoit et al. 2003; Wiener et al. 2003). Natural accretion processes in salt marshes continually supply fresh layers of mercury-contaminated Bay sediments, which can release mercury in a form that can become biologically available to mercury-methylating bacteria and subsequently bioaccumulate in the food chain. Because of the complex interactions between biological/physical processes, it is difficult to predict mercury concentrations in fish or other aquatic organisms, or birds, based on water or sediment mercury concentrations.

Mercury and methylmercury concentrations in surface waters and sediment have been assessed by regional monitoring activities in the Bay (*e.g.,* RMP) and by monitoring activities conducted for the SBSP Restoration Project. The lower South Bay and the South Bay typically have higher mercury and methylmercury concentrations in Bay waters than other sections of the Bay (see Figure 3.3-1) likely due to historic mining activities in the Guadalupe River watershed. During 2009 to 2015, methylmercury water concentrations in the lower South Bay averaged 0.1 nanogram per liter (ng/L) and concentrations in the South Bay, north of the Dumbarton Bridge, averaged 0.04 ng/L (SFEI 2016). Total mercury concentrations in Bay waters had a similar pattern, with high concentrations in the South Bay (9 ng/L) and highest concentrations in the lower South Bay (24 ng/L). No regulatory guidelines exist for methylmercury concentrations in surface water — regulatory guidelines for methylmercury target fish tissue concentrations.

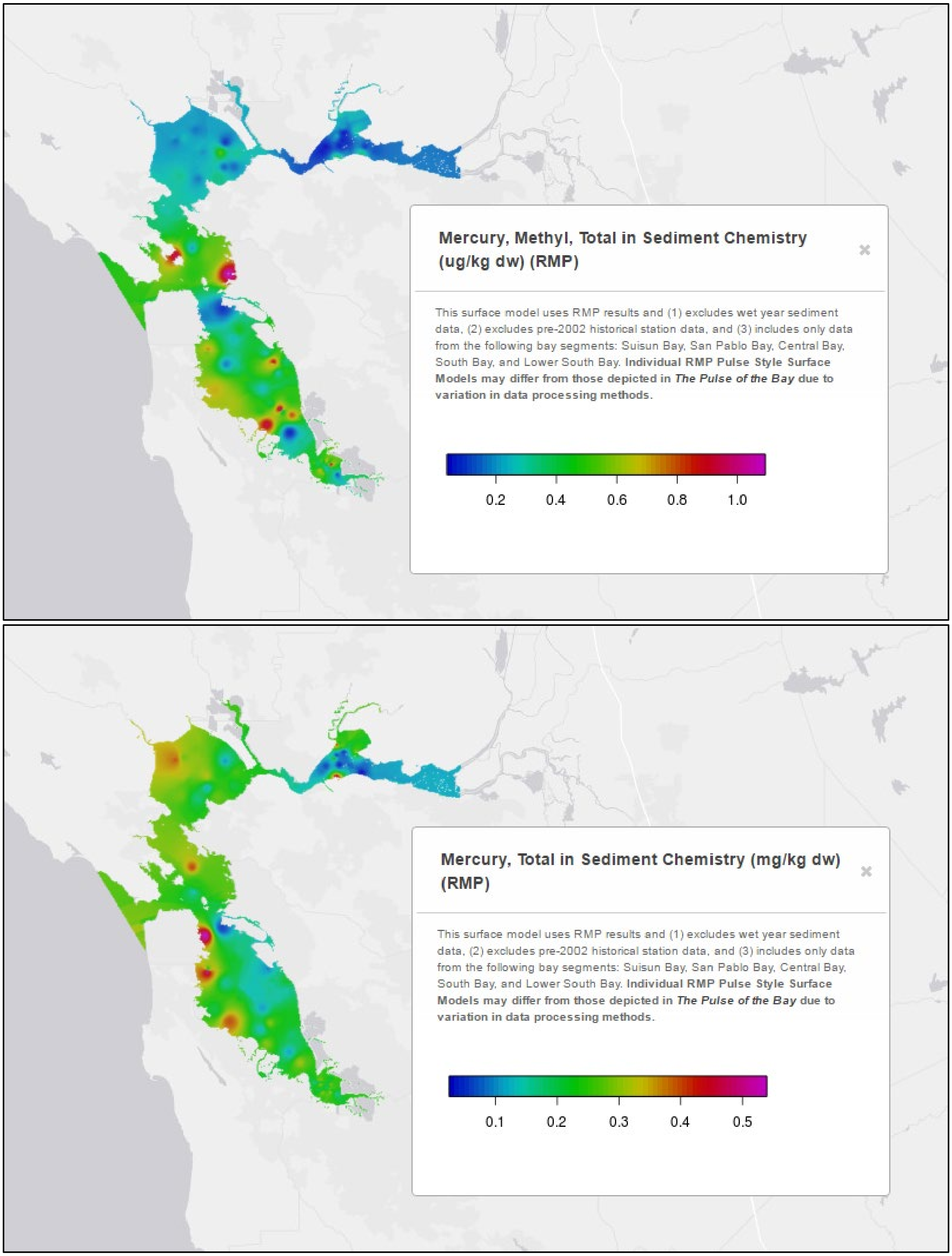
In contrast to the distribution pattern found in water (discussed above), higher concentrations of mercury and methylmercury in sediments are found in several section of the Bay (see Figure 3.3-2). During 2009 to 2015, methylmercury concentrations in sediment were, on average, highest in the Central Bay (0.63 microgram per kilogram [µg/kg]), while mercury concentrations were highest in the lower South Bay (0.27 milligram per kilogram [mg/kg]) (SFEI 2016). Mercury concentrations in Bay sediment do not appear to be increasing or decreasing (SFEI 2015). No regulatory standards exist for methylmercury or mercury concentrations in sediment.

Sediment samples collected in South Bay salt ponds typically contained total mercury concentrations either similar to or slightly greater than ambient mercury concentrations in the Bay (Brown and Caldwell et al. 2005). Preliminary results from monitoring tidal marsh restoration suggest that breaching salt ponds is not causing increases in food web mercury. For example, recent monitoring of marsh restoration projects in the North Bay indicates that opening ponds to tidal action is not leading to increased mercury in the food web. Fish monitoring in the Napa River region in 2012 and 2013 found that mercury concentrations in breached wetlands were not elevated relative to managed ponds and established tidal marshes (SFEI 2015, Robinson et al. 2014).



Source: SFEI, 2016

Figure 3.3-1. Mercury and Methylmercury Concentrations in the Bay



Source: SFEI, 2016

Figure 3.3-2. Mercury and Methylmercury Concentrations in Bay Sediments

Other Metals. Metals are present in the environment due to both natural conditions and anthropogenic influences. Depending on the chemical nature of the metal, ecological risks could result from concentrations elevated above toxic thresholds or bioaccumulation levels.

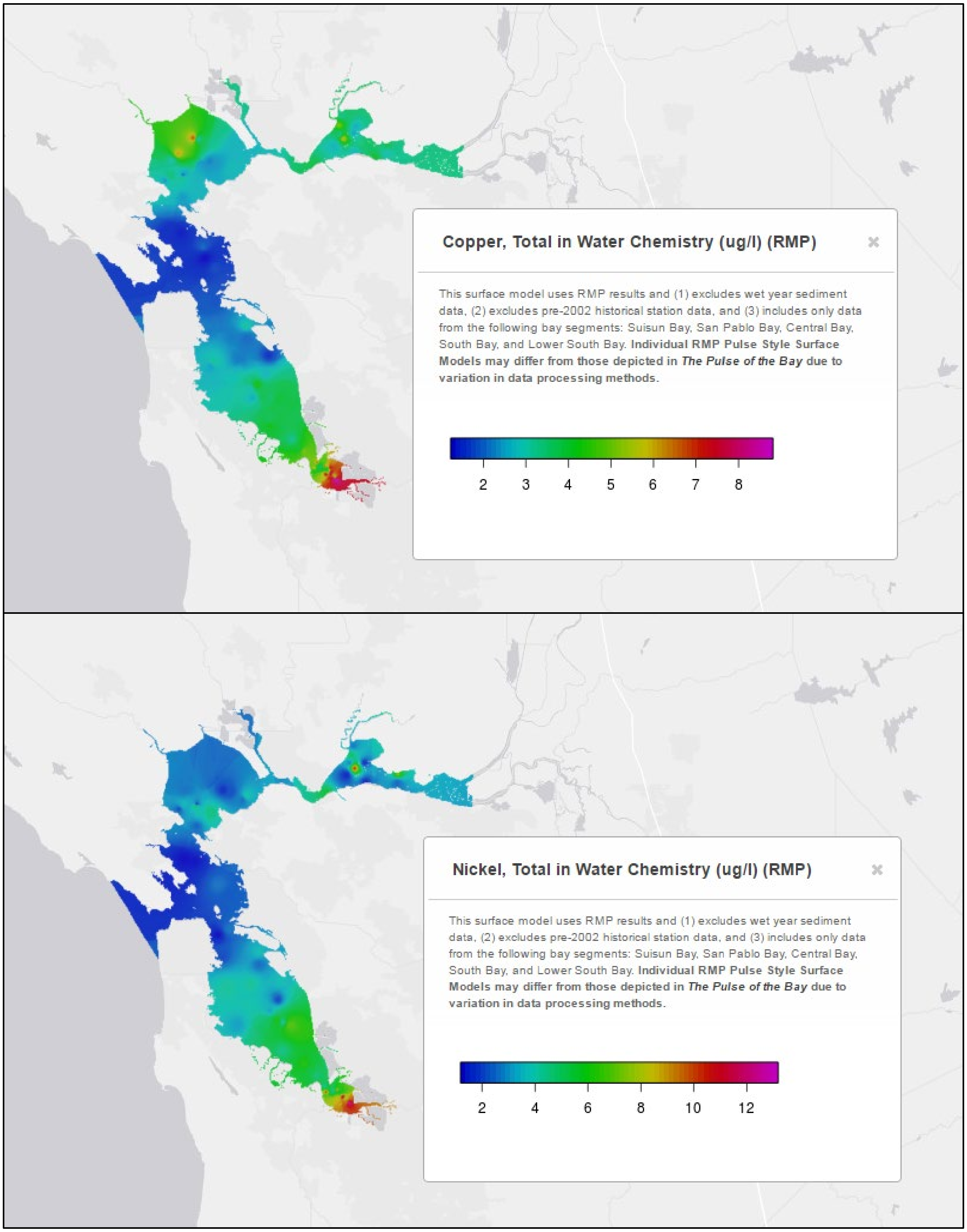
Copper and nickel are of particular concern for the Bay because ambient concentrations of dissolved copper and nickel in Bay waters can approach water quality objectives established in the Water Quality Control Plan for San Francisco Bay (Basin Plan) – 6.9 micrograms per liter (µg/L) and 11.9 µg/L, respectively. Copper and nickel concentrations are shown in Figure 3.3-3. During 2009 to 2015, total copper concentration in Bay waters averaged 5.9 µg/L in the lower South Bay and 3.7 µg/L in the South Bay north of the Dumbarton Bridge, which is greater than the Bay-wide average (3.6 µg/L) (SFEI 2016). Total nickel concentrations averaged 7.9 µg/L in the lower South Bay, and 5.0 µg/L in the South Bay north of the Dumbarton Bridge, which is also greater than the Bay-wide average concentration (4.5 µg/L).

Metals tested in SBSP Restoration Project area waters include arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc; in general, metal concentrations were low. However, dissolved nickel concentrations often exceed the water quality objectives and dissolved lead and dissolved arsenic concentrations have also exceeded their water quality objectives in at least one pond (Brown and Caldwell et al. 2005). South Bay and the SBSP Restoration Project area sediments were also tested for metals, including arsenic, cadmium, chromium, copper, lead, nickel, selenium, silver and zinc, and, in general, these metals were detected at concentrations similar to their respective RWQCB ambient criteria. Within the SBSP Restoration Project area, the spatial distribution of the detected metal concentrations suggests that there is not a localized metals impact.

Organic Chemicals. Bioaccumulative pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and legacy organochlorine pesticides are of general concern in the Bay because concentrations in fish often exceed human-health-based criteria for fish consumption. PCBs are a class of organic chemicals that do not break down quickly in the natural environment and have been found to pose bioaccumulation risks.

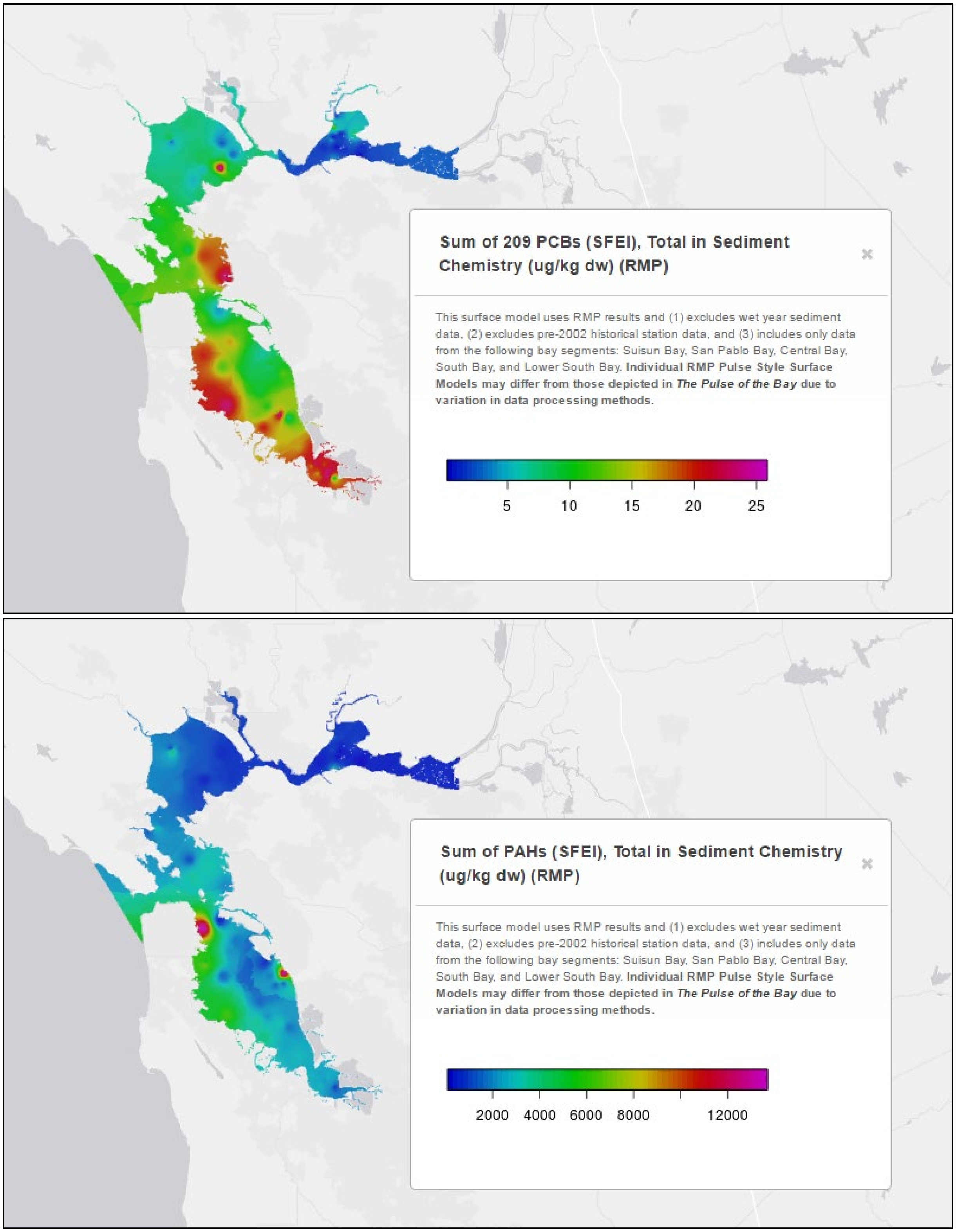
Concern for PCBs in the Bay is primarily due to concentrations in sport fish. PCB concentration in the South Bay consistently exceeded human-health-based criteria for fish consumption (0.17 ng/L), but rarely exceeded saltwater aquatic-life-based criteria (30 ng/L). PCB concentrations in Bay sediments are higher in the southern arm of the Bay (see Figure 3.3-4), likely due to historic and ongoing stormwater runoff from industrial areas and legacy PCB cleanup sites, such as military facilities, in this region (SFEI 2015). The lower South Bay and the South Bay north of the Dumbarton Bridge have PCB concentrations greater than Bay-wide averages (19.7 and 13.9 µg/kg, respectively, as compared to 12.3µg/kg) (SFEI 2016). Many of the highest concentrations have been observed along the shoreline of southwestern Central Bay and western South Bay.

PAHs are known to be environmentally persistent and pose a concern for bioaccumulation. PAH data for the South Bay exceeded human-health-based criteria for fish consumption (8.8 ng/L), but are below the saltwater aquatic-life-based criteria. PAH concentrations in Bay sediments are higher in the southern arm of the Bay (see Figure 3.3-4), likely due to runoff from the extensive paved surfaces in this region (SFEI 2015). The Central Bay has the highest PAH concentration in sediment (3.9 mg/kg), on average, of any Bay segment (SFEI 2016). The South Bay (3.1 mg/kg) and lower South Bay (2.3 mg/kg) also has PAH concentrations higher than the Bay-wide average of 2.2 mg/kg.



Source: SFEI, 2016

Figure 3.3-3. Copper and Nickel Concentrations in the Bay



Source: SFEI, 2016

Figure 3.3-4. PCB and PAH Concentrations in Bay Sediments

Organochlorine pesticides (including chlordanes and dichloro-diphenyl-trichloroethanes [DDTs]) are also environmentally persistent and pose a concern for bioaccumulation. Chlordane and DDT concentrations in South Bay surface waters typically exceed human-health-based criteria. Chlordanes in South Bay sediments are often greater than ambient values and sediment DDTs are similar to or greater than ambient values.

Within the SBSP Restoration Project area, sediments contained either non-detectable concentrations of organic constituents, or concentrations were found below ambient values (United States Fish and Wildlife Service [USFWS] and California Department of Fish and Game [CDFG] 2003). The Initial Stewardship Plan's sampling of the SBSPs focused primarily on the Alviso pond complex, but some samples were collected in both the Eden Landing and the Ravenswood pond complexes.

General Water Quality Conditions. Salinity in the open Bay waters below the Dumbarton Bridge varies with the daily tides and is typically near seawater levels at 28 to 33 parts per thousand (ppt), because the South Bay receives relatively little freshwater inflow except during the wet season, when local stream discharges can cause salinity to decrease to 20 ppt or lower (Schemel et al. 2003; USFWS and CDFG 2003). For more information regarding how hydrodynamics can affect salinity, see Section 3.2, Hydrology, Flood Management, and Infrastructure.

Historical salinity concentrations in the salt ponds varied considerably, ranging from as low as the Bay concentration to brines with salinity concentrations several times that of the Bay. However, these concentrations have been reduced as ponds have been operated for limited circulation.

Dissolved oxygen levels are generally above the water quality objective of 5 milligrams per liter (mg/L) in the open Bay, but frequently below it in some sloughs on the Bay margins (SFEI 2015). Diurnal and/or tidal cycling is particularly important for dissolved oxygen in sloughs and ponds, which is influenced by both circulation and respiration of algae. Algal growth in salt ponds can cause dissolved oxygen and pH levels to vary significantly over the course of a day. These levels vary because during daylight hours, photosynthesis produces oxygen and consumes dissolved carbon dioxide. At night, respiration produces dissolved carbon dioxide and consumes oxygen. Therefore, significant algal growth causes dissolved oxygen and pH levels to peak during the late afternoon and to be at their lowest levels before dawn. Diurnal and/or tidal cycling can also influence salinity, pH, temperature, and dissolved oxygen levels.

Under ideal conditions, photosynthesis generates dissolved oxygen faster than the system can consume it. The resulting dissolved oxygen surplus becomes depleted as respiration continues through the night. Whether or not the surplus that has accumulated throughout the day is sufficient to prevent a hypoxic event depends on a number of factors, the most influential of which being water temperature and daily solar input. Several researchers have linked hypoxic events to relatively high water temperatures during warmer months (Tyler, Brady et al. 2009). Continuous monitoring of dissolved oxygen in a representative pond in the South Bay was conducted as a part of the AMP. The data show low dissolved oxygen in the late morning when the tide is also low or outgoing (Figure 3.3-5).

Low dissolved oxygen levels have been observed in a number of the South Bay salt ponds, including the Eden Landing ponds, notably in the late-summer/early-fall when temperatures, winds and evaporation were highest. High wind and ambient temperature also result in greater evaporation and are of greatest concern during neap tide cycles, when circulation is reduced (CDFW 2015).

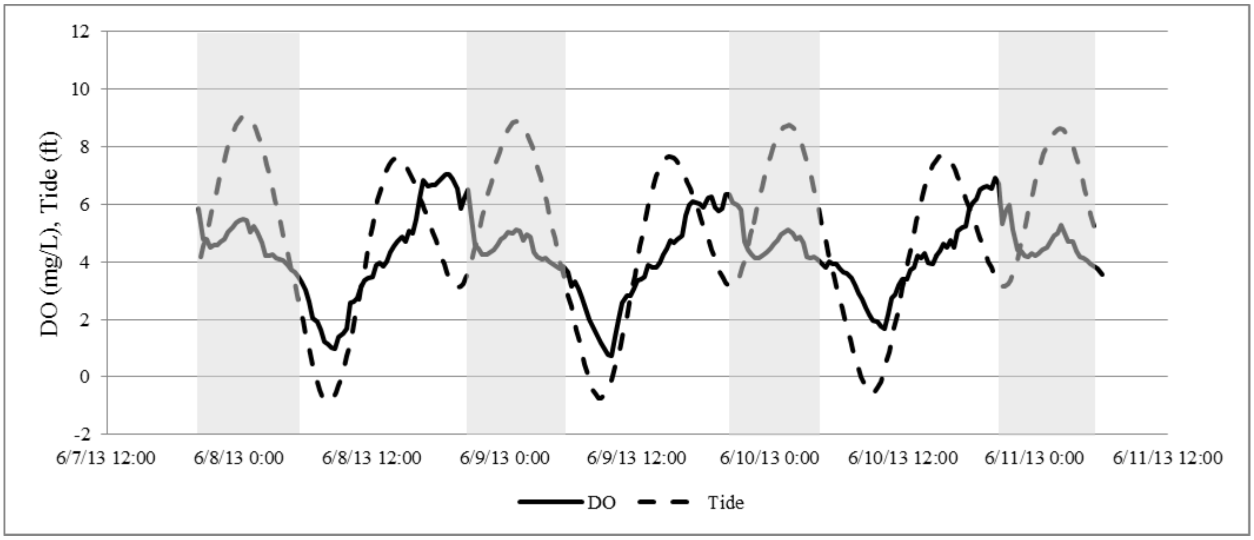


Figure 3.3-5. Time Series (80-hour) Plot of Dissolved Oxygen and Tide Height in Pond A21, 6/7/13 to 6/11/13 Spring Tide, New Moon.

Continuous monitoring data from within former salt ponds show that pH levels can vary significantly and are often above the Basin Plan objective of 8.5. However, receiving water data have also shown that high pH levels from pond discharges are quickly normalized in nearby sloughs and the Bay (RWQCB 2008).

Due to shallow water depths and limited tidal exchange, water temperature in the salt ponds is elevated and varies widely throughout the day. Annual water temperatures within the ponds generally range from 40 to 80 degrees Fahrenheit (°F) and generally track air temperature (RWQCB 2008).

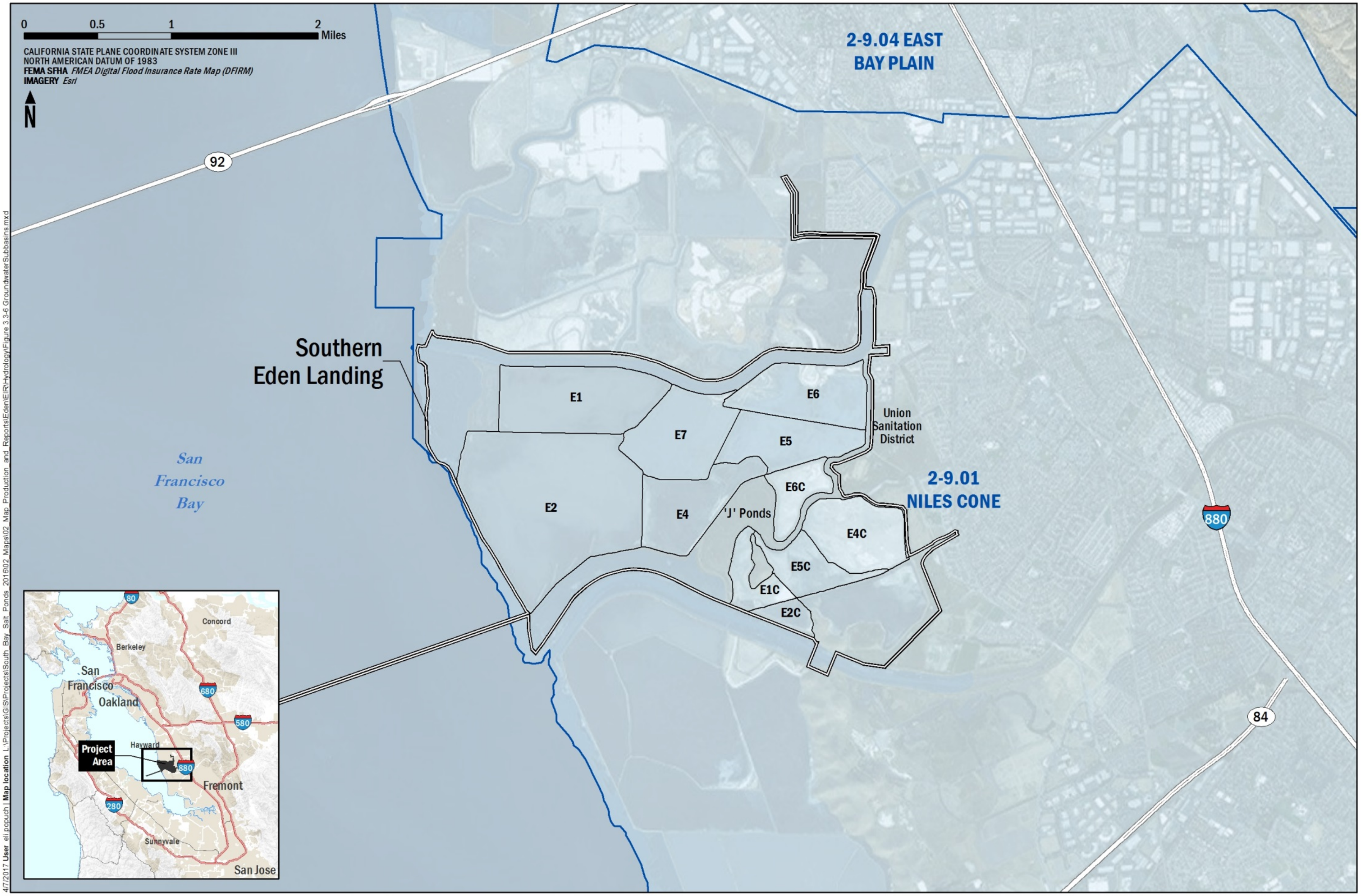
Groundwater

This section characterizes the existing physical setting with respect to groundwater. Groundwater can be affected by surface water conditions through surface water/groundwater interactions.

The Santa Clara Valley groundwater basin underlies the East Bay and the South Bay. The groundwater subbasin located at and near the Eden Landing pond complex is the Niles Cone subbasin (Niles Cone subbasin 2-09.01, or Niles Cone; see Figure 3.3-6).

Groundwater levels have previously been depleted by withdrawing groundwater at rates faster than it recharges naturally. However, groundwater levels have been restored in the past 40 years by regional groundwater management actions, and today, groundwater flow is generally bayward, providing a measure of protection from salinity intrusion.

Holocene Bay muds underlie almost the entire original Bay, including the SBSP Restoration Project area. The Holocene Bay muds are thin at the margins of the Bay, but can be as much as 30 to 50 feet thick beneath the Bay. The Bay mud is relatively impermeable to both infiltration and groundwater flow.



4/7/2017 User eli.popuch | Map location L:\Projects\GIS\Projects\South_Bay_Salt_Ponds_2016\02_Maps\02_Map_Production_and_Reports\Eden\EIR\Hydrology\Figure 3.3-6 GroundwaterSubbasins.mxd

LEGEND

- Groundwater Subbasin
- Eden Landing Phase 2 Project Area
- Southern Eden Landing Ponds

AECOM

South Bay Salt Pond Restoration Project

Figure 3.3-6

Santa Clara Valley Groundwater Subbasins

Groundwater Aquifers. The Niles Cone groundwater basin is an alluvial aquifer system consisting of unconsolidated gravel, sand, silt, and clay. The gravel and sand deposits are the aquifers, and the silt and clay layers form the aquitards. A series of relatively flat lying aquifers are separated by extensive clay aquitards in the Niles Cone below the Hayward Fault. These aquifers include (from shallowest to deepest) the Newark Aquifer, the Centerville Aquifer, the Fremont Aquifer, and the deep aquifers. The Newark Aquifer, an extensive permeable gravel and sand layer, is located between 40 and 140 feet below ground surface. Its thickness ranges from less than 20 feet at the western edge of the basin to more than 140 feet at the Hayward Fault. The Newark Aquifer is overlain by a thick layer of silt and clay called the Newark Aquiclude; layers of sand and silt within the Newark Aquiclude create a shallow water-bearing zone. An extensive thick clay aquitard separates the Newark Aquifer from the Centerville Aquifer. The Centerville Aquifer, the top of which lies at an average depth of 180 to 200 feet below ground surface, overlies a thick clay aquitard, which in turn overlies the Fremont Aquifer, which exists in the interval of 300 to 390 feet below ground surface. The Centerville and Fremont Aquifers are considered to be one combined aquifer (Centerville-Fremont Aquifer) in some parts of the basin, but in areas near the Bay, these two aquifers are isolated from each other a thick layer of silt and clay. The deepest water-bearing units, referred to collectively as the deep aquifers, are present at approximately 400 feet below ground surface and are deeper and separated from the overlying Fremont Aquifer by a regional aquitard (ACWD 2017).

The Newark Aquifer is generally considered to be in communication with the Bay. This is documented by a review of groundwater monitoring data from the Santa Clara Valley Water District (SCVWD) and ACWD that shows water levels are stable and not fluctuating substantially seasonally from pumping, as is typical of deeper wells. According to the California Department of Water Resources (DWR), interconnections between the Bay and the Newark Aquifer in the Niles Cone area may exist due to dredging of the shipping channel in the Dumbarton Bridge area. ACWD and SCVWD groundwater monitoring data that indicate high salinity in shallow wells also support the existing hydraulic interconnection between the Bay and shallow groundwater.

The relatively thin Holocene Bay muds at the margins of the Bay do not currently isolate the shallow Newark aquifer between the current outboard and inboard salt pond levees. However, Bay mud and fine-grained alluvial deposits do generally create differences in hydraulic head that are evidence of hydraulic separation. The thick alluvial deposits of silts and clays appear to isolate the Newark aquifer from surface infiltration. Upland of the inboard salt pond levees, the fine-grained alluvial deposits alone cause confinement of groundwater and a measure of protection for the water supply aquifers (the water-bearing zones). Some areas west of I-880 have a perched shallow water-bearing zone associated with the Newark Aquiclude that overlies the Newark Aquifer.

Groundwater Recharge. The ACWD provides retail water service primarily to the cities of Fremont, Newark, and Union City. For over 100 years, ACWD has managed the groundwater of the Niles Cone through programs that protect and improve water supplies. ACWD is identified in the Sustainable Groundwater Management Act as one of 15 agencies that were created by statute to manage groundwater: ACWD's groundwater statutory service area includes the cities of Fremont, Union City, and Newark, and the southern portion of the City of Hayward. The Niles Cone is a coastal aquifer system hydraulically connected to the Bay and is subject to saltwater intrusion when groundwater levels fall below mean sea level (msl) in the Newark Aquifer. The saltwater intrusion was first noticed in the 1920's and occurred due to historical pumping that created chronic overdraft of the basin. Since 1962, when supplemental water was first purchased from the State Water Project, ACWD has been engaged in a continuous water replenishment/recharge program in order to sustainably manage the quality and quantity of water in the Niles Cone while balancing and protecting environmental resources. ACWD's recharge efforts, in addition to ACWD's use of imported water, have caused water levels to slowly rise above sea level. As a result, water levels in the Newark Aquifer were restored above sea level in 1972 and the hydraulic gradient water returned to its natural bayward direction in the Newark Aquifer.

Although there has been substantial improvement in the groundwater basin, a considerable volume of saline water still remains in the aquifers. As a result, in1974, ACWD initiated its Aquifer Reclamation Program (ARP) to restore water quality in the groundwater basin by removing the saline water trapped in the aquifer system. ACWD has a total of eleven ARP wells. Brackish groundwater from five of the ARP wells is used as the source water for ACWD's Newark Desalination Facility, with any excess pumped brackish groundwater discharged to the Bay through flood control channels under an existing National Pollutant Discharge Elimination System (NPDES) permit. The quality of groundwater in the basin is improved as recharge water replaces the pumped brackish groundwater.

Groundwater Quality. The shallow Newark Aquifer near the Eden Landing pond complex has high salinity due to its hydraulic connection with the Bay and the historical salt ponds. Although monitoring data are not available for most of the salt pond area, ACWD monitors salinity in several shallow wells located near the eastern edge of the salt ponds between State Route (SR) 92 and the Alameda Creek Flood Control Channel (ACFCC). Historically, pumping impacts in the Niles Cone have resulted in significant cross-communication between the shallow (Newark), intermediate (Centerville-Fremont), and deeper aquifer (350 to 600 feet below ground surface) as documented in older reports on saltwater intrusion in the area. Data indicate that salinities up to 3.9 ppt are present beneath the City of Newark (approximately 10 percent of the concentration found in seawater), but salinity in the Eden Landing pond complex in the Centerville-Fremont Aquifer is generally lower (below 0.5 ppt salinity).

ACWD has two ARP wells near the southern Eden Landing ponds, immediately adjacent to, and east of, Ponds E5 and E4C. The brackish ARP wells have chloride concentrations ranging from 2,000 to 12,000 mg/L from water in the Newark Aquifer (approximately 10 to 60 percent of the concentration found in seawater) (ACWD 2017).

Project Setting

Eden Landing Phase 2

This section describes the physical setting of the Eden Landing Phase 2 area, which includes the entire southern half of the Eden Landing pond complex. A small portion of the South Bay is also included in the Eden Landing Phase 2 area. The water quality of the South Bay is described above in more detail in the Regional Setting.

The southern Eden Landing ponds are operated as either circulation ponds or as seasonal ponds. Circulation ponds have limited (sometimes muted tidal) inflows and outflows through water control structures. Seasonal ponds are typically allowed to dry out in the summer through seepage and evaporation, but water levels can also be actively managed through periodic inflows.

Bay Ponds

The Bay Ponds (Ponds E1, E2, E4, and E7) are in the western portion of southern Eden Landing. The Bay Ponds are operated for circulation during summer and winter. In October, higher salinity water from

Ponds E6 and E5 is mixed in Pond E4 and discharged through a water control structure in Pond E2. Salinity in the discharge is typically maintained below 44 ppt (CDFW 2016).

CDFW monitored instantaneous salinity, dissolved oxygen, and pH concentrations during periods of continuous circulation in 2007 (from late May to early November).[1] Mean daily salinity ranged from about 36.8 to 53.8 ppt. Daily mean pH values in Pond E2 ranged from 8.15 to 8.61 during that same period (CDFG 2008).

Low dissolved oxygen levels in the salt ponds are common and dissolved oxygen levels can fall below 3.3 mg/L at the point of discharge (i.e., at the Pond E2 water control structure). Low dissolved oxygen conditions occur during extended periods of high air and water temperatures and appear to be indicative of natural dissolved oxygen variations found in sloughs or lagoon systems. Dissolved oxygen levels below the Basin Plan standard of 5.0 mg/L have been observed in sloughs not affected by any pond discharge, and this concentration is considered to be within the natural range of variation in functional slough and lagoon environments of the South Bay. Correspondingly, low dissolved oxygen water of Bay origin has been observed at pond intake locations, such as Pond E1 (CDFW 2016).

During periods of continuous circulation in 2007, daily mean dissolved oxygen concentrations in Pond E2 were measured below 5.0 mg/L approximately 21 percent of the time, and of those days, daily mean dissolved oxygen was below 3.3 mg/L on one day. Adaptive management actions were triggered when the tenth percentile value of the instantaneous dissolved oxygen concentrations, when calculated on a calendar weekly basis, fell below 3.3 mg/L. During periods of continuous circulation in 2007, calendar-weekly tenth percentile dissolved oxygen values were below the 3.3 mg/L trigger approximately 67 percent of the time (CDFG 2008).

Several operational strategies have been implemented in the Eden Landing ponds to address low dissolved oxygen conditions in pond discharges. CDFW evaluated management practices where discharge structures were closed during periods of time when dissolved oxygen concentrations were expected to be below the 3.3 mg/L trigger. Because dissolved oxygen concentrations have a strong diurnal pattern, ceasing discharge from approximately 10 pm to 10 am avoided most periods of low dissolved oxygen; however, daily discharge timing was not found to be practicable over a sustained period due to staff and budget constraints. Instead, weekly discharge timing was used to minimize discharge of low dissolved oxygen water. Weekly discharge timing involved discharging greater volumes of water when daytime tides were lowest, resulting in more volume discharged during the day when dissolved oxygen concentrations were higher. CDFW found that substantially reducing discharge volume for an extended duration did not improve pond water quality because of the lower turnover and higher residence time resulting in less circulation and less mixing of in-pond waters. Reducing residence time of water in the ponds appeared to improve overall dissolved oxygen levels. Muted tidal intake and discharge provided for the greatest circulation and mixing in the ponds (CDFG 2008).

Total mercury and methylmercury concentrations were analyzed in sediment cores collected from 2003 to 2005 in the Bay Ponds. Total mercury concentrations ranged from 0.08 to 0.145 mg/kg (USGS 2005), which is less than average sediment concentrations in the Bay. Methylmercury concentrations in sediment

[1] Continuous monitoring data was collected by instruments deployed in Eden Landing ponds from 2004 to 2009. The most recent continuous monitoring data for the southern Eden Landing ponds is from 2007.

ranged from 0.256 to 2.17 µg/kg, which, with the exception of one sample collected in Pond E7, is greater than average sediment concentrations in the Bay.

Inland Ponds

The Inland Ponds (Ponds E5, E6, and E6C) are in the eastern portion of southern Eden Landing. The Inland Ponds typically have salinity values between 30 and 120 ppt, with higher salinities in the summer, when these ponds either are managed for open water conditions without circulation or are allowed to draw down. Lower salinities are found in the winter, when circulation is used for dilution. Salinity higher than 135 ppt is not desired because gypsum would precipitate in the ponds (CDFW 2016).

Total mercury and methylmercury concentrations were analyzed in sediment cores collected in January 2005 from the Inland Ponds. Total mercury concentrations ranged from 0.066 to 0.091 mg/kg (USGS 2005), which is less than average sediment concentrations in the Bay. Methylmercury concentrations ranged from 0.325 to 0.819 µg/kg, which, with the exception of one sample collected in Pond E6C, is greater than average sediment concentrations in the Bay.

Southern Ponds

The Southern Ponds (Ponds E1C, E2C, E4C, and E5C; referred to as the C-Ponds in some documents) are in the southeastern portion of southern Eden Landing. Ponds E5C, E4C and E1C are seasonal or batch ponds characterized by salinities ranging from low (35 to 40 ppt) to medium (40 to 80 ppt), with increased salinity in the summer due to evaporation. Pond salinity is decreased with additional inflows from Pond E2C.

Pond E2C operates with muted tidal circulation at the intake/discharge water control structure along ACFCC. Intake and discharge volumes are approximately 25 percent of the total volume in Ponds E2C and CP3C (CDFW 2016). Periodically water from Ponds E5C, E4C and E1C is mixed with water from Pond E2C prior to discharge.

CDFW monitored instantaneous salinity, dissolved oxygen, and pH concentrations during periods of continuous circulation in 2007 (from late May to early November). Daily mean salinity values at Pond E2C ranged between 27 and 49 ppt during this period. Daily mean pH values in Pond E2C ranged from 7.9 to 8.9 during the same period (CDFG 2008). While pH levels were above 8.5 for some periods within the pond, the pH in E2C receiving waters did not appear to be elevated during monitoring and there did not appear to be any adverse effect from brief periods of elevated pH.

During periods of continuous circulation in 2007, daily mean dissolved oxygen in Pond E2C was measured below 5.0 mg/L approximately 34 percent of the time, and of those days, daily mean dissolved oxygen was below 3.3 mg/L 8 percent of the time. During the same time period, 68 percent of the time calendar-weekly tenth percentile “trigger” values were below 3.3 mg/L (CDFG 2008).

Total mercury and methylmercury concentrations were analyzed in sediment cores collected in January 2005 from the Southern Ponds. Total mercury concentrations ranged from 0.054 to 0.161 mg/kg (USGS 2005), which is less than average sediment concentrations in the Bay. Methylmercury concentrations ranged from 0.413 to 1.79 µg/kg, which is greater than average concentrations in the Bay.

3.3.2 Regulatory Setting

Regulatory Authorities and Enabling Legislation

Federal and state agencies are authorized to ensure adequate surface water, sediment, and groundwater quality with respect to potential restoration impacts. The agencies, their enabling legislation, and their roles in establishing and implementing policies are described below.

The United States Environmental Protection Agency (USEPA) carries out the mandates set forth in federal Clean Water Act (CWA). The CWA requires that waters of the United States be protected by adopting and implementing a program of water quality standards. Water quality standards consist of defined beneficial uses of water and numeric or narrative criteria to protect those beneficial uses. The USEPA is authorized to delegate its authority to state agencies. In situations where a state fails to carry out the mandates of the CWA by enacting policies and regulations, the USEPA is authorized to promulgate federal regulations by which the state must abide. This federal-state relationship is the basis for USEPA's promulgation of the California Toxics Rule (CTR), which establishes numeric criteria for toxic pollutants.

In California, the State Water Resources Control Board (SWRCB) is the lead agency with delegated authority to implement the CWA. The SWRCB's authority is enabled by California's Porter-Cologne Water Quality Control Act (Porter-Cologne). The SWRCB is responsible for implementing statewide water quality standards programs. The SWRCB has delegated many duties to the nine Regional Water Quality Control Boards (RWQCBs), which are defined by distinct hydrologic regions. The SBSP Project Restoration area is within the jurisdiction of the San Francisco Bay RWQCB. The RWQCB is responsible for developing the water quality standards that are adopted in the Basin Plan after following the scientific and public review procedures set forth in Porter-Cologne Sections 13240–13245. The Basin Plan lists the beneficial uses of water and the water quality objectives [2] to protect those beneficial uses. The beneficial uses and water quality objectives are described below under "Existing Water Quality Standards Programs."

The Basin Plan also includes a plan of implementation that guides the RWQCB in carrying out its duties. Those duties include:

- Issuing NPDES permits, as authorized by CWA Section 402, to regulate discharges to navigable waters of the United States and their tributaries;
- Issuing state waste discharge requirements, as authorized by Porter-Cologne Sections 13260–13274, to regulate discharges to land and other discharges not requiring federal NPDES permits;
- Issuing water quality certifications as authorized by CWA Section 401 to projects with a federal component that may affect water quality, such as dredging and filling activities that require a CWA Section 404 certification from the United States Army Corps of Engineers;
- Issuing conditioned waivers of waste discharge requirements, as authorized by Porter-Cologne Section 13269, for discharges and other activities that are not considered to threaten the beneficial uses of waters;

[2] The distinction between objectives and criteria is important, as federal criteria are viewed as guidelines to be considered, whereas state-adopted objectives have force of law.

- Requiring monitoring data from permitted dischargers, as authorized by Porter-Cologne Sections 13225-c and 13267; and
- Conducting enforcement, as authorized by Porter-Cologne Sections 13300–13365, against parties that fail to apply for necessary permits or comply with existing permits and requirements.

The RWQCB also participates in many regional collaborative programs to monitor water quality and implement projects to protect and improve water quality. Examples of such collaborations include the San Francisco Bay RMP, the San Francisco Bay Clean Estuary Partnership, and the SWRCB's Surface Waters Ambient Monitoring Program. The RWQCB is also responsible for administering water-quality-related state grant programs.

There are two publicly owned water districts responsible for groundwater resources in the overall SBSP Restoration Project area: ACWD and SCVWD. Both of these agencies carry out their missions by operating groundwater recharge facilities, conducting monitoring at guard wells, ensuring that unused wells are properly abandoned, and encouraging water conservation by municipalities in their respective service areas. However, the SCVWD has no authority or responsibility in the Eden Landing portion of the SBSP Restoration Project area.

The responsibility for protection of stormwater quality is assigned to the countywide stormwater programs in the SBSP Restoration Project area. The Alameda Countywide Clean Water Program represents 15 municipal government co-permittees, the ACFCWCD, and the Zone 7 Water Agency. This stormwater program implements stormwater quality management plans with regulatory oversight from the RWQCB. The stormwater quality management plans describe a coordinated program of monitoring, watershed assessment, inspections, illicit discharge control, construction controls, municipal maintenance, and public education.

In the northern portion of the South Bay, the East Bay Dischargers Authority operates a deep-water outfall in the Bay that discharges secondary-treated effluent from four different municipal treatment plants. Also, the Union Sanitary District (USD) operates a treatment wetland to the north of the southern Eden Landing ponds. All of these municipal dischargers operate under NPDES permits issued and enforced by the RWQCB. There are numerous ongoing cleanup operations in the region that extract groundwater, remove pollutants (primarily fuels and organic solvents), and discharge the treated groundwater under coverage by the NPDES general permit for groundwater discharge administered by the RWQCB. Periodic spills of toxic materials (e.g., brines, chemicals) are subject to enforcement by the RWQCB.

The California Department of Toxic Substances Control (DTSC) regulates hazardous wastes. It derives its authority from Title 22 of the California Code of Regulations. Any areas known to have hazardous wastes in need of remediation near the SBSP Restoration Project area would be listed in the DTSC Envirostar database (http://www.envirostor.dtsc.ca.gov/public/).

Existing Water Quality Standards Programs

San Francisco Bay Region Basin Plan and California Toxic Rule

The existing water quality standards program implemented by the RWQCB is defined in the Basin Plan. The Basin Plan lists numerous beneficial uses of water that apply in the project and regional setting. The most relevant beneficial uses are ocean, commercial, and sport fishing; estuarine habitat; industrial service supply; fish migration; navigation; preservation of rare and endangered species; contact and non-contact recreation; shellfish harvesting; spawning; reproduction and/or early development of fish; and wildlife habitat. Designated groundwater beneficial uses include municipal and domestic supply, agricultural supply, and industrial service supply.

To protect these beneficial uses, the Basin Plan lists both narrative and numeric water quality objectives for surface and groundwater. Narrative objectives provide general guidance to avoid adverse water quality impacts. Narrative objectives relevant to this analysis include salinity, sediment (i.e., total suspended solids [TSS]), sulfides, toxicity, biostimulatory substances, bioaccumulation, and population and community ecology. Those narrative objectives are listed in Table 3.3-1. Numeric water quality criteria included in the Basin Plan establish objectives for trace metals, dissolved oxygen, turbidity, temperature, pH, bacteriological pathogens, and un-ionized ammonia. Numeric water quality criteria are summarized in Tables 3.3-2 through 3.3-4.

The Basin Plan specifies site-specific objectives for copper in the Bay and site-specific objectives for nickel in the South Bay, as shown in Table 3.3-2. The implementation plan establishes copper control measures to prevent increases in ambient dissolved copper concentrations, and metal translators are used to provide a ratio for total to dissolved copper and nickel concentrations for segments of the Bay.

Table 3.3-1 Basin Plan Narrative Water Quality Objectives Relevant to this Analysis

PARAMETER	NARRATIVE OBJECTIVE
Toxicity	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. Detrimental responses include, but are not limited to, decreased growth rate and decreased reproductive success of resident or indicator species. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median of less than 90 percent survival, or less than 70 percent survival, 10 percent of the time, of test organisms in a 96-hour static or continuous flow test. There shall be no chronic toxicity in ambient waters. Chronic toxicity is a detrimental biological effect on growth rate, reproduction, fertilization success, larval development, population abundance, community composition, or any other relevant measure of the health of an organism, population, or community. The health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ substantially from those for the same waters in areas unaffected by controllable water quality factors.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases from normal background light penetration or turbidity relatable to waste discharge shall not be greater than 10 percent in areas where natural turbidity is greater than 50 NTU [nephelometric turbidity units].
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses. Controllable water quality factors shall not cause a detrimental increase in the concentrations of toxic pollutants in sediments or aquatic life.
Suspended material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Settleable solids	Waters shall not contain substances in concentrations that result in the deposition of material that cause nuisance or adversely affect beneficial uses.
Floating material	Waters shall not contain floating material, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.

Table 3.3-1 Basin Plan Narrative Water Quality Objectives Relevant to this Analysis

PARAMETER	NARRATIVE OBJECTIVE
Sulfides	All water shall be free from dissolved sulfide concentrations above natural background levels. Sulfide occurs in Bay muds as a result of bacterial action on organic matter in an anaerobic environment. Concentrations of only a few hundredths of a milligram per liter can cause a noticeable odor or be toxic to aquatic life. Violation of the sulfide objective will reflect violation of dissolved oxygen objectives as sulfides cannot exist to a significant degree in an oxygenated environment.
Oil and grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water, that cause nuisance, or that otherwise adversely affect beneficial uses.
Biostimulatory substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll-a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll-a or phytoplankton blooms may indicate exceedance of this objective and require investigation.
Bioaccumulation	Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.
Population and community ecology	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota. In addition, the health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ substantially from those for the same waters in areas unaffected by controllable water quality factors.
Salinity	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat.
pH	The pH shall not be depressed below 6.5 nor raised above 8.5. This encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 units in normal ambient pH levels.
Dissolved oxygen	For all tidal waters, the following objectives shall apply in the Bay: Downstream of Carquinez Bridge 5.0 mg/L minimum Upstream of Carquinez Bridge 7.0 mg/L minimum For nontidal waters, the following objectives shall apply to waters designated as: Cold water habitat 7.0 mg/L minimum Warm water habitat 5.0 mg/L minimum The median dissolved oxygen concentration for any three consecutive months shall not be less than 80 percent of the dissolved oxygen content at saturation. Dissolved oxygen is a general index of the state of the health of receiving waters. Although minimum concentrations of 5 mg/L and 7 mg/L are frequently used as objectives to protect fish life, higher concentrations are generally desirable to protect sensitive aquatic forms. In areas unaffected by waste discharges, a level of about 85 percent of oxygen saturation exists. A three-month median objective of 80 percent of oxygen saturation allows for some degradation from this level, but still requires a consistently high oxygen content in the receiving water.

Table 3.3-2 Basin Plan Surface Water Objectives for Metals (µg/L)

PARAMETER	WATER QUALITY OBJECTIVE SOUTH OF HAYWARD SHOALS		WATER QUALITY OBJECTIVE NORTH OF HAYWARD SHOALS	
	CONTINUOUS (4-DAY AVERAGE)	MAXIMUM (1-HOUR AVERAGE)	CONTINUOUS (4-DAY AVERAGE)	MAXIMUM (1-HOUR AVERAGE)
Arsenic	36	69	36	69
Cadmium	9.3	42	9.3	42
Chromium	50	1100	50	1100
Copper	6.9	10.8	6.0	9.4
Lead	8.1	210	8.1	210
Nickel	11.9 [1]	62.4 [1]	8.2	74
Selenium (total recoverable)	5	20	5	20
Silver	—	1.9	—	1.9
Zinc	81	90	81	90

Notes:
[1] Lower South Bay (south of Dumbarton Bridge)
Hayward Shoals = Little Coyote Point to the Oakland Airport

Table 3.3-3 Other Numeric Surface Water Criteria

PARAMETER	EVALUATION CRITERIA
Dissolved oxygen	5 mg/L[1, 5]
Mercury (total, including organic compounds)	0.051 µg/L,[2, 6] see also Table 3.3-4, below
PCBs	0.17 ng/L[2, 7]
PAHs	15.0 µg/L[1, 8]
Dioxins and furans	0.014 picogram (pg)/L[3, 9]
Chlordanes	2.2 ng/L[2]
DDTs	0.59 ng/L[2]
TPH-diesel	200 mg/L[4]

Notes:
RWQCB, Water Quality Control Plan, San Francisco Bay Basin. Surface waters greater than 10 ppt salinity.
40 CFR Part 131.38 (California Toxics Rule [CTR]), May 18, 2000.
National Recommended Water Quality Criteria – Correction, USEPA, April 1999.
USEPA Multi-Sector Permit Benchmark Values.
Dissolved oxygen = water quality objective for tidal waters downstream of Carquinez Bridge.
Mercury = 0.051 µg/L, 30-day average (CTR). Applies south of Dumbarton Bridge.
PCB = 30-day average, water quality criteria value for human health for consumption of organisms, 10-6 risk.
PAH = water quality objective for 24-hour averaged level, salinity over 10 ppt.
Dioxins and furans = water quality criteria value for human health for consumption of organisms, 10-6 risk.

Table 3.3-4 Numeric Criteria for Mercury

LOCATION	BASIN PLAN WATER QUALITY OBJECTIVE FOR TOTAL MERCURY
San Francisco Bay	2.1 µg/L, 1-hour average in water
	0.2 mg/kg in fish, wet weight, trophic level 3 and 4 (larger fish which humans consume)
	0.03 mg/kg in fish, wet weight, 3 to 5 cm in length (smaller fish which wildlife consumes)

Notes:
The Basin Plan objectives listed above are applicable in marine waters— those in which the salinity is equal to or greater than 10 ppt, 95 percent of the time. For waters in which the salinity is between fresh and marine, that is between 1 and 10 ppt, the applicable objectives are the more stringent of the freshwater or marine objectives. For mercury, the marine objectives are more stringent.

The Basin Plan includes numeric water quality objectives for mercury concentrations in fish. Although water quality criteria and objectives are traditionally expressed as mass of pollutant per unit mass of water (e.g., µg/L), the Clean Water Act enables expression of criteria and objectives in alternative units. For bioaccumulative pollutants such as mercury, guidance by USEPA requires states to develop numeric criteria or objectives that are based on pollutant concentrations in fish tissue and then implement the tissue-based criteria or objectives by translating the tissue-based values to water-based and sediment-based metrics. The fish tissue targets for the Bay mercury are 0.2 mg/kg wet weight for trophic level 3 and trophic level 4 fish, and 0.03 mg/kg wet weight for smaller fish (3 to 5 centimeters in length) that are the prey of wildlife. These objectives are summarized in Table 3.3-4. To achieve the human health and wildlife targets and to attain water quality standards, the Bay-wide suspended sediment mercury concentration target was set at 0.2 mg/kg mercury in dry sediment. (This does not translate directly to a numeric guideline for sediments within the SBSP Restoration Project area. Rather, the evaluation of impacts considers the potential of a project activity to raise or lower the average concentration of mercury in the Bay near where the activity takes place.)

The Basin Plan includes a fish tissue concentration target for PCBs in the Bay that is used to protect beneficial uses. A sediment concentration goal of 1 µg/kg PCBs is used to support the fish tissue target of 10 µg/kg PCBs, wet weight. Currently, ambient Bay sediments are approximately ten-fold higher than the sediment concentration goal of 1 µg/kg. The impact of project activities on the concentration of PCBs in ambient Bay sediments has been evaluated with reference to this goal and other environmental indicators of ecological risk, as appropriate.

In addition to the Basin Plan, the CTR specifies numeric aquatic life criteria for 23 priority toxic pollutants and numeric human health criteria for 57 priority toxic pollutants. These criteria apply to all inland surface waters and enclosed bays and estuaries of the San Francisco Bay region, although Tables 3-3 and 3-4 of the Basin Plan include numeric water quality objectives for certain of these priority toxic pollutants that supersede the CTR criteria (except south of the Dumbarton Bridge). Human health criteria are further identified as for consumption of “water and organisms” and “organisms only.” These objectives are applied with consideration to the beneficial use of the waterbody.

Applicable water quality objectives are affected by both geography and salinity. Numeric and narrative objectives from the Basin Plan and most CTR numeric criteria apply to Bay waters. The Basin Plan and the CTR also establish different numeric objectives for freshwater and saltwater. Freshwater is defined as having salinity less than 1 ppt more than 95 percent of the time, whereas saltwater is defined as having salinity greater than 10 ppt more than 95 percent of the time. Conditions between these two endpoints define estuarine waters, in which case the more stringent (lower) of either the freshwater or the saltwater objectives apply.

SWRCB Sediment Quality Objectives

The SWRCB sediment quality objectives are based on chemical concentrations, bioassays, and benthic community conditions. The *Water Quality Control Plan for Enclosed Bays and Estuaries,* Part 1, *Sediment Quality* (SWRCB 2009) contains the following narrative water quality objective: “pollutants in sediments shall not be present in quantities that, alone or in combination, are toxic to benthic communities in bays and estuaries of California.” This Water Quality Control Plan became effective in August 2009, supersedes other narrative sediment quality objectives, and establishes new sediment quality objectives and related implementation provisions for specifically defined sediments in most bays and estuaries.

LTMS Guidelines

There is guidance for sediment assessment in the Beneficial Reuse of Dredged Materials: Sediment Screening and Testing Guidelines (RWQCB 2000) consistent with the Long-Term Management Strategy (LTMS) Management Plan (USACE, USEPA, BCDC, and RWQCB 2001). The LTMS Guidelines define statistically determined San Francisco Bay ambient sediment concentrations and ecological thresholds (Table 3.3-5). The ambient concentrations are established through previous sampling efforts around “unimpacted” areas of San Francisco Bay. The ecological thresholds defined in the LTMS Guidelines are the Effects Range–Low (ER-L) and the Effects Range–Median (ER-M) established by the National Oceanic and Atmospheric Administration (NOAA). ER-Ls represent the concentration below which adverse biological effects are unlikely, and ER-Ms represent the concentrations above which adverse biological effects are likely.

The LTMS Guidelines are not a set of regulatory objectives, although project-specific permits from the RWQCB often require that dredge materials placed in areas with direct contact with Bay waters meet the recommended screening guidelines for wetland surface materials. In general, the RWQCB considers sediment with concentrations less than ambient levels to be acceptable for wetland cover material (the upper 3 feet), and sediment with concentrations less than ER-Ms are acceptable for wetland foundation material (greater than 3 feet below current or designed ground surface elevations). (However, for PCBs the ER-L is used as a guideline for cover material.) For some chemical constituents, the ambient value is greater than the respective ER-L. However, the RWQCB acknowledges that it is not practical to regulate to concentrations “cleaner” than ambient conditions.

Table 3.3-5 LTMS Sediment Guidance

CHEMICAL CONSTITUENT	SAN FRANCISCO BAY AMBIENT SEDIMENT CONCENTRATIONS (MG/KG)	EFFECTS RANGE-LOW, ER-L (MG/KG)	EFFECTS RANGE-MEDIAN, ER-M (MG/KG)	SCREENING GUIDELINES FOR WETLAND COVER MATERIAL (MG/KG)
Metals				
Arsenic	15.3	8.2	70	15.3
Cadmium	0.33	1.2	9.60	0.33
Chromium	112	81	370	112
Copper	68.1	34	270	68.1
Lead	43.2	46.7	218	43.2
Mercury	0.43	0.15	0.71	0.43
Nickel	112	20.9	51.6	112
Selenium	0.64	-	-	0.64
Silver	0.58	1	3.7	0.58
Zinc	158	150	410	158
Pesticides				
Aldrin	0.0011	-	-	-
Dieldrin	0.00044	0.000715 [1]	0.0043 [2]	0.00072
p,p'-DDD	-	0.00122 [1]	0.00781 [2]	-
p,p'-DDE	-	0.00220	0.027	-
p,p'-DDT	-	0.00119 [1]	0.00477 [2]	-
Endrin	0.00078	-	-	-
Hexachlorobenzene	0.000485	-	-	0.000485
Sum of chlordanes (SFEI list)	0.0011	0.00226 [1]	0.00479 [2]	0.0023
Sum of DDTs (SFEI list)	0.007	0.00158	0.0461	0.007
Sum of HCH (SFEI list)	0.00078	-	-	0.00078
Sum of PCBs (SFEI list)	0.0216	0.0227	0.18	0.0227
PAHs				
1-Methylnaphthalene	0.0121	-	-	0.0121
1-Methylphenanthrene	0.0317	-	-	0.0317
2,3,5-Trimethylnaphthalene	0.0098	-	-	0.0098
2,6-Dimethylnaphthalene	0.0121	-	-	0.0121
2-Methylnaphthalene	0.0194	0.07	0.67	0.0194
2-Methylphenanthrene	0.0266	-	-	-
Acenaphthene	0.0317	0.016	0.5	0.026
Acenaphthylene	0.0266	0.044	0.64	0.088
Anthracene	0.088	0.0853	1.1	0.088
Benz(a)anthracene	0.244	0.261	1.6	0.412
Benzo(a)pyrene	0.412	0.43	1.6	0.371
Benzo(b)fluoranthene	0.371	-	-	0.371
Benzo(e)pyrene	0.294	-	-	0.294
Benzo(g,h,i)perylene	0.310	-	-	0.310

Table 3.3-5 LTMS Sediment Guidance

CHEMICAL CONSTITUENT	SAN FRANCISCO BAY AMBIENT SEDIMENT CONCENTRATIONS (MG/KG)	EFFECTS RANGE-LOW, ER-L (MG/KG)	EFFECTS RANGE-MEDIAN, ER-M (MG/KG)	SCREENING GUIDELINES FOR WETLAND COVER MATERIAL (MG/KG)
Benzo(k)fluoranthene	0.258	-	-	0.258
Biphenyl	0.0129	-	-	0.0129
Chrysene	0.289	0.384	2.8	0.289
Dibenz(a,h)anthracene	0.0327	0.0634	0.26	0.0327
Fluoranthene	0.514	0.6	5.1	0.514
Fluorene	0.0253	0.019	0.54	0.0253
Indeno(1,2,3-c,d)pyrene	0.382	-	-	0.382
Naphthalene	0.0558	0.16	2.1	0.0558
Perylene	0.145	-	-	0.145
Phenanthrene	0.237	0.24	1.5	0.237
Pyrene	0.665	0.665	2.6	0.665
Sum of HPAHs (SFEI list)	3.060	1.7	9.6	3.06
Sum of LPAHs (SFEI list)	0.434	0.552	3.16	0.434
Sum of PAHs (SFEI list)	3.390	4.022	44.792	3.39

Notes:

[1] Threshold Effects Level, as established by the Florida Department of Environmental Protection (FDEP); no ER-L was established.

[2] Probable Effects Level, as established by the FDEP; no ER-M was established.

Waste Discharge Requirements

The RWQCB has issued waste discharge requirements to the USFWS and the CDFW for discharges from the SBSPs and for ongoing maintenance activities. Water Quality Order No. R2-2004-0018 was issued in conjunction with actions taken under the Initial Stewardship Plan and Water Quality Order No. R2-2008-0078, as revised by R2-2012-0014, was issued for Phase 1 actions (RWQCB 2006, 2008, 2012). These requirements permit discharge from certain ponds under an initial release scenario where high salinities discharged from certain ponds may impact beneficial uses in the short term, but impacted areas are expected to fully recover within 1 year. The initial release refers to the time expected to substantially empty salt ponds of their current contents. These requirements also permit subsequent discharge from these ponds as waters from the South Bay are taken into pond systems and then discharged more-or-less continuously (continuous circulation). For the continuous circulation period, the pond systems are required to be managed to ensure beneficial uses remain protected.

The main parameters of concern initially identified by the RWQCB include salinity, metals, dissolved oxygen, pH, and temperature. Subsequent permits also identify mercury, nutrients, and algae. Discharge limitations include numeric criteria for salinity during the initial discharge and during continuous circulation, dissolved oxygen, pH, and temperature. (Salinity is used as an indicator parameter for the concentrations of metals in the salt ponds – concentrations of metals were considered to not impact Bay waters if the salinity of the discharge was limited to 44 ppt.) Water Quality Order No. R2-2008-0078 also specifies receiving water limitations at the contour line for mean lower-low water level (i.e., 0 foot elevation, North American Vertical Datum of 1988 [NAVD88]) for dissolved oxygen, dissolved sulfate, pH, ammonia, nutrients, and turbidity. The order also acknowledges that ponds and sloughs have variable dissolved oxygen levels and often are below the 5.0 mg/L objective due to algal activity.

As indicated in the SBSP waste discharge requirements, the RWQCB expects that the SBSP Restoration Project would create net environmental benefits with respect to water quality and beneficial uses. The RWQCB indicates that restoring tidal wetland functions to former salt ponds would improve water quality in the South Bay estuary on a spatially significant scale with large contiguous habitat to maximize transitional habitat (ecotones) and minimize non-native vegetation, if appropriate management efforts are taken to control non-native species. Marsh systems that are tidally connected to the estuary improve water quality by filtering and fixing pollutants in addition to protecting beneficial uses by providing nursery habitat and protection from predation for native fish species, significant biological productivity to the estuarine system, and habitat for rare and endangered species. Successful restoration would also provide shallow-water habitat for migrating shorebirds and foraging and nesting islands for birds. Operating former salt ponds as managed ponds is considered by the RWQCB to be a transitional phase between salt-making and tidal marsh restoration. This transitional pond management phase for most of the former salt ponds would benefit the environment in the near term by providing shallow open water habitat for shorebirds, thus avoiding the consequences of operating them as seasonal ponds. In addition to habitat and water quality benefits, tidal marsh restoration would also help protect communities from floods, storms, and sea level rise.

Emerging Programs of Water Quality Standards

Emerging programs that may result in new water quality or sediment quality criteria include:

- The RWQCB is working with the SWRCB, the Southern California Coastal Water Research Program, and SFEI to develop nutrient numeric endpoints for the Bay to address nutrient over-enrichment (eutrophication) in state waters. The Draft Scientific Plan for implementing the San Francisco Bay Nutrient Management Strategy was submitted to the SWRCB in March 2016, which describes the studies needed to inform major management decisions.
- Trash could be listed as an impairing pollutant in many urban creeks, including Alameda Creek, during the lifetime of this project. Measures to reduce trash would likely be implemented through the Municipal Regional Permit for stormwater; if these do not succeed, a trash Total Maximum Daily Load (TMDL) is a potential next regulatory step.
- The San Francisco Bay Beaches Bacteria TMDL and Basin Plan amendment has recently been adopted by the RWQCB (April 2016), and is currently being reviewed by the SWRCB for approval. This TMDL establishes a target condition for water contact recreation at San Francisco Bay beaches.

New objectives resulting from these programs are considered in the evaluation of impacts.

3.3.3 Environmental Impacts and Mitigation Measures

Overview

The potential to exceed the thresholds of significance for each impact is evaluated and summarized below. Impact evaluations for the Action Alternatives are assessed based on the existing conditions and the anticipated future conditions that would occur under the No Action Alternative. In this case, the No

Action Alternative represents no change from current management direction, practices, or level of management intensity provided in the AMP and CDFW's pond operations plan. Under each potential impact, the likelihood of occurrence and the potential for mitigation are discussed. If there is considerable uncertainty about the likelihood of occurrence, the information needed to reduce the uncertainty is described.

Significance Criteria

For the purposes of this EIR, the project is considered to have adverse impacts on water quality or groundwater resources if it would:

- Violate water quality standards or otherwise substantially degrade water quality; or
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge.

For the purpose of this impact assessment, the thresholds of significance are applied to changes from baseline conditions that result from factors within the control of the project proponents. Ambient water quality in the Bay itself, though discussed in the impact sections, is considered outside the control of the project proponents.

Water Quality

Thresholds of significance are used to define indicators of significant environmental impacts. In general, thresholds should be objective and based on existing standards (see Tables 3.3-1 through 3.3-5). Some potential impacts have also been identified as "staircase issues" for the AMP. The "restoration staircase" was a concept developed for the SBSP Restoration Project at its program-level and was included in the 2007 Final EIS/R. Staircase issues are areas of uncertainty for which it is difficult to predict specific outcomes based on the available data and current understandings of the system. The staircase issues are being addressed through the AMP, which includes monitoring to measure and track actual outcomes of management and restoration actions, together with predefined triggers designed to detect adverse outcomes early on, before they reach levels of significance. Corrective actions can thus be developed and implemented before the thresholds of significance are reached. If monitoring indicates that no adverse impacts are occurring, then the planned restoration can continue along the staircase to the next step.

For water quality impacts, the staircase issues are

- Changes in algal composition leading to nuisance algal blooms;
- Algal blooms leading to low dissolved oxygen levels;
- Increased mercury methylation and bioaccumulation; and
- Mobilization and transport of mercury-contaminated sediments and other pollutants.

Triggers for adaptive management actions are typically established well below the thresholds of significance to ensure that the thresholds of significance are not exceeded.

Threshold for Changes in Algal Composition and Abundance

Project activities that lead to unacceptable increases in algal abundance would be deemed to have significant impacts if the RWQCB narrative water quality objective for biostimulatory substances is violated:

> Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses. Changes in chlorophyll-a and associated phytoplankton communities follow complex dynamics that are sometimes associated with a discharge of biostimulatory substances. Irregular and extreme levels of chlorophyll-a or phytoplankton blooms may indicate exceedance of this objective and require investigation.

Concerns over nuisance algal blooms apply to both free-floating phytoplankton and attached macrophytes. In the Bay, where, nutrients are not limiting for algal growth, the biostimulatory substance could be sunlight, in which case the project activity that could potentially promote aquatic growth is localized reduction in suspended load outside a breached levee due to a net loss of suspended load inside the accreting marsh area.

The key indicator that a threshold of significant impact has been exceeded is if algal growth cause nuisance or adversely affect beneficial uses. A key difference between the regional setting (the Bay) and the Eden Landing Phase 2 project setting (managed ponds and restored tidal wetlands) is the baseline with respect to nuisance and protection of beneficial uses. In the regional setting, baseline levels of chlorophyll-a and the expected seasonal variations are well known because of regional monitoring programs. Likewise, dissolved oxygen levels in the open Bay typically meet the Basin Plan water quality objective of 5 mg/L. In contrast, the Bay fringe areas (i.e., former salt ponds, tidal marshes, and sloughs) that make up much of the project setting are known to have higher algal productivity and lower dissolved oxygen levels than in the open Bay. High algal productivity and lower dissolved oxygen levels are common to ponds, wetlands, and sloughs, and do not necessarily indicate degraded or impaired habitat.

Project activities that lead to unacceptable increases in algal composition would be deemed to have significant impacts if the RWQCB narrative water quality objective for population and community ecology is violated:

> All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce significant alterations in population or community ecology or receiving water biota. In addition, the health and life history characteristics of aquatic organisms in waters affected by controllable water quality factors shall not differ substantially from those for the same waters in areas unaffected by controllable water quality factors.

The narrative objective is helpful because it recognizes the interactive effect of toxicants on changes in community structure. For example, some species of algae (e.g., diatoms) are more resistant to free ionic copper than others (e.g., blue-green algae), and this difference can exert a significant effect on algal community structure. Establishing the narrative objective as a threshold ensures that adaptive management actions would address the interactive effects of biostimulation and other controllable water quality factors that can alter algal composition. The complexity of defining thresholds and baselines for algal abundance and composition is one reason this issue is being handled as a staircase issue. The narrative objectives cited above are sufficient as thresholds for the purposes of this analysis.

Threshold for Localized, Seasonal Low Dissolved Oxygen Levels

The threshold for low dissolved oxygen levels is established by the Basin Plan water quality objective for dissolved oxygen (see Table 3.3-1). Low dissolved oxygen levels can cause mortality in aquatic and benthic organisms (Impact 3.3-2, below), increased mercury methylation rates (Impact 3.3-3, below), and increased rates of disease such as avian botulism. In the Bay, low dissolved oxygen levels correspond to 5 mg/L dissolved oxygen or less for tidal waters, although the objective acknowledges that attaining 80 percent oxygen saturation as a 3-month median is satisfactory for protection of beneficial uses. In the Eden Landing Phase 2 project setting (managed ponds and restored tidal wetlands), the threshold for significance would vary depending on the habitat type. For open, fully tidal waters, the threshold is the same as for the regional setting—dissolved oxygen levels greater than 5 mg/L or at least 80 percent saturation as a 3 month median. But waters that are subject to muted or constrained tidal action (e.g., the managed ponds) function differently because they are managed primarily for wildlife habitat (avian species use). Restricted circulation often results in low dissolved oxygen levels. Therefore, for this analysis, low dissolved oxygen levels alone are not considered a threshold for managed ponds. Rather, the threshold for significant impacts is low dissolved oxygen levels and at least one of the following negative impacts of low dissolved oxygen: mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates (see discussion of methylmercury, below).

This impact is also considered a staircase issue. To avoid exceeding thresholds of significant impact, the AMP defines triggers and associated adaptive management actions to prevent an impact from occurring.

Increased Methylmercury Production, Bioaccumulation, and Mobilization and Transport of Mercury-Contaminated Sediments

The project would have significant impacts to both the regional setting and the project setting if project actions resulted in water quality conditions that exceed the tissue-based mercury water quality objectives in the Basin Plan, as summarized in Table 3.3-4. The Bay Mercury TMDL also discusses a bird egg monitoring target that is also considered during evaluation of impacts. The bird egg monitoring target is a concentration of less than 0.5 mg/kg mercury for bird eggs (wet weight). This concentration is the lowest observable effect level for reproductive impairment in the endangered least tern but is applied to all bird eggs. In addition, the narrative water quality objective for bioaccumulation is considered to be a threshold for significant impacts:

> Many pollutants can accumulate on particles, in sediment, or bioaccumulate in fish and other aquatic organisms. Controllable water quality factors shall not cause a detrimental increase in concentrations of toxic substances found in bottom sediments or aquatic life. Effects on aquatic organisms, wildlife, and human health will be considered.

Establishing this narrative objective as a threshold of significant impacts clarifies that the main concern over mercury is methylmercury, because methylmercury is the primary mercury form that bioaccumulates.

In the regional setting, the threshold for significant impacts for total mercury concentrations in sediments is based, in part, on the suspended sediment mercury target established in the Basin Plan. The Basin Plan includes a target for mercury in suspended sediments of 0.2 mg/kg, computed as an annual median. It is important to recognize that the Bay is currently over this target, which is in part why a TMDL for mercury is being implemented. Project activities that release sediments to the Bay with a median mercury concentration exceeding ambient conditions (and this target value) would be deemed to have significant impacts. The threshold for impacts to managed ponds and restored tidal wetlands for total mercury in sediments is based on the ER-M for mercury (0.7 mg/kg), from the LTMS Guidelines for the beneficial re-use of dredged and sediments (see Table 3.3-5). Project activities that would involve or result in sediments within the SBSP Restoration Project area that exceed this guideline (such as import of dredge material with mercury concentrations about the ER-M thresholds) would be deemed to have significant impacts. Low oxygen conditions are known to increase the risk of methylmercury production. Therefore, more sensitive thresholds for mercury concentrations in sediment could be considered for areas prone to low dissolved oxygen levels to stay below the threshold defined by the narrative objective for bioaccumulation.

Methylmercury bioaccumulation is identified as a staircase issue. The AMP is framed to avoid exceedance of thresholds by developing triggers for adaptive management actions. Triggers are based on methylmercury concentrations in water and sediments, net methylmercury production rates, and mercury concentrations in sentinel species in comparison to levels prior to restoration. Site-specific food web modeling and other tools have also been developed as part of the AMP. Because of the complexity of the biogeochemical processes affecting the conversion of mercury to methylmercury and its accumulation in the food chain, the impacts of mercury mobilization and transport and increased methylmercury production and bioaccumulation are addressed by the AMP.

Mobilization and Transport of Other Contaminants

For all other contaminants, the thresholds for significant impacts are the water quality objectives for the Bay established in the Basin Plan. Project activities that would cause an exceedance of these water quality objectives are deemed to have significant impacts. For pollutants of concern in sediments, the LTMS Sediment Guidance (Table 3.3-5) is also considered. A project activity would be considered to have significant impacts if it causes a detrimental increase in constituent concentrations above ambient conditions or above the ER-M. Some metals, such as nickel, have concentrations that are naturally higher than the ER-M.

Groundwater Quality

The threshold for an impact to groundwater quality is a substantial increase in the potential for salinity intrusion from the Bay into deep potable aquifers. This increase would be indicated by a project-related increase in salinity or total dissolved solids (TDS) at existing regional monitoring wells protecting water supplies that exceeds the narrative objective for salinity or the numeric objective for TDS or violates the state’s anti-degradation policy by unreasonably degrading the quality of high-quality water. The water quality objective for TDS in municipal water supplies is 500 mg/L.

Program-Level Evaluation Summary

The determination was made in the 2007 Final EIS/R that Programmatic Alternative A (the No Action Alternative) would result in a potentially significant impact and that the Action Alternatives would result in a less-than-significant impact for the following metrics:

- Changes in algal abundance and composition, which could in turn degrade water quality by lowering dissolved oxygen and/or promoting the growth of nuisance species;

- Potential to cause localized, seasonally low dissolved oxygen levels as a result of algal blooms, increased microbial activity, or increased residence time of water;
- Potential to mobilize, transport, and deposit mercury-contaminated sediments, leading to exceedance of numeric water quality objectives, TMDL allocations, and sediment quality guidelines for total mercury; and
- Potential increase in net methylmercury production and bioaccumulation in the food web.

The potential to cause seawater intrusion of regional groundwater sources was also considered potentially significant under No Action conditions, but less than significant in the Action Alternatives, one of which was selected for program-level implementation.

Under Programmatic Alternative A (No Action), it was determined that the lack of monitoring triggers and commitments to take adaptive management actions could lead to potentially significant changes in water quality. Under Programmatic Alternatives B and C, the conceptual designs of the overall alternatives in addition to the implementation of the AMP would reduce uncertainties, adverse water quality conditions, and adverse conditions associated with unintentional levee breaches. At the program level, the decision was made to select Programmatic Alternative C, the Tidal Habitat Emphasis, and implement Phase 1 actions.

Project-Level Evaluation

Phase 2 Impact 3.3-1: Degradation of water quality due to changes in algal abundance or composition.

Eutrophication, the process in which water bodies receive excess nutrients that stimulate excessive plant growth, is a potential concern in both the regional setting (the Bay) and the Phase 2 project settings (managed ponds and restored tidal wetlands). The conceptual model for coastal eutrophication emphasizes both direct and indirect factors that lead to changes in algal abundance and composition. These factors include water transparency, distribution and abundance of larger plants, nutrient ratios and their effect on algal assemblages, chemical transformations in sediment, the life cycle of bottom-dwelling and free-swimming invertebrates, and responses to toxic pollutants and other stressors (Cloern 2001). Changes to algal abundance and composition could cause nuisances and harm in aquatic ecosystems, including the red tides caused by dinoflagellates; paralytic shellfish poisoning caused by diatoms; and mats of blue-green algae that are unsightly, cause odors, and lead to depressed dissolved oxygen levels when they decay.

The potential for changes in algal abundance and composition depends on a number of factors, including:

- Availability of limiting nutrients. The additional input of nutrients that otherwise limit algae production can stimulate algal growth, although there are other attenuating factors. Bay waters typically have high nutrient concentrations. Although the Bay has shown resistance to some of the classic symptoms of nutrient over-enrichment, this is due, in part, to Bay waters generally being light limited.
- Water transparency. Increased water transparency can stimulate plankton growth where light is the limiting factor, rather than nutrients. Bay waters are generally light limited, however, the limiting factor within restored tidal wetlands and managed ponds is not known.

- Hydraulic residence time. Within a managed pond or tidal marsh, the growth of free-floating algae is balanced by removal due to seasonal releases, for ponds, or tidal flushing, for marshes.
- Composition of zooplankton grazers. The amount of grazing organisms present and their food preference exerts a direct effect on algal community structure.
- Concentrations of biologically available metals that are toxic to algae. Different species of algae have different tolerances for metal toxins, such as copper. Metal toxicity is regulated by the amount of metal available for uptake by algae.

Each of these direct factors is dependent on a number of indirect factors. For example, nutrient concentrations are affected by both external sources and internal cycling at the sediment-water interface. Hydraulic residence time can change as water depths decrease because of increased pond bottom elevations due to accretion. Water transparency decreases as suspended sediment concentrations increase, so wind shelter that creates quiescent areas can lead to increased light penetration inside restored tidal wetlands and managed ponds. Accretional areas that trap sediments within the ponds can decrease turbidity in areas adjacent to breached levees. Light penetration can be decreased by algal blooms, especially macrophytic algae. The composition of zooplankton grazer populations responds to changes both in the available food and the intensity of predation from higher organisms. The amount of biologically available metals, such as copper, present in the water column can shift in response to not only changes in metal concentrations but also the amounts of complexing agents present (e.g., dissolved organic matter) that reduce metal availability for uptake by algae. The intricacy of interactive effects between direct and indirect factors makes prediction of the exact response to project alternatives difficult, which is why effects are managed adaptively.

The AMP would address the uncertainties regarding the relationship between project activities and thresholds for significant impacts to algal abundance and composition by monitoring chlorophyll, growth rates, species composition, benthic habitat quality, benthic invertebrate communities, and sediment dissolved oxygen and oxidation-reduction (redox) profiles, as appropriate and when necessary. Should project activities cause adverse changes to water quality, adaptive management measures would be implemented to reduce potential impacts (e.g., manipulating hydraulic residence time or altering the depths of managed ponds and restored tidal marshes).

The baseline conditions are different for the analysis in this EIR than in the 2007 Final EIS/R. In the 2007 Final EIS/R, the Programmatic No Action Alternative assumed not doing the program-level project also meant that the AMP would not be implemented. A program-level Action Alternative (Alternative C) was selected and is being implemented; that alternative included the AMP. Therefore, for the purposes of this analysis, the assumption now is that the landowners will continue to implement the AMP measures that maintain water quality. For this reason, some of the Phase 2 project-level significance determinations for the No Action Alternative are different in this EIR analysis than in the 2007 Final EIS/R.

Alternative Eden A (No Action). Under Alternative Eden A (No Action), no new activities would be implemented as part of Eden Landing Phase 2. The southern Eden Landing ponds would continue to be managed through the activities described in the AMP, in accordance with current CDFW practices. These ponds are currently operated as seasonal ponds, batch ponds, or for limited directional circulation. Accretion rates in the ponds are minor due to the limited circulation. Residence times in the ponds are relatively long, and risk factors for algal abundance are high. Large algal blooms have been noted in the

Eden Landing ponds for several years and subsequent pond management changes require several days to several weeks to result in observable changes in water quality conditions, habitat quality, and use (CDFW 2015).

Managed pond operations would not change, and therefore algal abundance is expected to be similar to existing conditions (a substantial increase in algal abundance beyond what is found under existing conditions is not expected). Monitoring and implementation of adaptive management measures would be used to address harmful changes in algal species composition. Although algal abundance is high, this condition already exists and Alternative Eden A would not worsen this condition. Therefore, impacts would be less than significant.

Alternative Eden A Level of Significance: Less than Significant

Alternative Eden B. Alternative Eden B includes raising pond bottom elevations through the import of dredge material during the construction phase of the project. Dredge material or upland fill material would be used to build habitat transition zones. Upland fill material would also be used for other restoration, flood risk management, and recreational components. The dredge material would be deposited into the ponds in a slurry, and sediments would have the opportunity to settle. Once solids have settled in the ponds, excess water would be decanted and discharged into the Bay. Sediments are generally expected to remain in place when levees are breached and tidal flows are introduced to the ponds – areas near the external levee breaches would likely scour, but sediments deposited within the deep interior of the ponds are expected to remain intact. If sediments are not cohesive or do not have the opportunity to consolidate prior to breaching, additional sediment is expected to scour from the ponds with the initial outgoing tides. This sediment would likely remain in the South Bay, move back and forth through the breached levees and control structures with the tides, and over time, be reworked and redeposited in the ponds or nearby mudflats.

Alternative Eden B would increase tidal flows in the Bay, Inland, and Southern Ponds by breaching levees in the Bay and Inland Ponds and by adding water control structures and improving circulation in the Southern Ponds. Levees along the northern margins of Ponds E1 and E6 would be breached to OAC and the levee on the southern edge of Pond E2 would be breached to the ACFCWCD marsh, which in turn would be connected to the ACFCC via a water control structure. Portions of the outer levees around the Bay Ponds would be lowered to mean higher high water (MHHW), and internal levees would be breached to increase the hydraulic connectivity between channels and marshes, alter circulation and sedimentation patterns, and increase habitat complexity. Pilot channels would be excavated into and within the Bay, Inland, and Southern Ponds to improve circulation or drainage, and in the case of the Bay Ponds and Inland Ponds, to enhance tidal marsh formation.

Levee breaches would allow tidal inundation to the Bay and Inland Ponds, increase tidal flows and scour in adjacent sloughs, and increase accretion rates within the these ponds. Fully tidal systems (both tidal ponds and adjacent sloughs) have short residence times, are well mixed by tidal flows, and are subject to wind and wave action. Although muted, the Southern Ponds would be operated to simulate tidal flows to the maximum extent possible through the water control structures. The muted tidal flows in the Southern Ponds would increase circulation and decrease residence times in Ponds E1C, E5C, and E4C.

Restoration of tidal marsh habitat would import sediment from tidal waters and raise pond bottom elevations. Tidal flows would bring slough water through the breaches, where suspended sediments would settle out from the water before ebb flows. Accretion in tidal marsh habitat would decrease the suspended sediment supply in the surrounding sloughs and open waters of the Bay, potentially resulting in increased light penetration and algal abundance outside of the ponds.

High-risk factors for excess algal growth within any particular pond are waters that are deep, slow, rich in nutrients and chlorophyll, subject to calm wind exposure, and highly transparent. These types of conditions are more typical of batch ponds managed for deeper water depth with limited inflows and mixing with other ponds. Therefore, the risk factors for managed ponds are relatively high and the potential for excess algal abundance is greater.

Conversely, the lowest-risk waterbodies would likely be shallow, quickly turned over, poor in nutrients and chlorophyll, windy, and opaque. Fully tidal systems (both tidal ponds and adjacent sloughs) have short retentions times, are well mixed by tidal flows, and are often subject to wind and wave action. Therefore, the risk factors for fully tidal systems are relatively low and the potential for increased algal abundance is minimal.

During the construction phase of the project, tidal exchange between the ponds and adjacent sloughs and channels would be limited until external levees are breached. Water levels in the ponds would be lowered prior to placement of dredge materials, slurry material would fill the ponds, and water from the slurry would be decanted once the solids have settled. During most of this time, the ponds are expected to be shallow, turbid (opaque), warm, and have relatively long hydraulic residence times (up to a year). Risk factors during the construction phase of the project are, therefore, high for adverse changes to algal abundance. Although excess algae would be released with the decant water and when tidal flows are first introduced to the ponds, high algal productivity is common to Bay fringe areas, including wetlands and sloughs, and a short-term increase in algal abundance would not necessarily indicate degraded or impaired habitat.

Alternative Eden B would result in long-term changes to hydraulic residence times in the Bay, Inland, and Southern Ponds after tidal or muted tidal flows are introduced. Flow rates in the ponds and adjacent sloughs would increase, and residence times in the ponds would decrease. Treated wastewater from the USD's wastewater treatment plant or brackish water from ARP wells could also be diverted into the Inland Ponds. Treated wastewater from the USD could provide additional nutrients, but volumes would be small compared to the tidal prism. Therefore, risk factors associated with increased algal abundance and adverse changes in species composition would be low to moderate, but compared to existing conditions, risk factors would be reduced over the long-term. After the ponds are restored to tidal and muted tidal flows, adverse changes to algal abundance and composition are not anticipated due to the short hydraulic residence times in the ponds and due to flushing flows from the Bay. Impacts would be less than significant.

Alternative Eden B Level of Significance: Less than Significant

Alternative Eden C. Under Alternative Eden C, pond elevations would be raised in the Bay Ponds, the Bay Ponds would be breached for tidal inundation, and the Inland Ponds and Southern Ponds would remain managed ponds but be enhanced through the addition of water control structures. The northern levee at Pond E1 would be breached to OAC, the southern levee at Pond E4 would be breached to the ACFCWCD wetlands. Water control structures would be installed in the Inland Ponds and Southern Ponds to manage water quality, depth, salinity, and other aspects of habitat for certain species, including those at the boundaries with OAC, the ACFCC, the J- Ponds, and the ACFCWCD wetlands. Portions of the outer levees around the Bay Ponds would be lowered and internal levees would be breached during the construction period. Dredge material would be brought in to raise pond bottom elevations in the Bay Ponds and dredge material or upland fill material would be used to build habitat transition zones. Pilot channels would be excavated into and within the Bay Ponds to improve drainage and to enhance tidal marsh formation.

Potential construction-phase impacts from Alternative Eden C (i.e., short-term increases in algal abundance during construction and the initial release of algae from the ponds when tidal flows are first introduced to the Bay Ponds) would be similar to those described under Alternative Eden B.

Under Alternative Eden C, residence times would decrease in the Bay Ponds once external levees are breached, but residence times could remain similar to existing conditions in the Inland Ponds and Southern Ponds, depending on how those ponds were managed. Seasonal/batch ponds can have relatively long residence times with limited inflows and mixing. If not well managed, these ponds could become stagnant and rich in nutrients, and therefore risk factors are moderate to high for adverse changes to algal abundance and composition. However, the addition of new water control structures would allow for improved management control over circulation, water levels, and residence times. These and other management activities would be used to minimize adverse effects. Should these managed ponds cause adverse changes to algal abundance and composition, adaptive management measures would be implemented to reduce potential impacts (e.g., manipulating hydraulic residence time or altering the depths of the managed ponds). Because monitoring and adaptive management would be used to minimize adverse effects from managed ponds, impacts would be less than significant.

Alternative Eden C Level of Significance: Less than Significant

Alternative Eden D. Under Alternative Eden D, tidal flows would be introduced to the Bay Ponds, but the Inland Ponds and the Southern Ponds would remain as managed ponds until tidal or muted tidal flow is introduced at some future time. The northern levee at Pond E1 would be breached to OAC. Water control structures would be constructed in the Inland Ponds and Southern Ponds to improve management control over water quality, depth, salinity, and other aspects of habitat. Portions of the outer levees around the Bay Ponds would be lowered, and internal levees within the Bay Ponds and the Southern Ponds would be breached. Dredge material would be brought in to raise pond bottom elevations in the Bay and Inland Ponds and dredge material or upland fill material would be used to build habitat transition zones. Pilot channels would be excavated into and within the Bay, Inland, and Southern Ponds to improve circulation or drainage, and in the case of the Bay Ponds, to enhance tidal marsh formation.

Potential construction-phase impacts from Alternative Eden D (i.e., short-term increases in algal abundance during construction and the initial release of algae from the ponds when tidal flows are first introduced to the Bay Ponds) would be similar to those described under Alternative Eden B.

Potential operational-phase impacts from Alternative Eden D would be similar to the impacts from Alternative Eden B, with the exception that long-term circulation in the Inland and Southern Ponds would be less improved than in that alternative and would remain limited when operated as managed ponds. Managed ponds could become stagnant and rich in nutrients, and therefore risk factors are moderate to high for changes to algal abundance. However, the addition of new water control structures would allow for improved management control over circulation, water levels, and residence times. These and other management activities would minimize adverse effects. Should these managed ponds cause adverse changes to algal abundance and composition, adaptive management measures would be implemented to reduce potential impacts (e.g., manipulating hydraulic residence time or altering the depths of the managed ponds). Because adaptive management would be used to minimize adverse effects from managed ponds, impacts would be less than significant.

Alternative Eden D Level of Significance: Less than Significant

Phase 2 Impact 3.3-2: Degradation of water quality due to low dissolved oxygen levels.

Dissolved oxygen in the water column is necessary to support respiring organisms. Dissolved oxygen is depleted in pond and marsh environments by respiration and chemical and microbial aerobic processes. Dissolved oxygen is replenished in the system through photosynthesis and reaeration (i.e., oxygen transfer from the atmosphere). Changes in water flow, residence time, and algal abundance productivity (see Impact 3.3-1, above) could change dissolved oxygen levels in managed ponds, tidal marsh habitat, and discharges from project areas into the Bay. Potential impacts of low dissolved oxygen levels include depressed species diversity, fish kills, death of other aquatic organisms, and odor problems. Even short periods of very low dissolved oxygen levels can lead to death of aquatic organisms. Another impact of low dissolved oxygen levels, discussed under Impact 3.3-3, below, is increased net methylmercury production.

Microbial degradation of organic matter in pond and marsh sediments can have significant oxygen demand. The death and decay of algae and aquatic organisms contributes to dissolved oxygen demand. Respiration can also be a significant source of oxygen demand if algae and organism populations are large. Algae are net oxygen consumers at night – wind-driven reaeration is low and the oxygen used by algae is not replaced. Dissolved oxygen is replenished during the day when algae photosynthesis is greater than respiration and when wind-driven reaeration increases. Reaeration rates are largely dependent on wind mixing and flow rates. Mixing brings low dissolved oxygen waters to the surface, driving oxygen transfer, and turbulence increases the exchange rate with the atmosphere. Waters flowing slowly through a pond would not be as well mixed as faster moving waters. Stagnant conditions can lead to anoxic waters if oxygen demands exceed reaeration.

Environments of varying dissolved oxygen ranges can support different aquatic communities. Tidal marshes and ponds designed for shorebird habitat may flourish under lower dissolved oxygen conditions than deeper water communities. For this reason, the water quality standard for dissolved oxygen is thoughtfully applied to areas where the dissolved oxygen level is expected to be naturally low, such as slow moving or standing water over vegetated areas or mudflats. Fringe areas of the Bay, particularly managed ponds, are expected to experience periodic declines and low dissolved oxygen levels.

Alternative Eden A (No Action). Under Alternative Eden A (No Action), the Bay, Inland, and Southern Ponds would continue to be operated as circulation ponds, batch ponds, or seasonal ponds to provide a variety of water depths during summer and winter seasons and for the current water quality management which involves circulating water, as needed, to control pond discharge salinity.

Maintaining adequate dissolved oxygen levels in managed ponds can be a major water quality challenge. The RWQCB has recognized that it may not be feasible for a well-operated lagoon system to meet an instantaneous dissolved oxygen discharge limitation of 5.0 mg/L, and that sloughs in the South Bay unaffected by pond discharges often have dissolved oxygen levels below the Basin Plan objective of 5.0 mg/L. For this reason, adaptive management practices are implemented when dissolved oxygen levels fall below a trigger level (3.3 mg/L dissolved oxygen 10th percentile value, calculated on a weekly basis at the point of discharge.)[3] Even using this trigger value as a threshold, corrective measures such as discharge timing and increased circulation have been routinely implemented to address low dissolved oxygen levels in managed pond discharges (RWQCB 2008).

Adaptive management measures have been used in the Eden Landing ponds to address issues with low dissolved oxygen. For example, CDFW has temporarily ceased discharges and reduced discharge volumes when dissolved oxygen levels were thought to be below the 5.0 mg/L standard and the 3.3 mg/L trigger value. (Water levels and salinity values were used as a proxy for low dissolved oxygen conditions.) [4] After intake levels were sufficient to lower salinity and/or increase water levels, pond discharge resumed. Ceasing discharge for prolonged periods of depressed dissolved oxygen levels has been found to degrade water quality, while reducing residence time of water in the ponds appears to improve overall dissolved oxygen levels. Therefore, maintaining discharge, particularly at higher sustained volumes, is generally implemented for increased circulation and mixing in the ponds (CDFW 2015).

Under Alternative Eden A, similar adaptive management measures would be implemented during low dissolved oxygen conditions (e.g., changing residence times and/or increasing pond inflows). Due to the limited tidal flushing with the current system, low dissolved oxygen levels are expected to occur from time to time, a situation similar to existing conditions. Because this condition already exists, and Alternative Eden A would not worsen this condition, there would be a less-than-significant impact.

Alternative Eden A Level of Significance: Less than Significant

Alternative Eden B. Alternative Eden B would increase tidal flows in the Bay, Inland, and Southern Ponds by breaching levees in the Bay and Inland Ponds and by adding water control structures and improving circulation in the Southern Ponds. Dredge material would be brought in as a slurry to raise pond bottom elevations in the Bay and Inland Ponds and dredge material or upland fill material would be used to build habitat transition zones. Pilot channels would be excavated into and within the Bay, Inland, and Southern Ponds to improve circulation or drainage and to enhance tidal marsh formation. Depending on the need for supplemental discharge and/or to establish occasional brackish water conditions, treated wastewater from the USD wastewater treatment plant or brackish water from ARP wells could also be diverted to the Inland Ponds.

During the construction phase of the project, water levels in the ponds would be lowered, slurry material would fill the ponds, and water would be decanted once the solids have settled. Tidal exchange between the ponds and the adjacent sloughs and channels would be limited, particularly when dredge material is imported to the site, levees are lowered, and when pilot channels are excavated in the ponds. Low dissolved oxygen conditions are expected to develop in the ponds and the low dissolved oxygen water would be released when decanted and when levees are breached and tidal flows are first introduced. Initial breaching of the Bay and Inland Ponds and introduction of muted tidal flows in the Southern Ponds could also increase the amount of biological oxygen demand in sloughs and channels during ebb flows because algae and other accumulated biological detritus in the ponds would be flushed out through these

[3] This dissolved oxygen trigger was based on levels found in Artesian Slough near Heron Rookery in July 1997 (RWQCB 2008). The trigger value represents natural dissolved oxygen variations in sloughs or lagoon systems.
[4] A generalized relationship between pond management actions, circulation, and low oxygen conditions has been developed for the Eden landing ponds based on management experience and prior monitoring information.

channels into the Bay. Although dissolved oxygen concentrations within the ponds would likely be below the 3.3 mg/L trigger value, tidal currents would provide mixing, improve reaeration, and dilute nutrients, and the shallow water environment would allow dissolved oxygen from surface reaeration to rapidly become vertically well mixed. Dissolved oxygen concentrations are not expected to exceed trigger values in areas at a distance from the point of discharge.

Adaptive management would be used to minimize potential impacts from the water and sediment released from the ponds. Examples of such actions may include breaching levees on the incoming tide and/or introducing dilution flows from the Bay into the ponds prior to the initial release. Management actions would also draw upon prior knowledge based on data collected when levees were breached during Initial Stewardship Plan and Phase 1 actions. Breaching levees on the incoming tide would mix standing water within the ponds with Bay water and with water from adjacent sloughs and channels prior to the initial release. Once the ponds have been shallowly filled with water, dissolved oxygen concentrations are expected to remain at or above trigger values throughout the remainder of the breaching period. Although the initial release of water and sediments from the ponds are expected to create low oxygen conditions and may have short-term adverse effects to aquatic resources, benthic communities in impacted areas are expected to fully recover (RWQCB 2004).

Over the long-term, the introduction of tidal and muted tidal flows to the ponds would reduce the potential for low oxygen conditions developing within the ponds due to tidal mixing, reaeration, and frequent shallow water environments. Treated wastewater from the USD may provide additional nutrients, but volumes would be small compared to the tidal prism, and tidal mixing would be similar. Therefore, the risk of poor dissolved oxygen levels in the ponds would be reduced when compared to existing conditions. Impacts would be less than significant.

Alternative Eden B Level of Significance: Less than Significant

Alternative Eden C. Under Alternative Eden C, the Bay Ponds would be opened to tidal inundation, and the Inland Ponds and Southern Ponds would become enhanced managed ponds. Dredge material would be brought in to raise pond bottom elevations in the Bay Ponds and dredge material or upland fill material would be used to build habitat transition zones. Pilot channels would be excavated into and within the Bay Ponds to improve drainage and to enhance tidal marsh formation. Similar to the effects described for Alternative Eden B, low dissolved oxygen conditions are expected to develop in the ponds during the construction period and this low dissolved oxygen water would be released when decanted and when levees are first breached. Biological oxygen demand in sloughs and channels may temporarily increase after breaching the Bay Ponds, although tidal currents would provide flushing flows and mixing to improve reaeration and dilute nutrients. Potential construction-phase adaptive management measures implemented with Alternative Eden C would be similar to those described under Alternative Eden B.

The introduction of tidal flows to the Bay Ponds would cause tidal mixing, reaeration, and frequent shallow water environments thereby reducing the long-term potential for low oxygen conditions to develop in those ponds. Depending on how the water control structures in the Inland and Southern Ponds are operated (i.e., opened for continuous directional flow or primarily closed to provide maximum water depth), the residence time in the managed ponds could be on the order of days to weeks. If residence times are long, water in the managed ponds would likely be stagnant and rich in nutrients, particularly in summer months, and therefore dissolved oxygen concentrations may be low.

Adaptive management measures (e.g., changing residence times and/or increasing pond inflows in the managed ponds) would be implemented during low dissolved oxygen conditions to reduce the potential for adverse conditions associated with low dissolved oxygen levels, such as mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates. Because of monitoring and implementation of adaptive management measures as needed for managed ponds, impacts would be less than significant.

Alternative Eden C Level of Significance: Less than Significant

Alternative Eden D. Under Alternative Eden D, tidal flows would be introduced to the Bay Ponds. The Inland Ponds and Southern Ponds would remain as managed ponds until tidal or muted tidal flow is introduced at some future time. Dredge material would be brought in to raise pond bottom elevations in the Bay and Inland Ponds and dredge material or upland fill material would be used to build habitat transition zones. Pilot channels would be excavated into and within the Bay, Inland, and Southern Ponds to improve circulation or drainage, and in the case of the Bay Ponds, to enhance tidal marsh formation.

Potential construction-phase impacts from Alternative Eden D would be similar to those described under Alternative Eden B. Similar to the effects described for Alternative Eden B, low dissolved oxygen conditions are expected to develop in the ponds and low dissolved oxygen waters would be released when decanted and when levees are first breached. Biological oxygen demand in sloughs and channels may temporarily increase after breaching the Bay Ponds, although tidal currents would provide flushing flows and mixing to improve reaeration and dilute nutrients. Potential construction-phase adaptive management measures implemented with Alternative Eden D would be similar to those described under Alternative Eden B.

The introduction of tidal flows to the Bay Ponds would cause tidal mixing, reaeration, and frequent shallow water environments thereby reducing the long-term potential for low oxygen conditions to develop in those ponds. Depending on how the water control structures in the Inland and Southern Ponds are operated (i.e., opened for continuous directional flow or primarily closed to provide maximum water depth), the residence time in the ponds could be on the order of days to weeks. If residence times are long, water in the managed ponds would likely be stagnant and rich in nutrients, particularly in summer months, and therefore dissolved oxygen concentrations may be low.

Adaptive management measures (e.g., changing residence times and/or increasing pond inflows in the managed ponds) would be implemented during low dissolved oxygen conditions to reduce the potential for adverse conditions associated with low dissolved oxygen levels, such as mortality of aquatic or benthic organisms, odors that cause nuisance, degraded habitat, or unacceptably high methylmercury production rates. Because of monitoring and implementation of adaptive management measures as needed for managed ponds, impacts would be less than significant.

Alternative Eden D Level of Significance: Less than Significant

Phase 2 Impact 3.3-3: Degradation of water quality due to increased methylmercury production or mobilization of mercury-contaminated sediments.

A major concern with mercury pollution in the Bay is the accumulation of methylmercury in biota, particularly at the top of aquatic food webs. Mercury occurs in many forms, but methylmercury is the form that poses the highest bioaccumulation risk. Methylmercury is converted from inorganic mercury primarily by the metabolic activity of bacteria, especially sulfate-reducing bacteria. Because microbial activity is generally increased in productive wetlands and marshes, restoration of tidal marshes has the potential to increase net production of methylmercury.

This analysis of methylmercury impacts focuses on methylmercury in the food chain. The analysis recognizes the latest science supporting water quality standards and moves the evaluation closer to the actual beneficial uses of interest: making fish safe for people and wildlife to eat. Net methylation rates are emphasized because the overall release of methylmercury reflects the balance of production and degradation of methylmercury. Dissolved oxygen and sulfide concentrations are water quality factors that affect production of methylmercury. Microbial community composition (which is dependent on redox conditions) affects net methylmercury production by influencing both production and degradation.

Dissolved oxygen is a factor that can affect net methylmercury production. Sulfate-reducing bacteria that produce methylmercury are known to thrive under low-oxygen conditions. Low-oxygen conditions also promote the breakup of oxide surfaces on particles, which can release methylmercury into the water column. The introduction to Section 3.3.3, above, describes dissolved oxygen as a staircase water quality issue. One of the important points of that discussion is that low dissolved oxygen conditions do occur in wetland and marsh habitats. If low dissolved oxygen is found to drive elevated net methylmercury production and bioaccumulation, this would be considered a significant impact.

There are other factors that affect net methylmercury production, including redox conditions, the chemical form of the inorganic mercury, and sulfate concentrations. Some forms of inorganic mercury are more readily available to methylating bacteria than other forms, particularly neutrally charged soluble sulfide complexes. The amount of available sulfide can, in turn, be affected by iron redox chemistry, which is strongly affected by the nature of vegetative root matter and sediment characteristics. These characteristics set up complex spatial variation in the chemical form of inorganic mercury, with unique pockets of localized methylmercury production rates. There also appears to be an optimum window of sulfate concentrations that maximizes net methylmercury production. Too little sulfate prevents sulfate-reducing bacteria from thriving and producing sulfide, and too much produces so much sulfide that the availability of inorganic mercury is diminished (Benoit et al. 1998; Gilmour et al. 1992; Gilmour et al. 1998). Creation of estuarine microzones in a particular window of sulfate concentrations could enhance methylmercury production.

The ecological endpoint evaluated is methylmercury in the food web. This discussion has been focused on net methylmercury production rates, because net methylmercury production is an important factor affecting methylmercury bioaccumulation. However, the structure of the food web also is an important control on methylmercury bioaccumulation. Methylmercury bioaccumulation increases at increasing trophic levels and with increasing food web complexity. These characteristics are driven by the biomagnification of methylmercury. Methylmercury binds strongly to protein residues. Large organisms eat smaller organisms for their protein, and so retain the associated methylmercury. With every step up the food chain, mercury concentrations are found to increase, which is why large predators such as leopard sharks and striped bass have higher mercury concentrations than smaller fish like surf perch. Increasing food web complexity can also increase mercury concentrations at the top of the food web. Adding links to the food web increases the overall biomagnification of methylmercury for top-level predators. Therefore, project activities that alter ecosystem structure can also affect mercury accumulation.

Factors that add to risk of increased net mercury methylation include mercury-contaminated sediments; low dissolved oxygen levels, which promote methylating bacteria and/or the breakup of oxide surfaces; water quality factors that increase mercury bioavailability to methylating bacteria; and factors that reduce the activity of demethylating bacteria and photodemethylation. Factors that increase the risk of bioaccumulation include increased food web complexity, longer-lived prey items, and shifting foraging habits of predators. Effects are complex and difficult to predict, which is why methylmercury bioaccumulation impacts would be adaptively managed.

The impact analysis also focuses on the water quality and sediment quality impacts of inorganic mercury and so considers movement and transport of total mercury along with other water quality factors that affect net methylmercury production and bioaccumulation. The Basin Plan establishes a target concentration for mercury in suspended sediment of 0.2 mg/kg mercury in dry sediment, to help support the human health and wildlife fish tissue criteria (see Table 3.3-4). Mobilization and transport of mercury-contaminated sediments into and out of the project area could cause exceedance of sediment quality guidelines.

The geography and history of the Bay affects the distribution of mercury-contaminated sediments within and surrounding the project area. The lower South Bay has been subjected to discharges of mercury-contaminated sediments originating from the historic New Almaden mining district. The mining activities causing these discharges date back to the late 1800s and early 1900s, although the discharges persist as a legacy source in the Guadalupe River watershed. The Basin Plan's implementation plan for the Guadalupe River watershed is an effort to ensure that land in, around, and downstream of the New Almaden mines will be cleaned up and restored to beneficial use. However, a legacy of mercury contamination persists in the form of a north-south mercury concentration gradient (lower in the north and higher in the south) in sediments in the South Bay (RWQCB 2006).

Activities that result in sediments in managed ponds and restored tidal wetlands having mercury concentrations exceeding the LTMS Guidelines (0.7 mg/kg) have the potential to cause impacts to the Bay. In this case, the potential impact is toxic effects on benthic communities, not bioaccumulation. Re-mobilization of mercury-contaminated sediments into the water column can lead to exceedance of suspended sediment targets for mercury because there is a direct relationship between the concentration of suspended sediments in the water column, the concentration of mercury on those suspended sediments, and the concentration of total mercury in the water column. Project activities could impact attainment of suspended sediment targets for mercury by changing ambient TSS or by changing the mercury concentration on suspended particles.

Alternative Eden A (No Action). Under Alternative Eden A (No Action), the Bay, Inland, and Southern Ponds would continue to be operated as circulation ponds or batch ponds to provide a variety of water depths during summer and winter seasons. Mercury concentrations in pond sediments have been found below average concentrations in the Bay and below the Basin Plan's target concentration of 0.2 mg/kg, while methylmercury concentrations in the pond sediments are typically greater than bay-wide averages. This could be a result of high levels of primary production, low dissolved oxygen conditions, and limited tidal circulation, as mercury-methylating bacteria have higher rates of biological activity in low dissolved oxygen, nutrient-rich, and warm waters.

Managed ponds often have higher rates of net methylmercury production than fully tidal systems. The large pool of easily degraded organic matter in the managed pond (from algal production) could lead to higher methylmercury concentrations in sediment, water, and biota. Organic matter fuels the bacteria that methylate inorganic mercury. Ponds that experience very high rates of primary production would likely benefit (in terms of lowering current methylmercury concentrations) from tidal flushing (Grenier et al. 2010).

Adaptive management is used to monitor effects from the managed ponds. Adaptive management monitoring includes collecting methylmercury concentrations in water and biota; conducting special studies of methylmercury production, degradation, and transport; and monitoring changes in food web indicators and sentinel species. Adaptive management actions would be triggered when mercury concentrations of sentinel species increase substantially compared to nearby reference sites. If these triggers were exceeded, then adaptive management actions would be implemented at managed ponds. Examples of such actions could include changing hydraulic residence times or manipulating other factors depending on the specific case. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Eden A Level of Significance: Less than Significant

Alternative Eden B. Alternative Eden B would increase tidal flows in the Bay, Inland, and Southern Ponds by breaching levees in the Bay and Inland Ponds and by adding water control structures and improving circulation in the Southern Ponds. Dredge material would be brought in to raise pond bottom elevations in the Bay and Inland Ponds and dredge material or upland fill material would be used to build habitat transition zones. Pilot channels would be excavated into and within the Bay, Inland, and Southern Ponds to improve circulation or drainage and to enhance tidal marsh formation.

The conversion of managed ponds to tidal marsh habitat would lessen the risk of a mercury problem within the pond. The restored tidal marsh would produce less labile organic matter, as compared to existing conditions, providing less fuel for methylating bacteria. Dissolved oxygen concentrations are expected to be higher with tidal flows, leading to a decrease in net methylmercury production. There is, however, a potential risk associated with the remobilization of slough and channel sediments downstream of levee breaches due to scour following reconnection of the ponds to tidal flows. Scour could increase the amount of inorganic mercury that is available for methylmercury production and uptake into the food web, at least in the short term, because Bay and slough sediments are often above target goals for mercury. However, the remobilized sediment would mix with other sediment, be dispersed by the tides, and proceed through various fates of deposition, burial, or further transport (Grenier et al. 2010). In addition, tidal marsh restoration would create accretional areas, eventually resulting in a net loss of mercury from the Bay to the ponds. Because in-pond methylmercury concentrations are likely to decrease because of higher dissolved oxygen concentrations, and because preliminary results from monitoring tidal marsh restoration in the Bay suggest that restoration actions are not causing increases in food web mercury even in areas with higher background concentrations of mercury (SFEI 2015, Robinson et al. 2014), impacts of Alternative Eden B would be less than significant.

Alternative Eden B Level of Significance: Less than Significant

Alternative Eden C. Under Alternative Eden C, the Bay Ponds would be opened to tidal inundation, and the Inland Ponds and Southern Ponds would become enhanced managed ponds through the addition of water control structures. Dredge material would be brought in to raise pond bottom elevations in the Bay Ponds and dredge material or upland fill material would be used to build habitat transition zones. Pilot channels would be excavated into and within the Bay Ponds to improve drainage and to enhance tidal marsh formation.

Tidal marsh restoration in the Bay Ponds is expected to lessen the risk of a mercury problem in those ponds. Although there would likely be short-term increases in transport of mercury-contaminated sediments in nearby sloughs, tidal marsh restoration would create accretional areas, eventually resulting in a net loss of mercury from the Bay to the ponds. The Inland and Southern Ponds would be managed similar to existing conditions, with batch ponds managed for deeper water depth with limited inflows and mixing, but with more ability for managed control over water quality conditions.

Adaptive management would be used to monitor effects from managed ponds. Management actions would be triggered when mercury concentrations of sentinel species increase substantially, regardless of whether they are over or under desirable levels. If triggers were exceeded, then adaptive management actions would be implemented to avoid significant impacts. Examples of such actions could include changing hydraulic residence times or manipulating other factors depending on the specific case. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Eden C Level of Significance: Less than Significant

Alternative Eden D. Under Alternative Eden D, tidal flows would be introduced to the Bay Ponds. The Inland Ponds and Southern Ponds would remain as managed ponds until muted tidal flow is introduced at some future time. Dredge material would be brought in to raise pond bottom elevations in the Bay and Inland Ponds and dredge material or upland fill material would be used to build habitat transition zones. Pilot channels would be excavated into and within the Bay, Inland, and Southern Ponds to improve circulation or drainage, and in the case of the Bay Ponds, to enhance tidal marsh formation.

Potential effects to methylmercury production would be similar to those effects discussed under Alternative Eden B, with the exception that tidal marsh restoration in the Inland Ponds and Southern Ponds would be delayed. The Inland and Southern Ponds are expected to be managed similar to existing conditions until muted tidal flow is introduced at some future time. The conversion of managed ponds to tidal marsh habitat is expected to lessen the risk of a mercury problem within those ponds. Although there would likely be short-term increases in transport of mercury-contaminated sediments in nearby sloughs, tidal marsh restoration would create accretional areas, eventually resulting in a net loss of mercury from the Bay to the ponds. Adaptive management would be used to monitor effects from tidal marsh restoration and from the managed ponds. Because adaptive management would be used to minimize adverse effects, impacts would be less than significant.

Alternative Eden D Level of Significance: Less than Significant

Phase 2 Impact 3.3-4: Potential impacts to water quality from other contaminants.

The Eden Landing Phase 2 alternatives have the potential to affect water and sediment quality with various constituents other than mercury, methylmercury, and dissolved oxygen. This section describes the primary mechanisms that could impair water and sediment quality by introduction of these other contaminants. Program-wide comprehensive design measures are also incorporated into all of the Action Alternatives.

Alternative Eden A (No Action). Under Alternative Eden A (No Action), the Bay, Inland, and Southern Ponds would continue to be operated as circulation ponds, batch ponds, or seasonal ponds to provide a variety of water depths during summer and winter seasons and for the current water quality management which involves circulating water, as needed, to control pond discharge salinity. Managed pond operations would be similar to existing operations, and therefore effects from the ponds on water and sediment quality in adjacent sloughs and channels is not expected to substantially change compared to existing conditions. Adaptive management measures would be implemented to address adverse water and sediment quality conditions. Impacts would be less than significant.

Alternative Eden A Level of Significance: Less than Significant

Alternative Eden B. Alternative Eden B includes placement of dredge materials in the Bay and Inland Ponds to raise bottom elevations and construct habitat transition zones. An offloading facility would be located in the deep water channel of the Bay approximately 3 miles offshore of Pond E2. Dredge material would be offloaded at this facility, mixed with seawater, and the resulting slurry would be pumped from the offloader via pipelines to the Bay and Inland Ponds. The offloading facility would be comprised of a hydraulic offloader, landing barges, temporary mooring piles, delivery vessels, a feed water system (intake pump and fish screen), and slurry pipeline. The pipeline would be submerged from the offloading facility to shore. Up to two booster pumps would be located along the pipeline route, with potentially one in the Bay, depending on the hydraulic offloader's pumping capacity. Levees would be improved in the Bay and Inlands Ponds and existing water control structures would be used where possible to manage the slurry placed within the ponds; however, up to eight water control structures could be modified or added to maximize the residence time in the ponds and promote settling of solids. After the solids have settled in the ponds, excess water would be decanted and discharged into the Bay. Once complete, the infrastructure used for the import and placement of dredge material would be decommissioned/demolished prior to construction of other restoration, flood risk management, and recreational features.

Alternative Eden B would increase tidal flows in the Bay, Inland, and Southern Ponds by breaching levees in the Bay and Inland Ponds and by adding water control structures and improving circulation in the Southern Ponds. Upland fill materials would be used to improve the backside levees along the eastern edge of the Inland and Southern Ponds for added flood risk management. Along these improved backside levees, habitat transition zones would be constructed, and the Bay Trail spine would be extended on raised levees. Pilot channels would also be excavated into and within the Bay, Inland, and Southern Ponds to improve circulation or drainage and to enhance tidal marsh formation.

Construction Materials. The use of construction materials could lead to transient adverse water quality impacts during or shortly after the period of construction. Construction activities would bring equipment and materials not normally present in the project area onto the site. These activities would increase the possibility of exposure to or release of hazardous materials and waste associated with construction (such as fuels or oils) as a result of accidents or equipment malfunction or maintenance. With proper management and oversight, impacts associated with construction activities should not result in exceedances of any thresholds of significant impact for contaminants. If hazardous materials were spilled, appropriate clean-up procedures would be followed to confine the spill and clean-up the spilled materials. It is unlikely that any residual materials would result in the mobilization and transport of contaminated sediment during the construction period of a sufficient magnitude or extent as to cause exceedances of the thresholds identified after mitigation. Programmatic Mitigation Measure 3.4-5a applies to Alternative Eden B.

Programmatic Mitigation Measure 3.4-5a: Storm Water Pollution Prevention Plan. This measure will mitigate potential impacts due to construction-related activities and maintenance activities. The project sponsors will obtain authorization from the RWQCB before beginning construction. As part of this application, the project sponsors will prepare a Storm Water Pollution Prevention Plan (SWPPP) and require all construction contractors to implement the Best Management Practices (BMPs) identified in the SWPPP for controlling soil erosion and discharges of other construction-related contaminants. Routine monitoring and inspection of BMPs will be conducted to ensure that the quality of stormwater discharges is in compliance with the permit. BMPs that will appear in the SWPPP include:

- Soil stabilization measures, such as preservation of existing vegetation to minimize soil disturbance;
- Sediment control measures to prevent disturbed soils from entering waterways;
- Tracking control measures to reduce sediments that leave the construction site on vehicle or equipment tires; and
- Nonstormwater discharge control measures, such as monitoring hazardous material delivery, storage, and emergency spill response requirements, and measures by the project sponsors to ensure that soil-excavation and movement activities are conducted in accordance with standard BMPs regarding excavation and dredging of bay muds, as outlined in the San Francisco Bay Conservation and Development Commission's (BCDC's) bay dredge guidance documents. These BMPs include excavating slough channels during low tide; using dredge equipment, such as sealing clamshell buckets, designed to minimize escape of the fine-grained materials when excavating pilot channels through OAC; and testing dredge materials for contaminants prior to importing dredge materials for use in the ponds.

The contractor will select specific BMPs from each area, with project sponsor approval, on a site-specific basis. The construction general contractor will ensure that the BMPs are implemented as appropriate throughout the duration of construction and will be responsible for subcontractor compliance with the SWPPP requirements. Other impacts due to construction-related contaminants can be mitigated by appropriate additions to the SWPPP, including a plan for safe refueling of vehicles and spill containment plans. An appropriate hazardous materials management plan will be developed for any activity that involves handling, transport, or removal of hazardous materials.

Mobilization and Transport of Sediments and Contaminants. Project activities could affect the water and sediment quality of sloughs, channels, and the Bay during periods of active construction, when water is decanted from ponds, and when levees are breached and the contents of the ponds are initially released.[5] The main parameters of concern identified by the RWQCB include turbidity, metals, dissolved oxygen, pH, temperature, mercury, nutrients, algae, and salinity (RWQCB 2004, 2008).[6]

Active construction in open Bay waters, in OAC, and the ACFCC is expected to cause localized turbidity.

[5] The initial release refers to the time expected to substantially empty salt ponds of their current contents, expected to occur within the first few months.

[6] Because salinity has used as a surrogate for metals concentrations, waste discharge requirements for Initial Stewardship Plan and Phase 1 actions have focused on maintaining salinity levels below required thresholds at the discharge location.

Within the Bay, approximately 30 temporary mooring piles would be driven to secure the offloader, landing barges, delivery vessels, and supporting equipment, and approximately 3 miles of submerged pipeline would be anchored to the bottom of the Bay with precast concrete pipe weights. Within sloughs and channels, excavation would occur in OAC to connect the pilot channel in Pond E1 to the northern channel of the OAC. Water control structures would be newly constructed or modified in ACFCC. All of these activities have the potential to release some turbidity locally.

Dredge material operations could also affect water quality. In situ dredge materials are often anoxic and have higher levels of sulfides and other reduced compounds (such as reduced iron complexes), as compared to surface sediments, because only a thin layer of the in situ dredge materials would be oxygenated by overlaying waters. Dredge materials would be excavated by others and brought to the project offloading facility stationed in the deep-water channel of the South Bay. Only material meeting the RWQCB’s wetland cover suitability criteria and/or permit requirements would be accepted. The imported dredge sediments would be mixed with seawater and pumped to the ponds. Sulfides and other reduced compounds would likely be oxidized by contact with the air and aerobic waters; however it is unlikely that the pH of the slurry would change substantially when the sediments are mixed in the well buffered marine waters. Some metals could become soluble when oxidized; however, the concentration of dissolved metals is not expected to comparable to that expected under acidified conditions.

The dredge material would be deposited into the ponds in a slurry, and sediments would have the opportunity to settle. After the solids have settled in the ponds, excess water would be decanted and discharged into the Bay. Tidal currents in sloughs and channels would provide mixing, dilute dissolved constituents, and allow the water column to become vertically well mixed. The decant water is not expected to cause adverse effects in adjacent sloughs and channels because of the high sediment quality of the dredge materials (sediments would meet the RWQCB’s wetland cover suitability criteria and/or permit requirements) and the relatively low dissolved metal concentrations expected in the decant water.

Because water from the slurry would be decanted, sediments are more likely to become consolidated and remain in place when tidal flows are introduced to the ponds. Breaching on an incoming tide would reduce turbidity effects to the sloughs because the incoming water would move suspended sediments resulting from the breach into the ponds, where they have the opportunity to disperse and settle out. Areas near the levee breaches would likely scour with the outgoing tides, but sediments deposited within the deep interior of the ponds are likely to remain. If the sediments are not cohesive or do not have the opportunity to consolidate prior to breaching, additional sediment would be scoured from the ponds with the initial outgoing tides. This sediment would likely remain in the South Bay, move back and forth through the breached levee with the tides, and over time, be reworked and redeposited in the ponds or nearby mudflats.

Turbidity is expected to be temporarily elevated in OAC, the ACFCC, and the Bay during active construction and during the initial release of sediments from the ponds as they begin to fill and drain. Although turbidity concentrations are expected to be more than 10 percent above typical background concentrations, highly turbid water can occur in the open Bay, in sloughs, and on mudflats and shoals due to sediment transport from local tributaries, wind waves, and/or tidal and wind-driven currents. Episodic sediment loads dominate the sediment supply to the Bay. In the most extreme case, in water year 2003, Alameda Creek transported 76 percent of its annual sediment load in one day and 83 percent in the seven-day period during the storm and on the recession limb of the hydrograph. This one-day and seven-day load constituted 35 percent and 38 percent respectively of the total measured 11-year suspended sediment load for water years 2000 to 2010 (McKee et al. 2013). Turbidity concentrations are expected to be within this upper range in background levels.

Although the initial release of water and sediments from the ponds has the potential to adversely affect aquatic resources, benthic communities in impacted areas are expected to fully recover within 1 year (RWQCB 2004). Adaptive management would be used to minimize potential impacts from the water and sediment released during Eden Landing Phase 2 actions, as levees are breached and water control structures are used to fill and drain prior batch ponds. Examples of such actions could include breaching levees on the incoming tide to allow Bay water and water from adjacent sloughs and channels to mix with the standing water in the ponds, and to allow breach sediments the opportunity to settle deep within the pond interior prior to the outgoing tide, and introducing dilution flows from the Bay into the Southern Ponds prior to discharge through control structures. Management actions would also draw upon the prior knowledge based on data collected when levees were breached during Initial Stewardship Plan and Phase 1 actions.

It is expected that areas of increased tidal action would result in scour of tidal sloughs and channels. Concentrations of particle-associated "legacy" pollutants, such as PCBs and organochlorine pesticides (e.g., DDT and chlordanes), that were deposited during the times of their historic peak use are typically higher in subsurface sediments than surface sediments. Levee breaching, scour of undersized channels, and increased tidal mixing could lead to an increase in the mobilization and transport of contaminated surface and subsurface sediments from sloughs and channels. This could lead to deposition of contaminated sediments in restored areas of biological use.

Because of the spatial gradients for mercury and other sediment-associated contaminants (e.g., PCBs, PAHs), breaching levees would have the effect of either releasing contaminant loads from the restored tidal marshes and managed ponds to the Bay, or from the Bay to the restored tidal marshes and managed ponds, unless sediment contaminant concentrations are identical in the ponds and the Bay. The ponds are expected to have lower concentrations of urban-associated pollutants such as PCBs and copper in their sediments, because they have been largely cut off from Bay sediments during the past 100 years of industrialization and urbanization. Sediment accretion is expected in the restored ponds, which would cause net losses of particle-associated pollutants from the Bay to the ponds.

Sediment monitoring data would be used to evaluate effects from sediment transport. If sediment monitoring data indicate that tidal scour outside a levee breach could remobilize sediments that are significantly more contaminated than ambient conditions in the Bay, the appropriate regulatory agencies would be consulted regarding adaptive management actions.

Urban Runoff Management. Increased exchange of urban runoff with restored tidal marshes and managed ponds (via breaches or tide gates connected to flood control channels) could transport and/or deposit contaminants, including trash, from urban sources into the restored areas. Urban runoff in the South Bay has been shown to have contaminants such as PAHs, metals (copper and zinc), and urban pesticides (diazinon, pyrethroids) (McKee et al. 2006). Restored tidal marshes and managed ponds could sequester urban pollutants, thereby reducing overall pollutant loads from urban runoff to the Bay. However, the sequestering of urban pollutants in the biologically active restored areas could also render the pollutants more available to biological uptake. The project proponents would notify the appropriate urban runoff program of any physical changes (such as breaches) that would introduce urban discharges into the project area and request that the urban runoff program consider those changes when developing annual monitoring plans.

Maintenance-Related Activities. Hazards could result from the routine maintenance activities required for muted tidal or enhanced managed ponds and public access facilities. These activities may include levee repair, dredging, small-scale construction, and general cleaning. Hazardous materials that could lead to water or sediment quality impairments if spilled would primarily include spills and leaks of liquids (fuels and oils) from maintenance vehicles and equipment. The project proponents would implement the control measures specified in the project's waste discharge permit (Water Quality Order No. R2-2008-0078, as revised by R2-2012-0014, or current version). Provisions include specifications for repair, replacement, and servicing of existing facilities, dredging and placement of dredge and/or imported fill material on existing levees, placement of riprap, and general maintenance activities.

Surface Water Contamination from Groundwater. Because surface water and groundwater are in at least partial hydraulic communication, perched groundwater from the shallow water-bearing zone could seep into the ponds or restored tidal habitat or the surrounding sloughs and Bay. Fuel and solvent spills affect the shallow aquifers in industrialized areas of the South Bay, and the resulting plumes migrate in the groundwater flow direction.

Project actions are not expected to substantially affect either horizontal or vertical groundwater gradients and the resulting groundwater flows in the area, so project actions would not affect the concentrations, or the migration rates, or directions of plume migration when compared to baseline conditions. In addition, water management agencies (primarily ACWD) and the RWQCB (as well as DTSC and Alameda County) have coordinated programs that together ensure that fuel and solvent spills are identified, contained, and remediated in such a way that neither the ecosystem nor surface water resources are impacted by groundwater contamination.

Although Alternative Eden B has the potential to affect water and sediment quality in adjacent sloughs and channels, Programmatic Mitigation Measure 3.4-5a would be used to reduce potential construction-related effects to less-than-significant levels. Adaptive management measures and control measures would be used to address potential effects that would occur after construction, as described above, and sediment monitoring would be used to inform long-term adaptive management measures. Therefore, impacts would be less than significant.

Alternative Eden B Level of Significance: Less than Significant

Alternative Eden C. Under Alternative Eden C, the Bay Ponds would be opened to tidal inundation, and the Inland Ponds and Southern Ponds would become enhanced managed ponds. Dredge material would be brought in to raise pond bottom elevations in the Bay Ponds and pilot channels would be excavated into and within the Bay Ponds to improve drainage and to enhance tidal marsh formation. Potential effects to water and sediment quality from contaminants would be similar to those discussed under Alternative Eden B. Implementation of Programmatic Mitigation Measure 3.4-5a would reduce impacts to less-than-significant levels.

Alternative Eden C Level of Significance: Less than Significant

Alternative Eden D. Under Alternative Eden D, tidal flow would be introduced to the Bay Ponds, and the Inland Ponds and Southern Ponds would remain as managed ponds until tidal or muted tidal flow is introduced at some future time. Dredge material would be brought in to raise pond bottom elevations in the Bay and Inland Ponds and pilot channels would be excavated into and within the Bay, Inland, and Southern ponds to improve circulation or drainage, and in the case of the Bay Ponds, to enhance tidal marsh formation. Potential effects to water and sediment quality from contaminants would be similar to those discussed under Alternative Eden B. Implementation of Programmatic Mitigation Measure 3.4-5a would reduce impacts to less-than-significant levels.

Alternative Eden D Level of Significance: Less than Significant

Phase 2 Impact 3.3-5: Potential to cause seawater intrusion of regional groundwater sources.

Alternative Eden A (No Action). Factors associated with the risk of future salinity intrusion include improperly abandoned wells and salinity migration into areas with poorly confined aquifers. Artificial pathways can increase the risk of seawater intrusion into regional groundwater supplies. However, as described in Section 3.3.1, water typically flows from the groundwater basin into the Bay. As long as that condition persists, there is no significant risk of salinity intrusion into drinking water aquifers.

Under Alternative Eden A (No Action), the Bay, Inland, and Southern Ponds would continue to be operated as circulation ponds, batch ponds, or seasonal ponds to provide a variety of water depths during summer and winter seasons. Managed ponds with water levels that are near mean sea level would not result in significant changes in groundwater hydrology, as compared to existing conditions. Impacts would be less than significant.

Alternative Eden A Level of Significance: Less than Significant

Alternative Eden B. Alternative Eden B would increase tidal flows in the Bay, Inland, and Southern Ponds by breaching levees in the Bay and Inland Ponds and by enhancing water control structures and improving circulation in the Southern Ponds.

Abandoned Wells. The management of abandoned wells is a program-wide comprehensive design measure incorporated into all Action Alternatives. There are no known wells located within the Eden Landing Ecological Reserve (ELER, or Reserve). As part of Phase Out Agreement with Cargill Inc. (Cargill) and the Initial Stewardship Plan, all known well locations in the Reserve were closed. If new wells are discovered or abandoned wells were found to be improperly destroyed, those wells would be properly destroyed by the project, as per local and state regulations and in coordination with ACWD. Well destruction methods will meet local, county, and state regulations.

Salinity Intrusion. Tidal inundation of prior circulation or batch ponds would not result in a significant change in groundwater hydrology, but could provide beneficial changes in pond salinity. Salinity in tidally inundated ponds would continue to decline to concentrations comparable to the Bay. Although an increased tidal prism would draw Bay waters through the sloughs to the breach locations, OAC and ACFCC likely have similar salinities as Bay waters, because of their close proximity to the Bay, except during storm events. The salinity in upstream creeks is not expected to change substantially, and groundwater currently has positive flow into the Bay. Impacts would be less than significant.

Alternative Eden B Level of Significance: Less than Significant

Alternative Eden C. Under Alternative Eden C, the Bay Ponds would be opened to tidal flow inundation, and the Inland and Southern Ponds would become enhanced managed ponds. Potential effects to salinity intrusion would be similar to those discussed under Alternative Eden B, with the exception that the tidal prism in OAC and ACFCC would be changed less than in that alternative. The salinity in upstream creeks is not expected to change substantially, and groundwater currently has positive flow into the Bay. Impacts would be less than significant.

Alternative Eden C Level of Significance: Less than Significant

Alternative Eden D. Under Alternative Eden D, tidal flow would be introduced to the Bay Ponds, and the Inland Ponds and Southern Ponds would remain as managed ponds until tidal or muted tidal flow is introduced at some future time. Potential effects to salinity intrusion would be similar to those discussed under Alternative Eden B, with the exception that the changes in tidal prism would be phased over a period of decades instead of being implemented at once. The salinity in upstream creeks is not expected to change substantially, and groundwater currently has positive flow into the Bay. Impacts would be less than significant.

Alternative Eden D Level of Significance: Less than Significant

Impact Summary

Impacts, mitigation measures, and the level of significance after mitigation are summarized in Table 3.3-6. With the incorporation of programmatic mitigation and adaptive management measures, all impacts would be less than significant.

Table 3.3-6 Phase 2 Summary of Impacts – Water Quality

IMPACT	ALTERNATIVE EDEN A	ALTERNATIVE EDEN B	ALTERNATIVE EDEN C	ALTERNATIVE EDEN D
Eden Landing Phase 2 Impact 3.3-1: Degradation of water quality due to changes in algal abundance or composition.	LTS	LTS	LTS	LTS
Eden Landing Phase 2 Impact 3.3-2: Degradation of water quality due to low dissolved oxygen levels.	LTS	LTS	LTS	LTS
Eden Landing Phase 2 Impact 3.3-3: Degradation of water quality due to increased methylmercury production or mobilization of mercury-contaminated sediments.	LTS	LTS	LTS	LTS
Eden Landing Phase 2 Impact 3.3-4: Potential impacts to water quality from other contaminants.	LTS	LTS	LTS	LTS
Eden Landing Phase 2 Impact 3.3-5: Potential to cause seawater intrusion of regional groundwater sources.	LTS	LTS	LTS	LTS

Notes: Alternative Eden A is the No Action Alternative (No Project Alternative under CEQA). LTS = Less than Significant