4.0 WATER QUALITY

This chapter describes the water quality in the project salt ponds and surrounding creeks and sloughs. Information on the existing conditions is derived from extensive water quality monitoring by the USGS Water Quality of the San Francisco Bay (http://sfbay.wr.usgs.gov/access/wqdata/); on-going water quality monitoring data from the City of San Jose; and recent sediment and water quality sampling conducted specifically for the project by Hydroscience Engineers. This chapter also describes the results of hydrodynamic and water quality modeling developed for the restoration project by Schaaf and Wheeler.

4.1 AFFECTED ENVIRONMENT

4.1.1 Regulatory Setting

Several state and federal agencies have regulatory authority or responsibility over project-related activities that affect water quality. Table 4-1 below summarizes project related activities and the government agency with regulatory authority over the activity.

Table 4-1.
Summary of Regulatory Setting for Water Quality

Project Related Activity	**Regulatory Authority**
Construction activities that could adversely affect water quality	RWQCB-NPDES storm water permit (CWA Section 402); CWA Section 401 water quality certification
Operations of physical structures (e.g. gates, weirs, pumps, siphons) and/or levee breaches could adversely affect water quality	RWQCB-WDRs (Porter Cologne Act and Basin Plan) for waste discharge to waters of the state; CWA Section 401 water quality certification

Notes:
RWQCB = Regional Water Quality Control Board
NPDES = National Pollutant Discharge Elimination System
WDRs = waste discharge requirements
CWA = Clean Water Act
Basin Plan = Water Quality Control Plan, San Francisco Bay Region

Regional Water Quality Control Board (RWQCB) Authority

The RWQCBs have primary authority for implementing provisions of the federal, state, and California's Porter-Cologne Water Quality Control Act. These statutes establish the process for developing and implementing planning, permitting, and enforcement authority for waste discharges to land and water.

Water Quality Control Plan, San Francisco Bay Region (Basin Plan)

The Water Quality Control Plan, San Francisco Bay Region (Basin Plan) establishes beneficial uses for surface and groundwater resources (San Francisco Bay RWQCB 1995). Under the current Basin Plan, designated beneficial uses of the San Francisco Bay's surface waters include:

- Industrial service supply;
- Groundwater recharge;
- Contact and non-contact recreation;
- Freshwater fish habitat;
- Wildlife habitat;
- Migration of aquatic organisms; and
- Spawning, reproduction, and/or early development of fish.

Beneficial uses of San Francisco Bay area groundwater include municipal and domestic supply, agricultural supply, and industrial service supply.

The Basin Plan establishes numeric and narrative surface and groundwater quality objectives designed to protect designated beneficial uses of surface water and groundwater resources. Other applicable water quality criteria include the California Toxics rule (CTR), which establishes numeric criteria for aquatic life and human health protection for approximately 130 priority trace metal and organic constituents. Numeric water quality objectives include specific concentration-based values that may be imposed on the effluent or at the edge of an allowable mixing zone with the receiving water. Numeric Basin Plan and CTR criteria differ depending on the salinity content.

The Basin Plan defines fresh water and saltwater as follows:

- Fresh water has a salinity of less than 1 ppt more than 95% of the time; and
- Saltwater has a salinity of more than 10 ppt more than 95% of the time.

Estuarine water, therefore, has a salinity that is more than 1 ppt and less than 10 ppt more than 95% of the time. In general, the lower (more conservative) of the saltwater or freshwater criteria apply to estuarine conditions.

Narrative criteria provide general guidance to avoid adverse water quality impacts for constituents including salinity, sediment (i.e., total suspended solids [TSS]), tastes and odors, sulfides, toxicity, and bioaccumulation. Numeric criteria included in the Basin Plan include such parameters as trace metals, dissolved oxygen, turbidity, temperature, pH, bacteriological pathogens, and un-ionized ammonia. Table 4-2 shows selected surface water quality objectives (WQOs) of potential concern for tidal wetland management projects and applicable numeric and narrative criteria.

Table 4-2
Surface WQOs for Potential Constituents of Concern

Constituent	Units	Water Quality Objective (WQO)*
Temperature	ºF	Controllable water quality factors shall not increase temperature by more than 5 ºF.
Dissolved Oxygen	mg/l	5.0 mg/l. Minimum dissolved oxygen is applicable to tidal waters downstream of Carquinez Bridge. The median dissolved oxygen concentration for any 3 consecutive months shall not be less than 80% of the dissolved oxygen content at saturation.
Salinity	ppt	Controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to

Constituent	Units	Water Quality Objective (WQO)*
		adversely affect beneficial uses, particularly fish migration and estuarine habitat.
pH	Standard units	6.5 to 8.5. The pH shall not be depressed below 6.5 or raised above 8.5. This range encompasses the pH range usually found in waters within the basin. Controllable water quality factors shall not cause changes greater than 0.5 unit in normal ambient pH levels.
Turbidity	NTU	Water shall be free of changes in turbidity that could cause nuisance or adversely affect beneficial uses. Increases in turbidity as a result of discharge shall not be greater than 10% in areas where natural turbidity is greater than 50 NTU.
Sediment	mg/l	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.
Sulfide	mg/l	All waters shall be free of dissolved sulfide concentrations above natural background levels. Sulfide occurs in bay mud as a result of bacterial action on organic matter in an anaerobic environment.
Toxicity	N/A	All waters shall be maintained free of toxic substances in concentrations that are lethal to or that produce other detrimental responses in aquatic organisms. There shall be no acute toxicity in ambient waters. Acute toxicity is defined as a median less than 90% survival, or less than 70% survival more than 10% 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.
Bio-accumulation	N/A	Many pollutants can accumulate on particles or in the sediment or bio-accumulate 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.

Table 4-2
Surface WQOs for Potential Constituents of Concern (continued)

		Water Quality Objective (WQO)*	
Constituent	**Units**	**Salt Water**	**Fresh Water**
Arsenic	µg/l	36	150
Calcium	µg/l	9.3	1.1
Chromium, total	µg/l		180
Chromium, hexavalent	µg/l	50	11
Copper	µg/l	3.1	9.0
Lead	µg/l	5.6	2.5
Nickel	µg/l	8.2	5.2
Silver**	µg/l	1.9	3.4
Selenium	µg/l	7.1	5.0
Mercury	µg/l	0.025	0.025
Zinc	µg/l	81	23
PCBs, Total ***	µg/l	0.000170	0.000170

Notes:

* Narrative objectives are used where numeric objectives have not been established. Unless noted otherwise, single numeric values represent the chronic exposure (4-day average) concentration not to be exceeded at a frequency exceeding once every three years. Trace metal criteria represent the lower of the Basin Plan objectives or California Toxics Rule (CTR) for saltwater (S) or freshwater (F) conditions.

** Criteria applicable to acute exposure concentration only (instantaneous maximum).
*** CTR human health criteria for consumption of organisms.
mg/l = milligrams per liter
µg/l = micrograms per liter
ppt = parts per thousand
NTU = nephelometric turbidity units
PCBs = polychlorinated biphenyl compounds
NA = Not applicable

Clean Water Act (CWA) Section 402 and RWQCB Permitting Procedures

Section 402 of the CWA prohibits the discharge of all pollution into surface waters unless permitted under the National Pollutant Discharge Elimination System (NPDES), which is administered by the U.S. Environmental Protection Agency (USEPA), or by a state agency with a federally approved control program. In California, Section 402 authority has been delegated to the SWRCB and is administered by RWQCBs.

To ensure conformance with the Basin Plan and the federal CWA, the RWQCB issues WDR and/or NPDES permits to projects that may discharge wastes to land or water. The federal NPDES permit system includes procedures for point source waste discharges and storm water discharges.

It is anticipated that the San Francisco Bay RWQCB will not impose an NPDES point-source discharge permit on the proposed project because (1) there is currently no effluent guideline for this activity, (2) no pollutants have been added to the ponds as a result of salt making, and (3) available water quality and sediment data do not suggest elevated pollutant levels beyond that expected from evaporation. However, the RWQCB administers the statewide general NPDES storm water permit for general construction activity that applies to projects that disturb more than 5 acres of land; this permit will most likely be required. The NPDES permit requires filing with the San Francisco Bay RWQCB a public notice of intent (NOI) to discharge storm water and preparation and implementation of a storm water pollution prevention plan (SWPPP).

The SWPPP must include a site map and description of construction activities and identify best management practices (BMPs) that would be employed to prevent soil erosion and discharge of other construction-related pollutants (e.g., petroleum products, solvents, paints, cement) that could contaminate receiving waters. Monitoring may be required to ensure that BMPs are implemented according to the SWPPP and are effective at controlling discharges of storm water related pollutants.

Erosion and sediment delivery to estuaries would be minimized during project construction. Related efforts would include measures to minimize the potential for sediment to enter creeks and sloughs, as well as interim measures to stabilize soil, pending establishment of vegetative cover. As part of the SWPPP required for project construction, an erosion and sediment control plan would be prepared and incorporated into project construction plans and specifications.

CWA Section 401—Water Quality Certification

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval [such as issuance of a Section 404 permit]) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated to the State Water Resources Control Board (SWRCB) and applications for water quality certification under CWA Section 401 are typically processed by the RWQCB with local jurisdiction. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 criteria governing discharge of dredged and fill materials into waters of the United States.

4.1.2 Regional Water Quality Setting

The hydrologic processes and fate and transport factors for chemical constituents in San Francisco Bay, its tributary rivers, and adjacent estuaries are complex and result in dynamic water quality conditions. Water quality in the South Bay is a function of the mixing of ocean water and freshwater inflows from precipitation and other tributary streams. The physical mixing of sediment, nutrients, and salts combines with natural processes of light and heat input and associated primary and secondary production in higher trophic levels in the aquatic ecosystem of the bay. These ecosystem functions have secondary effects on dissolved oxygen, pH, and organic matter production and decay. In addition, the discharge of anthropogenic sources of conventional inorganic contaminants and trace metal and synthetic organic compounds also plays a major role in the quality of bay water and sediments. Examples include municipal and industrial wastewater treatment discharges and urban storm water runoff.

Descriptions of the water quality setting for salinity, metals and other chemicals, dissolved oxygen, turbidity, temperature, and pH are described along with the impacts and mitigation in Section 4.3.

4.2 Criteria for Determining Significance of Effects

Criteria based on the CEQA guidelines and NEPA implementing guidelines were used to determine the significance of water quality impacts. Under NEPA, analysis of significance requires considerations of both the context and intensity of an impact. Consideration of context means the significance of an action must be analyzed within the appropriate temporal and geographic ecological scale, while intensity refers to the severity of the impact. Impacts were evaluated with respect to:

- Temporary construction-related water quality impacts
- Project operations impacts (temporary and long-term changes to water and sediment quality within the salt ponds, receiving water bodies, and other water bodies that may be affected); and
- Constituents of concern including salinity, inorganic contaminants, dissolved oxygen, suspended solids and turbidity, and temperature.

According to criteria based on CEQA and NEPA, the project would have a significant impact on water quality if it would:

- Violate any water quality standards or waste discharge requirements, or
- Substantially degrade water quality. (Note: For this project, a substantial degradation of water quality would occur if ISP pond discharges would raise salinity levels in receiving waters to one that would have a substantial adverse impact on benthic invertebrates. Salinity significance thresholds are described in greater detail under Section 4.3.1.1, Overview of Potential Salinity Impacts, below, and under Section 6.2, Benthic Invertebrates.)

Potential impacts of the project on water quality were characterized qualitatively and quantitatively by evaluating both the intensity and context of direct, indirect, temporary, and permanent impacts. Direct impacts include direct disturbances, such as construction activities or direct discharges to receiving waters. Indirect impacts include the potential loss or gain of habitat in the receiving waters due to a change in pond salinities or water quality. Temporary impacts have a short duration. Examples would be impacts during construction or during the initial release period. A permanent impact would involve the long-term alteration of receiving water conditions. An example would include the ongoing discharge from the ISP during the continuous circulation period (CCP).

4.3 Impacts and Mitigation

This section addresses short- and long-term impacts to water quality within the project area, including impacts to the following water quality parameters discussed in Section 4.1:

- Salinity
- Levels of inorganic contaminants (metals)
- Dissolved oxygen (DO)
- Suspended sediments/turbidity
- Temperature
- pH

This following sections include overviews of impact analyses and results for each of the six water quality parameters listed above (Section 4.3.1 to 4.3.6), including a discussion of specific impacts for each of the project alternatives and a comparison of those impacts, including the No Project/No Action, Seasonal Ponds, Simultaneous Initial Release, and Phased Initial Release alternatives.

- Section 4.3.1 addresses salinity impacts to each of the receiving water bodies under each of the alternatives and provides a basis for comparison of impacts for the various alternatives.
- Section 4.3.2 addresses impacts from metals (specifically mercury and nickel) under each of the alternatives.
- Section 4.3.3 addresses impacts from reduced dissolved oxygen, Section 4.3.4 addresses impacts from suspended sediments/turbidity,
- Section 4.3.5 addresses impacts from elevated temperatures, and
- Section 4.3.6 addresses impacts from elevated pH for each alternative.

For each impact, it is clarified whether the impact would be temporary (short-term), occurring only during the Initial Release Phase (IRP) of the ISP, or permanent (long-term), occurring throughout the Continuous Circulation Phase (CCP) of the ISP.

Each section also presents proposed mitigation for impacts that are identified as significant or potentially significant. Proposed mitigation measures immediately follow each significant impact identified. CEQA/NEPA do not require the identification of or, mitigation for temporary impacts that are not significant. However, proposed mitigation measures have been identified for temporary impacts where feasible in order to minimize any negative effects.

4.3.1 Salinity

4.3.1.1 Regional Water Quality Setting Salinity

Salinity in the South San Francisco Bay estuary reflects a balance between the saline marine influence, freshwater dilution, and the effects of evaporation. Saltwater is more dense than fresh water, so fresh water will float on top of saline water. The density difference between saline and freshwater conditions also influences physical mixing between water layers of varying density. In general, salinity is lower in the northern portion of San Francisco Bay and higher in the southern portion, because of differences in the influx of fresh water. Slough salinities in the South Bay increase during the summer low-flow period when freshwater influx is reduced. The USGS and San Francisco Estuary Institute Regional Monitoring Program (RMP) conduct extensive water quality monitoring activities in San Francisco Bay and its freshwater tributaries (RMP 1999, 2000a). The USGS operates continuous salinity meters at the west end of the Bay Bridge and the San Mateo Bridge.

Seasonal and yearly variations in salinity are driven primarily by variability in freshwater flow. During periods of high freshwater inflow, salinity can vary substantially in South Bay, resulting in dynamic three-dimensional circulation patterns (McCulloch et al., 1970). A key feature of these circulation patterns is density-driven exchange between South Bay and Central Bay (Walters et. al., 1985). Therefore, winter salinity conditions in South Bay are dynamic, characterized by unsteady inflows, variable salinity and periodic vertical stratification. When freshwater flows decrease, generally in late spring, the salinity of South Bay gradually increases as water of oceanic salinity mixes into South Bay from the ocean (via Central Bay). During summer the largest sources of freshwater input to South Bay are wastewater treatment plants, and their flows are the same order of magnitude as evaporation in South Bay (Denton and Hunt, 1986). Therefore, salinity is relatively uniform and typically near oceanic (33 ppt) during late summer and fall.

Continuous observations of salinity are made by the USGS at station 162700, located at the west end of the Oakland Bay Bridge, and station 162765, located at the San Mateo Bridge on the east side of the ship channel (Schemel, 1998).

- Salinity was measured at a bottom sensor at the San Mateo Bridge salinity station from February 1994 through August 1995. Observed salinity at this location was strongly inversely related to freshwater inflow and varied from over 30 ppt during the summer of 1994 to less than 10 ppt during March of 1995.
- A similar trend is shown at the Dumbarton Bridge station, where salinity observed between November 1994 and August 1995 varies from less than 1 ppt to more than 31 ppt.

The USGS has collected detailed salinity data in San Francisco Bay since 1969 as part of the pilot Regional Monitoring Program (e.g., Edmunds et al, 1995). These data are collected at least once a month at a maximum of 17 stations in the channel of South Bay extending from the Oakland Bay Bridge to the mouth of Coyote Creek. Since 1988 this data has been reported in 1 meter vertical intervals. This data (from 1988 to 2000) has been analyzed to indicate the temporal variability of salinity in South Bay.

The variability of observed salinity at station 30, located in the main channel of South Bay directly west of the Baumberg Complex, shows values ranging from 8 ppt to 31 ppt, measured during winter and spring. A large range in salinity has also been observed at Station 36, located in the main channel of the South Bay near the Alviso Complex. At this location, the minimum salinity recorded during February was 4 ppt, while the maximum salinity was 26.

The existing regional context for salinity in the South San Francisco Bay is thus highly variable, showing at monitoring locations yearly seasonal variation at the San Mateo Bridge between 33 ppt and 9 ppt and between 32 ppt and 1 ppt at the Dumbarton Bridge.

Salinity in Tidal Sloughs Near the Alviso Complex

The Alviso Complex is located in Lower South Bay, defined as the portion of South Bay south of the Dumbarton Bridge.

- Lower South Bay is a relatively shallow sub-embayment with an average depth of 2.6 m at mean tide.
- Tides in this region are particularly strong due to amplification of tidal energy with distance landward in South Bay.
- Because of the strong tides and shallow depths, "the area covered by water in Lower South Bay at mean lower low water (MLLW) is less than half the surface area at mean higher high water (MHHW) indicated that over half of Lower South Bay consists of shallow mudflats that are exposed at low tides" (Schemel, 1998).
- The volume of water in Lower South Bay at MLLW is less than half the volume of water at MHHW, indicating that more than half of the water volume present in Lower South Bay at high water can pass through the Dumbarton Bridge during a single ebb tide (Schemel, 1998). Near-bottom salinity measured continuously by the USGS at the Dumbarton Bridge from 1995 to 1998 was highly correlated with freshwater flows and varied from approximately 5 ppt to 32ppt (Schemel, 1998).
- The daily range of measured salinity at the Dumbarton Bridge can also be great, particularly during winter, when the daily range is typically 5 ppt.

The tidal sloughs that border the Alviso salt ponds are Coyote Creek, Mud Slough, Artesian Slough, Alviso Slough, Guadalupe Slough, Stevens Creek, Mountain View Slough and Charleston Slough.

The largest tidal slough is Coyote Creek, which meets the South Bay at Calaveras Point. Coyote Creek is a substantial source of fresh water during winter and spring. Salt marsh regions are present in several parts of Coyote Creek, particularly bordering salt ponds. The bottom elevation of the main channel of Coyote Creek ranges from -1 to -4 m NGVD. The tidal range in Coyote Creek, reported as 2.2 m at NOAA Station 9414575 (NOAA, 2003), is particularly large.

Artesian Slough borders ponds Alviso A16 and Alviso A17 and is a tributary to Coyote Creek. The discharge from the City of San Jose municipal wastewater treatment plant enters the upstream end ofArtesian Slough with a flow of approximately 133 megagallons per day (mgd) (Davis et al, 2000). Artesian Slough thus generally has relatively low salinity (Kinnetic Labs, 1987).

Strong salinity gradients are present in both Coyote Creek and Artesian Slough (Kinnetic Labs, 1987) and frequently result in vertical salinity stratification (Simons, 2000). Observations of salinity suggest that, during winter Coyote Creek is periodically stratified, while Artesian Slough is persistently stratified (Simons, 2000). The daily range of salinity in Coyote Creek can be quite large. In a one week duration data set collected in late January and early February 2000, measured salinity typically ranged from approximately 3 ppt to over 20 ppt during most days (Simons, 2000). Salinity is also highly variable seasonally, with lower salinity during winter and spring in Coyote Creek and Artesian Slough (Kinnetic Labs, 1987)

At the western end of pond Alviso A21, Mud Slough splits off from Coyote Creek and, bordering the north side of ponds Alviso A21, A20, and A19, continues landward to connect with Warm Springs marsh restoration area. Mud Slough is a shallow tidal slough, which receives minimal freshwater input from several small creeks and stormwater channels during all seasons.

Alviso Slough borders ponds Alviso A7, A8, A9, A10, A11, and A12. Guadalupe River discharges to Alviso Slough. The bottom elevation of Alviso Slough ranges from -1 to -3 m NGVD. The tidal range in Alviso Slough is particularly large, with measured high water approximately a factor of 1.6 higher (relative to mean tide) than high water at the Golden Gate Bridge (NOAA, 2003). Given the combination of strong tides and shallow depths in Alviso Slough, it is clear that most of the volume present in Alviso Slough at high water drains to Coyote Creek (and subsequently South Bay) during ebb tide. Therefore this slough, as do Coyote Creek and Guadalupe Slough, actively exchanges water with South Bay due to tidal motions. Salinity is highly variable in Alviso Slough. Salinity observed by Cargill near high water at the mouth of Alviso Slough (measured at the Alviso A9 intake) is generally similar to salinity measured at Dumbarton Bridge.

Guadalupe Slough borders ponds Alviso A3W, A4, and A5. Guadalupe Slough receives flow from Calabazas Creek and San Tomas Creek. The Sunnyvale municipal wastewater treatment plant also discharges to Guadalupe Slough (approximately 18 mgd) and is the primary source of fresh water to Guadalupe Slough during summer and fall. The bottom elevation of Guadalupe Slough ranges from -1 to -4 m NGVD. The tidal range in Guadalupe Slough is similar to the tidal range in Alviso Slough (NOAA, 2003). Measured salinity in Guadalupe Slough varies from 0 ppt to approximately 25 ppt (Kinnetic Labs, 1987). A strong salinity gradient occurs along Guadalupe Slough during summer and fall conditions, with salinity of approximately zero near the Sunnyvale Water Pollution Control Plant (WPCP) discharge and measured salinity typically in the range of 10 to 20 ppt at the mouth of Guadalupe Slough (Kinnetics Labs, 1987).

Stevens Creek, Mountain View Slough and Charleston Slough are relatively shallow and narrow tidal sloughs, which contribute little freshwater flow to the South Bay and drain relatively small areas.

Salinity in Tidal Sloughs Near the Baumberg Complex

The Baumberg Complex borders the eastern shore of South Bay and extends from Alameda Flood Control Channel on the south to San Mateo Bridge on the north. Relevant tidal sloughs flanking the Baumberg salt ponds are Alameda Flood Control Channel (AFCC), also known as Coyote Hills Slough, Old Alameda Creek, and Mount Eden Creek. The region near the eastern shore of the Bay is a large mudflat.

The largest and most ecologically important slough in this region is Alameda Flood Control Channel (AFCC), designed by the Army Corps of Engineers.. Alameda Creek flows into AFCC. Alameda Creek, which flows into AFCC, drains an area of 633 square miles upstream of Niles (USGS, 2003), and is the largest tributary to South Bay. The deepest part of AFCC has bottom elevation of approximately -1.5 m NGVD near the mouth and slopes gently up with distance upstream. The portion of AFCC that adjoins the salt ponds is tidal, with high tide elevation slightly lower than the high tide elevation at San Mateo Bridge and low tide elevation considerably higher than low tide elevation at

San Mateo Bridge (NOAA, 1933). Thus the tidal range in AFCC is substantial but less than the tidal range in nearby portions of South Bay. Depths in the channel of AFCC typically range from 2 to 3 m at high water, while at low water depths can be less than 1 m in the deepest part of AFCC. In addition, AFCC contains a large inter-tidal area that is only covered with water near high water and is drained during ebb tides. Therefore a large portion of the water volume that is present in AFCC at high water drains into South Bay during ebb tides. Salinity generally varies from bay salinity at the mouth of AFCC to fresh water arriving from Alameda Creek. During periods of high flow, fresh water can displace the bay water in AFCC, and the salinity can be depressed significantly in South Bay near the mouth of AFCC (Huzzey et a., 1990). However, the opposite pattern has also been noted, with higher salinity in the shoals than the channel during periods of high Delta flow and relatively low local inflow in which less saline water enters South Bay from Central Bay primarily in the channel (Huzzey et. al., 1990).

The next tidal slough to the north of AFCC is Old Alameda Creek. Before Alameda Creek was diverted intoAFCC, it drained into what is now known as Old Alameda Creek. Currently Old Alameda Creek receives minimal freshwater input. It is comprised of two distinct channels, a narrow northern channel and a wider southern channel divided by a vegetated bar that is only submerged at higher high water during strong (spring) tides. The minimal amount of water level elevation data available on Old Alameda Creek indicates that high water elevations measured about 2 kilometers from the mouth of Old Alameda Creek as high are as 1.8 m NGVD with low water typically near the bed elevation of -.5 m NGVD (Kamman Hydrology, 2000). Observed salinity in this slough, measured at a Cargill intake location, is generally similar to observed South Bay salinity.

Additional tidal sloughs are currently under construction in the Baumberg Complex. These sloughs are part of an ongoing tidal restoration project and are being constructed using the Cargill dredge. When this restoration project is complete, a modified Mount Eden Creek and a new North Creek will connect the Eden Landing Ecological Preserve to San Francisco Bay. North Creek will connect from the preserve to Old Alameda Creek approximately 2 km from SSFB. Mount Eden Creek enters the bay approximately 2 km north of the mouth of Old Alameda Creek. The existing Mount Eden Creek will be expanded and extended as part of the ongoing project. These sloughs will not receive substantial freshwater flows and it is expected that salinity in these sloughs will be similar to Bay salinity.

Salinity in Tidal Sloughs Near the West Bay Complex

The West Bay Complex is located on the west side of the Dumbarton Bridge. The Dumbarton Strait, with a width of approximately 2 km, is the narrowest part of South Bay. The mean tidal range in the Bay at this location is 2.0 m (NOAA, 2003), and the salinity is similar to the salinity measured by the USGS at the Dumbarton Bridge. Observed velocities in this region (for example, currents measured at USGS/NOAA station C13), are relatively large due to the strong tides and narrow cross-section of the Dumbarton Strait.

The largest tidal slough located near the West Bay Complex is Ravenswood Slough. Local freshwater input to this slough is relatively low, and salinity in the Bay and sloughs bordering the West Bay Complex is typically similar to salinity measured at the Dumbarton Bridge.

4.3.1.2 Overview of Potential Water Quality Impacts from Salinity

Initial Discharge Salinities at ISP Ponds During the Initial Release Phase (IRP) and Continuous Circulation Period (CCP)

For purposes of the salinity modeling and impact analysis, the ISP conditions are divided into two phases. The Initial Release Phase (IRP) includes the initial discharge of the existing pond contents at the start of circulation through the individual pond systems. The existing salinity in the ponds is greater than normal oceanic or Bay salinities. The IRP was considered to be the period during which the predicted discharge salinity would exceed approximately 40 ppt. For all of the proposed systems the IRP would be eight weeks or less.

The Continuous Circulation Period (CCP) was considered to be the long-term pond operation period extending from the end of the IRP until the end of the ISP and marking the beginning of the long-term restoration project. The length of the CCP is anticipated to be at least five years for all ponds and longer for some ponds.

Upper limits for initial discharge salinities at the beginning of the ISP were proposed for the purposes of salinity modeling and impact analysis. Ponds were placed into one of three salinity groups, based on the maximum allowable salinity for each pond at discharge (see Table 4-3). Note that not all ponds would directly discharge to the Bay or sloughs, but Table 4-3 lists the maximum salinity of each pond at the time discharge would occur. Ponds were designated for a particular salinity group based on the historic operation of the salt pond and system constraints on changes to the existing salinities.

Figure 4-3 shows representative graphs of the area of Alviso Slough with daily average and daily maximum salinity greater than 32 ppt during the Initial Release Period for the Simultaneous April Initial Release. The area is expressed as a percentage of the entire slough area below high tide water levels from Coyote Creek upstream to near Gold Street. The time period shown is for the approximately two month duration of the IRP. Because the initial release salinity mixes with the water in the slough, the maximum area affected occurs one to two weeks into the IRP, and then decreases over the remainder of the IRP. This corresponds to the decreasing discharge salinity pattern shown in Figure 4-1.

Within the period of maximum effect, the one day with the maximum areas was evaluated to analyze the extent of the increased salinity. This is termed the maximum day, and was used to generate the areas listed in Table 4-5. The area on the maximum day is not representative of the entire IRP, but is the single day with the greatest area of salinity effects. For the example of Alviso Slough for Alternative 2, the maximum day is April 8.

The salinity values in Figure 4-3 and significance criteria for salinity increases are described in Section 4.3.1.3.

Table 4-3
ISP Ponds Within Each of the Salinity Groups (Ponds shown in bold print are discharge ponds)

Salinity Group	Maximum Discharge Salinity	Alviso Complex Ponds	Baumberg Complex Ponds	West Bay Complex Ponds
Group 1	65 ppt	A1, **A2W** A2E, B1, B2, **A3W**, A3N	1, **2,** 4, 7 10, **11**	
Group 2	100 ppt	A5*, **A7***, A8* A9, A10, A11, A14	5, 6, 1C, **2C**, 3C, 4C, 5C, 6C	
Group 3	135 ppt	A12, A13, A15 **A16, A17** **A19, A20, A21**	6A,6B 9, **8A**, 8 12, 13, 14	**1, 2, 3, 4**, 5, 5S **SF2**

* These ponds include an upper limit of 110 ppt.

The ISP salinity conditions for the bay and major sloughs were predicted by hydrodynamic computer models for the IRP and CCP conditions. The model analysis compares predicted salinity conditions based on existing conditions and predicted conditions for the two pond management alternatives. Since the No Project/No Action and Alternative 1 (Seasonal Ponds)do not include planned discharges to receiving waters, they were not modeled.

- **Alternative 2: Simultaneous March-April Initial Discharge --**All systems except the Island Ponds (A19, A20, and A21), the Alviso A23 system, and the West Bay Complex to begin discharge in April. Initial pond salinities to be based on the maximum salinities from Table 4-3 above. The actual initial discharge may have lower salinity values, depending on weather and pond conditions prior to the IRP. The modeled conditions are considered the maximum potential condition.
- **Alternative 3: Phased Initial Discharge—**The initial pond salinities for all ponds were based on the maximum salinities from Table 4-3 above. Selected ponds would begin initial release at the same time. These would include Alviso Systems A2W, A3W, and A7 and Baumberg Systems 2, 8A, and 11. The ponds were selected to represent a significant number of systems that could be included in a first phase of the project based on construction and operational constraints. The phased release was assumed to begin in July, to allow some construction in the spring after the winter rainy season. Most of the proposed system structures would not be accessible for construction during the winter. The remaining pond systems, Alviso Systems A14 and A16, and Baumberg System 2C, would start circulation in the following year. The initial release for these later systems is

proposed for the following April, and the model results for those ponds would be similar to the Simultaneous March-April Initial Discharge above. The actual initial discharge for all ponds may have lower salinity values, depending on weather and pond conditions prior to the IRP. The modeled conditions are considered the maximum potential condition for each pond system.

Both pond management alternatives (Alternatives 2 and 3) included a modification of the CCP operation from the Baumberg System 11 described in the ISP (Appendix A). Because the initial release would occur prior to completion of the Mount Eden Creek channel construction project, the proposed outlets to the new channel from ponds 10 and 11 would not be available for the IRP. An alternative initial operation scheme was included that would use the existing pond 10 intake as an intake/outlet. The initial release would be from the intake and would release the volume of ponds 10 and 11. After the initial release, pond 11 would be operated as seasonal with no intake or discharge. Pond 11 would partially fill with rainwater during the winter and dry out during the summer.

Estimates of the range of salinities of the discharges from the Alviso, Baumberg, and West Bay Unit Ponds during the Initial Release and Continuous Circulation Periods are summarized in Table 4-4. These estimates were made using mathematical modeling techniques that are described in Chapter 3 of the ISP (Appendix A). It is anticipated that discharges from Alviso Pond Systems A2W, A3W, A7, A14, and A16 and Baumberg 2, 2C, 8A, and 11 will begin during the initial years of the ISP and these discharges are further addressed in this evaluation. Due to constraints associated with the existing salt operations and agreements between Cargill and CDFG/USFWS, circulation and discharge of waters from the West Bay Unit Ponds and the Alviso Island Ponds (A19, A20, and A21) will not begin until later years.

Table 4-4
Estimated Range of Salinities at Discharge Point (ppt) during:

Discharge Point	Initial Release Period: Beginning on April 1 (first 2 months)	Phased Initial Release Period: Beginning on July 1 (first 2 months)	Continuous Circulation Period
Alviso Unit			
A2W	27-65	45-65	14-44
A3W	27-65	43-65	14-44
A7	26-110	41-110	12-44
A14	36-100		20-44
A16	29-135		15-44
A19, A20, A21	29-135		15-44
Baumberg Unit			
2	30-65	45-65	18-44
11	28-65	40-65	15-44
2C	32-100		18-44
8A	74-135	35-135	20-44
6A*			16-44
West Bay Unit			
SF-2	40-135		16-44
1	40-135		16-44
2	40-135		16-44
3	40-135		16-44
4	40-135		16-44

* 6A is presently dry no initial release required.

The salinity of each of the discharges is predicted to vary over the course of the ISP. In all cases, the salinity will be the highest during the Initial Release Period (IRP), when the water that has been concentrated by evaporation is first pushed out of the ponds. Discharge salinities during the IRP are discussed above. There will be variation among discharge points, but, in general, the discharge of the high salinity waters under the IRP will last between one and two months, with the salinity of the discharge decreasing with time. Figure 4-1 shows a representative graph of predicted pond discharge salinity through the first 18 months of operation.

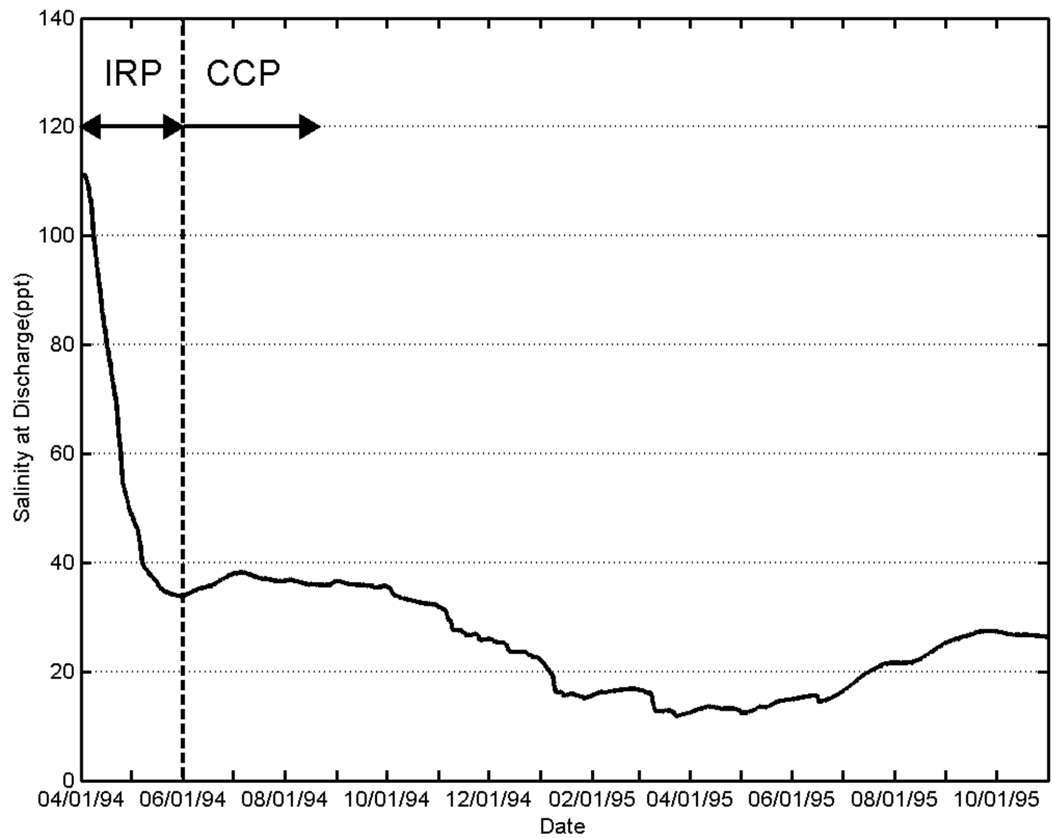


Figure 4-1 – Representative Pond Discharge Salinity (Pond A7)

The water control structures were designed to maintain discharge levels below 40 ppt year-round during the CCP. However, to anticipate potential operational issues that could occur during ISP operations, the possibility of salinity peaks up to 44 ppt were evaluated. After the IRP, discharge salinities during the CCP will also vary, but water will be circulated through the ponds in a manner that will generally prevent discharge salinities from exceeding 40 ppt throughout the year.

Under all scenarios, the actual discharge salinities during the CCP will vary over the course of the year, with lower salinities during the wet season (due to dilution by rainwater and low evaporation rates) and higher during the dry season (due to high evaporation rates).

Changes in Salinity in Receiving Water Bodies During the Initial Release Phase (IRP) and Continuous Circulation Period (CCP)

The saline water circulated from the salt ponds during the ISP will enter either directly into the South Bay or into one of several tributaries that eventually discharge into the South Bay. Segments of the South Bay and of each of these tributaries will experience increases in salinity as a result of these discharges. As with discharge salinities, the magnitude of these increases will vary over the course of the ISP, but will be the greatest during the Initial Release Period (IRP). In this section, the nature of these increases in salinity are discussed for two segments of San Francisco Bay proper (i.e., near the Alviso Complex and near the Baumberg Complex) and for each of four tributaries (Alameda Flood Control Channel, Coyote Creek, Alviso Slough, and Guadalupe Slough).

For each receiving water body, changes in salinity are predicted during both the IRP and CCP. For the IRP, in order to capture the full range of predicted changes in salinity, evaluations are made for two points in time:

(1) The week when the highest IRP salinities are being discharged, and

(2) At the end of the IRP when the lowest IRP salinities are being discharged.

Similarly, in order to capture the full range of outcomes for the CCP, evaluations are made for four points in time:

(1) At the end of September, when pond salinities are predicted to be the highest and freshwater inflow the lowest;

(2) During a winter storm event when pond salinities are predicted to be the lowest and freshwater inflow the highest;

(3) During a winter dry period when pond salinities are predicted to be low and freshwater inflow is moderate; and

(4) Late spring dry period, when pond salinities are relatively low, and freshwater inflow is relatively low.

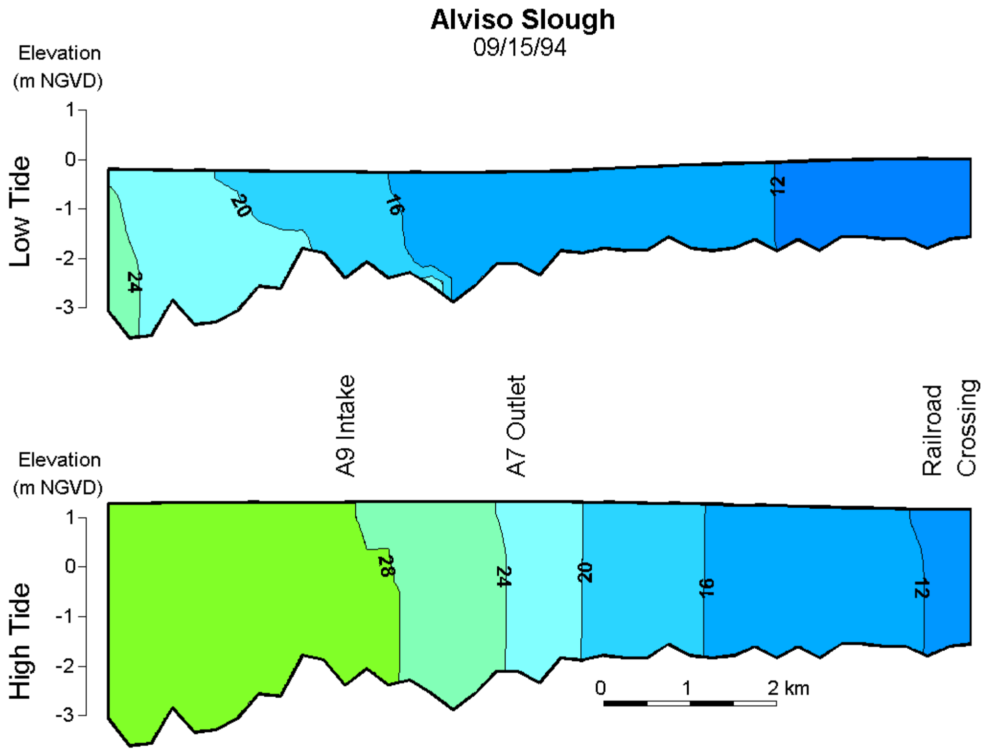
The ISP salinity conditions for the bay and major sloughs were predicted by hydrodynamic computer models for the IRP and CCR conditions. The model results describe several types of salinity values to characterize the salinity conditions in the receiving waters.

Depth-averaged salinity is the average salinity in the water column from the bottom to the surface. For well mixed areas the salinity in the entire water column would be similar to the depth-averaged salinity. For stratified areas, the bottom salinity would generally be higher than the depth-averaged salinity, while the surface salinity would be lower. Because the areas of significant stratification are highly variable, both spatially and temporally, most salinity values described are depth averaged to simplify the discussion.

Although depth-averaged salinity values are generally representative of salinity conditions in the water column, since bottom salinities may have a greater effect on benthic communities, a sensitivity analysis for Alviso Slough and AFCC was prepared to compare the area, extent and intensity of predicted bottom salinities to depth-averaged salinity conditions. The analysis showed no difference in daily average conditions and very small differences in intensity for daily maximum salinity values. Because the normal areas of stratification at the interface of bay water and fresh water moves with the tide cycle it has a limited effect on the areas of daily maximum salinity for salinities greater than 32 ppt. The small differences in intensity for the daily maximum salinity values tend to occur in the vicinity of the pond discharge due to short periods of stratification at low tide. Figure 4-2 shows high tide and low tide salinity profiles of a typical slough for existing conditions. The low tide profile shows an area of stratification in the downstream area of the slough, i.e., where the upper profile salinity contours of 16 and 20 ppt are slanted.

Daily averaged salinity is the average salinity at a particular location for one 24-hour period. The daily average salinity provides a measure of the typical salinity at a specific location, but does not represent the high and low salinity within the tidal cycles. The daily-averaged salinity provides an estimate of exposure over a period that is shorter that that used in the San Francisco. Water Quality Control Plan and in USEPA ambient water quality criteria in establishing chronic objectives and criteria and is longer than that used in establishing acute objectives and criteria. Consequently, if the assessment of impacts for this exposure is based on the results of chronic toxicity tests and/or observations made in the field following chronic duration exposures, the assessment should be conservative. Figure 4-2 shows the type of daily variability of salinity values in a slough area between high and low tide conditions.

Daily maximum salinity is the maximum salinity during the day at a specific location. Depending on the location and ISP discharge conditions, the daily maximum may occur at high or low tide. For locations away from the pond discharges, daily maximum salinity occurs at high tide due to inflows from the Bay. For locations in the vicinity of a pond discharge, the daily maximum may occur at low tide because the pond discharge occurs at low tide. Typically the daily maximum salinity would occur for one to two hours during the extremes of the tidal range. The daily maximum salinity provides an estimate of exposure over a relatively short period that is more similar to an estimate of acute exposure as defined in the S.F. Water Quality Control Plan and in USEPA ambient water quality criteria. Consequently, assessment of impacts for this short duration exposure would be based on the results of acute toxicity tests and/or observations made in the field following similarly short exposures.



Note: Salinity profile computed along a longitudinal transect in the hydrodynamic model. Predicted based on 1994-1995 weather and tidal conditions.

Figure 4-2 Predicted Alviso Slough Salinity (ppt) for Existing Conditions on September 15

Changes in Salinity in the Receiving Waters Near Alviso Complex

This segment of the receiving waters includes San Francisco Bay proper south of the Dumbarton Bridge. The salinity of this segment will be affected primarily by the circulation from five discharge points i.e., A2W (direct discharge to bay), A3W (discharge via Guadalupe Slough), A7 (discharge via Alviso Slough), A14 (discharge via Coyote Creek), and A16 (discharge via Artesian Slough) and three levee breaches in Ponds 19, 20, and 21. The breaches will occur several years after the initiation of the ISP.

Changes in Salinity in the Receiving Waters Near Baumberg Complex

This segment of the receiving waters includes San Francisco Bay proper between the Dumbarton Bridge and the San Mateo Bridge. The salinity of this segment will be affected primarily by the circulation from five discharge points i.e., Pond 2 (direct discharge to bay), Pond System 11 (direct discharge to bay through bidirectional gate in Pond 10 during IRP), Pond 2C (discharge via Alameda Flood Control Channel), Pond 8A (discharge via Old Alameda Creek, and Pond 6A (discharge via Old Alameda Creek).

Changes in Salinity in the Receiving Waters Near West Bay Complex

This segment of the receiving waters includes the San Francisco Bay proper at the Dumbarton Bridge. The salinity of this segment will be affected primarily by the circulation from three discharge points i.e., Pond 4 (discharge via Ravenswood Slough), Pond 1 (discharge via Ravenswood Slough), and Pond SF2 (direct discharge to the Bay).

Changes in Salinity in the Creek and Slough Areas

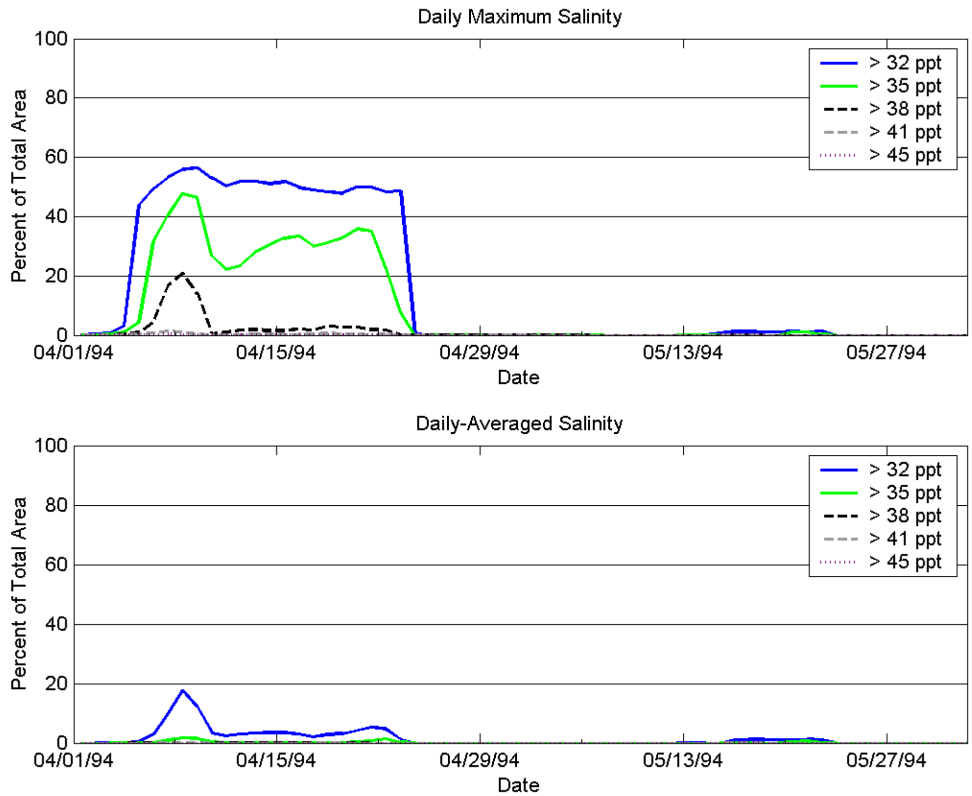
This segment of the receiving waters includes Coyote Creek, Alviso Slough, Guadalupe Slough, Alameda Flood Control Channel, and Old Alameda Creek. The existing salinity conditions within the creek and slough areas near the proposed discharge locations are highly variable. Average salinities near the bay are generally close to the bay salinity, which may vary from as low as 10 ppt in winter to as high as 33 ppt in late summer. Average salinities upstream at the limit of tidal influence may be as low as 0 ppt. In addition, the salinity at a single location can vary by 10 ppt or more between high and low tides. This variability is shown in the sample profiles in Figure 4-3.

The proposed ISP discharges would add to the existing salinity in the creek and slough areas. Since the discharge flow would generally occur at low tide, the higher salinity discharge would not immediately flow out the bay, but would contribute to the incoming tidal flow and raise the overall salinity in the creek or slough channel. In all the creeks and sloughs, the higher salinity discharge would increase low tide salinities near the outlet and increase the daily average salinities upstream and downstream of the outlet. The magnitude of the potential increase would be greatest at the outlet location and less upstream and downstream, depending on the mixing within the channel. For locations with a high freshwater inflow, such as Coyote Creek, the ISP discharge would have little effect on the daily maximum salinities.

The estimated salinity increases in the creeks and sloughs are greater during the IRP due to the higher initial release salinities. The potential magnitude of the salinity increases is a result of both the initial pond salinity values, and the discharge flow rates during the IRP.

Figure 4-3 shows representative graphs of the area of Alviso Slough with daily average and daily maximum salinity greater than 32 ppt during the Initial Release Period for the Simultaneous April Initial Release. The graphs show that the pond discharge effects increase to a maximum after approximately one week, as the general salinity levels in the slough increase due to the discharge. For approximately one week, the area with daily maximum salinity greater than 38 ppt was predicted to be greater than 10 percent of the overall slough and the area with daily averaged salinity greater than 32 ppt was predicted to be greater than 10 percent. As stated previously, the daily average values are averaged over 24 hours, the daily maximum values represent the maximum salinity averaged over 2 hours.

Within the period of maximum effect, the one day with the maximum areas was evaluated to analyze the extent of the increased salinity. This is termed the maximum day, and was used to generate the areas listed in Table 4-5. The area on the maximum day is not representative of the entire IRP, but is the single day with the greatest area of salinity effects. For the example of Alviso Slough for Alternative 2, the maximum day is April 8.



Note: Predicted based on 1994-1995 weather and tidal conditions.

Figure 4-3 - Percent of Alviso Slough Area in which the Predicted Depth-Averaged Salinity Is Greater than Category Minimums during the IRP for the Alternative 2, Simultaneous Initial Release

4.3.1.3 Significance Evaluation for Salinity Impacts to Water Quality

The data from modeling of salinities in each of the receiving water bodies during the Initial Release Phase (IRP) were used to evaluate the significance of the temporary (short-term) impacts of pond discharges. This evaluation process is described below.

There is no quantitative water quality objective for salinity in the bay and sloughs. The narrative objective indicates that changes in salinity should not adversely affect beneficial uses in the receiving waters. Uses of receiving waters that could be adversely affected by elevated salinity are limited to those that are aquatic-life based, most notably, Estuarine Habitat (EST). Therefore, the criteria for the significance evaluation were based on the potential response of existing benthic communities in the receiving waters. Benthic species were considered indicators of the habitat quality because many species are food sources for other species and may be sessile and cannot move away from areas with high salinity.

The project would have a significant impact on benthic populations if it would:

- Have the potential to substantially reduce habitat, cause a population to drop below self-sustaining levels, or threaten to eliminate a community;
- Conflict with the provisions of an approved local, regional or state policy or ordinance protecting biological resources;
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional or state Habitat Conservation Plan

The term "substantial" (applied to populations, habitat, or range), has not been quantitatively defined in CEQA or NEPA. What is considered substantial may vary with each species and with the particular circumstances pertinent to a particular geographic area.

Significance Evaluation for Short-term Salinity Impacts to Water Quality

The significance of short-term impacts to each of the receiving waters in the project area was evaluated by examining the percentage of receiving waters predicted to fall into several salinity classes, or stages, during the IRP. Each stage represents a salinity range that is expected to correspond with a different benthic response. Predictions of benthic responses to different levels of salinity were based on an extensive review of the available literature (see Section 6.2 Benthic Organisms). The salinity ranges in these stages are intended as a qualitative tool to categorize possible impacts to aquatic communities. It is not known how each species or aquatic community may respond to a particular salinity range; only that the potential for impacts would increase with higher stages. In addition, the potential for impacts would increase with longer durations of exposure (e.g., the same elevated salinity range experienced for 2 hours would be expected to produce a significantly smaller effect than if the exposure were for 24 hours).

A scale of salinity categories was developed to assess potential impacts to resident aquatic communities. This scale is based on available data from laboratory testing, field observations in the San Francisco Bay during drought years, and field observations of the salt ponds. Salinity ranges, benthic responses, and significance levels that correspond to each of the stages are as follows (see Section 6.1 for a complete discussion of the response stages):

- Ambient conditions–less than 33 ppt salinity; benthic species population may vary depending upon species salinity preferences; impacts less than significant.
- Drought conditions–33 to 35 ppt salinity. If exposure is chronic, benthic community changes to salinity tolerant species similar to drought years; effects quickly reversed with normal salinity regime. If exposure is acute (i.e., a few hours per day), less of a shift in species composition. In either case, impacts less than significant.
- Stage 1–36 to 38 ppt salinity. If exposure is chronic, benthic community may lose most sensitive species during initial release period. If exposure is acute (i.e., lasting a few hours per day), less impact on community. With chronic exposure, impacts considered potentially significant. With acute exposure, impacts considered less than significant.
- Stage 2–39 to 41 ppt. If exposure is chronic, benthic community may lose larger number of species during the initial release period. If exposure is acute (i.e., lasting a few hours per day), less impact on community. With chronic exposure impacts considered significant. With acute exposures, impacts considered potentially significant.
- Stage 3 – 42 to 45 ppt. If exposure is chronic, community may be limited to most salinity tolerant species. If exposure is acute, less impact on community but still loss of large number of species. In either case, impacts considered significant.
- Stage 4–greater than 45 ppt. For both chronic and acute exposures, community would be severely reduced. In either case, impacts considered significant.

The significance of the short-term impacts to each of the receiving water bodies was determined by analyzing the intensity of the impact and the context of the impact.

The intensity of the impact is characterized by the duration of the exposure and the salinity range of the impact.

- For a chronic exposure, a water body receiving a Stage 1 impact (some acreage of that water body would have salinities in the Stage 1:36 to 38 ppt range) would be considered to experience a potentially significant impact. A water body that would receive Stage 2 to 4 impacts (salinities greater than 39 ppt) would be considered to have experienced a significant impact. Impacts to water bodies that are predicted to have salinities of 35 ppt or less (ambient or drought conditions) would be considered to be not significant or less than significant. In terms of intensity any Stage 1 impact (between 36 to 38 ppt) would be potentially significant.
- For an acute exposure, a water body receiving a Stage 1 impact (some acreage of that water body would have salinities in the Stage 1: 36 to 38 ppt range) would be considered to have experienced no significant impact. A water body that would receive Stage 2 (salinities in the 39-41 ppt range) would be considered to have experienced a potentially significant impact. A water body that would receive Stage 3 to 4 impacts (salinities greater than 41 ppt) would be considered to have a

> significant impact. To summarize, impacts to water bodies that are predicted to have salinities of 38 ppt or less (ambient, drought, or Stage 1 conditions) would be considered to be not significant or less than significant. In terms of intensity, any Stage 2 impact (between 39 to 41 ppt) would be potentially significant.

For the IRP conditions, all discharge locations would undergo periods with discharge salinities greater than 45 ppt in the immediate vicinity of the discharge point. Therefore all discharges were considered potentially significant based on the intensity of the potential salinity.

The context of the impact is characterized by the percentage of the water body that would fall into a significant salinity range. There is not enough information about the ecology of the South Bay to determine the exact percentage of habitat affected above which impacts should be considered significant. For the purposes of this analysis, a conservative approach was taken. Ten percent was chosen as the threshold for the spatial component of impact assessment. This number is somewhat arbitrary, but is well below the 30 percent threshold used in many habitat assessments. Additionally, the duration of the impacts assessed is very short (ranges from 24 hours to several weeks). The area of each receiving water was calculated using an upstream boundary of estuarine environment (2 to 4 ppt salinity). For chronic exposures (i.e., based on 24-hr daily average conditions), impacts that would result in 10 percent or more of a water body falling into Stages 2 through 4 are considered significant. For acute exposures (i.e., based on 2-hr daily maximum conditions), impacts that would result in 10 percent or more of a water body falling into Stages 3 through 4 are considered significant.

These two significance thresholds, based on impact intensity and impact context, were combined qualitatively to arrive at an overall significance rating for short-term (Initial Release Period) impact for each receiving water body. The data used to determine the significance of short-term salinity impacts to receiving water bodies are presented in summary form in Table 4-5. As shown in Table 4-5, for each water body, the analysis looked at modeled daily maximum and daily average salinities under the Simultaneous April-March Initial Discharge Scenario (Alternative 2) and Phased Initial Discharge Scenario (Alternative 3). In addition, the analysis looked at short-term salinity impacts to Coyote Creek of breaching the Island Ponds.

For those areas with potentially significant temporary impacts affecting greater than 10 percent of a water body, preventative mitigation measures are proposed, even though the overall project impacts are predicted to be less than significant. In these cases, the results of monitoring efforts will be carefully scrutinized and operational changes made if necessary to minimize temporary adverse effects on benthic communities.

Significance Evaluation for Long-term Salinity Impacts to Water Quality

The data from modeling of salinities in each of the receiving water bodies during the Continuous Circulation Phase (CCP) were used to evaluate the significance of the long-term impacts of pond discharges. The significance of the long-term impacts to each of the receiving water bodies was determined by analyzing the intensity of the impact and the context of the impact, using the same salinity categories and significance criteria as for the short-term impacts.

The data used to determine the significance of long-term salinity impacts to receiving water bodies are presented in summary form in Table 4-6. The analysis looked at modeled daily maximum and daily average salinities under the ISP for each receiving water body during the late summer (September) when ambient salinities in the bay are at the annual maximums.

Table 4-5
Summary of Short-term (Temporary) Salinity Impacts for Maximum Day During IRP

Receiving Water and Alternatives	Date[2]	Total Acres	Ambient Conditions	Drought Conditions	Stage 1	Stage 2	Stage 3	Stage 4	Duration[3]	Context[4] – Percent of Area	Impact Significance
		Acres By Salinity Class[1]									
SF Bay - Alviso											
Alternative 2	4-Apr										
Daily Maximum (2-hr)[5]		29,536	27,869	849	316	198	256	48		1.0	LTS
Daily Average (24-hr)[6]		29,546	28,775	385	198	168	10	10		0.6	LTS
Alternative 3	4-Jul										
Daily Maximum (2-hr)[5]		29,536	22,120	5,387	1,384	376	206	63		0.9	LTS
Daily Average (24-hr)[6]		29,546	25,108	3,341	603	119	336	40		1.7	LTS
SF Bay - Baumberg											
Alternative 2	23-Apr										
Daily Maximum (2-hr)[5]		11,868	11,495	304	49	10	5	5		0.1	LTS
Daily Average (24-hr)[6]		11,868	11,631	168	49	0	10	10		0.2	LTS
Alternative 3	4-Jul										
Daily Maximum (2-hr)[5]		11,868	10,885	563	306	99	10	5		0.1	LTS
Daily Average (24-hr)[6]		11,868	11,186	385	208	89	0	0		0.7	LTS
Coyote Creek											
Alternative 2	5-May										
Daily Maximum (2-hr)[5]		1,232	1,212.5	1.7	0.9	0.3	0.2	4.2		0.4	LTS
Daily Average (24-hr)[6]		1,232	1,226.4	1.1	0.8	0.0	0.2	3.2		0.3	LTS
*Island Ponds***											
Breach		1,236	1,233	3	0	0	0	0		0.0	LTS
Alviso Slough											
Alternative 2	8-Apr										
Daily Maximum (2-hr)[5]		273	120.5	21.8	73.5	54.2	2.5	0.3		1.0	LTS
Daily Average (24-hr)[6]		273	224.7	43.2	4.6	0	0.2	0.0		0.0	LTS
Alternative 3	16-Jul										
Daily Maximum (2-hr)[5]		273	151.5	19.6	67	28.0	5.6	1.1		2.4	LTS
Daily Average (24-hr)[6]		273	271.0	1.5	0.2	0.0	0.0	0.0		0.0	LTS
Guadalupe Slough											
Alternative 2	22-Apr										
Daily Maximum (2-hr)[5]		376	368.3	4.0	1.7	1.4	0.2	0.2		0.1	LTS
Daily Average (24-hr)[6]		376	369.9	3.6	1.7	0.5	0.2	0.0		0.2	LTS

			Acres By Salinity Class[1]								
Receiving Water and Alternatives	**Date[2]**	**Total Acres**	**Ambient Conditions**	**Drought Conditions**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Duration[3]**	**Context[4] – Percent of Area**	**Impact Significance**
Alternative 3	24-Jul										
Daily Maximum (2-hr)[5]		376	158.3	92.4	121.3	3.3	0.3	0.2		0.1	LTS
Daily Average (24-hr)[6]		376	299.5	75.1	1.2	0.0	0.0	0.0		0.0	LTS
Alameda FCC											
Alternative 2	2-May										
Daily Maximum (2-hr)[5]		254	132.0	15.5	17.9	60.2	28.3	0.2	1 day	11.2	S
Daily Average (24-hr)[6]		254	187.1	64.7	2.1	0.1	0.0	0.1		0.0	LTS
Old Alameda Creek*											
Alternative 2											
Daily Maximum (2-hr)[5]		70						70	2 weeks	100	S
Daily Average (24-hr)[6]		70						70	2 weeks	100	S
Alternative 3											
Daily Maximum (2-hr)[5]		70						70	2 weeks	100	S
Daily Average (24-hr)[6]		70						70	2 weeks	100	S
All Sloughs (Total)											
Alternative 2	varies										
Daily Maximum (2-hr)[5]		2,205	1,833	43	94	116	31	75		4.8	LTS
Daily Average (24-hr)[6]		2,205	2,008	113	9	1	1	73		3.4	LTS
Alternative 3	varies										
Daily Maximum (2-hr)[5]		2,205	1,654	129	207	92	34	76		5.0	LTS
Daily Average (24-hr)[6]		2,205	1,984	142	4	0	0	73		3.3	LTS

Notes:

[1] Ambient Conditions = <33ppt salinity; Drought Conditions = 33-35 ppt salinity; Stage 1 = 36-38 ppt salinity; Stage 2 = 36-38 ppt salinity; Stage 3 = 42-45 ppt salinity; Stage 4 = >45 ppt salinity

[2] Date of maximum day of areal impact during IRP.

[3] Duration of period with 10% or more of area within significant category.

[4]Context – Areal extent of significant intensity classes; greater than 10% considered significant.

[5] Daily maximum salinity predicted for approximately 2 hours of maximum day of IRP.

[6] Daily average salinity over 24 hours of maximum day of IRP.

*** Old Alameda Creek was not modeled in the same detail as the other receiving waters.**

Table 4-6
Summary of Long-term (Permanent) Salinity Impacts for Late Summer Conditions During CCP

			Acres By Salinity Class[1]								
Receiving Water and Alternatives	**Date[2]**	**Total Acres**	**Ambient Conditions**	**Drought Conditions**	**Stage 1**	**Stage 2**	**Stage 3**	**Stage 4**	**Duration[3]**	**Context[4] – Percent of Area**	**Impact Significance**
SF Bay – Alviso											
Daily Maximum (2-hr)[5]		11,868	11,243	620	5	0	0	0		0	LTS
Daily Average (24-hr)[6]		11,868	11,598	270	0	0	0	0		0	LTS
SF Bay – Baumberg											
Daily Maximum (2-hr)[5]		29,536	7,386	22,150	20	0	0	0		0	LTS
Daily Average (24-hr)[6]		29,536	11,816	17,720	0	0	0	0		0	LTS
Coyote Creek											
Daily Maximum (2-hr)[5]		1,232	1,168	61	3.2	0	0	0		0	LTS
Daily Average (24-hr)[6]		1,232	1,202	30	0	0	0	0		0	LTS
Alviso Slough											
Daily Maximum (2-hr)[5]		273	270	3	0.1	0	0	0		0	LTS
Daily Average (24-hr)[6]		273	271	2	0	0	0	0		0	LTS
Guadalupe Slough											
Daily Maximum (2-hr)[5]		376	372	4	0.2	0	0	0		0	LTS
Daily Average (24-hr)[6]		376	373	3	0	0	0	0		0	LTS
Alameda FCC											
Daily Maximum (2-hr)[5]		254	102	152	0.2	0	0	0		0	LTS
Daily Average (24-hr)[6]		254	164	80	0	0	0	0		0	LTS
Old Alameda Creek*											
Daily Maximum (2-hr)[5]		70	0	70	0.1	0	0	0		0	LTS
Daily Average (24-hr)[6]		70	0	70	0	0	0	0		0	LTS
All Sloughs (Total)											
Daily Maximum (2-hr)[5]		2,205	1,911	290	3.8	0	0	0		0	LTS
Daily Average (24-hr)[6]		2,205	2,020	185	0	0	0	0		0	LTS

Notes:

[1] Ambient Conditions = <33ppt salinity; Drought Conditions = 33-35 ppt salinity; Stage 1 = 36-38 ppt salinity; Stage 2 = 36-38 ppt salinity; Stage 3 = 42-45 ppt salinity; Stage 4 = >45 ppt salinity

[2] Date of maximum day of areal impact during IRP.

[3] Duration of period with 10% or more of area within significant category.

[4] Context – Areal extent of significant intensity classes; greater than 10% considered significant.

[5] Daily maximum salinity predicted for approximately 2 hours of maximum day of IRP.
[6] Daily average salinity over 24 hours of maximum day of IRP.

4.3.1.4 Salinity Impacts to Water Quality By Alternative

Salinity Impacts to Water Quality—No Project/No Action Alternative

Under the No Project/No Action alternative, no waters would be let into or out of the ponds and the levees would not be maintained. Most of the existing open water habitats currently used by wildlife would be greatly reduced, significantly changing the character of the South Bay salt ponds. The duration and depth of water in the ponds would be reduced in most years, and the open water character of the salt ponds would be lost. The existing intake structures for each pond complex would be closed. Intake ponds would no longer be present, so the pond systems would not support fish and bay invertebrates, resulting in reduced foraging habitat for piscivorous (fish-eating) birds.

> *WATER QUALITY (SALINITY) IMPACT-1*: *Salinity in ponds could be concentrated by evaporation. Unplanned breaches of ponds could result in water quality impacts from increased salinity in receiving waters.*

Under the No Project/No Action Alternative, bay water would not be let into the ponds and salinity levels would not be managed. Additionally, levees would not be maintained and unplanned breaches of the ponds would be more likely to occur. Depending on the salt mass remaining in the ponds, salinity levels in the pond discharge after a breach may be greater than bay conditions at the time. Any breach of the project ponds would have potentially significant impacts on water quality and biota due to elevated salinity.

Significance: Potentially significant. Since this alternative would result in no project being implemented, no mitigation measures are required.

Alternative 1 – Seasonal Pond Alternative

This alternative minimizes impacts from uncontrolled discharge of pond contents into the bay. Maintenance of the levees and water control structures would prevent their deterioration and prevent the accidental breaching of the ponds and release of pond contents to the bay. Under this alternative, most of the existing open water habitats currently used by wildlife would be greatly reduced, significantly changing the character of the South Bay salt ponds. The duration and depth of water in the ponds would be reduced in most years, and the open water character of the salt ponds would be lost. The existing intake structures for each pond complex would be closed. Intake ponds would no longer be present. so the pond systems would not support fish and bay invertebrates, resulting in reduced foraging habitat for piscivorous (fish-eating) birds.

The Seasonal Pond Alternative would have minimal impacts on receiving waters, but existing, in-pond open water habitat values would decline because of the temporary seasonal water levels each year. The alternative would not meet project objectives of maintaining existing open water and wetland habitat for the benefit of wildlife, including habitat for migratory shorebirds and waterfowl and resident breeding species or maintaining ponds in a restorable condition to facilitate future long-term restoration.

> *WATER QUALITY IMPACT (CONSTRUCTION) 2-*: *Impacts from contaminants and/or suspended sediments could result from the mobilization of construction equipment to repair breached levee sites.*

This Seasonal Pond Alternative would require the maintenance of the levees. Contaminants (e.g., petroleum products) associated with the operation of equipment and other construction activities may enter the receiving waters. The contaminants could adversely affect fish and macroinvertebrates by affecting their growth, reproduction, and overall survival. In addition, sediment would be mobilized during repair activities. The increased suspended sediment could adversely affect benthic and planktonic organisms, including fish. The effect, however, would likely be minimal because of the relatively small area affected and the high rates of sediment mobility in the South Bay and associated creeks and sloughs.

Significance: Potentially Significant

> *WATER QUALITY (CONSTRUCTION) MITIGATION MEASURE-2A*: *Best management practices.*

As part of this alternative, best management practices (BMPs) for construction and levee repair and maintenance would be followed. A hazardous spill prevention and response plan would be prepared and incorporated as part of the alternative. In addition, an erosion control and sediment management plan would be developed and included as part of the alternative. Management plans (including emergency response, routine maintenance activity, and preventative maintenance activities) would be prepared and implemented as part of the levee repair and maintenance activities. Plans would be provided to NOAA Fisheries, CDFG, USFWS, and the RWQCB for review and comment.

Post Mitigation Significance: Less than significant.

Alternative 2-Simultaneous March-April Initial Release

In Alternative 2 (Simultaneous Initial Release), the contents of most of the Alviso and Baumberg Ponds would be released simultaneously in March and April. The ponds would then be managed as a mix of continuous circulation ponds, seasonal ponds and batch ponds, though management of some ponds could be altered through adaptive management during the continuous circulation period. Higher salinity ponds in Alviso and in the West Bay would be discharged in March and April in a later year when salinities in the ponds have been reduced to appropriate levels. The Island Ponds (A-19, 20, and 21) would be breached and open to tidal waters.

> *WATER QUALITY IMPACT (CONSTRUCTION)-2*: *Impacts from contaminants and/or suspended sediments could result from the mobilization of construction equipment to repair breached levee sites.*

The Simultaneous Initial Discharge Alternative would require the construction of intake and outlet structures and ongoing maintenance of the levees. Contaminants (e.g., petroleum products) associated with the operation of equipment and other construction activities may enter the receiving waters. The contaminants could adversely affect fish and macroinvertebrates by affecting their growth, reproduction, and overall survival. In addition, sediment would be mobilized during repair activities. The increased suspended sediment could adversely affect benthic and planktonic organisms, including fish. The effect, however, would likely be minimal because of the relatively small area affected and the high rates of sediment mobility in the South Bay and associated creeks and sloughs.

WATER QUALITY (CONSTRUCTION) MITIGATION MEASURE-2A: *Best management practices.*

As part of this alternative, best management practices (BMPs) for construction and levee repair and maintenance would be followed. A hazardous spill prevention and response plan would be prepared and incorporated as part of the alternative. In addition, an erosion control and sediment management plan would be developed and included as part of the alternative. Management plans (including emergency response, routine maintenance activity, and preventative maintenance activities) would be prepared and implemented as part of the levee repair and maintenance activities. Plans would be provided to NOAA Fisheries, CDFG, USFWS, and the RWQCB for review and comment.

Significance: Less than significant.

WATER QUALITY (SALINITY) IMPACT-3: *Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to the South Bay.*

During the Continuous Circulation Period, increases in average salinities in the South Bay proper are expected to be virtually nonexistent. For daily-averaged salinity, it is predicted that any increases will be 1 ppt or less and occur in very localized areas near discharge points and at the mouths of sloughs.

The predicted daily maximum salinity at the Alviso A2W discharge and Baumberg pond 2 and 10 discharges may exceed 35 ppt at low tide in September and October when pond and bay salinities reach their annual maximums. For the modeled dry year conditions, approximately 40 acres of the bay mudflats near the discharges could have daily maximum salinities in the range of 36 to 41 ppt. This estimate is based on sheet flow from discharge points without any channel formation. However, past experience indicates that at predicted average discharge flowrates of approximately 30 cubic feet per second (cfs) channels will form through the mudflats over time and this acreage would be greatly reduced. Approximately 43,000 acres, or 60 percent of the South San Francisco Bay south of the San Mateo Bridge, would have daily maximum salinities in the range of 33 to 35 ppt for the same period without the project discharges. Consequently, impacts to aquatic life in South Bay proper, resulting from elevated salinity, are not expected during the long-term Continuous Circulation Period.

For Alternative 2, during the Initial Release Period the increase in depth-averaged, daily-averaged salinity is predicted to be less than 3 ppt except in localized areas near discharge points and at the mouths of sloughs where increases may be as high as 4 ppt. The salinity increases are predicted to be less for Alternative 3. Based on the available literature, these small increases in salinity are unlikely to adversely impact the estuarine species that are resident in the affected segments of South San Francisco Bay. The resident organisms in the South Bay normally experience variations of several ppt on a daily basis and up to 10 ppt daily on a seasonal basis. The predicted maximum daily average salinity in the South Bay proper is less than the recorded drought conditions.

On the maximum day during the Initial Release Period, the daily maximum salinities in the mud flat areas near the discharges at Alviso A2W discharge and Baumberg Ponds 2 and 10 discharges would be close to the maximum discharge salinity of 65 ppt. The actual area of high salinity at low tide was assumed to be a shallow flow path through the mudflats, approximately 100 ft wide, from the discharge location to the deeper area of the bay. However, with deeper channel formation, the acreage would be less, with a mudflat channel on the order of 30 feet in width at the predicted discharge rates. This would correspond to approximately 15 acres of mudflat at Baumberg Pond 2 and less than 5 acres of mudflat at Alviso A2W and Baumberg Pond 10.

Significance: Short-term impact (IRP) - Less than Significant
Long-term impact (CCP) - Less than Significant

> *WATER QUALITY (SALINITY) IMPACT-4:* Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to Coyote Creek (Alviso Complex)

The total area of the portion of Coyote Creek and Artesian Slough considered in the impact analysis is 1,232 acres. Discharges are proposed from ponds A14 and A16 into the creek and slough. Both discharges have been evaluated for Alternative 2.

During the Continuous Circulation Period, elevated salinities in Coyote Creek are expected to be quite low. For daily-averaged salinity, it is predicted that any increases will be 3 ppt or less and will occur in creek segments in the immediate vicinity of the Pond A14 discharge point. The area of Coyote Creek is directly affected by the freshwater discharge from the San Jose WPCP (Water Pollution Control Plant), so additional salinity inputs would likely be beneficial to this creek section. The predicted daily maximum salinity at the Alviso A14 discharge may exceed 35 ppt at low tide in September and October when pond and bay salinities reach their annual maximums. For the modeled dry year conditions, only an approximate 3.2 acres of Coyote Creek in the immediate discharge channel would have daily maximum salinities in the range of 36 to 41 ppt. Consequently, impacts to aquatic life in Coyote Creek as a whole resulting from elevated salinity are not expected during the long-term Continuous Circulation Period.

For the maximum day during the Initial Release Period, for Alternative 2, the maximum increase in salinity in the creek is predicted to be 14 ppt near the Pond A14 discharge. Salinity increases will be lower in other segments of the creek, and nowhere in the creek away from the outlet will depth-averaged and daily-averaged salinities exceed approximately 32 ppt. At the end of the Initial Release Period, a maximum salinity increase of 6 ppt will occur near the Pond A14 discharge point, and lower salinity increases will occur in other segments of the creek.

During the maximum day during the Initial Release Period for the Alternative 2, a very limited area of Coyote Creek and Artesian Slough would have average daily salinity greater than 35 ppt (approximately 3.4 acres). There are 1,226 acres that would not exceed the ambient salinity category. The higher salinity areas include 3.2 acres greater than 45 ppt, which corresponds to salinity category Stage 4. This area primarily includes the access channel cut to the A15 dredge lock near the A14 discharge to the Coyote Creek.

Approximately 4.2 acres near the discharge outlet would have daily maximum salinity greater than 45 ppt. The daily maximum salinity would occur for a few hours of the day, with the estimate based on the highest twohours during the day. In these very limited areas, Coyote Creek may reach salinities in a range to affect sensitive species on the day with the highest salinity during the entire Initial Release Period.

Coyote Creek was not included in the Alternative 3 Phased Initial Release Alternative evaluation. If Alternative 3 is implemented, the pond A14 and A16 systems circulation would not occur in the first year, but would occur the following March/April. In that case, the predicted salinities in Coyote Creek and Artesian Slough would be similar to Alternative 2, which is based on a March/April Initial Release. The Coyote Creek salinities for the Phased Initial Release would be lower than the Simultaneous Initial Release Alternative because the other pond systems in Alviso (A2W, A3W, and A7) would not be in the same Initial Release Period.

Island Ponds Breach Conditions –The Island Ponds (A19, A20, and A21) will be breached as part of the ISP, though after the initial releases of the other ponds. The Island Pond Breach effects would be the same for both Alternative 2 and Alternative 3. It is anticipated that the Island Ponds breach construction would be completed after the Initial Release Period has been completed for all the other pond systems in the Alviso Unit. Until that time,the Island Ponds are necessary for operation of the existing salt pond system. The Island Ponds were evaluated for two conditions: a long-term operation condition with large established levee breaches and an Initial Release Period condition with restricted breach opening during the first few weeks of the breach condition.

The pond elevations is the Island Ponds are high enough to affect the timing and magnitude of tidal circulation. The existing pond bottoms for the Island Ponds are near elevation 2 feet NGVD, approximately 2 feet below mean higher high water. During the long-term operation of the Island Ponds with the breaches during the Continuous Circulation Period, the ponds (except for the perimeter borrow ditches) would only contain water for a few hours at high tide. Therefore, the ponds would not contain water with higher salinity than the inflow from Coyote Creek. Initially, there may be some limited saltpans on the pond bottom due to low areas, which do not drain. The effect of the Island Ponds on the salinity in Coyote Creek will be to increase the tidal prism entering Coyote Creek from the bay, and therefore to increase the minimum salinities in the creek. Based on the hydrodynamic model, it is predicted that the daily averaged salinities in Coyote Creek will increase by 4 ppt or less. These increases in salinity are unlikely to adversely affect the estuarine species, that are resident in the impacted segments of Coyote Creek. The resident organisms in Coyote Creek normally experience variations of 15-20 ppt on a daily basis and up to 30 ppt on a seasonal basis. However, since this area of Coyote Creek is predominantly affected by freshwater flowed from the San Jose WPCP, this long-term salinity increase would likely beneficially affect the benthic and vegetative communities in the area by restoring more natural conditions.

During the Initial Release Period, the maximum discharge salinity from the Island Ponds would be 135 ppt for all three ponds. The proposed Initial Breach Scenario included a restricted initial breach into each pond, with a bottom width of 25 m and the bottom of the breach at the bottom of the pond. Based on the rate of breach erosion observed at two breach locations in Napa, the assumed initial breaches are oversized and would result in conservatively high estimates for the discharge from the Island Ponds during the Initial Release. The maximum increase in salinity is predicted to be 12 ppt near the Island Pond discharges. Salinity increases will be lower in other segments of the creek, and nowhere in the creek will depth-averaged and daily-averaged salinities exceed approximately 30 ppt. At the end of the Initial Release Period, a maximum salinity increase of 4 ppt will occur near Pond A19 breaches and lower salinity increases will occur in other segments of the slough.

On the maximum day during the Initial Release Period for the Island Pond breach condition, an extremely small area (approximately 1 acre) of Coyote Creek Slough would have average daily salinity greater than 32 ppt. Approximately 2 acres near the discharge outlet would have daily maximum salinity greater than the drought salinity category.

These increases in salinity are unlikely to adversely impact the estuarine species, that are resident in the impacted segments of Coyote Creek. The resident organisms in Coyote Creek normally experience variations of 15-20 ppt on a daily basis and up to 30 ppt on a seasonal basis.

Significance: Short-term impact (IRP)-Less than Significant
Long-term impact (CCP)-Less than Significant

BENEFICIAL WATER QUALITY (SALINITY) IMPACT-1: Discharges from ISP ponds could result in beneficial water quality impacts from increased salinity inputs to Coyote Creek, which would help mitigate releases of fresh water from the San Jose WPCP.

Releases of fresh water from the San Jose WPCP have caused salinity in Coyote Creek to be lower than it would be under natural conditions. During the CCP, salinity input from the ISP ponds could cause a beneficial impact by raising salinity to more natural levels. No mitigation required for beneficial impacts.

WATER QUALITY (SALINITY) IMPACT-5: Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to Alviso Slough (Alviso Complex)

The total area of the portion of Alviso Slough considered in the model is 273 acres. Discharge is proposed from pond A7 into the slough. Alviso Slough has been evaluated for the Alternative 2 Simultaneous March/April Initial Release and the Alternative 3 Phased July Initial Release.

During the Continuous Circulation Period, elevated salinities in Alviso Slough are expected to be moderate. For daily-averaged salinity, it is predicted that any increases will be 8 ppt or less and will occur in slough segments near the Pond A7 discharge point. The predicted daily maximum salinity at the Alviso A7 discharge may exceed 35 ppt at low tide in September and October when pond and bay salinities reach their annual maximums. For the modeled dry-year conditions, approximately 0.1 acres of Alviso Slough in the immediate vicinity of the discharge would have daily maximum salinities in the range of 36 to 41 ppt. Consequently, impacts to aquatic life in Alviso Slough resulting from elevated salinity are not expected during the Continuous Circulation Period. However, some benthic community changes could occur near the discharge location.

During the Initial Release Period for Alternative 2 Simultaneous Initial Release, the maximum daily averaged increase in salinity is predicted to be 20 ppt near the Pond A7 discharge. Salinity increases will be lower in other segments of the slough and nowhere in the slough away from the outfall will depth-averaged and daily-averaged salinities exceed approximately 37 ppt. At the end of the Initial Release Period, a maximum salinity increase of 8 ppt will occur near the Pond A7 discharge point, and lower salinity increases will occur in other segments of the slough.

On the maximum day during the Initial Release Period for the Alternative 2 Simultaneous Initial Release, approximately 0.2 acres of Alviso Slough would have average daily salinity greater than 39 ppt which would be greater than the drought salinity category.

Approximately 3 acres would have daily maximum salinity greater than 42 ppt and would be in the Stage 3 salinity category or greater. The daily maximum salinity would occur for a few hours of the day, with the estimate based on the highest 2 hours during the day. Localized impacts to resident aquatic species may include temporary loss of the most sensitive benthic species. Fish may migrate out of the higher salinity slough segments during the period of highest salinity.

The area of significant salinity intensity for both the daily averaged and daily maximum salinity is less than 10 percent of the overall slough area. However, the area with potentially significant salinity does exceed 10 percent on the maximum day within the IRP. For approximately one week during the two-month IRP, the daily maximum salinity would be in the potentially significant category or above.

Significance: Short-term impact (IRP) – Potentially Significant
Duration approximately one week
Long-term impact (CCP) - Less than Significant

WATER QUALITY (SALINITY) MITIGATION MEASURE-1A: *Conduct pre-discharge and post-discharge monitoring.*

WATER QUALITY (SALINITY) MITIGATION MEASURE-1B: If monitoring identifies the potential for significant impacts to benthic invertebrates, operational changes in releases, such as slowing the rate of discharge, will be made. Reduced discharge flow rates may extend the period of increased salinity during the initial release. However, pond operation plans evaluated in the hydrodynamic models have not included adaptive management of the pond discharge during the IRP. The discharge culverts include control gates which were assumed partially open, but not adjusted during the IRP. Because the predicted salinity impacts for Alviso Slough occur for an estimated one week during the IRP it would be feasible to reduce the discharge for a portion of the IRP, and increase the discharge flow later. The modified operation would decrease the maximum predicted salinity conditions, but may extend the period with more moderate increased salinity.

Post-Mitigation Significance: Less than significant (short-term and long-term impacts)

WATER QUALITY (SALINITY) IMPACT-6: Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to Guadalupe Slough (Alviso Complex)

The total area of the portion of Guadalupe Slough considered in the impact assessment is 376 acres. Discharge is proposed from pond A3W into the slough. Guadalupe Slough has been evaluated for Alternative 2 Simultaneous March/April Initial Release and Alternative 3 Phased July Initial Release.

During the Continuous Circulation Period, elevated salinities in Guadalupe Slough are expected to be moderate. For daily-averaged salinity, it is predicted that any increases will be 8 ppt or less and will occur in slough segments near the Pond A3W discharge point. The predicted daily maximum salinity at the A3W discharge may exceed 35 ppt at low tide in September and October when pond and bay salinities reach their annual maximums. For the modeled dry-year conditions, approximately 0.2 acres of Guadalupe Slough in the immediate vicinity of the discharge would have daily maximum salinities in the range of 36 to 41 ppt. Consequently, impacts to aquatic life in Guadalupe Slough resulting from elevated salinity are not expected during the Continuous Circulation Period. However, some benthic community changes could occur near the discharge location.

During the Initial Release Period for Alternative 2, the increase in daily averaged salinity in the slough is predicted to be 18 ppt near the Pond A3W discharge. Salinity increases will be lower in other segments of the slough and nowhere in the slough away from the outlet will depth-averaged and daily-averaged salinities exceed approximately 37 ppt. At the end of the Initial Release Period, a maximum salinity increase of 14-16 ppt will occur near the Pond A3W discharge point, and lower salinity increases will occur in other segments of the slough.

On the maximum day during the Initial Release Period for Alternative 1 Maximum Salinity Scenario, approximately 0.4 acres of Guadalupe Slough would have average daily salinity greater than 39 ppt.

On the maximum day, the daily maximum salinity in Guadalupe Slough would exceed 42 ppt (Stage 3 or greater) for approximately 0.4 acres. The daily maximum salinity would occur for a few hours of the day, with the estimate based on the highest 2 hours during the day. In these limited areas, Guadalupe Slough may reach salinities in a range to affect sensitive species on the day with the highest salinity during the entire Initial Release Period.

Significance: Short-term impact (IRP) Less than Significant
Long-term impact (CCP) Less than Significant

> *WATER QUALITY (SALINITY) IMPACT-7:* Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to Alameda Flood Control Channel (AFCC) (Baumberg Complex)

The total area of the portion of Alameda Flood Control Channel considered in the impact assessment is 254 acres. The only ISP discharge is proposed from pond 2C into the channel. The AFCC has been evaluated for the Alternative 2 Simultaneous March/April Initial Release.

During the Continuous Circulation Period, elevated salinities in the AFCC are expected to be quite low. For daily-averaged salinity, it is predicted that any increases will be in the range of 1-4 ppt and occur in channel segments near the Pond 2C discharge point. The predicted daily maximum salinity at the Pond 2C discharge may exceed 35 ppt at low tide in September and October when pond and bay salinities reach their annual maximums. For the modeled dry year conditions, approximately 0.2 acres of the AFCC in the immediate vicinity of the discharge would have daily maximum salinities in the range of 36 to 41 ppt. Consequently, impacts to aquatic life in the AFCC resulting from elevated salinity are not expected during the long-term Continuous Circulation Period.

During the Initial Release Period, for Alternative 2, the maximum increase in daily average salinity is predicted to be 14 ppt near the Pond 2C discharge. Salinity increases will be lower in other segments of the channel, and nowhere in the channel will depth-averaged and daily-averaged salinities exceed approximately 41 ppt. At the end of the Initial Release Period, a maximum salinity increase of 6 ppt will occur near the Pond 2C discharge point, and lower salinity increases will occur in other segments of the channel.

On the maximum day during the IRP, average daily salinity would exceed 39 ppt (Stage 2 or greater) for approximately 0.1 acres. The average daily salinity in 99 percent of AFCC is in the ambient or drought salinity categories.

On the maximum day during the IRP, the daily maximum salinity in AFCC would exceed 42 ppt (Stage 3 or greater) for approximately 28 acres. Daily maximum salinities may exceed 42 ppt for 10 percent of the channel for less than one day during the Initial Release Period. The daily maximum salinity would occur for a few hours of the day, with the estimate based on the highest 2 hours during the day. Impacts to aquatic species may include temporary loss of the most sensitive benthic species. Fish may migrate out of the higher salinity or stream segments during this period.

The AFCC channel was not included in the Alternative 3 Phased Initial Release. If the phased scenario is implemented, the pond 2C circulation would not occur in the first year but would occur the following March/April. In that case, the predicted salinities in AFCC would be similar to Alternative 2, which is based on an March/April Initial Release.

Significance: Short-term impact (IRP) –Significant, mitigated (see below)
Duration approximately 1 day
Long-term impact (CCP) - Less than Significant

WATER QUALITY (SALINITY) MITIGATION MEASURE-2A: Conduct pre-discharge monitoring.

WATER QUALITY (SALINITY) MITIGATION MEASURE-2B: If monitoring identifies the potential for significant impacts to benthic invertebrates, operational changes in releases, such as slowing the rate of discharge, will be made. Reduced discharge flow rates may extend the period of increased salinity during the initial release. However, pond operation plans evaluated in the hydrodynamic models have not included adaptive management of the pond discharge during the IRP. Because the predicted salinity impacts for AFCC occur for an estimated one day during the IRP it would be feasible to reduce the discharge for a portion of the IRP, and increase the discharge flow later. The modified operation would decrease the maximum predicted salinity conditions, but may extend the period with more moderate increased salinity.

Post-Mitigation Significance: Less than significant (short-term and long-term impacts)

WATER QUALITY (SALINITY) IMPACT-8: Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to Old Alameda Creek (Baumberg Complex)

The total area of the portion of Old Alameda Creek Slough considered in the impact assessment is 70 acres. Discharge is proposed from pond 8A into the creek. Old Alameda Creek has been evaluated for Alternative 2 and Alternative 3.

Due to the size of the Old Alameda Creek channel, the creek was not modeled using the 3-dimensional hydrodynamic model used for AFCC and the Alviso Region sloughs. The existing creek channel has two separate flow paths, a north channel and a south channel. The existing deposited silt between the two is higher than mean higher high water in most areas. The north channel, which would include the proposed 8A discharge, is less than 200 feet wide overall, with a typical low flow channel about 40 feet wide. Due to the size of the channel, it was not considered feasible to model salinity in three dimensions.

Old Alameda was analyzed using a one-dimensional hydraulic model, the Corps of Engineers HEC-RAS computer model. The channel hydraulics were evaluated to estimate dilution ratios for the proposed pond 8A discharges. The dilution ratios were used to estimate the approximate salinity conditions in the creek. The hydraulic model included calculated tide and discharge estimates from the South San Francisco Bay modeling.

For the Continuous Circulation Period, the increase in salinity in Old Alameda Creek is expected to be minimal. The estimated dilution for long-term conditions in the pond is less than 15 percent pond discharge and 85 percent bay water. For late summer in a dry year with 28 ppt in the bay and 40 ppt discharge from pond 8A, the estimated salinity in the majority of Old Alameda Creek would be approximately 30 ppt. Consequently, impacts to aquatic life in Old Alameda Creek resulting from elevated salinity are not expected during the long-term Continuous Circulation Period.

The estimated dilution in the Continuous Circulation Period was based on existing channel and hydrology conditions in the north channel of Old Alameda Creek. However, the Eden Landing Restoration Project has started construction of the new North Creek and the Eden Landing Marsh. The project will increase the tidal prism and may increase the channel cross section over time. Therefore the Eden Landing Restoration Project will increase the estimated percentage of bay water available for dilution of the 8A discharge.

For Alternative 2 the maximum discharge salinity from pond 8A is 135 ppt. The estimated dilution ratio for the north channel of Old Alameda Creek is approximately 40 percent pond discharge and 60 percent bay inflow. This includes the estimated dilution of the average flood tide prism, the estimated pond discharge volume during the flood tide, and an allowance for “recycling” of the pond discharge. Recycling represents the portion of the pond discharge, that either would not reach the bay on the ebb tide or might be drawn back into the channel from the bay on a succeeding flood tide.

Based on a dilution ratio of 40 percent pond water, pond discharge salinity of 135 ppt, and average bay salinity of 22 ppt, the average salinity of Old Alameda Creek would be approximately 67 ppt. The majority of the north channel of Old Alameda Creek would be in the salinity category of Stage 4. This condition would occur for less than one week during the Initial Release Period. The pond discharge salinity would be less than 70 ppt within one week and less than 40 ppt within one month. The predicted salinity in Old Alameda Creek would be in the Stage 4 salinity category for one to two weeks during the initial discharge. This may result in potential impacts to resident aquatic species, including losses to most benthic, invertebrate, and fish communities.

The salinity evaluations for the Initial Release Scenarios were based on existing conditions in the north channel of Old Alameda Creek. The DFG has started construction of the Eden Landing Restoration Project, which includes construction of North Creek to connect the project area to Old Alameda Creek upstream of pond 8A. Completion of the North Creek channel would increase the daily tidal prism in Old Alameda Creek and would increase the potential dilution of the initial release discharges from Pond 8A. Beginning the Old Alameda Creek initial release after completion of channel improvements for the Eden Landing Restoration may reduce the predicted creek salinity and potential habitat impacts to near drought conditions.

Significance: Short-term impact (IRP) – Significant, mitigated (see below)
Duration approximately 2 weeks
Long-term impact (CCP) - Less than Significant

> *WATER QUALITY (SALINITY) MITIGATION MEASURE-2A:* Conduct pre-discharge monitoring.
>
> *WATER QUALITY (SALINITY) MITIGATION MEASURE-2B:* If monitoring identifies the potential for significant impacts to benthic invertebrates, operational changes in releases, such as slowing the rate of discharge, will be made. Reduced discharge flow rates may extend the period of increased salinity during the initial release. However, pond operation plans evaluated in the hydrodynamic models have not included adaptive management of the pond discharge during the IRP. Because the predicted salinity impacts for Old Alameda Creek occur for an estimated one day during the IRP it would be feasible to reduce the discharge for a portion of the IRP, and increase the discharge flow later. The modified operation would decrease the maximum predicted salinity conditions, but may extend the period with more moderate increased salinity.

Post-Mitigation Significance: Less than significant (short-term and long-term impacts)

Pond Management Alternative 3 (Phased Initial Release)

In Alternative 3 (Phased Initial Discharge), many of the lower salinity ponds in Alviso and Baumberg would be discharged in July, and the medium salinity ponds would be discharged the following March and April. These ponds would then be managed in the same manner as in Alternative 2 during the continuous circulation period. The higher salinity ponds would also be managed as in Alternative 2.

Note: Only the differences in impacts between Alternative 1 and 2 discussed below.

> *WATER QUALITY (SALINITY) IMPACT-5:* Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to Alviso Slough (Alviso Complex)

For the Alternative 3 Phased Initial Release the maximum increase in daily average salinity is predicted to be 18 ppt near the Pond A7 discharge. Salinity increases will be lower in other segments of the slough, and nowhere in the slough away from the outlet will depth-averaged and daily-averaged salinities exceed approximately 37 ppt. At the end of the Initial Release Period, a maximum salinity increase of 10 ppt will occur near the Pond A7 discharge location, and lower salinity increases will occur in other segments of the slough.

For the maximum day during the IRP for Alternative 3, no portion of Alviso Slough would have average daily salinity greater than 39 ppt (Stage 2 or greater).

For the maximum day during the IRP for Alternative 3, approximately 7 acres would have daily maximum salinity greater than 42 ppt (Stage 3 or greater). The daily maximum salinity would occur for a few hours of the day, estimated based on the highest 2 hours during the day. Localized impacts to resident aquatic species near the discharge location may include temporary loss of the most sensitive benthic species.

The area of significant salinity intensity for both the daily averaged and daily maximum salinity is less than 10 percent of the overall slough area. However, the area with potentially significant salinity does exceed 10 percent on the maximum day within the IRP. For approximately one week during the two-month IRP, the daily maximum salinity would be in the potentially significant category or above.

Significance: Short-term impact (IRP) – Potentially Significant
Duration approximately one week
Long-term impact (CCP) - Less than Significant

WATER QUALITY (SALINITY) MITIGATION MEASURE-1A: *Conduct pre-discharge and post-discharge monitoring.*

WATER QUALITY (SALINITY) MITIGATION MEASURE-1B: If monitoring identifies the potential for significant impacts to benthic invertebrates, operational changes in releases, such as slowing the rate of discharge, will be made. Reduced discharge flow rates may extend the period of increased salinity during the initial release. However, pond operation plans evaluated in the hydrodynamic models have not included adaptive management of the pond discharge during the IRP. The discharge culverts include control gates which were assumed partially open, but were not adjusted during the IRP. Because the predicted salinity impacts for Alviso Slough occur for an estimated one week during the IRP it would be feasible to reduce the discharge for a portion of the IRP, and increase the discharge flow later. The modified operation would decrease the maximum predicted salinity conditions, but may extend the period with more moderate increased salinity. Based on the modeled operation plan, the entire slough would have daily maximum salinity less than 32 ppt after 6 weeks of the IRP.

Post-Mitigation Significance: Less than significant (short-term and long-term impacts)

WATER QUALITY (SALINITY) IMPACT-6: Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to Guadalupe Slough

For Alternative 3 Phased July Initial Release, the maximum increase in daily averaged salinity in Guadalupe Slough is predicted to be 14 ppt near the Pond A3W discharge. Salinity increases will be lower in other segments of the slough. At the end of the Initial Release Period, a maximum salinity increase of 8 ppt will occur in the vicinity of the Pond A3W discharge location, and lower salinity increases will occur in other segments of the slough.

On the maximum day during the IRP for Alternative 3, approximately 1 acre of Guadalupe Slough would have average daily salinity greater than 35 ppt.

Approximately 4 acres of Guadalupe Slough would have daily maximum salinity greater than 39 ppt (Stage 2 or greater) for the maximum day of the Initial Release Period. The daily maximum salinity would occur for a few hours of the day, estimated based on the highest 2 hours during the day.

Significance: Short-term impact (IRP) – Less than Significant
Long-term impact (CCP) - Less than Significant

WATER QUALITY (SALINITY) IMPACT-8: Discharges from ISP ponds could result in water quality impacts from increased salinity inputs to Old Alameda Creek

For Alternative 3 Phased July Initial Release,the maximum discharge salinity from pond 8A is 135 ppt. The estimated dilution ratio for the north channel of Old Alameda Creek is approximately 60 percent pond discharge and 40 percent bay inflow. The pond dilution ratio is lower (increased fraction of pond discharge) than Alternative 2 because the Phased July Initial Release has increase initial discharge flow rates to avoid higher pond salinities during the summer season's increased evaporation. Based on a dilution ratio of 60 percent pond water, pond discharge salinity of 135 ppt, and average bay salinity of 22 ppt, the average salinity of Old Alameda Creek would be approximately 90 ppt. The majority of the north channel of Old Alameda Creek would be in the salinity category of Stage 4. This condition would occur for less than one week during the Initial Release Period. The pond discharge salinity would be less than 50 ppt within one week. The predicted salinity in Old Alameda Creek would be in the Stage 4 salinity category for one to two weeks during the Phased Initial Release Alternative. This may result in potential impacts to resident aquatic species, including severe losses to most benthic, invertebrate, and fish communities.

Significance: Short-term impact (IRP) – Significant, mitigated (see below)
Duration approximately 2 weeks
Long-term impact (CCP) - Less than Significant

WATER QUALITY (SALINITY) MITIGATION MEASURE-1A: Conduct pre-discharge monitoring.

WATER QUALITY (SALINITY) MITIGATION MEASURE-1B: If monitoring identifies the potential for significant impacts to benthic invertebrates, operational changes in releases, such as slowing the rate of discharge, will be made. Reduced discharge flow rates may extend the period of increased salinity during the initial release. However, pond operation plans evaluated in the hydrodynamic models have not included adaptive management of the pond discharge during the IRP. Because the predicted salinity impacts for Old Alameda Creek occur for an estimated one day during the IRP it would be feasible to reduce the discharge for a portion of the IRP, and increase the discharge flow later. The modified operation would decrease the maximum predicted salinity conditions, but may extend the period with more moderate increased salinity.

Post-Mitigation Significance: Less than significant (short-term and long-term impacts)

4.3.2 Metals and Organic compounds

4.3.2.1 Regional Water Quality Setting-Priority Trace Metal and Organic Compounds

Water and sediment contamination from priority trace metal and synthetic organic compounds in the San Francisco Bay area largely reflects the influence of past and present agricultural and mining activities, industrial uses, and urban development (San Francisco Estuary Institute, 1999). Contaminants known to be present in waters and sediments of the South San Francisco Bay include heavy metals (lead, copper, aluminum, mercury, nickel, vanadium, chromium, silver, zinc), polycyclic aromatic hydrocarbons (PAHs), PCBs, chlorinated hydrocarbon pesticides, and tributyltin (RMP, 1999, 2000a, San Francisco Bay RWQCB 1998).

Within the South Bay region, constituents of concern that routinely exceed numeric guidance levels, human health guidelines, and/or regulatory concentration criteria in water samples collected for the RMP monitoring program include copper, mercury, and PCBs (RMP, 2000a).

The sources and magnitude of contaminant loading to San Francisco Bay have been recently characterized as consisting primarily of the following categories:

- Local runoff of rivers and storm water runoff,
- Point-source discharges to the bay from municipal and industrial facilities,
- Atmospheric deposition, and
- Dredged material disposal (RMP, 2000b).

Atmospheric deposition and dredged material disposal are small contributions. The magnitude of contaminant loading from local watershed sources and point-source discharges depends on the chemical constituent in question. Point-source discharges comprise the majority of inorganic nutrient (nitrogen [N] and phosphorus [P]) loading to San Francisco Bay, whereas trace metals inputs are primarily associated with local watershed sources. Relative source contributions of organic compounds have not been determined.

4.3.2.2 Overview of Potential Water Quality Impacts from Metals and Organic Compounds

Available data indicate that concentrations of all organics and of all inorganics except nickel and mercury are present in the ISP ponds at concentrations well below applicable WQOs. Elevated detections of mercury and nickel in pond samples indicate that these metals may be present in some of the ISP ponds at concentrations exceeding applicable WQOs and could result in water quality impacts under the ISP.

Water Quality Impacts from Organic Compounds

Considering the source of the discharge water, it is unlikely that organic contamination will be high. Existing concentrations of organic compounds in the South Bay salt ponds were evaluated based on available surface water quality data from the Alviso, Baumberg, and West Bay Complexes. Available organics data for surface water include petroleum hydrocarbons, dioxins/furans, and SVOCs. These chemicals were detected in surface water at concentrations similar to ambient conditions in uncontaminated areas of San

Francisco Bay. Based on these results and the low concentrations of these and other organics (including semi-volatile organic compounds and polynuclear aromatic hydrocarbons) observed in water samples collected for the ISP and by others (see Appendix A), organics are unlikely to be present in ISP ponds in excess of background conditions or applicable WQOs. Therefore, the organic contaminant data are not discussed in detail.

Water Quality Impacts from Inorganic Compounds

Saline waters that will be circulated to South San Francisco Bay and its tributaries from the salt ponds during the Initial Stewardship Period will contain measurable concentrations of heavy metals. Using analytical data collected from a subset of these ponds, estimates were made of the range of concentrations that would likely occur in the proposed discharges during the initial release and the continuous circulation phases of the Interim Stewardship Period. Comparisons were made between these estimated discharge concentrations and applicable water quality objectives.

The results of these comparisons clearly indicate that, for every proposed discharge, during both the initial release and continuous circulation phases, the maximum predicted concentrations of arsenic, cadmium, chromium, copper, lead, selenium, silver, and zinc will not exceed the applicable water quality objectives. Therefore, for all the proposed discharges, these metals are not considered a threat to aquatic life in the receiving waters.

On the other hand, based on the aforementioned comparisons, both nickel and mercury were predicted to exceed their applicable water quality objectives under some circumstances:

- Dissolved nickel concentrations might exceed objectives applicable to discharges from ponds in the Alviso Unit during the Initial Release Period.
- Total nickel concentrations might exceed objectives applicable to discharges from the Baumberg and West Bay Complexes during both the Initial Release Period and the Continuous Circulation Period.
- Total mercury concentrations might exceed objectives applicable to discharges from the Baumberg and West Bay Complexes during the Initial Release Period.

To determine the significance of these potential exceedences, evaluations were performed to estimate how these discharges would alter concentrations in the receiving waters and how these alterations would impact aquatic life. The results of these evaluations are based on initial comparisons conducted by Stephen Hansen (2003) and are summarized below.

Samples Used for Inorganic Analysis—Estimates of the concentrations of dissolved and total metals that are expected to occur in each of the discharges are made based on the analysis of surrogate samples that match the salinity ranges predicted for each of the discharge points. It was assumed that an existing pond at a given salinity would have a representative metals concentration to an ISP discharge pond with a similar salinity. To cover a range of potential discharge salinities, the following two sets of surrogate samples were considered:

1. The major set of samples was collected from the salt ponds in October 2002 and covers the range of salinities from 31.6 to 279 ppt. The results of these analyses

are summarized in the ISP (see Appendix A). These surrogates are clearly relevant since they come from salt ponds in the system to be discharged.

2. Since salt ponds could not be located that had salinities at the lower end of the predicted discharge range (i.e., 12 – 20 ppt), data for the years 1997-99 were retrieved from the Regional Monitoring Program for the two southernmost San Francisco Bay stations (i.e., South Bay and Dumbarton Bridge). The results of these analyses are available on-line at the San Francisco Bay Estuary Institute website. These results are relevant because the bay water will be the intake during the ISP. Low salinity discharges should be essentially the same (i.e., little or no evaporative concentration has occurred).

Analytical Results for Inorganics—Analytical results for inorganics are presented in Table 4-6. The salinity of each sample is presented along with the dissolved and total recoverable concentrations of each of the ten metals of interest (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc). Table 4-6 also provides applicable WQOs for the Alviso and Baumberg Complexes. WQOs applicable to the Baumberg Complex are listed in the most recent version of the Water Quality Control Plan, San Francisco Bay Basin (Region 2) (RWQCB, 1995), including a May 22, 2002 amendment adopting site-specific WQOs for the South Bay. WQOs applicable to the Alviso Complex are listed in the Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. Federal Register, Volume 65, No. 97. May 18 (40 CFR Part 131) (California Toxics Rule [CTR]; USEPA, 2000) and are specified as dissolved concentrations, except for mercury and selenium, which are specified as total recoverable concentrations.

Table 4-7
Dissolved Concentrations of Inorganics in ISP and Adjacent Salt Ponds[a]

		Dissolved Concentration (ug/l)									
Pond No.	**Salinity (g/l)**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Selenium**	**Silver**	**Zinc**
Alviso Complex											
A2W	31.6	6.27	0.049	1.22	1.06	0.264	0.00126	8.05	0.199	0.012	1.21
A3W	42.0	10.7	0.044	1.22	1.10	0.307	0.00126	7.45	0.128	0.010	0.65
A15	89.4	14.0	0.077	1.12	0.86	0.313	0.00138	10.8	0.094	0.021	1.29
A14	92.6	18.3	0.039	1.35	0.97	0.309	0.00221	11.0	0.111	0.055	1.15
A16	109	14.4	0.053	1.27	1.07	0.446	0.00398	12.8	0.141	0.040	2.25
A18*	146	48.3	0.899 [b]	1.35	1.92	0.748	0.00114	19.7	0.224	0.023	2.88
A15	89.8	14.5	0.067	1.16	0.89	0.330	0.00128	10.6	0.124	0.027	1.83
I-3*	194	3.52	0.096	1.16	0.57	0.572	0.00056	10.8	0.304	0.015	2.87
I-3B*	224	3.14	0.124	1.47	2.64	1.33	0.00069	13.3	0.142	0.039	4.02
Baumberg Complex											
B2C	54.6	1.14	0.054	1.24	1.29	0.280	0.00036	4.96	0.055	0.016	1.18
B9	279	30.9	0.423	1.34	2.21	7.18	0.00041	14.5	0.140	0.028	3.80
WQOs – Alviso Complex (California Toxics Rule)											
Continuous		36	9.3	50	9[c]	8.1	-	8.2	-	1.9	81
Maximum		69	42	1100	5.3[c]	210	-	74	-	-	90
WQOs – Baumberg Complex (Basin Plan)											
4-hour Average		36	9.3	50	6.9[d]	5.6	-	11.9	-	1.9	58
1-hour Average		69	43	1100	10.8[d]	140	-	62.4	-	-	170

Notes:
WQO = Water Quality Objective; µg/l = micrograms per liter
[a] Source: Frontier Geosciences (November 11, 2002). Samples collected October 26, 2002
[b] Possible contamination of sample suspected; results unreliable
[c] Values shown are site-specific criteria obtained from the RWQCB
[d] Values shown are site-specific criteria for the South Bay adopted on May 22, 2002 as an amendment to the Bay Plan
shaded cell = Exceedence of applicable WQO

* Adjacent Salt Ponds. I3 and I3B are in Cargill Plant 1

Table 4-7
Total Recoverable Concentrations of Inorganics in ISP and Adjacent Ponds[a]

		Total Recoverable Concentration (ug/l)									
Pond No.	**Salinity (g/l)**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Lead**	**Mercury**	**Nickel**	**Selenium**	**Silver**	**Zinc**
Alviso Complex											
A2W	31.6	6.36	0.063	2.36	2.15	0.843	0.012	11.8	0.274	0.022	1.80
A3W	42.0	11.9	0.045	0.67	1.24	0.324	0.0048	8.42	0.173	0.015	0.79
A15	89.4	15.1	0.054	0.83	1.37	0.351	0.032	14.3	0.160	0.030	1.82
A14	92.6	20.1	0.053	1.17	2.04	0.395	0.044	13.5	0.220	0.063	3.16
A16	109	17.1	0.062	1.23	2.01	0.619	0.039	18.1	0.159	0.150	3.38
A18*	146	56.2	0.119	1.30	3.39	1.37	0.050	21.8	0.310	0.045	4.49
A15*	89.8	15.7	0.054	1.07	1.59	0.371	0.032	15.7	0.135	0.020	3.07
I-3*	194	4.28	0.119	1.47	2.07	0.892	0.036	9.73	0.295	0.128	6.77
I-3B*	224	5.18	0.136	1.38	2.45	1.15	0.041	12.3	0.352	0.044	7.22
Baumberg Complex											
B2C	54.6	1.00	0.050	0.67	1.59	0.392	0.0034	7.09	0.092	0.013	1.28
B9	279	33.1	0.123	1.12	2.61	6.48	0.030	15.1	0.143	0.416	4.28
WQOs – Alviso Complex (California Toxics Rule)											
Continuous		-	-	-	-	-	0.051	-	5	-	-
Maximum		-	-	-	-	-	-	-	-	-	-
WQOs – Baumberg Complex (Basin Plan)											
4-hour Average		-	-	-	-	-	0.025	-	5	-	-
1-hour Average		-	-	-	-	-	-	-	-	-	-

Notes:
WQO = Water Quality Objective; µg/l = micrograms per ;iter
[a] Source: Frontier Geosciences (November 11, 2002). Samples collected October 26, 2002
[b] Possible contamination suspected
[c] Values shown are site-specific criteria obtained from the RWQCB

[d] Values shown are site-specific criteria for the South Bay adopted on May 22, 2002 as an amendment to the Bay Plan
shaded cell = Exceedence of applicable WQO
* Adjacent Salt Ponds. I3 and I3B are in Carill Plant 1

Comparison of Metals in Sampled Ponds to WQOs—To assess metals impacts on potential water quality when discharging water from ISP ponds, a comparison was made between the detected concentrations of each of the metals of concern in the sampled ponds and the WQOs applicable to each area. All detected concentrations of arsenic, cadmium, chromium, copper, selenium, silver, and zinc were well below applicable WQOs. Only nickel and mercury were detected at concentrations exceeding WQOs. These exceedances are described below. The West Bay ponds are not included in this analysis because these ponds are currently high-salinity ponds and will be low-salinity ponds when they are discharged, thus representative ponds are not available for sampling and analysis at this time.

Exceedances of Nickel WQOs—Concentrations of nickel in eight of the sampled ponds exceeded applicable water quality criteria. The lowest concentrations were detected in the lower salinity Alviso ponds (A2W, A3W, and B2C); nickel was detected in these ponds at concentrations from 4.96 to 8.05 µg/l; these values are below the CTR limit of 8.2 µg/l. Concentrations of nickel detected in the remaining Alviso ponds exceeded the CTR limit; those concentrations ranged from 10.6 µg/l (slightly above the CTR limit) to 19.7 µg/l (more than twice the CTR limit). Nickel concentrations may be correlated with salinity. At higher salinities (89.4 to 279 ppt), detected concentrations of nickel were generally higher (10.6 to 19.7 µg/l), while in lower-salinity ponds (31.6 to 54.6 ppt), nickel concentrations were lower (4.96 to 8.05 µg/l).

Exceedances of Mercury WQOs—Detected concentrations of total mercury ranged from 0.0034 to 0.050 µg/l. Detected concentrations in the Alviso Complex were below the CTR limit of 0.051 µg/l. In ponds I-3, I-3B, and the Baumberg Complex, detected concentrations of mercury slightly exceed the Water Quality Control Plan San Francisco Bay Basin (Region 2) Board (SFBRWQCB, 1995) limit of 0.021 µg/l. Concentrations of mercury may be correlated with salinity. Detected concentrations in the ponds with lower salinity (31.6 to 54.6 ppt) ranged from 0.0034 to 0.12 µg/l, close to an order of magnitude lower than concentrations detected in ponds with salinities of 89.4 ppt and greater (0.032 to 0.050 µg/l). All of the samples which show WQO's exceedances come from ponds with salinities greater than the proposed discharge salinities.

Metal Impacts to Receiving Waters—Dissolved Nickel

Alviso Complex

Dissolved nickel concentrations in several of the discharges from the Alviso Complex might exceed the applicable water quality objective for water bodies south of the Dumbarton Bridge of 11.9 ug/l dissolved nickel. These exceedences are predicted to occur only when ponds are discharging at their maximum proposed salinities and would be limited to the Initial Release Period. The discharges that might exceed water quality objectives (from ponds A7, A14, and A16) have the potential to impact waters in Alviso Slough, Coyote Creek, and portions of South Bay.

Dissolved Nickel Impacts to Coyote Creek (Alviso Complex)—Another of the proposed discharges that might exceed the nickel objective of 11.9 ug/l is from Ponds A14 and A16 into Coyote Creek and Artesian Slough. These exceedences would be limited to the Initial Release Period and were only predicted to occur if A14 and A16 were discharging at their maximum proposed salinities. An in-depth evaluation indicated that after initial mixing, there would be no predicted exceedences of the nickel objective in either Coyote Creek or Artesian Slough and, consequently, no expected impact to aquatic life.

Dissolved Nickel Impacts to Alviso Slough—One of the proposed discharges that might exceed the nickel objective of 11.9 ug/l is from Pond A7 into Alviso Slough. These exceedences would be limited to the Initial Release Period and were only predicted to occur if A7 was discharging at its maximum proposed salinity. An in-depth evaluation indicated that after initial mixing, there would be no predicted exceedences of the nickel objective in Alviso Slough and, consequently, no expected impact to aquatic life.

Dissolved Nickel Impacts to the South Bay near the Alviso Complex—All of the discharges in the Alviso Unit eventually enter South S.F. Bay. Three of these (A7, A14, and A16) are predicted to exceed the nickel objective of 11.9 ug/l. These exceedences would be limited to the Initial Release Period and were only predicted to occur if the subject ponds were discharging at their maximum proposed salinities. An in-depth evaluation indicated that after initial mixing, there would be no predicted exceedences of the nickel objective in South South Francisco Bay and, consequently, no expected impact to aquatic life.

Baumberg Complex

The initial comparisons indicated that total nickel concentrations in all of the discharges from the Baumberg Unit might exceed the applicable water quality objective for water bodies north of the Dumbarton Bridge of 7.1 ug/l total nickel. These exceedences have the potential to occur during all phases of the Initial Stewardship Period and over a wide range of discharge salinities. During both the Initial Release and Continuous Circulation Periods, these discharges have the potential to impact waters in the Alameda Flood Control Channel (AFCC), Old Alameda Creek, and portions of South Bay.

Dissolved Nickel Impacts to Alameda Flood Control Channel (AFCC)—Two of the proposed discharges that might exceed the nickel objective of 7.1 ug/l are Ponds 2 and 2C. The Pond 2C discharge will flow directly into the AFCC, and the Pond 2 discharge will be circulated into the AFCC by tidal action. It is predicted that the exceedences of the nickel objective in these discharges might occur during both the Initial Release and Continuous Circulation Periods and might occur regardless of the salinity of the discharges. An in depth evaluation indicated that, after initial mixing, these discharges would have limited impacts on compliance with the nickel water quality objective in the AFCC. During the Initial Release Period, compliance with the nickel objective in the AFCC would depend upon both the ambient concentrations of nickel in the AFCC and the salinity of the discharges. If the ambient waters contain average concentrations of nickel, impacts on compliance of the nickel objective would be minimal. With average ambient nickel concentrations and discharge salinities at 2002 levels, there are no predicted exceedences of the nickel objective anywhere in the AFCC. With average ambient nickel concentrations and discharge salinities at their proposed maximum levels, exceedences of the objective are predicted for 3 kilometers of the AFCC. However, these exceedences would disappear at the end of the Initial Release Period.

During the Initial Release Period, if the ambient waters contain maximum concentrations of nickel, predicted impacts on compliance with the nickel objective would be somewhat greater, but still relatively limited in magnitude and scope. Under such conditions, it is predicted that, even without any discharges from the Baumberg Ponds, 3 kilometers of the AFCC would exceed the nickel objective. With the addition of the discharges at salinities near those observed in 2002, total nickel in most segments of the AFCC would increase slightly (i.e., generally by less than 1 ug/l), but exceedences of the objective are predicted to remain at 3 kilometers of the AFCC. With the addition of the discharges at salinities near the proposed maximum values, exceedences of the objective (by up to 3 ug/l) are predicted to increase to 4 kilometers of the AFCC. However, at the end of the Initial Release Period, the area of the AFCC exceeding the nickel objective would be reduced to 3 km; the same area that is predicted to be out of compliance under existing conditions.

During the Continuous Circulation Period, compliance with the nickel objective in the AFCC would depend upon the ambient concentrations of nickel in the AFCC. If the ambient waters contain average concentrations of nickel, it is predicted that after initial mixing, three of the AFCC segments would slightly exceed the nickel objective in May and five would slightly exceed the objective in September. If the ambient waters contain maximum concentrations of nickel, it is predicted that even without any discharge from the Baumberg ponds, the nickel objective would be exceeded in 4 kilometers of the AFCC in May and 5 kilometers in September. With the addition of the discharges, total nickel concentrations in all segments of the AFCC are predicted to increase by less than 1 ug/l, but the number of segments of the AFCC exceeding the nickel objective would not increase.

To further assess the potential for nickel exceedances during continuous circulation, a site-specific translater study was conducted. This study showed that nickel levels in AFCC during CCP will not adversely affect beneficial uses.

Dissolved Nickel Impacts to the South Bay near the Baumberg Complex—During the Initial Release Period, all of the discharges in the Baumberg Complex have the potential to exceed the nickel of objective of 7.1 ug/l and all of these discharges eventually enter the South San Francisco Bay. It is predicted that the exceedences of the nickel objective in these discharges might occur during both the Initial Release and Continuous Circulation Periods and might occur regardless of the salinity of the discharges. An in-depth evaluation indicated that, after initial mixing, these discharges would have no effect on compliance with the nickel water quality objective in the South Bay in the vicinity of the Baumberg Complex. When the waters in the South Bay contain average concentrations of total nickel, the discharges from the Baumberg ponds would increase total nickel in ambient bay water by 0.5 ug/l or less and would not cause an exceedence of the nickel objective. When the waters of South Bay contain maximum concentrations of total nickel, the discharge from the Baumberg ponds would have essentially no effect on compliance with the nickel objective. Under such conditions, the nickel objective would be exceeded throughout the South Bay by 1 to 3 ug/l and the input from the ponds would not cause measurable changes in these concentrations.

Metal Impacts to Receiving Waters—Total Mercury Discharged

Total Mercury Discharged from Ponds in the Baumberg Complex—The initial comparisons indicated that total mercury concentrations in all of the discharges from the Baumberg Complex might exceed the applicable water quality objective for water bodies north of the Dumbarton Bridge of 25 ng/l total mercury. These exceedences were predicted to occur only when ponds are discharging at their maximum proposed salinities and would be limited to the Initial Release Period. Under these conditions, these discharges have the potential to impact waters in the Alameda Flood Control Channel (AFCC), Old Alameda Creek, and portions of South Bay.

Total Mercury Discharged to Alameda Flood Control Channel (AFCC)—Two of the proposed discharges that might exceed the mercury objective of 25 ng/l are Ponds 2 and 2C. The Pond 2C discharge will flow directly into the AFCC and the Pond 2 discharge will be circulated into the AFCC by tidal action. It is predicted that the exceedences of the mercury objective in these discharges will be limited to the Initial Release Period and will only occur if the discharges are at their maximum proposed salinity. An in-depth evaluation indicated that, after initial mixing, these discharges would have minimal impact on compliance with the mercury water quality objective in the AFCC. When the waters in the AFCC contain average concentrations of total mercury, the discharge from Ponds 2 and 2C would at worst raise the ambient concentrations in the AFCC by approximately 10% and would result in equaling the objective in 3 to 4 kilometers of the channel. This condition would last for less than 8 weeks; disappearing at the end of the Initial Release Period. When the waters in the AFCC contain maximum concentrations of total mercury, the discharge from Ponds 2 and 2C would have essentially no effect.

Under existing conditions, the mercury objective would be exceeded throughout the creek by between 7 and 10 ng/l and the input from the ponds would increase these concentrations by less than 1 ng/l. Any increases due to the pond discharges would last for less than 8 weeks; disappearing at the end of the Initial Release Period.

Total Mercury Discharged to the South Bay near the Baumberg Complex—During the Initial Release Period, all of the discharges in the Baumberg Complex have the potential to exceed the mercury of objective of 25 ng/l and all of these discharges eventually enter South S.F. Bay. It is predicted that these exceedences would occur during the Initial Release Period only if the Baumberg ponds were discharging at their maximum proposed salinities. An in-depth evaluation indicated that, after initial mixing, these discharges would have no impact on compliance with the mercury water quality objective in the South Bay near the Baumberg Complex. When the waters in the South Bay contain average concentrations of total mercury, the discharges from the Baumberg ponds would increase total mercury in ambient bay water by less 1 ng/l and would not cause an exceedence of the mercury objective. When the waters of South Bay contain maximum concentrations of total mercury, the discharge from the Baumberg ponds would have essentially no effect. Under existing conditions, the mercury objective would be exceeded throughout the South Bay by approximately 11 ng/l and the input from the ponds would actually decrease these concentrations.

Metals Potentially Discharged to the South Bay near the West Bay Complex-As mentioned above, sampling and analysis have not been performed on the West Bay Ponds. It is anticipated that metals levels in discharge will be similar to those at the Baumberg Complex, because complexes are intaking from similar location in the South Bay, and both have the same metals WQOs.

4.3.2.3 Metals Impacts to Water Quality By Alternative

No Project/No Action Alternative

> WATER QUALITY (METALS) IMPACT-1: *Metals in pond sediments could be released or chemically changed by cycles of wetting and drying. Unplanned breaches of ponds could result in increased metals concentrations in the ponds and localized areas of the Bay.*

Under the No Project/No Action Alternative, bay water would not be let into the ponds and water levels would not be managed. Ponds would dry down seasonally. Fluctuating oxidation of the sediments may increase methyl-mercury in ponds when they fill up with winter rains. Additionally, levees would not be maintained, and unplanned breaches of the ponds would be more likely. Given the impacts of this alternative on the concentration of metals in discharge, any breach of the project ponds could have significant impacts on water quality and biota.

Significance: Potentially significant. Since this alternative will result in the project not being implemented, no mitigation measures are proposed.

Seasonal Pond Alternative 1

This alternative minimizes impacts in the receiving waters from discharge of pond contents into the bay. Maintenance of the levees and water control structures would prevent their deterioration and minimize the potential for the accidental breaching of the ponds and release of pond contents to the bay. Under this alternative, most of the existing open water habitats currently used by wildlife would be greatly reduced, significantly changing the character of the South Bay salt ponds. The duration and depth of water in the ponds would be reduced in most years, and the open water character of the salt ponds would be lost. The existing intake structures for each pond complex would be closed. Intake ponds would no longer be present. so the pond systems would not support fish and bay invertebrates, resulting in reduced foraging habitat for piscivorous (fish-eating) birds.

The Seasonal Pond Alternative appears to have the least water-quality impacts to the bay and other receiving waters with respect to metals compared to all other project alternatives. However, this alternative would not meet project objectives of maintaining existing open water and wetland habitat for the benefit of wildlife, including habitat for migratory shorebirds and waterfowl and resident breeding species or maintaining ponds in a restorable condition to facilitate future long-term restoration.

Alternative 2 - Simultaneous March/April Initial Release

In Alternative 2, the contents of most of the Alviso and Baumberg Ponds would be released simultaneously in March and April. The ponds would then be managed as a mix of continuous circulation ponds, seasonal ponds and batch ponds, though management of some ponds could be altered through adaptive management during the continuous circulation period. Higher salinity ponds in Alviso and in the West Bay would be discharged in March and April in a later year when salinities in the ponds have been reduced to appropriate levels. The Island Ponds (A-19, 20, and 21) would be breached and open to tidal waters.

WATER QUALITY (METALS) IMPACT-2: Exceedances of the nickel WQOs at the point of discharge may occur during the IRP only.

The project is not predicted to raise nickel concentrations above pre-project levels in the receiving waters and, consequently, is not expected to significantly impact water quality.

Significance: Less than Significant

WATER QUALITY (METALS) IMPACT-3: Under some circumstances, total mercury in discharged water and receiving water will exceed total mercury WQOs and may have temporary impacts on water quality.

In all cases, the potential exceedances will be either at or below current conditions or will be limited to the Initial Release Period.

Significance: Potentially Significant

WATER QUALITY (METALS) MITIGATION MEASURE-1A: Monitor the discharges and receiving waters for exceedances of the mercury objective.

WATER QUALITY (METALS) MITIGATION MEASURE-1B: If mercury exceeds predicted levels in the receiving waters by more than 10%, the RWQCB will be contacted and an adaptive management strategy will be devised to reduce mercury levels. Mitigation measures may include temporarily slowing discharge or additional dilution.

Post-mitigation Significance: Less than significant

Alternative 3-Phased July Initial Release

In Alternative 3, many of the lower-salinity ponds in Alviso and Baumberg would be discharged in July, and the medium salinity ponds would be discharged the following March and April. These ponds would then be managed in the same manner as in Alternative 2 during the continuous circulation period. The higher-salinity ponds would also be managed as in Alternative 2.

Based on the evaluation of Alternative 2, the lower salinity ponds proposed for discharge in the first stage of Alternative 3 would not represent any significant trace metals impacts. The medium-salinity ponds that may have potential trace metals impacts would be discharged beginning in March/April, as in Alternative 2. Therefore the potential receiving waters impacts of Alternative 3 would be the same as or similar to the impacts described for Alternative 2.

4.3.3 Dissolved Oxygen

4.3.3.1 Regional Water Quality Setting - Dissolved Oxygen (DO)

The majority of species in the bay require oxygen to sustain metabolic processes. Oxygen is supplied to the bay water by photosynthesis (performed by plants which take up carbon dioxide and release oxygen) and from the atmosphere (whose primary gases are nitrogen and oxygen). Oxygen is depleted during organism respiration and by decomposition of organic matter. Biochemical oxygen demand (BOD) is a measure of the amount of oxygen used per unit volume of water at a given temperature for a given time. In essence, it is the combined respiratory needs (demands) of the pelagic, benthic and epibenthic organisms, principally algae and aerobic bacteria contained in the water. BOD is often negatively correlated with dissolved oxygen (DO); the greater the BOD the lower the DO is likely to fall during non daylight hours when photosynthetic production drops and respiration usually exceeds the "demand".

Water temperature affects the metabolic rate of aquatic organisms, the tolerance of aquatic organisms to other environmental stressors, and other physical and chemical water-quality processes. The solubility of dissolved oxygen (DO) in water is a direct function of water temperature, with maximum possible DO values being greatest at lower water temperatures. This is why the period of greatest oxygen stress is during the warmer summer months when water temperatures are high, the oxygen solubility is low, and because of their cold-blooded metabolism, the biota need the most oxygen. The most extensive information for conventional constituents of concern in the salt ponds comes from recent data collected for temperature, DO, pH, and turbidity (Takekawa et al. 2000)

Light levels have an impact on DO as well. When plants and algae are actively photosynthesizing, they produce more oxygen than they consume, which often raises DO levels. At night, when plants and algae are not photosynthesizing the balance changes and plants and algae use oxygen and thus lower DO levels. This is why diurnal fluctuations in DO are common.

The USGS measures DO concentration as an indicator of water quality and of the activity level of the plants and animals living in the bay. When the oxygen content of water is under-saturated (less than the temperature equilibrium would allow), it indicates that oxygen is being consumed by either pelagic or benthic organisms faster than it is produced by the phytoplankton or rooted aquatic plants. Conversely, when the oxygen concentration is greater than saturation, oxygen is being produced by plant photosynthesis (mostly phytoplankton) faster than it is consumed by other organisms. Thus, oxygen concentration is an index of the balance between processes of food production and food consumption. This balance is a key descriptor of the changing status of the ecosystem. When the balance is disrupted, the oxygen concentration can fall to low levels.

Regions of San Francisco Bay experienced episodes of severe oxygen depletion (with fish kills) during the 1950s and early 1960s, before the era of advanced sewage treatment. South Bay again experienced a catastrophic episode of oxygen depletion in the early 80s following failures of a local sewage treatment plant. The oxygen content of bay waters is now generally high enough to supply the oxygen demands of aquatic life, reflecting a positive water-quality response to improved sewage treatment techniques. Although nutrient concentrations (e.g., phosphates and nitrates) are very high in San Francisco Bay, the bay does not have the noxious or toxic blooms of algae that are observed in many other estuaries that receive large inputs of nutrients from waste and land runoff.

Source: http://squall.sfsu.edu/courses/geol103/labs/estuaries/partVIIE.html

The oxygen content of bay water is not always uniform from surface to bottom. The surface water may have oxygen concentrations of about 9 milligrams per liter, while bottom waters more commonly have oxygen concentrations somewhat less. These kinds of vertical variations often occur as a result of salinity stratification, which slows the rate of vertical mixing of the water. Oxygen is added to the surface layers by atmospheric exchange and photosynthesis. Oxygen is mixed to the bottom waters by tidal and wind-driven stirring. This mixing is rapid in the absence of salinity stratification (ibid).

The distribution of oxygen differs from that of conservative properties such as salinity and temperature in that oxygen is biologically active: it is closely associated with changes in carbon and plant-nutrient concentrations (Conomos et al, 1979). DO is influenced by a variety of important processes:

- Exchange of oxygen across the water surface through atmospheric invasion (gain) and out-gassing (loss);
- Photosynthesis;
- Respiration by plants and animals, decomposition of organic matter by bacteria and chemical oxidation; and
- Advection and diffusion.

DO levels also interact with salinity and temperature. The amounts of oxygen or carbon dioxide present in water are proportional to the partial pressures exerted by these two gases. The solubility of oxygen and carbon dioxide, and, consequently, the absolute amount held in solution, decrease with increasing salinity (Kinne, 1964).

Studies in Mowry Slough, Newark Slough and Faber Tract Marsh (Smith, 1977) indicated that the DO levels were reduced to 3.5 ppm during time of tidal change. The data also indicate that vertical stratification of DO occurred in Newark Slough during August 1977. It was evident that there was a separate DO and salinity regime occurring in each of the three marsh areas studied. As part of the study, benthal demand analysis (oxygen uptake), which is a measure of the oxygen uptake by biological communities and chemical in the substrate, was conducted. Based on laboratory results, the chemical and biological demand in these slough channels or marshes could at times reduce the DO levels to below 1 ppm within the interstitial waters below the water-substrate interface.

4.3.3.2 Overview of Potential Water Quality Impacts from Decreased Oxygen (DO)

Reductions in dissolved oxygen (DO) have been identified as a concern in several locations where circulated pond waters would enter receiving water bodies during the ISP. This concern arises from the potential that pond water may have high productivity during warmer times of the year, and the resultant biological oxygen demand (BOD) may affect DO in sloughs, creeks, and portions of the bay proper.

To quantify potential increased BOD from proposed discharges in the receiving waters a detailed evaluation of ISP pond contents was performed. Samples were collected in the discharge ponds and in several segments of each receiving creek or slough. Complete results of this study are shown in Appendix C. The results indicate that, with the exception of the Guadalupe Slough segments, the BOD increases slightly under ISP conditions. For the Guadalupe Slough segments BOD actually decreases under ISP conditions.

In response to a Regional Board request, a study was performed in early September 2003 to evaluate diurnal patterns of dissolved oxygen (DO) in South Bay salt ponds (S.R. Hansen & Associates). Five ponds were selected for evaluation – i.e., Ponds 2 and 4 in the Baumberg Unit and Ponds A3W, A2E, and A13 in the Alviso Unit. Four of the ponds (i.e., Baumberg 2 and 4 and Alviso A2E and A3W) had salinities in the range of 32 to 43 ppt and were considered to be representative of the upper salinity conditions that might occur in discharge ponds during the Continuous Circulation Period in late summer. The fifth pond (i.e., Alviso A13) had a salinity of 63 ppt and was considered to be representative of the upper salinity conditions that might occur in discharges from Ponds A2W and A3W in the Alviso Unit and Ponds 2 and 11 in the Baumberg Unit during Phased Initial Release Periods commencing in July.

In each pond, the study consisted of measuring a number of parameters (i.e., temperature, specific conductivity, total dissolved solids, salinity, dissolved oxygen, pH, oxidation-reduction potential, and barometric pressure) at several stations over a 24-hr period. Measurements were typically made in mid-afternoon (when the DO would be expected to be the highest due to several hours of high algal photosynthesis), at dusk (when photosynthesis would be expected to have ceased and DO may have started to decrease), and at dawn (when the DO would be expected to be the lowest due to several hours of algal respiration but no photosynthesis due to the darkness). Sites in the ponds were selected to include those areas that had the maximum algal densities. However, in most ponds, large differences in algal density were not visually apparent between sites.

The results show that 7 of 16 of the dawn samples at the Alviso Complex showed DO under 5 mg/l over the study period and 13 of 20 of the dawn samples at the Baumberg Complex showed DO under 5 mg/l (20 out of 36 samples).

The results of this study show that at dawn, DO does drop below 5 mg/l in many of the ponds. However, this study presents the worst case scenario in that the current pond contents are in a static condition and the fall temperatures maximize algal productivity. Dissolved oxygen rises to its highest levels throughout the day within 6 hours of the low DO levels. It is likely that any excursions of the DO WQOs will be ephemeral.

4.3.3.3 Dissolved Oxygen Impacts to Water Quality by Alternative

No Project/No Action Alternative

Under the No Project/No Action Alternative, bay water would not be let into the ponds and water levels would not be managed. Ponds would dry down seasonally, levees would not be maintained, and unplanned breaches of the ponds would be more likely.

> *WATER QUALITY (DISSOLVED OXYGEN) IMPACT-1:* Ponds will be partially filled seasonally from rainfall; at some times of the year, waters could have a very high algal and bacterial biomass. Resultant diurnal fluctuations in DO could result in anoxia and resultant dieoff of invertebrates, exacerbating the potential for onset of avian botulism. Unplanned breaches of ponds could result in significant water quality and wildlife impacts from deteriorating water quality. Given the impacts of this alternative on the concentration of metals in discharge, any breach of the project ponds could have significant impacts on water quality and biota.

Significance: Potentially significant. Since this alternative will result in the project not being implemented, no mitigation measures are proposed.

Alternative 1 Seasonal Ponds

This alternative minimizes impacts from discharge of pond contents into the bay. Maintenance of the levees and water control structures would prevent their deterioration and prevent the accidental breaching of the ponds and release of pond contents to the bay. Under this alternative, most of the existing open water habitats currently used by wildlife would be greatly reduced, significantly changing the character of the South Bay salt ponds. The duration and depth of water in the ponds would be reduced in most years, and the open water character of the salt ponds would be lost. The existing intake structures for each pond complex would be closed. Intake ponds would no longer be present. The pond systems would not support fish and bay invertebrates, resulting in reduced foraging habitat for piscivorous (fish-eating) birds.

The Seasonal Pond Alternative appears to have the most minimal water quality impacts to the Bay and receiving waters with respect to DO compared to all other project alternatives. Nevertheless, DO levels in the ponds could be impacted. However, this alternative would not meet project objectives of maintaining existing open water and wetland habitat for the benefit of wildlife, including habitat for migratory shorebirds and waterfowl and resident breeding species or maintaining ponds in a restorable condition to facilitate future long-term restoration.

Alternatives 2 Simultaneous March/April Initial Release

WATER QUALITY (DO) IMPACT 1- Increased algal activity in ponds could lead to decreased dissolved oxygen in the ponds relative to the receiving waters. Under existing conditions DO does drop below the WQO in some ponds at night in September. The DO sags were ephemeral. If pond DO does not meet the Basin plan water quality objective of 5 mg/l, and the discharge causes receiving water DO concentrations to be below the WQO, then the discharge would cause a potentially significant impact. Such a significant impact could occur during the CCP in late summer with drought conditions, or in the event of equipment disrepair or malfunction.

Significance: Potentially Significant

WATER QUALITY (DISSOLVED OXYGEN) MITIGATION MEASURE 1A: The ponds, effluent, and receiving waters will be monitored to determine if excursions from the WQOs are occurring.

WATER QUALITY (DISSOLVED OXYGEN) MITIGATION MEASURE 1B: If monitoring shows excursions from the WQOs, one of the following mitigation measures will be implemented: supplemental aeration using a solar powered aerator and timer to be actuated during non-daylight hours will be installed at discharge outlet, or discharge ponds can be operated as muted tidal ponds for the duration of the DO excursion from the WQO.

Post-mitigation Significance: Less than Significant.

Alternative 3 - Phased July Initial Release

In Alternative 3, many of the lower-salinity ponds in Alviso and Baumberg would be discharged in July, and the medium-salinity ponds would be discharged the following March and April. These ponds would then be managed in the same manner as in Alternative 2 during the continuous circulation period. The higher salinity ponds would also be managed as in Alternative 2.

Based on the proposed initial release operations, the ponds proposed for discharge in Alternative 3 would not represent any significant difference from the dissolved oxygen conditions in Alternative 2. Therefore the potential receiving waters impacts of Alternative 3 would be the same as or similar to the impacts described for Alternative 2.

4.3.4 Suspended Sediment and Turbidity

4.3.4.1 Regional Water Quality Setting—Suspended Sediment and Turbidity

Turbidity is the characteristic of water that relates to its clarity or cloudiness and is derived optically in the laboratory by measuring the amount of light scatter within a sample. Turbidity is an important factor, as it plays a vital role in aquatic productivity. The South San Francisco Bay estuary has high concentrations of particles suspended in the water. The following water characteristics are related to turbidity:

- Suspended particles reduce the clarity of the water and give it color.
- Both planktonic algae and suspended sediments affect turbidity.
- The suspended particles absorb sunlight, warming the water and reducing sunlight penetration into the water, which is necessary for algal photosynthesis.

Suspended particulates consist of sediments (primarily clay), detritus, and phyto and zooplankton. Sediments are carried from the surrounding land surfaces into the bay by rivers and streams. Once in the bay they either settle onto the bottom or are carried through the bay into the open ocean. Strong tidal currents and wind waves can re-suspend these sediments into the water column. Most trace elements, such as lead, copper, and zinc, are associated with the surfaces of sediment particles and are transported, deposited, and eventually buried with the bay sediments. Many trace elements are toxic to marine life in very small quantities. Human activities have accelerated the cycling of trace elements and increased deliveries of these substances to the marine environment.

The concentration of particles is measured as either total suspended solids (TSS) or nephelometric turbidity units (NTU).

When there are low suspended solids the concentration and uniform distribution from the surface to bottom depths occurs; this is observed when tidal currents are weak and winds are calm, and thus the current stresses applied to the seafloor are not strong enough to suspend bottom sediments. When tidal currents are rapid enough, sediments are eroded from the bottom and move up into the water column. During periods of high stream inflow large quantities of suspended sediments are also carried into the bay. The water can become very turbid during these periods of rapid sediment input.

During years of low stream and river inflow sediment inputs are reduced, and the concentrations of suspended sediments are smaller. So the turbidity and the color of bay waters changes over time, because the concentrations of suspended solids change from season to season and from year to year.

During intense winter storms, tributary stream inputs greatly increase the concentrations of suspended solids in the South Bay, especially in the region below the San Mateo Bridge.

During very wet years, such as 1995, the bay waters may remain turbid during much of the year because of sustained riverine inputs of suspended sediments.

Suspended sediment concentration is controlled by:

- Loading from inland streams;
- Tidal influences on dilution and mass loading of biotic suspended matter (algae, zooplankton); and
- Re-suspension of previously deposited sediments within the bay.

Re-suspension of sediments within the bay is a function of tidal currents, wind strength and direction (i.e., the strength of wind-driven wave currents), and freshwater inputs. Freshwater influx shows a strong seasonal variation, with a peak during the winter (November–April) rainy season; land-derived sediment loading shows a corresponding peak in the winter. Tidal currents vary on a semi-monthly basis from neap tides to spring tides, with the greatest sediment mobility at spring tides. In general, TSS concentrations are highest in the San Pablo Bay region and at the southern end of San Francisco Bay. TSS concentrations are typically lower in central San Francisco Bay.

Measured TSS concentrations in the South Bay range from relatively low values (less than 50 mg/l TSS) to very turbid conditions exceeding 1,000 mg/l TSS. Seasonal RMP grab samples also indicate that TSS concentrations are somewhat elevated in the Coyote Creek area.

4.3.4.2 Overview of Potential Water Quality Impacts from Suspended Solids and Turbidity

Turbidity is a measure of the cloudiness of water and is a function of the amount of suspended material present. This material includes both organics, such as algae, and inorganics such as silt particles. Data available on the turbidity of receiving waters in the project area is limited to the Alviso Complex and includes only the winter months of January and February. This data is summarized in Table 4-7.

Table 4-9
Turbidity of receiving waters in the Alviso Complex. Values are averages (*n* >100) (City of San Jose).

	Turbidity (NTU)	
Receiving water body	**January 2000**	**February 2000**
Guadalupe Slough	75.7	135.2
Mud Slough	120.1	337

Mud Slough is located in the eastern portion of the Alviso ponds, and samples were collected from the north side of pond 21 near Drawbridge. Guadalupe Slough runs through the center of the Alviso portion of the project, and samples were collected from between ponds A3W and A5. This limited data suggests that in the winter Mud Slough tends to have greater turbidity relative to Guadalupe Slough.

Measurements of turbidity in Alviso ponds are shown in Table 4-8. Data are limited to one full year from July 2002 to May 2003. Of the ponds listed, only Alviso Ponds A14 and A16 are discharge (outlet) ponds under the ISP.

Table 4-10
Turbidity of selected Alviso ponds. Values are averages (*n*=1-6)
USGS Preliminary Data.

	Turbidity (NTU)						
Pond	**July '02**	**Sept '02**	**Oct '02**	**Dec '02**	**Feb '03**	**March '03**	**May '03**
A9	68.14	32.10	72.03	22.23	120.98	59.25	51.15
A10	20.28	30.93	45.48	28.34	183.57	59.45	53.75
A11	69.56	115.70	136.76	59.50	36.43	271.67	55.35
A12	64.32	57.23	67.88	35.56	136.70	172.53	51.07
A13	67.50	88.85	47.30	22.70	115.08	133.13	53.65
A14	248.60	182.00	116.55	64.70	51.55	76.65	66.45
A15	111.53	170.00	63.18	28.86	33.86	52.93	86.80
A16	165.00	102.55	82.93	169.20	38.38	47.03	70.70
Average:	101.87	97.42	79.01	53.89	89.57	109.08	61.12
SE	25.72	20.34	11.43	17.44	20.13	28.04	4.48

Table 4-8 indicates that variation in pond turbidity exists both among ponds and among months, with no clear trends evident. In February, the month in which turbidity values are available for both ponds and receiving waters, nearly all ponds had significantly lower turbidity relative to receiving waters. Turbidity of receiving waters may decrease in summer with decreasing sediment load.

A direct comparison of pond water turbidity with that of receiving waters must be made cautiously for several reasons. First, data were collected during different years, and between-year differences in weather conditions may be significant. Second, the receiving waters that were sampled are not adjacent to sampled ponds and therefore function primarily as examples of turbidity ranges that may occur in receiving waters during months for which data are available. Third, turbidity is strongly but indirectly affected by salinity, as algal communities that inhabit highly saline ponds increase turbidity relative to those present in lower salinity ponds.

In general, there are no strong indications that discharge from the ponds will contribute to higher turbidity in the sloughs, creeks, and bay. In contrast to receiving waters, pond sediments are well flocculated due to the high ionic strength of the pond solution. In addition, velocities of water movement through the pond systems are too low to suspend and transport appreciable quantities of sediment. It is also expected that pond water turbidity will decrease under ISP conditions, as most ponds will be managed for lower salinities than exist currently.

4.3.4.3 Turbidity Impacts to Water Quality By Alternative

No Project/No Action Alternative

> *WATER QUALITY (TURBIDITY) IMPACT-1:* Unplanned breaches of ponds could result in significant water quality and wildlife impacts from increased turbidity.

Under the No Project/No Action Alternative, bay water would not be let into the ponds and water levels would not be managed. Ponds would most likely be shallower and warmer which could lead to increased algal activity and turbidity. Additionally, levees would not be maintained and unplanned breaches of the ponds would be more likely. Given the impacts of this alternative on the turbidity of discharge, any breach of the project ponds could have temporary significant impacts on water quality and biota.

Significance: Potentially significant. Since this alternative will result in the project not being implemented, no mitigation measures are proposed.

Alternative 1 Seasonal Ponds

This alternative minimizes impacts from discharge of pond contents into the bay. Maintenance of the levees and water control structures would prevent their deterioration and prevent the accidental breaching of the ponds and release of pond contents to the bay. Under this alternative, most of the existing open water habitats currently used by wildlife would be greatly reduced, significantly changing the character of the South Bay salt ponds. The duration and depth of water in the ponds would be reduced in most years, and the open water character of the salt ponds would be lost. The single intake pond for each pond complex would be closed. Intake ponds would no longer be present, so the pond systems would not support fish and bay invertebrates, resulting in reduced foraging habitat for piscivorous (fish-eating) birds.

The Seasonal Pond Alternative appears to have the fewest water quality impacts to the bay with respect to turbidity compared to all other project alternatives. However, this alternative would not meet project objectives of maintaining existing open water and wetland habitat for the benefit of wildlife, including habitat for migratory shorebirds and waterfowl and resident breeding species or maintaining ponds in a restorable condition to facilitate future long-term restoration.

Alternative 2 Simultaneous March/April Initial Release

> *WATER QUALITY (TURBIDITY) IMPACT-2*: Discharge of pond water could lead to a greater than 10% increase in turbidity of receiving water and may adversely affect water quality and biota in adjacent waterways.

Significance: Potentially Significant

> *WATER QUALITY (TEMPERATURE) MITIGATION MEASURE-1A:* Monitor discharged water at discharge points of pond systems with known elevated turbidity.

> *WATER QUALITY (TEMPERATURE) MITIGATION MEASURE-1B:* Slow the discharge of water when the turbidity variance between the discharging water and the receiving water exceeds 10%.

Post-mitigation Significance: Less than significant

Alternative 3 - Phased July Initial Release

In Alternative 3, many of the lower salinity ponds in Alviso and Baumberg would be discharged in July, and the medium salinity ponds would be discharged the following March and April. These ponds would then be managed in the same manner as in Alternative 2 during the continuous circulation period. The higher salinity ponds would also be managed as in Alternative 2.

Based on the proposed initial release operations, the ponds proposed for discharge in Alternative 3 would not represent any significant difference from the turbidity conditions in Alternative 2. Therefore the potential receiving waters impacts of Alternative 3 would be the same as or similar to the impacts described for Alternative 2.

4.3.5 Temperature

4.3.5.1 Regional Water Quality Setting—Temperature

As mentioned in the DO section above, temperature is an important factor in the regional setting because of its influence upon chemical equilibria such as dissolved oxygen, and pH in the ponds and receiving waters, as well as metabolism of cold-blooded fish and aquatic invertebrates upon which they feed.

Like salinity, the temperature of bay water varies spatially and temporally and is an indicator of mixing and the relative contributions of fresh and salt water. The issue is somewhat more complicated because sometimes during the year the coldest water comes from the ocean and sometimes it comes from stream and creek runoff. Colder water is denser (heavier) than warm water and tends to sink to the bottom. This effect is very strong in the open ocean, where salinity variations are small. In the San Francisco Bay, where salinity variations are large, salinity has a greater impact on water mass sinking and mixing than temperature.

Water temperature is measured by the USGS because it is an indicator of mixing and because many biological processes (including fish migrations) respond to temperature changes. The seasonal range of water temperature in the bay is from about 8°C to about 23°C (USGS data, July 1996).

Temperature varies both spatially, along the length of the bay, and temporally, from season to season and year to year. Water temperature changes with season, and is warmest in August when temperatures reach 23°C (73° F). Bay waters are coldest in December and January, reaching minimum temperature of about 8°C (46° F). In summer, the water is warmer in the South Bay than in the Central Bay (Bay Bridge)due to mixing of warmer bay waters and colder waters from the Pacific Ocean.

Sometimes there are sharp temperature gradients. These gradients suggest regions of slow horizontal mixing. For example, a bump in the sea floor at the San Bruno Shoal, acts to slow mixing between the South Bay and Central Bay, allowing the South Bay waters to warm up faster than the Central Bay waters that are close to the colder Pacific Ocean.

During the summer, bay water is coldest near the Golden Gate, where colder ocean water enters, while during the winter, the water near the bay entrance is slightly warmer than in the rest of the bay, particularly the North Bay.

As discussed in Section 4.3.1.5, pond water temperature during the Initial Release and Continuous Circulation Periods is anticipated to be similar or less than existing conditions, though variation may occur in ponds that are managed shallower or deeper than present conditions. Discharge of pond water is proposed for low tide periods; therefore the time of day that discharges occur will vary. Some discharges will occur during daytime when pond temperatures are higher, while others will occur when pond temperatures are lower, during the night or very early morning.

During the Continuous Circulation Period, it is estimated that it would take 15 to 50 days for a complete exchange of water to occur within a pond system. Because the exchange is faster than under commercial salt pond operations, pond temperatures may be less than those that occur under present conditions. Clearly there will be a great deal of variation in pond water temperatures during release periods depending on the management of individual ponds, seasonal climate changes, and levels of solar exposure. Given these variables, temperatures in some ponds may be elevated above the receiving water during some scheduled, low tide release periods.

Available data indicate that only during the summer months is the temperature of discharged pond water likely to be higher than receiving waters.

4.3.5.2 Overview of Potential Water Quality Impacts from Temperature

Temperature is a factor that can influence how well fauna tolerate changes in salinity, and their possible responses to combined changes in salinity and temperature range widely. In San Francisco Bay, water temperature varies more widely than salinity. Bay temperatures are influenced by several factors, including local weather conditions and local discharge of waste heat, as well as by rivers and the ocean (Conomos, 1979). In the summer, salinity levels in the South Bay match that of the ocean, but water temperatures increase by 4-5°C as a result of solar heating in shallow water. This warming is enhanced by the long residence time of water in the South Bay and is especially evident during dry summers, when a warm-water lens forms and is maintained at the water surface despite vertical mixing (Conomos, 1979).

Available data indicate that only during the summer months is the temperature of discharged pond water likely to be higher than receiving waters. Table 4-9 shows water temperature data for ponds in the Alviso Complex and for receiving sloughs and creeks for 2003. Of the ponds listed, only Alviso Ponds A14 and A16 are discharge (outlet) ponds under the ISP. In the months of March and May, pond temperatures were similar to those of potential receiving waters. In the summer months of June and July, pond temperatures rose above those of receiving waters by a maximum of 4.6°C, although at most locations, temperatures were similar to receiving waters. Temperature data for receiving waters are not available for the months of August and September. However, pond temperatures did not increase further in August and September, suggesting that significant differences in temperature between pond water and receiving waters may not occur during these months.

Table 4-11
Water temperatures for Alviso Ponds and potential receiving water bodies.

Month	Pond	Ave. temp (ºC)	Receiving water body[1]	Ave temp (ºC)
March	A9	18.10	Coyote Creek	17.99
	A10	18.07	Alviso Slough	16.78
	A11	17.93	Guadalupe Slough	16.09
	A12	17.16		
	A13	16.65		
	A14*	17.33		
	A15	16.95		
	A16*	16.37		
May	A9	20.28	Coyote Creek	22.16
	A10	20.13	Alviso Slough	20.85
	A11	21.00	Guadalupe Slough	19.76
	A12	19.86		
	A13	22.57		
	A14*	19.90		
	A15	20.23		
	A16*	20.33		
June	A9	25.16	Coyote Creek	23.70
	A10	24.13	Alviso Slough	23.24
	A11	25.60	Guadalupe Slough	23.04
	A12	24.64		
	A13	23.65		
	A14*	25.13		
	A15	23.83		
	A16*	23.75		
July	A9	24.18	Coyote Creek	21.83
	A10	23.10	Alviso Slough	21.16
	A11	22.88	Guadalupe Slough	20.62
	A12	23.36		
	A13	23.94		
	A14*	23.36		
	A15	25.15		
	A16*	25.20		
August	A9	21.23	Coyote Creek	22.83
	A10	22.50	Alviso Slough	21.57
	A11	28.60	Guadalupe Slough	21.87
	A12	24.90		
	A13	22.50		
	A14*	20.40		
	A15	22.20		
	A16*	23.90		
September	A9	21.60	Coyote Creek	22.98
	A10	21.30	Alviso Slough	22.04
	A11	22.20	Guadalupe Slough	22.07
	A12	21.90		
	A13	23.80		
	A14*	24.70		
	A15	26.50		

Month	Pond	Ave. temp (ºC)	Receiving water body[1]	Ave temp (ºC)
	A16*	23.10		

* Pond proposed for discharge into adjacent slough or creek under ISP.
[1] **Alviso Slough and Guadalupe Slough data provided for information only. Coyote Slough is the receiving water body for discharges from Ponds A9-16.**

4.3.5.3 Temperature Impacts to Water Quality by Alternative

No Project/No Action Alternative

> *WATER QUALITY (TEMPERATURE) IMPACT-1:* Unplanned breaches of ponds could result in significant water quality and wildlife impacts from increased temperature.

Under the No Project/No Action Alternative, bay water would not be let into the ponds and water levels would not be managed. Ponds would most likely be shallower and warmer. Additionally, levees would not be maintained and unplanned breaches of the ponds would be more likely. Given the impacts of this alternative on the temperature discharge, any breach of the project ponds could have temporary significant impacts on water quality and biota.

Significance: Potentially significant. Since this alternative will result in the project not being implemented, no mitigation measures are proposed.

Alternative 1 Seasonal Ponds

This alternative minimizes impacts from discharge of pond contents into the bay. Maintenance of the levees and water control structures would prevent their deterioration and prevent the accidental breaching of the ponds and release of pond contents to the bay. Under this alternative, most of the existing open water habitats currently used by wildlife would be greatly reduced, significantly changing the character of the South Bay salt ponds. The duration and depth of water in the ponds would be reduced in most years, and the open water character of the salt ponds would be lost. The single intake pond for each pond complex would be closed. Intake ponds would no longer be present, so the pond systems would not support fish and bay invertebrates, resulting in reduced foraging habitat for piscivorous (fish-eating) birds.

The Seasonal Pond Alternative appears to have the fewest water-quality impacts to the bay with respect to temperature compared to all other project alternatives. However, this alternative would not meet project objectives of maintaining existing open water and wetland habitat for the benefit of wildlife, including habitat for migratory shorebirds and waterfowl and resident breeding species, or maintaining ponds in a restorable condition to facilitate future long-term restoration.

Alternative 2 Simultaneous March/April Initial Release

> *WATER QUALITY (TEMPERATURE) IMPACT-2*: Water Quality Control Plan for Control of Temperature in the Coastal and Interstate Waters and Enclosed Bays and Estuaries of California (Thermal Plan) states: for discharges to enclosed bays, the Thermal Plan indicates that maximum temperature of waste discharges shall not exceed the natural temperature of receiving waters by 20°F

and the discharge shall not cause temperatures to rise greater than 4°F above the natural temperature of the receiving water at any time or place. Discharge of pond water at temperatures more than 20º degrees Fahrenheit above the temperature of the receiving water may adversely affect water quality and biota in adjacent waterways.

Significance: Potentially Significant

WATER QUALITY (TEMPERATURE) MITIGATION MEASURE-1A: Monitor discharged water at discharge points of pond systems with known elevated temperatures.

WATER QUALITY (TEMPERATURE) MITIGATION MEASURE-1B: Slow the discharge of water when the temperature variance between the discharging water and the receiving water exceeds 20º degrees Fahrenheit.

Post-mitigation Significance: Less than significant

Alternative 3 - Phased July Initial Release

In Alternative 3, many of the lower salinity ponds in Alviso and Baumberg would be discharged in July, and the medium salinity ponds would be discharged the following March and April. These ponds would then be managed in the same manner as in Alternative 2 during the continuous circulation period. The higher salinity ponds would also be managed as in Alternative 2.

Based on the proposed initial release operations, the ponds proposed for discharge in Alternative 3 would not represent any significant difference from the temperature conditions in Alternative 2. Therefore the potential receiving waters impacts of Alternative 3 would be the same as or similar to the impacts described for Alternative 2.

4.3.6 pH

4.3.6.1 Regional Water Quality Setting –pH

As mentioned in both the DO and temperature sections above, pH is an important factor in the regional setting because of its influence upon chemical equilibria; it is intimately involved with solubility of metals in the ponds and receiving waters as well as having direct impacts on aquatic organisms. Like salinity and temperature, the pH of bay water varies spatially and temporally and is an indicator of mixing and the relative contributions of fresh and salt water.

pH is the measure of the acidity or alkalinity (basicity) of water (pH 7 is neutral, increasing values indicate alkalinity and decreasing value indicate acidity). In most natural systems, the pH of waters is primarily determined by balance between the dissolution of weakly acidic carbon dioxide and basic rocks and carbonates. pH in water systems in contact with the atmosphere is heavily influenced by anything that affects the concentration of carbon dioxide in the water. For example, the solubility of carbon dioxide increases as temperature decreases; temperature affects the pH. As described in the section on DO, the balance between photosynthesis and respiration by organisms affects the concentration of carbon dioxide in water and thus the pH. In general, as DO levels rise and carbon dioxide levels decrease with photosynthesis, pH will increase. Water turbulence can affect the amount of dissolved carbon dioxide.

The pH of a system is also controlled by how well "buffered" (resistant to change) the system is. Some systems have a large capacity to neutralize additions of acidic or basic materials and thus maintain a steady pH. pH levels fluctuate over time in an estuary like the San Francisco Bay. Estuarine pH levels generally average from 7.0 to 7.5 in the fresher sections to between 8.0 and 8.6 in the more saline areas. The slightly alkaline pH of seawater is due to the natural buffering from the carbonate and bicarbonate dissolved in the water.

4.3.6.2 Overview of Potential Water Quality Impacts from pH

Water pH is a factor that can both directly affect fauna and indirectly affect them through its role in many key chemical equilibria. In San Francisco Bay, water pH varies from 7.0 to 8.6. Available data indicate that only during the summer months is the pH of discharged pond water likely to be higher than receiving waters. Table 4-10 shows pH data for ponds in the Alviso Complex and for receiving sloughs and creeks for 2003. In the month of March, pond pH values were similar to those of potential receiving waters. In the warmer months of May, June and July, pond pH rose above those of receiving waters by a maximum of 1.16 pH units, although at most locations the difference was less. The pH data for receiving waters are not available for the months of August and September. However, pond pH did not increase further in August and September, suggesting that significant differences in pHbetween pond water and receiving waters may not occur during these months. Additional in pond pH data was taken in September which suggest that pH may occasionally be significantly higher than the receiving waters. On that day, average pH at the Alviso Complex was 9.86 with a range of 9.68 to 10.03 and the average pH at the Baumberg Complex was 8.17 with a range of 8.07 to 8.27.

Table 4-12
Water pH for Alviso Ponds and potential receiving water bodies

Month	Pond	Ave. pH	Receiving water body[1]	Ave pH
March	A9	8.2	Coyote Creek	8.25
	A10	8.07	Alviso Slough	8.84
	A11	8.5	Guadalupe Slough	8.71
	A12	8.38		
	A13	8.4		
	A14*	8.4		
	A15	8.4		
	A16*	8.23		
May	A9	8.58	Coyote Creek	7.57
	A10	8.13	Alviso Slough	7.73
	A11	8.73	Guadalupe Slough	7.70
	A12	8.42		
	A13	8.43		
	A14*	8.47		
	A15	8.40		
	A16*	8.30		
June	A9	8.42	Coyote Creek	7.52
	A10	8.20	Alviso Slough	7.65
	A11	8.90	Guadalupe Slough	7.72
	A12	8.34		

Month	Pond	Ave. pH	Receiving water body[1]	Ave pH
	A13	8.38		
	A14*	8.40		
	A15	8.40		
	A16*	8.31		
July	A9	8.03	Coyote Creek	7.69
	A10	8.43	Alviso Slough	7.75
	A11	8.70	Guadalupe Slough	7.73
	A12	8.44		
	A13	8.40		
	A14*	8.35		
	A15	8.35		
	A16*	8.23		
August	A9	8.11	Coyote Creek	7.18
	A10	8.51	Alviso Slough	7.39
	A11	8.46	Guadalupe Slough	7.31
	A12	8.34		
	A13	8.45		
	A14*	8.48		
	A15	8.37		
	A16*	8.22		
September	A9	8.52	Coyote Creek	7.45
	A10	8.05	Alviso Slough	7.67
	A11	8.47	Guadalupe Slough	7.59
	A12	8.34		
	A13	8.37		
	A14*	8.46		
	A15	8.38		
	A16*	8.29		

* Pond proposed for discharge into adjacent slough or creek under ISP.
[1] Alviso and Guadalupe Slough data provided for information only. Coyote Slough is the only receiving water body for Ponds A9-16.

4.3.6.3 Suspected pH Impacts to Water Quality by Alternative

No Project/No Action Alternative

WATER QUALITY (PH) IMPACT-1: Ponds will be seasonally filled; at some times of the year waters could have a very high algal and bacterial biomass. Resultant diurnal fluctuations in DO could result in fluctuations in pH. Unplanned breaches of ponds could result in significant water quality and wildlife impacts from deteriorating water quality. Under the No Project/No Action Alternative, bay water would not be let into the ponds and water levels would not be managed. Ponds would dry down seasonally, levees would not be maintained, and unplanned breaches of the ponds would be more likely. Given the impacts of this alternative on the concentration of metals in discharge, any breach of the project ponds could have significant impacts on water quality and biota.

Significance: Potentially significant. Since this alternative will result in the project not being implemented, no mitigation measures are proposed.

Alternative 1 Seasonal Ponds

This alternative minimizes impacts from discharge of pond contents into the bay and receiving waters. Maintenance of the levees and water control structures would prevent their deterioration and prevent the accidental breaching of the ponds and release of pond contents to the bay. Under this alternative, most of the existing open-water habitats currently used by wildlife would be greatly reduced, significantly changing the character of the South Bay salt ponds. The duration and depth of water in the ponds would be reduced in most years, and the open water character of the salt ponds would be lost. The single intake pond for each pond complex would be closed. Intake ponds would no longer be present, so the pond systems would not support fish and bay invertebrates, resulting in reduced foraging habitat for piscivorous (fish-eating) birds.

The Seasonal Pond Alternative appears to have the fewest water quality impacts on bay waters with respect to pH compared to all other project alternatives. However, this alternative would not meet project objectives of maintaining existing open water and wetland habitat for the benefit of wildlife, including habitat for migratory shorebirds and waterfowl and resident breeding species, or maintaining ponds in a restorable condition to facilitate future long-term restoration.

Alternative 2 Simultaneous March/April Initial Release

> *WATER QUALITY (PH) IMPACT-2*: Due to the lower temperatures during the initial release period and thus lower productivity of in pond biota, the effect on pond, and thus discharge pH should be minimal. The potential for excursion from the basin plan standards are most likely to occur during the warmer summer and fall months, especially on windless nights when DO sags may occur. Because pH and DO are intimately related in the salt ponds, mitigation measures designed to ameliorate DO sags will also act to reduce pH.

Significance: Potentially Significant

> *WATER QUALITY (PH) MITIGATION MEASURE 1A:* The ponds, effluent and receiving waters will be monitored to determine if excursions from the WQOs are occurring.

> *WATER QUALITY (PH) MITIGATION MEASURE 1B:* If monitoring shows excursions from the WQOs the one of the following mitigation measures will be implemented: supplemental aeration using a solar powered aerator and timer to be actuated during non-daylight hours will be installed at discharge outlet, discharge ponds can be operated as muted tidal ponds for the duration of the pH excursion from the WQO.

Post-mitigation Significance: Less than significant

Alternative 3 - Phased July Initial Release

In Alternative 3, many of the lower salinity ponds in Alviso and Baumberg would be discharged in July, and the medium salinity ponds would be discharged the following March and April. These ponds would then be managed in the same manner as in

Alternative 2 during the continuous circulation period. The higher salinity ponds would also be managed as in Alternative 2.

Based on the proposed initial release operations, the ponds proposed for discharge in Alternative 3 would not represent any significant difference from the pH conditions in Alternative 2. Therefore the potential receiving waters impacts of Alternative 3 would be the same as or similar to the impacts described for Alternative 2.