South Bay Salt Ponds Initial Stewardship Plan

Draft Environmental Impact Report/Environmental Impact Statement

December 2003

Submitted by:

California Department of Fish and Game

United States Fish and Wildlife Service

SOUTH BAY SALT PONDS INITIAL STEWARDSHIP PLAN

NOTICE: This document represents a Draft EIR/EIS prepared by California Department of Fish and Game and the US Fish and Wildlife Service. Due to differences in publication requirements, the CEQA and NEPA documents will have different circulation times.

CEQA: The Draft EIR/EIS will be circulated for a 45-day public and agency review period, beginning with the publication of this document on December 22, 2003 and ending 45 days after this date. Copies of the document have been made available to applicable local, state, and federal agencies and to interested organizations and individuals wishing to review and comment on the report. Written comments will be received by **CDFG** at the following address:

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NEPA: USFWS will consider all comments on the DEIR/EIS provided by the public and federal, state, and local agencies within the 45-day comment period starting upon publication in the Federal Register. Written comments will be received by **USFWS** at the following address:

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EXECUTIVE SUMMARY

Introduction

On March 16, 2003, the State of California and the United States of America acquired 16,500 acres of commercial salt ponds in San Francisco Bay from Cargill, Inc. This acquisition set the stage for the development of the largest tidal wetland restoration project on the West Coast. Specifically, the purpose of this acquisition was to protect, restore and enhance the property for fish and wildlife, as well as to provide opportunities for wildlife-oriented recreation and education. Of the acquired lands, 15,100 acres are located in South San Francisco Bay and the remaining lands are in the North Bay in Napa County. This Environmental Impact Report/Environmental Impact Statement (EIR/EIS) only addresses the 15,100 acres acquired in South San Francisco Bay.

Under commercial salt production, Cargill managed the South Bay salt ponds as shallow water ponds at various salinity levels. The salinity levels varied both geographically, based on the location of the pond within the system (for example, the highest salinities occurred in ponds closest to the production plant sites) and temporally, based on seasonal and climatic conditions (for example, salinities decreased during the winter rainy season and during wet years). Although these ponds were managed for commercial salt production, they provided habitat for many water bird species including waterfowl and shorebirds. Ponds that were owned by Cargill in fee title were closed to public access. Other ponds, for which Cargill only held salt-making rights and which were parts of the Don Edwards San Francisco Bay National Wildlife Refuge, were open to several types of public use.

The restoration of the salt ponds is taking place in three independent stages. First, Cargill is reducing the salinity levels in the ponds by moving the saltiest brines to its plant site in Newark. After they reduce the salinities to levels that are permitted to be discharged to the Bay, Cargill will no longer manage the ponds for salt production. Management of the Baumberg ponds will be turned over to the California Department of Fish and Game and management of the Alviso ponds and West Bay ponds will be turned over to the U.S. Fish and Wildlife Service.

In the second stage of restoration, the ponds will be managed by the agencies in a manner that provides habitat values while the long-term restoration plan is being developed and implemented. In this Initial Stewardship stage, Bay waters will be circulated through the ponds following installation of water control structures and the existing levees will be maintained for minimum flood protection. This EIR/EIS covers only the second stage of restoration, i.e., Initial Stewardship .

The third stage of restoration is the actual long-term restoration of the salt ponds to a mix of tidal marshes, managed ponds and other habitats. The planning process for this long-term restoration is just beginning and will include a substantial amount of data collection, studies, modeling efforts, and public involvement. The long-term planning process will include development of a separate EIR/EIS and therefore long-term activities are not discussed further in this document.

Purpose and Need

The purpose of the project is to maintain and enhance, to the extent possible, the biological and physical conditions within the south bay salt ponds in the interim period between the cessation of salt-making activities and the implementation of a long term restoration plan. The ponds currently support populations of fish and wildlife, including endangered species, migratory waterfowl, shorebirds, other water associated birds, resident fish and invertebrates.

The project is needed because:

- The ponds will be disconnected from ongoing salt making operations.
- Without initial stewardship the ponds will be subject to increasing salinity and declining ecological value.
- Deterioration of levees could lead to levee breaches and uncontrolled high-salinity discharges, resulting in potential adverse effects on aquatic populations in the adjacent open bay.
- Restoration costs would be increased with site deterioration.
- Water levels would become unmanageable and, especially during the summer months, would result in increased salinity, acidic conditions, and drying of most of the ponds..

Implementing the project will benefit the environment by

- Maintaining and enhancing to the maximum extent possible the ecological and physical health of the salt ponds until a long term restoration plan is completed and implemented
- Improving water circulation within the ponds to maintain and enhance existing fish and wildlife populations.

As part of normal salt making operations, bay water is brought in to the pond systems at several locations around the bay. After entering the system, it is moved through the concentrator ponds over five years until the salinities are ready for the precipitation of salt for harvest at the Newark Plant site. The salt making process is a closed system with water being taken with no discharge to the bay. End products of the process are (1) salt, which is harvested as a crop and (2) bittern, a byproduct which cannot be discharged back to the bay and is stored and used for commercial applications.

The salt making system included an array of ponds of varying salinities (low to high) and water levels (shallow to deep). Pond salinities and depths varied during the seasons depending on water movements within the system to optimize the salt concentration process. The ponds incidentally provided habitat for many species of fish and wildlife. Fish and wildlife values were not a management objective of the salt making process.

With acquisition of the South Bay Salt Ponds by the Department of Fish and Game and the U. S. Fish and Wildlife Service, the ponds will no longer be part of the salt making process. Consequently they must be managed as separate systems to assure that they provide fish and wildlife habitat value while minimizing future restoration costs. This management must continue through the planning and implementation of the long-term restoration plan. Implementation of the long-term restoration plan is expected to be conducted in phases beginning in about 5 years, but with subsequent phases extending to 20+ years. Therefore, some ponds may be managed under an initial stewardship plan for as little as 5 years, while others may require such management for 20+ years.

To achieve the purpose of the project, the two agencies must have the ability to establish a water circulation system which allows the bay water to discharge back into San Francisco Bay. Without the ability to discharge, bay water brought into the pond system will evaporate resulting in elevated salinities which will ultimately reduce fish and wildlife values as seen in the North Bay salt ponds. If the agencies are not able to circulate water through the system, they will not be able to bring bay water into the system due to the potential for increasing pond salinities to unmanageable levels. This will change the character of the pond system from what is currently shallow open water pond habitat of varying salinities, to seasonal pond habitat filled primarily by rain water during the winter and dry the remainder of the year. This change could significantly reduce the value of the ponds to fish and wildlife.

Project Alternatives

The purpose of this project is to provide a biologically sound interim management program for the ponds during planning and implementation of the long-term salt pond restoration. One No Action and three action alternatives were analyzed in detail in the EIR/EIS. A summary of the alternatives is shown on Table S-1, a comparison of alternatives in meeting project need is shown on Table S-2, and a comparison of project impacts of project alternatives is shown on S-3.

Table S-1: Summary of Alternatives

Alternative	Levee Maintenance	Initial Release Period (~2 months)	Continuous Circulation Period (5+ years)	Public Access
No Project/ No Action	No	N/A	N/A	No new access; existing access at risk
Seasonal Ponds	Yes	N/A	N/A	No new access; existing access maintained.
Simultaneous March/April Release	Yes	Low to mid-salinity brines released from most ponds at same time in spring	Ponds managed as combination of continuous flow through ponds, batch ponds and seasonal ponds, with options for changing	New docent-led tours/limited hunting; existing access maintained

Alternative	Levee Maintenance	Initial Release Period (~2 months)	Continuous Circulation Period (5+ years)	Public Access
			management based on monitoring.	
Phased Initial Discharge	Yes	Low to mid-salinity brines released from different ponds over several years in July and March/April	Ponds managed as combination of continuous flow through ponds, batch ponds and seasonal ponds, with options for changing management based on monitoring.	New docent-led tours/limited hunting; existing access maintained

Under the No Action alternative, the pond waters/brines remaining in the ponds would be allowed to evaporate. The ponds would then fill seasonally with rainwater in winter and dry through the evaporation process in summer. No new public access would be available. No action would be conducted by the agencies, including levee maintenance, and some levees would likely fail during this period. Existing public access would be lost in areas of levee failure.

In Action Alternative 1 (Seasonal Pond Alternative), the pond waters/brines remaining in the ponds would be allowed to evaporate. The ponds would then fill seasonally with rainwater in winter and dry through the evaporation process in summer. No new public access would be available. The only action taken by the agencies would be to maintain the levees at their current standard of maintenance (i.e., salt pond maintenance, not for flood control).

Under the two action alternatives which include circulation of bay waters through the ponds, the pond levees would continue to be maintained at the current level and the ponds previously kept closed by Cargill would be open to some public access, including docent led tours and limited hunting activities. These two action alternatives differ in the timing of the initial release of the existing low to mid salinity brines in the ponds.

In Action Alternative 2 (Simultaneous March/April 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.

In Action Alternative 3 (Phased Initial Release), 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.

Table S-2. Comparison of Alternatives in Meeting Project Objectives

Project Objective	No Project/ No Action	Seasonal Ponds	Simultaneous Discharge	Phased Discharge
Cease Salt Making Process[1]	+	+	++	+++
Circulate Bay waters through ponds/ Introduce tidal waters to Island Ponds[1]	- - -	- - -	++	+++
Maintain existing open water and wetland habitat	- - -	- - -	+++	+++
Maintain ponds in restorable condition	-	+	+++	+++
Meet all regulatory requirements, including discharge[2]	-	+	+++	+++
Work within existing funding constraints	+++	+++	++	++
Maintain existing levels of flood control	- - -	+++	+++	+++

[1] Includes time required before salt-making ceases and circulation begins
[2] Includes compliance with regulatory policies and air quality requirements

Environmental Impacts and Mitigation Measures

The major environmental impacts of the project and alternatives are summarized on Table S-3 and are briefly described by topic below.

Hydrology
Implementation of Alternatives 2 and 3 could lead to increased tidal prism within the ponds and subsequent suspension and deposition of sediments in receiving waters. Additionally, breaching of the Island Ponds could potentially lead to erosion of mud flats and impacts to the Southern Pacific railroad bridge pier. These impacts are potentially significant but would be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS.

Water Quality
Under Alternative 1 (Seasonal Ponds), most of the existing open water habitats currently used by wildlife in the South Bay would be lost. This alternative minimizes all impacts from discharge of pond contents to sloughs, creeks and the bay.

In general, Alternatives 2 and 3 could have potentially significant and significant short-term (24 hours to 8 weeks) impacts from elevated salinity in discharges to several of the creeks and sloughs in the project area during the initial release period. These short term impacts would be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS. Long term impacts would be less than significant during continuous circulation period .

In some circumstances discharges under Alternatives 2 and 3 could lead to excursions from the Basin Plan Water Quality Objectives and have potentially significant impacts (total mercury, dissolved oxygen, turbidity, temperature, and pH) These excursions are dependent on a number of environmental factors (including temperature, rainfall, and water level in the ponds) and may occur both during initial release and continuous circulation. These impacts would be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS.

Sediments
Changes in pond management under all the alternatives could lead to increased mobility and bioavailability of inorganic contaminants and increased exposure of wildlife to contaminants. Implementation of Alternative 1 does not allow for water level management which would mitigate these impacts. Adaptive management strategies described under Alternatives 2 and 3 allow these impacts to be mitigated to less than significant.

Biological Resources
Benthic Organisms- Under Alternative 1, benthic invertebrates in the existing ponds would be impacted by seasonal water fluctuations. In general, Alternatives 2 and 3 could have potentially significant and significant short-term (24 hours to 8 weeks) impacts from elevated salinity in discharges to benthic organisms in several of the creeks and sloughs in the project area during the initial release period. These short term impacts would be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS. The long-term impacts would be less than significant during continuous circulation period.

Vegetation- Disturbance form construction of water control structures or creation of new suitable habitat under Alternatives 2 and 3 could lead to the spread of invasive cordgrass. These impacts could be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS. Under these alternatives, breaching of the Island Ponds would lead to the establishment of transitional salt marsh and brackish marsh habitat; this would be a beneficial impact.

Wildlife- Changes in pond management under all the alternatives would result in wildlife habitat changes with positive or negative impacts for some wildlife species. For example conversion of project area salt ponds to seasonal ponds would result in a substantial loss of open water foraging habitat for water birds. This conversion would be beneficial to snowy plovers. Reduction in medium and high salinity ponds will substantially reduce the available foraging habitat for waterbirds which favor this habitat. These impacts could be mitigated to potentially significant levels by implementation of mitigation measures identified in this EIR/EIS.

Fish- Alternative 1 would have impacts to fishing living in the existing salt ponds by seasonally drying their habitat. In general, Alternatives 2 and 3 could have potentially significant and significant short-term (24 hours to 8 weeks) impacts from elevated salinity in discharges to fish in several of the creeks and sloughs in the project area during the Initial Release Period. There is also a potential for impacts to juvenile fish by entrainment by the water control structures. These short-term impacts would be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS. Long-term impacts would be less than significant during the continuous circulation period.

Cultural Resources
Implementation of Alternatives 2 and 3 could result in potentially significant impacts to unmapped surface archeological sites. These impacts could be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS.

Recreation, Public Access, Visual Resources, and Public Health
Changes in pond management under all the alternatives could lead to increased mosquito production. Implementation of Alternative 1 does not allow for water level management which could mitigate these impacts. Under Alternatives 2 and 3, these impacts could be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS.

Air Quality
Changes in pond management under all the alternatives could expose the public to objectionable odors. Implementation of Alternative 1 does not allow for water level management which could mitigate these impacts. Under Alternatives 2 and 3, these impacts could be mitigated to less than significant levels by implementation of mitigation measures identified in this EIR/EIS.

Socio-Economic Resources
All impacts were considered to be less than significant.

Land Use Planning
Impacts to land use are possible due to potential changes in air quality; impacts and mitigation are the same.

Unavoidable Significant Impacts

The impact to waterbirds from the loss of medium- and high-salinity ponds under the project alternatives is a significant impact. Measures are proposed to mitigate this impact (see Section 6.3.3.2), but the impact remains potentially significant even with these measures. All other impacts identified in this EIR/EIS are expected to be less than significant with the implementation of proposed mitigation measures.

Comparison of the Alternatives

There is a strong contrast in the comparisons of the NO Project/No Action Alternative and Alternative 1 (Seasonal Ponds) and the Pond Management Alternatives (2 and 3) from the perspectives of long-term versus short-term environmental consequences. Normally, with private development or public works projects, the "no action" alternative is associated with more environmentally benign protection of existing natural resources. In this case, the existing natural resources will undergo long-term degradation because if salinity and water levels are not managed.

The contrast between Alternatives 2 and 3 is more subtle. Under Alternative 2, circulation of bay waters through the low salinity ponds would be delayed for another year. This could push back the project for the medium and high salinity ponds and delay the restoration of the Island ponds several more years depending on future weather conditions. During the initial release period, short-term impacts (24 hour to 8 weeks) to juvenile bay shrimp may be somewhat less under Alternative 2 and potential for bioaccumulation of mercury by early stage benthic organisms may be somewhat less under Alternative 3.

Environmentally Superior (CEQA) and Preferred (NEPA) Alternative

The No-Project No-Action Alternative is not considered the environmentally superior alternative because of the continued deterioration of the site and potential for long-term impacts to wildlife and the physical environment.

Because the project is, in effect, the first stage of the long-term environmental restoration project, its primary adverse impacts are short-term, during the initial release of the pond contents. As described above, Alternatives 2 and 3 are very similar in their environmental impacts. However, Alternative 3 offers the added protection that monitoring of the impacts of the first releases can provide data to adaptively manage subsequent releases and thus reduce overall impacts. In addition, Alternative 3 will allow circulation of bay waters to occur at an earlier time for a substantial number of ponds resulting in more rapid restoration of the ponds.

TABLE S-3. COMPARISON OF IMPACTS OF PROJECT ALTERNATIVES

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Hydrology				
H-1: Increased flooding of adjacent properties may result from erosion of salt pond levees that offer some flood control benefit.	PS	PS	LTS	LTS
Post Mitigation Significance	**PS**	**PS**	**NS**	**NS**
H-2: Increased tidal prism within the ponds would re-suspend sediments, resulting in deposition in receiving waters.	NS	PS	PS	PS
Post Mitigation Significance	**NS**	**PS**	**LTS**	**LTS**
H-3: Breaching of Island Ponds could result in erosion of mud flats and damage to the Southern Pacific railroad bridge piers.	NS	NS	PS	PS
Post Mitigation Significance	**NS**	**NS**	**LTS**	**LTS**
H-4: Flow into the ponds may result in excessive sediment deposition near inlet/outlet structures that could impact operation of water control structures.	NS	NS	NS/PS	NS/PS
Post Mitigation Significance	**NS**	**NS**	**LTS**	**LTS**
Water Quality				
WQ (S)-1 Salinity in ponds could be concentrated by evaporation. Unplanned breaches of ponds could result in increased salinity in receiving waters.	PS	NS	NS	NS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
WQ-(CONSTRUCTION) 2-: Impacts from contaminants and/or suspended sediments could result from the mobilization of construction equipment to repair breached levee sites or install water control structures.	NA	PS	LTS	LTS
Post Mitigation Significance	**NA**	**LTS**	**LTS**	**LTS**
WQ (S)-3: Discharges from ISP ponds could result in increased salinity inputs to the South Bay	NA	NA	IRP-LTS CCP-LTS	IRP-LTS CCP-LTS
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
WQ (S) -4: Discharges from ISP ponds could result in increased salinity inputs to Coyote Creek (Alviso Complex)	NA	NA	IRP-LTS CCP-LTS	IRP-LTS CCP-LTS
Post Mitigation Significance	**NA**	**NA**	**NA**	**LTS**
BENEFICIAL WQ (S) -1: Discharges from ISP ponds could result in beneficial water quality impacts from increased salinity inputs to Coyote Creek, mitigating releases of fresh water from the San Jose WTP	NA	NA	**B**	**B**
WQ (S) -5: Discharges from ISP ponds could result in increased salinity inputs to Alviso Slough (Alviso Complex)	NA	NA	IRP-PS CCP-LTS	IRP-PS CCP-LTS
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
WQ (S) -6: Discharges from ISP ponds could result in increased salinity inputs to Guadalupe Slough (Alviso Complex)	NA	NA	IRP-LTS CCP-LTS	IRP-LTS CCP-LTS
Post Mitigation Significance	**NA**	**NA**	**NA**	**LTS**
WQ (S) -7: Discharges from ISP ponds could result in increased salinity inputs to Alameda Flood Control Channel (AFCC) (Baumberg Complex)	NA	NA	IRP-S CCP-LTS	IRP-S CCP-LTS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Post Mitigation Significance	**NA**	**NA**	**LTS**	**NA**
WQ (S) -8: Discharges from ISP ponds could result in increased salinity inputs to Old Alameda Creek (Baumberg Complex)	NA	NA	IRP-S CCP-LTS	IRP-S CCP-LTS
Post-Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
WQ (M) -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.	PS	NS	NS	NS
WQ (M) -2: Exceedances of the nickel WQOs at the point of discharge may occur during the IRP only.	NA	NA	LTS	LTS
WQ (M) -3: Under some circumstances total mercury in discharged water and receiving water will exceed total mercury WQOs and may have short-term impacts on water quality.	NA	NA	PS	PS
Post Mitigation Significance	**PS**	**NS**	**LTS**	**LTS**
WQ (DO) 1- Increased algal activity in ponds leads to decreased dissolved oxygen in receiving waters. The potential for excursion from the basin plan standards are most likely to occur during the warmer summer and fall months, especially on windless days.	PS	NA	PS	PS
Post Mitigation Significance	**PS**	**NA**	**LTS**	**LTS**
WQ (TURBIDITY) 2 - Unplanned breaches of ponds could result in significant water quality and wildlife impacts from increased turbidity.	PS	NS	NS	NS
WQ (TURBIDITY) 1 - 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	NA	NA	PS	PS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Post Mitigation Significance	**PS**	**NS**	**LTS**	**LTS**
WQ (Tº) -1: Unplanned breaches of ponds could result in significant water quality and wildlife impacts from increased temperature	PS	NS	NS	NS
WQ (Tº) -2: 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.	NA	NA	PS	PS
Post Mitigation Significance	**PS**	**NA**	**LTS**	**LTS**
WQ (PH) -1: Unplanned breaches of ponds could result in significant water quality and wildlife impacts from pH changes in receiving waters.	PS	NS	NS	NS
WQ (pH) – 2: Discharge of pond water could lead to excursions from the Basin Plan Water Quality Objectives	NA	NA	PS	PS
Post Mitigation Significance	**PS**	**NS**	**LTS**	**LTS**
Sediments				
SED-1: The mobility and bioavailability of inorganic contaminants may increase within project ponds.	PS	PS	PS	PS
Post Mitigation Significance	**PS**	**PS**	**LTS**	**LTS**
SED-2: Long-term pond drying may result in the formation and exposure of gypsum/salt-affected soils, limiting future restoration options.	PS	PS	PS	PS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Post Mitigation Significance	**PS**	**PS**	**LTS**	**LTS**
SED-3: Changes in pond water levels may alter exposure of wildlife to contaminants in sediments.	PS	PS	PS	PS
Post Mitigation Significance	**PS**	**PS**	**LTS**	**LTS**
SED-4: Unplanned breaches of ponds could result in significant water quality and wildlife impacts from contaminants in sediments.	PS	NS	NS	NS
Post Mitigation Significance	**PS**	**NS**	**LTS**	**LTS**
BENEFICIAL SED-1: Higher average water levels in some ponds could decrease the mobility and bioavailability of contaminants and the potential for wildlife exposure to contaminants in those ponds.	NA	NA	**B**	**B**
BENEFICIAL SED-2: In the CCP, freshening of salt/gypsum affected sediments will produce sediment and water conditions that can promote habitats more endemic to the South Bay ecosystem.	NA	NA	**B**	**B**
Biological Resources				
BENTHIC-1 If levee failure occurs, existing benthic communities located near the breach will be impacted.	PS	LTS	LTS	LTS
BENTHIC-2: The project would cause a reduction in aquatic habitat suitability because of deterioration of water quality	PS	NS	IRP-S CCP-LTS	IRP-S CCP-LTS
Post Mitigation Significance	**PS**	**LTS**	**LTS**	**LTS**
VEG-1**:** If levee failure occurs, existing vegetation, possibly including rare plant species, would be impacted.	PS	LTS	LTS	LTS
VEG-2: Disturbance of existing vegetation could promote the spread of invasive cordgrasses.	PS	LTS	PS	PS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Post Mitigation Significance	**PS**	**LTS**	**LTS**	**LTS**
BENEFICIAL VEG -1: Breaching of the Island Ponds would allow the establishment of transitional salt marsh and brackish marsh communities.	NA	NA	**B**	**B**
VEG-3: Installation or replacement of water control structures would remove or disturb existing areas of vegetation	NA	NA	LTS	LTS
VEG-4: Installation or replacement of water control structures would cause changes in pond parameters, which would have permanent indirect impacts on vegetation in the project area.	NA	NA	LTS	LTS
VEG-6: Seasonal wetting and drying cycles in ponds will create saline soil conditions that will inhibit vegetation growth within the ponds and at the pond margins.	LTS	LTS	LTS	LTS
VEG-7: Increase in pond water salinity in high salinity batch ponds will result in loss of vegetation along the shoreline.	NA	NA	LTS	LTS
VEG-8: Differences in seasonal management of ponds would cause a decrease in average pond depth and decreased fluctuations in salinity in some of the ponds, which could result in indirect impacts to vegetation, including elevation and type shifts of plant communities.	NA	NA	LTS/B	LTS/B
VEG-9: Muted tidal influence in the summertime in Baumberg Ponds 8A and 8X would create conditions favorable to invasive cordgrass.	NA	NA	PS	PS
Post Mitigation Significance	**LTS**	**LTS**	**LTS**	**LTS**
BENEFICIAL WL -1: An increase in the area of seasonal ponds would benefit western snowy plovers.	**B**	**B**	**B**	**B**

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
WL-1: Changes in pond hydrology would result in wildlife habitat changes with positive or negative impacts for some wildlife species.	S	S	S	S
WL-1A: Conversion of project area ponds to seasonal ponds would result in a substantial loss of open water foraging habitat for water birds including special status birds.	S	S	PS	PS
Post Mitigation Significance	**S**	**S**	**PS**	**PS**
WL-2: Changes in water levels in some ponds would result in impacts to nesting bird colonies from increased predator access and/or flooding, thereby substantially reducing the breeding habitat for certain waterbird species.	S	S	PS	PS
WL-2A: Drying of project area ponds would result in "land-bridging" of existing nesting colonies on islands and isolated interior levees, exposing special status species and other birds to increased predation.	S	S	PS	PS
WL-2C: Collapse of pond levees would result in the loss of nesting habitat on levees for special status species and other bird species.	S	LTS	LTS	LTS
Post Mitigation Significance	**S**	**S**	**LTS**	**LTS**
WL-3: Lower average water levels in project ponds could increase the exposure of some foraging water birds to contaminated sediments on the bottoms of ponds, potentially resulting in a reduction in foraging habitat for some species.	S	S	S	S
WL-3A: Drying of project ponds would increase the exposure of western snowy plover as well as other foraging birds to contaminated sediments on pond bottoms.	S	S	S	S

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Post Mitigation Significance	**S**	**S**	**LTS**	**LTS**
WL-4: The overall reduction in pond salinities and water depths may create conditions suitable for avian botulism, and could substantially reduce the populations of special status bird species and other waterbird species.	NA	NA	PS	PS
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
WL-5: Construction could impact existing tidal salt marsh habitat for the California clapper rail.	NA	NA	PS	PS
Post Mitigation Significance	NA	NA	**LTS**	**LTS**
WL-6: Construction could impact existing tidal or non-tidal salt marsh habitat for the salt marsh harvest mouse and salt marsh wandering shrew.	NA	NA	PS	PS
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
WL-7: Construction could impact burrowing owls and/or nesting northern harriers on the levees within the project area.	NA	NA	PS	PS
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
WL-8: Construction could result in disturbance to breeding activity of salt marsh common yellowthroat, Alameda song sparrow, and/or several nesting waterbird species.	NA	NA	PS	PS
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
WL-9: Construction for implementation of the ISP, and various maintenance operations, may impact harbor seals in the area.	NA	NA	PS	PS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
F-1: Discharge of pond contents would increase salinity levels in the receiving waters in the immediate vicinity of discharges beyond normal tolerance ranges for fish and macroinvertebrates, resulting in direct impacts to these aquatic organisms and indirect impacts to fish impacts to their food source (macroinvertebrates).	PS	NA	IRP - S CCP - LTS	IRP - S CCP - LTS
Post Mitigation Significance	**PS**	**NA**	**LTS**	**LTS**
F-2: Discharge of pond contents may impact other water quality variables (i.e., it may raise temperatures, decrease DO, and increase BOD) in the receiving waters in the immediate vicinity of discharges beyond normal tolerance ranges for fish.	PS	NA	LTS	LTS
F-3: Impacts from contaminants and/or suspended sediments could result from the mobilization of construction equipment to repair breached levee sites.	NA	LTS	LTS	LTS
BENEFICIAL F–1: Breach Island ponds resulting in tidal exchange and access for fish and macroinvertebrates to suitable habitat.	NA	NA	**B**	**B**
F-4: Changes in water quality during the Continuous Circulation Phase of the ISP could disrupt adult salmonid migration though dilution of "natal stream" signal and/or imprinting by juvenile salmonids.	NA	NA	CCP-LTS	CCP-LTS
F-5: Changes in water quality could disrupt fish migration though creation of salinity gradient reversals.	NA	NA	IRP - LTS CCP - LTS	IRP - LTS CCP - LTS
F-6: Installation of water control structures could lead to juvenile fish entrainment.	NA	NA	PS	PS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Post Mitigation Significance	**PS**	**LTS**	**LTS**	**LTS**
Cultural Resources				
C-1. Potentially significant archeological sites or human remains could be exposed through erosion and evaporation	PS	LTS	NA	NA
C-2. Accidental breaches of levees could result in impacts to surface archeological sites and features of the built environment.	PS	LTS	LTS	LTS
C-3. Ground-disturbing activities and use of heavy vehicles and machinery could damage known and unknown archaeological sites that meet the criteria for listing on the NRHP or CRHR.	NA	NS	PS	PS
Post Mitigation Significance	**PS**	**LTS**	**LTS**	**LTS**
C-4. Ground-disturbing activities and use of heavy vehicles and machinery could disturb or damage buried human remains not identified during field surveys.	NA	NS	PS	PS
Post Mitigation Significance	**NA**	**NS**	**LTS**	**LTS**
C–5. Project construction and elevated water levels resulting from implementing the ISP could affect potentially significant features of the built environment	NS	NS	PS	PS
C–6. Planned breaches of the Island Ponds could result in impacts to surface archeological sites and features of the built environment	NS	NS	PS	PS
Post Mitigation Significance	**NS**	**NS**	**PS**	**PS**
Recreation, Public Access, Visual Resources, and Public Health				
R-1. Recreational use and views of the project areas may be impacted by the loss of levee trail access.	PS	LTS	LTS	LTS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
R-2. Recreational use and views of the project areas may be impacted a consequence of changes in wildlife populations.	LTS	LTS	LTS	LTS
R-3. Construction of proposed water control structures would have temporary effects on public access to and recreational use of the project areas.	LTS	LTS	LTS	LTS
Post Mitigation Significance	**PS**	**LTS**	**LTS**	**LTS**
BENEFICIAL R -1. Additional public access will be available on previously closed private lands.	NA	**NA**	**B**	**B**
VIS-1. The quality of views of the project areas may be impacted as a consequence of changes in wildlife populations.	LTS	LTS	LTS	LTS
Post Mitigation Significance	**LTS**	**LTS**	**LTS/B**	**LTS/B**
VIS-2. Construction of proposed water control structures would have temporary effects on the quality of views of the project areas.	NA	NA	LTS	LTS
PH-1. As seasonal ponds dry down increased mosquito production may result from deterioration of pond water quality, requiring the MADs to undertake additional mosquito control and abatement.	S	S	PS	PS
Post Mitigation Significance	**S**	**PS**	**LTS**	**LTS**
Air Quality				
AQ-1. Increased dust generation due to exposed dry pond bottoms in seasonal ponds	PS	PS	LTS	LTS
AQ-2. Eutrophication of salt ponds has the potential to expose the public to objectionable odors.	PS	PS	PS	PS

Impacts	No Project/No Action	Alternative 1 Seasonal Ponds	Alternative 2 (Simultaneous March/April Initial Discharge)	Alternative 3 (Phased Initial Discharge)
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
AQ-3. Increased combustion emissions. The construction of structures required by Alternative 2 and 3, may result in a temporary increase in combustion emissions from construction equipment.			LTS	LTS
Post Mitigation Significance	**NA**	**NA**	**LTS**	**LTS**
Socio-Economic Resources				
All impacts considered less than significant				
Land Use Planning				
LU -1. Lack of management of the ponds has the potential to produce objectionable odors. These odors would be incompatible with nearby residential and commercial land uses.	PS	PS	NA	NA
LU -2 .The managed wetting and drying in the seasonal ponds have the potential to produce objectionable odors. These odors would be incompatible with nearby residential and commercial land uses.	NA	NA	PS	PS
Post Mitigation Significance	**S**	**S**	**LTS**	**LTS**

B = Benefical PS= Potentially Significant
NS = Non Signficant
LTS = Less than Significant
NA = Not Applicable
S = Significant

1.0 INTRODUCTION

The U.S. Fish and Wildlife Service (USFWS) and the California Department of Fish and Game (CDFG) have prepared this joint Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) to address the potential impacts of the Initial Stewardship Project (ISP) for the South Bay Salt Ponds in South San Francisco Bay, California. The ISP may be found in Appendix A.

The ISP identifies how the approximately 15,100 acres of South Bay salt production ponds acquired by the USFWS and CDFG from Cargill Corporation will be managed over an interim period while a long-term plan is developed for restoration of the project ponds. Prior to agency management, Cargill will phase out operation of the ponds for salt production and move much of the remaining salts in the ponds back to its salt production plant sites. The project proposes to use existing and new water control structures to release any remaining saline pond waters to the Bay, and to prevent further salt concentration by circulating Bay waters through the ponds. During the interim period, salinity and water levels will be managed to maintain existing high quality open water and wetland wildlife habitat.

The joint EIS/EIR addresses the design, implementation, and maintenance of the proposed ISP to comply with the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), and all necessary permits and approvals from other local, state, and federal agencies.

1.1 Project Location

In March 2003, the USFWS and CDFG acquired 16,500 acres of industrial salt ponds and/or associated salt-making rights from Cargill Salt. Of these, 15,100 acres are located in south San Francisco Bay, California. Under terms of the acquisition, the USFWS owns and will manage 8,000 acres of "Alviso Ponds" and 1,600 acres of "West Bay Ponds." The CDFG owns and will manage 5,500 acres of "Baumberg Ponds" (see Figures 1-1, 1-2, 1-3, and 1-4).

1.1.1 Alviso Pond Complex

The Alviso Ponds (Figure 1-2) consist of an 8,000-acre complex of 25 ponds on the shores of the South Bay in Fremont, San Jose, Sunnyvale and Mountain View, in Santa Clara and Alameda Counties. Palo Alto Baylands Nature Preserve and Charleston Slough border the acquisition area on the west, Moffet Naval Air Station and Sunnyvale Baylands Park border the area on the south, and Coyote Creek and Cushing Parkway in Fremont border the east side of the area. Major drainages which discharge into San Francisco Bay within the complex area include Charleston Slough, Mountain View Slough, Stevens Creek, Guadalupe Slough, Alviso Slough (Guadalupe River), Artesian Slough, Mud Slough, and Coyote Creek.

The Project does not include Ponds A18 and A4. Pond A4 will be used by Santa Clara Valley Water District to restore wetland and riparian habitats to mitigate for losses resulting from construction of the Lower Guadalupe River Flood Protection Project. The City of San Jose recently purchased Pond A18 from Cargill. The USFWS acquired fee title to Ponds A1 to A8 (with the exception of Pond A4) and portions of A22 and A23. Cargill Salt gave up its reserved salt-making rights on Ponds A9 to A17, Ponds A19 to

A21 and portions of Ponds A22 and A23. The FWS previously held fee title to these ponds.

The historic and abandoned town of Drawbridge, which still has standing hunting cabins and an active Union Pacific Railroad line (UPRR), is located between ponds A20 and A21. Ponds A19, A20 and A21 are surrounded by Mud Slough to the east and Coyote Creek to the west and are collectively known as the "Island Ponds."

The bottom elevations of the Alviso ponds are generally lower than other complexes due to subsidence from historic groundwater withdrawals. Broad expanses of mudflats exposed at low tide are found at the confluence of Coyote and Alviso creeks, outboard of pond levees.

1.1.2 West Bay Pond Complex

The West Bay Ponds (Figure 1-3) consist of a 1,600-acre complex of 7 ponds on both sides of Highway 84, west of the Dumbarton Bridge, and bayward of the developed areas of the City of Menlo Park in San Mateo County. Bayfront Park is located to the west, and the Dumbarton Bridge approach and the UPRR are located at its southern border. Ravenswood Slough discharges to the Bay through the complex.

1.1.3 Baumberg Pond Complex

The Baumberg Ponds (Figure 1-4) consist of a 5,500-acre complex of 23 ponds on the shores of the East Bay, west of Hayward and Union City in Alameda County. The approach to the San Mateo Bridge and the CDFG Eden Landing Ecological Reserve, form the northern boundary of the acquisition area. Alameda Creek Flood Control Channel and the Coyote Hills form the southern boundary. Major drainages that discharge into the San Francisco Bay within the complex include Old Alameda Creek and Alameda Creek Flood Control Channel.

1.2 Project Purpose and Need

The purpose of the project is to maintain and enhance, to the extent possible, the biological and physical conditions within the south bay salt ponds in the interim period between the cessation of salt-making activities and the implementation of a long term restoration plan. The ponds currently support populations of fish and wildlife, including endangered species, migratory waterfowl, shorebirds, other water associated birds, resident fish and invertebrates.

The project is needed because:

- The ponds will be disconnected from ongoing salt making operations.
- Without initial stewardship the ponds will be subject to increasing salinity and declining ecological value.
- Deterioration of levees could lead to levee breaches and uncontrolled high-salinity discharges, resulting in potential adverse effects on aquatic populations in the adjacent open bay.
- Restoration costs would be increased with site deterioration.
- Water levels would become unmanageable and, especially during the summer months, would result in increased salinity, acidic conditions, and drying of most of the ponds.

Implementing the project will benefit the environment by

- Maintaining and enhancing to the maximum extent possible the ecological and physical health of the salt ponds until a long term restoration plan is completed and implemented
- Improving water circulation within the ponds to maintain and enhance existing fish and wildlife populations.

As part of normal salt making operations bay water is brought in to the pond systems at several locations around the bay. After entering the system, it is moved through the concentrator ponds over five years until the salinities are ready for the precipitation of salt for harvest at the Newark Plant site. The salt making process is a closed system with water being taken with no discharge to the bay. End products of the process are (1) salt, which is harvested as a crop and (2) bittern, a byproduct which cannot be discharged back to the bay and is stored and used for commercial applications.

The salt making system included an array of ponds of varying salinities (low to high) and water levels (shallow to deep). Pond salinities and depths varied during the seasons depending on water movements within the system to optimize the salt concentration process. The ponds incidentally provided habitat for many species of fish and wildlife. Fish and wildlife values were not a management objective in the salt making process.

With acquisition of the South Bay Salt Ponds by the Department of Fish and Game and the U. S. Fish and Wildlife Service, the ponds will no longer be part of the salt making process. Consequently they must be managed as separate systems to assure that they provide fish and wildlife habitat value while minimizing future restoration costs. This management must continue through the planning and implementation of the long-term restoration plan. Implementation of the long-term restoration plan is expected to be conducted in phases beginning in about 5 years, but with subsequent phases extending to 20+ years. Therefore, some ponds may be managed under an initial stewardship plan for as little as 5 years, while others may require such management for 20+ years.

To achieve the purpose of the project, the two agencies must have the ability to manage a water circulation system that allows the bay water to discharge back into San Francisco Bay. Without the ability to discharge, bay water brought into the pond system will evaporate resulting in elevated salinities which will ultimately reduce fish and wildlife values as seen in the North Bay salt ponds. If the agencies are not able to circulate water through the system, they will not be able to bring bay water into the system due to the potential for increasing pond salinities to unmanageable levels. This will change the character of the pond system from what is currently shallow open water pond habitat of varying salinities, to seasonal pond habitat filled primarily by rain water during the winter and dry the remainder of the year. This change may significantly reduce the value of the ponds to fish and wildlife.

1.3 Project Background

1.3.1 Salt Production in the South San Francisco Bay

Solar evaporation is the simplest and perhaps most ancient method of producing salt. The Ohlone tribe—indigenous inhabitants of the San Francisco Bay area—are believed to have gathered salt deposited naturally through evaporation along the shallow edges of the bay, and commercial production using essentially the same process as that employed today began in 1854.

The commercial solar salt industry in San Francisco Bay began in the mid 1850s. Cargill has been the sole solar salt producer in San Francisco Bay since the late 1970s. Salt production involves a sequence of ponds through which seawater is progressively cycled to concentrate and ultimately precipitate salt. Salt production takes approximately five years from the time that the water enters the system from San Francisco Bay until the salt is harvested.

The salt production process begins as high tide brings bay water into an intake pond, the first in a series of ponds called evaporator or concentrator ponds. Evaporator ponds range in size from less than 100 acres to more than 850 acres. The ponds are separated by earthen levees and are interconnected with siphons and gates.

The increasingly saline brine is pumped or allowed to flow by gravity from one pond to the next around the southern edge of the bay. When siphons or gates are open, differences of less than a few inches in surface elevation or "hydraulic head" between two ponds will result in a net flow of brine from one pond to the next until the water surfaces are equal in elevation. At each step, more of the water evaporates under the influence of summer sunshine and steady coastal wind and as the brine flows from one evaporator pond to the next, it becomes increasingly concentrated with salt.

When fully saturated with salt, the brine is pumped into the "pickle ponds" for storage before it is crystallized and harvested. For final evaporation, the pickle pond solution is pumped into crystallizer beds at Cargill's salt production plants. The beds are shallow ponds with clay bottoms that have been carefully compacted and leveled. In the crystallizer beds, evaporation continues, and a layer of salt approximately 5 to 8 inches thick eventually accumulates on the bottom of the crystallizer bed. The remaining solution, called bittern is pumped into the desalting pond where additional sodium chloride is removed and then to the bittern pond for storage. Bittern contains highly concentrated magnesium, potassium, bromine and sulfate. It is toxic to marine life and cannot be discharged to the Bay. Before winter rains set in, salts are mechanically harvested from the crystallizer beds and transported to the wash house by truck and then by conveyer to the salt stack.

In the final stage of production, the raw salt is sent to the refinery at Newark for further processing, packaging and shipping to customers. The Newark plant produces about 650,000 tons of salt per year. Cargill will maintain production of 600,000 tons of salt a year and will continue to employ approximately 200 workers on 11,000 acres it has retained, including its plants in Newark and Redwood City.

About 200 miles of pond levees isolate salt production facilities from the Bay. In addition to the pond levees, on the Bay side of some of the salt ponds are salt pond dredge locks. Dredge locks are donut-shaped levees that intersect the salt pond levees and allow dredging equipment and other large equipment to enter the salt ponds without releasing higher saline pond water to the Bay. A dredger, for example, can enter one of these locks by removing a section of the lock levee, creating a "door" on the Bay side. Once inside the lock, the Bay side door is closed (the dredger "locks in") and a section of the salt pond levee is removed, creating a "door" into the pond. The existing salt ponds were created by constructing levees out of bay mud. Bay mud was also used to construct the dredge locks.

Levees and other water control structures require periodic maintenance. Currently, maintenance work is performed on approximately 10 miles of levees each year. Levee maintenance consists of excavating mud from salt pond borrow ditches and placing it on levees using a floating dredge. Operation and maintenance of existing levees, salt pond dredge locks, and water control structures is covered under Cargill's existing Operations and Maintenance Permit.

1.3.2 History of the Project

Restoration has long been a vision for local resource agencies, conservationists, and planners. The Cargill salt ponds restoration project will be one of the largest tidal restoration projects on the west coast of the United States and the largest of several similar projects that are being undertaken throughout the San Francisco Bay area. Similar projects in the Bay Area include the Napa River Salt Marsh Restoration Project and Bair Island Restoration Project.

Bay-wide restoration planning was conducted as part of the Baylands Ecosystem Habitat Goals Project (Goals Project), which provides a regional framework for this project. The Goals Project began in 1995 and involved more than 100 participants representing local, state, and federal agencies, academia, and the private sector. The process for developing the goals involved the selection of key species and key habitats, assembling and evaluating information, preparing recommendations, and integrating recommendations into the goals.

In March 2003, a consortium of state and federal agencies, along with private foundations, bought 16,500 acres of salt ponds from Cargill Salt, including 15,100 acres in the South Bay. The long-term planning process for the Cargill acquisition lands in the South Bay is expected to take at least five years and will include setting restoration priorities, determining how to best accomplish the restoration goals, and drafting an EIR/EIS for long-term habitat restoration. This process involves representatives of USFWS, CDFG, technical advisors from around the country, and public participants; coordinated by the California State Coastal Conservancy, a state agency based in Oakland.

In the interim period, Cargill, USFWS, and CDFG are working together with the San Francisco Bay Regional Water Quality Control Board (RWQCB), the U.S. Army Corps of Engineers (Corps), and Bay Conservation and Development Commission (BCDC) to secure permits that would allow the ponds to be reopened to the Bay. As noted above, Cargill will manage the ponds and reduce their salinity until they reach a level set by the RWQCB; at which point, Cargill will transfer management of the ponds to USFWS and CDFG. The ISP for the South Bay Salt Ponds addresses how this will be accomplished.

1.4 Project Description

The ISP proposes the following changes to existing operations:

1. Circulate bay waters through reconfigured pond systems and release pond contents into the Bay. The plan will require installing new water control features, consisting of intake structures, outlet structures and additional pumps to maintain existing shallow open water habitat. In addition, existing levees, dredge locks, and water control structures will be maintained and modified, as needed. The three complexes (Alviso, Baumberg, and West Bay) that are currently managed as one system will each be subdivided into several systems within which water will circulate. Some of the systems will be further divided into two or more

subsystems. Smaller systems allow circulating water to have a shorter residence time, with less time for evaporation and salt concentration.

2. Manage a limited number of ponds as seasonal ponds (ponds allowed to fill with rainwater in the winter and to dry down in the summer), to reduce management costs and optimize habitat for migratory shorebirds, including the threatened western snowy plover.
3. Manage different summer and winter water levels in a limited number of ponds to reduce management costs and optimize habitat for migratory shorebirds and waterfowl.
4. Restore a limited number of ponds to muted tidal or full tidal influence.
5. Manage several ponds in the Alviso system as higher salinity batch ponds, where salinity levels would be allowed to rise in order to support specific wildlife populations.

Installation of all proposed water control structures is anticipated to require several years to complete. Intake of Bay water into ponds and initial release of pond contents into the Bay will begin after water control structures are installed for individual pond systems. During the initial release period, the discharge salinity from the pond system may be significantly higher than normal Bay salinity.

For Alviso systems, expected water depths in most of the ponds will be 1 to 2 feet on average, similar to their existing condition. Average water depths in the Baumberg systems will range from zero (exposed muds) to about 2.5 feet in summer, and about 1 to 2.5 feet in winter. To save on pumping costs, water surface levels in the Baumberg systems will be operated at levels lower than existing conditions. Eliminating pumping in winter will result in different operating water levels between summer and winter. The West Bay Ponds will be managed in a similar manner to current salt making operations for at least five years. During this period, high salinity brines will be moved to the Cargill Newark Plant Site.

1.5 Overview of CEQA and NEPA Compliance

The California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.) and the National Environmental Policy Act (NEPA) (42 United States Code [USC] 4321; 40 code of Federal Regulations [CFR] 1500.1) are the state and federal laws that govern the disclosure and analysis of the environmental effects of agency actions. These regulations are described briefly below.

1.5.1 CEQA Compliance

CEQA is regarded as the foundation of environmental law and policy in California. CEQA's primary objectives are to:

- Disclose to decision makers and the public the significant environmental effects of proposed activities
- Identify ways to avoid or reduce environmental damage

- Prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures
- Disclose the public reasons for agency approval of projects with significant environmental effects
- Foster interagency coordination in the review of projects and
- Enhance public participation in the planning process

CEQA applies to all discretionary activities proposed to be carried out or approved by California public agencies, including state, regional, county, and local agencies, unless an exemption applies. It requires that public agencies comply with both procedural and substantive requirements. Procedural requirements include the preparation of the appropriate public notices (including notices of preparation), scoping documents, alternatives, environmental documents (including mitigation measures, mitigation monitoring plans, responses to comments, findings, and statements of overriding considerations); completion of agency consultation and State Clearinghouse review; and provisions for legal enforcement and citizen access to the courts.

CEQA's substantive provisions require agencies to address environmental impacts disclosed in an appropriate document. CEQA requires agencies to prepare a written statement of overriding considerations when they decide to approve a project that will cause one or more significant effects on the environment that can not be mitigated. CEQA establishes a series of action-forcing procedures to ensure that agencies accomplish the purposes of the law. In addition, under the direction of CEQA, the California Resources Agency has adopted regulations, known as the State CEQA Guidelines, which provide detailed procedures that agencies must follow to implement the law.

CDFG is the state lead agency for the ISP and would use the environmental impact report/ environmental impact statement (EIR/EIS) to comply with the State CEQA Guidelines and to document CEQA compliance.

1.5.2 NEPA Compliance

NEPA is the nation's broadest environmental law, applying to all federal agencies and most of the activities they manage, regulate, or fund that affect the environment. It requires federal agencies to disclose and consider the environmental implications of their proposed actions. NEPA establishes environmental policies for the nation, provides an interdisciplinary framework for federal agencies to prevent environmental damage, and contains action-forcing procedures to ensure that federal agency decision-makers take environmental factors into account.

NEPA requires the preparation of an appropriate document to ensure that federal agencies accomplish the law's purposes. The President's Council on Environmental Quality (CEQ) has adopted regulations and other guidance that provide detailed procedures that federal agencies must follow to implement NEPA.

USFWS is the federal lead agency for the ISP and would use this EIR/EIS to comply with CEQ's regulations and document NEPA compliance.

1.6 Scope and Intent of the EIR/EIS

CDFG and USFWS, as the lead agencies for compliance with CEQA and NEPA, respectively, have determined that the ISP may have significant environmental impacts.

CEQA and NEPA encourage the preparation of combined planning documents. Preparation of a combined EIR/EIS is intended to reduce the amount of paperwork produced and to facilitate the review and comment process for participating agencies and the public. Therefore, the agencies have opted to pursue a combined CEQA/NEPA review process to fulfill the statutory obligations of both CEQA and NEPA and to provide opportunity for public disclosure and participation in the planning and decision making process. Because the requirements for CEQA and NEPA are somewhat different, the EIR/EIS must be prepared to comply with whichever requirements are more stringent. The lead agencies have responsibility for the scope, content and legal adequacy of the EIR/EIS. All aspects of the EIR/EIS scope and process will be fully coordinated between these two agencies.

This joint EIR/EIS addresses the design, implementation, and maintenance of the proposed ISP to comply with CEQA and NEPA, and all necessary permits and approvals from the lead agencies, as well as other local, state, and federal agencies. As noted above, long-term management planning for the Cargill South Bay salt ponds is expected to take place during the next five years. The scope of this EIR/EIS is limited to the interim period during which USFWS and CDFG, in consultation with other agencies, technical advisors, and the public, will develop and implement a long-term management plan for the Cargill South Bay salt pond acquisition. This EIR/EIS does not address the environmental impacts of long-term habitat restoration; although, in some cases, impacts of habitat restoration may be considered indirect impacts of implementing the ISP (i.e., if such impacts would not occur but for implementation of the ISP). A separate CEQA/NEPA process will be undertaken for long-term restoration of these lands.

1.6.1 Resources Evaluated and Eliminated from Further Consideration

This EIR/EIS focuses on key issues that were identified through the scoping and public involvement process (see Sections 1.7 and 1.8, below). Early in the CEQA/NEPA process, CDFG and USFWS identified a number of areas of interest that are not relevant to the project and that were therefore eliminated from the scope of the EIR/EIS and from further CEQA/NEPA consideration. The following resources were evaluated and eliminated from further consideration because the project will not impact these resources:

Agriculture	The project sites are not suitable for agricultural use and are more beneficial to nearby agricultural resources by providing habitat for bird species that control agricultural pests.
Indian Trust Assets	There are no tribal assets proximal to the project sites nor are there nearby tribal holdings that are used for economic development.
Navigation and Navigation Safety	The project sites are predominantly between mud flats and dry land. As a consequence, the project sites do not have navigable waterways. In some creek areas, the levee structures provide the essential limits to navigable water and protect these waterways from the project sites. Current US Coast Guard marking buoys and channel markers are all at least 0.25-mile distant from the project sites. The closest navigation markers is the Marker 6 at Ravenswood Point, 0.3 miles distant from the project. The

	waterways between the pond system levees and the navigable waterways of the South San Francisco Bay typically have depths of less than one meter (NOAA, 2003).
Noise	Project activities involve equipment that produces noise at no more than 85 dBA (A-weighted decibels) at a 50-foot distance (trucks, cranes, small and medium-sized bulldozers long-reach excavators). Thus, project noise will be similar to or below the levels allowed under Cargill Salt's existing Operation and Maintenance permit. Only two proposed culvert sites are within 0.5 mile of human habitation. All other activity sites are either a mile or more from human habitation or are within the range of an existing noise source (airport) that already exists and produces noise levels above that of the project activities.
Population and Housing	The project sites are not populated and are not considered viable resources for housing development. Nor are the project sites included in the housing elements of any county General Plan.
Soils, Geology, and Geologic Hazards	Project activities do not involve any modification of the geology of the area and there are no geologic hazards that would be increased by project activities. If unplanned breaching of pond levees occurred (e.g., during an earthquake), flooding impacts could result, but the proposed project neither increases nor decreases the likelihood of such an occurrence. Impacts to pond sediments are addressed in the EIR/EIS.
Transportation, Traffic and Roadway Safety	Existing transportation, traffic, and roadway systems will remain unaltered by this project. A very small amount of traffic will result from moving project equipment into and out of the project area and culvert material into the project site. However, this will be similar to traffic under existing Cargill operations and will not result in new project impacts.

1.7 Key Issues Addressed in the EIR/EIS

Key issues addressed in the EIR/EIS include: hydrologic and hydraulic conditions, water quality, contaminated sediments, biological resources (including benthic aquatic organisms, vegetation and wetlands, wildlife, fish, and special status species), cultural resources, recreation and public access, air quality, utilities (including railroads), public services (including mosquito abatement services), socio-economic resources, and land use planning.

1.8 Public Involvement and Scoping

1.8.1 Scoping

The public involvement process was initiated when CDFG issued a Notice of Preparation (NOP) for the project on March 13, 2003 and the USFWS issued a Notice of Intent (NOI) for the project on March 13,2003. Scoping is the first step in the CEQA/NEPA process, after filing an NOP/NOI. Scoping is the process of identifying the issues to be addressed in the analysis and documentation. Often, the public and federal, state, and local agency personnel have considerable information about a project's potential impacts at the beginning of the CEQA/NEPA analysis. For this reason, public and agency participation are solicited as early as possible to identify key issues.

A public scoping meeting to solicit comment on the environmental effects of the ISP and the scope and significant issues to be analyzed in the EIS/EIR was held on March 27, 2003 from 7:00 pm to 9:00 pm at the Visitor Center, Don Edwards San Francisco Bay NWR, #1 Marshlands Road, Fremont, California.

The public was asked to address comments and questions regarding the NEPA process to:

Margaret Kolar
Refuge Manager
U.S. Fish and Wildlife Service
San Francisco Bay NWR Complex
P.O. Box 524
Newark, California 94560
FAX (510) 792-5828

The public was asked to address concerns regarding the CEQA process to:

Carl Wilcox
Habitat Conservation Manager
California Department of Fish and Game
Region 3 Headquarters
P.O. Box 47
Yountville, CA 94599
FAX (707) 944-5563

The deadline for receipt of written comments to be considered in the Draft EIR/EIS was April 20, 2003. All comments received, including names and addresses are part of the Administrative Record for the project and may be made available to the public.

The NEPA/CEQA process is outlined below. Additional opportunities for public involvement are identified at each step in the process.

1.8.2 Involvement with Draft EIR/EIS

This document constitutes the Draft EIR/EIS. It discusses the project purpose, need, and background; describes the project alternatives (including a No Project/No Action Alternative); and identifies the affected environment, project effects, and mitigation measures for significant adverse effects. A Notice of Availability (NOA) for the Draft EIR/EIS will be published in the *Federal Register* and in local newspapers. USFWS/CDFG will send notices to all who provided scoping comments or expressed interest in this project and will furnish a copy of the Draft EIR/EIS to all who request copies. USFWS/CDFG will also place copies of the Draft EIR/EIS in the Visitor Center, Don Edwards San Francisco Bay NWR, #1 Marshlands Road, Fremont, California.

The Draft EIR/EIS will be circulated for a 45-day public and agency review period, beginning with the publication of this document and ending 45 days after the date of publication and release to the public. Copies of the document have been made available to applicable local, state, and federal agencies and to interested organizations and individuals wishing to review and comment on the report. Written comments will be received by:

DFG at the following address:

Carl Wilcox
Habitat Conservation Manager
California Department of Fish and Game
Region 3 Headquarters
P.O. Box 47
Yountville, CA 94599
FAX (707) 944-5563

USFWS at the following address:

Margaret Kolar
Refuge Manager
U.S. Fish and Wildlife Service
San Francisco Bay NWR Complex
P.O. Box 524
Newark, California 94560
FAX (510) 792-5828

USFWS will consider all comments on the Draft EIR/EIS provided by the public and federal, state, and local agencies within the 45-day comment period starting upon publication in the Federal Register.

1.8.3 Final EIR/EIS

Written and oral comments received in response to the Draft EIR/EIS will be addressed in the Final EIR/EIS. The Final EIR/EIS will incorporate changes suggested by comments on the Draft EIR/EIS, as appropriate, and responses to all substantive comments received during the Draft EIR/EIS review period. The Final EIR/EIS shall (1) provide a full and fair discussion of the proposed action's significant environmental impacts, and (2) inform the decision-makers and the public of reasonable measures and alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. An NOA for the Final EIS will be published in the *Federal Register* and in local newspapers. USFWS/CDFG will provide notices of the Final EIR/EIS to all who commented on the Draft EIR/EIS and others, and will provide copies of the Final EIR/EIS to those who request copies. USFWS/CDFG will also place copies of the Final EIR/EIS in the local public information repositories identified above.

1.8.4 Thirty-Day Waiting Period/Public Comment Period

USFWS will accept and consider comments on the Final EIR/EIS received within 30 days of publication of the NOA and will not proceed with implementing the ISP during this time period.

1.8.5 Record of Decision (ROD)/EIR Certification

The final step in the NEPA process is the preparation of a Record of Decision (ROD), a concise summary of the decision(s) made by the USFWS. The ROD can be published immediately after the Final EIR/EIS comment period has ended. At the conclusion of the 30-day waiting period on the Final EIR/EIS, the USFWS will prepare and sign a ROD regarding the ISP. The ROD will summarize the proposed action and alternatives considered in the EIR/EIS; identify and discuss factors considered in the USFWS' decision; and state how these considerations entered into the final decision. The ROD will state how the ISP will be implemented should the project be approved and describe any associated mitigation measures.

The final step in the CEQA process is certification of the EIR, which includes preparation of a Mitigation Monitoring and Reporting Plan and adoption of its findings, should the project be approved. A certified EIR indicates the following: (1) The document complies with CEQA; (2) the decision-making body of the lead agency reviewed and considered the Final EIR prior to approving the project; and (3) the Final EIR reflects the lead agency's independent judgment and analysis.

1.8.6 Mitigation Monitoring and Reporting Program (CEQA)

CEQA Section 21081.6(a) requires lead agencies to "adopt a reporting and mitigation monitoring program for the changes to the project which it has adopted or made a conditions of project approval in order to mitigate or avoid significant effects on the environment." The Mitigation Monitoring and Reporting Program (MMRP) required by CEQA need not be included in an EIR. However, throughout this EIR/EIS, measures have been clearly identified in order to facilitate establishment of an MMRP. Any mitigation measures adopted as a condition of approval of the project will be included in CDFG's project MMRP to verify compliance.

1.9 Issues and Concerns

The public and resource agencies are largely supportive of the project; however, several areas of known controversy exist, particularly related to water quality and ecosystem effects. Most of the controversy concerning the project relates to long-term management decisions. Water quality concerns relate to environmental effects on aquatic resources, including those effects resulting from the potential project discharges. Some water quality impacts are anticipated in the short-term during the ISP phase; additional impacts are anticipated in the long term. The ecosystem concerns relate to the short-term impacts and the long-term evolution and use of the site by various fish and wildlife species (i.e., controversy over whether endangered species habitat [marsh] should take priority over migratory waterfowl habitat [ponds]). Two other potential areas of controversy, which are particularly relevant to long-term management impacts, relate to how quickly the levees are likely to deteriorate, thereby necessitating quick salinity reduction, and the potential interim loss of accreted marsh habitat.

An ISP Technical Team meeting was held April 17, 2003 to identify major issues of concern regarding implementation of the ISP to be considered in the ISP EIR/EIS. Based on discussions at this meeting, public scoping input from the March 27, 2003 public scoping meeting, and additional consultation with government agencies and Cargill Corporation, several key issues were identified. These issues, discussed below, were used to assist in the development of alternatives, to focus the effects analysis, and to develop mitigation measures.

1.9.1 Issue 1: Hydrologic and Hydraulic Resources, including Flood Protection

There is concern regarding effects of the project on levees that provide an incidental flood protection benefit and concern regarding changes in the risk of flooding in neighboring developments caused by changes in water circulation, particularly at the Alviso ponds. There is concern that delta formation resulting from ISP implementation may interfere with water control structures. There is concern regarding the scouring effect of increased water flows, in particular the effect of breaching the Island Ponds on Coyote Creek, including potential impacts to levee stability, the railroad bridge, and mudflat and marsh habitat at this location.

The EIR/EIS evaluates project-induced changes in erosion and deposition that would significantly affect channel stability and estuarine habitat. It evaluates potential scouring effects, including impacts to a South Pacific Railroad bridge and mudflats in the vicinity of several ponds that may be breached under the proposed project (the three "Island Ponds"). The EIR/EIS also evaluates the increase in risk or severity of flooding caused by the project and considers whether the project would expose people or property to significant damage, loss, injury or death resulting from flooding.

1.9.2 Issue 2: Water Quality

There is concern regarding the potential water quality effects of pond water discharges, including changes in salinity, turbidity, dissolved oxygen, BOD, and metals. There is concern that changes in water levels could affect the acidity of the levees. A question was raised through public scoping whether the Santa Clara Valley Water District needs to install water control structures for a wetlands mitigation restoration project if FWS is installing structures. There is concern about how changes in water levels in the ponds will affect metal levels and concern about bioaccumulation and health risks to fish and wildlife.

The EIR/EIS evaluates existing water quality conditions in the salt ponds within the project area and existing water quality conditions of receiving waters and considers the potential effect of the timing of discharges as well as the specific location of discharges. The EIR/EIS considers whether implementation of the ISP would violate the San Francisco Bay Regional Water Quality Basin Plan or waste discharge requirements. The EIR/EIS also considers whether implementing the ISP would degrade water quality, resulting in harm to human health and/or wildlife.

1.9.3 Issue 3: Contaminated Sediments

There is a general concern for the remobilization of and exposure to mercury, selenium, arsenic, and other heavy metals that are currently buried in pond, Bay, creek and slough sediments as a result of excavation operations and fluctuating water levels that could expose and oxidize sediments, making them more bioavailable. There is also concern that the exposure of sediments containing mercury could promote methyl mercury production. There is also concern that increased water flows may scour channels and re-suspend contaminants which could then be deposited in the Bay. There is concern about how changes in water levels in the ponds will affect metal levels and concern about bioaccumulation and health risks to humans, fish and wildlife.

The EIR/EIS describes existing contaminant levels in sediments of the salt ponds and adjacent Bay, creek and slough waters, including levels of chromium, copper, lead, nickel, silver, zinc, arsenic, cadmium and mercury. The EIR/EIS considers potential effects of water level management in remobilization of buried contaminants. The EIR/EIS also considers whether implementing the ISP would result in sufficient levels of heavy metals to cause acute or chronic toxicity to humans and/or wildlife.

1.9.4 Issue 4: Biological Resources

Vegetation and Wetlands. Issues pertaining to vegetation and wetlands include potential direct and indirect impacts to wetland plant communities from construction of water control structures and changes in salinity. There is also a concern regarding the potential of the project to promote invasive weed establishment, including invasive species of cordgrass. The EIR/EIS addresses these concerns.

Wildlife, Fish, and Benthic Invertebrates. There is concern regarding the impact of ISP implementation on shorebirds and other species. Specifically, there is concern regarding impacts of changes in terrestrial habitat and the depth and salinity of open water habitat, impacts to migratory birds that use the salt ponds, increased predator access to nesting birds, erosion of nesting islands or land bridges, other impacts to bird breeding colonies, decreases in brine shrimp as a food source for birds, and increases in avian botulism (AB).

There is concern about effect of the timing of water discharges from the ponds on migratory fish and birds. In addition, there is concern regarding fish entrapment in water control structures. There is concern regarding changes in benthic organisms, including the growth of invasive brine-adapted invertebrate populations, as a result of changes in salinity and contaminants in pond, Bay, creek and slough waters.

The EIR/EIS evaluates the likelihood that implementing the ISP would cause substantial impacts to existing fish and wildlife habitat and a substantial decline in existing fish or wildlife populations. The EIR/EIS describes existing habitat and characterizes anticipated project-related changes in wildlife habitat and wildlife use in ponds and receiving waters, including changes in the habitat and food sources of shorebirds and waterfowl. The EIR/EIS addresses species interactions and relationships between the ponds and neighboring Bay, creeks, and sloughs and addresses possible synergistic effects upon the ecosystem. The EIR/EIS also investigates ecological pathways for the transport of contaminants.

Special Status Species. There is concern regarding potential impacts to special status species. In particular, there is concern regarding impacts of intake structures on Chinook salmon and steelhead trout; impacts of water level management, salinity control, and construction and maintenance to Western snowy plover and California least tern; and impacts of construction to salt marsh harvest mouse and California clapper rail.

The EIR/EIS identifies potential sensitive species and habitats in or near the project area and determines their abundance and the extent of sensitive habitats that may be impacted by project implementation. The EIR/EIS evaluates the potential of the project to jeopardize the continued existence of state and federally listed species or to preclude the recovery of special status species.

1.9.5 Issue 5: Cultural Resources

There is concern regarding the potential of the project to impact historic properties eligible for listing on the National Register of Historic Places (NRHP), or historic resources eligible for listing on the California Register of Historic Resources (CRHR). In particular, there is concern regarding impacts to the historic town of Drawbridge in the Alviso Pond Complex and to the Cargill salt production facilities. Neither of these resources has been formally evaluated and they both have the potential to qualify for listing on the NRHP or CRHR as individually eligible historic properties or historic districts. The EIR/EIS addresses potential impacts to historic properties and historic resources and recommends procedures to be followed for evaluating the resources and mitigating impacts, if necessary.

1.9.6 Issue 6: Recreation, Public Access, and Public Health

There is concern about impacts to recreational duck hunting and future public access to the ponds for hunting and other recreational uses. There is also concern that the project would cause lower pond levels which could create mosquito breeding grounds and that this would cause an increased risk of sickness and death due to the Mosquito Abatement District's inability to maintain acceptable levels of service or protection under this scenario. The EIR/EIS evaluates impacts to recreation, public access, and public health in the project area.

1.9.7 Issue 7: Air Quality

There is concern that changes in water quality and water elevations may cause the release of hydrogen sulfide and other odorous organic gases. The EIR/EIS considers whether this project would create objectionable odors that would affect a substantial number of people, beyond existing impacts from the Cargill salt pond operations.

1.9.8 Issue 8: Utilities and Infrastructure

There is concern regarding the effect of project implementation on transmission lines. There is also concern whether breaching several of the existing salt ponds (the "island ponds") would have a scour effect on a South Pacific Railroad bridge at those ponds. The EIR/EIS evaluates these potential impacts.

1.9.9 Issue 9: Socio-economics

There is concern about the availability of adequate funding and labor force to actively manage water levels and salinity in the ponds under the ISP. In addition, there is concern regarding the potential of the project to entrain Bay shrimp in ponds and the effects of the project on commercial fishing of Bay shrimp, including the initial release of pond contents to sloughs and creeks where juvenile shrimp are found. There is also concern about socioeconomic impacts of the reduction in commercial salt production. The EIR/EIS evaluates substantial decreases in employment and/or income, losses in tax revenue, and loss of the availability of a locally important mineral source likely to be caused by ISP implementation.

1.9.10 Issue 10: Land Use Planning

There is concern regarding the consistency of the project with existing land use plans. The EIR/EIS evaluates the project's consistency with the goals of approved habitat management plans and land use plans, including the Comprehensive Conservation Management Plan, Baylands Ecosystem Habitat Goals Report, USFWS Endangered Species Recovery Plans, San Francisco Bay Regional Water Quality Control Board Basin Plan, Bay Conservation and Development Commission Bay Plan, and the San Francisco Bay Joint Venture Implementation Strategy.

1.9.11 Issue 11: Cumulative Impacts

There is a concern about the cumulative impacts of the ISP and past, ongoing, and probable future projects, particularly on water quality and biological resources. The EIR/EIS examines the cumulative impacts of past, ongoing, and probable future projects affecting tidal marsh and estuarine habitats in the South Bay. Projects will include other salt pond restoration projects and wetland habitat improvement projects.

1.10 Availability of Project Files

The Administrative Record is a comprehensive project file documenting the process of developing this EIR/EIS. The official Administrative Record will be maintained at the Visitor Center, Don Edwards San Francisco Bay NWR, #1 Marshlands Road, Fremont, California.

1.11 Report Organization

This EIR/EIS is organized into the following chapters:

- Summary
- Chapter 1—Introduction
- Chapter 2—Alternatives
- Chapter 3—Hydrologic and Hydraulic Conditions
- Chapter 4—Water Quality
- Chapter 5—Sediments
- Chapter 6—Biological Resources
- Chapter 7—Cultural Resources
- Chapter 8—Recreation and Public Access
- Chapter 9—Air Quality
- Chapter 10—Socio-economic Resources
- Chapter 11 – Land Use Planning
- Chapter 12 – Cumulative Impacts and Other Required Analysis
- Chapter 13 – Mitigation Measures and Monitoring
- Chapter 14 – References Cited
- Chapter 15 – List of Preparers
- Chapter 16 – List of Recipients
- Chapter 17 – Abbreviations and Acronyms
- Chapter 18 - Glossary

1.12 Consultation and Other Requirements

1.12.1 Required Permits, Consultation, and Approvals

In addition to complying with CEQA and NEPA, the South Bay Salt Ponds ISP must obtain the following agency approvals:

- U.S. Army Corps of Engineers (Corps) Section 404 Clean Water Act and Section 10 Rivers and Harbors Act permits
- Federal and State Endangered Species Act Consultation
- National Historic Preservation Act Section 106 Consultation
- San Francisco Bay Conservation and Development Commission approval
- CDFG Streambed Alteration Agreements(s) Section 1601 of the CDFG Code
- California State Regional Water Quality Control Board (RWQCB) 401 Certification and/or Discharge Permit

1.12.2 Federal, State, and Local Environmental Requirements

The ISP must fulfill federal, state, and local environmental requirements as summarized in Table 1-1. Specific requirements for compliance with other environmental regulations are described in the EIR/EIS chapters, as indicated in Table 1-1. Descriptions of federal, state, regional/local requirements are provided following the table.

Table 1-1.
Federal, State, and Local Environmental Requirements

Legal statute	Status of compliance	Reference EIR/EIS chapter
Federal requirements		
NEPA	Ongoing as part of this document	
Federal Endangered Species Act (ESA)	Ongoing as part of this document	Chapter 6
Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)	Ongoing as part of this document	Chapter 6
Fish and Wildlife Coordination Act (FWCA)	Ongoing., as part of the Corps permitting process.	Chapter 6
Clean Water Act (CWA)	Ongoing. Regional Water Resources Control Board (RWRCB) will issue water quality certification and waste discharge permits after the environmental documents are completed.	Chapter 4, 5, 6
Clean Air Act (CAA)	In compliance since conformity analysis is not required.	Chapter 9
Costal Zone Management Act	Ongoing. Concurrence on FWS consistency determination from San Francisco Bay Conservation and Development Commission has been requested.	Chapter 11
National Historic Preservation Act (NHPA)	Ongoing.No known cultural resources or historic properties will be directly affected. Construction sites will be monitored	Chapter 7
Executive Order 11988—Floodplain Management	In compliance.	Chapter 3
Executive Order 11990—Protection of Wetlands	In compliance.	Chapter 5, 6
Executive Order 12898—Federal Actions to Address Environmental Justice in Minority and Low-Income Populations	In compliance since the project will not significantly change current management practices.	N/A
State (California) requirements		
CEQA	Ongoing as part of this document	
California Endangered Species Act (CESA)	Ongoing as part of this document	Chapter 5, 6
McAteer-Petris Act	Ongoing. BCDC San Francisco Bay permit or conformity determination for minor bay fill is needed.	Chapter 3, 5
California Fish and Game Code (Section 1600 Lake or Streambed Alteration Agreement Program)	Ongoing. The project complies with Section 1600 by using this document to address expected project effects.	Chapter 6

1.12.3 Federal Requirements

Endangered Species Act (ESA) Section 7 of the federal ESA of 1973, as amended (16 USC 1531), requires federal agencies to consult with the Secretary of the Interior

(USFWS) and with the Secretary of Commerce (NMFS) to ensure that agency actions do not jeopardize the continued existence of species federally listed as endangered or threatened, or destroy or adversely modify designated critical habitat that supports such species. For properties under federal ownership and management, USFWS will serve as the lead federally agency for ESA compliance. The USFWS will consult internally for certain species and will consult with NMFS for others. For properties under state ownership and management, the Corps of Engineers, through their regulatory permit authority, will serve as the lead federal agency for ESA compliance, consulting with both USFWS and NMFS.

Magnuson-Stevens Fishery Conservation and Management Act The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) establishes a management system for national marine and estuarine fishery resources. This legislation requires that all federal agencies consult with NMFS regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect essential fish habitat (EFH). EFH is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The legislation states that migratory routes to and from anadromous fish spawning grounds should also be considered EFH. The phrase *adversely affect* refers to the creation of any impact that reduces the quality or quantity of EFH. Federal activities that take place outside an EFH but that may, nonetheless, have an impact on EFH waters and substrate must also be considered in the consultation process. Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered.

The Magnuson-Stevens Act states that consultation regarding EFH should be consolidated, where appropriate, with the interagency consultation, coordination, and environmental review procedures required by other federal statutes, such as NEPA, the Fish and Wildlife Coordination Act (FWCA), the CWA, and ESA. In most cases, the environmental compliance required for federal activities will satisfy consultation requirements under the Magnuson-Stevens Act. EFH consultation requirements can be satisfied through concurrent environmental compliance requirements if the federal lead agency provides NMFS with timely notification of actions that may adversely affect EFH and if the notification meets requirements for EFH assessments.

Fish and Wildlife Coordination Act (FWCA) The FWCA (16 USC 661 *et seq.)* requires federal agencies to consult with USFWS or, in some instances, with NMFS, and with state fish and wildlife resource agencies before undertaking or approving water projects that control or modify surface water. The purpose of this consultation is to ensure that wildlife concerns receive equal consideration with water resource development project objectives and that provisions for wildlife are incorporated into the features of these projects. The consultation process is intended to promote the conservation of fish and wildlife resources by preventing their loss or damage and provide for the development and improvement of fish and wildlife resources in connection with water projects. Federal agencies undertaking water projects are required to fully consider the recommendations made by USFWS, NMFS, and state fish and wildlife resources agencies in project reports, such as documents prepared to comply with CEQA and NEPA. They must also include measures to reduce significant impacts on wildlife in project plans.

Clean Water Act (CWA) Section 404 of the CWA requires that a Corps permit be obtained for the discharge of dredged and fill material into waters of the United States, including wetlands. Fill is defined as any material used to convert an aquatic area to dry land or to change the bottom elevation of a water body. Discharges of fill material generally include permanent or temporary fills necessary for the construction of any structure.

The geographic limit of the Corps' Section 404 permit jurisdiction is as follows:

- Non-tidal waters. In the absence of adjacent wetlands, jurisdiction extends to the ordinary high-water mark; when wetlands are adjacent, jurisdiction extends beyond the ordinary high-water mark to the upper limit of the adjacent wetlands (as officially determined by the Corps). When the waters of the United States consist only of wetlands, jurisdiction extends to the limit of the wetlands. The ordinary high-water mark is defined as the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.
- Tidal waters. Jurisdiction extends to the high-tide line; when wetlands or non-tidal waters of the United States are adjacent, jurisdiction extends to the limit of those waters as described above. The high-tide line is defined as "the line of intersection of the land with the water's surface at the maximum height reached by a rising tide." This line can be determined by physical markings or characteristics, vegetation lines, tidal gages, or other means that determine the general height reached by the rising tide. The high-tide line includes spring high tides and other high tides that occur with periodic frequency, but it does not include storm surges caused by hurricanes or other intense storms.

Under Section 401 of the CWA, applicants for a federal license or permit to conduct activities that may result in a 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 the affected waters at the point where the discharge would originate. For the ISP, Section 401 certification must be obtained from the San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). The Corps permit will not be valid until the Section 401 certification is issued.

River and Harbors Act Section 10 of the Rivers and Harbors Act of 1899 prohibits the obstruction or alteration of navigable waters of the U.S. without authorization from the Corps. Navigable waters are defined as waters that have been used in the past, are now used, or are susceptible to use as a means to transport interstate or foreign commerce up to the head of navigation. A Corps permit is required for the construction of any structure in or over any navigable water. Structures or work outside the limits defined for navigable waters of the United States would also require a Section 10 permit if the structure or work affects the course, location, or condition of the water body. The law applies to any dredging or disposal of dredged materials, excavation, filling, rechannelization, or any other modification of navigable waters of the United States, and applies to all structures.

Installation of water control structures and subsequent maintenance of levees constitute placement of dredged or fill material within waters of the United States. Work could also affect the Bay's navigable capacity. Work would be subject to regulation under Section 10 of the Rivers and Harbors Act and Section 404 of the CWA. For the ISP, the Corps will combine the requirements of both acts into a single permit process.

Clean Air Act (CAA) National ambient air quality standards (NAAQS) were established in 1970 by the federal Clean Air Act (CAA) for six pollutants: carbon monoxide, ozone, particulate matter, nitrogen dioxide, sulfur dioxide, and lead. Areas that do not meet the ambient air quality standards are called non-attainment areas. The CAA requires states to submit a state implementation plan (SIP) for non-attainment areas. The SIP, which is reviewed and approved by the U.S. Environmental Protection Agency (USEPA), must delineate how the federal standards would be met. States that fail to submit a plan or to secure approval may be denied federal funding and/or required to increase emissions offsets for industrial expansion. The 1990 amendments to the CAA established categories of air pollution severity for non-attainment areas, ranging from marginal to extreme. SIP requirements vary, depending on the degree of severity.

The conformity provisions of the CAA are designed to ensure that federal agencies contribute to efforts to achieve NAAQS. USEPA has issued two regulations implementing these provisions. The general conformity regulation addresses the actions of federal agencies other than the Federal Highway Administration and the Federal Transit Administration. General conformity applies to a wide range of actions or approvals by federal agencies. Projects are subject to general conformity if they exceed the emissions thresholds set in the rule and if they are not specifically exempted by the regulation. Such projects are required to fully offset or mitigate the emissions caused by the action, including both direct and indirect emissions over which the federal agency has some control.

A conformity analysis is not required for the ISP because emissions of reactive organic gases (ROG) and oxides of nitrogen (NO_x) would be below the conformity thresholds of 55 metric tons (50 tons) of ROG and I110 metric tons (100 tons) of NO_x, per year.

National Historic Preservation Act (NHPA) The National Historic Preservation Act (NHPA) of 1966, as amended, requires federal agencies to take into account the effects of a proposed undertaking on cultural resources listed or eligible for listing on the National Register of Historic Places (NRHP). Because historic properties could be affected by the ISP, the FWS is complying with Section 106 of the NHPA.

The Section 106 review process consists of 4 steps:

1. Identify and evaluate historic properties.
2. Assess the effects of the undertaking on properties that are eligible for listing in the NRHP.
3. Consult with the California State Historic Preservation Officer (SHPO) and appropriate agencies, and if necessary, develop an agreement addressing the treatment of historic properties.
4. Provide opportunity for the Advisory Council on Historic Preservation (ACHP) to comment on any agreement or the results of consultation.

Once these steps are completed, the ISP would proceed in accordance with the conditions of the agreement.

Executive Order 11988: Floodplain Management Executive Order 11988 requires federal agencies to recognize the significant values of floodplains and to consider the public benefits that would be realized from restoring and preserving them. Under this order, the Corps is required to provide leadership and to take action to accomplish the objectives listed below.

- Avoid development in the base floodplain, unless such development is the only practicable alternative.
- Reduce the hazard and risk associated with floods.
- Minimize the impact of floods on human safety, health, and welfare.
- Restore and preserve the natural and beneficial values of the base floodplain.

Executive Order 11990: Protection of Wetlands Executive Order 11990 directs federal agencies, in carrying out their responsibilities, to provide leadership to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance their natural and beneficial values. This policy states that federal agencies should avoid, to the extent possible, the long- and short-term adverse impacts associated with destruction or modification of wetlands. It also states that an agency should avoid undertaking and providing support for new construction in wetlands, including draining, dredging, channelizing, filling, diking, impounding, and other related activities, unless the agency finds that there are no practicable alternatives and all practical measures have been taken to minimize harm to wetlands.

Executive Order 12898: Federal Actions to Address Environmental Justice in Minority and Low-Income Populations Executive Order 12898: Federal Actions to Address Environmental Justice in Minority and Low-Income Populations requires each federal agency to identify and address any disproportionately high and adverse human-health or environmental effects of its actions on minority and low-income populations.

1.12.4 State Requirements

California Endangered Species Act (California ESA) The California ESA is similar to the federal ESA. Listing decisions are made by the California Fish and Game Commission. All state agencies are required to consult with CDFG about projects that affect state-listed species. CDFG is required to render an opinion as to whether a proposed project would jeopardize a listed species and, if so, to offer alternatives to avoid the impact. State agencies must adopt reasonable alternatives unless there are overriding social or economic conditions that make such alternatives infeasible. For projects causing incidental take of state-listed species, CDFG is required to specify reasonable and prudent measures to minimize take. Any take that results from activities that are carried out in compliance with these measures is not prohibited.

Many California species are both federally and state listed. The California ESA directs CDFG to coordinate with USFWS and NMFS in the consultation process, so that consistent and comparable opinions or findings can be adopted by both federal and state agencies.

California Fish and Game Code (Section 1600 Lake or Streambed Alteration Agreement Program) CDFG regulates work that would substantially affect resources associated with rivers, streams, and lakes in California, pursuant to Fish and Game Code Sections 1600-1607. Under Section 1601 of the Fish and Game Code, any state or local governmental agency or public utility must notify the department if it proposes to:

- Divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake designated by CDFG, in which there is at any time an existing fish or wildlife resource, or from which these resources derive benefit
- Use materials from the streambeds designated by CDFG
- Dispose or deposit debris, waste, or other materials containing crumbled, flaked, or ground pavement where it can pass into any river, stream, or lake designated by CDFG

Any person, governmental agency, or public utility that proposes any activity that would divert or obstruct the natural flow or change the bed, channel, or bank of any river, stream, or lake, or that proposes to use any material from a streambed, must first notify CDFG of such proposed activity. This notification requirement applies to any work undertaken within the 100-year floodplain of a body of water or its tributaries, including intermittent streams and desert washes. In practice, however, the notification requirement generally applies to any work in the riparian corridor of a wash, stream, or lake that contains or once contained fish and wildlife, or supports or once supported riparian vegetation.

Porter-Cologne Water Quality Control Act The Porter-Cologne Water Quality Control Act is California's comprehensive water quality control law and is a complete regulatory program designed to protect water quality and the beneficial uses of the state's waters. The act requires adoption of water quality control plans by the state's nine regional water quality control boards (RWQCBs). These plans are subject to approval from the SWRCB, and ultimately USEPA.

The primary method of implementing the plans is to require each discharger of waste that could affect the waters of the state to meet formal waste discharge requirements. Anyone discharging waste or proposing to discharge waste into the state's waters must file a "report of waste discharge" with the RWQCB. Those failing to file a report on discharges are subject to a wide variety of actions under administrative, civil, and criminal laws. After a report is filed, the RWQCB may issue waste discharge requirements that impose conditions on the discharge. The waste discharge requirements must be consistent with the water quality control plan for the body of water and protect the beneficial uses of the receiving waters. The RWQCBs also implement Section 402 of the CWA, which allows the state to issue a single discharge permit for the purposes of both federal and state law.

McAteer-Petris Act. Following passage of the McAteer-Petris Act in 1965, the California Legislature established the San Francisco Bay Conservation and Development Commission (BCDC) in response to broad public concern about the future of San Francisco Bay. The BCDC is charged with:

- Regulating all filling and dredging in San Francisco Bay (which includes San Pablo and Suisun Bays, sloughs and certain creeks and tributaries that are part of the Bay system, salt ponds, and certain other areas that have been diked off from the Bay)
- Protecting Suisun Marsh, the largest remaining wetland in California, by administering the Suisun Marsh Preservation Act in cooperation with local governments

- Regulating new development within the first 30.5 meters (m) (100 feet) inland from the Bay to ensure that maximum feasible public access to the Bay is provided
- Minimizing pressures to fill the Bay by ensuring that the limited amount of shoreline area suitable for high-priority water-oriented uses is reserved for ports, water-related industries, water-oriented recreation, airports, and wildlife areas
- Pursuing an active planning program to study Bay issues so that BCDC plans and policies are based on the best available current information
- Administering the federal Coastal Zone Management Act (CZMA) within the San Francisco Bay segment of the California coastal zone to ensure that federal activities reflect BCDC policies
- Participating in the region-wide state and federal program to prepare a long-term management strategy (LTMS) for dredging and dredge material disposal in San Francisco Bay
- Participating in California's oil spill prevention and response planning program.

1.13 Other Pertinent Studies and Documents

The San Francisco Bay, including the South Bay Salt Ponds, has been studied extensively. A complete list of pertinent studies and documents used for this EIR/EIS is provided in Chapter 15 (References Cited). Additional information on a few of the key pertinent studies and documents for this project are discussed below.

1.13.1 Biological Analysis

Baylands Ecosystem Habitat Goals—A Report of Habitat Recommendations

This report presents recommendations for the kinds, amounts, and distribution of wetlands and related habitats needed to sustain diverse and healthy communities of fish and wildlife resources in the San Francisco Bay area (Goals Project 1999). The Goals Project began in 1995 and involved more than 100 participants representing local, state, and federal agencies, academia, and the private sector. The process for developing the goals involved the selection of key species and key habitats, assembling and evaluating information, preparing recommendations, and integrating recommendations into the goals.

Baylands Ecosystem Species and Community Profiles—Life Histories and Environmental Requirements of Key Plants, Fish, and Wildlife *The companion volume* to the Report of Habitat Recommendations (Goals Project 2000), this report is a reference volume for the 120 species of invertebrates, fish, amphibians, reptiles, mammals, and birds evaluated as part of the Goals Project. It provides a detailed overview of each species' historic and modern distribution, use of habitats, migration, relationship and interaction with other species, conservation and management issues, research needs, and habitat recommendations.

1.13.2 Management Plans and Strategies

Comprehensive Conservation and Management Plan The San Francisco Estuary Project developed a Comprehensive Conservation Management Plan (CCMP) for San Francisco Bay with input from more than 100 representatives from the public and private sectors, including government, industry, business, and environmental interests, as well as elected officials from all 12 San Francisco Bay/Sacramento-San Joaquin Delta (Bay-Delta) counties.

The CCMP presents a blueprint of 145 specific actions to restore and maintain the chemical, physical, and biological integrity of the Bay and Delta. It seeks to achieve high standards of water quality; to maintain an appropriate indigenous population of fish, shellfish, and wildlife; to support recreational activities; and to protect the beneficial uses of the Bay-Delta estuary.

Implementation Strategy of the San Francisco Bay Joint Venture (SFBJV) The SFBJV is a partnership of public agencies, environmental organizations, the business community, local governments, the agricultural community, and landowners working cooperatively to protect, restore, increase, and enhance wetlands and riparian habitat in San Francisco Bay and adjoining watersheds. The SFBJV shares the following objectives:

- Secure, restore, and improve wetlands, riparian habitat, and associated uplands by applying incentives and using non-regulatory techniques
- Strengthen and promote new sources of funding for such efforts
- Improve habitat management on public and private lands through cooperative agreements and incentives
- Support the monitoring and evaluation of habitat restoration projects and research to improve future restoration projects

The implementation strategy is a blueprint for acquiring, enhancing, and restoring Bay habitats, seasonal wetlands, and creeks and lakes. Over the next two decades, SFBJV partners plan to protect 63,000 acres, restore 37,000 acres, and enhance another 35,000 acres of bay habitats that include tidal flats, marshes, and lagoons.

Ecological Restoration of Salt Ponds, South San Francisco Bay, California—A Feasibility Analysis The Feasibility Analysis examines a range of biological, physical, chemical, and economic issues relevant to restoring tidal marsh on Cargill Salt Corporation's former 26,000-acre industrial salt complex, including the over 15,000 acres included in the acquisition agreement between Cargill and CDFG and USFWS. The study identifies seven key conclusions and a rough estimate of costs to restore the area included in the public acquisition agreement. The study's conclusions are as follows:

- **Conclusion 1:** Mix tidal marsh restoration and shallow open water management. Promoting recovery of federal listed species and species of concern should be a primary consideration in restoration planning and implementation. To accommodate conflicting ecological requirement between many of these species, an overall restoration plan should include about one-third of the salt ponds retained as managed shallow open water areas and two-thirds restored to tidal marsh.
- **Conclusion 2:** Resolve sediment deficit with phased restoration and/or dredged sediment reuse.
- **Conclusion 3:** Dredged sediment reuse may be desirable and economically competitive.
- **Conclusion 4:** Account for all bittern and hypersaline brine in the short and long term.

- **Conclusion 5:** Commit to immediate and long-term operations, maintenance and monitoring.
- **Conclusion 6:** Restoration needs to consider the many pressures on biological resources.
- **Conclusion 7:** Buyer beware of differential restoration feasibility.

The total roughly estimated cost to restore the 15,000-plus acres offered by Cargill for public acquisition ranges from $614 million to $1.4 billion, depending upon whether natural sedimentation or dredged sediment reuse is employed and depending upon whether low or high unit costs apply.

Inventory of Existing Conditions at Potential Mitigation Sites for San Francisco International Airport's Proposed Runway Reconfiguration Program This report describes existing conditions for selected resource areas (habitats, special-status species, land use, and utilities and infrastructure) at 40 sites in the North and South San Francisco Bay. The sites may be restored to former tidal flow and habitat to mitigate for biological effects of fill placement that would be needed to extend San Francisco International Airport's existing runway. The study includes the Baumberg, Redwood City, Charleston to Guadalupe and Coyote Creek complexes in the present project study area. The airport has been customizing conceptual restoration designs for each of the potential mitigation sites, working from original restoration designs that were based on recommendations of the Goals Project (Goals Project 1999).

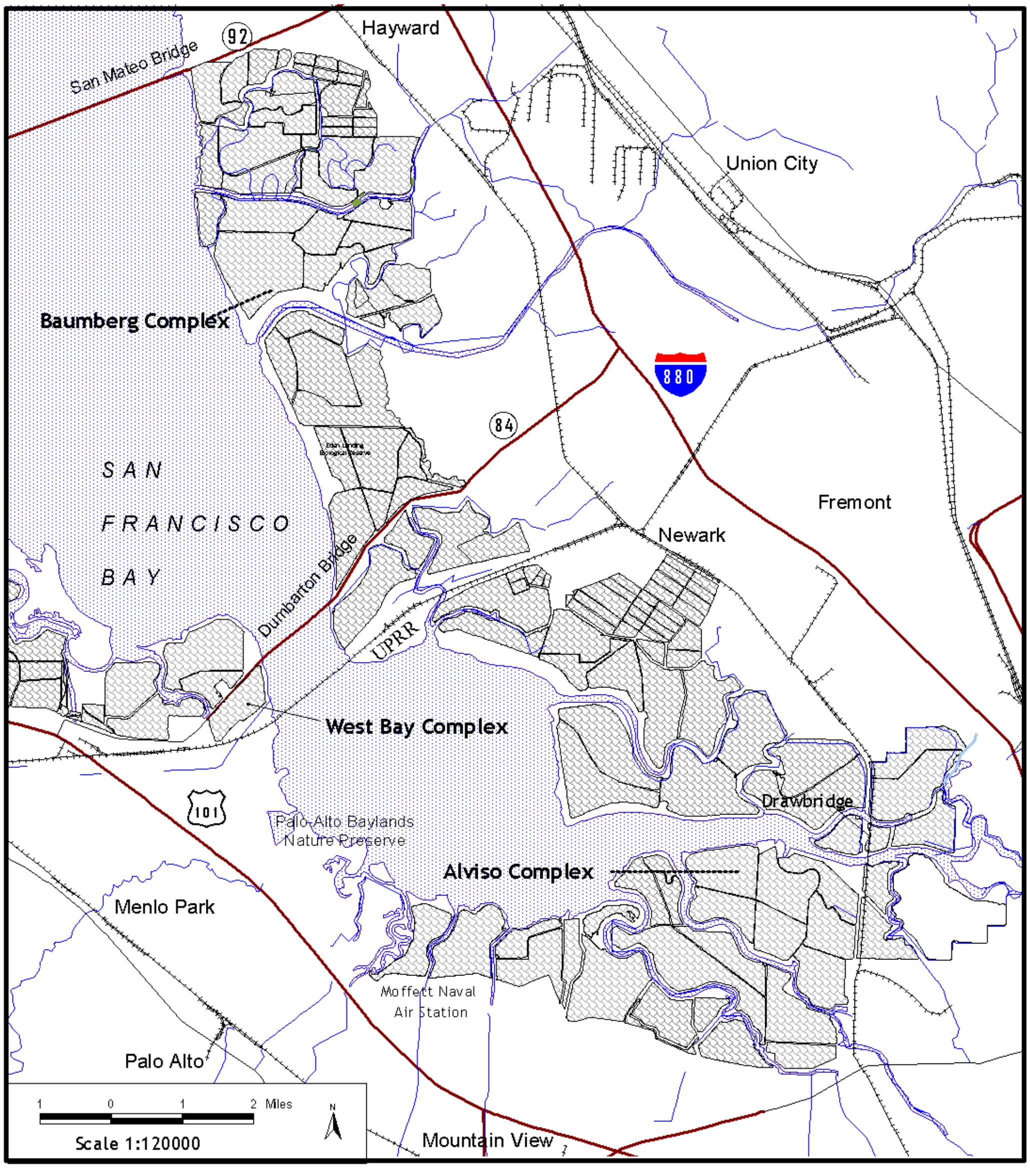

Figure 1-1

Map of Baumberg, Alviso, and West Bay Complexes

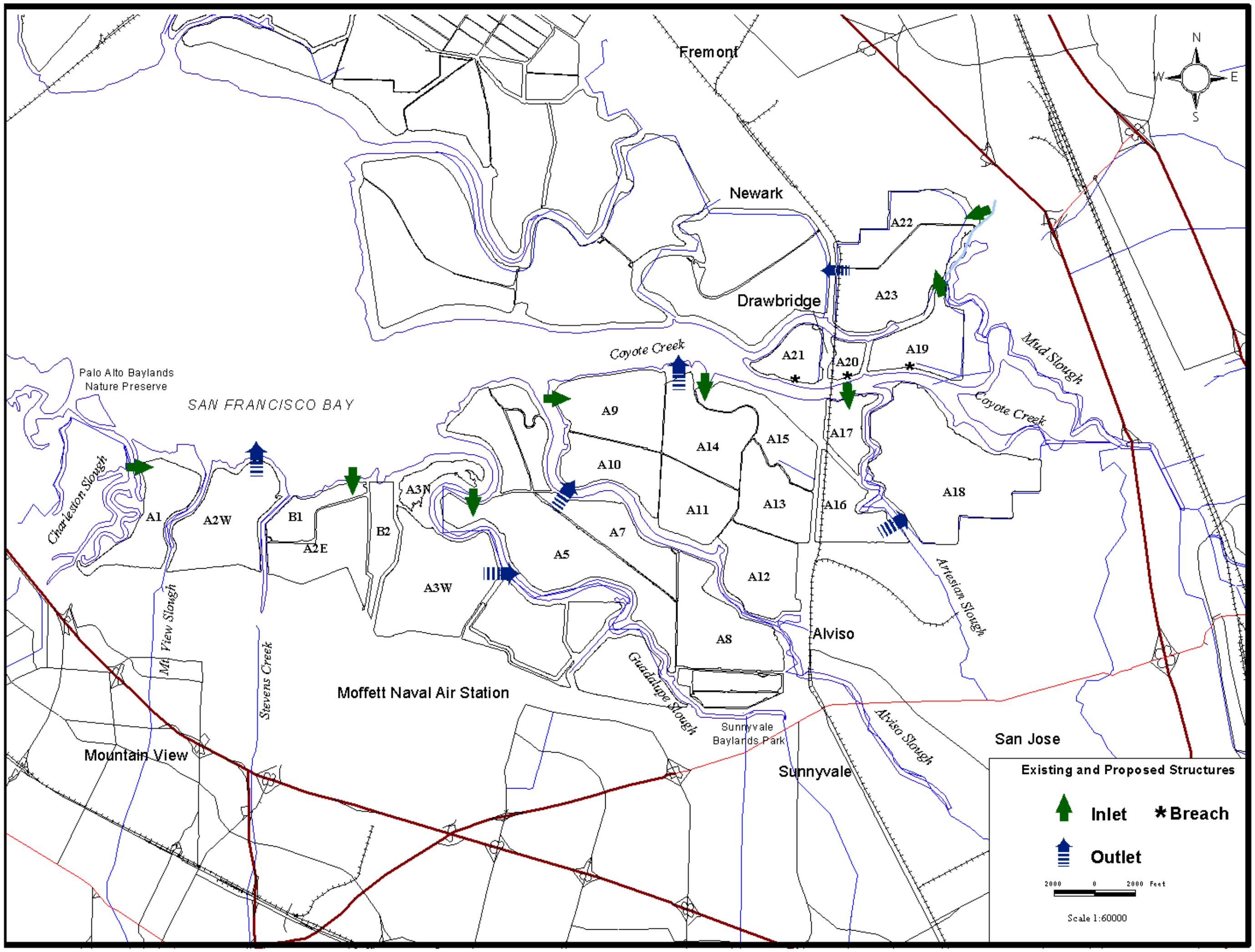

Figure 1-2

Alviso Pond Complex

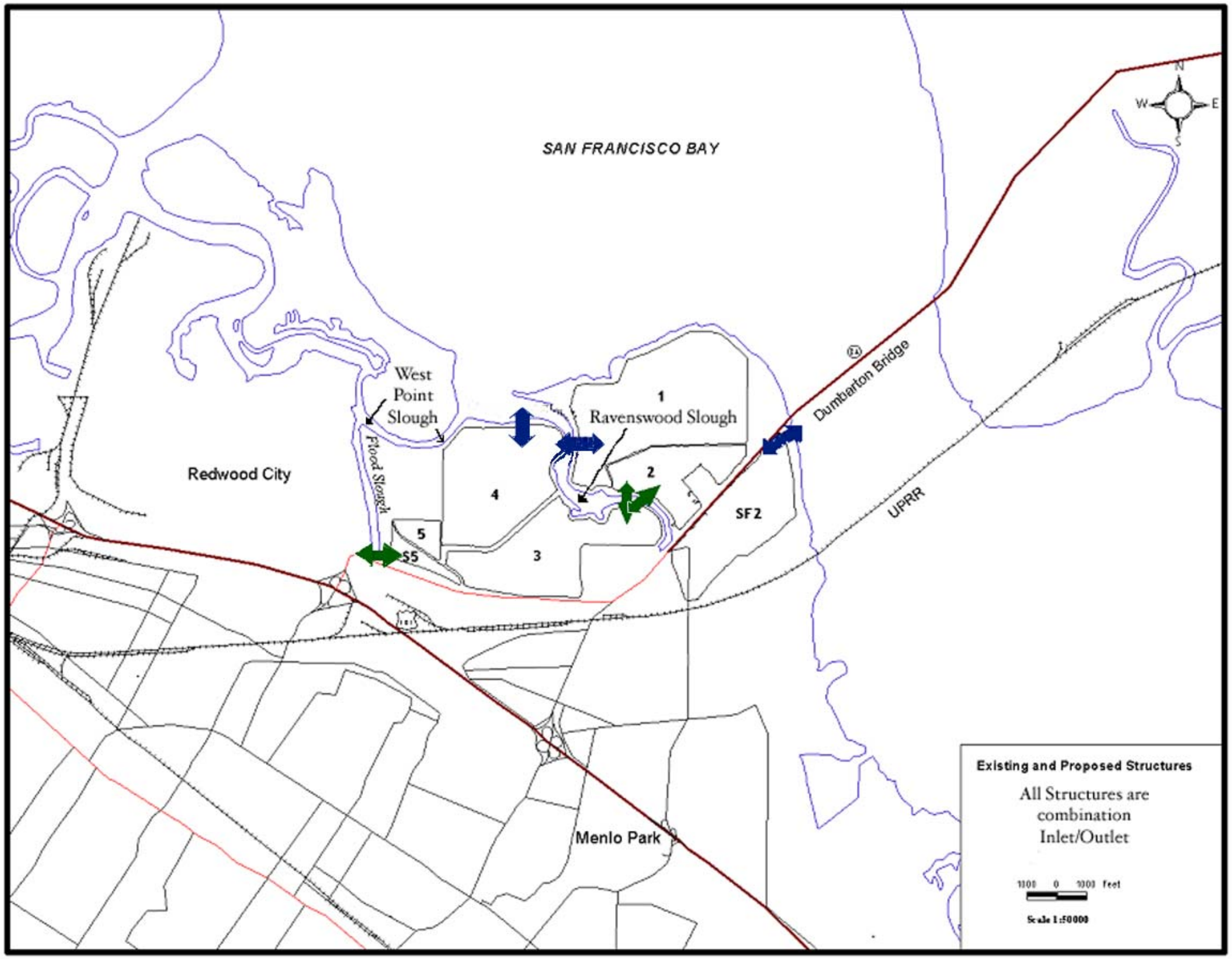

Figure 1-3

West Bay Complex

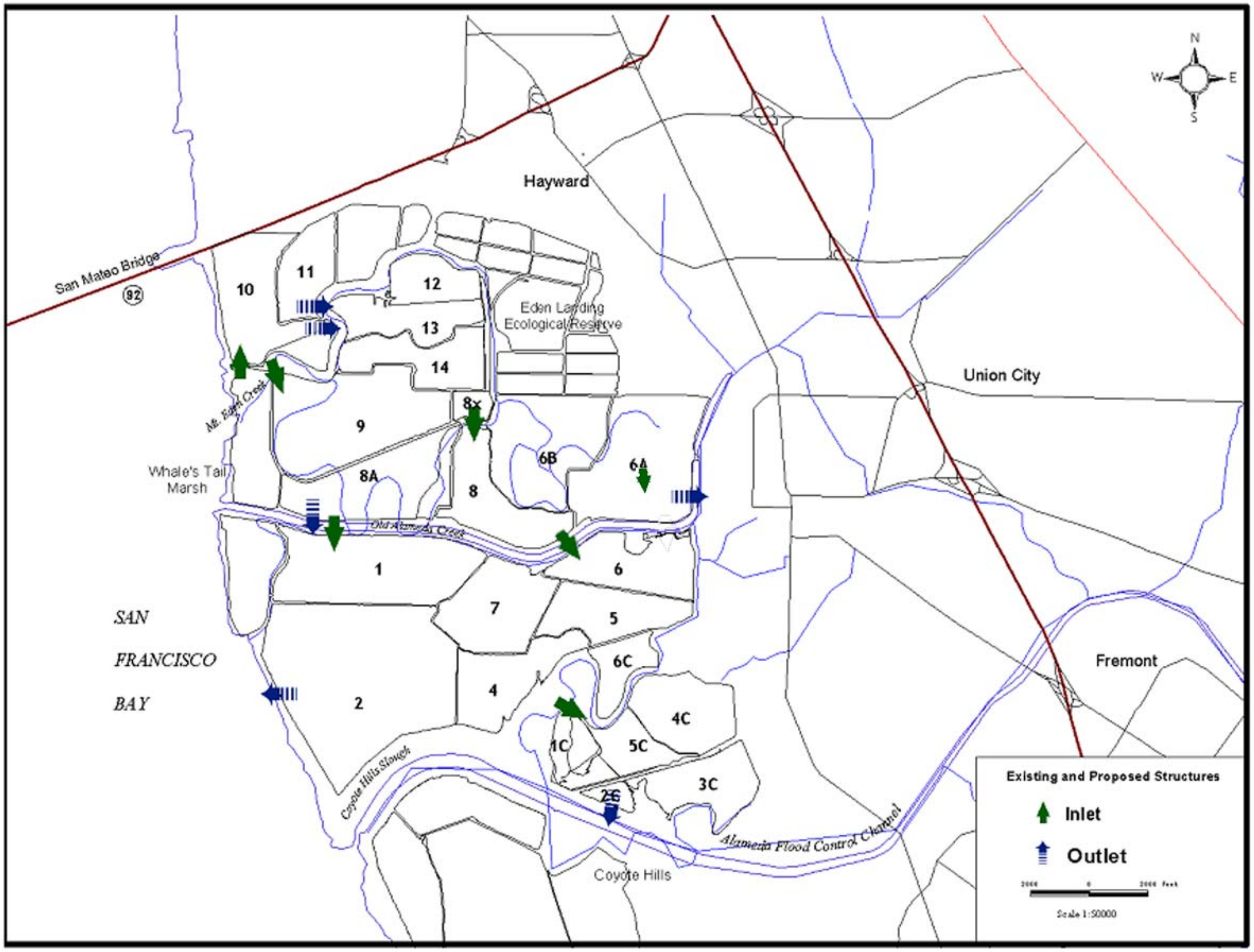

Figure 1-4

Baumberg Pond Complex

2.0 ALTERNATIVES

2.1 Introduction

This chapter describes and compares the alternatives considered by the USFWS and DFG for interim management of the South Bay salt ponds acquired from Cargill Corporation. Section 2.2 discusses the process followed to develop a reasonable range of alternatives that meet the overall project objectives. It identifies the project objectives and project opportunities and constraints that were considered in formulating alternatives. Section 2.3 briefly describes those alternatives that were initially considered, but were eliminated from detailed study because they did not meet the project objectives or were infeasible. Section 2.4 describes in detail those alternatives, including the No Action alternative, a Seasonal Pond alternative,, and two alternatives for interim pond management, including the Preferred Alternative. Section 2.5 compares the major characteristics and effects of the alternatives in relation to the significant issues described in Chapter 1. This chapter meets the requirements of NEPA Regulations Section 1502.14 (Alternatives including the proposed action) and CEQA Regulations.

2.2 Development of Alternatives

NEPA Regulations (Section 1502.14) require that agencies “rigorously explore and objectively evaluate all reasonable alternatives….” NEPA Regulations (Section 1502.14) also require that agencies “devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.”

CEQA requires that an EIR “describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives” (CEQA Guidelines Section 15126.6(a), Consideration and Discussion of Alternatives to the Proposed Project). According to the Guidelines (Section 15126.6(a), “an EIR need not consider every conceivable alternative to a project. Rather it must consider a reasonable range of potentially feasible alternatives that will foster informed decision-making and public participation.” Among the factors that may be taken into account when addressing the feasibility of alternatives are site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, jurisdictional boundaries (projects with a regionally significant impact should consider the regional context), and whether the proponent can reasonably acquire, control, or otherwise have access to the alternative site (or the site is already owned by the proponent).

The general goal of the Initial Stewardship Plan (ISP) is to operate and maintain the South Bay Salt Ponds in an environmentally sound and cost-effective manner while long-term restoration plans are developed and implemented. See Appendix A. The ISP Team sought to develop a reasonable range of alternatives to be considered in this EIR/EIS that meet this general goal and a number of specific objectives of the ISP. The specific objectives of the ISP include:

A. Cease salt concentrating process.

B. Circulate bay water through the ponds and introduce tidal hydrology to Island Ponds, if feasible.
C. Maintain existing open water and wetland habitat for the benefit of wildlife, including habitat for migratory shorebirds and waterfowl and resident breeding species.
D. Maintain ponds in a restorable condition to facilitate future long-term restoration.
E. Meet all regulatory requirements, especially discharge requirements to maintain water quality standards in the South Bay.
F. Work within existing funding constraints.

In addition, in developing a reasonable range of alternatives to be considered in this EIR/EIS, the ISP Team sought to take advantage of various opportunities and to account for various constraints.

Opportunities include:

- Existing intakes. These conduits, gates, and channels have been in place for decades and are well understood by operational engineers.
- Existing connection infrastructure. Various structures between and among the ponds have been used for years to allow waters in various salinity conditions to flow between ponds in a controlled manner.
- Accessible bay water for circulation. Each of the complexes described in the ISP has multiple potential access points for waters from San Francisco Bay to be admitted to control the water features of the ponds.
- Multiple locations for outlets. Each complex also has multiple exit points for water to be let back into the Bay. The inputs and outputs from the Bay maintain the salt ponds at acceptable water levels, salinity levels, habitat values, and potential restoration conditions.

Constraints include:

- Direction of water flow. Ponds generally have a singular flow direction and sequence established by existing pond bottom elevations and operational infrastructure.
- Existing salt pond levees. These levees, unless modified, may limit pond water elevations.
- Existing pond connections. The maximum flow capacity of existing pond connections is limited by the structure size and the available water surface difference between ponds, although in some cases the connection may be replaced in order to establish greater flow potential.
- Flood protection. Although the salt production levees were not designed for flood control, they have provided incidental flood protection.
- Bottom elevations within ponds. High pond bottoms require high water surface elevations and reduce gravity inflow. In turn, low pond bottoms require low water surface elevations to minimize erosion from wave action and can limit gravity outflows.

- Infrastructure effects. Because of the generally passive nature of the infrastructure, pond water levels vary during weak or strong tidal cycles and after rainfall events.
- Seasonal conditions. The high summer evaporation increases the need for circulation to minimize salinity increases. The longer it takes for water to circulate through the pond systems, the more it evaporates and the more salinity concentrates. Conversely, the low evaporation and rainfall during winter decreases the need for circulation of bay water.
- Water Quality Objectives. WQOs may limit long-term pond discharge salinities. Implementation of the ISP must not degrade water quality to a degree that would have a long-term impact on existing beneficial uses in the receiving waters.
- Slough conditions. Because of the relative lack of water movement in sloughs, discharges to sloughs are more sensitive to water quality concerns and will have to be monitored closely.
- Migrating salmonids. Since water intakes have the potential to entrain juvenile fish or attract adult fish, placement and operation of structures needs to reduce the potential for such impacts.
- Tidal marsh habitat. The location of structures should avoid or minimize impacts to the existing tidal marsh habitat in the South Bay.

2.3 Alternatives Considered But Eliminated from Detailed Study

NEPA Regulations (Section 1502.14) require that agencies "rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated." Likewise, CEQA Guidelines (Section 15126.6(c)) specify that an EIR should identify alternatives that were considered by the lead agency, but were rejected during the scoping process and should identify the reasons for eliminating the alternative from further consideration. Among the reasons that may be used to eliminate an alternative from detailed consideration in an EIR, CEQA Guidelines include the alternative's 1) failure to meet most of the basic project objectives, 2) infeasibility, and 3) inability to avoid significant environmental impacts.

During the project design phase that led to the ISP, a number of operational alternatives were considered. Some of these alternatives were limited from more detailed study because they failed to meet one or more of the project objectives, listed in Section 2.2, or because the constraints, also listed in Section 2.2, render them infeasible. These alternatives are described briefly below, along with a statement of why they were eliminated from further analysis in this EIR/EIS.

Note that the purpose of this project is to develop an interim management plan for lands recently acquired from Cargill. USFWS and DFG must determine how to best manage these specific lands over the period covered by this EIR/EIS. Therefore, no alternative locations are offered for this project.

The following alternatives have been eliminated from further study in this EIR/EIS:

2.3.1 Three-System Alternative

Under this alternative, the Alviso Ponds, Baumberg Ponds, and West Bay Ponds, would each be managed as a single system with continuous flow between all of the ponds within each of the three larger pond complexes. This would be similar to the existing process in which all three complexes are managed as a single system.

Although this alternative would involve relatively low costs and would maintain the existing infrastructures (Objectives F and D, respectively), it would not meet other project objectives (A, B, C, and E). Under this alternative, the single-point discharge from each of the systems would be highly saline because the residence time of salt water passing through these larger systems would be much longer than it would be through a system involving a smaller number of ponds (a two- to three-pond system, for example). The longer the salt water takes to move through the system, the more time there is for evaporation and salt concentration. The objective under Cargill operations was to concentrate the salt; the objective of the project is to dilute it (Objective A). The discharge of highly saline water into creeks and sloughs would not meet regulatory requirements, including water quality objectives for pond discharges (Objective E) and would have significant impacts on fish and wildlife. This alternative would also provide less fine-tuned control over individual pond surface elevations, flow rates, and salinity levels, and may make it difficult to control for habitat values within the ponds (Objective C).

2.3.2 Pump All the Baumberg Ponds Alternative

Most of the Baumberg ponds are above tidal elevation. Therefore, tidal water does not flow into these ponds by gravity alone and water must be pumped into the ponds instead. The existing Baumberg infrastructure includes pumps at most ponds, but use and maintenance of these pumps is a significant operational expense.

The continued operation of the Baumberg Pond pumps would have the advantage of maintaining existing open water and wetland habitats during the 5-year interim period (Objective C). This alternative would also meet Objectives A, B, D, and E (i.e., it would cease the salt concentration process, introduce bay water circulation, maintain ponds in a restorable condition, and make it possible to meet discharge WOQs and other regulatory requirements). However, this alternative would not meet financial objectives for the project (Objective F). It was therefore considered infeasible and was eliminated from further study in this EIR/EIS.

2.3.3 Culvert Structures for Island Ponds Alternative

This alternative for the Island Ponds (A19, A20, and A21) would involve constructing and managing a separate culvert inlet/outlet for each pond. The ponds would be managed to maintain water levels in the ponds approximately one foot above the average bottom elevation. The culverts would be constructed to connect to either Mud Slough or Coyote Creek. Since the barge access to A19 and A20 would be from Mud Slough, the preferred location would be along Mud Slough.

This alternative would also meet Objectives A, B, C, D, and E (i.e., it would cease the salt concentration process, introduce bay water circulation, maintain ponds in a restorable condition, maintain existing open water and wetlands habitat, and make it possible to meet discharge WOQs and other regulatory requirements). This alternative would have an advantage over the ISP proposal to breach the Island Ponds on the Coyote Creek side (see below) in that it would allow for a greater degree of control over the surface elevations, flow rates, and salinity levels of the ponds than the ISP proposal and would allow for greater control over habitat values. It would also not have the initial salinity impact that the full breach proposal would have on receiving waters and wildlife. However, the costs of this alternative would be considerably higher than the breach alternative. Due to the Island Ponds' location between Lower Coyote Creek and Mud Slough, they are fairly inaccessible. The culvert structures would be difficult and expensive to construct and to actively manage. Therefore, this alternative would not meet financial objectives for the project (Objective F). It was consequently considered infeasible and was eliminated from further study in this EIR/EIS.

2.3.4 Breach All Ponds Alternative

Under this alternative, all ponds in the Alviso, Baumberg, and West Bay systems would be breached to establish full tidal conditions throughout the systems. This alternative would meet Objectives A and B (i.e., it would cease the salt concentration process and introduce bay water circulation) and would probably be the least expensive alternative (Objective F). However, it would not meet the remaining Objectives C, D, and E (to maintain the ponds in a restorable condition, to maintain existing open water and wetlands habitat, and to make it possible to meet discharge WOQs and other regulatory requirements). At least in the short-term, impacts to receiving waters, wildlife, and wildlife habitat of a one-time introduction of highly saline water from the breached ponds would be significant. In addition, the long-term goal for the project area is to manage it for a diversity of habitat values, which would not be possible under this alternative. As with the Three-System Alternative, described above, the Breach All Ponds Alternative would provide less fine-tuned control over individual pond surface elevations, flow rates, and salinity levels, and may make it difficult to control for habitat values within the ponds. This alternative would represent a significant departure from the long-term habitat planning process. Finally, the breaching of levees which have served a flood control purpose in the past would introduce a potentially significant flood hazard to the project area. For these reasons, this alternative was eliminated from further consideration early in the alternative development process.

2.3.5 Individual System Alternatives

In addition to the alternatives above, a number of individual system alternatives were considered in the project design. However, these alternatives would require different infrastructure than that proposed in the ISP and some of the alternatives would result in significant impacts to receiving waters, habitat, and wildlife. Therefore, they were also ruled out early in the alternative development process for the EIR/EIS.

Alviso A3W System Alternative—In the Alviso A3W system, an alternative intake location was considered for Pond B1. The alternative location was close to the northern end of the pond near Stevens Creek. The alternative location would avoid existing marsh areas along the bay levee and was close to the deeper channel maintained by flows from Stevens Creek. The existing intake location has marsh elevations outside the intake which limit inflow to only high tide periods. After consultation with NMFS, Stevens Creek was identified as potential steelhead habitat. The alternative intake location was not included in the ISP to avoid potential conflicts with steelhead migration to and from Stevens Creek. For this reason, it was also eliminated from further study in this EIR/EIS.

Alviso A14 System Alternatives (2)—The Alviso A14 system included two separate alternatives which would include continuous circulation through all of the ponds. The ISP includes ponds A12, A13 and A15 as batch ponds.

The first alternative included four separate sub systems. A9 and A14 would be one sub system with flow from A9 to A14. A10 and A11 would be intake/outlet sub systems with tidal inflow and outflow to and from Alviso Slough into each pond. A15, A13 and A12 would be the last sub system with flow from A15 to A12. The alternative included potential issues with multiple discharges to Alviso Slough during initial release. The spring or summer freshwater flow in Alviso Slough may not be sufficient to carry the salinity from the pond discharges out to the Bay during the initial release. In addition, the flow from A15 to A12 would transfer Coyote Creek water to Alviso Slough and could represent a distracting trace flow to upstream migrating salmonids which may follow chemical clues from Coyote Creek. Due to this potential impact, the alternative was eliminated from further study in this EIR/EIS.

The second alternative would include all of the ponds in the Alviso A14 system, without sub systems. The inflow would be at A15, the highest pond in the system. The flow would be from A15, through ponds A14, A13, A12, A11, A10 and discharge at A9 to lower Alviso Slough. The alternative would allow gravity flow without the use of the existing pump from A13 up to A15. However, the alternative would reverse the flow of the entire system and would increase operating water levels in ponds A14, A13, and A12, and decrease operating water levels in ponds A9 and A10. The higher water levels in several ponds would require raising several internal levees and the levee along the railroad southeast of ponds A12 and A13. Consequently, the alternative was eliminated from further study in this EIR/EIS.

Alviso A16 System Alternatives —Two alternatives were considered for the Alviso A16 system. The first alternative would reverse the ISP direction of flow to intake from Artesian Slough and discharge to Coyote Creek. The intake from Artesian Slough would avoid potential entrainment of migrating salmonids in Coyote Creek. However, the intake from Artesian Slough would contain low salinity water from the San Jose Waste Water Treatment Plant (SJWWTP), and the entire system could operate at much lower salinities. The lower pond salinities could increase the risk of avian botulism in the ponds. Although not considered as a main system alternative, the option for changing the direction of flow will be considered as an adaptive management practice if needed to protect migrating fish during certain times of the year (see Section 2.4.3).

Another alternative operation was considered for the Alviso A16 system which would operate ponds A16 and A17 as batch ponds at higher salinities similar to ponds A12, A13 and A15 in the A14 system. This alternative would require a high salinity discharge to either Coyote Creek or Artesian Slough. Evaluation of the predicted pond discharge shows that the high salinity discharge may not meet receiving WQOs on a long-term basis. Due to this potential impact, the alternative was eliminated from further study in this EIR/EIS.

Baumberg 2 System Alternative—An alternative operation was considered for the Baumberg 2 system to maintain the water levels in all four ponds on a year around basis. This would require additional pumping at the pond 1 intake and construction of additional pumping capacity. Due to the high cost of pumping during the summer peak evaporation season, the alternative was eliminated from further study in this EIR/EIS.

Baumberg 2C System Alternative—An alternative flow operation was considered for the Baumberg 2C system to maintain the existing direction of flow from pond 4C to 5C to 1C. However, the existing Coyote intake pump would have to be used to supplement the flow from the pond 6 intake pump. Due to the high cost of pumping during the summer peak evaporation season, the alternative was eliminated from further study in this EIR/EIS.

Baumberg 8A System Alternative—An alternative operation was considered for the Baumberg 8A system to maintain the water levels in all four ponds on a year-round basis. This would require construction of an intake pump into the system. The intake pump was proposed at pond 8A to flow through to pond 9 and discharge at pond 9 to Mount Eden Creek. The flow from 8A to 9 was proposed to follow the existing pond bottom elevations to maintain similar pond depths in the two ponds. However, due to the high cost of pumping during the summer peak evaporation season, the alternative was eliminated from further study in this EIR/EIS.

2.4 Alternatives Considered in Detail

Alternatives considered in detail include:

- No Project/No Action Alternative
- Alternative 1 (Seasonal Ponds Alternative)
- Alternative 2 (Simultaneous March/April Initial Release)
- Alternative 3 (Phased Initial Release)

The No Project/No Action Alternative and Alternative 1 are similar, except that under No Project/No Action, existing levees and water control structures would not be maintained and would be allowed to deteriorate. Over time, the integrity of these structures would likely deteriorate. Under Alternative 1, by contrast, levees and water control structures would be maintained and repaired as needed. Under this alternative, the ponds would be managed as seasonal ponds until the final restoration plan has been completed.

Alternatives 2 and 3 closely follow the June 2003 Initial Stewardship Plan. The main difference between the two alternatives is in the timing of initial release from system ponds. Alternative 2 includes a March/April initial release, while Alternative 3 includes a phased initial release. Both alternatives incorporate plans to breach the Island Ponds (Ponds A19, A20, and A21 only) and a similar combination of individual pond management strategies, as proposed in the ISP. Alternatives 2 and 3 both incorporate flexibility for pond management by proposing a number of alternative management strategies for individual ponds and pond systems, including the Island Ponds. Alternative 3 represents the agencies' Preferred Alternative.

Alternatives 2 and 3 incorporate the following four management strategies, which are defined below:

- Batch ponds management
- High salinity batch ponds management
- Seasonal batch pond management
- Seasonal pond management

Batch ponds are ponds that do not have a direct hydrologic connection to the Bay or tidal sloughs and creeks and are not integrated into one of the continuous tidal circulation systems. They remain peripheral to these systems, but normally remain wet throughout the year. The volume and frequency of the intake and release from/to a neighboring pond can be used to control the batch pond salinity and water levels. Bottoms of batch ponds may be high, generally requiring pumping to fill the ponds (Baumberg 12, 13, and 14). For other batch ponds, the pond bottoms may be low, generally requiring pumping to remove water from the ponds (Alviso A8, A12, and A13). The batch pond management strategy allows for fine-tuned control over habitat values. Batch ponds can be managed for salinities in the range of 120-150 parts per thousand (ppt) to favor brine shrimp and brine fly production, an important food source to certain migratory birds. A **high salinity batch pond** is a batch pond that is specifically managed for high salinity levels throughout the year.

A **seasonal batch pond** is a pond that is peripheral, but remains connected, to one of the continuous tidal circulation system. In the winter, rainwater fills the seasonal batch pond and additional water may be brought in from a neighboring pond. The pond remains wet and is operated as a batch pond throughout the winter. That is, the volume and frequency of the intake and release from/to a neighboring pond can be used to control the batch pond salinity and water levels to achieve water quality or habitat objectives. In the summer, the seasonal batch pond is allowed to dry out (although, depending upon the amount of winter precipitation and the depth of the pond, some ponds may never completely dry in the summer). The seasonal batch pond strategy allows for some control over habitat values, but is less costly than the batch pond strategy because it does not involve year-round pumping and operation of water control structures.

A **fully seasonal pond** involves minimal management and operates basically independently from any tidal circulation systems. Seasonal ponds will fill from high groundwater or rain during winter and be allowed to dry-down through the summer. The pond salinity would not be controlled, but would fluctuate due to residual salt in the pond, rainwater inflows, and seasonal evaporation. In the summer, like the seasonal batch pond, the fully seasonal pond is allowed to evaporate. In the wintertime, depending upon bottom elevations across the pond, a seasonal pond may fill to only a few inches or may not fill completely. In the summer, the pond may dry out completely or may retain some water. The major benefits of a seasonal operation are the habitat provided for certain species and the elimination of costly pumping of water to maintain water levels.

2.4.1 No Project/No Action Alternative

Evaluation of the "No Action" or "No Project" Alternative is required under NEPA Regulations 1502.14 and CEQA Guidelines 15126.6(e), respectively. As stated in the CEQA Guidelines, "the purpose of describing and analyzing a no project alternative is to allow decision-makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project."

Under the No Project/No Action alternative, there would be no flow circulation through the pond systems. No additional water control structures would be installed, no release of pond contents or management of water and salinity levels would occur, and the existing infrastructure would not be maintained. During the interim period and until a long-term restoration plan is developed for the ponds, the existing levees and water control structures would be allowed to deteriorate.

Operation and management of the ponds will be transferred to DFG and FWS once the ponds meet the discharge requirements established by the Regional Water Quality Control Board. At transfer, the depth of water and salinity will vary among the ponds. Depending on climatic conditions and starting depth, ponds would evaporate at varying rates, leaving behind salt-crusted flats and, in deeper areas, residual pools of concentrated brine. The deepest portions of the ponds would be seasonally wet during winter, filling with water after rain events.

It is important to note that the No Project/No Action Alternative is not identical to the existing environmental setting, and therefore the No Action Alternative is not the baseline for determining whether the proposed project's environmental impacts may be significant. The existing environmental setting includes the pond infrastructure in its presently maintained condition. As noted above, under the No Project/No Action Alternative, the existing pond infrastructure would not be maintained.

Under the No Project/No Action Alternative, impacts to the existing environmental setting would occur. The advantage of this alternative is that it would be the lowest cost alternative. It would also minimize additional inputs of salinity and would not require a permit to discharge pond contents into the Bay. However, most of the existing open water habitats currently used by wildlife would be eliminated. Without maintenance, pond levees and control structures would be prone to failure, increasing risk of uncontrolled intake and release of flows from/to the Bay. This would present potentially significant impacts to water quality, fish, and wildlife habitat. It would also introduce a flood hazard to neighboring areas since some of the existing pond levees have come to serve a purpose of flood control for these areas. Long-term pond drying may cause some gypsum/salt-affected soils to be left on the sediment surface of some ponds. This may cause the chemistry of the soil to be affected in a manner that would likely increase the cost and level of effort of future restoration. However, results from other restoration efforts indicate that soil conditions return to normal once bay waters are returned. In addition, ponds would take 1 to 2 years to dry. During this time, there would be potentially significant impacts to nearby residents from nuisance odors.

The No Project/No Action Alternative would meet project Objectives A (cease salt production) and F (cost objectives), but would fail to meet several of the stated project objectives. Specifically, it would fail to meet Objective B (circulate bay water through the ponds), Objective D (maintain ponds in a restorable condition), and Objective E (meet all regulatory requirements). Although it would maintain some of the existing open water and wetland habitat, at least seasonally, it would not allow fine-tuned control of the ponds for habitat values (Objective C). Although the No Project/No Action Alternative would not meet most of the project objectives, in compliance with NEPA and CEQA, it is evaluated in detail in this EIR/EIS.

2.4.2 Alternative 1 (Seasonal Pond Alternative)

This alternative is the same as the No Action Alternative, except that the levees and water control structures would be maintained and repaired as needed. The ponds would be managed as seasonal ponds until the final restoration plan has been completed. Under this scenario, the pond contents would be allowed to evaporate during the summer and would be allowed to remain dry throughout the summer to minimize construction and management costs. During winter, they would fill during precipitation events, but contents would not be discharged.

This alternative minimizes additional inputs of salinity and does not require a permit to discharge 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; the pond systems would not support fish and bay invertebrates, resulting in reduced foraging habitat for piscivorous (fish-eating) birds.

Alternative 1 would meet project Objectives A (cease salt production), E (meet all regulatory requirements), and F (cost objectives). By preventing deterioration of the existing infrastructure, it would partially meet Objective D (maintain ponds in a restorable condition). It would only partially meet this objective because, as with the No Project/No Action alternative, long-term pond drying may result in some gypsum/salt affected soil conditions in some ponds. This may cause the soil chemistry of those ponds to be affected, and increase the cost and level of effort of future restoration. However, results from other restoration efforts indicate that soil conditions return to normal once bay waters are returned. This alternative would also fail to meet Objective B (circulate bay water through the ponds) and Objective C (maintain existing open water and wetland habitat). Nevertheless, in order to evaluate the impacts of a complete range of reasonable and feasible alternatives, Alternative 1 is evaluated in detail in this EIR/EIS.

2.4.3 Pond Management Alternative 2: Simultaneous March/April Initial Discharge

This alternative includes an initial release period of March/April for project ponds and a variety of adaptive management strategies for individual ponds, including the option of breaching the Island Ponds (A19, A20, and A21) in the Alviso Complex. To accommodate the movement of brines out of the systems to the plant, implementation of all features described in the ISP may take up to 6 years. The operation of Alviso Ponds A22 and A23 will remain under current operations for years 1-2 of the ISP; during years

3-6, they will be operated as seasonal ponds with some intake of Bay waters to reduce salinity. Similarly, the West Bay Ponds will remain under current operations for years 1-3 of the ISP; during years 3-6, pond salinities will be reduced to meet discharge standards. Once the ponds can be discharged, they will transition to ISP circulation.

Initial Release Period. The initial release period is the startup period for the circulation of bay water through the pond systems. Using tidal water management techniques, the targeted ponds' salinity will be reduced to levels similar to the salinity of the Bay. Under the proposed ISP, structures would be installed when site constraints allow and initial discharge of the existing pond contents would begin the following March/April when salinities within the ponds and receiving waters are the lowest. March/April was considered a reasonable time for the initial release because bay salinities are generally low to maximize dilution of the higher initial release salinities within the ponds before discharge and in the receiving waters after discharge. Also, March/April is the beginning of the summer high evaporation season, before the salinity levels in the ponds start to increase. It is anticipated that initial releases from one or two ponds would occur in 2004 and releases from the remaining ponds would occur in 2005.

Individual Pond Management Strategies The description of individual pond management strategies contained in this section includes a brief summary of the proposed circulation hydraulics and management operations for each of the pond systems in the Alviso, Baumberg, and West Bay complexes. This information is summarized from the ISP. Table 2-1 provides a comparison of pond-specific existing conditions and proposed ISP conditions. The table also identifies options for flow direction, possible alternative operations, and management constraints. Alternative operations for adaptive management of individual ponds are also discussed in detail below.

Additional pond-specific information, including existing water surface elevations and seasonal salinity levels and modeled water surface elevations and seasonal salinity levels under the proposed interim management are described in detail for each of the ponds in the ISP (see Appendix A).

The proposed ISP is a pioneering project. The restoration of salt production ponds to a diversity of tidal habitats has not previously been undertaken on such a massive scale at any known location. The South Bay hydrology and habitats comprise a complex interrelated system. Partly due to a lack of existing data from related projects, it cannot be known what effect the project will have on fish and wildlife and their habitats. Impacts can only be inferred from a variety of vaguely related projects, such as from reported impacts to fish and wildlife from highly saline waters discharged from desalinization plants in Saudi Arabia and other remote locations.

Due to the complexity of the project and the abundance of unknown factors and potential for significant impacts, USFWS and CDFG prefer to have flexibility in the implementation of management strategies for specific ponds and pond systems. Alternative 2 incorporates a number of additional pond-specific or system-specific management alternatives, which are noted in Table 2-1 (below) and discussed further in the text that follows. These alternatives employ a combination of batch pond, high salinity batch pond, seasonal batch pond and seasonal pond management strategies. They introduce a considerable degree of flexibility into on-going habitat restoration planning and infrastructure management efforts at the project sites and allow project managers to make adjustments to respond to impacts as they are observed.

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
Alviso Ponds												
A2W*[2]	A1	277	System intake	11-42	1.8	System intake	<40	1.4-1.7	Close to existing			Minimize disturbance to tidal marsh and mudflat outboard of this pond
A2W*[2]	A2W	429	System pond	15-43	1.8	System outlet	<40	1.2-1.7	Close to existing			
A3W*[2]	B1	142	System intake	13-41 (low)	1.5	System intake	<40	1.2-1.7	Close to existing			Locate intake to avoid entrainment of Stevens Creek salmonids
A3W*[2]	A2E	310	System pond	18-43	1.9	System pond	<40[*3]	2.6-3.1	Deeper		Possible batch pond. Could be managed for high salinity, depending on dilution flow in A3W	
A3W*[2]	B2	170	System pond	13-43	1.3	System pond	<40	1.0-1.5	Close to existing			
A3W*[2]	A3W	560	System pond	23-44	1.9	System outlet	<40	1.8-2.1	Close to existing			Minimize disturbance to marsh along A3W slough levee
A3W*[2]	A3N	163	Batch	16-41	0.6	Seasonal	<40[*3]	NA	Close to existing		Could be managed as high salinity batch pond	

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Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *1**	**Management constraints**
A7*2	A5	615	System pond	28-60	0.7	System intake	<40	1.0-1.2	Close to existing	Reversible		Locate intake to avoid entrainment of migrating steelhead using Alviso Slough
A7*2	A7	256	System pond	28-75	0.6	System outlet	<40	0.9-1.1	Deeper	Reversible		
A7*2	A8	406	System pond (partially seasonal, bermed southern portion)	31-110	1.6	Seasonal	<40*3	Variable	Variable		Northern portion could be operated as high salinity batch pond	
A14 (3 sub-systems)	A9	385	System intake	11-38	4.1	System intake	<40	2.2-1.7	Shallower			Avoid entrainment of salmonids by limiting winter inflow
A14	A10	249	System pond	17-45	3.3	System pond	<40	2.6-2.3	Shallower			Avoid entrainment of salmonids by limiting winter inflow
A14	A11	263	System pond	28-69	3.5	System pond	<40	3.1-3.2	Close to existing			Avoid entrainment of salmonids by limiting winter inflow
A14	A14	341	System pond	48-135	1.4	System outlet	<40	0.9-1.3	Close to existing			
A14	A12	309	System pond	35-66	3.4	High salinity batch (multiple intakes)	120-150	3.0-3.4	Close to existing			Avoid entrainment of salmonids by limiting winter inflow

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
A14	A13	269	System pond	38-77	2.3	High salinity batch (multiple intakes)	120-150	2.0-2.3	Close to existing			
A14	A15	249	System pond	40-111	2.2	High salinity batch (multiple intakes)	120-150	2.0-2.2	Close to existing			Avoid entrainment of salmonids by limiting winter inflow
A16	A17	131	System pond	45-137	1.6	System intake	<40	1.2-1.1	Close to existing	Reversible		Avoid entrainment of salmonids by reversing winter flow; Minimize Avian Botulism (AB) by controlling salinity (AB is a particular concern for Pond A16 intake)
A16	A16	243	System pond	43-122	2.1	System outlet	<40	1.7-1.6	Close to existing	Reversible		Avoid entrainment of salmonids by reversing winter flow; Minimize AB by controlling salinity
Island Ponds	A19	265	System pond	79-290	2.0	Tidal	Not managed	Not managed	Tidal	N/A	Operate as seasonal pond	Locate breaches to minimize disturbance to tidal marsh habitat
Island Ponds	A20	63	System pond	87-289	1.9	Tidal	Not managed	Not managed	Tidal	N/A	Operate as seasonal pond	Locate breaches to minimize disturbance to tidal marsh habitat

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
Island Ponds	A21	147	System pond	87-304	1.2	Tidal	Not managed	Not managed	Tidal	N/A	Operate as seasonal pond	Locate breaches to minimize disturbance to tidal marsh habitat
A22/A23	A22*[4]	270	Batch	66-296	1.0 Vari-able	Intake pond; Seasonal	NA	NA	NA			Primarily seasonal. Intake only to dissolve salt deposits when plant capacity is available.
A22/A23	A23*[4]	445	Batch	178-302	1.5 Vari-able	Intake pond; Seasonal	NA	NA	NA			Primarily seasonal. Intake only to dissolve salt deposits when plant capacity is available.
Baumberg Ponds												
2*[2]	1	337	System pond	18-46	2.6	System intake	<40	1.3-2.3	Lower than existing (different summer/ winter surface elevation)	Reversible flow at intake to drain system		
2*[2]	4	175	System pond	16-60	1.5	Winter - System pond; Summer-seasonal	<40*[3]	0.2-1.5	Lower than existing (different summer/ winter surface elevation)		Possible batch pond. Could be managed for high salinity, depending on dilution flow in pond 2	

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
2*[2]	7	209	System pond	23-59	2.3	Winter - system pond; Summer-seasonal	<40*[3]	0.6-1.9	Lower than existing (different summer/ winter surface elevation)		Possible batch pond. Could be managed for high salinity, depending on dilution flow in Pond 2	
2*[2]	2	673	System pond	20-49	2.7	System outlet	<40	1.0-2.3	Lower than existing (different summer/ winter surface elevation)	Reversible flow at outlet to fill system		
2C	6	176	System pond	25-148	2.3	System intake	<40	2.8-2.5	Similar to existing (different summer/ winter surface elevation)			
2C	5	159	System pond	23-149	2.2	System pond	<40	2.7-2.5	Similar to existing (different summer/ winter surface elevation)			

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
2C	6C	78	System pond	23-132	1.7	System pond	<40	2.2-2.1	Similar to existing (different summer/ winter surface elevation)			
2C	4C	175	System pond	23-143	1.0	System pond (intake from 5C)	<40	1.3-1.6	Similar to existing (different summer/ winter surface elevation)			
2C	3C	153	System pond	23-145	1.3	System pond	<40	1.1-1.7	Similar to existing (different summer/ winter surface elevation)			
2C	2C	24	System pond	20-178	1.3	System outlet	<40	1.3-1.7	Similar to existing (different summer/ winter surface elevation)			

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
2C	1C	66	System pond	22-147	0.6	System intake	<40*[3]	0.9-1.2	Similar to existing (different summer/ winter surface elevation)		Operate as high salinity batch pond	
2C	5C	111	System pond	20-136	0.8	Outlet to 4C	<40*[3]	1.1-1.4	Similar to existing (different summer/ winter surface elevation)		Operate as high salinity batch pond	
6A	8	180	System pond	48-296	2.5	Winter – intake/ Summer-seasonal	<40	Winter – 0.6	Lower than existing (different summer/ winter surface elevation)			
6A	6B	284	System pond	35-231	0.9	Winter – system pond/ Summer-seasonal	<40	Winter – 0.9	Lower than existing (different summer/ winter surface elevation)			

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
6A	6A	340	System pond	32-184	2.2	Winter – outlet/ Summer-seasonal	<40	Winter – 2.1	Lower than existing (different summer/ winter surface elevation)		Summer – may include a limited muted tidal area	
8A*[2]	9	366	System pond	62-241	2.1	System intake	<40	0.8-2.0	Lower than existing (different summer/ winter surface elevation)	Reversible intake to drain pond		
8A*[2]	8A	256	System pond	69-265	0.7	Winter – system outlet/ Summer-seasonal, tidally muted in borrow ditch	<40	2.0-0.6	Lower than existing (different summer/ winter surface elevation)	Intake and outlet		
8A*[2]	8X					Open tidal culvert to ditch-Pond is seasonal	<40		Lower than existing (different summer/ winter surface elevation)			

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
8A*[2]	12	99	System pond	27-328	1.7	Winter intake; Summer-seasonal	<40*[3]	Winter - 1.1	Lower than existing (different summer/ winter surface elevation)		Possible batch pond. Could be managed for high salinity, depending on dilution flow in Pond 9	
8A*[2]	13	132	System pond	27-334	1.5	Winter - intake; Summer-seasonal	<40*[3]	Winter - 0.9	Lower than existing (different summer/ winter surface elevation)		Possible batch pond. Could be managed for high salinity, depending on dilution flow in Pond 9	
8A*[2]	14	156	System pond	32-304	1.2	Winter batch; Summer seasonal	<40*[3]	Winter – 0.5	Lower than existing (different summer/ winter surface elevation)		Possible batch pond. Could be managed for high salinity, depending on dilution flow in Pond 9	
11*[2]	10	214	Muted tidal (Open culvert)	16-74	1.3	Winter system intake; Summer intake and outlet	<40		Lower than existing (different summer/ winter surface elevation)	Reversible	Alternative 3 (phased release): Pond 10 intake operates as combined intake/ outlet	

Table 2-1
Summary of Existing and Proposed Management for Individual Ponds

			Existing Management			Alternatives 2 and 3 Proposed Management						
System	**Pond**	**Pond Area (Acres)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (year-round)**	**Type of Pond**	**Salinity Range (ppt)**	**Average depth (summer - winter)**	**Proposed water level compared to existing**	**Flow direction options**	**Possible alternative operations *[1]**	**Management constraints**
11*[2]	11	118	System pond	16-81	1.4	Winter system outlet; Summer seasonal	<40	Winter – 1.1	Lower than existing (different summer/ winter surface elevation)	Reversible	Alternative 3 (phased release): operate as fully seasonal (year-round)	
West Bay Ponds												
	1*[5]	445	System intake	35-326	0.5	System outlet	<40	0.9	Deeper than existing			
	2*[5]	145	System pond	64-306	1.6	System intake	<40	0.8	Lower than existing			Locate intake to minimize disturbance to tidal marsh habitat.
	3*[5]	273	System pond	145-320	1.2	System intake	<40	0.8	Lower than existing			Locate intake to minimize disturbance to tidal marsh habitat.
	4*[5]	297	System pond	88-341	0.4	System outlet	<40	0.7	Close to existing			.
	5*[5]	31	System pond	96-340	0.6	System pond	<40	1.0	Deeper than existing			
	S5*[5]	29	System pond			System intake	<40	1.2				Locate intake to minimize disturbance to tidal marsh habitat.
	SF2*[5]	242	System pond	76-316	1.0	System outlet	<40	0.7	Lower than existing			

Notes for Table 2-1:

1 Proposed management under Alternative 3 is identical to proposed conditions under Alternative 2, except where noted here.
2 Systems with July/August 2004 initial discharge under phased release scenario (Alternative 3).
3 Salinity levels could be higher than those proposed under Alternative 2 if pond is managed as a high salinity batch pond (Adaptive management strategy).
4 In years 1-3 the operation will remain similar to existing conditions; in years 3-6 the ponds will be operated as seasonal ponds to reduce salinity.
5 In years 1-3 the operation will remain similar to existing conditions; in years 3-6 the pond salinities will be reduced to transfer standards. After year 6, the ponds will transition to ISP circulation

Alviso System A2W— System A2W will consist of two ponds, A1 (intake) and A2W (outlet). See Figure 4-1 in the ISP (Appendix A). The proposed system would make use of an existing gate intake at A1 from lower Charleston Slough, an existing siphon under Mountain View Slough between A1 and A2W, and an existing staff gauge at A1. It would involve constructing a new gate outlet structure at A2W to the Bay and a new staff gage at A2W.

The intake location at the northwesterly end of A1 was selected to utilize the existing intake, as well as to allow inflow from lower Charleston Slough. The high tide salinities near the Bay would be closer to normal bay salinity than farther upstream. The bay salinity would be closer to existing conditions in the ponds. The outlet location at the northerly end of A2W was selected to allow outflow directly into the Bay. The specific location of the outlet was selected because the mudflat and tidal marsh communities outside the levee are narrowest at the proposed location. However, the rate of discharge from A2W into the Bay may be limited by the elevations of mudflat/marsh area in the vicinity.

Ponds A1 and A2W will require limited active management. This would include on-going monitoring and inspections. The system may require adjustment of the control gates monthly or seasonally. System A2W could be operated with reduced inflow and circulation during the winter season when evaporation is low. The proposed system includes an outlet weir to maintain minimum water levels with low flow rates. The system can be operated without an outlet weir, but may require more frequent adjustment of the control gates to control both water levels and salinities.

Alviso System A3W— Alviso System A3W consists of 5 ponds: B1 (intake), B2, A2E, A3N, and A3W (outlet). See Figure 4-2 in the ISP (Appendix A). The proposed system would make use of three existing gate structures, existing pipes between A2E and A3W, and existing staff gages at all ponds. It would require construction of four new gate structures.

The intake location at the northeasterly end of B1 was selected to be near the existing intake and avoid inflow from the Bay near the mouth of Stevens Creek. Stevens Creek has been identified as a potential salmonids fishery and migrating salmonids could be entrained in the intake flow if the intake were at Stevens Creek. The outlet location at the easterly end of A3W was selected to allow outflow into Guadalupe Slough in close proximity to the existing dock structure near the Sunnyvale WWTP discharge. At that location, the new outfall would have the least impact on existing marsh along the slough levee.

The proposed control gates will allow intake at the outlet structure. It may be useful to intake at A3W to dilute the pond contents if the pond salinity exceeds the discharge goals. Because of the flapgates and the relative elevations of the tide and pond water levels, all intake flow would occur at high tide, and all outflows would occur at low tide. The long term discharge salinity levels at A3W would be at or above bay salinity, and would generally be higher than low tide salinity in Guadalupe Slough. Due to freshwater inflow from San Thomas Aquino Creek, Calabazas Creek, and the Sunnyvale WWTP, the salinity in Guadalupe Slough is typically lower than bay salinity, particularly at low tide water levels.

Ponds B1, B2, and A3W will require limited active management. The intake, internal connections, and outlet structures generally have sufficient capacity and gravitational head for salinity control in winter and spring.

Pond A3N would be operated as a seasonal pond. For seasonal operations, the pond would be drained initially and no further operation would be required. The pond would fill with 1 to 2 feet of rainwater during the winter, which would evaporate during the summer. Because the bottom of pond A3N is 1½ feet below sea level, some groundwater seepage may occur to keep portions of the pond bottom wet during the summer.
The discharge flow from the gravity outlet from pond A3W to Guadalupe Slough may be affected by high flood tides during periods of high rainfall. There is a low levee on the south side of the pond which can be eroded by wave action if the water levels are high. It may be preferable to limit or stop inflow to the system during the winter to control the maximum water level. This is similar to the existing commercial salt operation. The outlet gates would need to be adjusted after large storms to drain excess volume from the system. Based on system model estimates, the outlet culverts would have capacity to allow circulation during the winter.

Alviso System A3W Adaptive Management Alternatives

Alviso Complex Pond A2E—Pond A2E, in the Alviso A3W System, is currently operated as a system pond and Alternative 2 proposes to operate it as a low salinity system pond. As an additional alternative, Pond A2E could be managed as a high salinity batch pond, depending on the dilution flow in A3W.

Alviso Complex Pond A3N—Pond A3N, in the Alviso A3W System, is currently operated as a batch pond and Alternative 2 proposes to operate it as a seasonal pond. As an additional alternative, Pond A3N could be managed as a high salinity batch pond. Pond A3N has existing gates to operate as a batch pond. Water would be released from B2 to A3N to manage the volume in the pond and thus manage the amount of salt in the pond. This may affect the circulation in B1, B2, and A3W and may require additional analysis of flow rates and mixing in A3W. If the salinities in A3N become significantly higher than the salinity in A3W, there may be constraints on the discharge flow to A3W and the Guadalupe Slough. The flows through B1 and B2 to A3W would need to dilute the higher salinity inflow from A3N to a level that could be discharged from A3W. This may be limited during the summer high evaporation season due to the hydraulics of the system. The availability of the batch operation alternative also depends upon potential levels of methyl mercury that exist in pond sediments and the potential need to maintain higher water levels to reduce bioavailability of sediment contaminants to wading and shorebirds. Additional sediment sampling to determine levels is planned for fall and winter (2003-2004).

Alviso System A7— System A7 consists of 3 ponds: A5 (intake) and A7 (outlet) and seasonal pond A8. See Figure 4-5 in the ISP (Appendix A). The system would make use of the existing control gate from A7 to A8, the existing pump from A8 to A11 and existing staff gages in all ponds. The system would involve construction of new intake and outlet gates. A new cut would be made at the internal levee between A5 and A7 and the existing cut between these ponds would be filled.

The intake location at the northwesterly end of A5 was selected to allow inflow from Guadalupe Slough as close to the Bay as possible. The high tide salinities near the Bay would be closer to normal bay salinity than farther upstream. Due to freshwater inflows from Calabazas and San Tomas Aquino Creeks, other drainage channels, and the Sunnyvale WWTP, the salinity upstream in Guadalupe Slough generally is lower than bay salinity. The bay salinity would be closer to existing conditions in the ponds.

The outlet location at the northerly end of A7 was selected to allow outflow into Alviso Slough as close to the Bay as possible. The outlet salinity levels would be at or above bay salinity, but would generally be higher than low tide salinity in Alviso Slough. Due to freshwater inflow form Guadalupe River the salinity in Alviso Slough generally is lower than bay salinity, particularly at low tide levels.

Ponds A5 and A7 will require limited active management. Pond A8 would be operated as a fully seasonal pond. The pond would be drained initially and no further operation would be required. It would fill with 10 to 20 inches of rainwater during the winter, which would evaporate during the summer. Because the bottom of pond A8 is over 3 feet below sea level, some groundwater seepage may occur to keep portions of the pond bottom wet during the summer.

If the salinity in A8 is significantly higher than the salinity in A11 or A7, there may be constraints on the flow to A11 or A7. The flow through the A14 system, which includes A11, or the A7 system, would need to dilute the higher salinity inflow from A8 to a level that could be discharged from A14 or A7. This may be limited during the summer high evaporation season due to the hydraulics of the system. The flow to A11 would also be limited during the winter when the flow through the A14 system would be reduced or closed to limit potential entrainment of salmonids.

Pond A5 includes an existing siphon under Guadalupe Slough from pond A4. Pond A4 has been acquired by the Santa Clara Valley Water District (SCVWD) for a proposed restoration project. Based on the proposed schedule for the long-term restoration of pond A4 there may be a requirement for interim management of the pond during the initial stewardship period for the DFG and FWS ponds. One or more alternatives being considered by the SCVWD for interim management may include operation of pond A4 as a batch pond with periodic outflows through the siphon to pond A5. If SCVWD and USFWS agree that flows from A4 are appropriate, the flows would be restricted to time periods and salinity levels which would not have a significant effect on flow rates or discharge salinities from pond A7. SCVWD would be responsible for preparation of a suitable operation plan for interim management of pond A4 in coordination with the operation of System A7.

The Santa Clara Valley Water District is in the process of obtaining permits to implement the Lower Guadalupe River Flood Protection Project, which will accommodate the 17,000 cfs 100-year flood capacity of the Guadalupe River Flood Control Project currently under construction. The Guadalupe River Project is located upstream of the

Lower Guadalupe River Flood Protection Project and is scheduled to go on line in spring 2004.

As currently designed, the Lower Guadalupe River Flood Protection Project would affect the magnitude and duration of flooding downstream of the project at the Cargill Salt Ponds, and in Alviso. Currently, when flood flows in the lower Guadalupe River exceed 6,800 cfs, Alviso Slough downstream of the Union Pacific Railroad crossing will over-top its west bank at Pond A8W. The flood control project would increase lower Guadalupe River channel capacity at the railroad crossing 17,000 cfs and therefore increase the potential for flooding conditions in the downstream salt ponds. During flood conditions, estimated depths in ponds A5, A7, A8D and A8W would increase by up to 1 foot compared to current conditions. Flood volumes would increase from 15 to 21% and duration of flooding would increase by 12 to 30%. Without pumping or other evacuation methods, it would take months, even years for the floodwaters to evaporate under current conditions.

To reduce the potential for flooding and duration of flooding in the ponds, additional mitigation measures to be implemented include constructing an Alviso Slough Overflow Weir at pond A8W and hardening of the pond A6 levee. Continuing flood flows into ponds A5, A6, A7, A8, and A8D via the Alviso Weir would allow adequate storage of flood waters to minimize overbanking in Alviso Slough.

Note that, although the proposed interim batch management of the SCVWD's Pond A4 and potential projects at Ponds A6 and A8 in conjunction with the SCVWD's Lower Guadalupe River Flood Protection Project would directly and indirectly impact ponds included in the ISP project, these SCVWD are not part of the ISP project. These projects are being developed separately and their environmental impacts are being evaluated separately. Implementation of the ISP is not dependent upon implementation of these projects. Nor is implementation of these projects dependent upon implementation of the ISP.

Alviso System A7 Adaptive Management Alternatives

Alviso Complex Pond A8—At the present, the only pond in the project area that is truly seasonal is a portion of A8 (referred to a A8 South in the Alviso A7 System. The depth of this pond is sufficiently shallow that the south portion of the pond, which has been separated from the remainder of the pond by a berm, dries out during the summer and provides seasonal habitat for snowy plovers. Alternative 2 proposes to operate the remainder of Pond A8 as a fully seasonal pond.

As an alternative strategy, A8 could be operated as a seasonal batch pond and the northern portion of the pond could be managed as a high salinity batch pond to favor brine shrimp and brine fly production, an important food source to certain migratory birds. As a seasonal batch pond, A8 would not have continuous flow operation similar to A5 or A7. All outflows from A8 must be pumped to A11 or A7. The seasonal batch pond operation would minimize the amount of pumping required. Water would be diverted from A7 to maintain the volume in the pond. Water would be pumped from A8 to A11 or A7 to decrease the volume in the pond and reduce the amount of salt in A8. If the salinity in A8 is maintained at a level similar to the A11 or A7 levels, there would be no constraint on the timing and flow from A8 to A11 or A7.

If the salinity in A8 is significantly higher than the salinity in A11 or A7, there may be constraints on the flow to A11 or A7. The flow through the A14 system, which includes A11, or the A7 system, would need to dilute the higher salinity inflow from A8 to a level that could be discharged from A14 or A7. This may be limited during the summer high evaporation season due to the hydraulics of the system. The flow to A11 would also be limited during the winter when the flow through the A14 system would be reduced or closed to limit potential entrainment of salmonids.

The availability of this alternative for Pond A8 depends on the extent to which this pond will be flooded with fresh waters under the Lower Guadalupe River Flood Control Project.

Alviso System A14— System A14 consists of 7 ponds: A9 (intake), A10, A11 and A14 (outlet) and batch ponds A12, A13, and A15. See Figure 4-7 in the ISP (Appendix A).

The existing intake at A9 allows intake only, and would not be modified. The new outlet structures would include operable gates and flapgates, to allow inflow at the outlet when necessary. For instance, it may be necessary to use A14 as a mixing chamber for higher salinity flows from A15, which may require inflows from Coyote Creek to A14. In addition, the control gates would allow partial culvert openings to control water levels. Because of the flapgates and the relative elevation of the tides and pond water levels, all intake flow would occur at high tide, and all outflows would occur at low tide.

The outlet location at the northerly end of A14 was selected to allow outflow into Coyote Creek at a location near an existing channel within the marsh area along the levee. The existing channel drains part of the marsh area to the existing dredge lock cut at the north end of A15. This would minimize the potential disturbance in the marsh.

Ponds A12, A13, and A15 are proposed for batch operations that will allow higher salinities in those ponds. The goal for these higher salinity ponds would be to reach summer salinity levels between 120 and 150 ppt to provide habitat for brine shrimp and wildlife which feeds on the brine shrimp. Lower salinity water would be diverted from ponds A11 and A14 in A12 and A13 and evaporation would increase the salinity over time. Higher salinity water would be pumped up to A15 as needed to maintain the pond volume. Additional low salinity water would be added to make up lost volume and lower salinity if needed. Excess volume in the batch system would be released to the A16 system for dilution and discharge to Artesian Slough and Coyote Creek.

Ponds A12, A13, and A15 are called a batch system because it is anticipated that the ponds will be operated in a series of batch operations to control the individual pond volumes and salinities. For example, a typical operation may be to add 3 inches of low salinity water from A11 to A12 to make up lost volume and reduce the pond salinity, or release 6 inches of water from A15 to A16 to lower the pond volume to make room for inflows from A12 and A13. Using individual transfers of volume from one pond to another simplifies the planning necessary for control of the pond salinities.

Ponds A9, A10, A11, and A14 will require limited active management. During the winter season, the A9 intake would be closed to prevent entrainment of migrating salmonids. For planning purposes, this was assumed to extend from December through April. During the winter, rainfall would tend to increase the water levels in the ponds. The water levels in the ponds would be set by a weir at the outfall or adjustment of the control gates to avoid flooding of the existing internal levees or wave damage to the levees.

Ponds A12, A13 and A15 would be operated as batch ponds to maintain summer salinity levels in the range of 120 to 150 ppt for brine shrimp habitat. Water would be diverted from A11 or A14 into ponds A12 and A13 for makeup water as necessary to control salinity. Water would be pumped from A13 to A15 for makeup water in A15. Excess volume in A12 and A13 would be pumped up to A15. Excess water in A15 would be discharged to A16.

The proposed intake to A15 from Coyote Creek would also allow flow from the creek into A15 during the summer. Inflows from the creek would have lower salinity than makeup water from A13. This would lower the salinity in A15, if necessary. In addition, control gates would be available from A9 to A14 and from A15 to A14. These gates could be used to increase the flow through A14 from A9 and allow A14 to be used as a mixing pond for releases from A15. Flow could also be released from A13 to A14 by adjusting the water level in A13.

For winter operation, the gates from A9, A10, and A11 were assumed to be open to allow rainfall to drain to A14. This would minimize the need for water level management during the winter. However, the water levels in A9 and A10 would be lower than existing conditions. The winter water level in A9 would be approximately 2.3 feet below the average winter water levels for the existing commercial salt operations. The winter water levels in each individual pond could be maintained at different water levels by closing the internal pond connection gates at the start of the winter season. Excess water from rainfall would need to be drained from the system after larger storms and would require additional active management to adjust the interior control gates.

The summer water level for pond A9 for the ISP condition is approximately 1.9 feet below the existing condition average summer water level. The lower water level was required to increase the intake flow through the existing intake gates and provide sufficient circulation flows to maintain salinities within the system. The gravity intake flows are dependent on the size of the intake structure and the pond water level in comparison to the slough water levels. More active management of water levels in the system may allow summer operation of ponds A9 and A10 at higher levels depending on the discharge salinities, flows to the batch ponds, and the intake salinities. The modeled discharge salinities at pond A14 were near 35 ppt during the summer with higher than normal intake salinities.

Alviso System A16— System A16 consists of 2 ponds: A17 (intake) and A16 (outlet). See Figure 4-9 in the ISP (Appendix A).

The inlet and outlet structures would include operable gates and flapgates to close off all flow, allow inflow only, or allow outflow only. Therefore, the inflow and outflow direction for the system could be reversed if necessary. For instance, a summer operation with an intake from Coyote Creek was preferred to avoid inflows from Artesian Slough at the City of San Jose wastewater treatment plant outfall. However, it may be necessary to intake at A16 from Artesian Slough during the winter to minimize potential entrainment of migrating salmonids in Coyote Creek. The control gates would allow partial culvert openings to control water levels. Because of the flapgates and the relative elevations of the tides and pond levels, all intake flow would occur at high tide, and all outflows would occur at low tide.

Ponds A16 and A17 will require limited active management. During the winter season, December through April, the A17 intake would be closed to prevent entrainment of migrating salmonids. The control gates would need to be adjusted weekly or monthly during the summer circulation period.

Pond A16 includes a siphon from pond A15 in the A14 system. Pond A15 would contain higher salinity water between 120 and 150 ppt to provide brine shrimp habitat. Excess water from ponds A12, A13, and A15 would be released to A16 on a batch basis. Because the proposed salinity in A15 would be significantly higher than the salinity in A16, there may be constraints on the flow to A16. The flow through the A16 system would need to dilute the higher salinity inflow from A15 to a level that could be discharged from A16. This may be limited during the summer high evaporation season due to the hydraulics of the system. It would also be limited during the winter when the flow through the A16 system would be reduced or closed to limit potential entrainment of salmonids from Coyote Creek at A17. An operational alternative would be to reverse the flow in the A16 system during the winter and intake from Artesian Slough instead of Coyote Creek. Salinities in Artesian Slough are lower than in Coyote Creek due to the San Jose WWTP discharge, and may be more effective to dilute higher salinity inflows from A15. In addition, Artesian Slough does not have a salmonid fishery.

Based on the average salinity of the inflows from Coyote Creek and the average summer inflows to the A16 system, in an average year the release from the batch ponds through A15 to A16 would need to extend for approximately 4 months to prevent the salinity in A16 from exceeding 40 ppt.

Island Ponds (A19, A20, and A21) — The Island Pond group in the Alviso Complex contains three separate ponds. Under this alternative, there would be one or more levee breaches to Coyote Creek at each pond, allowing full tidal circulation within the ponds. The ponds would operate independently. The proposed breach locations were selected to avoid locations near the existing railroad bridge at Coyote Creek and to minimize impacts within the existing marsh areas along Coyote Creek (see Figure 4-11 in the ISP, Appendix A). The existing Coyote siphon pump and Mud Slough pump would be removed. The existing control gate from pond A21 to the Mud Slough pump would also be removed. Existing water surface elevations and seasonal salinity levels and modeled water surface elevations and seasonal salinity levels under the proposed interim management are described in detail in the ISP (Appendix A, Sections 4.2.6.2 and 4.2.6.3).

Following the breaching of the Island Ponds, these ponds will require no active management or maintenance. It is anticipated that the existing levees will degrade over time due to erosion from rainfall, tidal flows, and flood flows. The existing pond bottoms are relatively high in elevation and would become vegetated with middle level salt to brackish marsh vegetation relatively quickly. The estimated maximum breach velocities for certain breach locations may be higher than 4 feet per second (fps). The initial breach size and configuration would be expected to erode over time to a more stable configuration. The size and shape of breaches would depend on long-term circulation through the individual breach, elevation of the Coyote Creek marsh at the breach location, and durability of soils within the levee. Depending on site conditions, individual breaches may become deeper and wider.

Adaptive Management Alternative - Island Ponds (A19, A20, and A21) —This alternative would include the potential for operating the island ponds as seasonal ponds for the Initial Stewardship period. The existing brines in the ponds would be transferred to the Cargill Plant 2 to the maximum extent possible. The residual brines in the borrow ditches and low areas would evaporate in place. As seasonal ponds, the Island Ponds would partially fill with winter rainfall. The rainwater would evaporate during the spring and summer, and the ponds would be dry until the following winter. The seasonal pond alternative would not require construction of any intake or outlet structures at the Island Ponds. There would be no discharges to the Bay or sloughs. The ponds could be breached in the future as part of the long-term restoration plan.

Alviso System A22/A23— This system includes ponds A22 and A23, both of which are presently operated as batch ponds. The operation of Alviso Ponds A22 and A23 will remain under current operations for years 1-2 of the ISP. During years 3-6, they will be operated as seasonal ponds to reduce salinity. See Figure 4-16 in the ISP (Appendix A). They would, however, each be able to intake water from Mud Slough as needed to dissolve salt deposits when plant capacity is available.

Baumberg System 2—The Baumberg System 2 consists of 4 ponds: ponds 1 (intake), 2 (outlet), 4 and 7. See Figure 4-17 in the ISP (Appendix A).

The circulation pattern for the system would be to intake at pond 1, then flow through ponds 7 and 4 to the outlet at pond 2. All four intake culverts would include operable gates and flapgates to allow inflow. Two culverts would include gates to allow outflow, if necessary. Controls to allow outflow at the intake structure are included to maintain management flexibility and allow discharge from pond 1 in the event of flooding or a gate failure within the system. Because of the flapgates and the relative elevation of the tides and pond levels, all gravity intake flow would occur at high tide, and all outflows would occur at low tide.

The existing intake pump station at pond 1 will remain to supplement gravity inflows into the system during the summer high evaporation period. Because the pond bottom elevations and water elevations are relatively high, the gravity flow intakes are effective only during short periods at high tides. During periods of weak tides, little gravity inflow would occur and the pump would be needed to supplement the inflow. The intake pump station also operates only at high tide.

The outlet structure at pond 2 to the Bay would include operable gates and flapgates to close off all flow or allow outflow only. The control gates at the intake and outlet culverts would allow partial culvert openings to control water levels.

The initial stewardship conditions would include different operation plans for the winter and summer. The operating water levels in the ponds would be lower during the summer to increase the gravity inflow into the system during the higher evaporation season. The water level in pond 2 would be approximately 3.1 feet (ft) NGVD during the summer, and 3.4 ft NGVD during the winter. Because of the high bottom elevations in ponds 7 and 4, they would be only partially wet during the summer.

Baumberg System 2 will require active management during the summer, as well as during the transitions to and from the summer operation. The intake culverts do not have sufficient capacity to allow adequate flow for salinity control during the summer. The inflow may need to be supplemented using the intake pump to control the summer salinity. It is anticipated that the supplemental pump would be controlled manually based on the measured salinity in pond 2 on approximately a weekly basis. The intake pump includes an automatic level switch to turn the pump on at high tide and off at low tide.

For the winter operation, the gate from Pond 1 to Pond 7 would be open and the gate from Pond 1 to Pond 2 would be closed. Water from the Bay would circulate from Pond 1 to 7, to 4, and to Pond 2. Because of rainfall and low evaporation during the winter, no supplemental pumping would be required in normal years. The water level in the system would be controlled by the outlet gate settings.

In the spring the system would be changed to the summer operation condition. This was assumed to occur in early May, but could vary depending on habitat conditions in the ponds. For example, the transition could be delayed or advanced based on use of the pond by migratory birds, or salinity levels in the ponds.

For the summer operation, the planned water levels would be lower by approximately 1 foot. The water levels in the system would be controlled by the outlet gate settings. The lower operating levels throughout the system would provide a significant increase in the gravity inflow from the intake culverts in pond 1. In addition, the gate from pond 1 to pond 2 would be at least partially opened to reduce the headloss for flow from pond 1 to pond 2. The gate from pond 1 to pond 7 would be partially open to provide limited circulation through ponds 7 and 4.

Based on modeling of the system for historic tide and evaporation conditions in 1994, the gravity intake system would not be sufficient to maintain the maximum salinity goals during periods of weak tides. Gravity inflows would only occur at high tide levels in the Bay. During periods of weak tides, with lower high tides, the inflow would be reduced. Weak tide periods may extend for a week to 10 days. With low inflows from the Bay and high evaporation, the salinity levels in the ponds would increase, and may exceed the design goal of 40 ppt. Therefore, supplemental pumping would be provided from the existing intake pump from Old Alameda Creek to pond 1. A proposed operation scheme was developed in which pumping would start if the discharge salinity exceeds 37 ppt, and stop if the discharge salinity is below 36 ppt. Because the discharge salinity responds slowly to the increased inflow, the pumps generally would operate for several days or weeks at a time. The pumping criteria could be modified to conform to other discharge goals. A higher allowable discharge goal would reduce the need for pumping. Based on the pond modeling for 1994 and 1995, the supplemental pumping would be necessary during summer periods with higher bay intake salinity, but may not be required during wet years with lower ambient salinity in the Bay.

Baumberg System 2 Adaptive Management Alternatives

Baumberg Complex Pond 4—This pond is presently managed as a low salinity system pond within the Baumberg 2 system. Alternative 2 proposes to operate this pond as a low salinity seasonal batch pond (see Section 2.4.3). As an alternative, Pond 4 could be operated as a high salinity batch pond (120-150 ppt salinity), depending upon the dilution flow in Pond 2 of the Baumberg 2 system.

Baumberg Complex Pond 7—This pond is presently managed as a low salinity system pond within the Baumberg 2 system. Alternative 2 proposes to operate this pond as a low salinity seasonal batch pond (see Section 2.4.3). As an alternative, Pond 7 could be operated as a high salinity batch pond (120-150 ppt salinity), depending upon the dilution flow in Pond 2 of the B2 system.

Baumberg System 2C—The Baumberg System 2C consists of eight ponds: ponds 6 (intake), 5, 6C, 4C, 3C, 2C (outlet), 1C (intake) and 5C. See Figure 4-19 in the ISP (Appendix A).

The proposed intake pump would provide continuous circulation through ponds 6, 5, 6C, 4C, 3C, and 2C during the summer months. Water would be pumped primarily during high tide into pond 6 and then be conveyed by gravity into ponds 5, 6C, 4C, 3C and 2C. A new gravity outlet at pond 2C consisting of two 48" gates would discharge flows into the Alameda FCC.

The existing intake pump at pond 1C would operate to provide inflows to a smaller sub-system consisting of pond 1C and 5C. This pond sub-system would operate on a continuous basis or could be operated seasonally as a batch system to allow higher salinity in ponds 1C and 5C. Pond 5C would discharge to pond 4C.

Flows through both these two sub-systems would be primarily unidirectional to pond 2C. The outlet structure from pond 2C would discharge to Alameda FCC through two 48" flapgates at low tide. The new outlet in pond 2C would be constructed as close to San Francisco Bay as possible. The outlet structure would also include a weir to control the minimum water level in pond 2C. The weir would include weir boards to adjust the weir elevation.

The control gates at the intake and outlet culverts would allow partial culvert openings to control water levels. Because of the flapgates, all gravity outflows would occur during low tide in the channel. Because of the shallow depths in Old Alameda Creek, all pumped inflows would occur at high tide.

The initial stewardship conditions would include different operation plans for the winter and summer. The operating water levels in the lower ponds (4C, 3C, and 2C) would be slightly lower during the summer to increase the gravity flow through the system from the upper ponds (6, 5, and 6C) during the higher evaporation season. The water level would vary approximately 1 foot in elevation NGVD during the summer between the upper and lower ponds.

Baumberg System 2C will require active year round management because the intake pumping would be controlled by the discharge salinities at pond 2C. Active management will also be important in the transition period entering and exiting the summer management regime. The water surface elevations would be controlled primarily by the intake pump operations at ponds 6 and 1C and the discharge weir elevation at pond 2C.

Because of rainfall and low evaporation during the winter, winter pumping would typically not be required. However, limited pumping may be required during extreme drought winters with low rainfall. For winter operation, the discharge weir elevation at the 2C outlet structure would be set high enough (4.3 NGVD) to provide open water throughout the system. Winter operation pumping may be required to maintain water levels.

In the spring the system would be changed to the summer operation condition. The outlet weir would be lowered by approximately 1 foot (3.6 NGVD). This was assumed to occur in early May, but could vary depending on habitat conditions in the ponds. For example, the transition could be delayed or advanced based on use of the pond by migratory birds, or salinity levels in the ponds.

Lowering the discharge weir would lower the operating levels throughout the system and provide a significant increase in the gravity flow between ponds. The summer operation elevations would be similar to the existing operating elevations for downstream ponds. The new intake pump at pond 6 and the existing pump at pond 1C should have sufficient capacity to provide flow for salinity control during the spring, summer, and fall as needed. A proposed operation scheme was developed in which pumping would start if the discharge salinity exceeds 37 ppt, and stop if the discharge salinity is below 36 ppt. Because the discharge salinity responds slowly to the increased inflow, the pumps generally would operate for several days or weeks at a time. The pumping criteria could be modified to conform to other discharge goals such as a reduction in odors associated with pond drying.

A higher allowable salinity discharge goal would reduce the need for pumping. Based on the pond modeling for 1994 and 1995, the supplemental pumping would be necessary during summer periods with higher bay intake salinity, but may be significantly reduced during wet years with lower ambient salinity in the Bay.

Ponds 1C and 5C would be a separate sub system within the overall system. Inflows from Alameda Flood Control Channel would be pumped as necessary to control salinity in the sub system. The sub system would discharge to pond 4C. This sub system may also be operated as a batch system with higher salinity to provide habitat for brine shrimp and related species. This may require additional analysis of pond salinities in pond 2C.

There are no salmonid migration concerns in Old Alameda Creek to limit pumped intake at pond 6, however there is the potential for future restoration of anadromous fish in Alameda Flood Control Channel. Steelhead go up Alameda Creek, but are blocked from migration to spawning areas by several barriers. Local anglers transport some fish above the barriers. Until fish movement past the barriers is addressed, there is not a viable steelhead fishery in Alameda Creek.

Baumberg System 2C Adaptive Management Alternatives

Baumberg Complex Pond 1C—This pond is presently managed as a low salinity system pond within the Baumberg 2C system. Alternative 2 proposes to operate this pond as a low salinity intake pond. As an alternative, Pond 1C could be operated as a high salinity batch pond (120-150 ppt salinity).

Baumberg Complex Pond 5C—This pond is presently managed as a low salinity system pond within the Baumberg 2C system. Alternative 2 proposes to operate this pond as a low salinity outlet to Pond 4C. As an alternative, Pond 5C could be operated as a high salinity batch pond (120-150 ppt salinity).

Baumberg System 6A—The Baumberg System 6A consists of 3 ponds: ponds 8 (intake), 6B and 6A (outlet). See Figure 4-21 in the ISP (Appendix A).

As a seasonal or muted tidal pond system, the system would not be subject to continuous circulation through ponds during the summer high evaporation season. The seasonal ponds would be filled during the fall to provide open water during the winter and early spring. The seasonal ponds would be drained in the spring. Due to the hydraulic limitations of the intake to pond 8 and the limited capacity of Old Alameda Creek, it was not considered practical to maintain continuous circulation in the 6A system during the summer.

Pond 6A may be operated as a muted tidal pond during the summer. With muted tidal operation, the outlet culvert would be opened to allow both inflow and outflow on each tidal cycle. The pond would then have a daily cycle of wetting and drying for part of the pond. Because of the limitation of the culvert and the creek channel, the daily tidal cycle within the pond would be relatively small, generally less than one foot. The tidal cycle in the Bay is generally over six feet.

The intake and outlet structures and internal connections were designed to provide circulation for filling the pond system in the fall and to empty the ponds in the spring. The proposed intake structure into pond 8 at North Creek would include one 48” gravity culvert. All gravity intake flows would occur at high tide. The proposed intake structure would be constructed as part of the North Creek levee improvements to be completed as part of the Eden Landing restoration project.

In addition, the existing control structures include two control ponds located between the three ponds near Old Alameda Creek. The control ponds are shown in Figure 4-19, but not to scale. The actual ponds are each less than 1 acre. As shown in the plan, the south control pond (also called a donut) is connected by gated culverts to ponds 8 and 6A, to the north control pond and the siphon to pond 6 across Old Alameda Creek. The north control pond is connected to Pond 6B. The north control pond was the source for water for the Continental pump, which pumped up into pond 8. For the salt making operations, the control ponds and pump were used to transfer water to and from pond 6. For the initial stewardship conditions, the pump and siphon would not be required. The system would be separate from the pond system south of Old Alameda Creek.

The system outlet structure would be located on the eastern end of pond 6A, and would discharge to Old Alameda Creek. All outflows would occur at low tide.

The initial stewardship conditions would include different operation plans for the ponds during the winter and summer seasons. The ponds would be seasonal and would have open water through the system during the winter. During the summer, the ponds would be dry or include a limited area of muted tidal area in pond 6A.

Baumberg System 6A will require limited active management, primarily during the transitions to and from the winter operation conditions. Pond water surface elevations would be controlled primarily by adjusting the control gates at the intake and outlet, between ponds. Intake salinities would be the similar to the bay salinity and pond salinities would be similar to existing bay salinities.

For the winter operation, the gates from pond 6B to pond 6A would be open to equalize the water surface elevations within the ponds. Water from the Bay would circulate from pond 8 to 6B and 6A. Pond 8 would operate at a higher elevation because the pond bottom is higher. The water level in pond 8 may be controlled by a weir at the discharge, or by adjustment of the pond 8 control gates.

In the spring the system would be drained for the summer condition. This was assumed to occur in early May, but could vary depending on habitat conditions in the ponds. For example, the transition could be delayed or advanced based on use of the pond by migratory birds, or salinity levels in the ponds.

Because ponds would be operated as seasonal ponds, the ponds would slowly drain and dry during the late spring, and no further management would be required until winter. The ponds would then become part of the continuous flow operation in winter.

If pond 6A is to be operated as a muted tidal pond during the summer, the outlet culvert would be opened to allow inflow and outflow and the water level would be controlled by the outlet weir. Without the outlet weir the pond would only contain minimal water at extreme high tides.

Baumberg System 6A Adaptive Management Alternatives

Baumberg Complex Pond 6A—This pond is presently managed as a system pond with widely ranging seasonal salinities within the Baumberg 6A system. Alternative 2 proposes to operate this pond as a low salinity outlet pond in the winter and as a seasonal pond in the summer. As an alternative, Pond 6A could include a limited muted tidal area in the summertime.

Baumberg System 8A—The Baumberg System 8A consists of 6 ponds: ponds 9 (intake), 8x and 8A (outlet) and seasonal ponds 12, 13 and 14. See Figure 4-23 in the ISP (Appendix A).

All four culverts of the pond 9 intake structure at Mount Eden Creek would include operable gates and flapgates to allow inflow. However two culverts would include gates to allow outflow, if necessary. Controls to allow outflow at the intake structure are included to maintain management flexibility and allow discharge from pond 9 in the event of flooding or a gate failure within the system. A 48” intake gate has been constructed at the northeasterly end of pond 8A as part of the Eden Landing restoration project. The pond 8A intake would increase circulation within pond 8A.

The outlet structure from pond 8A would include operable gates and flapgates to close off all flow or allow outflow only or allow inflow and outflow. The control gates at the intake and outlet culverts would allow partial culvert openings to control water levels. All gravity intake flow would occur at high tide, and all outflows would occur at low tide.

The operating water levels in the ponds would be lower during the summer to increase the gravity inflow into the system during the higher evaporation season. The water level in pond 9 would be approximately 3.4 ft NGVD during the summer, and 4.6 ft NGVD during the winter. The minimum water level in pond 9 would be controlled by fixed weirs at the connections to pond 8A. The fixed weirs would not be adjustable using weir boards. Because of the high bottom elevations in pond 8A, it would be only partially wet during the summer.

The existing brine pump at pond 13 will remain to provide inflows to the seasonal ponds 12, 13, and 14. The pump will intake from pond 8x. Inflows to pond 8x will use the existing intake from North Creek. Because of the high bottom elevation in pond 8x, only the borrow ditches will be wet for normal tidal conditions. The ditches will be used to transport inflow from North Creek to the pump at pond 13.

Baumberg System 8A will require limited active management, primarily during the transitions to and from the summer operation conditions, as well as winter management of ponds 12, 13, and 14 if they are operated as batch ponds.

For the winter operation, the gates from pond 9 to pond 8A would be open. Water from the Bay would circulate from pond 9 to 8A. The outlet control gates from pond 8A would be set to control the water levels in ponds 8A and 9.

In the spring the system would be changed to the summer operation condition. This was assumed to occur in early May, but could vary depending on habitat conditions in the ponds. For example, the transition could be delayed or advanced based on use of the pond by migratory birds, or salinity levels in the ponds.

For the summer operation, the inlet and outlet structures at pond 8A should be open for muted tidal inflow and outflow. The water level in pond 9 would be controlled by fixed weirs between pond 9 and pond 8A.

Based on modeling of the system for historic tide and evaporation conditions in 1994, the gravity intake system would be sufficient to maintain the maximum salinity goals during periods of weak tides. Weak tide periods are the portion of the lunar cycle with higher low tides and lower high tides. Gravity inflows would only occur at high tide levels in the Bay. During periods of weak tides, with lower high tides, the inflow may be reduced. Weak tide periods may extend for a week to 10 days. A sensitivity analysis was prepared to evaluate the potential effects of extreme high evaporation combined with weak tides. The 1994 weak tide summer period was rerun using evaporation values 20 percent higher than normal. This corresponds to an evaporation condition with approximately a 25-year recurrence interval. This means that on average, it would be exceeded once in a 25-year period.

Ponds 12, 13, and 14 would be operated as seasonal or winter batch ponds. For seasonal pond operations, the pond would be drained initially and no further operation would be required. The pond would fill with 10 to 20 inches of rainwater during the winter that would evaporate during the summer.

As batch ponds, ponds 12, 13, and 14 would not have continuous flow operation similar to 9 and 8A. All inflows to 12, 13, and 14 must be pumped from pond 8x and North Creek. Water would be pumped from 8x in the fall to establish an operational water level in the ponds. Supplemental water may be added during the winter to maintain water levels in dry years. In wet years, surplus water may be released from pond 14 to pond 9 to limit the maximum water level in the ponds. Depending on weather conditions, the batch operation may require gate adjustment weekly or more frequently. If the salinity in ponds 12, 13 and 14 begins to increase in the spring the ponds may require additional inflows to control the salinity. In general, the batch ponds would be drained to pond 9 in the spring to minimize the pumping required for salinity control in the seasonal ponds during the summer high evaporation season.

Baumberg System 8A Adaptive Management Alternatives

Baumberg Complex Pond 12—This pond is presently managed as a system pond with widely ranging seasonal salinities within the Baumberg 8A system. Alternative 2 proposes to operate this pond as a low salinity intake pond in the winter and as a seasonal pond in the summer. As an alternative, Pond 12 could be operated as a batch pond, and possibly as a high salinity batch pond (120-150 ppt salinity), depending upon the dilution flow in Pond 9.

Baumberg Complex Pond 13—This pond is presently managed as a system pond with widely ranging seasonal salinities within the Baumberg 8A system. Alternative 2 proposes to operate this pond as a low salinity batch pond in the winter and as a seasonal pond in the summer. As an alternative, Pond 13 could be operated as a batch pond, and possibly as a high salinity batch pond (120-150 ppt salinity), depending upon the dilution flow in Pond 9.

Baumberg Complex Pond 14—This pond is presently managed as a system pond with widely ranging seasonal salinities within the Baumberg 8A system. Alternative 2 proposes to operate this pond as a low salinity batch pond in the winter and as a seasonal pond in the summer. As an alternative, Pond 14 could be operated as a batch pond, and possibly as a high salinity batch pond (120-150 ppt salinity), depending upon the dilution flow in Pond 9.

Baumberg System 11—The Baumberg System 11 consists of ponds 10 (intake and outlet) and pond 11 (outlet). See Figure 4-25 in the ISP (Appendix A).

This pond group would contain two continuous circulation ponds: 10 & 11. The system has different operation plans for winter and summer seasons to meet summer evaporation conditions. The intake and outlet structures and internal connections were designed to provide circulation for water quality control during the summer evaporation season and allow seasonal flow through pond 11. All four intake gates would allow tidal inflow to pond 10. Two of the culverts would include control gates to allow outflow at the intake structure. All gravity intake flows would occur at high tide. The proposed intake structure would replace an existing intake structure from San Francisco Bay into pond 10. The replacement has been proposed due to the age and condition of the existing intake. The new location has been proposed to improve flow conditions at the intake. The existing intake is located in a large marsh area with tidal action only at high tide. The proposed location would be in an area of lower Mount Eden Creek with less marsh area.

A new 48" gate would be installed between ponds 10 & 11 at the southern end of pond 11. This additional internal connection would supplement existing inflows to pond 11 from pond 10 via two 43" wood gates located in the northern half of the ponds.

There are existing wooden gates from ponds 10 and 11 to a brine ditch on the west side of Mount Eden Creek that would be removed. The brine ditch has been used to transfer water for the commercial salt operation. The ditch connected ponds 10 and 11 with the existing brine pump at pond 13. The brine ditch and the existing gates to the brine ditch will be removed as part of Mount Eden Creek improvements for the Eden Landing Restoration project.

Two outlet structures, one on the eastern end of pond 10 and the other on the southeastern end of pond 11, would discharge to Mount Eden Creek. The outlet structures would both consist of a single 48" culvert. All outflows would occur at low tide. The outlet culverts would be constructed as part of the Mount Eden Creek improvements for the Eden Landing restoration project to replace the existing wooden gates and the existing brine ditch.

The initial stewardship conditions would include different operation plans for each pond during the winter and summer seasons. The operating water levels in the ponds would be lower during the summer to increase the gravity inflow into the system during the higher evaporation season. The water level would be approximately 3.1 ft NGVD during the summer, and 4.0 ft NGVD during the winter. Because of the high bottom elevations in pond 11, it would be only partially wet during the summer. Therefore, pond 11 would be closed off from pond 10 and pond 11 would be operated as a muted tidal or seasonal pond during the summer. Pond 10 would discharge directly to Mt. Eden Creek during the summer.

During the winter, the circulation pattern would be from pond 10 to pond 11, then to Mount Eden Creek. The control gates would be adjusted to maintain higher water levels and create open water habitat in both ponds. Pond 11 would discharge into Mt. Eden Creek during the winter.

Baumberg System 11 will require active management, primarily during the transitions to and from the summer operation conditions. Water surface elevations would be primarily controlled by adjusting the outlet control gates. Intake salinities would be the same as bay salinities and pond salinities would be similar to existing bay salinities.

For the winter operation, the gates from pond 10 to pond 11 would be open. Water from the Bay would circulate from pond 10 to 11. The control gates at the outlet structures from ponds 10 and 11 would be set to provide open water throughout the system.

In the spring the system would be changed to the summer operation condition. This was assumed to occur in early May, but could vary depending on habitat conditions in the ponds. For example, the transition could be delayed or advanced based on use of the pond by migratory birds, or salinity levels in the ponds.

For the summer operation, the pond 10 outlet gate would be adjusted to lower the pond water level by approximately 1.0 feet. This would provide a significant increase in the gravity inflow from the intake culverts in pond 10. The internal connections between ponds 10 and 11 would be closed so that pond 11 would be operated as a seasonal pond or muted tidal pond.

Based on modeling of the system for historic tide and evaporation conditions in 1994, the gravity intake system would be sufficient to maintain the maximum salinity goals during periods of weak tides. Gravity inflows would only occur at high tide levels in theBbay. During periods of weak tides, with lower high tides, the inflow may be reduced. Weak tide periods may extend for a week to 10 days. A sensitivity analysis was prepared to evaluate the potential effects of extreme high evaporation combined with weak tides. The 1994 weak tide summer period was rerun using evaporation values 20 percent higher than normal. This corresponds to an evaporation condition with approximately a 25-year recurrence interval. This means that on average, it would be exceeded once in a 25-year period. The estimated inflow from the gravity intake culverts would maintain the discharge salinity below approximately 40 ppt.

Because pond 11 would be operated as muted tidal or seasonal pond, the pond would slowly drain and dry up over summer and no further management would be required until winter. The pond would then become part of the continuous flow operation in winter. If pond 11 is to be operated as a muted tidal pond during the summer, the outlet culvert would be opened to allow inflow and outflow and the water level would be controlled by the outlet weir. Without the outlet weir the pond would only contain minimal water at extreme high tides.

West Bay Ponds— The West Bay pond group consists of five pond systems. The complex includes seven ponds: 1, 2, 3, 4, 5, S5 and SF2. See Figure 4-27 in the ISP (Appendix A).

As noted above, the West Bay Ponds will remain under current operations for years 1-3 of the ISP. During years 3-6, pond salinities will be reduced to meet discharge standards. Once the ponds can be discharged, they will transition to ISP circulation, under which they would contain five separate sub systems. Ponds 1, 2, 3, and SF2 would each be an independent single pond system with inlet/outlet structures. The inlet/outlet structures would allow tidal inflow at high tide and outflow at low tide. The intake/outlet structures were designed to provide circulation for water quality control during the summer evaporation. All gravity intake flows would occur at high tide, and all outflows would occur at low tide. The proposed intake/outlet structures were located minimize construction within the existing marsh areas along the Bay and slough levees.

The other West Bay pond group would include S5 (inlet), 5, and 4 (inlet/outlet). The major flow to the system would be from the pond 4 intake. There would be a supplemental intake structure to provide circulation from the Flood Slough Restoration Area west of pond S5. The supplemental intake would provide circulation through both ponds S5 and 5.

The West Bay ponds will require limited active management. Once the muted tidal and tidal circulation operation has been established the operation would only require active management to adjust the operating water surface elevations. With outlet weirs, this may be necessary for an unusual event or maintenance, or to improve the habitat conditions within the ponds. Without the outlet weirs, the water levels would be controlled by the outlet control gate settings. The gate settings may require adjustment on weekly or monthly periods.

The five separate sub systems in the West Bay complex include intake/outlet structures. Since the inflows and outflows would occur at the same location, there may be limited mixing within the individual ponds. Shallow areas within the ponds may not be well mixed by wind and wave action. For ponds 1, 2, 3, and 4, the Ravenswood pump station and existing connection structures between the ponds may be used to increase mixing by providing circulation to other locations within the individual ponds.

Alternative 2 would meet all of the stated project objectives, including Objectives A (cease salt production), B (circulate bay water through the ponds), C (maintain existing open water and wetland habitat), e D (maintain ponds in a restorable condition), E (meet all regulatory requirements), and F (cost objectives). Alternative 2 is evaluated in detail in this EIR/EIS.

2.4.4 Pond Management Alternative 3: Phased Initial Discharge

With the exception of a difference in the timing of initial discharge from project ponds and a change in the proposed management of ponds in Baumberg System 11, Alternative 3 is identical to Alternative 2.

Alternative 2 would meet all of the stated project objectives, including Objectives A (cease salt production), B (circulate bay water through the ponds), C (maintain existing open water and wetland habitat), e D (maintain ponds in a restorable condition), E (meet all regulatory requirements), and F (cost objectives). Alternative 2 is evaluated in detail in this EIR/EIS.

Initial Release Period. Under this alternative, the initial release from a limited number of ponds would occur in July/August 2004, with release from other pond systems to follow in subsequent years as salinity levels are sufficiently reduced to meet WQOs. Most of the proposed water control structures are not accessible for construction during the winter. Phased release would allow early July releases from some ponds that can be accessed earlier and that can achieve WQOs for discharge more rapidly, while structures are installed and salinities reduced at the remaining ponds as site constraints allow. Initial discharge of existing pond contents at these remaining ponds would begin the following March/April when salinities within the ponds and receiving waters are the lowest.

Based on construction and operational constraints, ponds that could be included in the first release phase (July release) include Alviso Systems A2W, A3W, A7 and Baumberg Systems 2, 8A and 11. Initial releases from Alviso Systems A14 and A16, and Baumberg System 2C, would likely take place in the subsequent year. Initial releases from the Island Ponds (A19, A20, A21) would not occur for 3 years, and from the West Bay Ponds for six years due to the time needed for Cargill to move the salts from these high salinity ponds back to its plant site in Newark.

The advantages of this alternative are that it allows for early initial releases from some priority ponds and it allows room for adjustments in proposed releases, depending upon observed impacts from first phase releases. However, there remain some concerns regarding this alternative, relative to the ability to meet regulatory requirements for the initial discharge of pond contents and effects of elevated salinity at discharge locations to salmonids and bay shrimp for March/April releases.

Individual Pond Management Strategies The phased release scenario includes modification of the operation for Baumberg System 11 from the operation proposed under Alternative 2 and described in Section 2.4.3, above. Pond 10 is presently managed as a muted tidal pond with an open culvert in the Baumberg 11 ystem and Pond 11 is presently managed as a low to medium salinity system pond within the Baumberg 11 system. Alternative 2 proposes to operate Pond 10 as a low salinity intake pond in the winter and as an intake and outlet pond in the summer. Alternative 2 proposes to operate Pond 11 as a low salinity outlet pond in the winter and as a seasonal pond in the summer.

Because the phased 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 phased release scenario. An alternative initial operation scheme 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 a seasonal pond with no intake or discharge. Pond 11 would partially fill with rainwater during the winter and dry out during the summer.

Pond management would be identical to Alternative 2 for all other systems.

Preferred Alternative. NEPA does not specifically require that agencies identify a preferred alternative. However, under NEPA Regulations 1502.14, agencies shall "identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference." Under CEQA, a typical EIR identifies a "proposed Project" studied in considerable detail, and then identifies a "reasonable range of alternatives" considered in much less detail. Like NEPA, CEQA does not specifically require that agencies identify a preferred alternative. However, CEQA's statutory and regulatory scheme presupposes a single proposed Project as the starting point against which environmental effects are studied and alternatives are measured.

As discussed in Section 2.4.3 above, due to the pioneering nature of the project and lack of existing data from related projects, the impacts of the project are difficult to predict. Therefore, the responsible agencies (USFWS and CDFG) prefer to have flexibility in the implementation of management strategies for specific ponds and pond systems. Alternative 3 incorporates the phased initial release scenario, which offers the maximum flexibility in the timing of initial release, as well as the individual pond management strategies included in Alternatives 2 (including the proposal to breach the Island Ponds and various adaptive management alternatives for individual ponds). Selection of this alternative would allow the agencies a high degree of flexibility to adjust management strategies in response to water quality, habitat, and wildlife impacts that are observed as various components of the project are implemented. The complexity of this project and its pioneering nature call out for such an iterative process. Therefore, the agencies (CDFG and USFWS) have identified this alternative as the Preferred Alternative.

2.5 Comparison of Alternatives

NEPA Regulations (Section 1502.14) require that an EIS present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision-maker(s) and the public. While CEQA requires a greater level of analysis for the Proposed Project, NEPA requires that all project alternatives be given an equivalent level of analysis. Since this project must comply with both CEQA and NEPA standards, all alternatives were considered equally.

Table S-3 in the preceding summary presents the anticipated impacts for each of the alternatives described in Section 2.4 that were analyzed in detail in this EIR/EIS. The standard for information contained in Table S-3 is information without which the public and responsible agencies cannot make a fully informed decision regarding the project.

3.0 HYDROLOGIC AND HYDRAULIC CONDITIONS

This chapter describes the existing hydrological resources within the project area, including the regional hydrology, project hydrology, and flood control benefits of the existing salt production pond levees. It describes hydraulic modeling conducted for the proposed pond management alternatives and identifies hydraulic impacts, including flooding impacts, which could result from implementing the various alternatives.

3.1 Affected Environment

The San Francisco Bay estuary is the largest estuary on the west coast of North and South America and is typically divided into three distinct areas: San Pablo Bay, the Central San Francisco Bay, and the South San Francisco Bay. The Cargill South Bay Salt Ponds encompass 15,100 acres located in South San Francisco Bay. This area of the Bay is shallow and hydrodynamic processes are highly variable and are greatly influenced by tides, wind and wave activity, and freshwater inflows.

South San Francisco Bay (SSFB) is defined as the portion of San Francisco Bay south of the Oakland Bay Bridge. The length of SSFB from the Oakland Bay Bridge to the southern end at Coyote Creek is approximately 50 kilometers. The width of SSFB varies from less than 2 kilometers (km) near the Dumbarton Bridge to approximately 20 km north of the San Mateo Bridge. SSFB consists of broad shoals and a deep relict river channel (Walters, 1982). The mean depth of SSFB is less than 4 meters (m), while the channel is typically 10-15 m deep. Intertidal areas typically contain a system of small branching channels that effectively drain these areas at low water.

3.1.1 SSFB Tides and Tidal Currents

Tidal flows contribute to erosion and sedimentation which affect the formation and shape of channels and inlets in SSFB. The hydrodynamics of SSFB are fairly well understood due to extensive data collection by the USGS and others (e.g., Cheng & Gartner, 1984) as well as modeling of the areas (e.g., Cheng et. al., 1993 and Gross et. al., 1999a). Currents in SSFB are predominantly tidally driven (e.g., Walters et. al., 1985). Tidal amplitude increases with distance from Central Bay SSFB. The mean tidal range at the Golden Gate Bridge is 1.25 meters, the tidal range at Alameda is 1.45 meters and the tidal range at the Dumbarton Bridge is 2.00 meters (NOAA, 2003). The tides in SSFB are “mixed semidiurnal” meaning that high tides occur twice daily and one of the high tides is significantly higher than the other. Tidal currents are stronger in the channel than in the shoals (Walters et. al., 1985) and slack water generally occurs in the shoal regions before the channel. Additional tidal data for SSFB are presented in Section 2.5 (*Hydraulic Setting*) of the ISP.

3.1.2 Freshwater Inflows to SSFB

Most freshwater inflow enters SSFB during the winter and spring. During summer, there is little freshwater inflow to SSFB and most of this freshwater inflow is effluent from municipal wastewater treatment plants. The largest tributaries to SSFB are:

- Alameda Creek, which flows into the Alameda Flood Control Channel (AFCC)
- Guadalupe River, which flows into Alviso Slough
- Coyote Creek, which becomes a tidal slough and connects to SSFB

Streamflow varies greatly from season to season and year to year. As an example of variability within a given year at a single station, the average gauged flow at USGS station #11179000 (Alameda Creek near Niles) during February is 12.5 centimeters per second (cms), while the average gauged flow during October is 0.4 cms. As an example of variability at a single station between years, during February of 1994 the average gauged flow at this location was 3.7 cms, while during February of 1998 the average was 105.2 cms (USGS, 2003).

3.1.3 SSFB Tidal Sloughs

SSFB has several tidal sloughs that provide important habitat for various species. Sloughs also impact the tidal and freshwater flows into and out of the Bay. Descriptions of the tidal sloughs within or near each of the three pond complexes (Alviso, Baumberg, and West Bay) are provided below.

Alviso Complex Tidal Sloughs. The Alviso Complex is located in the Lower South Bay, defined as the portion of SSFB south of the Dumbarton Bridge. The Lower South Bay is a relatively shallow subembayment 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 south in SSFB. Because of the strong tides and small depths, "the area covered by water in the Lower South Bay at mean lower low water (MLLW) is less than half the surface area at mean higher high water (MHHW), indicating that over half of Lower South Bay consists of shallow mudflats that are exposed at low tides" (Schemel, 1998). Furthermore, the volume of water in the Lower South Bay at MLLW is less than half of 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). The following tidal sloughs border the Alviso salt ponds:

- Coyote Creek
- Mud Slough
- Artesian Slough
- Alviso Slough
- Guadalupe Slough
- Stevens Creek
- Mountain View Slough
- Charleston Slough

The largest of these is Coyote Creek, which meets SSFB 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 National Geodetic Vertical Datum 1929 (NGVD). The tidal range in Coyote Creek, reported as 2.2 m at NOAA Station 9414575 (NOAA, 2003), is particularly large.

At the western end of Alviso Pond A21, Mud Slough splits off from Coyote Creek and, bordering Alviso Ponds A21, A20 and A19 (the Island Ponds), continues landward to connect with the Warm Springs marsh restoration area. Mud Slough is a shallow tidal slough, which receives minimal freshwater input during all seasons.

Artesian Slough borders Alviso Ponds A16 and A17 and is a tributary to Coyote Creek. The discharge from the City of San Jose municipal wastewater treatment plant enters the upstream end of Artesian Slough with a RWQCB-permitted dry season flow of 120 million gallons per day (mgd) though flows in recent years have been less.).

Alviso Slough borders ponds Alviso A7, A8, A9, A10, A11 and A12. The Guadalupe River, the second largest tributary to SSFB (after Alameda Creek) in terms of drainage area and flow, 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, most of the volume present in Alviso Slough at high water drains to Coyote Creek (and subsequently SSFB) during ebb tide. Therefore this slough, as well as Coyote Creek and Guadalupe Slough, actively exchanges water with SSFB due to tidal motions.

Guadalupe Slough borders Alviso Ponds 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 freshwater 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).

Stevens Creek, Mountain View Slough and Charleston Slough are relatively shallow and narrow tidal sloughs that contribute little freshwater flow to SSFB and drain relatively small areas.

Baumberg Complex Tidal Sloughs. The Baumberg Complex borders the eastern shore of SSFB and extends from AFCC on the south to San Mateo Bridge on the north. The region near the eastern shore of SSFB is a large mudflat. Relevant tidal sloughs flanking the Baumberg salt ponds are:

- Alameda Flood Control Channel (AFCC; also known as Coyote Hills Slough)
- Old Alameda Creek
- Mount Eden Creek
- North Creek

The largest and most ecologically important slough in this region is the AFCC. Alameda Creek flows into the AFCC. Alameda Creek, which drains an area of 633 square miles upstream of Niles (USGS, 2003), is the largest tributary to SSFB. The U.S. Army Corps of Engineers (Corps) designed and constructed the AFCC. The deepest part of the channel has bottom elevation of approximately -1.5 m NGVD near the mouth of the AFCC and slopes gently up with distance upstream. The portion of the 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). Therefore, the tidal range in the AFCC is quite substantial, but less than the tidal range in nearby areas. Depths in the channel of the AFCC typically range from 2 to 3 m at high water and less than 1 m at low water in the deepest part of the AFCC. In addition, the AFCC contains a large intertidal area, which is only covered with water near high water and is drained during ebb tides. Therefore, a large portion of the water volume present in the AFCC at high water drains into SSFB during ebb tides.

North of the AFCC is Old Alameda Creek. Before Alameda Creek was diverted into the AFCC, it drained into what is now known as Old Alameda Creek. Currently, Old Alameda Creek receives minimal freshwater input. It comprises 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. Limited water elevation data for Old Alameda Creek indicate that high water elevations, measured about 2 km from the mouth of Old Alameda Creek, are as high as 1.8 m NGVD, and low water elevations are typically near the bed elevation of -0.5 m NGVD (ISP September 2003).

Additional tidal channels and marsh areas are currently under construction in the Baumberg Complex. These sloughs are part of an ongoing tidal restoration project. When this restoration project is complete, Mount Eden Creek and North Creek will connect the Eden Landing Ecological Preserve to San Francisco Bay. North Creek will connect directly to Old Alameda Creek, approximately 2 km from SSFB, and Mount Eden Creek will enter the Bay, approximately 2 km north of the mouth of Old Alameda Creek.

West Bay Complex Tidal Sloughs. The West Bay Complex is located on the western side of the Dumbarton Bridge. The Dumbarton Strait, with a width of approximately 2 km, is the narrowest part of SSFB. The mean tidal range in the Bay at this location is 2.0 m (NOAA, 2003). Observed velocities in this region, for example currents measured at USGS/NOAA station C14, 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 System is Ravenswood Slough. Local freshwater input to this slough is relatively low.

3.1.4 Flood Protection

Previous studies (USACE 1988) identified approximately 80 miles of of salt pond levees that are boundaries to other private and public properties. Many of these levees were not designed to provide flood protection and do not meet Corps of Engineers design standards. The salt pond levees have been raised periodically to compensate for past land subsidence and have been maintained by Cargill (and previously the Leslie Salt Company) for erosion. The majority of the levees in the project area were not designed or maintained as flood control measures. Furthermore, the levees were not designed to Corps standards for flood control. Therefore the levees do not provide for flood control as they are currently designed and maintained.

According to the USACE 1988 shoreline study, there have been few failures of the salt pond levees. However, the crest of some levees may not be high enough to prevent overtopping during extreme high tide and wind wave events. The USACE report identified the following as salt pond levees that were selected for additional tidal flooding analysis.

- Reach 17- Alviso
- Reach 19 – Sunnyvale
- Reach 21/22 – Mountain View/South Palo Alto
- Reach 23 – North Palo Alto

This list may not include all salt pond levees that may provide incidental flood control benefits. The Coastal Conservancy has recently retained a flood control specialist to review and update the list of critical flood control levees as part of final design efforts.

The work on this review is under way at this writing and there are no results that are suitable for reporting here.

3.2 Criteria for Determining Significance of Effects

Criteria for determining significance of hydrological effects are based upon professional judgment, review of previous studies, and CEQA Guidelines. Criteria pertaining to water quality issues are presented in Chapter 4 (Water Quality). A project would have a significant hydrologic impact if it would:

- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in flooding on- or off-site.
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows.
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam, inundation by seiche, tsunami, or mudflow.
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

For NEPA purposes, Executive Order 11988, Floodplain Management, applies to the project. In addition, DOT Order 5650.2, Floodplain Management and Protection, requires that federal agencies take actions that will "preserve the natural and beneficial values served by floodplains."

3.3 Environmental Impacts and Mitigation Measures

Schaaf and Wheeler (S&W) used several hydraulic models to evaluate the hydrologic impacts of various pond management alternatives. These models and their results are discussed below under Alternative 2: Simultaneous March/April Initial Release. The No Project/No Action Alternative and Alternative 1: Seasonal Ponds were not specifically modeled, but the results of modeling for the pond management alternatives serves as the benchmark against which impacts from the other alternatives can be compared.

3.3.1 No Project/No Action Alternative

Under the No Action alternative waters would be allowed to evaporate in the ponds. The ponds would then fill seasonally with rainwater each winter and dry through the evaporation process each summer. No action would be conducted by the agencies, including levee maintenance, and some levees would likely fail during this period. Existing public access would be lost in areas of levee failure

HYDROLOGY IMPACT-1: Increased flooding of adjacent properties may result from erosion of salt pond levees that offer some flood control benefit.

The majority of the salt pond levees in the project area were never designed to provide flood protection for adjacent properties. However, these levees have been providing some flood control protection as an incidental benefit. Under the No Project/No Action Alternative, the existing levees would be allowed to degrade over time, which may lead to an increased risk of flooding of adjacent properties from those levees that do provide this incidental flood control benefit.

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

HYDROLOGY IMPACT-2: Increased tidal prism and associated velocities within the ponds due to uncontrolled levee breaches may re-suspend sediments, resulting in erosion of pond sediments and subsequent deposition in receiving waters.

As the existing salt pond levees degrade over time, the individual levees may fail in an uncontrolled manner, allowing tidal circulation into the ponds. Tidal circulation would result in an increase in velocities and shear forces within the ponds. The increased velocity may result in erosion of sediments and input of additional suspended sediments to receiving waters. In ponds with known or potential contaminated sediments at depth, this increased velocity may result in erosion of contaminated sediments and transport and deposition into receiving water bodies. Impacts pertaining to suspended sediments and contaminated sediments and their transport are also addressed in Chapters 4 (Water Quality) and 5 (Sediments).

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

3.3.2 Alternative 1: Seasonal Ponds

In Alternative 1 waters would be allowed to evaporate in the ponds. The ponds would then fill seasonally with rainwater each winter and dry through the evaporation process each summer. The only action taken by the agencies would be to maintain the levees at their current standard of maintenance (i.e., salt pond maintenance, not for flood control).

The flood protection benefit provided by pond levees to adjacent properties would be maintained and the potential flooding impacts considered under the No Project/No Action Alternative would not apply. Maintenance of the levees would also reduce potential impacts from increased erosion of pond sediments and transport into receiving waters.

3.3.3 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 later years when salinities in the ponds have been reduced to appropriate levels. The Island Ponds (A19-A21) would be breached and open to tidal waters.

Schaaf and Wheeler (S&W) conducted extensive hydraulic and salinity modeling of various project alternatives considered in the ISP (LSI 2003 (ISP). S&W did not study or model sediment transport. Impacts considered in this section are limited to hydrology and sedimentation. Chapter 4 (Water Quality) addresses salinity impacts. The ISP (Appendix A) and other technical reports (Appendix D) describe modeling methods and results in detail. This section summarizes information contained in these documents and provides specific references to the relevant documents.

Description of Hydrologic Models Used. The key feature of the water management plan for the project is the circulation of Bay water through the ponds and release of this water to the receiving sloughs and channels in the South Bay. During the first period of circulation through the ponds, referred to as the initial release period, the water currently in the ponds will be discharged to the Bay and replaced with Bay water brought into the ponds at the intakes. This circulation is different than the existing salt making operations because the pond systems will circulate water back to the Bay and because the flow rate through the ponds will be increased relative to existing flows.

Computer models were applied to estimate the water surface elevations and velocities within the ponds and receiving water bodies during the Initial Stewardship period. S&W used two types of models:

1. Pond Model. The Pond Model was used to estimate inflows to the ponds from the Bay, flows between ponds, volume of water evaporated from the ponds, volume of water added to the ponds by precipitation and flow rates from the ponds to the Bay and sloughs. Section 3.3.1 of the ISP (Appendix A) contains a description of the Pond Model. Results of the Pond Model are presented in the ISP (LSI, 2003) and are summarized below.
2. South San Francisco Bay Model. A three-dimensional hydrodynamic model was used to estimate physical conditions (flows, tides, currents etc.) in the Bay and sloughs. Section 3.3.2 of the ISP (Appendix A) contains a description of the South San Francisco Bay Model. Model results are presented in Appendix D.

S&W modeled both the simultaneous March/April initial release and the phased release alternatives. Results of the Pond Model were used as an input to the hydrodynamic models to evaluate potential project impacts on receiving waters.

In addition, S&W conducted finer resolution modeling of the impacts of breaching the Island Ponds (Alviso Ponds A19, A20, and A21) and restoring them to tidal flow.

The Pond Model and South San Francisco Bay Model require tide and weather input data. As discussed in Section 3.3.3 of the ISP (Appendix A), pond and receiving water conditions were modeled for a simulation period of 19 months (April 1994 to October 1995), which includes two summer periods and one winter period. The particular period was selected to include a relatively recent period where Bay tidal and salinity profile information was available, and to include a range of meteorological conditions. 1994 represents a relatively dry year, with above average salinity in the South Bay, while 1995 represents a relatively wet year with low average salinity in the Bay and sloughs and a higher likelihood of flood conditions that could affect the stability or erosion of the ponds.

Results of Hydrologic Modeling. This section summarizes the modeled hydrologic changes within the pond complexes. Chapter 4 of the ISP presents detailed descriptions of the water levels anticipated within each of the ponds and other modeling results.

The modeled initial release scenarios in the ISP are as follows:

- Alternative 2: Simultaneous March/April Initial Release - All systems except the island ponds (A19, A20, and A21), the A23 system, and the West Bay pond group to begin discharge in April. Initial pond salinities based on maximum salinities shown in Table 4-3.
- Alternative 3: Phased Initial Release - Selected ponds would begin initial release at the same time. These would include Alviso Systems A2W, A3W, 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 staggered 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 initial pond salinities were based on the maximum salinities from ISP Table 4.1.5. The remaining pond systems, Alviso Systems A14 and A16, and Baumberg System 2C, would start circulation in the subsequent year. The initial release for these later systems is proposed for April and would be similar to the Simultaneous Release scenario above.
- April 2002 Values – An additional modeling scenario, not directly related to an Alternative, used actual pond salinity values from April 2002 (rather than maximum values) to examine more likely results of a March/April simultaneous discharge.

Alviso Complex Ponds

Results for each pond system are complex and presented in detail in Chapter 4 of the ISP (Appendix A). Although the ISP operation would allow tidal circulation through the pond system, the flow into and out of the ponds on a daily basis would be relatively small compared to the volume in the ponds. A goal of all the pond modeling alternatives is to maintain long-term discharge salinities below 40 ppt and to maintain water levels as close to existing conditions as possible. Typical daily water surface elevations would fluctuate by less than 0.1 ft in most pond systems. The ponds are managed to reduce salinity within the ponds to an acceptable level within an initial discharge period.

Island Ponds

The Island Ponds (Alviso Ponds A19, A20, and A21) would be breached in a controlled manner to allow them to return to full tidal action. If the ponds are restored to full tidal action, available hydrologic modeling indicates that they would be inundated on the higher high tides but would be above water at other times during the tidal cycle (S&W, 2003).

S&W ran hydrodynamic simulations of existing conditions and breach conditions for the Island Ponds. The models and model results are described in the Alviso Island Pond Breach Initial Stewardship Plan Study in Appendix __ (referred to hereafter as the Island Pond Study (S&W, 2003). In the analysis, Ponds A19 and A21 contain two breaches and A20 contains a single breach. S&W analyzed flow through nine cross-sections and through each of the five breaches (see Figure 1-2 of Appendix A). The dimensions of the initial pond breaches is equal to the smallest grid spacing of the model at 25 meters and is larger than what will likely be constructed in the field. It is expected that the actual initial breaches constructed for the project would be fairly small and that they would be allowed to open up over time due to erosion. These assumptions are considered to be conservative, since they may overestimate the rate at which water is initially released from the ponds to Coyote Creek.

Two different initial breach scenarios were evaluated for the ISP. The first scenario assumes that the elevation in each breach is near the elevation of the pond bottom, and is referred to as the Breach at Pond Bottom Elevation scenario. The breach width in this scenario is 25 m. This scenario provides a conservative estimate of the initial release of the pond water because, though it is expected that the initial breach elevation may be near the pond bottom elevation, it is likely that the initial breach width will be less than 25 m. This scenario is discussed further in Section 5.1 of the Island Pond Study (S&W, 2003)

The second scenario assumes that each breach elevation is at 0 ft NGVD, and is therefore referred to as the Breach at 0 ft NGVD scenario. The breach width in this scenario is also 25 m. This scenario provides an even more conservative estimate of the initial release of the pond water and represents the maximum rate of exchange in Coyote Creek that is plausible for the initial breach of Ponds A19, A20, and A21. This scenario is discussed further in Section 5.2 of the Island Pond Study (S&W, 2003)

The model report uses conservative assumptions that result in the maximum possible tidal prism in the ponds. However, as a result of other various model assumptions and limitations, the S&W analysis should not be considered a worst-case or overly conservative estimate. The velocities and velocity differences could be greater than predicted by the simulations, although this is not considered likely.

A comparison of simulation results for existing conditions and the two breach scenarios is summarized below and presented in detail in the Island Pond Study (S&W, 2003). These results give an indication of the potential effect that breaching the Island Ponds would have on the tidal range, tidal prism, local velocities, and local bed shear stresses in the Alviso region.

Tidal Elevation Impacts of Island Pond Breaching—The breaches would affect the tides in Coyote Creek, with effects varying by location. Adjacent to the Island Ponds, the predicted tidal range decreases and both low water and high water elevations are affected. At the Island Ponds, the tidal range is reduced by approximately 6 inches. The existing tidal range is approximately 7 feet. Downstream of the Island Ponds, the predicted tidal range changes only slightly by increasing the elevation at low water. Upstream of the Island Ponds, the predicted tidal range decreases slightly, due to decreased high water elevations.

Tidal Prism Impacts of Island Pond Breaching—Breaching the Island Pond levees would increase the tidal prism in the Alviso region; in particular, it would influence the tidal prism of Coyote Creek. An increase in flow into and out of Coyote Creek during the tidal cycle would lead to increased velocities in Coyote Creek. Because Coyote Creek is known to be a depositional environment, increased velocities could either cause the Coyote Creek sedimentation regime to become less strongly depositional or lead to scour. Velocity simulation results are discussed further below ("Velocity Impacts of Island Pond Breaching").

Based on the S&W simulation results, it is expected that breaching the Island Pond levees will increase the tidal prism in regions of Coyote Creek located adjacent to the levee breaches and downstream of the levee breaches. For the regions adjacent to the levee breaches, the predicted increases in tidal prism are substantial, while in the regions downstream of the levee breaches, the predicted increases in tidal prism are smaller. Upstream of the levee breaches, in portions of Coyote Creek and Artesian Slough, the predicted tidal prism decreases. The analysis of cross-sectional velocities predicted maximum velocities at the Island Pond breaches ranging from 1.79 to 4.54 feet per second (ft/s). The maximum velocity magnitude for a stable inlet channel should be about 1.0 ± 0.15 m/s (3.28 ± 0.5 ft/s, Goodwin 1996). The maximum predicted velocities at the downstream breach for Pond A21 and the downstream breach for Pond

Velocity Impacts of Island Pond Breaching—The S&W analysis included simulation of cross-sectional velocities and depth-averaged velocities throughout the Alviso region under existing conditions and breach conditions. A19 exceed this range, which suggests that these breaches may scour to be wider than 25 m (the initial breach width for both breach scenarios modeled).

The analysis of depth-averaged velocity throughout the Alviso Region gives a prediction of the daily Root Mean Square (RMS) velocity and maximum velocity at each horizontal location in the model grid for a representative day (June 7, 1994) from the month-long (June 7 to July 7, 1994) simulation. The RMS velocity gives a weighted average of the velocity that occurs at each modeled grid cell.

Results of the depth-averaged velocity analysis show that the levee breaches will result in increased tidal velocities in regions of Coyote Creek located adjacent to the levee breaches and smaller increases downstream of the levee breaches. The tidal velocities are expected to decrease upstream of the levee breaches and in Artesian Slough, Mud Slough and the Warm Springs Marsh area. For the majority of the area, the breach scenario results in a less than 0.1 ft/s change in predicted maximum velocities compared to existing conditions. Maximum predicted velocity magnitude increases of 0.1 to 0.2 ft/s are seen in the channel of Coyote Creek from the open boundary to the mouth of Mud Slough. The greatest increases in predicted RMS velocities under breach conditions occur between the mouth of Mud Slough and the Pond A19 breach.

Between the mouth of Mud Slough and the Alviso A19 breach (downstream of the breach), maximum predicted depth-averaged velocities also increase by approximately 0.5 fps, with the highest increases seen immediately adjacent to the levee breaches. Upstream of the Pond A19 breach, the predicted maximum velocities in Upper Coyote Creek and Artesian Slough are reduced under the Long-Term Breach scenario.

Concerns have been raised that increased velocities in Coyote Creek could cause scour at the Union Pacific railroad bridge which crosses Coyote Creek between ponds A21 and A20. S&W conducted an analysis of the potential for scour of this railroad bridge if the Island Ponds are breached. The analysis assumed that, at present, the channel cross-sectional geometry (bathymetry) at the railroad bridge is at or near equilibrium with the cross-sectional velocities. That is, it was assumed that under present conditions neither scour nor deposition occurs. This implies that, with an increase in velocity following breaching of the Island Pond levees, the cross-sectional area would increase at the railroad bridge until the cross-sectional average velocity at this location is equal to the cross-sectional average velocity under existing conditions (i.e., the geometry of the channel would return to equilibrium with cross-section velocities). Under this assumption, larger than existing tidal velocities would lead to scour. Conversely, smaller tidal velocities should lead to deposition.

The assumption that the channel geometry at the railroad bridge is presently at or near equilibrium with cross-section velocities is considered conservative and is likely to overestimate the extent of scour that would result from the levee breaches for several reasons. First, as noted above, field data suggests that Coyote Creek is not presently in equilibrium and that it is actually a depositional environment. Therefore, it is likely that tidal velocities could actually increase to some extent without leading to scour. In addition, at present, the channel of Coyote Creek may already be scoured to some extent during and following large storms when freshwater flows in Coyote Creek are large. Scour, which presently occurs due to freshwater flows, would probably not be significantly changed by the presence of the levee breaches.

Based on the modeling results, it is estimated that during both flood and ebb tides, following the breaching of the Island Pond levees, the cross-sectional area at the railroad bridge would increase by approximately 20 to 30 percent before the channel would return to a state of equilibrium with channel velocities equivalent to existing conditions.

Either a widening or a deepening of the channel could accomplish the predicted increase in cross-sectional area. During flood tide, a depth adjustment of approximately 1.5 to 3 feet would be required in the channel region. It is unknown what the impact to the existing railroad bridge will be due to the potential 3 foot deepening of the channel in this area. Therefore, a mitigation measure to inspect the bridge piers has been included as described below.

Baumberg Complex Ponds

Hydrologic modeling indicates that, in general, the ISP will result in slightly lower elevations and possibly more frequent drawdown. Under ISP modeled conditions, Baumberg System 2C (Ponds 6, 5, 6C, 4C, 3C, 5C, 1C, and 2C) would have average water depths about 0.1 to 1 foot higher than existing conditions, although some of those Ponds (1C and 5C) would still be seasonal. The remaining Baumberg ponds would have average water depths about 0.5 to 2 feet lower than existing conditions. Average water depths in the Baumberg Ponds would range from zero to about 2.5 feet in summer, and about 1.0 to 2.5 feet in winter. Water levels under the ISP are therefore likely to be at or below the sediment elevation for some portion of the year. Hydrologic modeling indicates that water levels would vary by about 0.5 feet, due to weather and tides.

West Bay Complex Ponds

Hydraulic modeling of the West Bay Ponds was included in the final ISP (Appendix A). The West Bay pond group consists of five pond systems. The complex includes seven ponds: 1, 2, 3, 4, 5, S5 and SF2. The ponds will be managed to maintain long term discharge salinity levels to below 40 ppt and to establish tidal circulation through the ponds.

> *HYDROLOGY IMPACT-1:* Increased flooding of adjacent properties may result from erosion of salt pond levees that offer some flood control benefit.

The project design allows for increased tidal flows through hydraulic structures to accelerate reduction of pond salinity. Although unlikely, this increased tidal flow could lead to the acceleration of levee erosion and a reduction in flood control benefits. As noted above under the No Project/No Action Alternative, salt pond levees were never specifically designed to provide flood protection for adjacent properties. However, these levees have been providing some flood control protection as an incidental benefit.

Except for the Island Ponds (A19, A20, and A21), the existing levees would be maintained to meet existing flood control benefits under this alternative. Therefore, for the pond levees, the existing level of flood control benefit would be maintained and impacts would be less than significant.

Significance: Less than Significant.

> *HYDROLOGY IMPACT-2:* Increased tidal prism and associated velocities within the ponds could re-suspend sediments, resulting in erosion of pond sediments and subsequent deposition in receiving waters.

Under Alternative 2, tidal inflows would circulate through the pond systems and return to the Bay. The increased flow through the ponds may result in an increase in velocities and shear forces within the ponds. This increased velocity may result in erosion of sediments, transport of suspended sediments, and deposition of those sediments into receiving water bodies. In ponds with known or potential contaminated sediments at depth, this could result in transport of contaminants to receiving waters. The exact nature and location of scour that could result is impossible to predict.

For most of the managed pond systems, significant increases in tidal prism and in velocities and shear forces are not anticipated. Therefore, the potential for widespread scour within tidal marshes and channels adjacent to these systems is considered unlikely. Typical flow velocities in the ponds are estimated to be much smaller than existing wind and wave-generated velocities.

The Island Ponds are likely to be breached and to function as fully tidal systems. Sediments in the Island Ponds do not contain elevated levels of contaminants. The Island Pond breaches may increase scour and release sediments at the breach locations, some channel areas, and within the ponds as pond bottoms drain at low tide. At the same time, the ponds represent a major depositional area added to Coyote Creek. At high tide, water from Coyote Creek will deposit sediment within the ponds as the pond bottoms transition to high marsh. The balance between net erosion and sedimentation will depend on the rate at which the breaches expand by erosion in comparison to the deposition within the ponds

Significance: Less than Significant.

> *HYDROLOGY IMPACT-3:* Breaching of Island Ponds could result in increased velocities in the surrounding areas, resulting in erosion of mud flats and damage to the Southern Pacific railroad bridge piers.

Modeling by S&W (see discussion above) concluded that breaching of the Island Ponds is likely to cause an increase in velocities and scour potential within Coyote Creek around the railroad bridge. S&W estimated scour depths of 2-3 feet around the railroad bridge based on conservative assumptions regarding existing sedimentation conditions in Coyote Creek. It is not anticipated that this scour depth would cause damage to the railroad bridge. However, the exact nature and extent of any scour problems on adjacent mud flats or the railroad bridge piers is unknown and difficult to quantify with modeling alone. It is also possible that the current depositional environment could handle an increase in velocities without significant erosion or scour.

The potential erosion in the marsh and mudflat areas of Coyote Creek were not included in the scour analysis. However, S&W found that the potential for scour of existing mudflats is limited by several factors including the brief inundation period at high tide, low velocities near slack water, protection from existing marsh vegetation and limited water depths.

Significance: Potentially significant.

> *HYDROLOGY MITIGATION-2A:* A qualified engineer should conduct regular inspections of adjacent mudflats and the railroad bridge piers during the first 5 years following breaching to look for evidence of scour or damage to bridge pier supports. This inspection should be coordinated with regular bridge inspections conducted by Union Pacific

The engineer should prepare inspection reports documenting the results of the inspection and any recommendations for additional work.

> *HYDROLOGY MITIGATION-2B:* If bridge inspections identify excessive scour or damage to bridge piers not related to weather patterns or upstream changes, then a qualified engineer shall develop a plan for protecting the piers and USFWS work with the railroad tol implement the plan.

Post-mitigation Significance: Less than significant

> *HYDROLOGY IMPACT-4:* Flow into the ponds may result in excessive sediment deposition near inlet/outlet structures that could impact operation of water control structures.

As velocities of water carried away from the water control structures are reduced, additional sediments are deposited adjacent to water control structures and "delta" formation occurs. Excessive sediment deposition could impede operation of the water control structure and impact water management operations.

Significance: Not significant in Island Pond under full breached conditions (since no structures are used). Potentially significant in other pond systems.

HYDROLOGY MITIGATION-3A: Conduct annual inspections of all water control structures.

USFWS and DFG will conduct an annual inspection of all water control structures to look for areas of excessive sediment deposition or scour. Results of these inspections will be recorded on maintenance log sheets along with any follow-up inspections or maintenance sediment removal or regrading operations.

> *HYDROLOGY MITIGATION-3B:* Remove deposited sediment and regrade as required to avoid deposition impacts.

In areas where sediment deposition interferes with culvert function, USFWS or CDFG, as appropriate, shall implement measures to remove deposited sediment and regrade as required to avoid deposition impacts.

Post-mitigation Significance: Less than significant

3.3.4 Alternative 3: Phased Initial Release

Impacts and associated mitigation measures are as described for Alternative 2 above (Section 3.3.3). The timing of initial release will not affect hydrologic impacts. It is not anticipated that there will be different impacts beyond those described for Alternative 2.

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.

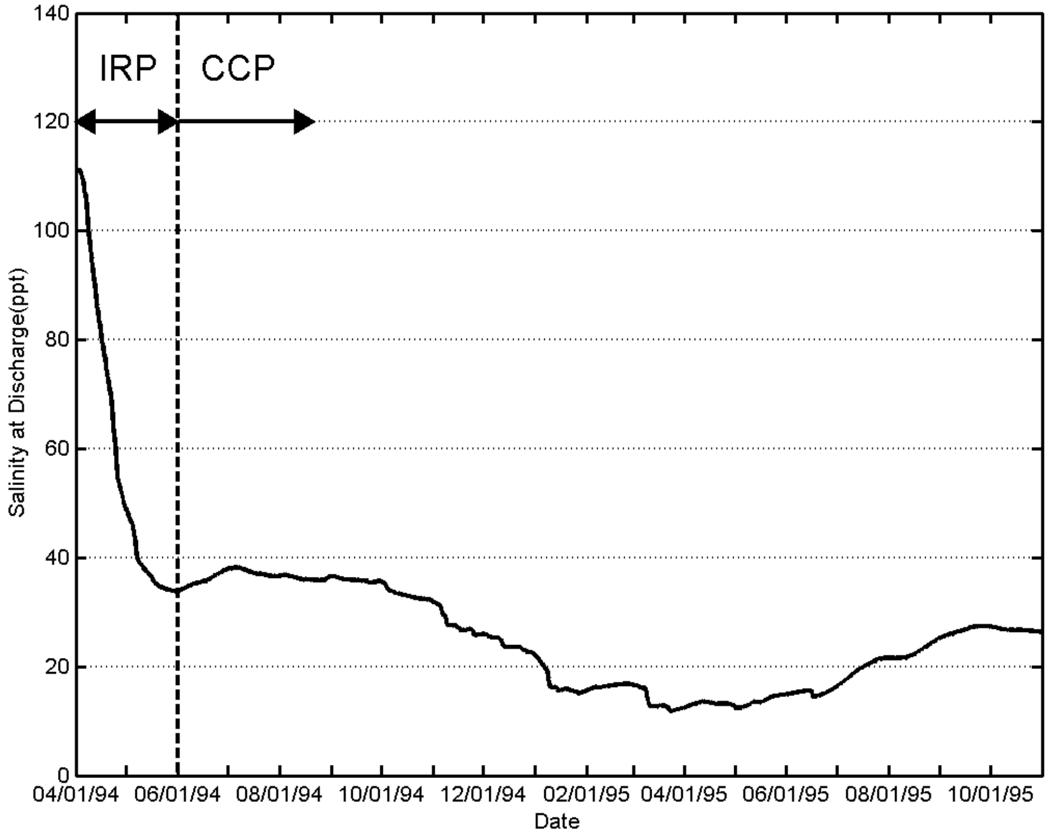


Figure 4-1 – Representative Pond Discharge Salinity (Pond A7)

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.

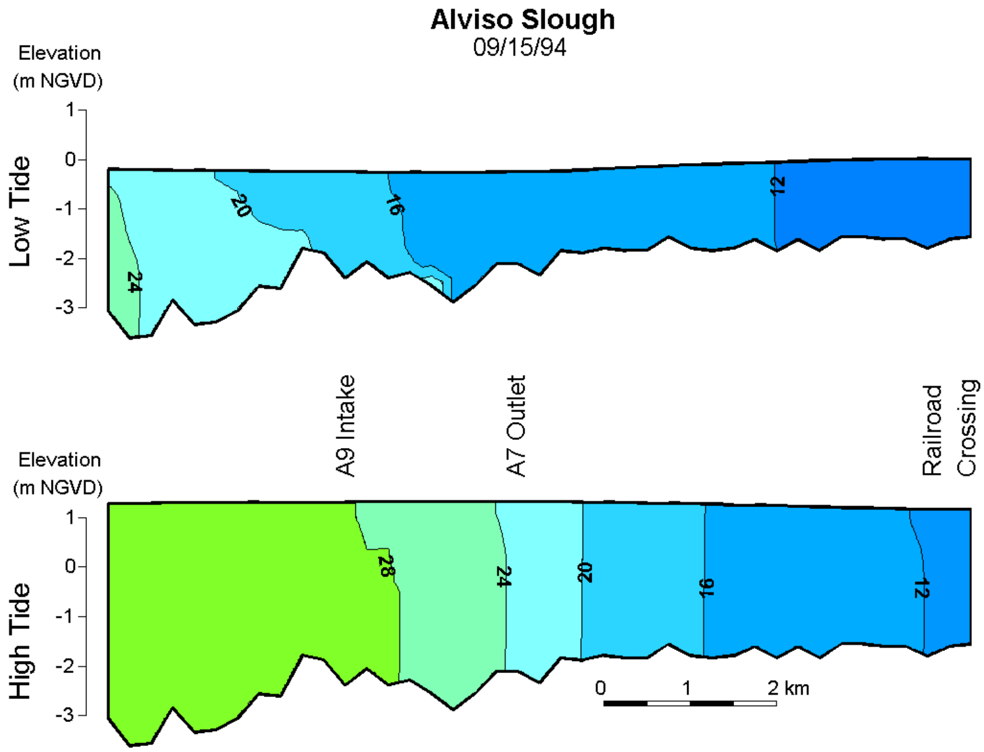
The ISP salinity conditions for the bay and major sloughs were predicted by hydrodynamic computer models for the IRP and CCR conditions. The model results describe several types of salinity values to characterize the salinity conditions in the receiving waters.

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

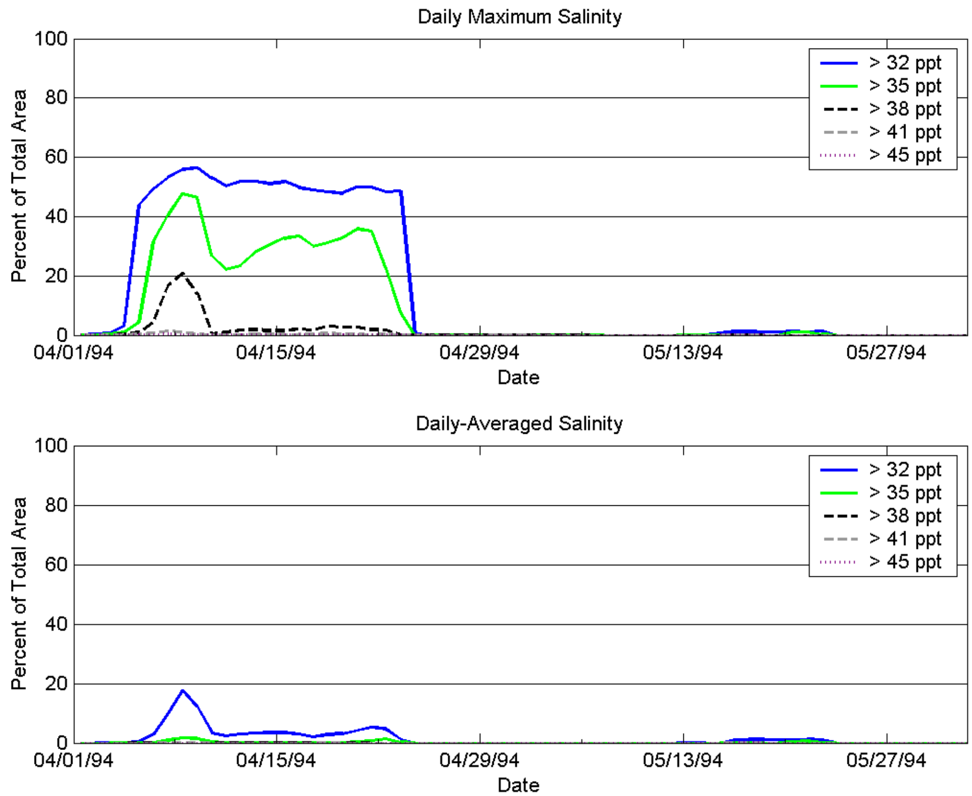
This segment of the receiving waters includes Coyote Creek, Alviso Slough, Guadalupe Slough, Alameda Flood Control Channel, and Old Alameda Creek. The existing salinity conditions within the creek and slough areas near the proposed discharge locations are highly variable. Average salinities near the 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	Acres By Salinity Class[1]: Ambient Conditions	Drought Conditions	Stage 1	Stage 2	Stage 3	Stage 4	Duration[3]	Context[4] – Percent of Area	Impact Significance
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

Receiving Water and Alternatives	Date[2]	Total Acres	Acres By Salinity Class[1] 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.

5.0 SEDIMENTS

This chapter describes existing sources and levels of contamination in pond sediments within the project area. Available sediment data from past sampling efforts are compared to various sediment screening criteria. The available sampling data are most abundant for the Alviso ponds and are more scant for the Baumberg and West Bay ponds.

The project is not anticipated to generate additional contaminants that could impact sediments; however, the proposed changes in pond hydrology could impact the mobility and bioavailability of sediments. These and other sediment-related impacts are addressed in this section. Since organic chemicals were either not detected in pond sediments, or were detected at very low concentrations and are not likely to pose any additional risk to human health or the environment, the analysis of impacts focuses on impacts related to inorganic chemical contamination. Sediments will also be impacted by and will cause impacts to water quality in the project area. Water quality impacts are addressed in Chapter 4. Biological impacts related to sediment contamination are also addressed in the Biological Resources section, Chapter 6.

5.1 Affected Environment

5.1.1 Sources of Sediment Contamination

The Cargill ponds were constructed for salt making purposes starting in the early 1900s by building levees around existing marshes, mudflats, and open water areas. Some of the Alviso ponds (A1 through A7) were constructed in the late 1940s. The sediments in the Alviso area have historically been subject to significant sources of contamination from historical mining activities (especially for mercury) in the Coastal Range and Guadalupe River watershed. These mining activities resulted in the mobilization of large amounts of mercury-rich sediment into these downstream, wetland areas. Since diking the areas into ponds for salt-making operations, the source of contaminant input into these areas has generally been restricted to what comes in with the intake water, including some suspended sediment. Some contamination may also originate from the large wastewater treatment plant located upstream from the salt ponds and from urban runoff from the heavily populated and industrialized watershed. Ponds A5, A7 and A8 are not fully isolated during flooding events in the Guadalupe River, and can receive suspended sediment in floodwaters. Suspended sediment in the ponds can then be transferred between ponds by an array of weirs and culverts.

5.1.2 Description of Available Pond Sediment Contamination

Assessment of sediment quality in the ISP ponds was based on available sediment analytical data. Sediment samples were collected from 19 of the 57 ponds that are included in the ISP. These ponds are generally representative of all the ponds addressed by the ISP because they reflect the range of water depths and salinities present throughout the ISP ponds. Sampled ponds ranged in average water depth between 0.7 feet and 4.1 feet; historic salinities in sampled ponds have ranged between 11 and 340 parts per thousand.

More specifically, the ISP pond sediments data set consists of:

- 18 samples collected by the U.S. Fish and Wildlife Service ("USFWS data") from Alviso ponds A1, B1, A5, A9, A10, and A16.

- 12 samples collected by Cargill in 2002 (“Hydroscience data”) from Alviso ponds A2W, A3W, A5, A9, A15, A16, and A17; Baumberg ponds 2C, 8A, and 10; and West Bay Pond 1. This data set also includes two samples collected from the Bay adjacent to the Alviso and Baumberg pond complexes.
- 59 samples from Pond A18 collected by the City of San Jose prior to purchase of that pond from Cargill (“A18 data”).
- 20 samples from Ponds A4 and A8 collected by the Santa Clara Valley Water District in 1997 and 2000 as part of Phase I and Phase II hazardous substance liability assessments (“A4 and A8 data”).
- 6 samples from Ponds A19, A20, and A21 collected by Cargill in 2002 (“Island Pond data”).

Pond A4 is owned by the Santa Clara Valley Water District and Pond A18 is proposed to be purchased by the City of San Jose. Although these ponds are not part of the ISP, they are part of the South Bay salt pond system and are illustrative of general sediment quality in the area. Therefore, the A4 and A18 data were included in this evaluation to maximize available data and facilitate evaluation of ISP pond sediments.

As noted above, most of the available data are from the Alviso ponds. The Alviso ponds are located near the mouths of Alviso Slough, Guadalupe Slough, and Coyote Creek. This area is more directly affected than other ISP pond complexes by contaminants associated with historic mercury mining in the Guadalupe River drainage, municipal and industrial wastewater discharge, and the outflow of contaminants from an urban watershed. The weighting of the data toward the ponds closer to contamination sources is environmentally conservative.

5.1.3 Sediment Criteria

Available sediment data were compared with a variety of screening criteria that are commonly used to assess the quality of San Francisco Bay Area sediment. Those screening criteria comprised the San Francisco Bay ambient values, the San Francisco Bay Regional Water Quality Control Board (RWQCB) cover and noncover criteria, Effects Range-Low and Effects Range-Median criteria (ER-Ls and ER-Ms), and local ambient data from the Guadalupe River and other areas in the vicinity of the ISP ponds. These screening criteria are described below.

San Francisco Bay Ambient Values The RWQCB developed the San Francisco Bay ambient values (SFBRWQCB 1998) to represent the typical range of concentrations currently found in Bay sediments located away from sources of contamination. These values are listed in Table 5-1.

Typical “ambient” concentrations in Bay sediments are distinguished from “background” values that are defined as pre-industrialization (i.e., before about 1850) or naturally occurring levels of chemicals. Sediment chemistry data were obtained from the 1991 Pilot Study, Regional Monitoring Program Data from 1992 through 1995, and the RWQCB Bay Protection and Toxic Cleanup Program’s 1995 Reference Site Study (as cited in RWQCB 1998). Sediment samples were collected from the spine (i.e., deep portions) of the Bay away from known sources of constituents of concern (COC) or “hot spots” and were compiled into a database representative of ambient conditions in open water areas of the Bay. Because these Bay sediment samples were collected from the deepest portions of the Bay away from contaminant sources, these values are widely used as “clean” background standards in place of other nationally based criteria, such as ER-Ls**.**

The data set was screened for statistical outliers, and the 85th percentile of the remaining data distribution for each chemical was selected to represent the upper bound or threshold value for ambient sediments. Increasing COC concentrations were found to be associated with increasing percentage of fine-grained sediments (fines; i.e., clays and silts). For some COCs, the distribution of the data indicated two subgroups (bi-modal) associated with sediment samples: a group above and a group below 40 percent fines. To take the two subgroups (bi-modal distribution) into account, the RWQCB calculated two upper-bound numbers: one for sediments containing less than 40 percent fines, and one for sediments containing 40 to 100 percent fines. Sediments at the project site are predominantly fine-grained (versus coarse-grained, sandy sediments); ambient values for 100 percent fines were used for comparison with ISP pond sediment data.

Table 5-1
San Francisco Bay Ambient Values

Constituent	San Francisco Bay Ambient Values (mg/kg)
Arsenic	15.3
Cadmium	0.33
Chromium, total	112
Copper	68.1
Lead	43.2
Nickel	112
Mercury	0.43
Selenium	0.64
Silver	0.58
Zinc	158
PAHs, total	3.39
DDT	0.007
PCBs, total	0.0148

Notes: mg/kg = milligrams per kilogram; PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenols

ER-Ls and ER-Ms ER-Ls and ER-Ms are toxicity-based thresholds for sediment that were developed by the National Oceanic and Atmospheric Administration (Long et al. 1995). Although NOAA did not develop these values for use as regulatory criteria, they are commonly used by state and federal regulatory and resource agencies as screening guidelines for assessing the potential for biological effects associated with contaminants in San Francisco Bay sediments. ER-L and ER-M values for inorganics and organics are listed in Table 5-2.

It should be noted that some inorganics, including arsenic, chromium, copper, mercury, nickel, and zinc, are commonly detected in ambient Bay sediments at concentrations higher than ER-Ls. Therefore, while ER-L values are useful as a measure of predicted biological effects, they are not commonly used by the agencies for regulating sediment quality in and around the Bay.

These values were calculated by examining the range of chemical concentrations associated with observed adverse biological effects data from a nationwide database that included co-located samples of freshwater, estuarine, and marine sediments. Because the data set includes only data for which biological effects occur (i.e., no-effects data were not included), it is considered to be a relatively conservative approach for predicting biological effects. For each chemical, the ranges of chemical concentrations associated with observed biological effects were determined and sorted in ascending order, and two values were calculated for each chemical: an ER-L and an ER-M. The ER-L values represent the lower 10th percentile concentration of the data, which is considered to be concentrations where adverse biological effects are rarely expected to occur (less than 10 percent of the time). The ER-M values represent the 50th percentile of the data, which is considered to be concentrations below which biological effects may be expected to occur less than 50 percent of the time and above which adverse biological effects are expected to occur more than 50 percent of the time.

Table 5-2
NOAA ER-Ls and ER-Ms

Constituent	Effects Range-Low (ER-L) Criteria (mg/kg)	Effects Range-Median (ER-M) Criteria (mg/kg)
Arsenic	8.2	70
Cadmium	1.2	9.6
Chromium, total	81	370
Copper	34	270
Lead	46.7	218
Nickel	20.9	51.6
Mercury	0.15	0.71
Selenium	N/A	N/A
Silver	1.0	3.7
Zinc	150	410
PAHs, total	4.022	44.792
DDT	0.0016	0.046
PCBs, total	0.0227	0.18

Notes: mg/kg = milligrams per kilogram; PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenols

RWQCB Wetland Cover and Noncover Criteria The San Francisco Bay RWQCB has promulgated sediment screening guidelines for use in evaluating the beneficial reuse of dredged sediment for wetland creation, levee repair, and landfill cover (SFBRWQCB 1992). The criteria are intended to facilitate the creation, enhancement, and restoration of wetlands in marine and estuarine environments. The criteria were developed in part based on NOAA's ER-L and ER-M criteria.

The RWQCB criteria specify the allowable use based on two categories: use for wetland noncover where exposure to the aquatic environment would be limited and wetland cover or levee construction where sediments would be exposed to the water. RWQCB has also begun to refer to noncover sediment as "foundation" sediment, since it essentially serves as the foundation of the marsh. Cover sediment contains lower chemical concentrations and must pass chronic and acute bioassay tests. Cover material is deemed suitable for placement in the surface of a wetland environment. Because noncover sediment is characterized by higher concentrations, it must be covered with 3 feet of cover sediment, and must not leach chemicals that could harm aquatic resources.

The RWQCB guidelines require evaluation of sediment chemical concentrations, leachability data, and bioassay results in comparison to reference data and applicable water quality criteria. Cover and noncover criteria have been commonly used over the past ten years by interagency task forces (including the Dredged Material Management Office) for making sediment disposal/reuse suitability determinations. The RWQCB has circulated a draft revision of the guidelines (SFBRWQCB 2000) that proposes use of "background" values for cover criteria, and Effects Range-Median (ER-M) values for noncover criteria. Unlike the 1992 guidelines, the recently proposed changes have not been formally adopted by the RWQCB; therefore, the 1992 values were used for comparison with ISP pond sediments. Table 5-3 shows the applicable (1992) criteria for trace metals and organic compounds.

Table 5-3
RWQCB Sediment Screening Criteria

Constituent	Wetlands Creation Noncover (mg/kg, dry weight)	Wetlands Creation Cover and Levee Restoration (mg/kg, dry weight)
Arsenic	33-85	<33
Cadmium	5-9	<5
Chromium, total	220-300	<220
Copper	90-390	<90
Lead	50-110	<50
Nickel	140-200	<140
Mercury	0.35-1.3	<0.35
Selenium	0.7-1.4	<0.7
Silver	1.0-2.2	<1.0
Zinc	160-270	<160
PAHs, total	4-35	<4
DDT	0.003-0.1	<0.003
PCBs, total	0.05-0.4	<0.05

Notes: mg/kg = milligrams per kilogram; PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenols

Local Ambient Data, including Guadalupe River Data Available data from the Guadalupe River and other areas in the vicinity of the ISP ponds were compiled for the ISP in order to allow comparison of pond data with local ambient conditions. These values include mercury data obtained from USFWS and RWQCB. In addition, a large amount of data from inorganic analyses was obtained for Guadalupe River sediments.

These data include a number of values that appear to be “outliers” based on either unrealistically high detected concentrations (e.g. 600,000 mg/kg copper) or notably high concentrations that are more than an order of magnitude higher than ambient sediment concentrations normally encountered in the South Bay. Means and ranges for Guadalupe River sediments were calculated without these outliers. Additionally, calculation of mean concentrations did not include the non-detects for which detection limits were not available. While the determination of “outliers” was qualitative and no quality control/quality assurance information is currently available for these data, the means and ranges calculated without these apparent outliers are consistent with available means and ranges calculated for Guadalupe watershed sediment by other parties, including the RWQCB and USFWS. Local Guadalupe River data from upstream and near the mouth of Alviso Slough are provided in Table 5-4. The apparent outliers are indicated in the ISP tables.

Table 5-4
Local Ambient Data, Guadalupe River

Constituent	Guadalupe River Low (mg/kg)	Guadalupe River High (mg/kg)	Guadalupe River Mean (mg/kg)
Upstream of Alviso Slough			
Cadmium	0.25	4.5	0.88
Mercury	0.05	9.2	2.09
Selenium	0.16	3	0.52
Near the Mouth of Alviso Slough			
Mercury	0.8	1.2	

Notes: mg/kg = milligrams per kilogram; PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenols

5.1.4 Pond Sediment Sampling Results

Available sediment data were compared with the screening values described above. These comparisons are useful because sediments contain a wide array of inorganic chemicals from natural geologic sources, as well as from anthropogenic activities like mining. The results of this evaluation are summarized below. Section 2.3 (Sediment Quality) in the ISP (Appendix A of this EIR/EIS) contains inorganic contaminant data for the ponds and a detailed discussion of these data. Appendix B in the ISP (Appendix A of this EIR/EIS) contains tables with organic contaminant data for the ponds.

Sediment in the ponds would be expected to have similar characteristics to ambient conditions in the vicinity of each pond system, including elevated concentrations of some inorganics (e.g mercury). Available sediment data from the ponds generally support this premise. The concentrations of contaminants in the ponds taken as a whole are similar to San Francisco Bay ambient concentrations and within the range of concentrations found within the Guadalupe River. In the Alviso ponds, the concentrations of some inorganics (notably arsenic, mercury, and selenium) are elevated over some reported San Francisco Bay ambient concentrations, but are within the range of ambient concentrations found within the South Bay and associated watersheds.

Organic chemicals (i.e., petroleum-based chemicals, including PAHs, PCBs and pesticides) were either not detected in pond sediments, or were detected at very low concentrations similar to ambient concentrations found in the cleanest parts of the Bay. Therefore, organic chemicals in the ponds do not likely pose any additional risk to human health or the environment beyond that found in the cleanest parts of the Bay.

Alviso Complex Sediment Sampling Results Sampling has been most extensive in the Alviso Complex ponds, including the Island Ponds. Available sediment quality data indicate that concentrations of contaminants in the Island Ponds (Ponds A19, A20, and A21) are similar to ambient conditions in the cleaner portions of San Francisco Bay. Data is not available for Alviso Ponds A22 and A23.

In general, concentrations of inorganics were detected in Alviso pond sediments at levels similar to San Francisco Bay ambient concentrations. Arsenic, cadmium, mercury and selenium were detected in some ponds at concentrations elevated above Bay ambient concentrations, but within the concentration ranges observed within the Guadalupe River watershed. Detected concentrations of these chemicals in the Alviso Complex sediments are discussed further below.

Chromium, copper, lead, nickel, silver and zinc were detected in the Alviso ponds at relatively lower concentrations, very similar to Bay ambient conditions. Mean concentrations of these chemicals were approximately half San Francisco Bay ambient concentrations. Maximum detected concentrations of these chemicals were only about 20% to 30% higher than San Francisco Bay ambient values.

Arsenic—Arsenic was detected at low concentrations in all but one of the Alviso ponds sampled. Detected concentrations ranged from <5 mg/kg to 19 mg/kg. The mean detected concentration of arsenic in the USFWS and Hydroscience data sets (10.74 mg/kg and 11.21 mg/kg, respectively) were lower than the San Francisco Bay ambient concentration (15.3 mg/kg). The maximum detected concentrations in those data sets (19 mg/kg and 17.5 mg/kg, respectively) were slightly above the San Francisco Bay ambient concentration. Arsenic was detected at higher concentrations in Pond A4, but the Pond A4 arsenic data appear to be of questionable quality, and the Santa Clara Valley Water District, the owner of this pond, has indicated its intention to collect additional sampling for this data. With the exception of Pond A4, detected arsenic concentrations are similar to background values and are unlikely to adversely affect water quality or wildlife.

Cadmium—Cadmium concentrations detected in the Alviso ponds were generally low. The highest concentrations were detected in the USFWS samples; concentrations in that data set ranged from non-detectable (<0.2 mg/kg) to 1.5 mg/kg, with a mean concentration of 0.96 mg/kg. This mean concentration in that data set was somewhat elevated over San Francisco Bay ambient conditions (0.3 mg/kg), but was below the RWQCB 1992 wetland cover criterion (5 mg/kg) and the ER-L (1.2 mg/kg). The maximum detected concentration detected by USFWS (1.5 mg/kg) was below the RWQCB 1992 wetland cover criterion, only slightly higher than the ER-L, and significantly below the ER-M (9.6 mg/kg).

Available Guadalupe River background data indicate that cadmium is present at similar concentrations (0.25 to 4.5 mg/kg, with a mean of 0.88 mg/kg) to those detected in the Alviso Ponds, but higher maximum concentrations were detected in the Guadalupe River. These data indicate that concentrations of cadmium in the Alviso Ponds are slightly elevated over San Francisco Bay ambient conditions, but are very similar to local ambient conditions, and are below concentrations that are likely to cause adverse effects to aquatic organisms.

Mercury—The highest concentrations of mercury were detected in the Hydroscience and USFWS samples. Hydroscience detected concentrations of mercury ranging from 0.3 mg/kg to 1.92 mg/kg, with a mean of 0.55 mg/kg. USFWS detected concentrations ranging from 0.3 mg/kg to 1.2 mg/kg, with a mean concentration of 0.84 mg/kg. Those mean concentrations are elevated in comparison with the San Francisco Bay ambient value (0.43 mg/kg). The maximum detected concentrations are similar to the RWQCB noncover criterion and significantly above the ER-L (0.15 mg/kg), the ambient value (0.43 mg/kg), the wetland cover criterion (0.35 mg/kg), and the ER-M (0.71 mg/kg).

Concentrations of mercury appear to be mostly within the range of San Francisco Bay ambient values, but there are localized areas of elevated concentrations. The highest concentrations of mercury were detected in Ponds A5, A9, A10, A15, A16, and A17.

These ponds are all located adjacent to either Alviso Slough, Guadalupe Slough, or Coyote Creek, and are within the historic Guadalupe River delta. This area is characterized by elevated background concentrations of mercury as a result of mercury mining in the watershed. Based on available data, concentrations of mercury in the Guadalupe River upstream of Alviso Slough range from about 0.05 to 9.2 mg/kg with a mean of 2.09 mg/kg. Concentrations near the mouth of Alviso Slough are about 0.8 to 1.2 mg/kg. The concentrations of mercury detected in the ISP ponds are similar to current ambient sediment concentrations and consistent with the distribution of historically high levels of mercury in the watershed.

Selenium—The highest concentrations of selenium were detected in the USFWS and Hydroscience data sets. USFWS detected selenium at concentrations ranging from 0.5 mg/kg to 2.1 mg/kg, with a mean concentration of 0.77 mg/kg. Hydroscience detected selenium at concentrations ranging from 0.71 mg/kg to 1.17 mg/kg, with a mean concentration of 0.97 mg/kg. Those mean concentrations are similar to or slightly elevated in comparison with the San Francisco Bay ambient concentration (0.64 mg/kg) and the RWQCB wetland cover criterion (0.7 mg/kg), but significantly below the RWQCB noncover criterion (1.4 mg/kg). The maximum detected concentrations are somewhat higher than background values and the cover and noncover criteria. There are no ER-L or ER-M values for selenium.

The elevated selenium concentrations (i.e., 1.03 to 2.1 mg/kg) were detected in ponds A2W, A3W, A9, A10, and A17, all of which are within or very close to the historic delta of the Guadalupe River. Based on available data, selenium concentrations in the Guadalupe River range from 0.16 to 3 mg/kg, with a mean of 0.52 mg/kg. These data indicate that selenium concentrations in the Alviso ponds are within the range of concentrations observed in ambient sediments.

Alviso Complex Island Pond Sediment Sampling Results—Two composite samples are available for each of the three Island Ponds (A19, A20, and A21). One composite sample per pond represented surface sediments and one composite sample represented sediments at depth. Each composite sample comprised three discrete samples. Mean concentrations of detected inorganics were well below San Francisco Bay ambient conditions. Maximum concentrations were also below ambient concentrations for all inorganics, except mercury and selenium. The maximum detected concentration of mercury (0.48 mg/kg) was similar to the San Francisco Bay ambient concentration and RWQCB cover criterion (0.43 and 0.35 mg/kg, respectively), but above the ER-L (0.15 mg/kg). The maximum detected concentration of selenium (0.88 mg/kg) slightly exceeded the San Francisco Bay ambient concentration and RWQCB cover criterion. No ER-L or ER-M is available for selenium. With the exception of nickel, which exists naturally in the Bay at concentrations above its ER-L and ER-M, detected concentrations of inorganics were well below RWQCB noncover values and ER-Ms.

While available data are limited, they indicate that the Island Pond sediments are similar to San Francisco Bay ambient concentrations and are unlikely to pose a risk to water quality or wildlife above that found in background sediment.

Baumberg Complex Sediment Sampling Results Available sediment quality data indicate that concentrations of contaminants in the Baumberg Ponds are similar to ambient conditions in the cleaner portions of San Francisco Bay; however, extensive sediment sampling of these ponds has not been conducted. Assessment of sediment quality in the Baumberg ponds is constrained by the small amount of data available. Available data consist of four samples collected by Hydroscience. These samples represent three of the 23 ponds in the Baumberg system. However, the ponds for which data are available are generally representative of the range of water depths and salinities that characterize the Baumberg ponds. In the sampled ponds, average existing water depths range from 0.7 to 1.3 feet, and average salinities range from 16 to 265 parts per thousand (ppt). In comparison, average existing water depths for all the Baumberg ponds range from 0.6 to 2.7 feet; average salinities for all the Baumberg ponds range from 16 to 334 ppt. In general, lower concentrations of contaminants are expected in the Baumberg ponds based on their greater distance from known sources such as the Guadalupe River drainage.

With the exception of selenium, inorganics were detected in the Baumberg ponds at concentrations below San Francisco Bay ambient concentrations. Mean and maximum detected concentrations of arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc were below ambient values and wetland cover criteria. Mean concentrations of arsenic, cadmium, chromium, copper, lead, silver, and zinc were below ER-Ls. Maximum concentrations of silver and zinc were also below ER-Ls. With the exception of nickel, which exceeded the ER-M (51.6 mg/kg), detected concentrations of inorganics were well below the ER-M and wetland noncover values. It should be noted that the nickel ER-M is lower than the San Francisco Bay ambient concentration (112 mg/kg).

Selenium was detected at a mean concentration of 0.76 mg/kg and a maximum concentration of 0.87 mg/kg. These concentrations are slightly elevated compared to the San Francisco Bay ambient concentration of 0.64 mg/kg and the RWQCB wetland cover criterion of 0.7 mg/kg, but well below the wetland noncover criterion of 1.4 mg/kg. These minor exceedences are near the range of laboratory error (typically 10 to 20%, depending on analytical method). No ER-L or ER-M is available for selenium. One sample ("Bay") was collected from Bay sediments immediately adjacent to Pond 10 to characterize local background conditions. Selenium was detected in that sample at 0.68 mg/kg, which is similar to San Francisco Bay ambient and wetland cover criteria. The mean concentration of selenium in the sampled ponds is within 11% of the Bay sample, indicating that pond conditions are very similar to ambient conditions.

The number of samples makes it difficult to confirm that these exceedences are localized; but it appears that exceedences are slight, and that selenium in Baumberg sediments is unlikely to pose a higher risk to water quality or wildlife than Bay ambient conditions.

West Bay Complex Sediment Sampling Results Assessment of sediment quality in the West Bay Ponds has a high degree of uncertainty due to the fact that only one sample is available. However, concentrations of all inorganics in that sample were well below San Francisco Bay ambient conditions, RWQCB cover criteria, and RWQCB noncover criteria. With the exception of nickel, which exists naturally in the Bay at concentrations above its ER-L and ER-M, detected concentrations of inorganics were also below ER-Ls and ER-Ms. While it is not possible to characterize sediment definitively on the basis of a single sample, the available data for this single sample indicate that inorganics are present at concentrations below background conditions and are unlikely to pose risks to water quality or wildlife.

5.1.5 Fate/Transport and Toxicity of Inorganic Contaminants in Pond Sediments

Fate/Transport and Toxicity of Mercury— Mercury contamination is widespread in sediments and waters of the San Francisco Bay area (San Francisco Estuary Institute 2000, SFBRWQCB 2000). Mercury is a constituent of particular concern to wetland restoration projects because of its ability to convert to the methylated form of the metal, which is relatively more mobile in the aquatic environment than other forms. Data for total mercury in water and sediment from long-term monitoring data under the USGS and San Francisco Estuary Institute Regional Monitoring Program (RMP) has consistently shown elevated concentrations, primarily in the north and south bay areas and river tributaries. There is also a strong correlation between total mercury and suspended sediment transport in the water (SFEI, 2000).

Elevated mercury levels are in large part a legacy of the California gold mining era, when mercury was used in the gold refining process. Mines such as south San Francisco Bay's New Almaden Mine, which operated for many years in the upper Guadalupe River watershed extracting the mercury ore cinnabar, are known to be a source of mercury in the bay system. Over time, leaching of mine tailings and overland transport of mercury-bearing sediments have resulted in the downstream accumulation of mercury in the watershed.

In aquatic environments, most mercury is chemically bound to suspended particles of soil or sediment; a smaller fraction is bound to dissolved organic carbon. Sediment-bound mercury may be available to aquatic organisms and is thus a pollutant of concern; the potential for adverse environmental effects from sediment-bound mercury depends primarily on transport and depositional characteristics (e.g., particle size) and on the physical and chemical properties of the sediment.

Additionally, sediment-bound mercury may be converted through both biotic and abiotic processes to its more bioavailable methylated form. Factors conducive to methylation of mercury include low-flow or stagnant waters, hypoxic or anoxic conditions in the water or sediment column, low pH ($pH<6$), and high concentrations of dissolved carbon. Most of these factors are in turn affected by biological processes such as metabolism, growth, and decay; for example, mercury methylation has been linked to the activity of sulfate-reducing bacteria in the shallow anoxic sediment column.

Aquatic plants, fish, and wildlife readily adsorb methylmercury. It can then accumulate in their tissues, creating contaminated food sources (plant or animal tissues) that transfer through the food web (Santa Clara Valley Water District and U.S. Army Corps of Engineers 2001). It is a mutagen, teratogen, and carcinogen, and has embryotoxicological, cytochemical, and histopathological effects. In aquatic organisms, concentrations of 0.1–200 micrograms per liter (µg/l) have been shown to produce adverse effects. Toxicity increases with age of the organism, exposure time, temperature, lowered salinities, and the presence of other metals.

Fate/Transport and Toxicity of Selenium—Concerns about the potential impacts of selenium in the San Francisco Estuary were raised in the mid-1980s when elevated selenium concentrations were detected in water and biota in the northern reaches of the Estuary, and in Kesterson Reservoir where the most dramatic evidence of selenium poisoning in waterfowl was observed (CDFG 1988, 1989; Ohlendorf et al. 1990).

A review of available South San Francisco Bay selenium data, collected primarily between 1995 and 2000, has shown the dominance of riverine sources in the overall selenium mass loading to the South Bay (LFR Levine-Fricke 2002). Estimates based on flow and dissolved selenium data indicated that the Guadalupe River is responsible for about 1/3 of the total selenium flow into the South Bay. The San Francisco Estuary Institute (SFEI 2000) also identified the Guadalupe River as a significant contributor of selenium to the South Bay. The LFR report estimated that all the creeks and rivers (including Guadalupe River, Alameda and Coyote Creeks) contributed more than 60% to the South Bay. Publicly-owned treatment works (POTWs) were estimated to contribute about 20% of the total selenium load, while stormwater runoff was estimated to contribute about 15%. Although the average daily water flow from the Guadalupe River is relatively low compared with Alameda Creek and the San Jose/Santa Clara POTW, it contained by far the highest selenium concentrations of any water body in the area, with an average selenium concentration of 4.7 µg/l.

The ultimate source of selenium in the South Bay watersheds is geologic. Although geologic formations containing naturally elevated selenium may be present, historical mining activities in the Santa Cruz Mountains have likely increased selenium concentrations in tributaries to the Guadalupe River that ultimately flow into the South Bay. Selenium is often associated with the types of geologic formations and mineral deposits found in the Santa Cruz Mountains, from which tributaries of both the Guadalupe River and Coyote Creek emerge.

The New Almaden region within the Santa Cruz Mountains contains well-known mercury ore deposits. The geologic processes responsible for the formation of mercury-rich deposits (cinnabar, a mercury sulfide) in this area are unrelated to the processes resulting in selenium enrichment; however, cinnabar is associated with pyrite and other sulfides (Bailey and Everhart 1964), which commonly contain selenium impurities. The high pyritic content of shales in the Coast Ranges is considered a major reason for their high selenium content (Martens and Suarez 1997). Therefore, it is quite likely that exposed and/or oxidized sulfide deposits in the New Almaden region are an important source of selenium to the Guadalupe River. In addition, Upper Cretaceous marine shales, often enriched with selenium, are also found near the headwaters of Alamitos Creek, a tributary to the Guadalupe River.

Concentrations of selenium in biota in the South Bay have been reported to be elevated relative to average levels in the North and Central Bays (SWRCB 1988; CDFG 1989). However, there are no major industrial sources of selenium known in the South Bay, in contrast to the North Bay where oil refineries have historically discharged significant amounts of selenium in their wastewater.

POTWs have been identified as a potential source of selenium to the South Bay (SFBRWQCB 1997). Selenium in POTW effluent has been assumed to be "strongly influenced by selenium levels in groundwater," which are in turn a result of "naturally-high (Se) concentrations in local geology and evaporative concentration" (SFBRWQCB 1997). Cutter and San Diego-McGlone (1990) reported that selenium concentrations in South Bay POTW discharges in March 1988 were as high as 1.43 µg/l, and generally higher than those from San Francisco or East Bay POTWs. However, according to a review conducted by LFR in 2002, most reported POTW discharge data revealed less than 1 µg/l selenium in samples. Based on 27 measurements collected between December

1987 and March 1988, Cutter and San Diego-McGlone (1990) estimated that the total selenium flux from South Bay, East Bay, and San Francisco POTWs was approximately 400 kilograms per year (kg/yr). This estimated flux is five times smaller than the total selenium flux from North Bay refineries prior to selenium reduction efforts carried out by the refineries in the 1990s.

The hydrology of the South Bay differs from the other Bay regions in that it is enclosed on three sides, is much shallower, and has a longer water residence time than other parts of the Bay (San Francisco Estuary Project [SFEP] 1992). As such, the South Bay, and in particular the South Bay south of the Dumbarton Bridge, is relatively stagnant and subject to a higher evaporation rate, as manifested in the relatively higher concentrations of numerous constituents of South Bay water compared to other parts of the Bay (SFEI 1999).

Selenium mobility, bioavailability, and toxicity depend on the selenium species (i.e., its form) in the environment. Selenium chemistry is complex and the element exists in several different forms and oxidation states, including: the oxyanions selenate (Se [VI]) and selenite ([Se[IV]); and the more reduced forms of elemental selenium and inorganic and organic selenides.

Selenite is generally considered more harmful to biota than selenate because of its potential to bioaccumulate more readily (Ogle et al. 1988; Zhang et al. 1990), and tendency to adsorb to particulate matter, which can be ingested by bivalves (Luoma et al. 1992). Selenite is strongly adsorbed by soil surfaces (especially iron hydroxides) at acid to near-neutral pHs; alkaline conditions can release selenite from soil surfaces. Selenate, the most oxidized and most common form in natural waters, is not adsorbed strongly by soil and is consequently the selenium form most readily taken up by plants. Selenate is readily reduced to selenite under common wetland conditions, which can then be adsorbed and/or precipitated by a number of soil solid phases, including iron hydroxides, carbonates, and organic materials. Alternatively, selenite can be oxidized under drying conditions to selenate, thus becoming more mobile in the environment. Under anaerobic conditions, which can readily occur in wetland environments, selenite can be further reduced to elemental selenium and into selenides (e.g., FeSe). Although these reduced forms of selenium are typically less bioavailable than the oxyanionic forms (e.g., selenate and selenite), microbial transformations and uptake of these reduced forms are known to occur (Oremland 1994).

Like mercury, selenium can be methylated by a variety of microorganisms, generally producing dimethyl-selenides (DMSe). Unlike mercury, however, methylated selenium is believed to be less toxic than the oxyanions, and because of its high volatility, has received a lot of attention for its potential use as a remediation technique to lower selenium concentrations in contaminated soil and sediment. Addition of carbonaceous materials to soil has been reported to enhance formation of DMSe, especially under aerobic conditions.

5.2 Criteria for Determining Significance of Effects

Potential effects of the various project alternatives (including No Project/No Action and Alternatives 1, 2, and 3) on sediments were assessed qualitatively and quantitatively based on a comparison between existing conditions and projected post-implementation conditions with regard to contaminant mobility, exposure, and bioavailability. Criteria based on CEQA and NEPA guidelines were used to determine the significance of potential impacts of sediment-associated contaminants on biota or water quality. 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, geographic, and ecological scale, while intensity refers to the severity of the impact. Impact intensity and context were fundamental to the development of RWQCB screening criteria for wetlands cover materials, which are included in the significance thresholds for sediment impacts (below). As discussed above (see Section 5.1.3), these criteria are based partly on NOAA ER-Ls and ER-Ms, which are themselves based on observed toxicity responses in organisms (intensity). The RWQCB criteria take into consideration the particular situation of the San Francisco Bay region (context).

Sediment impacts were considered significant if they would reasonably be expected to:

- Result in substantial changes in the mobility or bioavailability of sediment-associated contaminants
- Increase exposure of wildlife to contaminants in excess of relevant regulatory criteria and guidelines (RWQCB screening criteria for wetlands cover materials)
- Increase exposure of listed species to bioaccumulatable contaminants
- Result in indirect impacts to water quality that could cause exceedances of water quality criteria (see Chapter 4 for water quality criteria)
- Result in impacts to potential future restoration of the project ponds

Since the process of freshening saline water bodies with sediments containing various levels of metals has never before been monitored, the actual potential for impacts is not known. Consistent with NEPA guidelines, impacts were considered significant if available information indicates potential adverse effects, but insufficient information is available to determine the severity of those effects.

5.3 Impacts

The discussion of impacts from sediments focuses on those ISP ponds that contain levels of inorganic contaminants that exceed RWQCB screening criteria for wetland cover materials, based on available sediment sample data (see Section 5.1). A total of 11 ponds, all located in the Alviso Complex, contain levels of mercury or selenium that exceed the screening criteria. These ponds include A1 (mercury), A2W (selenium), B1 (mercury), A3W (selenium), A3N (mercury), A5 (mercury), A9 (mercury and selenium), A10 (mercury and selenium), A15 (mercury), A17 (mercury and selenium) and A16 (mercury). The elevated concentrations of selenium and mercury detected in sediment and/or tissue samples from these Alviso ponds indicate that potential oxidation or wetting/drying cycles in these ponds would be of particular concern.

As discussed in Section 5.1.4.1, sampling has been most extensive in the Alviso Complex ponds, including the Island Ponds. Available sediment quality data indicate that concentrations of contaminants in the Island Ponds (Ponds A19, A20, and A21) are similar to ambient conditions in the cleaner portions of San Francisco Bay. Data is not available for Alviso Ponds A22 and A23. Available sediment quality data indicate that concentrations of contaminants in the Baumberg Ponds are similar to ambient conditions in the cleaner portions of San Francisco Bay (see Section 5.1.4.2); however, extensive sediment sampling of these ponds has not been conducted. Only one sediment quality sample is available to assess sediment quality in the West Bay Ponds (see Section 5.1.4.3). Concentrations of all inorganics in that sample were well below ambient conditions in the cleaner portions of San Francisco Bay.

Changing the depths of water levels in the ponds in the project area could cause impacts to water quality and biota, particularly in those ponds that contain elevated levels of inorganic contaminants by: 1) creating acidic conditions in sediments and soils; 2) increasing the mobility, availability, and concentration of contaminants (through oxidation, acidification, freshening and methylation of mercury); 3) increasing the opportunities for wildlife contact with contaminants in exposed sediments; and 4) impacting vegetation growth in gypsum/salt-affected soils. These types of impacts are discussed generally first and then in relationship to each of the proposed project alternatives below.

Impacts from Oxidation—Oxidation of exposed sediments can increase the mobility and bioavailability of inorganic contaminants. Drying of ponds can expose sediments to air and can result in oxidation of sulfides and organic matter that are known to bind inorganic contaminants strongly, making the inorganic contaminants more mobile and bioavailable. Oxidation can also generate acid conditions in sediment and levee soil which can further increase the mobility of inorganic contaminants, especially the cationic heavy metals (e.g., copper, lead, mercury). Impacts to water quality and biota could occur indirectly from the increased mobility of inorganic contaminants following oxidation reaction.

Impacts from Acidification— Oxidation of exposed sediments can generate low pH (acidic) conditions in sediments and levee soil, which can further increase the mobility and bioavailability of inorganic contaminants. If the pH should drop into the acid range (e.g., below pH 6), adsorption of inorganics by clays and iron hydroxides would be depressed and inorganics could be released from the sediment. The cationic heavy metals (e.g., copper, lead, mercury) are especially subject to this type of impact. Arsenic and selenium are exceptions to the rule. In their common anionic forms, selenite and arsenate are typically more strongly adsorbed and immobilized under acidic conditions. Impacts to water quality and biota from mercury could occur under these conditions, both indirectly from increased mobility of contaminants and directly through contact with low pH sediment and soil.

Impacts from Freshening Effects. The introduction of fresher water into saline ponds where salt precipitates exist may increase the release of contaminants. In higher salinity ponds, salts containing inorganic contaminants may precipitate out of the water column and/or become adsorbed on sediment surfaces. Introduction of fresher water into the ponds (freshening) may dissolve the precipitated salts, providing a source of inorganic contaminants in discharge water. This could be a problem in ponds that have consistently been managed at above 150 ppt, which is the point that gypsum (calcium sulfate) precipitates (i.e., Ponds A19-23, the West Bay ponds, and some Baumberg ponds. However, levels of mercury and selenium were not found to be high in those ponds. The extent and duration of the freshening effect is unknown. The magnitude of this impact would be dependent on a number of physiochemical factors, as well as the amount and types of contaminants in pond precipitates and sediment**.**

Impacts from Mercury Methylation. Drying/wetting cycles in ponds can promote methylation of mercury, increasing the mobility and bioavailability of mercury.

Sediment-bound mercury released as a result of drying and oxidation could become available for methylation when the ponds are re-flooded by winter rains. As discussed in Section 5.1.5.1 above, the organic form of mercury, methylmercury, is more mobile and bioavailable than the inorganic form. In general, ponds with higher total mercury concentrations have greater potential for methylmercury production, although low concentrations of total mercury can also produce considerable concentrations of methylmercury under certain hydrologic and biogeochemical conditions.

Impacts from Gypsum/Salt-Affected Soils. Gypsum/salt affected soils may impede vegetation growth and impact habitat values. Long-term pond drying of sediment can result in gypsum/salt affected soils, which can impede the establishment and growth of wetland vegetation. Saline-sodic soils commonly have a pH of about 8.5, and freshening can create more alkaline sodic soils (e.g., with a pH above 9). These soils are typically very compact with poor hydraulic conductivity and tend to inhibit plant colonization and growth. These conditions may also limit restoration options in the future. Extremely saline and sodic conditions could also reduce the diversity and/or or biomass of invertebrates, thereby decreasing the value of certain ponds as foraging habitat for some other birds and fish. For some birds (e.g., snowy plover), unvegetated ponds actually provide better habitat, and in many cases can provide dense populations of certain invertebrates, such as brine flies and brine shrimp.

Impacts from Changes in Water Level. Changes in water levels can increase wildlife exposure to contaminants by introducing fish and other wildlife to ponds where they weren't previously present and increasing the contact between wildlife and contaminants in exposed sediments**.** For example, changing water depths will change foraging opportunities for birds. Diving and dabbling waterfowl are exposed to different levels of contaminants in sediments than probing birds. Exposure may be through increased bioavailability of contaminants resulting from oxidation and methylation, and potential concentration of contaminants in diminishing overlying water. In general, more forms of wildlife could be exposed to contaminants as pond levels decrease.

5.3.1 No Project/No Action Alternative

SEDIMENTS IMPACT-1: The mobility and bioavailability of inorganic contaminants may increase within project ponds.

Under the No Project/No Action Alternative, ponds would be operated as seasonal ponds and would dry down during the summer months. Drying of formerly inundated or saturated sediments under the No Project/No Action Alternative would result in oxidation of exposed sediments. As noted above, oxidation of sediments can increase the mobility and bioavailability of inorganic contaminants and can also result in acidic conditions in sediments and soils, which can further increase the mobility and bioavailability of inorganic contaminants. Drying/wetting cycles, which would occur in the ponds under the No Project/No Action Alternative, could also promote methylation of mercury, as discussed above.

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

SEDIMENTS IMPACT-2: Long-term pond drying may result in the formation and exposure of gypsum/salt-affected soils, decreasing the habitat value of ponds for some wildlife species and limiting future restoration options.

Under the No Project/No Action Alternative, some gypsum/salt-affected soils will be left or will develop on the sediment surface of some ponds. As discussed above, gypsum/salt-affected soils can impede growth of wetland vegetation and reduce the diversity and/or biomass of invertebrates, thereby decreasing the value of the ponds as foraging habitat for some species. Other species would benefit. Since there is presently little vegetation at the project ponds, the impact from the development of gypsum/salt-affected soils is primarily an impact to the potential for future restoration of ponds. That is, the presence of gypsum/salt-affected soils may limit future restoration options for certain ponds.

Significance: Potentially significant and unavoidable

Under the No Project/No Action Alternative, some gypsum/salt-affected soils will be left or will develop on the sediment surface of some ponds. As discussed above, gypsum/salt-affected soils can impede growth of wetland vegetation and reduce the diversity and/or or biomass of invertebrates, thereby decreasing the value of the ponds as foraging habitat for some species. Other species would benefit. The development of gypsum/salt-affected soils may also limit future restoration options for certain ponds.

SEDIMENTS IMPACT-3: Changes in pond water levels may alter exposure of wildlife to contaminants in sediments.

Under the No Project/No Action Alternative, the dry-down cycles that would occur in seasonal ponds could create additional foraging opportunities for birds, where currently access is limited by deeper water levels. Additional foraging access could increase exposure of foraging birds to contaminants in sediments. While diving and dabbling waterfowl may be exposed to some contaminants in sediments covered with ponded water; in general, more forms of wildlife could be exposed to contaminants as pond levels decrease. Increased access to sediments, combined with potential increased mobility and bioavailability of contaminants, could impact foraging birds.

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

SEDIMENTS IMPACT-4: Unplanned breaches of ponds could result in significant water quality and wildlife impacts from contaminants in sediments.

Under the No Project/No Action Alternative, levees would not be maintained and unplanned breaches of the ponds would be more likely. Given the impacts of this alternative on the mobility, bioavailability, and concentration of inorganic contaminants bound in sediments, 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.

5.3.2 Alternative 1 (Seasonal Pond Alternative)

Impacts under this alternative are nearly the same as those under the No Project/No Action Alternative. The primary difference would be that the potential for sediment contaminant impacts on water quality and biota as a result of levee failure (see Sediments Impact-4 under No Project/No Action above) would be reduced since the infrastructure (levees, weirs, etc.) that separates the ponds from the Bay and sloughs would be maintained. Unlike Alternatives 2 and 3, Alternative 1 does not allow for flexibility and adaptability in the management of the ponds in response to project impacts that may be observed in the field in the future. Thus, Sediments Impacts-1 and -3, which are related to the management of the ponds as seasonal ponds with wetting and drying cycles, would be potentially significant and unavoidable under this alternative.

SEDIMENTS IMPACT-1: The mobility and bioavailability of inorganic contaminants may increase within project ponds.

Under Alternative 1, ponds would be operated as seasonal ponds and would dry down during the summer months. Drying of formerly inundated or saturated sediments under this alternative would result in oxidation of exposed sediments. As noted above, oxidation of sediments can increase the mobility and bioavailability of inorganic contaminants and can also result in acidic conditions in sediments and soils, which can further increase the mobility and bioavailability of inorganic contaminants. Drying/wetting cycles, which would occur in the ponds under this alternative, could also promote methylation of mercury, as discussed above.

Significance: Potentially significant and unavoidable.

SEDIMENTS IMPACT-2: Long-term pond drying may result in the formation and exposure of gypsum/salt-affected soils, decreasing the habitat value of ponds for some wildlife species and limiting future restoration options.

Under the No Project/No Action Alternative, some gypsum/salt-affected soils will be left or will develop on the sediment surface of some ponds. As discussed above, gypsum/salt-affected soils can impede growth of wetland vegetation and reduce the diversity and/or biomass of invertebrates, thereby decreasing the value of the ponds as foraging habitat for some species. Other species would benefit. Since there is presently little vegetation at the project ponds, the impact from the development of gypsum/salt-affected soils is primarily an impact to the potential for future restoration of ponds. That is, the presence of gypsum/salt-affected soils may limit future restoration options for certain ponds.

Significance: Potentially significant and unavoidable

SEDIMENTS IMPACT-3: Changes in pond water levels may alter exposure of wildlife to contaminants in sediments.

Under Alternative 1, the dry-down cycles that would occur in seasonal ponds could create additional foraging opportunities for birds, where currently access is limited by deeper water levels. Additional foraging access could increase exposure of foraging birds to contaminants in sediments. While diving and dabbling waterfowl may be exposed to some contaminants in sediments covered with ponded water; in general, more forms of wildlife could be exposed to contaminants as pond levels decrease. Increased access to sediments, combined with potential increased mobility and bioavailability of contaminants, could impact foraging birds.

Significance: Potentially significant and unavoidable.

5.3.3 Pond Management Alternative 2: Simultaneous March/April Initial Discharge

Under Pond Management Alternative 2, potential sediment-related impacts include an increase in the mobility and bioavailability of contaminants in sediments, which could adversely impact water quality and biota; changes in hydrology that may increase wildlife exposure to contaminants in sediments; and an increase in the transport of suspended sediment, which could also adversely impact water quality and biota. Removal of brines in accordance with the terms of the Cargill Ponds Acquisition and the introduction of fresher water into highly saline ponds to dilute existing salts as proposed in the ISP would prevent the formation and exposure of gypsum/salt-affected soils that can result in adverse effects to habitat values. Mitigation measures proposed for Sediments Impact-1 (Sediments Mitigation Measures 1A, 1B, and 1C) are also proposed for Sediments Impacts-3 and -6 under this alternative.

SEDIMENTS IMPACT-1: The mobility and bioavailability of inorganic contaminants may increase within project ponds.

Hydrologic changes anticipated under Pond Management Alternative 1 may affect the mobility and bioavailability of contaminants through several mechanisms including oxidation, acidification, freshening, and wetting/drying cycles that increase production of methylmercury**.** Increases in levels of contaminants measured in pond water may be an indication of the effect of one or more of these mechanisms, which are discussed further below and were also discussed above in the summary of the types of project impacts anticipated.

Introduction of fresher bay water into the more saline ponds may release inorganic contaminants. Under Pond Management Alternative 1, initial release of all the ponds in March/April would mean that the pond systems would be released when incoming water salinities would be at their lowest (i.e., freshest). This freshening may increase dissolution of salts from sediments and cause more concentrated release of sediment-associated contaminants in comparison with Alternative 2, under which many of the pond systems with elevated concentrations of mercury and/or selenium are planned for initial release in July. However, the larger volume of water that may be present in the ponds in March/April may mitigate for the greater mass of contaminants potentially dissolving from salts. This impact would be short-term in duration, occurring only during the initial discharge period.

Oxidation Impacts. Average water depths and anticipated variation in water depths were modeled by Shaaf & Wheeler based on rainfall and tide data from 1994-1995 (see Section 4 of the ISP; Appendix A). Hydrologic changes expected under Pond Management Alternative 1 are presented in Table 2-1. As discussed above, changes in water levels in project ponds are relevant to the impacts to water quality and biota of contaminants in sediments.

Of the ponds that are known to have elevated levels of selenium and/or mercury higher than RWQCB screening criteria for wetland cover materials (Alviso Ponds A1, A2W, B1, A3W, A5, A9, A10, A15, A17, and A16), only Ponds A9, A10, A16, and A17 will be managed with water levels substantially shallower than existing conditions. The proposed hydrologic regimes for these ponds could result in periodic exposure of sediment to air. Of these, Ponds A1, A7, A8, A9 and A16 also support breeding and/or foraging populations of shorebirds, including some listed species, and are therefore considered to be sensitive habitat. Only two ponds (A9 and A16) currently have exposed "islands" that are used for nesting by shorebirds.

Variability in water levels, such as for batch ponds, will have an effect on the frequency and duration of sediment exposure as well. In batch ponds, large volumes of water are transferred from pond to pond during relatively short periods of time and water elevations can vary significantly over a number of weeks or months. In Ponds A9, A10, A16, and A17, reduced variability in water levels under this alternative may counteract the effects of the lower average water levels proposed for these ponds, and therefore the anticipated frequency and duration of sediment exposure within these ponds may be similar to or less than existing conditions. Predicted hydrologic conditions are based on tide and rain data from 1994-1995, and actual water levels will depend on future tide heights and weather patterns. Lower water levels than anticipated can result from weak tide cycles and/or prolonged dry weather.

Acidification Impacts. In ponds where average water levels will be more than 6 inches higher than existing conditions, exposure to acid levee soils could affect water pH in localized areas of the ponds. Although some North Bay levee soils have been found to be acidic, at this time, there is no indication that South Bay levee soils are the same. However, if some areas were found to have low pH levels, localized areas of acidic pond water could increase the mobility of sediment-associated contaminants. Lowered pH can also adversely affect wildlife through loss of invertebrate colonies that serve as food sources for birds. Foraging birds could experience direct toxicity if acid conditions are present. However, the impact of lowered pH is likely to be short–term. This is because saturating currently exposed levee sideslopes can restore reducing conditions that are known to decrease acidity; and saline bay waters contain carbonates that can buffer acid conditions towards more neutral conditions. Experience in the North Bay salt ponds shows that acid conditions resulting from pond drying was buffered back to neutral conditions after bay waters were introduced into ponds through levee breaches (Personal communication Mike Rugg).

Freshening Impacts. Introduction of fresher bay water into the more saline ponds may release inorganic contaminants. Of the ponds with elevated concentrations of inorganic contaminants (mercury and/or selenium), there are several ponds of medium salinity levels that will become substantially fresher under Alternative 1. These are Alviso Ponds A5, A8, A9, A10, A15, A17, and A16.

Significance: Potentially significant.

> *SEDIMENTS MITIGATION MEASURE-1A*: Conduct pre-project sampling of sediments from specific ponds, in accordance with the project Additional Sediment Sampling Analysis Plan (SAP).

The RWQCB, upon review of the Report of Waste Discharge (ROWD) for the ISP, recommended additional sediment sampling to further characterize the nature and extent of mercury and selenium contamination in ISP pond sediments. As a result, an Additional Sediment Sampling and Analysis Plan (SAP) was prepared (see Appendix J). The SAP describes the proposed sample locations, sample collection procedures, and chemical and physical analyses to be performed. The SAP proposes sampling 2 depths at each of 50 sampling locations distributed within 16 ponds, including ponds in the all three pond complexes. Sediment samples will be analyzed for metals, methylmercury, total organic carbon, salinity, and pH.

SEDIMENTS MITIGATION MEASURE-1B: Conduct post-implementation monitoring in areas with elevated concentrations of inorganics to determine whether conditions are occurring that would increase contaminant mobility (e.g., methylation, acidification, or oxidation of sediments, or visual observation of increased drying or wetting/drying cycles).

Post-implementation monitoring would focus on ponds where available data indicate the presence in sediments of concentrations of inorganics that exceed standards and where proposed hydrologic regimes could result in exposure of contaminated sediments. To date, these ponds include Alviso Ponds A9, A10, A16, and A17. If results of the SAP indicate additional ponds with elevated inorganics and hydrologic regimes of concern, these ponds would be monitored as well**.**

SEDIMENTS MITIGATION MEASURE-1C: If post-implementation monitoring during the Continuous Circulation Period (Sediments Mitigation Measure-1B) indicates the presence of conditions that would increase contaminant mobility, implement water management measures to mitigate these conditions.

The following measures would be implemented in the order presented:

1. Assess the risk posed by the increase relative to ambient conditions in the South Bay.
2. Adjust water management to raise water levels and minimize wetting/drying cycles.
3. Monitor pH levels. If levels below pH 6 are identified, restore saturated conditions to acid sediments/levee soils to promote the buffering of pH towards neutral conditions.
4. Add water management structures. Minor adjustments to water levels can be made in some ponds by decreasing or increasing pumping in ponds where pumps will be present, or adding or removing weir boards in ponds where weirs are present. Modification of water control structures/pumps in one pond will affect the hydrology of other ponds in that system, so effects of specific water level changes on all ponds in the system must be evaluated before implementing this measure.

SEDIMENTS MITIGATION MEASURE 1D: If post-implementation monitoring (Sediments Mitigation Measure 1B) during the Initial Release Period identifies elevated levels of inorganic impacts in discharge waters, potentially attributable to freshening effects, this impact may be mitigated in future releases by implementing additional water control measures designed to reduce freshening effects.

Freshening may be slowed during the Initial Release Period by introducing bay water in summer when salinities in incoming water are higher. By reducing the salinity difference between introduced bay water and existing pond water, the rate of freshening may be slowed such that dissolution of contaminants may be reduced. Although reductions in flow through the ponds could also reduce freshening effects, such reductions would result in higher salinities in discharge waters. Therefore, a better solution to freshening impacts may be to increase the volume of water prior to discharge, which would dilute the contaminants that dissolve and become re-suspended as a result of freshening and to reduce the concentrations of these contaminants in discharge water.

Post-mitigation Significance: Less than significant

> *SEDIMENTS IMPACT-3*: Changes in pond water levels may alter exposure of wildlife to contaminants in sediments.

Under Alternative 2, the dry-down cycles that would occur in ponds that would be managed as seasonal ponds could create additional foraging opportunities for birds, where currently access is limited by deeper water levels. Additional foraging access could increase exposure of foraging birds to contaminants in sediments. While diving and dabbling waterfowl may be exposed to some contaminants in sediments covered with ponded water; in general, more forms of wildlife could be exposed to contaminants as pond levels decrease. Increased access to sediments, combined with potential increased mobility and bioavailability of contaminants, could impact foraging birds.

Significance: Potentially significant

> *SEDIMENTS MITIGATION MEASURE-1A*: Conduct pre-project sampling of sediments from specific ponds, in accordance with the project Additional Sediment Sampling Analysis Plan (SAP).

See Appendix J and discussion under Sediments Impact-1.

> *SEDIMENTS MITIGATION MEASURE-1B*: Conduct post-implementation monitoring in areas with elevated concentrations of inorganics to determine whether conditions are occurring that would increase contaminant mobility (e.g., methylation, acidification, or oxidation of sediments, or visual observation of increased drying or wetting/drying cycles).

See discussion under Sediments Impact-1.

> *SEDIMENTS MITIGATION MEASURE 1C*: If post-implementation monitoring indicates the presence of conditions that would increase contaminant mobility, implement water management measures to mitigate these conditions.

See discussion under Sediments Impact-1.

Post-mitigation Significance: Less than significant

> *SEDIMENTS IMPACT-3A:* Changes in hydrology may increase wildlife exposures to contaminants.

Increasing the number of connections to receiving waters, or changing the nature of the connections (for example creation of uncontrolled openings such as gaps in the levee or installation of culverts with no water control structures) can create more opportunities for fish to enter the ponds. Introduction of fish into ponds where they are not currently present could increase the potential for biotic exposure to sediment-associated contaminants. To the extent that predators consume these fish, bioaccumulation could increase, especially for mercury and selenium.

Significance: Potentially significant.

> *SEDIMENTS MITIGATION MEASURE-1A*: Conduct pre-project sampling of sediments from specific ponds, in accordance with the project Additional Sediment Sampling Analysis Plan (SAP).

See Appendix J and discussion under Sediments Impact-1.

> *SEDIMENTS MITIGATION MEASURE-1B*: Conduct post-implementation monitoring in areas with elevated concentrations of inorganics to determine whether conditions are occurring that would increase contaminant mobility (e.g., methylation, acidification, or oxidation of sediments, or visual observation of increased drying or wetting/drying cycles).

See discussion under Sediments Impact-1.

> *SEDIMENTS MITIGATION MEASURE 1C*: If post-implementation monitoring indicates the presence of conditions that would increase contaminant mobility, implement water management measures to mitigate these conditions.

See discussion under Sediments Impact-1.

Post-mitigation Significance: Less than significant

> *BENEFICIAL SEDIMENT IMPACT-1*: Higher average water levels in some ponds could decrease the mobility and bioavailability of contaminants and the potential for wildlife exposure to contaminants in those ponds.

No mitigation is required for beneficial impacts.

> *BENEFICIAL SEDIMENT IMPACT-2:* In the long term, freshening of hypersaline sediments will produce sediment and water conditions that can promote habitats more endemic to the South Bay ecosystem. This would be a beneficial impact.

No mitigation is required for beneficial impacts.

5.3.4 Pond Management Alternative 3: Phased Initial Discharge

The only difference between Pond Management Alternatives 2 and 3 is in the timing of initial discharge of pond waters. As described in Chapter 2, under Pond Management Alternative 2, water control structures would be installed in summer or fall and initial discharge of the existing pond contents would begin the following year in March/April when salinities within the ponds and receiving waters are the lowest. Under Alternative 3, on the other hand, the initial discharge from a limited number of ponds would occur in July/August, with discharge from other pond systems occurring in subsequent years. Ponds with a July/August initial release are noted in Table 2-1.

Impacts and mitigation measures under Pond Management Alternative 3 would be mostly the same as those under Pond Management Alternative 2 (see Section 5.3.3). After initial discharge, operational water levels and salinities would be the same as for Alternative 2 No additional increases in long-term sediment contaminant bioavailability or potential wildlife exposure are anticipated due to the timing of the initial discharge. The mobility and bioavailability of inorganic contaminants in sediments (addressed under Sediments Impact-1) may be reduced under the July/August initial discharge scenario (Alternative 3) due to reduction in the freshening effect and other changes, as described below.

> *SEDIMENTS IMPACT-1:* The mobility and bioavailability of inorganic contaminants may increase within project ponds.

Under Alternative 3, this impact will be reduced compared to similar impacts under Alternative 2. The phased timing of initial release proposed under Alternative 3 would allow releases to occur in such a way as to minimize impacts to water quality. For example, the initial release of several pond systems is planned for July, when incoming water salinities are higher. As described in Chapter 2, initial release of Alviso System A7, which contains Ponds A5 and A8 with elevated mercury and selenium, is anticipated to occur in July. Initial release from Baumberg Systems 2, 8A, and 11 is also planned for July under this alternative**.** Limited sampling data for Baumberg System 2 doesn't indicate elevated levels of inorganics. Sampling data do not presently exist for Baumberg Systems 8A and 11. The higher Bay water salinity would result in reduced freshening effects in these ponds during the initial discharge period only. Although this impact is reduced under Alternative 2, it is still potentially significant. Since freshening is only a concern where pond sediments contain elevated levels of inorganic chemicals, mitigation for this impact includes sampling for these chemicals and monitoring their mobility (Sediments Mitigation Measures 1A, 1B, and 1C, below). In addition, effects potentially attributable to freshening may be mitigated by implementing additional water control measures proposed in Sediments Mitigation Measure-1D.

Significance: Potentially significant.

> *SEDIMENTS MITIGATION MEASURE-1A:* Conduct pre-project sampling of sediments from specific ponds, in accordance with the project Additional Sediment Sampling Analysis Plan (SAP).

See Appendix J and discussion under Sediments Impact-1, Section 5.3.3.

> *SEDIMENTS MITIGATION MEASURE-1B:* Conduct post-implementation monitoring in areas with elevated concentrations of inorganics to determine whether conditions are occurring that would increase contaminant mobility (e.g., methylation, acidification, or oxidation of sediments, or visual observation of increased drying or wetting/drying cycles).

See discussion under Sediments Impact-1, Section 5.3.3.

> *SEDIMENTS MITIGATION MEASURE 1C:* If post-implementation monitoring indicates the presence of conditions that would increase contaminant mobility, implement water management measures to mitigate these conditions.

See discussion under Sediments Impact-1, Section 5.3.3.

> *SEDIMENTS MITIGATION MEASURE 1D*: If post-implementation monitoring (Sediments Mitigation Measure 1B) during the Initial Release Period identifies elevated levels of inorganic impacts in discharge waters, potentially attributable to freshening effects, this impact may be mitigated in future releases by implementing additional water control measures designed to reduce freshening effects.

See discussion under Sediments Impact-1, Section 5.3.3.

Post-mitigation Significance: Less than significant

6.0 BIOLOGICAL RESOURCES - REGULATORY SETTING

This section describes the federal and state policies and laws relevant to biological resources in the project area.

6.0.1 Regulatory Environment and Policies

6.0.1 Federal Endangered Species Act (ESA)

The ESA protects listed wildlife species from harm or "take." The term "take" is broadly defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." An activity is defined as a "take" even if it is unintentional or accidental. Project-related impacts to federally-listed, proposed, and candidate species or their habitats are considered "significant" under CEQA guidelines.

USFWS (with jurisdiction over plants, wildlife, and resident fish) and NOAA Fisheries (formerly NMFS; with jurisdiction over anadromous fish and marine fish and mammals) oversee ESA. The purpose of consultation with USFWS and NOAA Fisheries is to ensure that the federal agencies' actions do not jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat for listed species.

ESA does not give plants legal protection on nonfederal lands unless a state law or regulation is being violated. ESA does prohibit malicious damage or destruction of threatened or endangered plant in any area under federal jurisdiction, and the removal, cutting, digging up, or damaging or destroying of any such species in any other area in knowing violation of any state law or regulation, or in the course of any violation of a state criminal trespass law.

The Corps of Engineers has requested informal Section 7 consultation for the proposed project. Information has been supplied to USFWS and NOAA Fisheries, as appropriate and informal consultation is ongoing. Based on this information and consultations, USFWS and NOAA Fisheries will prepare Biological Opinions on the proposed project.

6.0.2 Clean Water Act - Section 404

Under Section 404 of the Clean Water Act, the U.S. Army Corps of Engineers (Corps) is responsible for regulating the discharge of fill material into waters of the United States. Section 404 regulates any discharge activity below the ordinary high-water level—the water level equal to the mean annual flood level—of a stream channel. Examples of such discharge activities include placement of fill material, placement or alteration of structures that have the intended effect of functioning as fill, or any discharge activity that would affect wetlands or the surface-water conveyance or capacity of a channel.

"Waters of the United States" and their lateral limits are defined in 33 CFR (Code of Federal Regulations) Part 328.3 (a) and include tidal waters, streams that are tributary to navigable waters, and their adjacent wetlands. "Wetlands" are defined for regulatory purposes, at 33 CFR 328.3 and 40 CFR 230.3, as areas "inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands that are not adjacent to waters of the United States are termed "isolated wetlands" and are subject to Corps jurisdiction under certain circumstances.

In general, a Corps permit must be obtained before placing fill in wetlands or other waters of the U.S. The type of permit depends on the amount of acreage and the purpose of the proposed fill and is subject to discretion from the Corps. Corps authorizations are usually granted under either a nationwide permit or an individual permit. To qualify for a nationwide permit, a project must meet certain conditions and have no more than a minimal adverse effect on the aquatic ecosystem. The Corps typically interprets this condition to mean that impacts are minor and there will be no net loss of either wetland acreage or wetland habitat value, and this process usually results in the need to provide mitigation for project-related fill of any tidal water, creek, or wetland.

An individual permit is usually required where a nationwide permit is not applicable. The consideration of an individual permit includes, but is not limited to, factors such as significant acreage of wetlands or waters of the U.S., areas of high biological or unique value, or length of watercourse affected. Individual permits require review of the project by the public, an alternatives analysis that demonstrates that wetland impacts have been avoided or minimized to the extent possible, and appropriate compensatory mitigation for unavoidable impacts.

Pursuant to Section 401 of the Clean Water Act, projects that apply for a Corps permit for discharge of dredged or fill material into wetlands or other waters of the U.S./State, must obtain water quality certification from the RWQCB. This certification ensures that the project will uphold State water quality standards. Alternatively, the RWQCB may elect to notify an applicant that the State may issue Waste Discharge Charge Requirements in lieu of a Section 401 certification for a project.

A federal ruling issued in 2001 may affect whether wetlands are considered jurisdictional by the Corps (January 9, 2001, Solid Waste Agency of Northern Cook County [SWANCC] ruling [*SWANCC* v. *United States Army Corps of Engineers* (121 S.Ct. 675,2001)]). Guidance on non-navigable, isolated and intrastate waters was published on January 19, 2001, by counsel for USEPA and the Corps in response to the SWANCC ruling. The guidance essentially resulted in the determination that non-navigable, isolated waters may not be regulated by the Corps.

For the proposed project, the Corps has agreed to the assumption all areas below the mean higher high water (MHHW) level are jurisdictional wetlands and are subject to Section 404 requirements. This assumption is highly conservative, as many of the areas designated as jurisdictional wetlands for the project do not contain vegetation.

Preliminary consultation with the Corps indicates that the agency is most likely to issue a Nationwide Permit for the proposed project. Nationwide permits are general permits that cover activities such as minor dredging, construction of temporary structures (e.g., cofferdams) and fill activities. Nationwide permits have a set of general conditions that must be met for the permits to apply to a project, as well as specific conditions that apply to each nationwide permit.

For the proposed project, the following conditions would need to be met as part of the Section 404 permitting process:

- Procurement of Section 401 water quality certification from the San Francisco Bay RWQCB (discussed above)
- Compliance with ESA, involving consultation with USFWS and NOAA Fisheries (discussed above)

- Compliance with the requirements of Section 106 of the National Historic Preservation Act (NHPA)

6.1.3 Other Statutes, Codes, and Policies Affording Species Protection

Migratory Bird Treaty Act—The federal Migratory Bird Treaty Act (16 U.S.C., Sec. 703, Supp. I, 1989) prohibits killing, possessing, or trading in migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, and bird nests and eggs.

Bald and Golden Eagle Protection Act—The federal Bald and Golden Eagle Protection Act prohibits persons within the United States (or places subject to U.S. jurisdiction) from "possessing, selling, purchasing, offering to sell, transporting, exporting or importing any bald eagle or any golden eagle, alive or dead, or any part, nest, or egg thereof."

Executive Order 11990—Protection of Wetlands—Executive Order 11990 (issued in 1977) is an overall wetland policy for all agencies managing federal lands, sponsoring federal projects, or providing federal funds to state and local projects. It requires federal agencies to follow procedures for avoidance, mitigation, and preservation, with public input, before proposing new construction in wetlands. Compliance with Section 404 permit requirements may constitute compliance with the requirements of Executive Order 11990.

6.0.4 California Endangered Species Act

California implemented the California Endangered Species Act (CESA) in 1984. CESA is similar to the federal ESA both in process and substance; it is intended to provide protection to threatened and endangered species in California. CESA does not supersede the federal ESA, but operates in conjunction with it. Species may be listed as threatened or endangered under both acts (in which case the provisions of both State and federal laws would apply) or under only one act.

CESA prohibits the take of any plant or animal listed or proposed as threatened, endangered, or rare (applies only to plants). Habitat destruction is not included in the state's definition of take. Section 2090 of CESA requires state agencies to comply with endangered species protection and recovery and to promote conservation of these species. CDFG administers the act and authorizes take through Section 2081 agreements, except for species designated as "fully protected". (According to CESA, species designated as "fully protected," such as the salt harvest mouse, cannot be impacted and are not subject to Section 2081 take agreements.

6.1.5 California Native Plant Protection Act (CNPPA)

Regarding plant species, CESA defers to the CNPPA of 1977,which prohibits importing rare and endangered plants into California, taking rare and endangered plants, and selling rare and endangered plants. CEQA can provide protection for plants listed as rare under the CNNPA that would not otherwise be protected under CESA.

6.0.6 Other State Statutes, Codes, and Policies Affording Species Protection

California State Wetlands Conservation Policy—The Governor of California issued an executive order on August 23, 1993, that created a California State Wetlands Conservation Policy. This policy is being implemented by an interagency task force that is jointly headed by the State Resources Agency and the California Environmental Protection Agency (Cal/EPA). The policy has three goals:

- to ensure no overall net loss and a long-term net gain in wetlands acreage and values in a manner that fosters creativity, stewardship, and respect for private property;
- to reduce the procedural complexity of state and federal wetlands conservation program administration; and
- to encourage partnerships that make restoration, landowner incentives, and cooperative planning the primary focus of wetlands conservation.

“Waters of the State”—Water Code Section 13260 requires “any person discharging waste, or proposing to discharge waste, in any region that could affect the waters of the state to file a report of discharge (an application for waste discharge requirements [WDRs]).” “Waters of the state” is defined in the Porter-Cologne Water Quality Control Act as “any surface water or groundwater, including saline waters, within the boundaries of the state” (Water Code Section 13050[e]). The SWANCC ruling described above has no bearing on the Porter-Cologne definition. Although all waters of the United States that are within the borders of California are also waters of the state, the converse is not true (i.e., in California, waters of the United States represent a subset of waters of the state). Thus, California retains authority to regulate discharges of waste into any waters of the state, regardless of whether the Corps has concurrent jurisdiction under Section 404. The Regional Water Quality Control Boards (RWQCBs) are responsible for imposing WDRs for fill material placed into waters of the state.

As noted above, for the proposed ISP, all areas under the MHHW level within the project area are considered jurisdictional wetlands, subject to Section 404 requirements.

State Fish and Game Code = Fully Protected Species and Species of Special Concern— Under the State Fish and Game Code, the CDFG also has jurisdiction over species that are designated as “fully protected.” These species are protected against direct impacts. The CDFG maintains informal lists of “species of special concern.” These species are broadly defined as plants and wildlife that are of concern to the CDFG because of population declines and restricted distributions, and/or they are associated with habitats that are declining in California. Project-related impacts to species on the State lists of endangered or threatened species, “fully protected” species, and species of special concern are considered “significant” under *CEQA Guidelines* (discussed below).

State Fish and Game Code Section 1601 to 1503 – Streambed Alterations—The CDFG exerts jurisdiction over the bed, banks, and channels of watercourses according to the provisions of Section 1601 to 1603 of the Fish and Game Code. CDFG requires a Streambed Alteration Permit for the fill or removal of any material from any natural drainage. The jurisdiction of the CDFG extends to the top of bank and often includes the adjacent riparian vegetation.

State Fish and Game Code, Section 3503.5—Additionally, birds of prey (hawks, eagles, falcons, and owls) are protected in California under the State Fish and Game Code, Section 3503.5. Section 3503.5 states that it is “unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto.” Disturbance that causes nest abandonment and/or loss of reproductive effort is considered “taking” by the CDFG and would be considered a significant impact.

CEQA Guidelines, Section 15380—Although threatened and endangered species are protected by specific federal and State statutes, CEQA *Guidelines*, Section 15380(b) provides that a species not included on the federal or State lists of protected species may be considered rare or endangered if the species can be shown to meet certain specified criteria. These criteria have been modeled after the definitions in the federal ESA and the California Fish and Game Code. This section was included in the guidelines primarily to deal with situations in which a public lead agency is reviewing a project that may have a significant effect on a species that has not yet been listed by either the USFWS or CDFG. Thus, CEQA provides a lead agency with the ability to protect a species from a project's potential impacts until the respective government agencies have an opportunity to designate the species as protected, if warranted.

6.1 BIOLOGICAL RESOURCES – BENTHIC ORGANISMS

This section describes the benthic communities within the project area and the effects of project implementation on these communities, including the salinity changes to receiving waters caused by ISP discharges. This section also addresses impacts to the California Bay shrimp.

References specific to the project or to the region that were used to prepare this section included: *Evaluation of the Potential for Impacts on Bay Shrimp Associated with Circulation of Saline Pond Water during the Initial Stewardship Period* (Appendix G), and *Assessment of Impacts to Aquatic Life Associated with Circulation of Saline Pond Water during the Initial Stewardship Period* (Appendix B). In addition, data collected in 1994-96 as part of the Benthic Pilot Study of the San Francisco Estuary Regional Monitoring Program (RMP) were used (RMP 1997).

6.1.1 AFFECTED ENVIRONMENT

Benthic organisms are bottom-dwellers living on and in the bottom sediments of the Bay and include animals, plants and bacteria. Benthic organisms are ecologically important as food resources for other benthic invertebrates, both scavengers and predators, fish, birds and mammals. Benthic invertebrates in their adult life stages often are differentiated by their habitat.

Epifauna are motile invertebrates that live on specific substrates. The muddy and sandy bottom in open water areas and major channels is important habitat for large invertebrates, including the California bay shrimp, Dungeness crab, and rock crab. Most epifauna invertebrates are herbivores or predators.

Infauna are invertebrates that burrow or bore through mud or clay sediments. Examples are polycheate and oligocheate worms, most bivalves, some gastropods, and some crustaceans. Some infaunal species filter plankton from the water as food, whereas others prey on other infauna. Most live within a few centimeters of the substrate surface. Worms and clams form their own community structure beneath the bottom sediments, connected to the water by tubes and tunnels. Sessile species are permanently or semi-permanently attached to their substrates and include tubeworms, oysters, mussels and barnacles.

In addition to serving as a major food source for higher order predators, benthic organisms affect the physical and chemical condition of water and sediments. Filter feeders pump large volumes of water through their bodies and extract food from it. As they filter water for food, they also remove sediments and organic matter, cleaning the water. Since many chemical contaminants often are present in sediments, benthic fauna often are exposed to and can be harmed by these pollutants. Infaunal deposit feeders plow through the sediments in search of food. Many benthic animals bind sediments together as fecal pellets that remain at the bottom. Predators, such as crabs, scurry across the bottom searching for food. These activities stir the sediments, increasing the rate of exchange of materials into the water column. This mixing also increases diffusion of oxygen into the sediments.

6.1.1 Regional Overview

A significant decrease in native benthic invertebrate fauna in San Francisco Bay has been documented over the last several decades (URS 2001). This decline has resulted primarily from habitat loss and the introduction of invasive non-native species that either compete with or feed on the native benthic invertebrates. It is estimated that 40%-100% of the benthic invertebrate fauna in any area of the Bay are non-native species (Carlton 1979, URS 2001). Asian clam, green crab (*Carcinus maenas*), and Chinese mitten crab (*Eriocheir sinensis*) are invasive non-native species of particular ecological concern that have become well established in the bay. Along the intertidal mudflats and beaches, a variety of mites, springtails, flies, and beetles scavenge among flotsam along beach and estuary margins. Tiger beetles, many carabid beetles, and various fly species are active predators on these scavenging insects. Tiger beetle is a common insect predator, particularly on mudflats, tidal channel edges, and salt pans.

Some crab species are amphibious, and scavenge or prey on other invertebrates on the mudflats, vegetated wetland margins, or rocky shoreline areas during low tides. Invertebrate fauna important to the commercial fishery include *Cancer* crabs (primarily the Dungeness crab and rock crabs) and caridean shrimp. *Cancer* crabs and caridean shrimp are estuarine species that typically do not occur in deep water. Rock crabs and caridean shrimp support substantial fisheries in San Francisco Bay. Dungeness crabs in the bay mature at nearly twice the rate of those in populations outside the bay, probably as a result of higher water temperatures. Early planktonic larval stages (zoea) typically are limited to the central bay, but later planktonic larval stages (megalops) are found throughout the bay.

Sloughs – The composition of the benthic invertebrate communities inhabiting the five tributaries (Coyote Creek, Artesian Slough, Guadalupe Slough, Old Alameda Creek, Alameda Flood Control Channel, Mount Eden Creek, and Alviso Slough) into which pond water will be circulated is not well characterized. No benthic data could be found for any of the five tributaries in the project area. However, a 1997 City of Palo Alto study (Cressey 1997) does provide data that are probably relevant to the five tributaries of concern. In the Cressey study, benthic communities in San Francisquito Creek and the discharge channel from the Palo Alto Wastewater Treatment Plant were sampled and the collected specimens identified. These two tributaries will not be receiving circulated pond water, but since they are geographically close to the tributaries in question and have similar morphologies, it is likely that they will also have similar benthic communities. The results of this study indicate that benthic communities in the tributaries of concern are likely to be fairly simple, with the most abundant taxa being four species of annelids (*Neanthes succinea*, *Eteoni lighti*, *Tubificidae spp*, and *Heteromastus filiformis*), three species of arthropods (*Nippoleucon hinumensis*, *Corophium alienense*, and *Grandidierella japonica*), and two species of molluscs (*Macoma balthica* and *Potamocurbula ameurensis*). Interestingly, all of these species, except for *P. ameurensis,* were found at all stations in San Francisquito Creek and in the discharge channel, with salinities ranging from 1 to 27 ppt.

San Francisco Bay Proper – The composition of the benthic invertebrate community inhabiting the mudflats of South San Francisco Bay has been described by Nichols and Thompson (1985a & 1985b). Based on data from 1974-83, it appears that the communities in the vicinity of the Alviso Complex and the Baumberg Complex are probably very similar, with three species being "the overwhelming numerical dominants" – these are *Gemma gemma* (a mollusc), *Ampelisca abdita* (an arthropod), and *Streblospio benedictii* (an annelid). In addition, according to Nichols and Thompson (1985b), "although much less abundant, the mollusks *Macoma balthica*, *Mya arenaria*, and *Illyanassa obsoleta* often represent the bulk of benthic invertebrate biomass."

A more recent dataset was collected in 1994-96 as part of the Benthic Pilot Study of the San Francisco Estuary Regional Monitoring Program (RMP 1997). Based on these data, for estuarine muddy sediments, the most common and abundant species are *Potamocorbula amurensis*, *Ampelisca abdita, Nippoleucon hinumensis*, *Corophium heteroceratum*, *Corophium alienense*, *Grandiderella japonica*, *Balanus improvisus*, *Tubificidae sp.*, *Neanthes succinea*, and *Streblospio benedicti* . These data indicate that the species composition in the bay sediments in the vicinity of the Alviso and Baumberg complexes has remained fairly consistent over time, with the exception of the marked increase in the abundance of a recent invading species, *Potamocorbula amurensis*.

6.1.1.2 CALIFORNIA BAY SHRIMP

Bay shrimp (*Crangon franciscorum*) is a common invertebrate species in South S.F. Bay and its tributaries. At present, bay shrimp support the only commercial fishery in the South Bay and the juveniles of this species probably live in all of the sloughs into which saline pond water would be circulated during the ISP. Reportedly, these juveniles have specific salinity requirements which are currently being met in South Bay sloughs and creeks.

Bay shrimp use all of the sloughs into which saline pond water will be circulated during the ISP as rearing habitat. The use is seasonal, with most shrimp being absent during the months of March and April, when adults migrate to the ocean to spawn. Starting in May, juveniles migrate to the sloughs from the ocean and apparently seek out slough segments based on prevailing salinity profiles. As the shrimp grow and mature, they are found in those segments of the sloughs that contain higher salinity waters (i.e., closer to the bay). In January and February, when the shrimp are mostly adults, they leave the sloughs and begin their annual migration to their ocean spawning grounds.

In the South Bay and its tributaries, the salinity preference of bay shrimp is apparently associated with the age and, correspondingly, the size of the individuals. Juvenile bay shrimp (defined as individuals between 11 and 25 mm total length) are found in South Bay sloughs from May (when they first arrive from the ocean) through August (after which they are considered adults). CDFG data indicate that the juveniles are found in waters of between 3 and 19 ppt salinity, but seem to prefer a salinity range of 10 and 15 ppt (Baxter et al. 1999).

As the bay shrimp get older and larger, they are found in higher salinity waters (Baxter et al 1999, Kinnetic Labs 1987). In the months of September through February, the average size of the adult bay shrimp in the potential circulation areas consistently increases from 30 mm to almost 50 mm. In the main channel of the South Bay, bay shrimp in this size range are commonly found in waters with average salinities of between 17 and 27 ppt (depending upon year), and at maximum salinities as high as 32 ppt. In the sloughs, from September through December, the adult shrimp are found in waters of between 4 and 27 ppt, but seem to prefer a range of between 10-20 ppt.

6.1.2 CRITERIA FOR DETERMINING SIGNIFICANCE OF EFFECTS

Criteria based on the CEQA Guidelines and NEPA implementing guidelines were used to determine the significance of impacts to benthic organisms. Under NEPA, analysis of significance requires consideration of both the context and intensity of an impact. Consideration of context means the significance of an action must be analyzed within the appropriate ecological and temporal scale and intensity refers to the severity of the impact.

Potential impacts of the project on benthic organisms were characterized qualitatively and quantitatively by evaluating both the intensity and context of direct, indirect, temporary, and permanent impacts. Direct impacts may include, for example, construction activities or removal of habitat within the construction footprint. Indirect impacts include the loss or gain of a primary food source through a change in pond salinities. Temporary impacts have a short duration, and benthic populations would be expected to recover within a few months after implementation. An example would be habitat changes during the initial release of brines from the ponds. A permanent impact would involve the long-term alteration of habitat quality because the project would result in a change in habitat type. An example would be the permanent removal of a levee section, resulting in the conversion of diked salt pond to tidal marsh.

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 varies with each species and with the particular circumstances pertinent to a particular geographic area. Water salinity is the primary determinant of the significance of impacts to benthic organisms. Therefore, for the purposes of this analysis, significance thresholds for benthic organisms are based on short- and long-term impacts to the salinity of receiving waters under the Initial Release Period and Continuous Circulation Period of the ISP.

6.1.3 IMPACTS AND MITIGATION MEASURES

This section addresses impacts to benthic populations within the project area. The section also presents proposed mitigation for impacts that are significant or potentially significant.

The project will have the potential to impact benthic populations through impacts to water quality, substrate, continuity, and habitat area and type. In general, the following types of project impacts are considered in this section:

- Impacts to benthic populations related to increased salinity
- Impacts to benthic populations related to other water quality changes
- Impacts to benthic populations related to introduction of non-native opportunistic organisms

The No Action/No Project Alternative would not include pond discharges to the receiving waters, but may result in potential impacts to benthic populations from salinity and water quality changes in receiving waters following uncontrolled breaches pond levees. In addition, all invertebrate populations within the ponds would be greatly affected.

Alternative 1 (Seasonal Ponds) would have a minimum of potential impacts to benthic populations in the receiving waters, although substantial impacts would occur to populations within the ponds themselves. The alternative would not include pond discharges and would include levee maintenance comparable to existing conditions.

Alternatives 2 and 3 would include a combination of continuous circulation systems, seasonal ponds, and batch ponds. Pond discharges may include temporary salinity and water quality impacts in limited areas near the discharge locations. Pond management techniques and water quality monitoring, as proposed, would reduce these impacts to less than significant.

Alternatives 2 and 3 include the option to breach the Island Ponds, which would be expected to provide access to habitat for a variety of benthic species. Increasing habitat access by levee breaching and re-establishing tidal exchange with the South Bay is identified as a beneficial impact of the project on benthic communities under all three alternatives.

Implementation of the project will potentially cause the following changes in environmental conditions relevant to the benthic community:

- Increases in salinity
- Increases in heavy metal exposure
- Changes in availability of oxygen
- Changes in water temperature

Additionally, the project may have indirect impacts to benthic communities by allowing non-native opportunistic species to become established. The types of anticipated project impacts are discussed generally first and then in relationship to each of the proposed project alternatives below. Additional information on the effects of the project on water salinity, heavy metals, dissolved oxygen (DO), and temperature is provided in Chapter 4, Water Quality.

6.1.3.1 Overview of Impacts to Benthic Organisms Related to Increases in Salinity

When salinities increase above the normal range experienced at a site in an estuarine system, resident aquatic organisms can be adversely impacted (Hopkins 1973). The adverse impacts could range from altered physiological functions (e.g., metabolism, reproduction, growth) to acute lethality. Both ends of this spectrum could result in altered community structure and/or function.

Aquatic organisms that occur in the South Bay and associated creeks and soughs are estuarine species that are currently subject to daily and seasonal changes in salinity levels. Estuarine species must be able to tolerate environmental changes (e.g., benthic species) or must be able to move to more optimal conditions (e.g., planktonic species). Because of the dynamic nature of their surrounding environment, estuarine benthic species must be able to react to fresh water and saltwater. Most estuarine species are capable of surviving a wide salinity range.

Mobile organisms exposed to conditions less than optimal may move to areas with more suitable salinity. Sessile or benthic organisms or passive swimmers are not able to move away from unsuitable conditions, and so they are much more tolerant of variable conditions. Sessile or benthic organisms, such as clams, typically will close their shells or burrow into the mud until conditions improve, or until they acclimate to the new conditions. The sessile and benthic communities in the project area are adapted to periods of high salinity, particularly during the summer months.

It is not possible to determine a valid single threshold salinity value that would protect all the potentially exposed organisms. The variety of resident species, lack of scientific data on individual salinity tolerances at all life stages for most of the South Bay fauna makes such a task extremely difficult. Additionally, 51% of the benthic species that occur in South Bay are introduced; this adds additional uncertainties as these introduced species are opportunistic and may have wider tolerances than the literature indicates for surrogate species. Little if any data is available on the tolerance of the interstitial fauna or those micro-benthic organisms living at the water-substrate interface. We do know that wide changes in biological communities occur in the bay during drought conditions and extended times of higher salinity during the continuous circulation period could result in similar water quality conditions.

Based upon the literature reviewed there are two potential salinity threshold ranges:

1. The upper tolerance range that if exceeded causes the organism to die (acute level).
2. A salinity range that does not cause death but adversely affects metabolism, reproduction, larval survival, and other physiological functions. This chronic level could lead to the eventual decrease in the population vitality and possibly the collapse of the population if conditions were maintained over a long period of time.

Within these possible threshold range guidelines, a discussion of salinity threshold ranges can be attempted. Under normal salinity conditions in the summer, levels reach 28-30 ppt. During drought conditions in South Bay, salinities are rarely over 35 ppt. (Table 1). Even at this level, large changes in the biota are seen during long term drought conditions. Two multi-year studies have shown that, in addition to within-year periodicity, major restructuring of the benthic community can occur as a result of anomalous (usually climate-related) perturbations of the benthic habitat (salinity-temperature-dissolved oxygen concentrations). For example, during wet years, freshwater-intolerant species (*Mya arenaria, Corophium acherusicum, Ampilisca abdita* and *Streblospio benedicti*) disappear from the upper part of the estuary (Carquinez Strait) and from shallow areas of the bay. During a two-year drought these same species colonized the extreme upper end of the estuary (Suisun Bay) in large numbers (Nichols &Thompson, 1985). During the 1976-77 drought the effects of increased salinity levels greatly reduced phytoplankton blooms in San Francisco Bay. Organisms living in an estuarine system are usually tolerant of some variation in salinity, but typically have a preferred range. Large salinity changes over a wide area could adversely alter the distributions of organisms in the San Francisco Bay (Davis, 1982).

Table 6-1
Salinity Levels During Drought Conditions-Three South Bay Sloughs

	Newark	Mowry	Faber Tract
Month	Salinity high (ppt)	Salinity High (ppt)	Salinity High (ppt)
August	33	28	31
September	33	29	31
October	34	32	32
November	35	35	31
Data collected in 1977 over a single tidal cycle (Smith, 1978)			

Data from the San Jose/Santa Clara WWTP (2002) studies in the Coyote Creek and Alviso Slough areas provide information on recent salinity levels. The area of study is influenced by the discharge of fresh water from the waste treatment plant that discharges into Coyote Creek. Based upon results from continuously recording stations, surface water salinities decreased during falling and low tides and increased on rising and high tides. These results indicate that the creek system is stratified in that fresh water, from all local sources, flows out across the more saline bay water during the falling and low tides. Conversely, during rising or high tides, fresh water flows are impounded upstream or are mixed with more saline tidal waters. The results that are presented in Table 6-2 were selected to show the higher range of salinities measured during the incoming tidal cycle in the summer months from selected stations.

Table 6-2
Maximum Salinity from South Bay (San Jose/Santa Clara WWTP Study)

Date	Coyote Creek (fixed)	Date	Coyote Creek (floating)	Date/time	Alviso Slough
6/3/00	22.9	7/2/01	20.75	9/1/99-16:30	23.92
7/2/00	18.4	7/5/01	20.83	9/1/99- 17:00	24.47
7/31/00	19.4	7/20/01	21.59	9/1/99- 17:50	24.46

1. Coyote Creek near RR Bridge
2. Fixed = recording by fixed instrument
3. Floating = recording by floating instrument
4. Alviso Slough data taken on a single date.

These salinity levels are below those taken by USGS at stations in Coyote Creek during 2002. These differences could reflect station location (further away from freshwater inflow), seasonal differences and methods of measurement. Salinity levels measured by USGS during the same 2002 cruise at stations outside the direct influence from the waste discharge (Coyote Hills, Ravenswood Point) reached 30 ppt in August, September and October. These levels most likely reflect the salinity of the more open water and perhaps sloughs in South Bay that are not influenced by the fresh water coming from treatment plants.

At salinity levels to 34 ppt, the response of the South Bay biota might resemble that seen during a long-term drought period. At salinity levels to 36 or 38 ppt, conditions are likely to exceed the acute levels for many species. For example, sea urchin embryos showed developmental problems at 36.5 ppt and did not survive salinity above 38.5 ppt (SCCWRP, 1993). While there are no echinoderms in the South Bay fauna, the sea urchin embryo bioassay test is used for testing sewage discharges under NPDES permits within the bay. In this range other species, which do occur in South Bay, reach their upper tolerance range (e.g., *Mytilus galloprovincalis* at 38 ppt (Mars, 1950). There are other species where the upper tolerance was between 40 and 45 ppt (Pierce, 1970).

Table 6-3 summarizes the types of potential benthic species effects which may occur with increased salinities. The ambient and drought classes represent minimal effects. Stages 1 through 4 represent increasing salinity classes and increasing potential species effects. These classes and estimated salinity ranges are approximate and species impacts can be affected by local salinity conditions and species aclimatization to local conditions.

Table 6-3
Summary of Potential Salinity Response Characteristics (Summer Conditions)

Class	Salinity Range (ppt)	Potential Response
Ambient	<33	Benthic species population may vary depending upon species salinity preferences.
Drought	33-35	Chronic exposure: benthic community changes to salinity tolerant species similar to drought years, effects quickly reversed with normal salinity regime. Acute exposure: less of a shift is species composition. In either case, impacts less than significant
Salinity ranges above those encountered in South Bay		
Stage 1	36-38	Chronic exposure: benthic community may lose most sensitive species, impacts considered potentially significant. Acute exposure: less impact on community, impacts considered less than significant.
Stage 2	39-41	Chronic exposure: benthic community may lose larger number of species, impacts considered significant. Acute exposure: less impact on community, impacts considered potentially significant.
Stage 3	41-45	Chronic exposure: community may be limited to most salinity tolerant species, impacts considered significant. Acute exposure: less impact on community but still lose of large number of species, impacts considered significant.
Stage 4	>45	For both chronic and acute exposures, community would be severely reduced. In either case, impacts considered significant.
NOTE: Response criteria based on scant scientific data for local species and therefore must be considered speculative.		

These levels are based on some species that do not occur in the bay, and there is limited data on the salinity tolerances of the native opportunistic species that may be responsive to higher salinity levels. In addition, it is not known whether an artificial drought salinity condition due to the initial release during normally less saline periods of the spring may affect reproductive cycles of any of the bay biota.

At increased salinity levels above the 30 ppt level, the likelihood that more species will be adversely affected would increase with increasing salinity. At salinities above the 40 ppt range the impacts would be widespread. These response levels are based on the assumption that the salinity discharge concentrations would be immediate (no period of acclimation for the fauna). The response levels indicated in Table 6-3 are based mostly on adult forms exposed to ambient temperature levels.

Conversely, benthic surveys within the salt ponds (Lonzarich, 1989) also provide valuable insights as to the sensitivities of benthic invertebrate species inhabiting the receiving waters. Lonzarich found one annelid species (*Polydora ligni*) and four crustacean species (*Artemia salina, Balanus sp., Copepoda sp., and Corophium sp.*) which could tolerate salinities from 22 to 84 ppt. Several other species were not found in the highest salinity ponds, but were observed in ponds that seasonally reached 40 ppt. These included three mollusk species

(*Gemma gemma*, *Ilyanassa obsoletus*, and *Tryonia imitator*), two annelid species (*Neries succinea* and *Tubificoides sp*.), and 6 crustacean species (*Anisogammarus confervicolus*, *Crangon spp*., *Hemigrapsus oregonensis*, *Ostracoda sp*., *Palaemon macrodactylus*, and *Sphaeroma quoyana*). Comparison of these Lonzarich results with the invertebrate species expected to be found in the waters into which the salt ponds will be circulated indicates that several members of the benthic invertebrate community-at-risk can tolerate significantly elevated salinities. Two of the crustacean species common to the discharge areas (*Balanus sp*. and *Corophium sp*.) were observed to tolerate salinities as high as 84 ppt. In addition, one common annelid species (*Tubificoides sp*.) and two common mollusk species (*Gemma gemma* and *Ilyanassa obsoletus*) were observed to tolerate salinities as high as 40 ppt.

In addition, two salt pond releases have occurred in Napa at ponds 2a and 3. These ponds were uncontrolled breaches with extended periods of releases at 50 and over 60 ppt into South Slough. Because the breaches were not planned, there has been limited monitoring data available for these discharges. However, limit observational data has not identified extensive losses of benthic invertebrates or other common species.

During the ISP (Alternatives 2 and 3), the salinity of the discharges from the Alviso Unit, Baumberg Unit, and West Bay Unit ponds will generally be greater than the salinity of the receiving waters. The greatest differences in salinity between discharge and receiving water will occur during the Initial Release Period, when the highest salinity waters (estimated to be up to 135 ppt) will be pushed out of the ponds. There will be variation between discharge points, but, in general, the discharge of the higher salinity waters will last for between 1 and 2 months, with the salinity of the discharge decreasing over time. After this Initial Release Period, bay water will be continuously circulated through the ponds so that pond salinities are maintained at levels suitable for future restoration. During the Continuous Circulation Period, the discharge salinities may be as high as 44 ppt. However, under most scenarios, the actual discharge salinities during this Continuous Circulation Period will be considerably less than 44 ppt.

The significance of impacts to each of the receiving waters in the project area was determined 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 as described above. 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).

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

- For a chronic exposure, a water body that would receive a Stage 1 impact (some acreage of that water body would have salinities in the Stage 1, or 36 to 38 ppt range) would be considered to have 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 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 that would receive a Stage 1 impact (some acreage of that water body would have salinities in the Stage 1, or 36 to 38 ppt range) would be considered to have a no significant impact. A water body that would receive Stage 2 (salinities in the 39-41 ppt range) would be considered to have 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. 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.

6.1.3.2 Overview of Impacts to Benthic Organisms Related to Increases in Heavy Metal Exposure

Based upon the evaluation of the potential discharge levels of nickel and mercury during initial release under the maximum salinity scenarios, the levels of nickel and mercury in the discharge would likely be above the water quality objectives (WQOs) for the South Bay. WQOs are regulatory thresholds that are based upon long-term response criteria (i.e., bioassay data, behavioral response) with appropriate safety factors to assure adequate protection for sensitive species not tested (see Chapter 4, Water Quality). Thus, these criteria cannot be used to predict effects, but rather to indicate a level of additional risk should they be exceeded.

The higher levels of nickel and mercury are associated with increased salinity discharged from the ponds. Salinity by itself does not seem to increase the toxicity of metals (Klapow et al. 1979) and in the case of chromium; increased salinity levels may actually reduce the toxicity (Sprague, 1985). However, if increased salinity levels stress the existing biota, particularly where salinity levels approach biotic tolerance levels, concentrations of metal may have cumulative adverse effects. If the discharge of the project ponds were to coincide with the infaunal invertebrate reproductive stages or recently settled larvae in the sloughs, impacts could occur. Fish and epibenthic species would most likely move out of the areas with toxic levels of metals, and would therefore not be exposed.

Even low levels of metals can be very toxic to aquatic organisms at early developmental stages. There are also other pathways by which metals in the South Bay could contribute to chronic effects in benthic and other aquatic organisms. In 1994, a spring phytoplankton bloom in South San Francisco Bay caused substantial reductions in concentrations of dissolved cadmium, nickel, and zinc (Luoma, et al. 1998). The phytoplankton bloom reduced the nickel levels by 75%. Luoma et al. (1998) estimated that about 60% of the dissolved cadmium, nickel, and zinc from South Bay treatment plants are cycled through the phytoplankton. Part of this dissolved metals load is then moved into the food chain and can be taken up by plankton-feeding fish and invertebrates out of the water column or collected by infauna at the water-substrate interface.

We know that South Bay organisms do bioaccumulate metals as shown by studies of the clam *Macoma baltica* from the mudflats in Palo Alto (Primo et al. 2001). Data for nickel and mercury were evaluated from 1994-2001 and it was noted that nickel and mercury levels decreased during this time, with tissues concentrations of 6 µg/g for nickel and 0.35 µg/g for mercury Kinnetic Lab (1983) noted that South Bay shrimp averaged 35% higher in Mercury when compared to reference samples taken from North Bay. The levels that exceed the criteria are artifacts of the solar evaporation process and the potential discharge concentrations may not be above other historic or current sources in San Francisco Bay. What role the possible discharge of nickel and mercury from the ponds would play in this bioaccumulation cycle is unclear, but the potential for impacts should not be ruled out.

Exposure of benthic organisms in early developmental stages to mercury poses the biggest potential pathway for impacts from the pond discharges. If the discharges are initiated in April (as proposed under Alternative 2), some species may still be undergoing early developmental stages in some of the sloughs. Discharges later in the summer (as proposed for some ponds under Alternative 3) would be less likely to cause cumulative metal effects because most eggs and larvae have already hatched and settled.

6.1.3.3 Overview of Impacts to Benthic Organisms Related to Changes in Available Oxygen

The distribution of oxygen differs from parameters such as salinity and temperature in that it is biologically active: it is closely associated with changes in carbon and plant-nutrient concentrations (Conomos et al, 1979). Dissolved oxygen (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
- Advection and diffusion

It is important to remember that 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).

Hansen (2003e) presented a detailed report on estimates of the composition (percentages of bay water, upstream slough water, and each type of discharged pond water) that would be found in selected slough and bay segment under existing (no circulation) and IRP conditions. Analytical tests were conducted to determine biological oxygen demand (BOD) on each of the mixtures to estimate their oxygen demand. Predictions were presented on whether any observed changes in oxygen demand would result in adverse conditions to aquatic life. Based upon this data, the author determined that the discharge from the ponds would not affect the DO in the receiving water. See Section 4.3.1.3 for additional discussion of this study.

Studies in Mowry Slough, Newark Slough and Faber Tract Marsh (Smith, 1978) indicated that the DO could reach levels of 3.5 ppm during time of tidal change. The data also indicated that vertical stratification of DO occurred in Newark Slough during August of 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 chemicals in the substrate, was conducted. Based on laboratory results, the chemical and biological demand could at times reduce the DO levels to below 1 ppm within the interstitial waters below the water-substrate interface. While the preliminary information strongly indicates that DO will not be a problem during the discharge from the ponds, it is conceivable that if high density water remains in contact with the water-substrate interface, DO levels could be depressed for a longer time than normally encountered during a tide cycle. If temperatures are elevated along with increased salinity levels the DO could become depressed.

6.1.3.4 Overview of Impacts to Benthic Organisms Related to Changes in Temperature

Similar to their responses to changes in salinity, benthic organisms respond to changes in water temperature through a number of physiological, behavioral, and ecological mechanisms that affect survival, growth, migration, and reproduction. In addition, temperature can influence how well benthic 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 impact benthic fauna in receiving waters. 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 were a maximum of 4.6°C higher than temperatures of receiving waters, 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.

6.1.3.5 Resilience of Benthic Communities and Impacts Related to Non-native Opportunistic Species

Over a 10-year period (1974-83), Nichols and Thompson (1985) studied benthic invertebrate communities in South San Francisco Bay mudflats. These communities are probably very similar to those found in many of the bay and slough segments which will receive salt pond discharges during the ISP. Nichols and Thompson report that these communities are very persistent over time because many of the member species can respond quickly to major changes in salinity and other perturbations. During these perturbations, local populations of some of the resident species may greatly diminish in numbers or even disappear. However, when favorable conditions return, these species often become re-established within a matter of months. According to Nichols and Thompson, the key to this rapid recovery are the "opportunistic life history strategies (rapid maturity, brooding of young, multiple generations each year, ease of local dispersal of both juveniles and adults) that permit continued colonization of the mudflat surface or rapid re-colonization after disturbances".

A second study by Hopkins (1987), reported similar findings for four intertidal sites in San Francisco Bay. Two of these sites, near Palo Alto and near Hayward, are in the general area of the proposed Alviso and Baumberg Complex discharges and would be expected to have similar benthic invertebrate community structure. Over a two year period, the benthic invertebrate community structure varied considerably at each of these sites due to changes in salinity resulting from changing rainfall patterns. The fall of 1982 to the spring of 1983 was an unusually wet period and many of the species that are commonly found in the study areas were lost from the benthic communities. However, during the following year, rainfall was back to normal and many of the "lost" species were re-established.

Other corroborating information on the ability of estuarine species to rapidly become re-established can be found in the literature on the colonization of constructed salt wetlands. This process is clearly a worst-case example because, when initially constructed, the ecosystem in these wetlands is starting from scratch. Not only are there no estuarine animals or plants present, but the physical habitat is still being modified. In a paper by Levins et al. (1996), it is reported that one month after the creation of a salt marsh, there is early colonization of benthic invertebrates and after six months, the macrofaunal densities and species richness of sediments resemble those of natural marshes. Similarly, Simenstad and Thom (1996) report that in created wetlands, fishes immediately occupied the intertidal habitat, with the number of species present during the first year being fairly equivalent to later years.

Other information which demonstrates the ability of natural benthic invertebrate communities to recover from major perturbations includes the accidental spill of metam sodium, a toxic soil sterilant, into the Upper Sacramento River at the Cantara Loop in July 1991. According to a Department of Water Resources report (DWR 1997), immediately after this accident, the benthic invertebrate community was totally eliminated for a 26-mile stretch downstream of the Cantara Loop. However, within 30 days, colonization of the entire impacted area was significantly underway and within 4 months, the diversity found at the impacted sites was similar to that found at the upstream control area. Within one year, most metrics of benthic community health indicated recovery at the downstream sites.

It is important to take into consideration the presence of non-native opportunistic species and their potential impact on post-project recruitment time, succession and benthic community structure. Over 50% of the species now present in the receiving waters are introduced and are most likely very opportunistic. These species can become established after disturbance and hinder the re-establishment of functioning benthic communities.

An example of community disruption is presented by the invasion of San Francisco Bay by the Asian clam *Potamocorbula amurensis*. During years of normal or high river inflow, the resident community in the North Bay consisted of a few brackish or freshwater species (Nichols et al. 1990). During prolonged periods of low river inflow, the number of species doubled as estuarine species (e.g. *Mya arenaria*) migrated up the estuary. In June 1987, at the beginning of the longest dry period in recent decades, large numbers (>12,000 per m^2) of juvenile *P. amurensis* were discovered at the Suisun Bay site (Nichols et al. 1990). By mid-summer 1988, the new clam predominated (>95%) in both total number of individuals and biomass, and the expected dry-period estuarine species did not become re-established.

A second example of community disruption by the introduction of non-native species can be found in the South Bay where *Macoma balthica,* a native species of clam, is abundant only when, during its periods of larval settlement, *Ampelisca abdita* (non-native species) is very low in abundance or absent. This finding suggests that *Macoma* abundance is controlled locally by the presence of a large population of *A. abdita.*

6.1.3.1 No-Project/No Action

Under the No Action alternative the ponds would dry through the evaporation process in summer and then fill seasonally with rainwater in winter. No action would be conducted by the agencies, including levee maintenance, and some levees would likely fail during this period.

> *BENTHIC IMPACT-1* If levee failure occurs, existing benthic communities located near the breach will be impacted.

The No-Project/No Action Alternative would result in both direct and indirect impacts to the benthic community along the outboard of pond levees and adjacent sloughs and creeks in the event of a levee failure. In addition, benthic communities within the ponds would be severely impacted by the lack of sustained water levels in the ponds. Levee failure would result in the release of pond contents, and may expose benthic communities to high salinity water. Levee failure would restore tidal action and may cause localized scouring and/or deposition of the bottom substrate which would remove and/or smother benthic communities. Once conditions have stabilized, the restored tidal action would decrease pond water salinity within the pond area and create conditions appropriate for the re-establishment and colonization of estuarine benthic communities (a potential beneficial impact).

Significance: Potentially Significant

6.1.3.2 Alternative 1 – Seasonal Ponds.

In Alternative 1, the ponds would dry through the evaporation process in summer and then fill seasonally with rainwater in winter. The only action taken by the agencies would be to maintain the levees at their current standard of maintenance (i.e., salt pond maintenance, not for flood control).

Maintenance of the levees and water control structures would prevent their deterioration and prevent the accidental breaching of the ponds.

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.

Alternative 1 would have minimal impacts to receiving waters, but existing, in-pond habitat value would decline as a result of changing the existing open-water ponds to seasonal ponds. In addition, 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.

6.1.3.3 Alternative 2- Simultaneous March/April Discharge

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.

> *BENTHIC IMPACT-2:* The project would cause a reduction in aquatic habitat suitability because of deterioration of water quality

Initial release of the existing pond contents as part of project operations would result in the discharge of moderately to highly saline water that could lead to a deterioration of water quality and a reduction in aquatic habitat. There are no quantitative standards established for salinity discharges, but the San Francisco Bay RWQCB has a narrative standard that states that the allowable increase in salinity cannot adversely affect beneficial uses such as aquatic habitat. The specific water quality effects are described in Chapter 4, “Water Quality.”

Additionally, bay shrimp use the sloughs into which saline pond water will be circulated during the ISP as rearing habitat. The use is seasonal, with most shrimp being absent during the months of March and April. This two-month period encompasses the time when the adults leave the South Bay to spawn in the ocean. In May, the young-of-the-year return to the sloughs to grow and mature until February when their annual migration to the ocean once again begins. In order to minimize any potential impacts to bay shrimp, this window of low abundance (March and April) would be an ideal time to initiate the circulation of saline water from the ponds. The discharged pond water will have the highest salinities at the beginning of the ISP and an opportunity to eliminate those more saline waters when the majority of the shrimp are absent would be advantageous.

Under Alternative 2, the initial release from the ponds is scheduled to begin in March/April when ambient salinities are low, and to coincide with the time of the year when the densities of bay shrimp are at their lowest in the receiving waters and, therefore, to minimize potential impacts. If initial pond salinities are at their proposed maximum levels, temporary local decreases in preferred shrimp habitat are predicted for a few months following the commencement of initial discharge. The major change will be a shift of the most preferred salinities (for bay shrimp) to locations further upstream in the sloughs in question.

Under proposed maximum salinities and the Alternative 2 discharge scenario, there is no predicted reduction in the amount of adult preferred habitat area in any of the four sloughs studied. In addition, for two of the sloughs (the Alameda Flood Control Channel and Guadalupe Slough) there is no predicted reduction in the amount of juvenile preferred habitat either. On the other hand, for Alviso Slough and Coyote Creek, discharges under these conditions are predicted to reduce the amount of preferred juvenile habitat, but the lost area will still retain some value to the juvenile shrimp.

In summary, this evaluation indicates that, with regard to bay shrimp habitat, the major change that the circulation of saline pond water will produce during the ISP is a shift of the preferred salinities to locations further upstream in the sloughs in question. If the discharges are at proposed maximum salinities (with the initial release beginning in either April or July), there is a predicted decrease in juvenile preferred habitat in Alviso Slough and Guadalupe Slough during the Initial Release Period, but adult preferred habitat is not expected to be affected. After the initial release from the ponds has been completed, it is anticipated that juvenile and adult shrimp habitat in the sloughs will not be significantly impacted by the planned continuous circulation of relatively low salinity pond water.

Refer to Chapter 4 (Water Quality) for a complete discussion of impacts to water quality affecting habitat values for aquatic organisms. Since significance thresholds for salinity impacts to water quality are based on impacts to benthic organisms, potentially significant and significant salinity impacts to water quality are, by definition, also potentially significant and significant impacts to benthic organisms. In Chapter 4, short-term and long-term salinity impacts to water quality are addressed separately for each of the receiving water bodies. Other constituents could also affect the receiving waters and be toxic to aquatic organisms, degrading habitat and affecting populations. Water quality impacts from other constituents are also discussed in detail in Chapter 4.

As discussed in Chapter 4 (see Section 4.3), the following significant short-term water quality impacts may affect benthic organisms:

- Short-term impacts to aquatic habitat are anticipated from elevated salinities in the following receiving water bodies:
- Alameda Flood Control Channel (Baumberg Complex)— See Water Quality (Salinity) Impact-7 for a complete discussion.
- Old Alameda Creek (Baumberg Complex)— See Water Quality [Salinity] Impact-8 for a complete discussion.
- Under some circumstances, total mercury in discharged water and receiving water will exceed total mercury WQOs and may have short-term impacts on water quality—See Water Quality (Metals) Impact-3 for a complete discussion.
- Increased algal activity in ponds leads may lead to decreased dissolved oxygen in receiving waters—See Water Quality (DO) Impact-1 for a complete discussion.
- Discharge of pond water at temperatures more than 5 degrees Fahrenheit above the temperature of the receiving water may adversely affect water quality and biota in adjacent waterways—See Water Quality (Temperature) Impact-2 for a complete discussion.

Significance: Short-term impact—Significant

Long-term impact—Less than Significant

Implementation of mitigation measures proposed in Chapter 4 (Water Quality), in combination with Benthic Mitigation Measure-1 below, would reduce this impact to less-than-significant level. Relevant mitigation measures in Chapter 4 are as follows (see Section 4.3 for details):

- WQ-Salinity Mitigation Measure 1A
- WQ- Salinity Mitigation Measure 1B
- WQ-Metals Mitigation Measure 1A
- WQ- Metals Mitigation Measure 1B
- WQ-DO Mitigation Measure 1A
- WQ- DO Mitigation Measure 1B
- WQ-Temperature Mitigation Measure 1A
- WQ- Temperature Mitigation Measure 1B
- WQ-pH Mitigation Measure 1A
- WQ- pH Mitigation Measure 1B

Benthic Mitigation Measure-1: Assess and maintain salinity and other water quality parameters at levels protective of aquatic resources.

The data developed through WQ-Salinity Mitigation Measure 1A will be assessed relative to the salinity and other water quality requirements of benthic communities. If the assessment of water quality, based on analysis of monitoring data, indicates a potential measurable effect on population abundance, measures could be implemented to minimize the water quality effects. The measures may include change in discharge magnitude, timing, and duration. The data would support real time operations that could minimize effects to all life stages.

Post Mitigation Significance: Less Than Significant

6.1.3.4 Alternative 3 Phased Initial Discharge

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.

In general, impacts to benthic organisms under Alternative 3 are essentially the same as those for Alternative 2. The potential impacts from mercury bioaccumulation by early life stages of benthic organisms may be less under Alternative 3 than under Alternative 2. Most eggs and larvae have already hatched and settled by July. During the initial release period, Alternative 3 does have a greater short-term impact on juvenile Bay Shrimp habitat. Mitigation proposed for Alternative 3 is identical to mitigation proposed for Alternative 2 and would reduce all identified impacts to a less than significant level. A list of impacts and proposed mitigation for Alternative 3 is provided below.

As discussed in Chapter 4 (see Section 4.3.1.3), the following significant short-term water quality impacts may affect benthic organisms under Alternative 3:

- Short-term impacts to aquatic habitat are anticipated from elevated salinities in the following receiving water bodies:
- Guadalupe Slough (Alviso Complex)— See Water Quality (Salinity) Impact-6 for a complete discussion.

- Old Alameda Creek (Baumberg Complex)— See Water Quality [Salinity] Impact-8 for a complete discussion.
- Old Alameda Creek (Baumberg Complex)— See Water Quality [Salinity] Impact-8 for a complete discussion.
- Under some circumstances, total mercury in discharged water and receiving water will exceed total mercury WQOs and may have short-term impacts on water quality—See Water Quality (Metals) Impact-3 for a complete discussion.
- Increased algal activity in ponds leads may lead to decreased dissolved oxygen in receiving waters—See Water Quality (DO) Impact-1 for a complete discussion.
- Discharge of pond water at temperatures more than 5 degrees Fahrenheit above the temperature of the receiving water may adversely affect water quality and biota in adjacent waterways—See Water Quality (Temperature) Impact-2 for a complete discussion.

Significance: Short-term impact—Significant
Long-term impact—Less than Significant

Implementation of mitigation measures proposed in Chapter 4 (Water Quality), in combination with Benthic Mitigation Measure-1 below, would reduce this impact to less-than-significant level. Relevant mitigation measures in Chapter 4 are as follows (see Section 4.3 for details):

- WQ-Salinity Mitigation Measure 1A
- WQ- Salinity Mitigation Measure 1B
- WQ-Metals Mitigation Measure 1A
- WQ- Metals Mitigation Measure 1B
- WQ-DO Mitigation Measure 1A
- WQ- DO Mitigation Measure 1B
- WQ-Temperature Mitigation Measure 1A
- WQ- Temperature Mitigation Measure 1B
- WQ-pH Mitigation Measure 1A
- WQ- pH Mitigation Measure 1B

Benthic Mitigation Measure-1: Assess and maintain salinity and other water quality parameters at levels protective of aquatic resources.

The data developed through WQ-Salinity Mitigation Measure 1A will be assessed relative to the salinity and other water quality requirements of benthic communities. If the assessment of water quality, based on analysis of monitoring data, indicates a potential measurable effect on population abundance, measures could be implemented to minimize the water quality effects. The measures may include change in discharge magnitude, timing, and duration. The data would support real time operations that could minimize effects to all life stages.

Post Mitigation Significance: Less Than Significant

6.2. Biological Resources – Vegetation and Wetlands

This section describes the biological communities known to occur within the salt ponds, levees, sloughs and creeks, and along the Bay shoreline within the project area and the effect that project implementation may have on these communities. The section also addresses impacts to special status plant species within the project area. Finally, the section addresses potential concerns of the project pertaining to invasive plant species.

Site-specific plant surveys were conducted only for those areas that will be directly impacted by the project (i.e., inlet and outlet locations). However, additional information specific to the project area or to the region was available from a number of sources, including reports prepared for the Goals Project 2000, the Spartina Control Program, Cargill operations and maintenance permits, the Eden Landing Ecological Reserve, San Francisco International Airport's proposed runway reconfiguration program, and the Napa River Salt Marsh Restoration Project. Additional information was available from databases, including the California Native Plant Society's Electronic Inventory of Rare and Endangered Vascular Plants of California, and CDFG's California Natural Diversity Database (CNDDB). These sources are cited below and full references are provided in Chapter 15.

6.2.1Affected Environment

Regional Vegetation Characteristics

The San Francisco Bay Estuary supports the largest and most ecologically important expanses of tidal marshes and mudflats in the contiguous western United States. These vegetation communities are characterized for the project region below.

Tidal Marsh

Tidal marsh can be found along the Bay shoreline from MSL to extreme high water line. Tidal marsh is categorized by elevation as belonging to the low marsh zone, middle marsh zone, or high marsh zone. The low marsh zone occurs from mean sea level to mean high water (MHW). The middle marsh zone occurs from approximately MHW to mean higher high water (MHHW). The high marsh zone occurs near and above MHHW, up to the extreme high water line.

In the San Francisco Bay, native Pacific cordgrass generally dominates the low marsh zone, and along tidal creek banks and the edges of tidal mudflats. The middle marsh zone makes up an extensive portion of the San Francisco Bay. Younger marshes in this zone are characterized by vegetation dominated by pickleweed (*Salicornia virginica*) with some areas containing saltgrass (*Distichlis spicata*), salt marsh dodder (*Cuscuta salina*), alkali heath (*Frankenia salina*) and spearscale or fat hen (*Atriplex triangularis*). The high marsh zone commonly includes natives such as gumplant *(Grindelia stricta*) (often dominant in the zone), salt marsh dodder, pickleweed, alkali heath, sea lavender (*Limonium californicum*) and spearscale. Common non-native species in the high marsh zone include perennial pepperweed (*Lepidium latifolium*), bassia (*Bassia hyssopifolia*), saltwort (*Salsola soda*), wild beet (*Beta vulgaris*), annual iceplant (*Mesembryanthemum nodiflorum*), iceplant (*Corpobrotus edulis*), Australian saltbush (*Atriplex semibaccata*), ripgut brome (*Bromus diandrus*), sicklegrass (*Parapholis incurva*) and rabbit's-foot grass (*Polypogon monspeliensis*) (Goals Project, 1999).

The low marsh and middle marsh zones are increasingly being impacted by several invasive species of cordgrass, including an Atlantic species of invasive cordgrass (*Spartina alterniflora,* or smooth cordgrass). (See discussion of this and other invasive species in Section 6.2.1, below.)

Within each of the elevation zones in the Bay, tidal marsh communities can be categorized as salt marsh or brackish marsh, according to their salinities and the type of plant assemblages present. According to a long-term study that monitored tidal and soil characteristics affecting marsh vegetation, interstitial soil salinity is the greatest factor controlling marsh vegetation (H.T. Harvey and Associates, 2002). Salt marsh in the Bay is defined as having a water column salinity range from 20 to 32 ppt. Water in the soil pores (interstitial salinity) was found to have salinities ranging from 35-42 ppt in the South Bay salt marshes (H.T. Harvey and Associates, 2002). Dominant plant species include Pacific cordgrass in the low marsh, and common pickleweed and other halophytes at higher elevations. Brackish marsh occurs where freshwater inputs reduce salinity from15-20 ppt, and is dominated by alkali bulrush, cattails and California bulrush (H.T. Harvey and Associates, 2002; Goals Project, 2000). At salinity ranges between those defined as salt marsh or brackish marsh, species from both these habitats co-occur.

Tidal Mudflats

Below the low marsh zone are tidal flats, which occur from below MLLW to MLW and are defined as having less than 10% vascular plant cover other than eelgrass (Goals Project 2000). They include large areas of mudflats, expanses of barren mud that are uncovered during low tides and are habitat to diatoms, invertebrates, and a variety of algae. When exposed, mudflats are considered the most crucial habitat for shorebird populations that feed heavily upon them. During inundation periods (twice daily at high tides), mudflats are feeding areas for fish.

According to one account, prior to filling and diking in San Francisco Bay, tidal mudflats were ubiquitous and as wide as two miles. In the South Bay, each day as the tide went out, almost 50,000 acres of tidal flats emerged along margins of bays and larger tidal creeks and sloughs (Goals Project, 2000). Currently, the South Bay supports approximately 30,000 acres of tidal mudflat (San Francisco Bay Conservation and Development Commission, 1994). In areas where salt ponds have been constructed, mudflats are located outboard of the salt pond levees.

6.2.2 Vegetation Characteristics in the Project Area

Salt ponds in the project area are largely unvegetated. Because the South Bay Salt Ponds receive no tidal influence, they do not support tidal marshlands. In addition, due to elevated salinities and prolonged inundation, the ponds support few vascular plants. As discussed below, vascular plants are present only along the edges of the pond levees.

Vegetation varies across the project site depending on the characteristics of the habitat adjacent to the pond levees. Tidal marsh vegetation and associated mudflats are located on the levee toes and fringe marsh adjacent to the Bay. As freshwater streams approach the Bay, plant associations change as salinity levels increase from freshwater to brackish to saltwater. This is especially prevalent along channels within the Alviso Complex. The marshes located farther up the creeks and sloughs have vegetation that is increasingly dominated by brackish marsh species.

Vegetation within Salt Ponds—Most salt pond complexes in the South Bay were built on tidal marsh. Salt ponds were constructed using bay mud for the levees around the ponds. Active salt ponds are inundated year-round and do not support tidal marsh. In addition, vascular plants are limited to the edges of the pond levees (see descriptions of plant cover at proposed water control sites in Tables 6.2-2, 6.2-3 and 6.2-4 below). However, the ponds do support a distinctive group of halophilic (salt-loving) biota made up of microalgae, photosynthetic bacteria and invertebrates. Vascular plants only exist along the edges of the pond levees. With presence varying by salinity, the dominant organism in these hypersaline ponds is the single-celled green algae (Dunaliella salina), halobacteria and purple sulfur-reducing bacteria. Ponds that serve as intake areas with salt concentrations closer to sea levels, contain marine algae, such as sea-lettuce (Ulva), Enteromorpha ssp., Cladophora ssp., and sometimes Fusus ssp. and Codium ssp. in firmer substrate. These areas also include marine diatoms, dinoflagellates and cryptomonads (Goals Project, 1999).

Colors in salt ponds range from pale green to deep coral pink and indicate the salinity of the ponds. In low-to mid-salinity ponds (50-110 parts per thousand [ppt]), green algae proliferate, lending the water a green cast. The typical salinity of sea water is 32 ppt. As the salinity increases, *Dunaliella* out-competes the other microorganisms in the pond, and the color shifts to an even lighter shade of green. In mid-to high-salinity ponds (200-250 ppt), high salt concentrations actually cause the *Dunaliella* to produce a red pigment. Brine shrimp in mid-salinity ponds contribute an orange cast to the water. Halophilic bacteria such as *Stichococcus* and purple sulfur-reducing bacteria also contribute red and reddish purple tints to high-salinity brine (Goals Project, 1999).

Vegetation on Levees—Levees around salt ponds and dredge lock ponds support both native and weedy species. Plant communities are often dominated by ruderal species adapted to disturbed upland habitat. In some areas sufficient water is present to support patches of native marsh species. Levee vegetation varies at the toe according to whether it is located on: 1) along tidal waters, 2) along non-tidal ponds, 3) along creeks and sloughs.

Levees above the extreme high tide zone support alkali heath, salt grass, perennial pepperweed, and coyote brush. Perennial pepperweed is a common dominant species on many levee crowns and disturbed sites and can form monotypic stands on recently disturbed sites, displacing native marsh vegetation. While it can establish through seed, it spreads primarily by subsurface rhizomes, which sprout and form new plants when broken by tilling or excavation (Wetland Research Associates, 2000).

Vegetation along Sloughs and Creeks—As freshwater streams approach the Bay, plant associations change as salinity levels increase from freshwater to brackish to saltwater. This is especially prevalent along channels within the Alviso Complex. In general, the upper reaches of creeks and sloughs support predominantly alkali bulrush and/or peppergrass. Lower reaches support single species stands, or mixed stands of pickleweed and cordgrass, depending on water depth. Pacific cordgrass occurs primarily in areas of persistent high salinity; alkali bulrush occurs in brackish water conditions; and California tule (Scirpus californicus) in freshwater conditions. Their distribution and abundance are related to their tolerance to water salinity and other factors, including tidal regime, disturbance, substrate type, marsh age, erosion and accretion (sedimentation) patterns.

Vegetation in and adjacent to streams and sloughs around the South Bay salt ponds were mapped by Jones & Stokes for San Francisco International Airport to assess the potential of complexes for habitat mitigation in conjunction with a proposed runway reconfiguration program (Jones & Stokes, 2001). Dominant communities of some of the major creeks and sloughs in the initial plan area for the airport project appear below in Table 6-4:

Table 6-4
Acreage of Slough and Creek Habitats

	Acres of Habitat			
	Mudflat	**Salt Marsh**	**Brackish/ Freshwater**	**Open Water**
Alviso Slough	58	57	118	83
Coyote Creek	293	116	306	258
Guadalupe Slough	37	60	156	122
Mt. View Slough	9	30	x	8
Mud Slough	x	29	112	38
Ravenswood Slough	57	8	x	17

6.2.3 Vegetation at the Proposed Impact Sites

In March through June of 2002, vegetation surveys were conducted where the addition of new or replacement of existing water control structures is proposed. The surveys did not included proposed locations of levee breaches on the Island Ponds. This section describes the survey methods and results, and provides a description of the existing vegetation.

Survey Methods—At each proposed structure location, surveyors measured the percentage of the area of impact that is vegetated. Plant species that cover at least 20 percent of the area of impact were noted. Species that comprise less than 20 percent cover were lumped together as “Other Halophytes.”

Survey Results— Tables 6-5, 6-6, and 6-7 identify the vegetation found at each location. Survey locations noted in the table correspond to locations noted on Figures 6-1, 6-2, and 6-3.

The most prevalent species across all project sites are pickleweed, pepperweed, and hare barley. Species that are common, but present at lower densities, include gum plant, bulrush, rip-gut brome, and species categorized as “other halophytes” (see note to Table 6.2-3). Although these species occur less frequently, they are occasionally co-dominant.

There are few differences between the complexes in the amount or composition of vegetation at proposed structure locations, although levee tops in the West Bay Complex tend to be more densely vegetated. However, the survey results indicate that there is a great deal of variation in percent cover of vegetation, and also in the dominant species present between surveyed locations within a single complex. For example, in the Baumberg 2C system, despite the proximity and similarity in conditions at replacement gate locations 2C-4 and 2C-5, the outboard levee slope of 2C-4 contains 30% hare barley cover, while the outboard levee slope of 2C-5 contains 100% pickleweed and other halophytes cover.

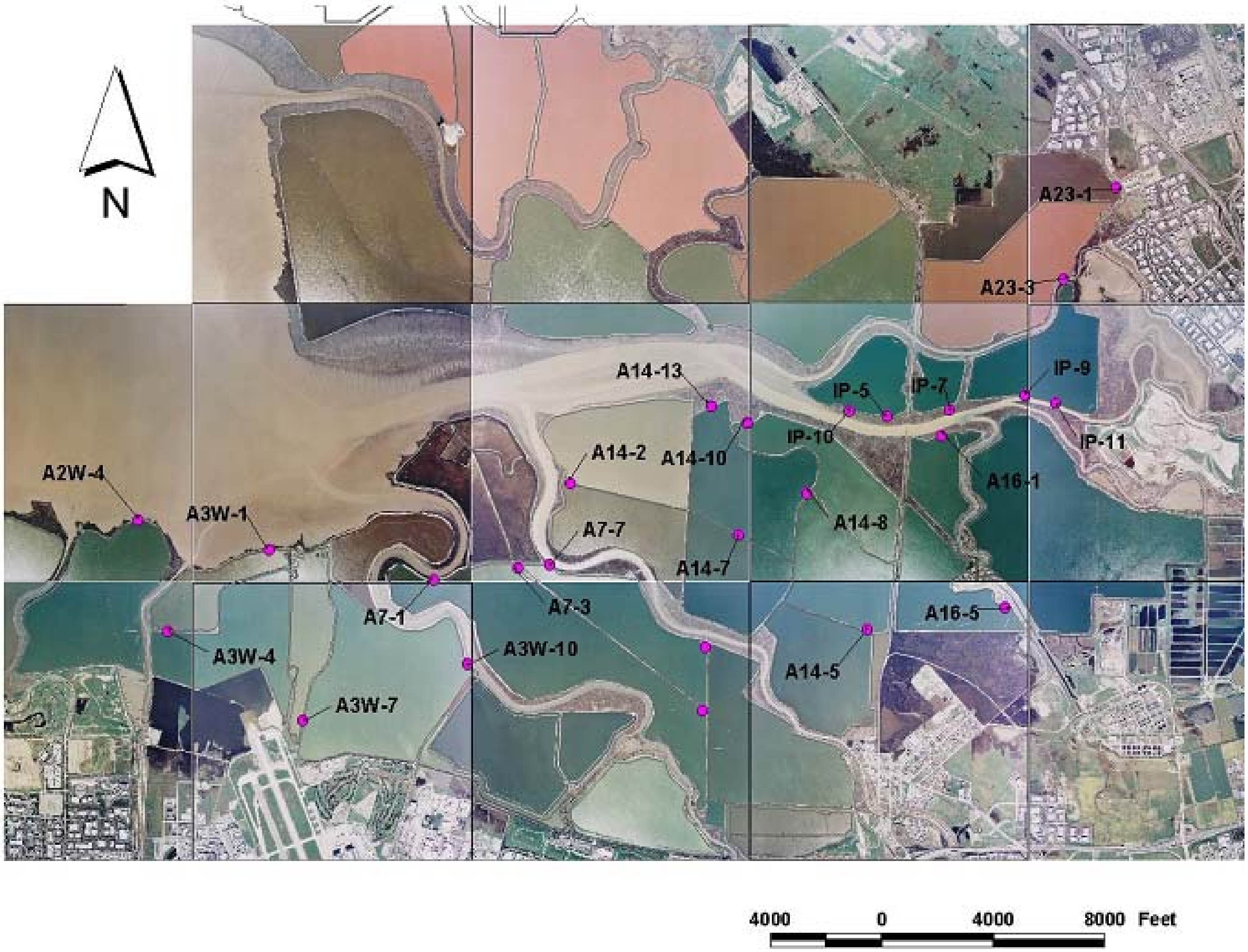


Figure 6-1
Alviso Complex Structure and Breach Locations

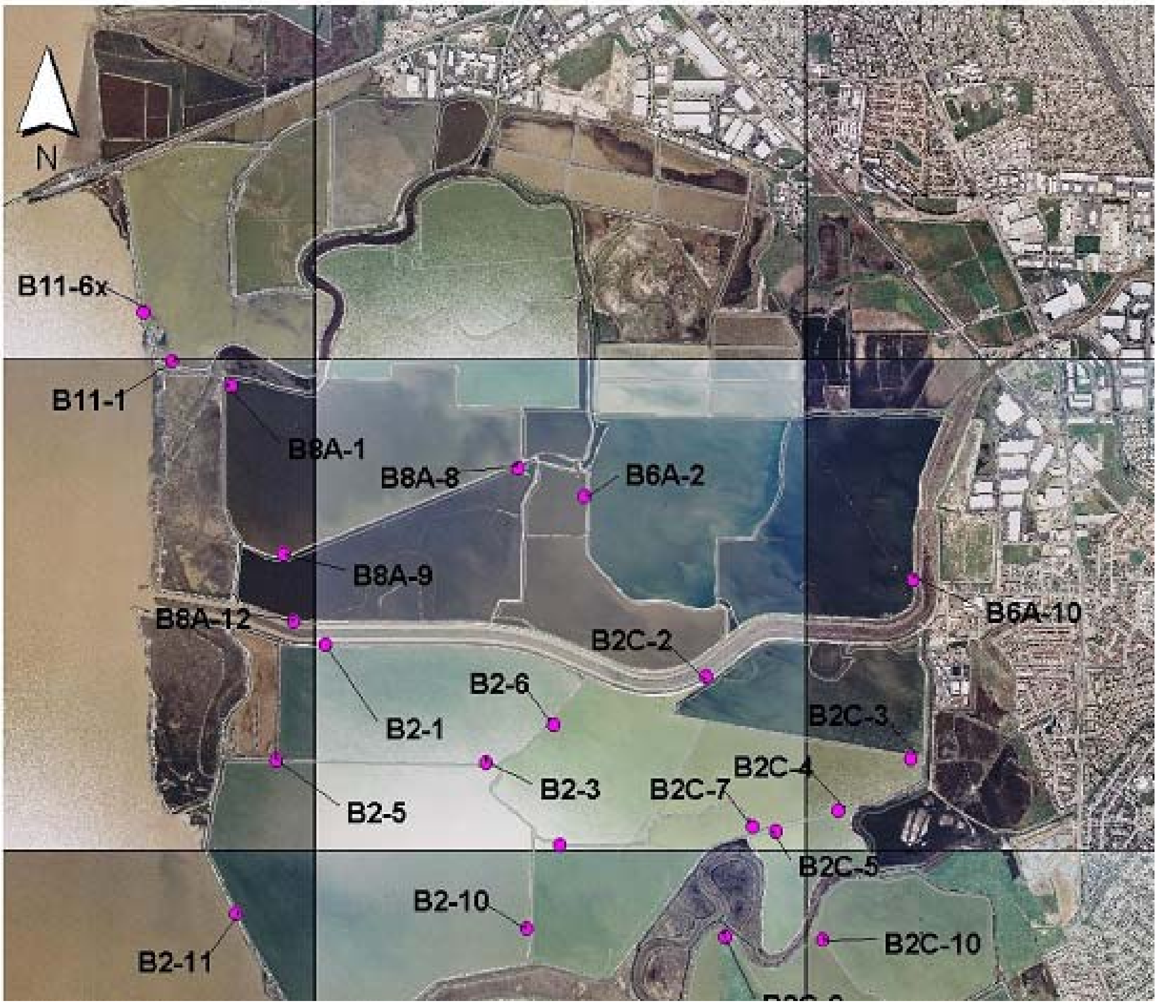


Figure 6-2.
Baumberg Complex Structure Locations.

Figure 6-3
West Bay Complex Structure Locations

Table 6-5
Vegetation at Proposed Alviso Complex Water Control Structures

Structure	Vegetation (total% cover; species with at least 20% cover)		
	Inboard Side	**Levee Top**	**Outboard Side**
A2W-4	36% total cover; hare barley, other halophytes	2% total cover	no vegetation
A3W-1	80% total cover; pickleweed, cordgrass, rip-gut brome, other halophytes	5% total cover	20% total cover
A3W-4	90% total cover; pickleweed	5% total cover	100% total cover; pickleweed, alkali heath,
A3W-7	15% total cover	no vegetation	10% total cover
A3W-10	100% total cover; rip-gut brome, pickleweed	50% total cover; rip-gut brome	100% total cover; pickleweed
A7-1	75%; Pickleweed, other halophytes	no vegetation	no vegetation
A7-2	no vegetation	no vegetation	no vegetation
A7-3	no vegetation	no vegetation	no vegetation
A7-6	no vegetation	no vegetation	10% total cover; other halophytes
A7-7	2% total cover	82%; pickleweed, other halophytes	50%; pepperweed
A14-12	no vegetation	no vegetation	80% total cover; pickleweed, other halophytes
A14-13	1% total cover	no vegetation	99% total cover; pepperweed
A14-10	100% total cover; pepperweed, pickleweed	no vegetation	no vegetation
A16-1	100% total cover; pepperweed, pickleweed	no vegetation	10% total cover; other halophytes
A16-5	1% total cover	2% total cover	100% total cover; *Scirpus*

Structure	Vegetation (total% cover; species with at least 20% cover)		
	Inboard Side	Levee Top	Outboard Side
			sp.
A23-1	95% total cover; rip-gut brome	no vegetation	5% total cover
A23-3	95% total cover; pepperweed, pickleweed	90% total cover; pickleweed	3% total cover

Notes:

inboard = inlet side of the levee, or the side from which water will flow

outboard = outlet side of the levee, or the side into which water will flow

"other halophytes" category includes the following species with less than 10% cover: marsh coyote brush (*Baccharis pilularis*), brass buttons (*Cortula coronopifolia*), pickleweek (*Salicornia sp.*), gum plant (*Grinelia stricta*), and alkali health (*Frankenia salina*).

Table 6-6
Vegetation at Proposed Baumberg Complex Water Control Structures

Structure	Vegetation (total% cover; species with at least 20% cover)		
	Inboard Side	Levee Top	Outboard Side
B2-1	90% total cover; pickleweed, hare barley	no vegetation	100% total cover; pickleweed, other halophytes
B2-4	no vegetation	no vegetation	10% total cover; pickleweed
B2-5	no vegetation	no vegetation	8% total cover
B2-6	10% total cover	30% total cover; hare barley	30% total cover; pickleweed
B2-11	10% total cover	90% total cover; pickleweed	no vegetation
B2-12	no vegetation	20% total cover; pickleweed	no vegetation
B2C-2	100% total cover; pickleweed, hare barley, other halophytes	no vegetation	100% total cover; hare barley, rip-gut brome, other halophytes
B2C-4	60% total cover; hare barley, picklweed	5% total cover	30% total cover; hare barley
B2C-5	1% total cover	no vegetation	100% total cover; pickleweed, other halophytes
B2C-14	100%; pickleweed, hare barley	no vegetation	100% total cover; pickleweed, *Scirpus sp*.
B6A-10	100% total cover; pickleweed, pepperweed, gum plant	40% total cover; Hare barley	100% total cover; *Scirpus sp.*
B8A-1	70% total cover; hare barley	5% total cover	100% total cover; pickleweed, gum plant, hare barley
B8A-12	100% total cover; pickleweed, gum plant	no vegetation	90% total cover; hare barley, other halophytes
B11-1	16% total cover	no vegetation	no vegetation

Table 6-7
Vegetation at Proposed West Bay Complex Water Control Structures

Structure	Vegetation (total% cover; species with at least 20% cover)		
	Inboard Side	Levee Top	Outboard Side
WB-1a	no vegetation	100% total cover; gum plant	100% total cover; cordgrass, alkali heath
WB-4	100% total cover; pickleweed	100% total cover;gum plant, alkali heath	no vegetation
WB-2	100% total cover; pickleweed	100% total cover; alkali heath, pickleweed	no vegetation
WB-13	<5% total cover	20% total cover; jaumea	100% total cover; pickleweed, cordgrass, alkali heath
WB-11	100% total cover; pickleweed, *Avena sp.*, cordgrass	no vegetation	100% total cover; *Avena sp.*
WB-6	100% total cover; pickleweed	no vegetation	no vegetation

In general, levee slopes are more densely vegetated than levee tops. When vegetation is present on levee tops, halophytes tend to dominate, although hare barley is prevalent at some locations. Vegetation characteristics also vary between the inboard and outboard sides of a levee at a single water control structure location. Vegetation characteristics on levee slopes located along tidal sloughs or Bay shoreline (levees that receive tidal influence), such as the outboard levees at A16-5 or B2C-2, also vary significantly compared to vegetation characteristics on levee slopes along non-tidal salt ponds.

6.2.4 Special-Status Plant Species and Sensitive Communities

Special-Status Plant Species—Special-status plants are defined as species that are legally protected under the California and federal ESAs or other regulations (see Section 6.0, above), or species considered sufficiently rare by the scientific community to qualify for such listing. Special-status plants are species in the following categories:

- Plants listed or proposed for listing as threatened or endangered under the federal ESA (50 CFR 17.12 [listed plants], and various notices in the *Federal Register* [proposed species])
- Plants that are candidates for possible future listing as threatened or endangered under the federal ESA (62 *Federal Register* [FR 182:49397-49411, September 19, 1997)
- Plants listed or proposed for listing by the State of California as threatened or endangered under the California ESA (14 CCR 670.5)

- Plants listed under the California Native Plant Protection Act (California Fish and Game Code sec. 1900 *et seq.*)
- Plants that meet the definition of rare or endangered under CEQA (State CEQA Guidelines sec. 15380), including those considered by the California Native Plant Society (CNPS) to be "rare, threatened, or endangered in California"

Species of Concern— Species of concern is an informal term used by some, but not all USFWS offices. Species of concern are sensitive species that have not been listed, proposed for listing, or placed in candidate status. Species of concern receive no legal protection, and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a threatened or endangered species. Potential project-related effects on species of concern, however, are disclosed as part of this document.

California Native Plant Society Listings—CNPS tracks plant species considered rare in California and assigns them to one of five lists in an effort to categorize their degree of rarity. Project-related effects on plant species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380) should be disclosed in EIRs and EISs. CDFG recognizes that plants on CNPS Lists 1A, 1B, and 2 would qualify for listing under Sections 2062 and 2067 of CESA and recommends they be addressed in EIRs. Some of the plants on CNPS Lists 3 and 4 may also qualify for listing under Sections 2062 and 2067 of CESA, and project-related effects should be described in EIRs and EISs. In addition, CDFG recommends, and local governments may require, protection and disclosure of impacts on plants that are regionally significant, such as locally rare species or disjunct populations of more common plants.

Special-Status Plant Species in the Project Area—There are two special status plant species that historically may have occurred in the project area. Point Reyes bird's beak (*Cordylanthus maritimus* ssp. *palustris*; federal species of concern, CNPS 1B) and California seablite (*Suaeda californica*, federal endangered, CNPS 1B). These species may be extremely rare in South Bay salt marshes and CNDDB records (CNDDB, 1993) indicate that known populations are most likely destroyed. Point Reyes bird's beak grows in tidal salt marsh and had been reported from Alviso and Palo Alto marshes (CDFG Natural Diversity Data Base 1993). California seablite was historically reported from one location in salt flats at the Palo Alto Yacht Harbor. This species occurs in salt marsh and upper littoral habitats. There are no recorded occurrences of either species at the project sites.

Sensitive Communities—Sensitive communities are those described as Significant Natural Areas (SNAs) by CDFG. These are communities that are known or believed to be of high priority for inventory in the CNDDB because of their rarity or level of threat (CDFG, 2001), or they are communities that are protected or regulated by federal, state, or local laws and regulations.

Sensitive Communities in the Project Area—In the project area, sensitive communities include tidal marshes, which are described for the San Francisco Bay region in Section 6.2.1.1, above.

6.2.1 Invasive Plant Species

Many non-native species of plants and animals have been introduced to the San Francisco Bay Estuary, and some now threaten fundamental changes in the structure, function, and value of the estuary's tidal lands. Within the last 30 years, the San Francisco Estuary has become host to a number of invasive cordgrasses from the Atlantic coast (*Spartina alterniflora* and *S. patens*), Chile (*S. densiflora*), and Europe (*S. anglica*). One of these species, *S. alterniflora*, has crossed with the native Pacific cordgrass (*S. foliosa)*, producing a hybrid that is highly fertile, adaptive, and robust. Though valuable in their native settings, these introduced cordgrasses are highly aggressive in this new environment, and frequently become the dominant plant species in areas they invade.

Cordgrasses are hydrophytic plants that thrive on mean salinities of 27 ppt and on tidal fluctuations in water levels. In the San Francisco Bay, native Pacific cordgrass generally dominates the low marsh zone, and along tidal creek banks and the edges of tidal mudflats. The low marsh and middle marsh zones are increasingly being impacted by the introduced species of cordgrass.

Researchers in 1992 (Callaway and Josselyn 1992) predicted that, left unabated, *S. alterniflora* would become a dominant salt marsh plant species in the South Bay, changing important ecosystem functions such as sedimentation dynamics and detrital production. At that time, *S. alterniflora* was found in seven locations in the South and Central Bay, including locations in the three counties (Alameda, San Mateo, and Santa Clara) in which the presently proposed project is located. At three of the seven locations, *S. alterniflora* was described as "abundant." The San Francisco Bay Area Wetlands Ecosystem Goals Project (Goals Project 1999) identified *S. alterniflora* and its hybrids as a serious threat to future restoration of bayland habitats, and called for an immediate, systematic, and coordinated program of control. In 2000, monitoring by the San Francisco Estuary Invasive *Spartina* Project found that non-native *Spartina* species had spread to dominate nearly 500 acres of tidal marsh (97% of that being S. alterniflora and its hybrids) interspersed throughout 5,000 acres of the Bay, predominantly in the South and Central Bay (Coastal Conservancy and USFWS, 2003). Once established in the San Francisco Bay Esturary, invasive cordgrasses could rapidly spread to other estuaries along the California coast through seed dispersal on the tides.

Possible long-term impacts of the *Spartina* invasion include local or total extinction of native *Spartina foliosa* (by genetic assimilation and/or displacement)*,* changes in available detritus*,* decreased benthic algal production, increased wrack deposition and disturbance of upper marsh, changes in habitats for native wetland animals, changes in benthic invertebrate populations, loss of critical shorebird and wading bird foraging areas (Callaway and Josselyn, 1992; Coastal Conservancy and USFWS, 2003), regional loss of small tidal sloughs and choking of channels, alteration of estuarine beaches, and grave impacts to populations of state and federally listed endangered species (Coastal Conservancy and USFWS, 2003).

In 1999, the State Coastal Conservancy and USFWS initiated the Invasive *Spartina* Project, a region-wide program to control non-native *Spartina* in the San Francisco Estuary. The Invasive *Spartina* Project currently predicts that *S. alterniflora* and hybrids will be effectively eradicated from most of the Central and South Bays by 2009 (P. Olofson, pers. comm.).

In addition to the invasive species of cordgrasses, other invasive species that have been noted in the middle marsh zone in the project area include brass buttons (*Cotula coronopifolia*) and Mediterranean saltwort (*Salsola soda*).

6.2.2 Criteria for Determining Significance of Effects

Potential impacts of the project on vegetation resources were characterized qualitatively by evaluating direct, indirect, temporary, and permanent impacts. Direct impacts include the direct removal of vegetation within the footprints of ground-disturbing actions at proposed water control structure locations and levee breaches. An indirect impact results from changes to habitat that are incidental to project implementation. An example would be the establishment of a non-native invasive weed species that out-competes native vegetation as a result of ground disturbance during project implementation.

Temporary impacts have a short duration, and the vegetation would be expected to recover within a few years after implementation. An example would be the removal of vegetation to add or replace an inlet structure, where the vegetation soon re-colonizes the repair site. A permanent impact would involve the long-term alteration of habitat quality and vegetation, because the project would result in the removal or change in the vegetation type. An example would be the permanent removal of a levee section that currently supports vegetation. A change in the hydrology of a pond, such as the conversion of a system pond to a seasonal pond, could also cause a permanent impact on the pond's vegetation characteristics.

Criteria based on NEPA and CEQA Guidelines were used to determine the significance of vegetation impacts. The following general criteria were considered in determining whether a vegetation impact would be considered significant:

- Federal or state legal protection of the resource or species
- Federal or state agency regulations and policies
- Documented resource scarcity and sensitivity both locally and regionally
- Local and regional distribution and extent of biological resources

The project would have a significant impact on botanical resources if it would result in:

- substantial reduction in local population size attributable to direct mortality or habitat loss, lowered reproductive success, or habitat fragmentation of plant species that are
- listed as endangered, threatened, or proposed for listing under CESA or ESA;
- listed as rare under CNPPA; or
- qualified as rare or endangered under CEQA; or
- the removal or alteration of substantial portions of a sensitive vegetation community, any vegetation community of particular public or regulatory concern, or other natural vegetation community, such that the viability of the community is threatened in the project area or vicinity.

6.2.3 Impacts and Mitigation Measures

For the most part, vegetation impacts are anticipated to be minor. Existing conditions in the project area are not conducive to tidal marsh plants and most of the project ponds are largely unvegetated. Ground disturbance within the footprints of proposed water control structures will cause direct impacts to vegetation, including some tidal marsh plants. The total area of disturbance is estimated at 2.91 acres of jurisdictional wetlands and 1.99 acres of areas with a greater than 25% cover of pickleweed. By complex, this breaks down as follows:

- Alviso Complex: 1.56 acres of jurisdictional wetlands and 0.81 acres of pickleweed (areas having greater than 25% pickleweed)

- Baumberg Complex: 1.03 acres of jurisdictional wetlands and 0.51 acres of pickleweed (areas having greater than 25% pickleweed)
- West Bay Complex: 0.32 acres of jurisdictional wetlands and 0.67 acres of pickleweed (areas having greater than 25% pickleweed)

By lowering pond salinities and opening up some of the ponds to tidal influence, on the other hand, the project is expected to produce conditions which are more conducive to plant growth, including tidal marsh. Breaching of the three Island Ponds (Alviso Ponds A19, A20, and A21) would open a total of approximately 475 acres of ponds to tidal influence, with significant benefits for wetlands vegetation. Restoration of wetlands habitat is one of the long-term goals for the project area and one of the major goals of the ISP. Overall, then, the project is expected to have a beneficial impact on vegetation, including wetlands.

The project does have the potential to create conditions favorable to the spread of invasive species of cordgrass *(Spartina spp.).* As discussed in Section 6.2.1.5, above, a major effort is currently underway to control the spread of these cordgrasses. An objective of the ISP is to assure that interim construction and management practices do not impede *Spartina* control efforts. CDFG and USFWS have committed to working closely with the Invasive *Spartina* Project to assure that non-native *Spartina*, and particularly, *S. alterniflora* and its hybrids, are adequately controlled near salt pond restoration sites prior to opening sites to tidal flow. Proposed mitigation would reduce all potentially significant project impacts to less than significant.

6.2.3 No-Project/No Action Alternative

VEGETATION IMPACT-1: If levee failure occurs, existing vegetation, possibly including rare plant species, would be impacted.

The No-Project/No Action Alternative would result in both direct and indirect impacts on vegetation along the pond levees and adjacent sloughs and creeks in the event of a levee failure and during emergency repairs.

Levee failure (more likely under this alternative since levees and other infrastructure would not be maintained) and related repair activities would remove vegetation in the failed section and in adjacent areas used for construction-related repair actions (direct impact). Vegetation types that may be affected include lower, middle, and upper tidal marsh on levee slopes bordering tidal areas. Other common vegetation types on the levee structures, including tidal and non-tidal levee slopes, may also be affected. Although there are no reports of populations of special-status plants within or adjacent to the project areas, since the levees have not been completely surveyed, the possibility remains that rare plant species may be present that could also be impacted by levee failure and repair activities.

Slough channel scouring and erosion due to levee failure may indirectly affect tidal marsh vegetation that occurs in outboard levee habitats. In addition, if levee failure occurs, highly saline water would be released into adjacent sloughs and creeks. Such a release would have negative indirect effects on vegetation alongside receiving waters. Other indirect impacts resulting from levee failure could include decreased pond water salinity and a dramatic increase in tidal influence in the ponds, creating conditions more conducive to vegetation, including establishment of wetland communities (a potential beneficial impact).

For most vegetation, these impacts would be temporary, as vegetation would re-establish in these affected areas. It is less clear that rare plants, if any exist, in the project area would re-establish following such an impact. Since the presence of rare plants cannot be ruled out without a thorough survey of all potentially affected areas, this impact must be considered potentially significant.

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

VEGETATION IMPACT-2: Disturbance of existing vegetation could promote the spread of invasive cordgrasses.

Disturbance of existing vegetation due to levee failure and related repair activities would create conditions more favorable to the establishment of invasive cordgrass species and hybrids. The spread of invasive cordgrass species is a permanent impact that will have long-term effects on existing plant communities. The Baumberg Complex currently contains fairly dense, contiguous stands of a variety of invasive cordgrass species, including *S. alterniflora* and its hybrids. These hybrids are also present near the Alviso and West Bay complexes. Levee failure may result in successful establishment of these hybrids in areas that are not currently impacted.

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

6.2.3.2 Alternative 1 (Seasonal Ponds)

Levee failure is considered less probable under this alternative compared to the No Project/No Action alternative. Direct and indirect vegetation impacts that could be caused by levee failure and related repair activities, as discussed for the No Action/No Project Alternative, are not likely under Alternative 1.

6.2.3.3 Alternative 2 (Simultaneous March/April Discharge)

This alternative would result in beneficial impacts overall. Direct impacts to vegetation at proposed water control structure locations are considered less than significant. Disturbance of existing vegetation as a result of breaching the Island Ponds (Alviso Ponds A19, A20, and A21) could promote the spread of invasive cordgrasses, which is a potentially significant impact. However, proposed mitigation would reduce this impact to less than significant.

VEGETATION BENEFICIAL IMPACT-1: Breaching of the Island Ponds (Ponds A19, A20, and A21) would allow the establishment of transitional salt marsh and brackish marsh communities.

Alternative 2 includes the proposal to breach the Island Ponds (Alviso Ponds A19, A20, and A21). Once the Island Ponds are breached, pond water depth and salinity no longer would be managed, but would be driven solely by tidal effects. Ponds would take on water during high tides, and would drain during low tides. Ponds are expected to be inundated for 6 to 10 hours a day, and salinities would decrease from a range of 79 to 304 to a July average of 8 to 19 ppt. Mean depth would be slightly lower than currently existing, but with significant, daily tidal fluctuations.

Breaching of the Island Ponds, which are currently mostly unvegetated, would result in a beneficial impact on a total of approximately 475 acres. Under this alternative, the conversion to lower salinity tidal ponds would provide conditions favorable for the establishment of transitional salt marsh and brackish marsh species, including California bulrush, alkali bulrush and perennial pepperweed. Although pickleweed may remain on levee slopes at the upper edge of the tidal marsh, it will be excluded by tidal flooding from lower elevations in the ponds.

Significance: Beneficial impact.

> *VEGETATION IMPACT-2:* Disturbance of existing vegetation could promote the spread of invasive cordgrasses.

Under Alternative 2, breaching of the Island ponds would convert these high salinity, non-tidal ponds to low salinity tidal ponds. These changes would create conditions more favorable to the establishment of invasive cordgrass species and their hybrids. Currently, there are several small, localized clusters of *S. alterniflora* hybrids in the area of the Island Ponds. If the existing populations are not removed, the introduction of favorable conditions for there expansion could be a significant impact. At present, the Santa Clara Valley Water District plans to remove these populations in spring of 2004, prior to the expected date for ISP implementation.

Significance: Potentially significant.

> *VEGETATION MITIGATION MEASURE-1:* USFWS will coordinate with the Santa Clara Valley District to ensure that existing clusters of S. alterniflora in the vicinity of the Island Ponds are removed prior to breaching the ponds.

Post-mitigation Significance: Less than significant

> *VEGETATION IMPACT-3:* Installation or replacement of water control structures would remove or disturb existing areas of vegetation.

The installation or replacement of water control structures under Alternative 2 will result in direct, permanent impacts on vegetation in the area of ground disturbance, excavation and other construction activities. This option would remove areas of vegetation for the placement of new structures, or would disturb vegetation around existing structures proposed for replacement. The total area of disturbance is estimated at 2.91 acres of jurisdictional wetlands and 1.99 acres of areas with a greater than 25% cover of pickleweed. By complex, this breaks down as follows:

- Alviso Complex: 1.56 acres of jurisdictional wetlands and 0.81 acres of pickleweed (areas having greater than 25% pickleweed)
- Baumberg Complex: 1.03 acres of jurisdictional wetlands and 0.51 acres of pickleweed (areas having greater than 25% pickleweed)
- West Bay Complex: 0.32 acres of jurisdictional wetlands and 0.67 acres of pickleweed (areas having greater than 25% pickleweed)

There are no reports of populations of special-status plants within or adjacent to the project areas, and survey of the proposed water control structure sites did not identify special-status plants in these specific locations. Disturbance and/or loss of common plant communities at these locations would not jeopardize their existence. Therefore, this impact is considered less than significant.

Significance: Less than significant.

> *VEGETATION IMPACT-4:* Installation or replacement of water control structures would cause changes in pond parameters, which would have permanent indirect impacts on vegetation in the project area.

The installation or replacement of water control structures will result in changes to several pond parameters, including salinity, water depth, amount of tidal influence, and connectivity to adjacent ponds. These changes will have permanent indirect impacts on vegetation in the project areas. Since these ponds are largely unvegetated, the overall effect of the project will be beneficial. Salinities in most of the ponds would be lowered. This, together with increasing tidal influence in the ponds, would promote plant growth. Changes in pond parameters may cause disturbances to common plant communities and shifts in some plant communities, but would not jeopardize the existence of these communities. In addition, there are no reports of populations of special-status plants within or adjacent to the project areas. Therefore, this impact is considered less than significant.

Significance: Less than significant.

Management of individual ponds as seasonal ponds and as high salinity batch ponds, or seasonal differences in pond management (e.g., management of ponds as winter system ponds and summer seasonal ponds) will cause indirect vegetation impacts, most of which are minor (less than significant).

> *VEGETATION IMPACT-6: Seasonal wetting and drying cycles in ponds managed as seasonal ponds will create saline soil conditions that will inhibit vegetation growth within the ponds and at the pond margins.*

Adaptive Management under Alternative 2 includes the option to manage Alviso ponds A3N, A8, A22 and A23, and Baumberg ponds 12 and 13 as seasonal ponds. Under this option, ponds would be hydrologically isolated from adjacent ponds, and water and salinity levels would no longer be controlled. Water depth in the winter would be influenced by ground water depth and by rainfall, and in the summer, ponds are expected to dry completely. This option would have an indirect impact on vegetation.

Field observations made at CDFG's Eden Landing Ecological Reserve, where salt production had ceased in 1972, provides an indication of what may occur at the seasonal ponds within the Baumberg Complex. At the reserve, vegetation cover is generally limited to ponds with salinity levels lower than 30 ppt. Vegetated areas had a mean salinity of 22 ppt compared to non-vegetated areas with mean salinity of 65 ppt. At the reserve, the lower salinity ponds had characteristics of a San Francisco Bay salt marsh, with transitional pickleweed and saltgrass. In these ponds, there was a gradual succession from pickleweed stands to mixed stands of pickleweed and ruderal (disturbed)/hydrophytic (salt-loving) grassland associations. Higher salinity muds were colonized on a seasonal basis by annual pickleweed (*Salicornia europa*). A correlation was also observed between percent vegetative cover greater than 50 percent and salinity less than 50 ppt (Resource Management International, Inc., 1999).

Seasonal wetting and drying cycles within the proposed Baumberg Complex seasonal ponds will convert these ponds into largely unvegetated salt pannes. The saline soil surface will likely prevent establishment of most plants within the ponds. A shift from system or batch to seasonal is expected not to affect existing levee vegetation, but increased soil salinity levels will result in the loss of some vegetation currently at the pond edge. However, these ponds are currently largely unvegetated. The loss of common plant communities at these locations would not jeopardize their existence. In addition, there are no reports of populations of special-status plants within or adjacent to these ponds. Therefore, this impact is considered less than significant.

Significance: Less than significant.

> *VEGETATION IMPACT-7: Increase in pond water salinity in ponds managed as high salinity batch ponds will result in loss of vegetation along the shoreline.*

Adaptive Management under Alternative 2 includes the option to manage Alviso ponds A12, A13 and A15 as high salinity batch ponds. Under this change, pond water salinity would increase significantly to levels ranging from 120 to 150 ppt. Pond water depth would not be altered. This increase in salinity is expected to result in the loss of pickleweed habitat and other vegetation present near the shoreline. According to a long-term monitoring study conducted by H.T. Harvey and Associates (2002), maximum interstitial salinity for pickleweed is 70 ppt. These changes are not expected to affect vegetation growing higher up on inboard levee slopes. The loss of common plant communities at these locations would not result in the substantial loss of these habitat types, and is not expected to jeopardize their existence. In addition, there are no reports of populations of special-status plants within or adjacent to these ponds. Therefore, this indirect impact is considered less than significant.

Significance: Less than significant.

> *VEGETATION IMPACT-8:* Differences in seasonal management of ponds would cause a decrease in average pond depth and decreased fluctuations in salinity in some of the ponds, which could result in indirect impacts to vegetation, including elevation and type shifts of plant communities.

Adaptive Management under Alternative 2 includes the option to manage a number of ponds in the Baumberg Complex differently on a seasonal basis. Under this option, Baumberg Ponds 4, 7, 8, 6B, 6A, 14 and 11 would continue to be managed as system ponds in the winter, but would be seasonal in the summer. Under this alternative, mean salinity levels in Ponds 4, 7 and 11 would not change, although average pond depth would decrease.

No significant changes in vegetation are expected, although it is likely that an elevation shift will occur, with plants growing further down on the levee slope. Ponds 8, 6B, 6A and 14 will experience decreased fluctuation in salinity concentrations from the current range of 35 to 296 ppt to less than 40 ppt. Stabilization of salinity will permit establishment and long-term persistence of salt marsh dominant species, including pickleweed. The elevation shift of plant communities at these ponds would not result in the substantial loss of habitat, and salt marsh plant cover may increase with stabilization of salinity levels at these ponds. Therefore, this impact is considered less than significant and would likely be beneficial.

Significance: Less than significant; probably beneficial.

> *VEGETATION IMPACT-9:* Muted tidal influence in the summertime in Baumberg Ponds 8A and 8X would cause some changes in vegetation and would create conditions favorable to the establishment of invasive cordgrass.

Adaptive Management under Alternative 2 includes the option to manage Baumberg Ponds 8A and 8X as system ponds in winter and as seasonal ponds in the summer. Unlike the other ponds that could receive differential seasonal management (discussed directly above, Vegetation Impact-8), Ponds 8A and 8X would also receive muted tidal influence in the summer. Pond 8A would be tidally influenced by an adjacent borrow ditch, and Pond 8X would be influenced by a culvert that extends from an adjacent ditch. Under this option, salinity levels are expected to decrease from a range of 69 to 265 to less than 40 ppt. Because pond salinity will be managed in the winter, soil surface salinity during the summer is not expected to reach levels similar to ponds managed as seasonal year-around. Despite the decrease in salinity, the establishment of salt marsh vegetation would be inhibited by long-duration ponding in the winter. Therefore, this proposed adaptive management measure would not have an effect (beneficial or negative) on most plant communities.

However, the proposed changes, including decreases in salinity and increases in tidal fluctuations would create conditions more favorable to the establishment of invasive cordgrass species and their hybrids. The project site currently contains fairly dense, contiguous stands of invasive *S. alterniflora* hybrids. During project implementation, invasive cordgrass could be spread through either the opening of newly disturbed habitat, or the movement, by construction equipment, of propagules from the existing stands of *S. alterniflora* into previously inaccessible sites.

Significance: Potentially significant.

> *VEGETATION MITIGATION MEASURE-2A:* All equipment shall be cleaned prior to movement from an infested site.
>
> *VEGETATION MITIGATION MEASURE-2B:* Conduct post-implementation monitoring for new, establishing populations of cordgrass.
>
> *VEGETATION MITIGATION MEASURE-2C:* Gain control of new, establishing populations using protocols suggested by the San Francisco Estuary Invasive Spartina Project.

Post-mitigation Significance: Less than significant

6.2.3.4 Pond Management Alternative 3 (Phased Initial Release)

The only difference between Pond Management Alternatives 2 and 3 is in the timing of initial release of pond waters. As described in Chapter 2, under Pond Management Alternative 2, water control structures would be installed in the Spring and initial discharge of the existing pond contents would begin in July.

Impacts and mitigation measures under Pond Management Alternative 3 would be the same as those under Pond Management Alternative 2 (Section 6.2.3.3, above). The timing of initial discharge would not change the anticipated impacts.

6.3 BIOLOGICAL RESOURCES – BIRDS AND OTHER WILDLIFE

This section describes the wildlife known to occur within the salt ponds, levees, sloughs and channels, and along the Bay shoreline within the project area, including special status species. It also assesses the effects that project implementation may have on wildlife, including special status species, and proposes mitigation measures.

Site-specific wildlife surveys were not conducted for this document. However, numerous previous and ongoing studies of wildlife of the project area (or the South Bay region) were available from a number of sources. These included several reports prepared for the Goals Project (1999 and 2000); numerous reports and data provided by San Francisco Bay Bird Observatory (SFBBO), Point Reyes Bird Observatory, U.S. Geological Survey (USGS), USFWS, and CDFG; and prior studies prepared to assess the impacts of Cargill's maintenance operations. Additional information was available from the CDFG's California Natural Diversity Database (CNDDB). These sources are cited below, and full references are provided in Chapter 14.

6.3.1 Affected Environment

This section describes the various habitat types that are currently present within the project area, with a focus on attributes of those habitats that are attractive to wildlife. Refer to Section 6.1.1 for a detailed description of vegetation communities on the site.

Habitat types within the project area generally fall into one of four categories: open water, tidal mudflat, tidal marsh, barren levees, and non-native grassland/ruderal vegetation. Open water is by far the most extensive habitat type and the primary attractant for the hundreds of thousands of waterbirds that occur on the salt ponds each year (see detailed discussion below). Salinity and water depth, which vary from pond to pond (Table 2-1), as well as location within the salt pond system (i.e., intake pond vs. system pond), are the primary attributes of salt ponds that determine waterbird species composition and abundance.

For this section of the EIR/EIS, salinity categories are defined as low (<60 ppt), medium (60-180 ppt), and high (>180 ppt). These categories were based on those of the Goals Project bird focus teams, which based their classification on observations of birds rather than of plants and invertebrates (Goals Project 1999). Note that these are different than the salinity categories defined in Chapter 2, including Table 2-1. Although Table 2-1 defines batch ponds as "high salinity," they actually fall within the medium-salinity category used by the Goals Project and in the Biology section of this document. To avoid confusion, when referring to ISP management options, the term "high salinity batch pond" will continue to be used.

Most (but not all) of the salt ponds in the South Bay are located within the ISP project area or within the Newark pond complexes, which are located between the Baumberg and Alviso salt pond complexes and are still owned by Cargill. Using the categories defined in the paragraph above, the project area includes about 7,159 acres of low-salinity salt ponds, 4,386 acres of medium-salinity ponds, and 1,316 acres of high salinity ponds. The Newark complexes include about 2,300 acres of low-salinity ponds, 3,100 acres of medium-salinity ponds, and 1,600 acres of high salinity ponds (Kirk Wheeler, personal communication). Figures 6-4 through 6-9 illustrate the configuration of the salt ponds in the project area, along with their existing and proposed salinities and hydrologic conditions.

Tidal marsh and tidal mudflats are present within the project area, along the numerous sloughs and channels within the salt pond complexes, as well as along the bay shoreline outboard of several bayside ponds. Tidal marsh vegetation often occurs on the sideslopes of salt pond levees that are exposed to tidal waters. Tidal marsh areas provide potential habitat for special-status species such as California clapper rail and salt marsh harvest mouse. Tidal mudflats provide important foraging habitat for shorebirds, when uncovered by low tides, and for waterfowl and other waterbirds, when inundated by high tides. In addition, non-tidal mudflats occur within the salt pond dredge locks (see description in Glossary) and within the salt ponds themselves, when water levels are lowered (i.e., when drained due to management operations). Much of the upland (non-wetland) habitat in the project area consists of the upper portions of levees, above the water line, and much of this habitat is essentially barren, with little or no vegetation. These barren levees provide roosting and/or nesting habitat for many species of shorebirds and other waterbirds. In some areas, the upper portions of levees are covered with non-native grassland/ruderal vegetation. This habitat is used by a limited number of mammalian and landbird species (see Section 6.3.1.3, "Other Wildlife" below).

Waterbirds

Many studies over the past 30 years have documented the habitat value of South Bay salt ponds to waterbirds (e.g., shorebirds, waterfowl, wading birds, grebes, cormorants, pelicans, terns, and gulls). Salt ponds provide important habitat for many species of migratory shorebirds and waterfowl during the non-breeding season (Goals Project 1999). Salt ponds also provide year-round foraging habitat for a number of resident species, such as American avocet, black-necked stilt, and western snowy plover (Harvey et al. 1992, Goals Project 1999). These and other species, including California gull, western gull, Forster's tern, and Caspian tern, nest on partially-dry salt ponds, levees, and salt pond islets and islands (Harvey et al. 1992). In all, more than 40 species of waterbirds are common on salt ponds of varying salinities.

Lower-salinity ponds (including most intake ponds) provide habitat for several species of euryhaline fish (fish tolerant of wide salinity fluctuations; Lonzarich 1989). These fish, in turn attract piscivorous (fish-eating) bird species, such as American white pelican, double-crested cormorant, Forster's tern and great egret. Medium- and high-salinity ponds support higher densities of microalgae, photosynthetic bacteria, brine shrimp (*Artemia franciscana*), brine flies (*Ephydra* spp.), and water boatmen (*Trichocorixa reticulata*), which provide an abundant food source for waterbirds (Anderson 1970). Highest densities of these prey species occur in salinities of 60-200 ppt (Larsson 2000, Maffei 2000a, b).

Water depth is another factor influencing the abundance and distribution of waterbirds using the ponds. Most shorebirds forage in water depths less than 1.5 inches (Isola et al. 2000), while dabbling ducks and diving ducks prefer water depths from 4-12 inches and greater than 12 inches, respectively (Page 2001). However, since water depth is extremely variable both spatially (within the same pond) and temporally (throughout different seasons), it is difficult to predict which species will occur in any given pond at any given time (Warnock, 2003 pers. comm.).

Salt ponds also support several special-status waterbird species. Western snowy plovers (*Charadrius alexandrinus nivosus*; a federally threatened species) nest on salt pond levees and dikes. The federally- and state endangered California clapper rail (*Rallus longirostris* *obsoletus*) also occurs in the tidal marshes adjacent to the salt ponds. These and other special-status species are discussed in more detail in Section 6.3.1.4.

Shorebirds. San Francisco Bay salt ponds support large numbers of wintering and migratory shorebirds, with single-day counts during peak spring migration reaching as high as 200,000 shorebirds in a single salt evaporation pond (Stenzel and Page 1988). Indeed, the San Francisco-San Pablo Bay estuary and associated wetlands have been designated as a site of hemispheric importance by the Western Hemisphere Shorebird Reserve Network (Harrington and Perry 1995). In addition, the Don Edwards National Wildlife Refuge (the Refuge) has recently been designated as a Globally Important Bird Area (IBA) (American Bird Conservancy 2003).

Salt ponds and associated levees are important high-tide roosting areas for species that forage in the Bay's tidal mudflats, such as western and least sandpiper, dunlin, dowitchers, marbled godwit, willet, and long-billed curlew (Stenzel et al. 2002). Some shorebird species only use salt ponds for roosting, while others (e.g., western sandpiper, least sandpiper, dunlin, American avocet, willet, and greater yellowlegs) will also use salt ponds as supplemental high tide foraging habitat (Harvey et al. 1988, Stenzel et al. 2002). Still other species (e.g., black-necked stilt, Wilson's phalarope, and red-necked phalarope) in San Francisco Bay feed and roost almost exclusively in salt ponds (Harvey et al. 1988). Salt pond levees and dikes also provide nesting habitat for various shorebirds, including American avocet, black-necked stilt, and the federally-threatened western snowy plover.

In their recent study on waterbird use of South Bay salt ponds (from October 1999-February 2000 and September 2000-February 2001), Warnock et al. (2002) found a relationship between tidal height and the abundance and species richness of shorebirds using salt ponds. Their data revealed higher numbers of shorebirds in the salt ponds during high tides and lower numbers during low tides, when most shorebirds move to adjacent tidal flats to forage. This pattern, however, does not apply to all shorebird species. According to Warnock, et al. (2002), large numbers of American avocets and black-necked stilts remain in the ponds throughout the tidal cycle (although substantial numbers of avocets, and some of the stilts, also move to tidal flats or tidal marshes during low tides). The two phalarope species do not leave the salt ponds during low tides, as noted above.

Using linear models and controlling for pond, year, month, tide, and pond area, Warnock et al. (2002) also found the highest numbers of waterbirds (including, but not limited to, shorebirds) at 140 ppt salinity, with the highest species diversity at 126 ppt. Although Wilson's phalaropes, red-necked phalaropes, and black-necked stilts reportedly prefer higher salinity ponds (Swarth et al. 1982, Harvey et al. 1988), Harvey et al. (1992) stated that most shorebirds show no salinity preference. They suggested that the presence of shallow water and isolated islands and dikes is generally the most important criteria in pond selection by shorebirds.

However, a recent study by Stralberg et al. (*in prep.*) showed that densities of small shorebird species such as western sandpiper, least sandpiper, and dunlin were highest in ponds with salinities greater than 120 ppt (medium-salinity ponds; see Figure 3 in Appendix J). In the same study, more than 75 percent of feeding detections of these three species (as well as several others) were at salinities greater than 60 ppt (breaking point for low to medium salinity; Table 1 in Appendix J). (Note: The study was conducted from October 1999-April

2001. Birds were counted in 11 low-salinity ponds, 1 low/medium-salinity pond, and 9 medium- or high-salinity ponds.)

Therefore, medium-salinity salt ponds may provide important high-tide feeding areas for shorebirds that traditionally feed in tidal mudflats, particularly when their energy demands are increased (Stenzel et al. 2002). Although further research is needed on what shorebirds gain energetically from salt ponds as compared to tidal marshes and mudflats, preliminary studies (Warnock et al. 2002, Stralberg et al. *in prep.*) suggest that salt ponds, particularly those with medium salinities, are indeed an important component of shorebird foraging habitat in the South Bay.

Although Warnock et al. (2002) did not include water depth in their predictive models of habitat attributes affecting waterbird distribution within salt ponds, other studies have shown that shorebirds (other than phalaropes) generally do not feed in water at depths much greater than about 10-15 cm (4-6 inches), and most prefer water depths under about 4 cm (1.5 inches) (Isola et al. 2000).

Waterfowl. The San Francisco Estuary is an important wintering and migrational stopover area for many species of waterfowl (Accurso 1992, Harvey et al. 1992). Winter surveys conducted from 1987-1990 showed that South Bay salt ponds supported 27 percent or 76,000 of the Estuary's total waterfowl population, including 67 percent of San Francisco Bay's overwintering ruddy ducks and 50 percent of the buffleheads (Accurso 1992). Large numbers of dabbling ducks were also documented in salt ponds during the winter, including 89 percent of all northern shovelers in the San Francisco Bay (Accurso 1992). This finding was recently corroborated by Warnock et al. (2002), who found dabbling ducks to be the second-most abundant waterbird group (after shorebirds) counted in South Bay salt ponds during the winter. A related study by Stralberg et al. (*in prep.*) found northern shovelers to be the third most abundant waterbird species in the salt ponds, behind dunlin and western sandpiper (Table 2 in Appendix K). In addition to being important wintering habitat for waterfowl, San Francisco Bay salt ponds also provide valuable nesting habitat. At least six species of waterfowl nest within South Bay salt ponds, albeit in small numbers: Canada goose, mallard, gadwall, northern pintail, cinnamon teal, and ruddy duck.

Waterfowl use of South Bay salt ponds is at least partially associated with pond salinity. Accurso (1992) found that waterfowl, especially plant-eating dabbling ducks, were concentrated in lower-salinity (20-63 ppt) ponds, with few waterfowl present in ponds above 154 ppt. The majority of waterfowl were observed in ponds with salinities between 35-64 ppt. This indirect relationship is likely a result of prey (*i.e.*, salt-tolerant invertebrates) availability and abundance, which is directly influenced by pond salinity.

Other Waterbirds. The South Bay salt ponds provide foraging and nesting habitat for several other waterbird species in addition to shorebirds and waterfowl. Low-salinity ponds, particularly intake ponds, contain populations of salt-tolerant fish that attract fish-eating birds such as American white pelican, brown pelican, double-crested cormorant, snowy egret, black-crowned night heron, Forster's tern, and Caspian tern. Eared grebes, which primarily feed on brine shrimp, water boatmen and brine fly larvae, occur nearly exclusively on the medium- to high-salinity ponds that support these prey species (Anderson 1970, Swarth et al. 1982). They occur primarily from late August to April or early May, when individuals may number up to several thousand per pond.

Salt pond levees, dikes, and islands within salt ponds provide nesting habitat for California gull, western gull, Forster's tern, and Caspian tern. These dry areas in an otherwise vast pond complex are well-isolated from adjacent uplands and thus provide substantial protection from predators (Cogswell 2000b). California gulls were first documented nesting at the Knapp Property (Pond A6) near Alviso in 1980, and have since expanded to five "satellite" colonies in the South Bay (Ryan 2000b). This South Bay breeding population represents the only nesting colony of California gulls west of the Sierra Nevada/Cascade mountains (Harvey et al. 1992). Nesting colonies of all the above species, with the exception of western gull (i.e., California gull, Forster's tern, and Caspian tern), are considered California Species of Special Concern (see Section 6.3.1.4).

Six species of herons and egrets breed in the South Bay: great blue heron, great egret, snowy egret, black-crowned night heron, little blue heron, and cattle egret. Potential nesting habitat for these species in the vicinity of salt ponds includes trees and large shrubs such as coyote brush (*Baccharis pilularis*). Historically, the largest breeding colony (which included several species of herons) was at Mallard Slough, between Ponds A16 and A18 (WRA 1994), but apparently it is now abandoned (M. Rogers, pers. comm.).

Other Wildlife

Salt ponds generally provide marginal habitat for other wildlife species besides waterbirds. Landbirds, including several raptor species (e.g., red-tailed hawk), use pond levees for foraging and roosting. Common bird species that occur within the project area include: barn swallow, cliff swallow, black phoebe, common raven, American crow, mourning dove, Brewer's blackbird, red-winged blackbird, western meadowlark, savannah sparrow, and house finch. Special-status raptor species that occur within the study area are addressed in Section 6.3.1.4.

The number of mammal species using salt ponds is limited by low prey availability and lack of vegetative cover. Two special-status mammal species, salt marsh harvest mouse (*Reithrodontomys raviventris*) and salt marsh wandering shrew (*Sorex vagrans halicoetes*), occur (or may occur) in tidal salt marshes within and adjacent to the project area and are discussed in Section 6.3.1.4. Two introduced non-native mammal species, Norway rat (*Rattus norvegicus*) and red fox (*Vulpes vulpes*), forage along the salt pond levees and within the salt marsh and are known predators of several nesting bird species (e.g., California clapper rail, black rail, and California least tern). Other common mammal species that may occur along the pond levees include Virginia opossum (*Didelphis virgiana*), racoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), feral house cat (*Felis catus*), Townsend's vole (*Microtus townsendii*), and black-tailed jackrabbit (*Lepus californicus*).

Amphibians probably do not occur within the salt ponds or in the adjacent sloughs and channels, due to high salinity. Western fence lizards (*Sceloporus occidentalis*) occur on salt pond dikes and outfall structures (Eric Lichtwardt, LSA Associates, pers. obs.), but are probably the only reptilian species to occur within the project area.

6.3.1 Special-Status Wildlife Species

Special-status wildlife species are animals that are legally protected under the state and federal endangered species acts or other laws and regulations (see Section 6.0, Regulatory

Setting), and species that are considered rare by the scientific community. Special-status species are defined as follows:

- Animals that are listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (50 CFR 17.12 for plants; 50 CFR 17.11 for animals; various notices in the Federal Register [FR] for proposed species);
- Animals that are listed as rare, threatened, or endangered under the California Endangered Species Act (Fish and Game Code 1992 Sections 2050 et seq.; 14 CCR Sections 670.1 et seq.);
- Animals that are candidates (i.e., former Category 1 candidates) for possible future listing as threatened or endangered under the federal Endangered Species Act (61 FR 7595, February 28, 1996);
- Animals that are "fully protected" in California (Fish and Game Code, Sections 3511, 4700, 5050, and 5515);
- Animals that meet the definition of rare or endangered species under the CEQA Guidelines Section 15380, which includes species that are not protected under the state or federal endangered species acts;
- Animals that are designated as "Species of Special Concern" by CDFG; and
- Animals that are designated as "Special Animals" by CDFG, a general term that refers to all of the taxa the California Natural Diversity Data Base (CNDDB) is interested in tracking, regardless of their legal or protection status.

Database Search

The project area is contained within portions of the San Leandro, Newark, Mountain View, and Redwood Point USGS 7.5-minute quadrangle maps. A search of the CNDDB revealed records of 17 special-status terrestrial vertebrates (amphibians, birds, and mammals) that have been observed within these quads. Other potentially occurring species were identified based on personal field observations and consultations with other biologists familiar with the study area. These species are discussed below.

Species Not Likely to Occur (or Nest) in Project Area. Several of the special-status amphibian and bird species that are known (or likely) to occur in the vicinity of the project are not expected to occur in the actual project area, due to lack of suitable habitat. The California tiger salamander *(Ambystoma californiense)* and California red-legged frog *(Rana aurora draytonii)* are both amphibians. They breed in various types of freshwater environments where predatory fish are absent. These two species do not occur in salt- or brackish-water environments and are not expected to occur within the project area, due to the lack of suitable habitat.

Several bird species that are designated as species of special concern are considered special-status species only at their nesting sites. Some of the species in this category may occur within the project area during the non-breeding season (e.g., as migrants or winter residents) but are not known or expected to nest within the project area, due to the lack of suitable nesting habitat. These species include: common loon *(Gavia immer)*, American white pelican *(Pelecanus erythrorhynchos)*, double-crested cormorant *(Phalacrocorax auritus)*, canvasback *(Aythya valisineria)*, Barrow's goldeneye (*Bucephala islandica*), white-tailed kite *(Elanus leucurus)*, Cooper's hawk *(Accipiter cooperii)*, sharp-shinned hawk *(Accipiter striatus)*, osprey *(Pandion haliaetus)*, American peregrine falcon *(Falco peregrinus anatum)*, long-billed curlew *(Numenius americanus)*, and bank swallow *(Riparia riparia)* These species are not discussed any further because the proposed project (and alternatives) would not cause impacts to their nesting sites.

Species Known or Likely to Occur in Project Area. Special-status species that have been documented to occur within the project area or have a reasonable potential to occur there are listed in Table 6.3-1. This table notes the common and scientific names for each of the species, their legal protection status, their habitat in the project area, and their potential for occurrence within the project area. More detailed information on each of the species is provided in the text below. Records for most of these species were found in the CNDDB search.

California Brown Pelican. The California brown pelican (*Pelecanus occidentalis californicus*) is a state- and federally-listed endangered species and a California fully protected species. This species breeds at scattered localities along the western coast of Mexico, in the Gulf of California, along the Pacific Coast of Baja California north to the Channel Islands of southern California, and at the Salton Sea (Shields 2002). After breeding, thousands of individuals disperse north from their nesting grounds to spend the summer and fall along the central California coast and in San Francisco Estuary (Ainley 2000).

TABLE 6-8
SPECIAL-STATUS WILDLIFE SPECIES KNOWN TO OCCUR OR POTENTIALLY OCCURRING WITHIN THE SOUTH BAY SALT POND PROJECT AREA

Species	Status* (Federal/State/CDFG)	Habitat within Project Area	Potential for Occurrence in the Project Area
California brown pelican *(Pelecanus occidentalis californicus)*	FE/SE/CFP	Open water for foraging, isolated levees for roosting.	High. This species does not breed in the Bay Area. It occurs regularly, but in low numbers, in the South Bay during summer and fall.
Great egret *(Ardea alba)*	–/–/SA(rookery)	Rookeries located in trees and shrubs. Forages on shorelines, marshes, sloughs, and other wetland habitats. Sometimes forages in upland habitats.	Low (nesting). A rookery was located along Mallard Slough, just south of the Alviso complex but this site has been abandoned.
Great blue heron *(Ardea herodias)*	–/–/SA(rookery)	Rookeries located in trees. Forages on shorelines, marshes, sloughs, and other wetland habitats. Sometimes forages in upland habitat.	Low (nesting). A former rookery was located along Mallard Slough, just south of the Alviso complex.
Snowy egret *(Egretta thula)*	–/–/SA(rookery)	Rookeries located in trees, shrubs, and sometimes in tules. Forages on shorelines, marshes, sloughs, and other wetland habitat.	Low (nesting). A former rookery was located along Mallard Slough, just south of the Alviso complex.
Black-crowned night heron (*Nycticorax nycticorax*)	–/–/SA(rookery)	Rookeries located in trees and shrubs. Forages on shorelines, marshes, sloughs, and other wetland habitats	Low (nesting). A former rookery was located along Mallard Slough, just south of the Alviso complex.
Northern harrier *(Circus cyaneus)*	–/–/CSC(nesting)	High salt marsh, grasslands, and ruderal habitats for nesting and foraging.	High (nesting). This species is expected to nest within the project area.

Species	Status* (Federal/State/CDFG)	Habitat within Project Area	Potential for Occurrence in the Project Area
Merlin *(Falco columbarius)*	–/–/CSC (wintering)	Open areas, shorelines, mudflats, perches on poles, buildings and isolated trees.	High. This species occurs regularly during migration in the Bay Area. Small numbers are expected to winter in the South Bay.
American peregrine falcon *(Falco peregrinus anatrum)*	–/SE/CFP (nesting)	Open areas, shorelines, mudflats, perches on poles, buildings and isolated trees. Nests in the Bay Area on buildings, bridges, and high cliffs.	High. This species is expected to occur primarily during migration and is not likely to nest in the project area. Nearby breeders may forage within the project area.
California clapper rail *(Rallus longirostris obsoletus)*	FE/SE/CFP	Tidal salt marsh	High. This species is known to be present within the project area.
California black rail *(Laterallus jamaicensis)*	–/ST/CFP	Tidal salt marsh	Moderate. This species is known to winter within the project area but is not known to nest in the South Bay.
Western snowy plover *(Charadrius alexandrinus nivosus)*	FT/–/CSC	Dry salt evaporators and salt pans for nesting. Forages along shorelines, including brine ponds.	High. This species nests within the project area.
California gull *(Lars californicus)*	–/–/CSC (nesting)	Isolated islands or levees (nesting).	High. A large colony of California gulls currently nests within the project area.
Black skimmer *(Rynchops niger)*	–/–/CSC (nesting)	Isolated islands or levees (nesting).	High. This species is known to nest within the project area.
California least tern *(Sterna antillarum)*	FE/SE/CFP	Isolated barren islands, and levees (nesting). Forages for fish over open waters and along sloughs.	Moderate. This species does not nest in the project area, but is known to occur occasionally during migration or post-breeding dispersal.
Caspian tern *(Sterna caspia)*	–/–/SA(nesting)	Isolated barren islands, levees, and sandbars (nesting). Forages for fish over open fresh and/or salt water.	High. This large tern is known to nest within the project area.

Species	Status* (Federal/State/CDFG)	Habitat within Project Area	Potential for Occurrence in the Project Area
Forster's tern *(Sterna forsteri)*	–/–/SA(nesting)	Isolated barren islands, levees, and sandbars (nesting). Forages for fish over open fresh and/or salt water.	High. The Forster's tern is known to nest within the project area.
Burrowing owl *(Athene cunicularia)*	–/–/CSC	Tops and upper slopes of levees, ground squirrel burrows.	High to moderate. These owls are known to be present within the project area but numbers may vary from year to year.
Short-eared owl *(Asio flammeus)*	–/–/CSC (nesting)	Grasslands, ruderal habitats, and marshes for nesting and foraging.	Low (nesting). There is little available information on the breeding status of this owl in the South Bay region. May occur as a breeding species during years of high vole abundance.
Loggerhead shrike (*Lanius ludovicianus*)	–/–/CSC	Open grasslands and woodlands with scattered shrubs, fence posts, utility lines, or other perches. Nests in dense shrubs and lower branches of trees.	High. This species has been observed in the project area. Although shrikes have not been documented nesting within the project area, suitable nesting habitat (coyote brush) is present along channels and sloughs.
Salt marsh common yellowthroat *(Geothlypis trichas sinuosa)*	–/–/CSC	Brackish and salt marshes and adjacent ruderal vegetation.	High. This species nests within the project area.
Tricolored blackbird *(Agelaius tricolor)*	–/–/CSC	Typically nests in extensive freshwater marshes and occasionally in other dense, non-forested vegetation. Forages on the ground in open habitats.	Low (nesting). No freshwater marsh is located within the project area, and other potential nesting habitats are rare or absent.
Alameda song sparrow *(Melospiza melodia pusillula)*	–/–/CSC	Tidal salt marsh (nesting and foraging).	High. Known to nest in the project area.
Salt marsh wandering shrew *(Sorex vagrans halicoetes)*	–/–/CSC	Tidal salt marsh.	Moderate to high. This small mammal is known to be present in the South Bay area and suitable habitat is present within the project area.

Species	Status* (Federal/State/CDFG)	Habitat within Project Area	Potential for Occurrence in the Project Area
Salt marsh harvest mouse *(Reithrodontomys raviventris)*	–/–/CSC	Densely vegetated tidal and non-tidal salt marsh and adjacent grassland/herbaceous vegetation.	High. The salt marsh harvest mouse is known to be present in the South Bay area and suitable habitat is present within the project area.
Harbor seal *(Phoca vitulina)*	MMPA/–/–	Open water of bays and inner coastal waters. Uses isolated beaches, islands, or ledges for haul-out and pupping sites.	High. Within the project area, harbor seals are expected to use isolated beaches along the bay for pupping and as haul-out sites.

*** Status**

Federally Protected Species

FE Federal Endangered
FT Federal Threatened
MMPA Fully protected under the Marine Mammal Protection Act

State-Protected Species

SE State Endangered
ST State Threatened
FP Fully Protected

Informal Lists

CSC California Species of Special Concern
SA "Special animal" listed by the California Natural Diversity Data Base
– No status

Brown pelicans forage by sighting prey (i.e., schooling fish) from the air and plunge-diving from heights as great as 65 feet (Shields 2002). In the San Francisco Bay Estuary, important prey items include northern anchovies *(Engraulis mordax)* and other small schooling species. When the water is too shallow or turbid for plunge-diving, they will occasionally forage while swimming on the water surface using surface-seizing to catch small fish. This type of surface-feeding behavior has been observed in South Bay salt ponds (Cogswell 2000b).

The brown pelican is found primarily in the deeper portions of the Bay and also some salt ponds (Ainley 2000). Within the project area, pelicans forage over low-salinity, deepwater ponds and roost on man-made structures and occasionally on salt pond levees (WRA 1994). A wildlife survey of salt evaporator ponds A4, A5, and A8, in the Alviso Complex, found brown pelicans to be rare visitors to the project area, with most individuals being seen near slough channels (Ryan 2000a).

Herons and Egrets. The black-crowned night heron *(Nycticorax nycticorax),* snowy egret *(Egretta thula)*, great egret *(Ardea alba)*, and great blue heron *(Ardea herodias)* are all considered state species of special concern at rookery sites. These heron species use a variety of wetland and upland habitats around the San Francisco Estuary and can be observed foraging along sloughs, channels, shorelines, and on mudflats. In addition, great egrets and great blue herons can be seen foraging for frogs, snakes, and small mammals in moist grasslands around the Bay Area.

Herons nest in colonies (i.e., rookeries) that often contain multiple species. All four of the species noted above formerly nested at a historical heron rookery at Mallard Slough, between Pond A16 and A18 (WRA 1994). This rookery, however, is apparently now abandoned (M. Rogers, pers. comm.).

Northern Harrier. The northern harrier (*Circus cyaneus*) is a state species of special concern at its nesting sites. This raptor is a species of open habitats, including grasslands, ranchlands, marshes, and fields. Northern harriers typically forage low over these habitats, searching for small mammals, birds, reptiles, and frogs (MacWhirter and Bildstein 1996). They generally nest on the ground in open country, with the nest located in tall, dense grasses or other vegetation.

The northern harrier is present throughout the year and nests in suitable habitat around the South Bay (CNDDB 2003). Upper marsh and ruderal vegetation on levees within the project area provide potential nesting habitat. The northern harrier is probably present as a breeding species within the project area. Three pairs exhibiting courtship behavior were observed within the Alviso Complex during spring 2003 (E. Lichtwardt, pers. obs.).

Merlin. The merlin (*Falco columbarius*) is a state species of special concern. These small falcons do not breed in California, but occur as uncommon migrants and winter visitors. Merlins frequent open habitats such as grasslands, shorelines, marshes, and baylands. They often perch on isolated trees or structures such as telephone poles.

The merlin occurs annually as a migrant and winter visitor in areas around the South Bay and forages over salt ponds and adjacent habitats (Cogswell 2000b). The probability of this species occurring within the project area during the fall, winter, and spring is considered high, but the numbers of individuals present at any given time would be relatively low, as is typical of many raptor species.

California Clapper Rail. The California clapper rail (*Rallus longirostris obsoletus*) is a state- and federally-listed endangered species. This secretive bird prefers tidal salt marshes dominated by pickleweed and cordgrass (*Spartina* spp.) with adjacent areas of high marsh cover, e.g. pickleweed, gumplant (*Grindelia* spp.), saltgrass (*Distichlis spicata*), alkali heath (*Frankenia salina*), and fleshy jaumea (*Jaumea carnosa*) (Albertson and Evens 2000). Clapper rails also occupy tidal brackish marshes dominated by bulrush. This subspecies of the clapper rail is now restricted to the tidal marshlands around the San Francisco, San Pablo, and Suisun Bays.

A California clapper rail survey in the early 1970s estimated a total population of between 4,000 and 6,000 birds (Gill 1979). By the early 1990s, the population had declined drastically to 300 to 500 birds (Takekawa 1992). Habitat loss has contributed to this decline, but the major reason appears to be the introduction and spread of the red fox *(Vulpes vulpes)* to the baylands ecosystem. Predator control programs implemented in the San Francisco Bay National Wildlife Refuge (the Refuge) and adjacent areas have reduced the numbers of red fox and other predators and resulted in a rebound of the clapper rail population. The San Francisco Bay Estuary population has most recently been estimated to be 1,040-1,264 individuals (Albertson and Evens 2000).

There are numerous records of the California clapper rail in South Bay salt marshes (Albertson and Evens 2000, CNDDB 2003), but this species is much less common today than historically. This species is known to be present within the project area in many areas where suitable habitat is present (e.g., tidal marshes along sloughs and along the Bay shoreline).

California Black Rail. The California black rail (*Laterallus jamaicensis coturniculus*) is a state-listed threatened and California fully protected species. Around the San Francisco Bay Estuary, these rails inhabit tidal salt marsh dominated by pickleweed, but they also occupy brackish marshes dominated by bulrush. California black rails prefer tidal marshes but apparently will use higher marshlands during “wet” years (Trulio and Evens 2000). In the South Bay marshes, there are a number of records of this highly secretive species during the non-breeding season, and there is an old breeding record from Alviso but none elsewhere (Trulio and Evens 2000). Based on these records, there is at least a moderate potential for this species to occur within the project area during the non-breeding season, but it is not known to breed in the South Bay.

Western Snowy Plover. The Pacific coast population of the western snowy plover (*Charadrius alexandrinus nivosus*) is listed as federally threatened, and the snowy plover is also a California species of special concern. Snowy plovers occur in a narrow coastal zone along the Pacific and Gulf coasts of the United States and Mexico and in a disjunct area in the arid interior of the western U.S. and Mexico (Page et al. 1995). They nest on barren sandy beaches, levees and flats of salt evaporation ponds, dry lakebeds, and river sand bars. They forage on mudflats, salt flats, and along shorelines. The Pacific coast population has declined due to human impacts on beaches, coastal dunes and salt flats.

One of the largest breeding populations of snowy plovers on the Pacific Coast occurs in the South Bay, mainly east of Guadalupe Slough (WRA 1994, Page et al. 2000). Nesting habitat within the salt pond complex is confined to levees or dried pond bottoms. Historic nesting locations within the Alviso complex include levees and salt flats south of Pond A8, along the levee between Ponds A5 and A7, and at Pond A22 (WRA 1994). Historic nesting locations within the Baumberg complex include ponds 14B-17B, at two sites along the levee forming the southern edge of Pond 2, just west of Pond 1C, and at the northeastern portion of Pond 4C (WRA 1994). The most recent nesting locations from the 2003 season include: Ponds SF2 and 2 in the West Bay complex (chicks were also observed in Ponds 3, 4, and 5); Ponds A22 and A23 in the Alviso complex; and Ponds 6A, 6B, and 12 in the Baumberg complex (J. Albertson, pers. comm.). Preferred snowy plover foraging sites within the salt ponds include dried ponds with borrow ditches around the perimeter and shallow pond edges where brine flies and shrimp collect (C. Wilcox, pers. comm.). These borrow ditches retain water when the rest of the pond has dried out and are a source of brine flies for foraging snowy plover chicks.

California Gull. The California gull (*Larus californicus*) is a California species of special concern at its nesting sites. This gull nests in colonies at inland lakes in western North America but recently (1980) a breeding colony was established at Pond A6 in the Alviso complex (Shuford and Ryan 2000). From this initial colony (12 pairs) the population has grown, and currently the breeding population in the South Bay is around 10,000 individuals (Ryan 2000b). The primary nesting sites within the project area are in the Alviso complex, at Ponds A1, B2, A6, A9/A10 levee, and on the Mowry M1/M2 levee (Ryan 2000b).

The California gull winters along the Pacific Coast, primarily from central California to southern Mexico, and in the Central Valley. California gulls are abundant around the San Francisco Estuary during the winter.

Black Skimmer. The black skimmer (*Rynchops niger*) is a California species of special concern at its nesting sites. This unusual water bird has dramatically expanded its breeding range in California since it was first found nesting in the state in the early 1970's (Collins and Garrett 1996). This species was first discovered nesting in the San Francisco Estuary in 1994 (Layne et al. 1996). Skimmers have nested on Ponds A1, A8 (new site in 2003), and A16 of the Alviso complex, and Pond 1 of the West Bay complex (C. Strong, pers. comm.). Currently black skimmers nest in small numbers within the project area but may not be present at the same nesting sites from year to year (M. Rogers, pers. com.).

Black skimmers forage over open water, often at night, for small fish. Presumably they use the low salinity ponds for foraging, as well as the adjacent Bay and sloughs.

Forster's and Caspian Terns. The Forster's tern *(Sterna forsteri)* and the Caspian tern *(S. caspia)* nest on levees and dredge spoil islands within the project area. Both of these species are designated by the CNDDB as Special Animals at their nesting sites. Both Forster's and Caspian terns occur widely in North America (AOU 1998) and forage over saltwater and freshwater habitats. Within the project area, Forster's terns nest in the Baumberg complex at Ponds P6, P12, and P11, and the Alviso complex at Ponds A1, A7, A8, A16, and B2 (Ryan 2000c). Caspian terns nest within the Alviso complex at Pond A3 and A7 (Ryan 2000d). Both tern species return year after year to established colonies, although Forster's terns are more opportunistic in their nesting habits than Caspian terns (C. Strong, pers. comm.). For example, during the 2003 breeding season at Baumberg Pond 10, Forster's terns attempted to nest on a new dredge spoils mound created as a result of ongoing restoration by CDFG and the East Bay Regional Parks District (EBRPD) (C. Strong, pers. comm.). Both these tern species would be expected to forage over low-salinity ponds supporting substantial populations of small fish.

California Least Tern. The California least tern (*Sterna antillarum browni*) is a state- and federally-listed endangered and California fully protected species. During the breeding season, the California least tern occurs along the west coast of North America from central California south to northwestern Mexico. This subspecies winters in coastal marine areas off Mexico and Central America. Least terns nest in colonies on barren or sparsely vegetated areas, including sand flats, low dunes, beaches, levees, river bars, sandy islands, and shell islands (Thompson et al. 1997). They forage for fish over shallow to deep waters.

In the San Francisco Bay area the largest nesting colony of least terns is at the former Alameda Naval Air Station. Small numbers also nest (some years) at the Oakland Airport and the Pittsburg Power Plant (Feeney 2000). Although least terns do not currently nest in South Bay salt ponds, they have been documented to use several ponds as post-breeding foraging habitat in late summer and early fall. Specific ponds where they have been seen (at various times) include: Baumberg Ponds 10, 11, 12, 9, 1, 2, 4, and 7; and Alviso Ponds A1, B1, A2E, B2, A3W, A3N, A9, A11, and A14 (Wilcox 2003). In addition, the CNDDB identifies Charleston Slough (just west of Alviso Pond A1) as a potential post-breeding foraging area for this species (CNDDB 2003).

Burrowing Owl. The burrowing owl (*Athene cunicularia*) is a California species of special concern. These small owls are widely distributed in western North America, Florida, and portions of Mexico, the Caribbean, and South America. Burrowing owls typically require open, dry habitats with populations of burrowing mammals such as the California ground squirrel. Burrowing owls nest in ground squirrel burrows and artificial cavities such as riprap and culverts, and feed on insects and small mammals.

This species has declined greatly throughout many areas of central and coastal California, including the Bay Area, and is now rare or extirpated in many counties. The decline has resulted, at least in part, from a loss of suitable habitat, through development of open grasslands and fields (Center for Biological Diversity 2003). These owls are known to occur on levees around salt ponds and in fields in the South Bay (Trulio 2000, CNDDB 2003) but the current status of burrowing owl populations within the study area is unknown. Small nesting colonies of burrowing owls occur in areas adjacent to the Alviso complex (e.g., Sunnyvale Baylands Park, Moffett Field, and Alviso [Center for Biological Diversity 2003]).

Short-eared Owl. The short-eared owl (*Asio flammeus*) is a California species of special concern that occurs in grasslands, meadows, and saline and freshwater emergent wetlands. Short-eared owls nest on the ground in dense, tall herbaceous vegetation, in upland or wetland areas without standing water. Their numbers have declined over most of their range in recent decades due to destruction and fragmentation of grassland and wetland habitats, and grazing (Remsen 1978).

The current breeding status of this species in the South Bay is not well known. Short-eared owls have not been known to nest in the South Bay salt ponds since the early 1970's (Cogswell, pers. comm. *in* WRA 1994). The last known nesting record in the South Bay was in 1977 at Bair Island, approximately 3 miles north of the West Bay complex (Remsen 1978 *in* CNNDB 2003). However, suitable nesting habitat is still present, and short-eared owls are still occasionally sighted in the South Bay (WRA 1994).

Loggerhead Shrike. The loggerhead shrike (*Lanius ludovicianus*) is a California species of special concern. This species occurs in open habitats (e.g., grasslands, deserts, oak savannahs) with scattered shrubs, trees, fenceposts, utility lines, or other perches. Dense-foliaged shrubs or trees are required for nesting. Shrikes feed on large insects, small mammals, reptiles, and amphibians, which they frequently impale on thorns or barbed wire after capturing.

Loggerhead shrikes have not been documented nesting within the project area (CNDDB 2003). However, they have been observed there (Stralberg et al. *in prep*., C. Strong, pers. comm.) and could potentially nest in coyote brush, which occurs along sloughs and channels adjacent to the salt ponds.

Salt Marsh Common Yellowthroat. The salt marsh common yellowthroat (*Geothlypis trichas sinuosa*) is a California species of special concern. The common yellowthroat is a widely-distributed warbler in North America, occurring in wetlands, moist thickets, and grasslands (Dunn and Garrett 1997). The salt marsh common yellowthroat is a subspecies restricted to riparian habitat, brackish marsh, freshwater marsh, tidal salt marsh, and adjacent grassland and ruderal vegetation along the margins of San Francisco Bay. Large areas of former habitat of this subspecies have been lost around the Bay due to development and flood control projects.

There are a number of records of this species from the project vicinity (CNDDB 2003). Within the project area, the salt marsh common yellowthroat is expected to be present along channels and sloughs that support suitable habitat (e.g., brackish marsh dominated by bulrush [*Scirpus* sp.] and cattail [*Typha* sp.]).

Tricolored Blackbird. The tricolored blackbird (*Agelaius tricolor*) is a California species of special concern at its nesting sites. This blackbird is largely endemic to the lowlands of California (Beedy and Hamilton 1999). Tricolored blackbirds are highly colonial, often forming large nesting aggregations in extensive freshwater marshes, but they also nest in moist thickets, grain fields, and willows. The CNDDB (2003) contains a 1986 record of a nesting colony in North Marsh, located on the northeast edge of the Coyote Hills Regional Park, just south of the Baumberg complex. However, the tricolored blackbird is not expected to nest within the project area due to the lack of suitable nesting habitat.

Alameda Song Sparrow. The Alameda song sparrow (*Melospiza melodia pusillula*) is a California species of special concern. This subspecies of the widely distributed song sparrow is restricted to the salt marshes and adjacent uplands around the San Francisco Bay (Cogswell 2000a). Alameda song sparrows occur primarily in tidal salt marshes, but may also nest or forage in other shoreline habitats such as seasonal wetlands, intertidal mudflats, and adjacent uplands (e.g., on dikes and levees) (Cogswell 2000a). They are expected to be present throughout the project area where suitable habitat occurs.

Salt Marsh Wandering Shrew. The salt marsh wandering shrew (SMWS) (*Sorex vagrans halicoetes*) is a California species of special concern. This shrew is known only from tidal salt marsh habitats around the San Francisco Bay (Shellhammer 2000a, Williams 1986). The salt marsh wandering shrew is a subspecies of the vagrant shrew, which ranges from southern British Columbia south to northern California and east to western Utah and Idaho (Kays and Wilson 2002); an isolated population is present in central Mexico.

The salt marsh wandering shrew occurs in areas supporting wet, medium-high salt marsh (6-8 feet above mean sea level), dominated by pickleweed, with large amounts of cover (e.g., driftwood), and an abundance of small invertebrates (Shellhammer 2000a, Willams 1986). Salt marsh wandering shrews have not been found within the project area (Shellhammer 2000a, WRA 1994). However, potential habitat is present within the project area, and there are recent records both to the north and the south (Shellhammer 2000a, CNDDB 2003). This small mammal is potentially present in salt marsh habitats along sloughs and channels within the project area.

Salt Marsh Harvest Mouse. The salt marsh harvest mouse (SMHM) (*Reithrodontomys raviventris*) is a state- and federally-listed endangered species and California species of special concern. SMHM are found only in tidal marshes around San Francisco Bay, San Pablo Bay, and Suisun Bay (Shellhammer 2000b). These mice inhabit marshes dominated by pickleweed, but they also use upland areas adjacent to the salt marsh, particularly during high tides. For the purposes of this document, “primary SMHM habitat” is defined as all areas with dense herbaceous vegetation providing at least 80 percent plant cover, a dominance (at least 50 percent) of pickleweed (or other halophytes), and vegetation height that averages 8 inches or more. “Secondary SMHM habitat” is defined as all other areas with dense herbaceous vegetation providing at least 80 percent plant cover, provided that such areas are adjacent to (and within 150 feet from) primary SMHM habitat.

The SMHM is known to occur in the project area, within the mid-upper tidal salt marsh habitat along the Bay shoreline, sloughs, and channels, as well as in diked salt marshes adjacent to salt ponds (Shellhammer 2000b). Populations of SMHM have been found within areas of tidal and non-tidal salt marsh vegetation in and surrounding the Baumberg complex, but not in the ponds themselves which lack suitable vegetative cover (C. Wilcox, pers. comm.). They have also been found along Mowry Slough, Coyote Creek, and Alviso Slough; and at other localities within the Alviso complex (Shellhammer 2000b, CNDDB 2003). No harvest mice have been recorded at the West Bay complex, although suitable habitat is present (WRA 1994).

Harbor Seal. The harbor seal (*Phoca vitulina richardsi*) is fully protected by the Marine Mammal Protection Act and is a common non-migratory pinniped found along the entire mainland coast of California. Recorded numbers of seals in San Francisco Bay range from between 550 in the summer to 125 during the winter months (Harvey et al. 1992). This species forages opportunistically in shallow littoral water, feeding on fish, crustaceans, and cephalapods. Harbor seals usually occur singly, in mother/pup pairs, or in small groups (Zeiner et al. 1990). Courtship and mating occur in the water, but undisturbed haul-out sites are necessary for pupping. In California, harbor seals breed from March through June with peak pupping activity occurring in April and May (Zeiner et al. 1990).

Harbor seals require haul-out areas free from human disturbance with unrestricted access to water for resting and breeding. Of the approximate dozen known haul-out sites in the South Bay, four occur in close proximity to the project area: (1) Guadalupe Slough, near the northeast end of Alviso Pond A3N; (2) the mouth of the Alameda Flood Control Channel, offshore from the southwest corner of Baumberg Pond 2; (3) along Coyote Creek, across from the mouth of Alviso Slough and Pond A9; and (4) along Coyote Creek, at the south end of Alviso Pond A20 (E. Griggs, pers. comm., NOAA/CDFG-OSPR 1998).

6.3.2 Criteria for Determining Significance of Effects

Criteria based on the CEQA Guidelines and NEPA implementing guidelines were used to determine the significance of wildlife 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 ecological scale and intensity refers to the severity of the impact.

Potential impacts of the project on wildlife 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 removal of habitat within the construction footprint. Indirect impacts include habitat alterations that result in a change in abundance or breeding success of a species (or group of species), due to the loss or gain of a primary food source through a change in pond salinities, the conversion of salt ponds to seasonal ponds or tidal marsh, the flooding of islands used for nesting, an increase in avian botulism, increased exposure to contaminants, or some other factor. Temporary impacts have a short duration, and wildlife populations would be expected to recover within a few months after implementation. An example would be the noise disturbances from operation of construction equipment. A permanent impact would involve the long-term alteration of habitat quality because the project would result in a change in habitat type. An example would be the permanent removal of a levee section, resulting in the conversion of diked salt pond to tidal marsh.

The project would have a significant impact on wildlife if it would:

- Have the potential to substantially reduce the habitat of a wildlife species, cause a wildlife population to drop below self-sustaining levels, or threaten to eliminate an animal 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 following significance criteria apply specifically to special status species. The project would have a significant impact on wildlife if it would:

- Result in a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by CDFG or USFWS, with habitat modifications specifically considered significant if they would:
- Result in the permanent loss of occupied special-status species habitat or the direct mortality of individuals of special-status species (not including a minor loss of occupied habitat for species that are not listed as threatened or endangered),
- Result in a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by CDFG or USFWS; or

- Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites for longer than two weeks.

The term “substantial” (applied to wildlife populations, habitat, or range, has not been quantitatively defined in CEQA or NEPA. What is considered substantial varies with each species and with the particular circumstances pertinent to a particular geographic area. For the purposes of this analysis, a “substantial” reduction in wildlife habitat is defined as:

- A greater than 30% decrease in the available acreage or quality of habitat for migrating or wintering waterfowl or shorebirds.

The project would have a beneficial impact if it would result in a substantial increase (a 30% or greater increase) in the quantity or quality of habitat for wintering waterfowl, migrant and wintering shorebirds, or special status species.

6.3.3 Impacts and Mitigation Measures

This section addresses impacts to wildlife within the project area, including impacts to special-status wildlife species. The section also presents proposed mitigation for impacts that are significant or potentially significant.

Temporary (short-term) impacts to individual species were assessed qualitatively, based on the likely sensitivity or susceptibility of the species to disruption as a result of activities that may be associated with construction (e.g., noise associated with equipment operation). Permanent impacts to wildlife were assessed by comparing the quantity and quality of habitats predicted to develop over time under the project alternatives with pre-project habitat conditions. Wildlife species that occur or have potential to occur at the project site were presumed to be indirectly affected if the quantity or quality of habitats with which they are typically associated would be affected.

Each of the project alternatives, including the No Project/No Action alternative and Alternative 1, would result in the following general types of impacts:

- Short-term and long-term changes to wildlife habitat, generating negative impacts for some wildlife species (including special status species and water birds in particular), and beneficial impacts for other species
- Impacts to nesting colonies of birds (including special status birds) due to increased predator access to and/or flooding of nesting habitat
- Impacts to birds (including special status birds) from increased exposure to sediments in pond bottoms

However, the intensity of these impacts and the specific species they would affect vary from alternative to alternative, as described in Section 6.3.3.1 through 6.3.3.5 below.

In addition, the Pond Management alternatives (Alternatives 1, 2, and 3) would create the following type of impact:

- Impacts to birds (including special status birds) from the creation of conditions suitable for avian botulism

The No Project/No Action and Alternative 1 would result in lower pond levels, but would not create many of the other conditions that can promote avian botulism (e.g., warm and shallow water, fluctuating water levels, high ambient temperatures, presence of vertebrate and invertebrate carcasses, poor water quality, and rotting vegetation). Therefore this impact does not apply to these two alternatives.

Under the Pond Management alternatives (Alternatives 1, 2, and 3), impacts include those impacts related directly to proposed construction activities and to the Initial Discharge Phase of the project, as well as impacts are related to the Continuous Pond Circulation Phase of the project.

The impacts of Pond Management Alternatives 1, 2, and 3 would be very similar. The changes in habitat conditions that would occur in each pond (i.e., changes in type of pond, salinity range, and average depth) are shown in Table 2-1. All of these changes would be implemented both for Alternatives 1 and 2, but the timing of the initial releases from the ponds would vary. Alternative 1 specifies an April initial release, while Alternative 2 specifies a phased initial release. Alternative 3 varies in that it incorporates more flexibility for pond management, by proposing a number of "possible alternative operations" for individual ponds (see Table 2-1). The proposed changes (including the possible alternative operations) are illustrated in Figures 6-4 through 6-9 [*LSA maps]*. The changes in habitat conditions would be implemented over a period of up to 8 years, depending on the particular pond and the alternative that is implemented (see Chapter 2).

Most of the impacts to wildlife that would result from implementing the pond management alternatives can be mitigated to less than significant. The exception is Wildlife Impact-1. Under all three pond management alternatives, the changes in foraging habitat described under this impact would be significant and unavoidable, even with the proposed mitigation measures. The intensity of Wildife Impact-1 is identical under Alternatives 1 and 2. The intensity of this impact would be somewhat reduced under Alternative 3, since there would be a smaller loss of mid-salinity ponds (as defined specifically for wildlife; see Section 6.3.1.1) under Alternative 3 compared to Alternatives 1 and 2. However, this impact would remain significant and unavoidable under Alternative 3, even with the proposed mitigation.

6.3.3 No Project/No Action Alternative

In the near term, project area ponds would be allowed to dry down and would convert to seasonal ponds. Eventually, without maintenance, the pond levees would collapse and the project area ponds would convert to open-water lagoons and eventually to tidal marsh. In some of the ponds, tidal flats would be exposed at low tides, depending on the elevations of the pond bottoms. Natural processes (e.g., sedimentation and colonization by marsh plants) would eventually lead to the re-establishment of tidal marsh vegetation in the lagoons.

Impacts are different for individual species and for the two phases (i.e., initial conversion to seasonal ponds [near-term impacts] and eventual conversion to tidal marsh [long-term impacts]), as described below. As for all of the alternatives, this alternative would result in near- and short-term changes to wildlife habitat, which would have species-specific negative and beneficial impacts. In addition, this alternative would result in impacts to nesting birds from increased predator access (near-term) and flooding (long-term); and impacts from increased exposure to contaminants in pond sediments.

It is unknown how long the levees would hold up without maintenance. Failure of levees and concomitant wildlife impacts may not occur for years, but could occur within months. Once they do fail, the resulting impacts would be long-term.

> *WILDLIFE BENEFICIAL IMPACT-1:* An increase in the area of seasonal ponds would benefit western snowy plovers that could use these ponds for nesting and foraging (near-term).

One of the initial concerns about the ISP was how it would affect western snowy plovers that currently use some of the ponds for nesting and foraging. It was determined, however, that under the proposed ISP (Alternatives 1, 2, and 3), the area of seasonal ponds would increase from 715 to at least 15,100 acres. This would greatly increase the available habitat for snowy plovers, which nest and forage on pond bottoms that have dried out (at least partially) after the end of the rainy season. Furthermore, snowy plovers are quite opportunistic in their choice of nest sites and will move from year to year to wherever suitable habitat is available (Wilcox 2003). Therefore, implementation of the ISP (Alternatives 1, 2, and 3) is expected to have a beneficial impact on western snowy plover.

Significance: Significant.

> *WILDLIFE IMPACT-1:* Changes in pond hydrology would result in wildlife habitat changes with positive impacts for some wildlife species and negative impacts for some wildlife species.

Beneficial impacts are discussed above.

> *WILDLIFE IMPACT-1A:* Conversion of project area ponds to seasonal ponds would result in a substantial loss of open water foraging habitat for waterbirds, including special status birds (near-term).

Waterbirds would still forage in the seasonal ponds that develop in the pond basins, but overall there would be a significant decrease in foraging habitat, especially for tidal flat specialists (e.g., western sandpiper, least sandpiper, dunlin) for which the ponds represent foraging habitat throughout the tidal cycle (Stenzel et al. 2002). Although the ponds would provide foraging habitat during the wet season (from approximately December-April), they would be dry the remainder of the year, during the breeding season and fall migration period. Therefore, waterbirds that currently forage within the ponds during these periods would have to travel farther distances and expend more energy to find suitable foraging sites during high tide periods.

Once abandoned, most of the ponds would likely remain highly saline due to salts that have built up in the substrate (Granholm 1989). Rooted vegetation would consequently be sparse or absent, except for limited pickleweed growth. Waterbird species that prefer lower-salinity ponds (e.g., plant-eating dabbling ducks and fish-eating species) would therefore be limited in their foraging opportunities even when water is present during the wet season. Moreover, as water depths decrease towards the end of the wet season, foraging habitat for dabbling ducks would decline, as well.

The loss of open water foraging habitat would impact the following special status species: California least tern, Forster's tern, Caspian tern, black skimmer, and California gull. The conversion to seasonal ponds would have a beneficial impact on western snowy plovers (see Wildlife Beneficial Impact-1, below).

WILDLIFE IMPACT-1B: Eventually, conversion to open-water lagoons and tidal marsh would result in habitat impacts (both positive and negative) for various species, including special status species (long-term).

This habitat conversion would be detrimental to wildlife species that prefer seasonal ponds (e.g., snowy plover) and open-water habitats (e.g., waterfowl and terns), but would benefit tidal marsh species (e.g., salt marsh harvest mouse, salt marsh wandering shrew, California clapper rail, and Alameda song sparrow).

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

WILDLIFE IMPACT-2: Changes in water levels in some ponds would result in impacts to nesting bird colonies from increased predator access and/or flooding, thereby substantially reducing the breeding habitat for certain waterbird species in the South Bay.

WILDLIFE IMPACT-2A: Drying of project area ponds would result in "land-bridging" of existing nesting colonies on islands and isolated interior levees, exposing special status species and other birds to increased predation (near-term).

As a result of reduced water depths and seasonal dry-down in project area ponds, some isolated levees or islands could be temporally connected to mainland areas, thereby allowing increased access by mammalian predators. For example, decreased water levels in Pond 10 may land-bridge the existing islands at the southwest and west-northwest corners, which currently support nesting Caspian terns, Forster's terns, and American avocets (SFBBO, unpubl. data).

The following special-status species could be adversely affected by increased predator access to islands and isolated interior levees: western snowy plover, California gull, black skimmer, Caspian tern, and Forster's tern. These species nest and generally roost on the ground and are vulnerable to predators such as the red fox, raccoon, and Norway rat. Ideal nesting habitats are isolated from mainland areas by open water. Open water serves as a barrier to mammalian predators, greatly reducing their ability to gain access to sensitive nesting and/or roosting areas.

Note that California gulls currently nest in the Knapp property (Pond A6 near Alviso), which dries in the summer. In addition, snowy plovers primarily nest in dry pond bottoms and other areas which are currently accessible by terrestrial predators. Therefore, impacts to nesting colonies of these species already exist in the project areas.

WILDLIFE IMPACT-2B: Eventually, conversion to tidal marsh would further increase predator access to islands (long-term).

WILDLIFE IMPACT-2C: Collapse of pond levees would result in the loss of nesting habitat on levees for special status species and other bird species (long-term).

Without regular maintenance, the levees are expected to erode and eventually collapse and thus be unsuitable to support nesting waterbirds. Salt pond levees and dry ponds and islands they protect currently support nesting populations of five special status species (Caspian tern, Forster's tern, western snowy plover, California gull, and black skimmer) and two additional bird species (American avocet and black-necked stilts).

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

> *WILDLIFE IMPACT-3*: Lower average water levels in project ponds could increase the exposure of some foraging waterbirds to contaminated sediments on the bottoms of some ponds, potentially resulting in a substantial reduction in suitable foraging habitat for some species.

> *WILDLIFE IMPACT-3A*: Drying of the project ponds would increase the exposure of western snowy plover (a special status species) as well as other foraging birds to contaminated sediments on the pond bottoms (near-term).

Several ponds that currently receive high waterbird use (e.g., Alviso Pond A9) also have been shown to contain levels of mercury in the pond sediments comparable to levels found in the adjacent tidal mudflats and slough channels. For tidal areas around Alviso Slough/Guadalupe River, these levels may be sufficient to cause impacts to avian species through bioaccumulation. Lower water levels in the adjacent ponds would increase the area available for exposure of certain avian species (i.e., probers) to these contaminants. Refer to Section 5.3.1 for more detailed information.

> *WILDLIFE IMPACT-3B*: Eventually, conversion to open water lagoon and tidal marsh, would cause additional special-status wildlife species to be exposed to contaminated sediments (long-term).

Sensitive species that would be affected by this impact include California clapper rail, Alameda song sparrow, salt marsh wandering shrew and salt marsh harvest mouse. Within the project area, in areas where contaminated sediments are known to occur in the salt ponds, the surrounding tidal marshes also have contaminated sediments (C. Wilcox, pers. comm.). Thus, the tidal marsh species are already exposed to contaminants. With this impact, however, the acreage of contaminated tidal marsh would eventually be substantially increased. Refer to Chapter 5 and Wildlife Impact 0.2 for more information. Refer to Section 5.3.1 for more detailed information.

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

6.3.3.2 Alternative 1 (Seasonal Ponds)

Impacts under this alternative would initially be similar to those under the No Project/No Action Alternative, but since the levees would be maintained, long-term impacts would differ as noted below for each of the impacts discussed for the No Project/No Action Alternative in Section 6.3.3.1 above.

> *WILDLIFE IMPACT-1 (CHANGES IN WILDLIFE HABITAT)*: Since the levees would be maintained, there would be no conversion to tidal marsh, and hence no beneficial impacts on tidal marsh species, as expected under the No Project/No Action Alternative.

> *WILDLIFE IMPACT-2 (IMPACTS TO NESTING BIRD COLONIES)*: Since the levees would be maintained, there would be no loss of nesting habitat on levees. However, as ponds dry down, nesting colonies on islands, would be exposed to increased predation due to land-bridging. Since levees would be maintained, this would be a long-term ongoing impact, rather than a just a near-term impact as under the No Project/No

Action Alternative. Since the seasonal ponds within the pond basins would persist indefinitely under this alternative, western snowy plovers would derive a long-term benefit from the creation of nesting habitat (rather than the short-term benefit anticipated under the No Project/No Action Alternative).

WILDLIFE IMPACT-3 (INCREASED EXPOSURE TO CONTAMINANTS IN POND SEDIMENTS): In some ponds, the potential impact on snowy plovers due to increased exposure to contaminated sediments would be long-term, rather than short-term as it is under the No Project/No Action Alternative). However, adverse impact on tidal marsh species due to increased exposure to contaminated sediments, anticipated under the No Project/No Action Alternative, would be eliminated under the Seasonal Pond Alternative.

6.3.3.3 Alternative 2 (Simultaneous March-April Initial Discharge)

Under the Pond Management alternatives (Alternatives 2, and 3), impacts include those impacts related directly to proposed construction activities and to the Initial Discharge Phase of the project, as well as impacts are related to the Continuous Pond Circulation Phase of the project.

In general, impacts during the Continuous Pond Circulation Phase of the project would include changes in wildlife habitat (Wildlife Beneficial Impacts-1 and -2, Wildlife Impact-1), impacts from disruption of nesting bird colonies (Wildlife Impact-2), and impacts from increased exposure to contaminated pond sediments (Wildlife Impact-3), all of which are also anticipated under the No Project/No Action and Alternative 1, although the intensity of impacts and specific species impacted vary for each of these alternatives. In addition, Alternative 2 would create conditions that could produce avian botulism (Wildlife Impact-4). Also, there would be a number of short- and long-term impacts to special status species as a result of construction activities proposed under Alternative 2 (Wildlife Impacts-5 through -9).

Public access and hunting activities will not increase substantially under Alternatives 1, 2, or 3, and thus, these activities will not result in a significant impact on wildlife species. Similarly, salt pond maintenance activities (primarily consisting of the maintenance of water control structures and levees) will be very similar to those previously conducted by Cargill, when the ponds were in salt production. These activities will be subject to the conditions of the existing maintenance permit, which is being transferred to the CDFG and USFWS. Those conditions include measures to mitigate impacts on biological resources. Thus, the maintenance activities will not result in significant biological impacts.

Most of the impacts to wildlife that would result from implementing Alternative 1, including the impacts related to construction activities can be mitigated to less than significant. The exception is Wildlife Impact-1. The changes in foraging habitat described under this impact would be significant and unavoidable, even with the proposed mitigation measures.

Impacts During the Alternative 2 Continuous Circulation Phase

WILDLIFE BENEFICIAL IMPACT-1: An increase in the area of seasonal ponds would benefit western snowy plovers that could use these ponds for nesting and foraging.

Under Alternative 2, the area of seasonal ponds would increase from 715 to 3,233 acres. This would greatly increase the available habitat for snowy plovers, which nest and forage on pond bottoms that have dried out (at least partially) after the end of the rainy season. Snowy plovers are expected to utilize these new seasonal ponds, because they are opportunistic in their choice of nest sites and will move from year to year to wherever suitable habitat is available (Wilcox 2003).

Significance: Significant.

> *WILDLIFE BENEFICIAL IMPACT 1.5:* The increase in low-salinity ponds and intake ponds will result in an increase in high-quality foraging habitat for dabbling ducks and piscivorous (fish-eating) waterbirds.

Under the proposed ISP, the number of low-salinity ponds would increase from 22 to 44. In addition, the number of intake ponds, which have been noted to support higher numbers of waterbirds than other system ponds (M. Kolar, pers. comm.), will increase from four to 16. This habitat modification would be beneficial for fish-eating waterbirds (e.g., terns, herons, pelicans, and cormorants) and several species of dabbling ducks (e.g., northern shoveler, American wigeon, and mallard), which typically forage in larger numbers in lower-salinity and intake ponds.

Significance: Significant.

> *WILDLIFE IMPACT-1*: Changes in hydrology would result in changes in wildlife habitat with positive impacts for some wildlife species and negative impacts for some wildlife species.

Beneficial impacts are discussed above. Reduced salinity in many of the ponds may substantially reduce foraging habitat for waterbird species that occur primarily in medium-salinity (60-180 ppt) ponds. (Please see the Wildlife Setting [Section 6.3.1.1] for the definitions of salinity categories, which differ from those in other sections of the EIR/EIS.)

Although salt ponds provide foraging and roosting habitat for a wide variety of waterbirds, several species occur almost exclusively in medium-salinity ponds; these include black-necked stilt, Wilson's phalarope, red-necked phalarope, and eared grebe (Anderson 1970, Swarth et al. 1982, Harvey et al. 1988, Stenzel et al. 2002). A significant portion of the total eared grebe species population occurs on the South Bay salt ponds (Cogswell 2000c).

Three species of shorebirds that traditionally forage in tidal mudflats (western sandpiper, least sandpiper, dunlin) also occur at high densities in medium-salinity ponds. These species' use of the salt ponds is highly dependent on the amount of prey available, which in turn depends upon pond salinity. The highest densities of three important waterbird prey species in San Francisco Bay (brine shrimp, water boatmen, and brine flies) occur in salinities of 60-200 ppt (Larsson 2000, Maffei 2000a, b). In one of the few studies to sample invertebrate (i.e., prey) biomass in salt ponds, Swarth et al. (1982) found biomass to be greater in high-salinity ponds than low-salinity ponds in the Coyote Hills (i.e., Newark) pond complex (they did not provide definitions for "high" and "low" salinity).

The Wilson's phalarope was selected by the Goals Project Waterfowl and Shorebirds Focus Team as representative of species that are most dependent on the salt ponds for foraging habitat (Takekawa et al. 2000, Hanson 2000). It is also one of the most halophilic bird species in the world (Jehl 1988). From late June to August, tens of thousands of phalaropes congregate on the South Bay salt ponds (Swarth et al. 1982, Harvey et al. 1988). During this time, adults and juveniles molt into basic plumage and accumulate fat reserves for their non-stop southbound migration to their wintering grounds in South America. During the breeding season, Wilson's phalaropes nest in seasonal wetlands and freshwater marshes in North American grasslands and prairies. Their migratory stopover habitat, however, is mostly tied to highly saline lakes (e.g., Mono Lake [CA], Great Salt Lake [UT], Lake Abert [OR]), where an abundance of prey (brine flies and brine shrimp) provides sorely-needed food for their long migration to South America. San Francisco Bay's salt pond system is the major staging area for this species on its Pacific Coast migration route (Colwell and Jehl 1994).

Under Alternative 2, the total number of medium- or high-salinity ponds will be reduced from 24 to 3 (Alviso Ponds A12, A13, and A15) (Table 2-1), which represents a decrease of 5,702 to 827 acres (an 85 percent decrease). These habitat changes would substantially reduce the amount of available foraging habitat in the South Bay for waterbird species that favor medium- and high-salinity ponds (e.g., black-necked stilts, Wilson's phalaropes, red-necked phalaropes, eared grebes, western sandpipers, least sandpiper, and dunlin. From a regional perspective (including the ISP project area and Cargill's Newark ponds), the acreage of medium- or high-salinity ponds will be reduced from 10,402 to 5,527 acres (a 47 percent decrease). These habitat changes would substantially reduce the amount of available foraging habitat in the South Bay for waterbird species that favor medium- and high-salinity ponds.

Since San Francisco Bay is one of only a few sites in North America that regularly support shorebirds in the hundreds of thousands, the loss of such habitat could have significant impacts on regional shorebird populations, especially for the shorebird species noted above.

Significance: Significant.

> *WILDLIFE MITIGATION MEASURE-1A:* Continue monthly surveys of waterbird use and at least one "window" survey each spring.

USGS has monitored waterbird use at Alviso Ponds A9-A16 for several years and is conducting baseline monitoring for all ponds included in the ISP from April 2003 to April 2004 (ISP, p. 52) Monthly surveys are conducted at high tides and include counts of birds involved in feeding or roosting. Monthly high-tide surveys will continue throughout implementation of the ISP.

In addition, at least one "window" survey will be conducted each spring in all CDFG- and USFWS-owned ponds in the South Bay (including those not included in the ISP), i.e., all ponds will be surveyed within the same time period to determine waterbird distribution and abundance.

> *WILDLIFE MITIGATION MEASURE-1B:* Compare monthly monitoring data to monthly post-ISP implementation data.

The data from monthly high tide surveys carried out throughout implementation of the ISP will be compared to USGS monthly baseline waterbird monitoring data.

> *WILDLIFE MITIGATION MEASURE-1C*: If survey results show a major decline in waterbird populations, manage more ponds as medium- or high salinity batch ponds.

As noted in Section 6.3.2, a "significant" decline in a population is a decrease of 30% or more, compared to baseline conditions of phalaropes, black-necked stilts, eared grebes, or small shorebirds (i.e., western sandpiper, least sandpiper, dunlin), or other waterbird species. If it appears that these declines are related to the loss of medium- and high-salinity ponds, to the extent feasible, more ponds would be managed as medium- or high-salinity batch ponds (see the "possible alternative operations" in Table 2-1), to increase the acreage of medium- and high-salinity habitat and to offset the loss of foraging habitat from ISP implementation,.

Please note that, although Table 2-1 defines batch ponds as "high salinity," they actually fall within the medium-salinity category used by the Goals Project and in the Biology section of this document. To avoid confusion, when referring to ISP management options, the term "high salinity batch pond" will continue to be used.

Post-mitigation Significance: Potentially significant.

> *WILDLIFE IMPACT-2:* Changes in water levels in some ponds would result in impacts to nesting bird colonies from increased predator access and/or flooding, thereby substantially reducing the breeding habitat for certain waterbird species in the South Bay.

Currently, isolated salt pond levees and islands in salt ponds support nesting bird colonies. Ideal nesting habitats are isolated from mainland areas by open water. Open water serves as a barrier to mammalian predators, greatly reducing their ability to gain access to sensitive nesting and/or roosting areas. As a result of reduced water depths, seasonal dry-down, increased tidal action, and changing water levels within various ponds, Alternative 1 could result in "land-bridging" of existing nesting islands and isolated interior levees, exposing nesting colonies to predators that could more easily access islands from levees and the surrounding tidal marsh. Fluctuating water levels could also flood some of the nesting colonies.

The following special-status species could be adversely affected by increased predator access to islands and isolated interior levees: western snowy plover, California gull, black skimmer, Caspian tern, and Forster's tern. American avocets (not a listed species) could also be adversely impacted. These species nest and generally roost on the ground and are vulnerable to predators such as the red fox, raccoon, and Norway rat. For example, decreased water levels in Baumberg Pond 10 may land-bridge the existing islands at the southwest and west-northwest corners, which currently support nesting Caspian terns, Forster's terns, and American avocets (SFBBO, unpubl. data).

Significance: Potentially significant.

> *WILDLIFE MITIGATION MEASURE -2A*: Identify islands and interior levees in need of protection from water level fluctuation.

SFBBO is currently conducting breeding bird surveys throughout the South Bay salt ponds. CDFG and USFWS will use those survey results to identify islands and interior levees in need of protection from water level fluctuation.

> *WILDLIFE MITIGATION MEASURE-2B:* During implementation of the ISP, islands and interior levees will be checked weekly (as access conditions permit) from March to July for nesting waterbirds that could be impacted by flooding or land-bridging.

> *WILDLIFE MITIGATION MEASURE-2C*: Water levels will be manipulated as needed to ensure proper isolation from the surrounding levees and tidal marsh during the nesting season and to avoid flooding of nest sites.

Specific ponds that may require close monitoring include Alviso Ponds A1, A7, and A16, and Baumberg Pond 10.

Post-mitigation Significance: Less than significant.

> *WILDLIFE IMPACT-3*: Lower average water levels in project ponds could increase the exposure of some foraging waterbirds to contaminated sediments on the bottoms of some ponds, potentially resulting in a substantial reduction in suitable foraging habitat for some species.

Several ponds that currently receive high waterbird use (e.g., Alviso Pond A9) also have been shown to contain high levels of mercury in the bottom sediments similar to levels in adjacent tidal mudflats and slough channels. For tidal areas around Alviso Slough/Guadalupe River, these levels may be sufficient to cause impacts to avian species through bioaccumulation. Lower water levels in the adjacent ponds would incrase the area available for exposure of certain avian species (i.e., probers) to these contaminants. Refer to Section 5.3.3 for more detailed information.

Significance: Significant

> *WILDLIFE MITIGATION MEASURE-3*: Implement Sediments Mitigation Measure-1A through 1D.

Post-mitigation Significance: Less than significant.

> *WILDLIFE IMPACT-4*: The overall reduction in pond salinities and water depths may create conditions suitable for avian botulism, which could substantially reduce the populations of special status bird species and other waterbird species in the project area.

Avian botulism is a neurological disease caused by ingestion of a toxin produced by the bacterium *Clostridium botulinum*. Symptoms include inability to fly, followed by paralysis of the legs. As the disease progresses, the inner eyelid and neck muscles are also paralyzed. Affected birds often drown, as they are no longer able to hold their heads out of the water (Friend and Franson 1999). Some of the environmental conditions which can influence an outbreak of avian botulism are warm and shallow water, fluctuating water levels, high ambient temperatures, presence of vertebrate and invertebrate carcasses, poor water quality, and rotting vegetation.

In surveys conducted from June 28 through November 17, 2002 at Artesian Slough, Coyote Creek, and Alviso Slough, the SFBBO found no evidence of avian botulism in 17 birds that were collected. In addition, avian botulism has not yet been documented in saline waters in the Bay Area (C. Wilcox, pers. comm.). Nevertheless, the overall reduction of water levels within the salt ponds may create conditions susceptible to outbreaks of avian botulism, especially during the warmer summer months.

The following special-status species could potentially be impacted by an outbreak of avian botulism: California brown pelican, California clapper rail, western snowy plover, Caspian tern, Forster's tern, California gull, black skimmer, and California least tern.

Significance: Potentially significant.

WILDLIFE MITIGATION MEASURE-4: The following measures would be taken to reduce the spread of avian botulism through the project area:

WILDLIFE MITIGATION MEASURE-4A: If there is evidence of avian botulism in areas surveyed by SFBBO, Refuge staff will survey the adjacent ponds using shallow draft boats.

WILDLIFE MITIGATION MEASURE-4B: All personnel conducting operational activities in the ponds will be trained to recognize symptoms of avian botulism and will make special observation efforts during late August, September, and October, when outbreaks generally occur.

WILDLIFE MITIGATION MEASURE-4C: If dead birds are found, they will be retrieved and incinerated in an approved facility. Sick birds will be brought to an approved avian rehabilitation facility.

Post-mitigation significance: Less than significant.

Impacts Related to Alternative 2 Construction Activities

WILDLIFE IMPACT-5: Construction could impact existing tidal salt marsh habitat for the California clapper rail.

The California clapper rail is known to occur in the densely-vegetated portions of mid- to high tidal marsh habitat found along the sloughs and channels in the project area. Construction associated with implementation of the ISP could disturb nesting California clapper rails or their habitat on the outboard side of levees, along sloughs and along the bay shoreline. The vegetation at proposed water control structure locations is described in Section 6.1.1.3. Six of these locations contain suitable clapper rail habitat (Table 6-5). It is possible, however, that additional locations support clapper rail habitat within 100 feet of proposed construction work. (Note: The construction buffer distance used to minimize harassment to clapper rails is 100 feet. If clapper rails are breeding within that distance from a construction site, work is typically delayed until after the breeding season. However, if a clapper rail is detected within 700 feet of a survey point, and if clapper rail habitat is present at that survey point, then the breeding territory is assumed to include that survey point.)

Significance: Potentially significant.

WILDLIFE MITIGATION MEASURE 5: The following measures will be implemented:

WILDLIFE MITIGATION MEASURE-5A: Survey construction sites for clapper rails.

Prior to the start of construction activities, a qualified wildlife biologist will visit all construction sites, including locations of water control structures and proposed levee breaches (if any). The biologist will determine whether potential clapper rail nesting habitat is present within 100 feet of each site.

WILDLIFE MITIGATION MEASURE-5B: Locate construction outside clapper rail nesting habitat.

Whenever possible, construction sites will be located in areas that do not support potential nesting habitat for clapper rails. No construction work will occur within 100 feet of potential clapper rail nesting habitat during the nesting season (February 1 - August 31), unless prior surveys indicate that the habitat is not part of an active clapper rail breeding territory. Such surveys will be conducted in accordance with a project-specific clapper rail survey protocol that has been approved by the USFWS and CDFG.

> *WILDLIFE MITIGATION MEASURE-5C*: Any short-term impacts to clapper rail habitat will be offset by the long-term benefits of restoring Alviso Ponds A19, A20, and A21 (475 acres) to tidal marsh.

Post-mitigation Significance: Less than significant. With the implementation of these measures, the amount of construction-related disturbance (e.g., due to displacement or harassment) and habitat loss will be limited in extent and duration. Temporary and localized effects of construction disturbance and habitat loss will likely occur in a few locations as a result of implementing the ISP, but the mitigation measures noted above would reduce these effects to a less-than-significant level.

> *WILDLIFE IMPACT-6*: Construction could impact existing tidal or non-tidal salt marsh habitat for the salt marsh harvest mouse (SMHM) and salt marsh wandering shrew (SMWS).

Construction for implementation of the ISP could impact known or potential habitat for the SMHM and SMWS. Descriptive information has been collected regarding the site-specific characteristics of the vegetation at each of the proposed construction locations (see Section 6.3.1.3). Twenty-three of these locations contain suitable habitat for salt marsh harvest mouse and wandering shrew (Table 6-5).

Measures are incorporated into the project (Mitigation Measure 1.3, below) to relocate salt marsh harvest mice and wandering shrews as well as other native small mammal species from construction areas. The extent of construction will be limited. This should allow movement of mice and shrews from temporarily disturbed marshes to existing undisturbed marshes in the project area. Overall, this short-term, minor reduction in available habitat at a few locations that results from construction for implementation of the ISP will be offset by the long-term establishment of tidal marsh habitat in the project area.

Significance: Potentially significant.

> *WILDLIFE MITIGATION MEASURE-6:* The following measures will be implemented:

> *WILDLIFE MITIGATION MEASURE-6A*: Survey construction sites for SMHM and SMWS prior to construction.

Prior to the start of construction activities, a qualified wildlife biologist will visit all construction sites. The biologist will determine whether potential SMHM or SMWS habitat is present within the immediate disturbance area of each construction site.

> *WILDLIFE MITIGATION MEASURE-6B*: Whenever possible, construction sites will be relocated if necessary to avoid areas that support potential habitat for SMHM or SMWS.

WILDLIFE MITIGATION MEASURE-6C: If a construction site(s) cannot be located outside of such areas, construction impacts will be limited to the smallest possible area of suitable SMHM or SMWS habitat.

The construction areas will be clearly demarcated by temporary fencing and signs throughout the construction period. No construction activities will be allowed in tidal marsh, except within the fenced areas.

WILDLIFE MITIGATION MEASURE-6D: Just before construction, vegetation within the fenced areas will be cleared using hand tools, if feasible.

The purpose of the vegetation clearing is to discourage SMHM or SMWS from remaining in the construction areas by removing the vegetative cover that they require, and making it possible to see any mice that are present. Construction work will start as soon as possible (and no longer than one week) after the vegetation has been cleared.

WILDLIFE MITIGATION MEASURE-6E: A qualified biological monitor will oversee vegetation clearing and construction activities at the construction sites.

The monitor will remain on-site during all construction work directly affecting SMHM habitat. The monitor will have the authority to control or halt construction activity that is not consistent with the protection measures noted above. Additionally, the monitor will notify the USFWS and CDFG of any unanticipated damage to protected habitat areas, or any dead or injured special-status species.

WILDLIFE MITIGATION MEASURE-6F: Short-term impacts to SMHM and SMWS habitat will be offset by the long-term benefits of restoring Alviso Ponds A19, A20, and A21 (475 acres) to tidal marsh.

Post-mitigation Significance: Less than significant.

WILDLIFE IMPACT-7: Construction could impact burrowing owls and/or nesting northern harriers on the levees within the project area.

Burrowing owls and northern harriers nest and forage in upland habitats on levees, and are known to occur within the ISP project area. During the breeding season, construction activities for implementation of the ISP could destroy active nests or disrupt the breeding activities of nesting burrowing owls or harriers. Additionally, construction-related activities that occur during the non-breeding season could adversely affect and displace burrowing owls from their burrows.

Significance: Potentially significant.

Note: Wildlife Mitigation Measure 7, below, applies to impacts to burrowing owls. Wildlife Mitigation Measure-8 applies to impacts to northern harriers.

WILDLIFE MITIGATION MEASURE-7: The following measures will be implemented to avoid or minimize adverse effects to burrowing owls:

WILDLIFE MITIGATION MEASURE-7A: Survey construction sites for burrowing owls prior to construction.

Pre-construction surveys for burrowing owls will be conducted in and adjacent to all construction areas within 30 days of all construction activities, or by following the CDFG survey protocols currently in effect at that time. If construction activities at a site are delayed or suspended for more than 30 days, the site will be re-surveyed.

WILDLIFE MITIGATION MEASURE-7B: During the breeding season (February 1 through August 31), if burrowing owls are found on or adjacent to a construction site, a clearly-delineated construction buffer will be established around each occupied burrow at a minimum radius of 250 feet from the burrow.

If construction vehicles must pass through an established buffer in order to access a construction site, a "no stopping" policy will be implemented, and appropriate signs will be posted at the buffer periphery.

WILDLIFE MITIGATION MEASURE-7C: During the non-breeding season, if destruction of an occupied burrow is unavoidable, or if a construction site is located within 160 feet of an occupied burrow, passive relocation measures will be implemented to encourage the owl(s) to move away from the burrow prior to construction. If no suitable alternate burrows are present within 500 feet of the destroyed burrow, two artificial burrows will be installed at an appropriate location, to be determined by a qualified wildlife biologist.

Passive relocation methods and artificial burrow locations will be subject to CDFG approval, but will follow guidelines outlined in the CDFG *Staff Report on Burrowing Owl Mitigation* (CDFG 1995). Passive relocation will not be conducted during the breeding season (February 1-August 31).

WILDLIFE MITIGATION MEASURE-7D: All protection measures will remain in place for the duration of construction at the occupied sites or until a qualified biological monitor verifies that burrowing owls are no longer present.

WILDLIFE MITIGATION MEASURE-8: The following measures will be implemented to avoid or minimize adverse effects to northern harriers:

WILDLIFE MITIGATION MEASURE-8A: Survey construction sites for northern harriers prior to construction at sites where construction is scheduled during the northern harrier nesting season (generally late March through August).

Pre-construction surveys for northern harriers will be conducted in and adjacent to all construction areas within 30 days of all construction activities, or by following the CDFG survey protocols currently in effect at that time. If construction activities at a site are delayed or suspended for more than 30 days, the site will be re-surveyed.

WILDLIFE MITIGATION MEASURE-8B: If an active harrier nest is found at or adjacent to a site, construction activities will be rescheduled until after the nesting season. If this is not feasible, construction buffers will be established around each nest, at a minimum radius of 300 feet from the nest.

The buffers will be clearly marked with temporary fencing and signs. No construction activities will occur within the buffer as long as the nest is active. If construction vehicles must pass through an established buffer in order to access a construction site, a "no stopping" policy will be implemented, and appropriate signs will be posted at the buffer periphery.

WILDLIFE MITIGATION MEASURE-8C: Active nest sites will be monitored by a qualified biologist throughout the nesting season to verify that the protective measures are effective and to implement additional measures, if necessary.

The protection measures will remain in effect until the biological monitor determines that the nesting cycle has been successfully completed or that the nest is no longer active.

Post-mitigation Significance: Less than significant.

WILDLIFE IMPACT-8: Construction could result in disturbance to breeding activity of salt marsh common yellowthroat, Alameda song sparrow, and/or several nesting waterbird species (western snowy plover, Caspian tern, Forster's tern, California gull, black skimmer, herons, and egrets).

Construction activities associated with implementation of the ISP could destroy active nests and/or disrupt the breeding activities of these special-status bird species. For example, the proposed construction activities on the internal levee between Ponds A5 and A7 could impact Forster's terns reported to nest there.

Significance: Potentially significant.

Note: Wildlife Mitigation Measure 9, below, applies to impacts to salt marsh common yellowthroat and Alameda song sparrow. Wildlife Mitigation Measure-10 applies to impacts to western snowy plover, Caspian tern, Forster's tern, California gull, black skimmer, and other special-status waterbird species (e.g., herons and egrets).

WILDLIFE MITIGATION MEASURE-9: The following measures will be implemented to avoid or minimize adverse effects to salt marsh common yellowthroat and Alameda song sparrow.

WILDLIFE MITIGATION MEASURE-9A: Construction associated with implementation of the ISP will be located and timed to avoid impacts to potential nesting habitat of these species, to the extent feasible.

WILDLIFE MITIGATION MEASURE-9B: If avoidance of construction during the nesting season is not feasible, pre-construction surveys will be completed, prior to the initiation of project construction, at construction sites that are located within, or adjacent to, suitable nesting habitat for these species (e.g., tidal marsh, riparian, or adjacent brushy habitat).

WILDLIFE MITIGATION MEASURE-9C: If active nests are present, construction buffers will be established at a minimum radius of 50 feet from the nest. Active nest sites will be monitored by a qualified biologist periodically during the nesting season to verify that the protection measures are effective and to implement additional measures, if necessary.

If construction vehicles must pass through an established buffer in order to access a construction site, a "no stopping" policy will be implemented, and appropriate signs will be posted at the buffer periphery. The protection measures will remain in effect until the biological monitor determines that the nesting cycle has been successfully completed or that the nest is no longer active.

WILDLIFE MITIGATION MEASURE-10: The following measures will be implemented to avoid or minimize adverse effects to nesting sites of western snowy plover, Caspian tern, Forster's tern, California gull, black skimmer, or other special-status waterbird species (e.g., herons and egrets):

WILDLIFE MITIGATION MEASURE-10A: Construction associated with implementation of the ISP will be located and timed to avoid impacts to potential nesting sites of these species, to the extent feasible. This construction timing restriction will be implemented from February through August for western snowy plover and from April through August for the other waterbird species.

WILDLIFE MITIGATION MEASURE-10B: If avoidance of construction during the nesting season is not feasible, pre-construction surveys will be completed, prior to the initiation of project construction, at construction sites that are located within, or adjacent to, suitable nesting habitat for these species (e.g., seasonal ponds, islands, and levees).

WILDLIFE MITIGATION MEASURE-10C: If active nests are present, construction buffers will be established at a minimum radius of 300 feet from the nesting site or nesting colony periphery. Active nest sites will be monitored by a qualified biologist periodically during the nesting season to verify that the protection measures are effective and to implement additional measures, if necessary.

If construction vehicles must pass through an established buffer in order to access a construction site, a "no stopping" policy will be implemented, and appropriate signs will be posted at the buffer periphery. The protection measures will remain in effect until the biological monitor determines that the nesting cycle has been successfully completed or that the nest is no longer active.

Post-mitigation Significance: Less than significant.

WILDLIFE IMPACT-9: Construction for implementation of the ISP, and various maintenance operations, may impact harbor seals in the area (short-term and long-term impacts).

Harbor seals at haul-out sites are susceptible to human disturbance. They typically flush from haul-out sites when people approach them from shore or by boat or when they are disturbed by various construction activities and noises. Such disturbances can have an adverse impact on harbor seals, particularly during the pupping and molting seasons, when individuals are considered more vulnerable than at other times of the year.

Significance: Potentially significant.

WILDLIFE MITIGATION MEASURE-11: The following measures will be implemented to avoid or minimize adverse effects to harbor seals:

WILDLIFE MITIGATION MEASURE-11A: At locations near known harbor seal haul-outs and pupping sites, pre-construction surveys will be conducted prior to initiating project construction.

WILDLIFE MITIGATION MEASURE-11B: To the extent feasible, water control structures will not be located at or adjacent to active haul-out or pupping sites.

The installation of such structures and the subsequent maintenance could be a source of significant disturbance to the seals.

> *WILDLIFE MITIGATION MEASURE-11C*: If installation of structures and subsequent maintenance is proposed for locations in close proximity to sensitive harbor seal sites (i.e., within 200 feet for haul-outs and 500 feet for pupping sites; distance subject to approval of NOAA), such activities will be conducted outside of the pupping season (March to May) and the molting season (June to August).

> *WILDLIFE MITIGATION MEASURE-11D*: If construction and operations activities cannot be timed to avoid disturbance to haul-out sites, disturbance to hauled out individuals will be minimized. A qualified biological monitor will be present during construction activities near harbor seal haul-outs. A clearly-marked, protective buffer (200 feet wide, as measured from the edge of the haul-out site; distance subject to approval of NOAA) will be established and maintained, and no construction personnel or equipment will be allowed to enter this area while hauled out individuals are present.

Adaptive Management Strategies

A variety of adaptive management strategies have been proposed. If these strategies are implemented, there would be a smaller loss of mid-salinity ponds (as defined specifically for wildlife; see Section 6.3.1.1) compared to the ISP. Therefore, the intensity of Wildlife Impact-1 would be reduced under the adaptive management strategies. Mitigation measures proposed for Wildlife Impact-1 under alternatives 2 and 3 would further reduce the severity of the impact, but would not eliminate it. Even with the reduced severity of impact and the proposed mitigation, Wildlife Impact-1 would remain potentially. These would be long-range impacts during the Continuous Circulation Phase of the project.

In addition, parts of Wildlife Mitigation Measures-5 and -6 would not apply if the adaptive management strategies are implemented, because alternatives 2 and 3 include "possible alternative operations" that, if implemented, would convert Alviso Ponds A19, A20, and A21 to seasonal ponds, rather than to tidal marsh. In that case, these ponds would not be available to mitigate for potential impacts on tidal marsh species such as California clapper rails, salt marsh harvest mice, and salt marsh wandering shrews.

The differences between Wildlife Impact-1 and Wildlife Mitigation Measures -5 and -6 if the adaptive management strategies are implemented, compared to Alternatives 2 and 3, are noted below.

> *WILDLIFE IMPACT-1:* Changes in hydrology would result in changes in foraging habitat with positive impacts for some wildlife species (e.g., western snowy plover, a special status species) and negative impacts for some wildlife species.

Adaptive management strategies include system-specific alternatives that are not included in the ISP (see Table 2-1). These alternatives allow considerable management flexibility to the agencies responsible for implementing the ISP. For example, many ponds currently proposed by the ISP as low-salinity ponds could alternatively be managed as medium or high-salinity batch ponds (see salinity categories in Section 6.3.1). These include: Alviso Ponds A2E, A3N, and A8; and Baumberg Ponds 4, 7, 1C, 5C, 12, 13, and 14. As a result, the area of medium- and high salinity habitat would be reduced from 5,702 to 1,872 acres (67 %

decrease) rather than 5,702 to 827 acres (85% decrease), as proposed in Alternatives 2and 3. Thus, if the adaptive management strategies are implemented, the reduction would be between 67% and 85%. From a regional perspective (including the ISP project area and Cargill's Newark ponds), the acreage of medium- and high-salinity ponds will be reduced from 10,402 to 6,572 acres (a 37 percent decrease).

Post-mitigation Significance: Potentially significant.

> *WILDLIFE MITIGATION MEASURE-1A*: Continue monthly surveys of waterbird use and at least one "window" survey each spring.

See discussion of this mitigation measure under Section 6.3.3.3.

> *WILDLIFE MITIGATION MEASURE-1B:* Compare monthly monitoring data to monthly post-ISP implementation data.

See discussion of this mitigation measure under Section 6.3.3.3.

> *WILDLIFE MITIGATION MEASURE-1C:* If survey results show a major decline in waterbird populations, manage more ponds as medium or high salinity batch ponds.

See discussion of this mitigation measure under Section 6.3.3.3.

Post-mitigation Significance: Potentially significant.

> *WILDLIFE IMPACT-5*: Construction could impact existing tidal salt marsh habitat for the California clapper rail.

See discussion under Section 6.3.3.

Significance: Potentially significant.

> *WILDLIFE MITIGATION MEASURE 5*: The following measures will be implemented:

See Wildlife Mitigation Measures 5A and 5B under Section 6.3.3.

> *WILDLIFE MITIGATION MEASURE-5C*: Any short-term impacts to clapper rail habitat will be offset by the long-term benefits of restoring Alviso Ponds A19, A20, and A21 (475 acres) to tidal marsh.

Installation of water control structures will disturb only a minimal area of tidal marsh habitat, and most of this area will revegetate naturally after construction. If the adaptive management strategies are implemented, the Alviso "Island Ponds" (A19, A20, or A21) will either be restored to tidal marsh or managed as seasonal ponds. If they are managed as seasonal ponds, no levees will be breached (thus avoiding short-term loss of tidal marsh due to levee breaching). If they are restored to tidal marsh, the levees will be breached, possibly resulting in a short-term loss of existing tidal marsh. However, the long-term benefits of tidal marsh restoration will compensate for the short-term impacts on small areas of tidal marsh. In addition, any long-term impacts on tidal marsh will be mitigated by the large-scale tidal marsh restoration to be implemented under the long-term management plan for the ISP area.

Post-mitigation Significance: Less than significant.

WILDLIFE IMPACT-6: Construction could impact existing tidal or non-tidal salt marsh habitat for the salt marsh harvest mouse (SMHM) and salt marsh wandering shrew (SMWS).

See discussion under Section 6.3.3.

Significance: Potentially significant.

WILDLIFE MITIGATION MEASURE-6: The following measures will be implemented:

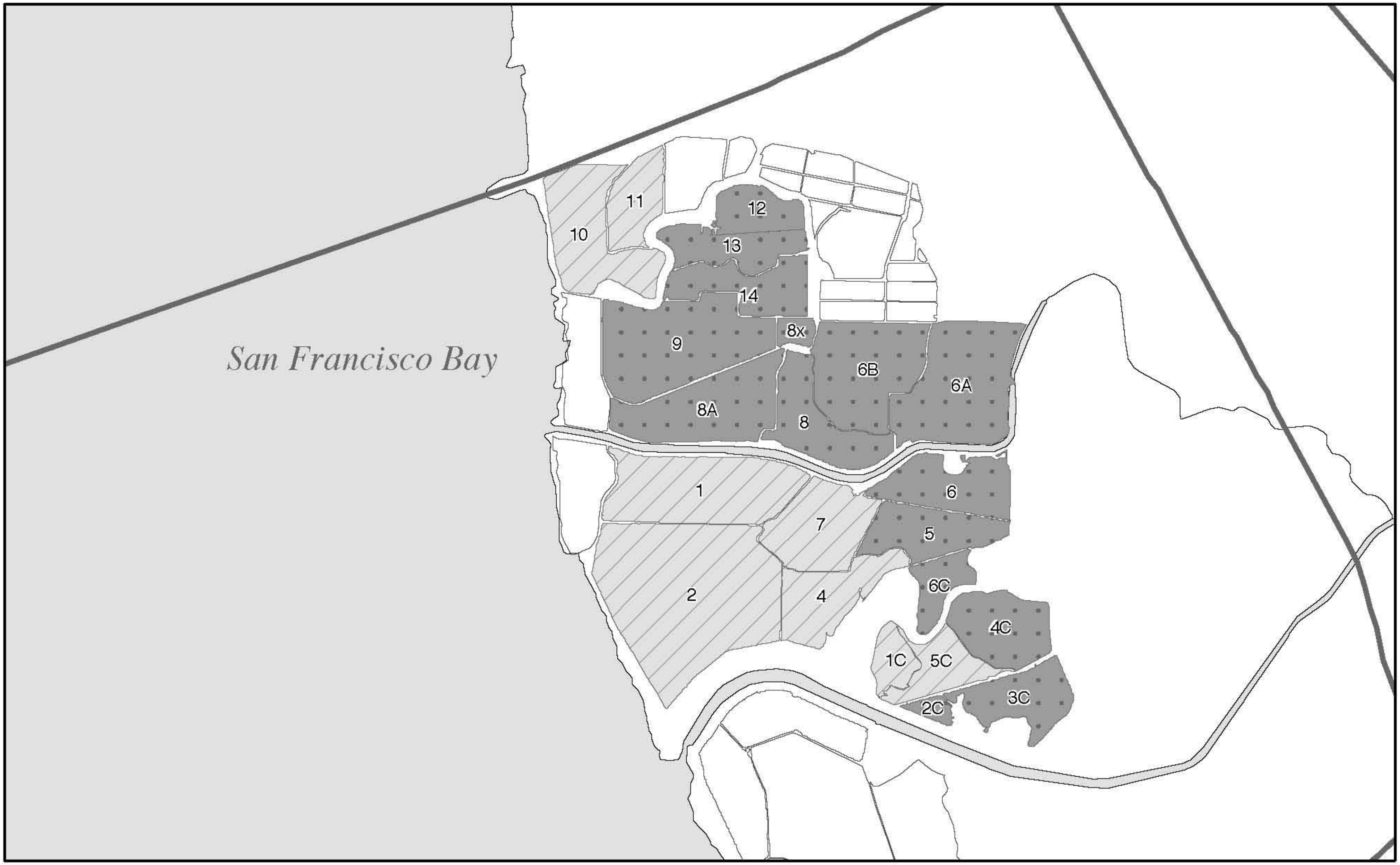
See Wildlife Mitigation Measures 6A through 6E under Section 6.3.3.

WILDLIFE MITIGATION MEASURE-6F: Short-term impacts to SMHM and SMWS habitat will be offset by the long-term benefits of restoring Alviso Ponds A19, A20, and A21 (475 acres) to tidal marsh.

Installation of water control structures will disturb only a minimal area of tidal marsh habitat, and most of this area will revegetate naturally after construction. If the adaptive management strategies are implemented, the Alviso "Island Ponds" (A19, A20, or A21) will either be restored to tidal marsh or managed as seasonal ponds. If they are managed as seasonal ponds, no levees will be breached (thus avoiding short-term loss of tidal marsh due to levee breaching). If they are restored to tidal marsh, the levees will be breached, possibly resulting in a short-term loss of existing tidal marsh. However, the long-term benefits of tidal marsh restoration will compensate for the short-term impacts on small areas of tidal marsh. In addition, any long-term impacts on tidal marsh will be mitigated by the large-scale tidal marsh restoration to be implemented under the long-term management plan for the ISP area.

6.3.3.4 Alternative 3 (Phased Initial Discharge)

Impacts would be very similar to those under Alternative 2. No additional significant (or potentially significant) impacts are expected.



LSA

Type of Pond

Low Salinity (0-60 ppt)

Medium Salinity (60-180 ppt)

High Salinity (Above 180 ppt)

3 1.5 0 3 miles

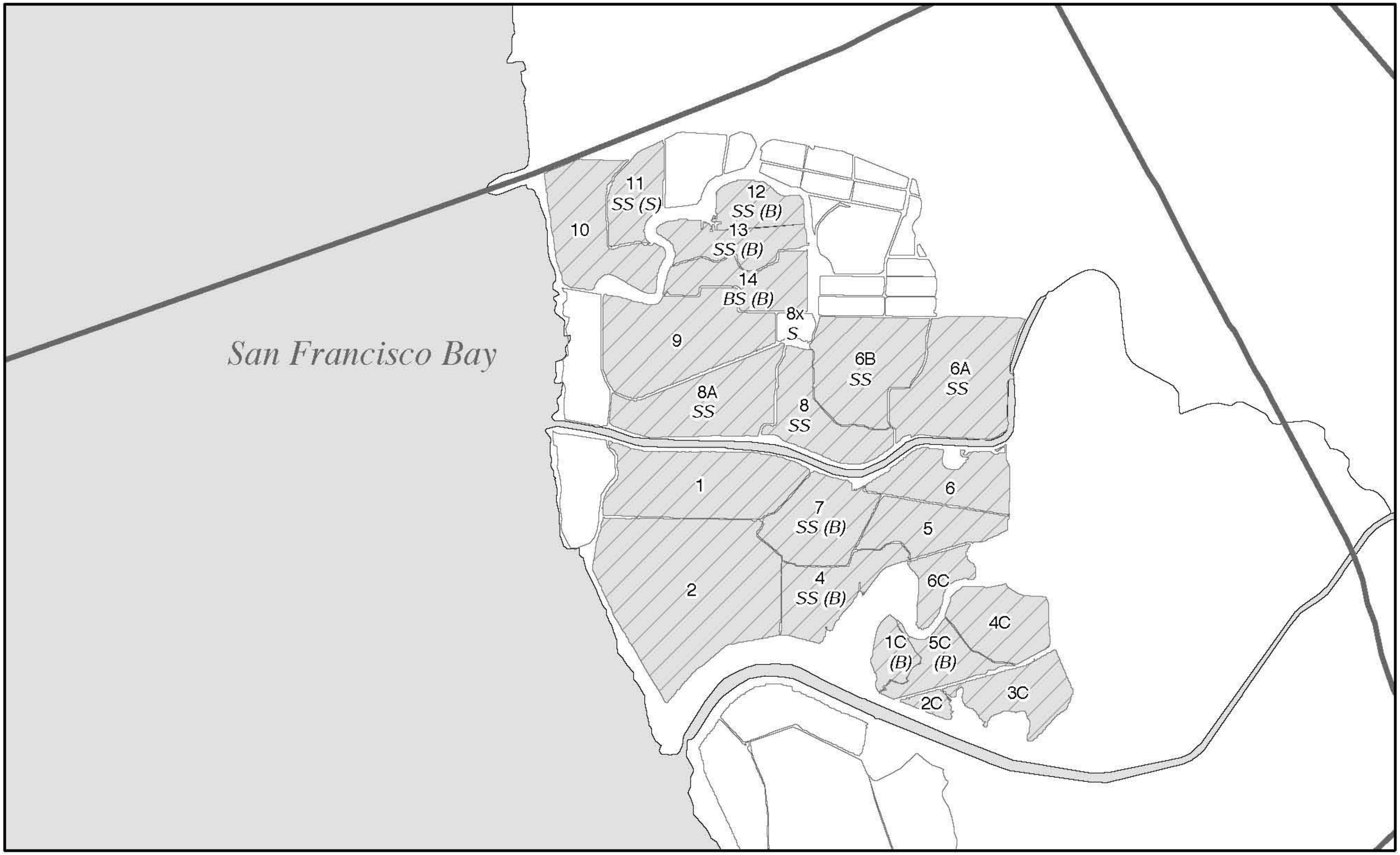
1 inch equals 3.0 miles

I:/lsg230/gis/maps/Baumberg_existing

Notes: (1) The "type of pond" is based on average salinity. (2) All of these ponds are system ponds.

Figure 6-4

Cargill Salt Ponds
Existing Conditions
Baumberg Complex



L S A

Type of Pond

Low Salinity (0-60 ppt)

Medium Salinity (60-180 ppt)

High Salinity (Above 180 ppt)

Tidal or Seasonal

S = Seasonal Pond
BS = Batch/Seasonal Pond
SS = System/Seasonal Pond

Possible Alternative Operations

(*B*) = Batch (Medium salinity)
(*S*) = Seasonal

3 1.5 0 3 miles

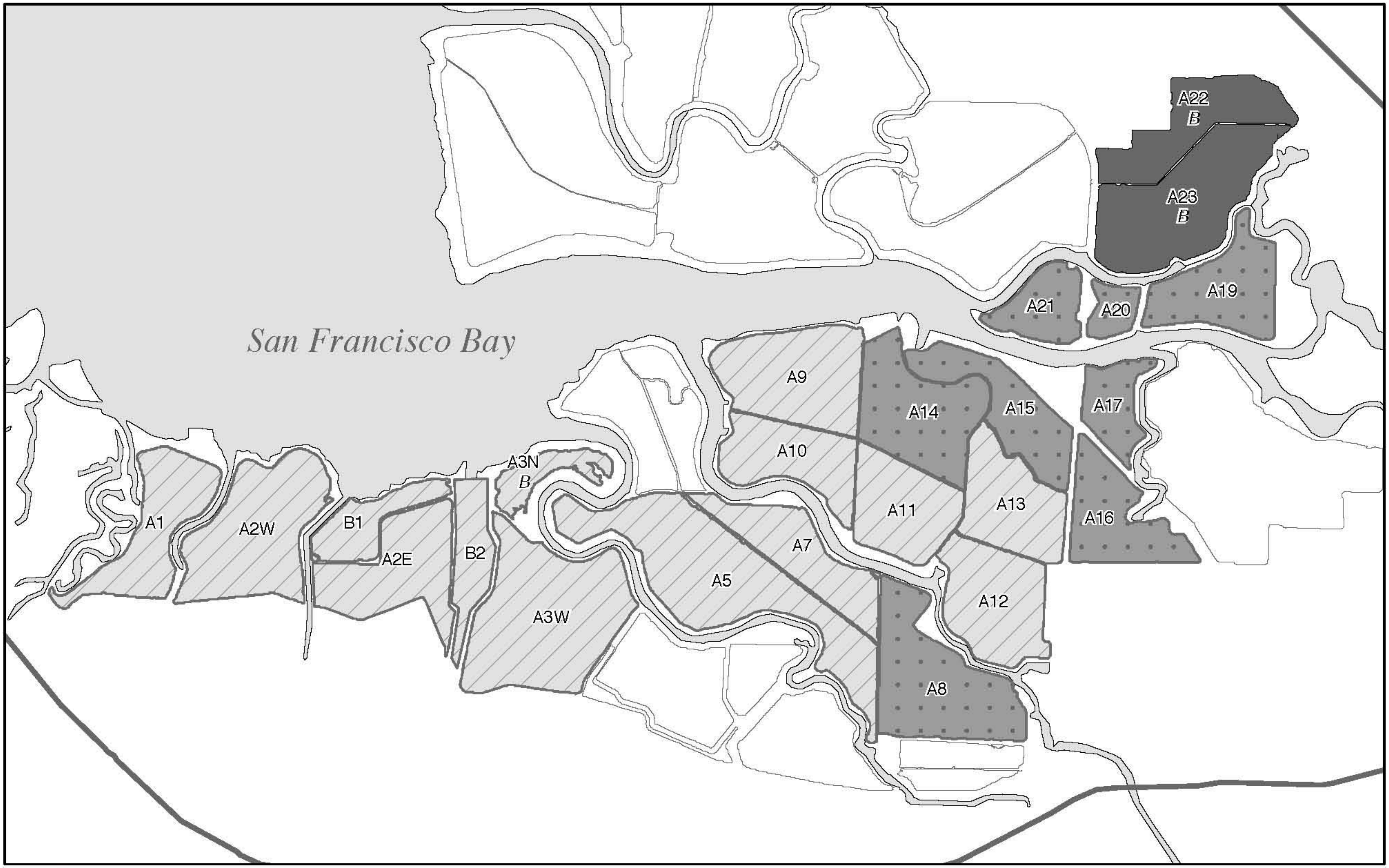
1 inch equals 3.0 miles

Notes: (1) The "type of pond" is based on average salinity. (2) The other ponds (not labeled as *S*, *BS* or *SS*) are system ponds.

Figure 6-5

Cargill Salt Ponds
Proposed ISP Conditions
Baumberg Complex

I:/lsg230/gis/maps/Baumberg_proposed



LSA

Type of Pond

- Low Salinity (0-60 ppt)
- Medium Salinity (60-180 ppt)
- High Salinity (Above 180 ppt)
- Tidal or Seasonal

B = Batch Pond

3 1.5 0 3 miles

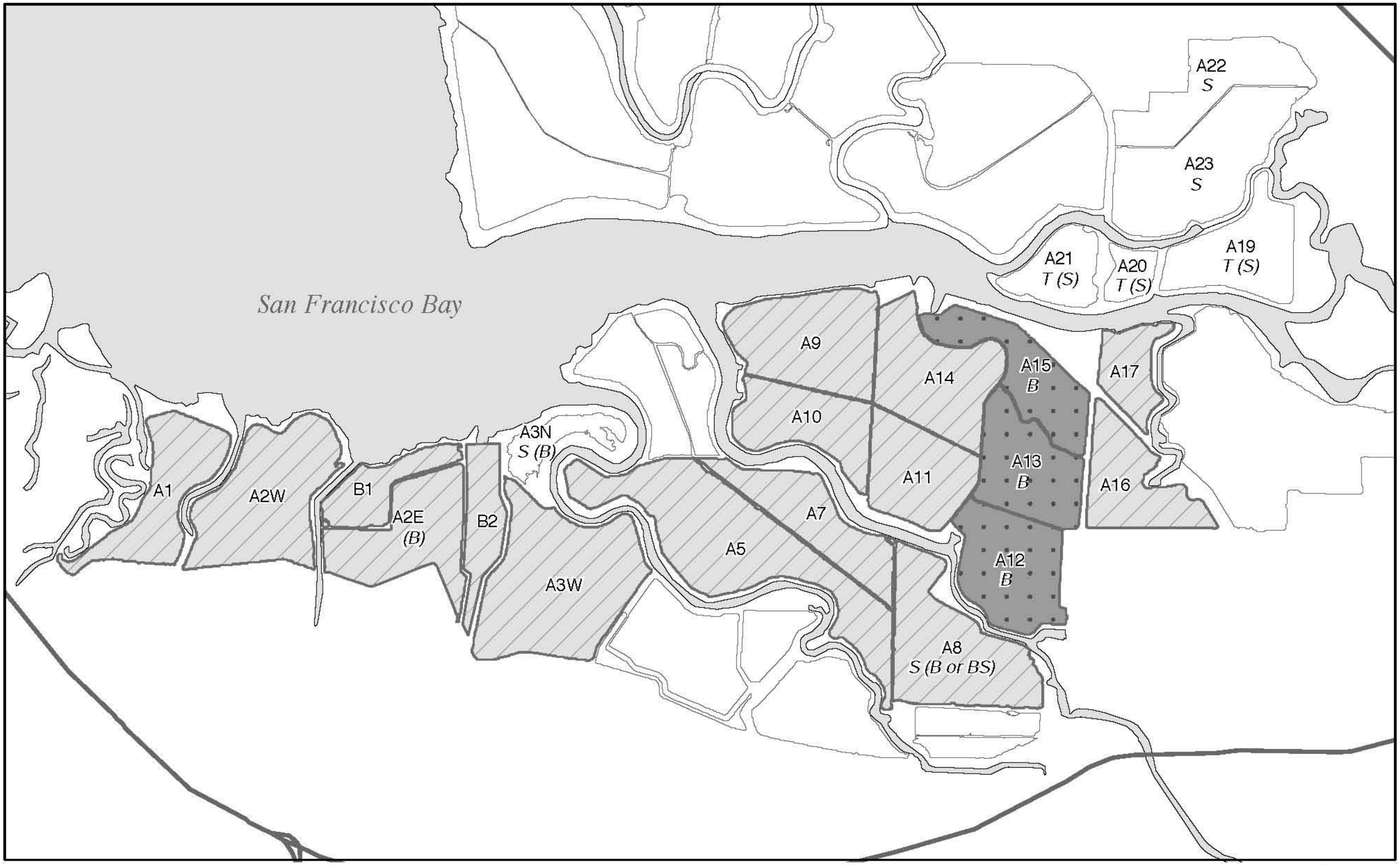
1 inch equals 3.0 miles

Notes: (1) The "type of pond" is based on average salinity. (2)The other ponds (not labeled as *B*) are system ponds.

I:/lsg230/gis/maps/Alviso_existing

Figure 6-6

Cargill Salt Ponds
Existing Conditions
Alviso Ponds



L S A

3 1.5 0 3 miles

1 inch equals 3.0 miles

I:/lsg230/gis/maps/Alviso_proposed

Type of Pond

Low Salinity (0-60 ppt)

Medium Salinity (60-180 ppt)

High Salinity (Above 180 ppt)

Tidal or Seasonal

B = Batch Pond

T = Tidal Pond

S = Seasonal Pond

Possible Alternative Operations

(*B*) = Batch (medium salinity)

(*S*) = Seasonal

(*BS*) = Batch/Seasonal

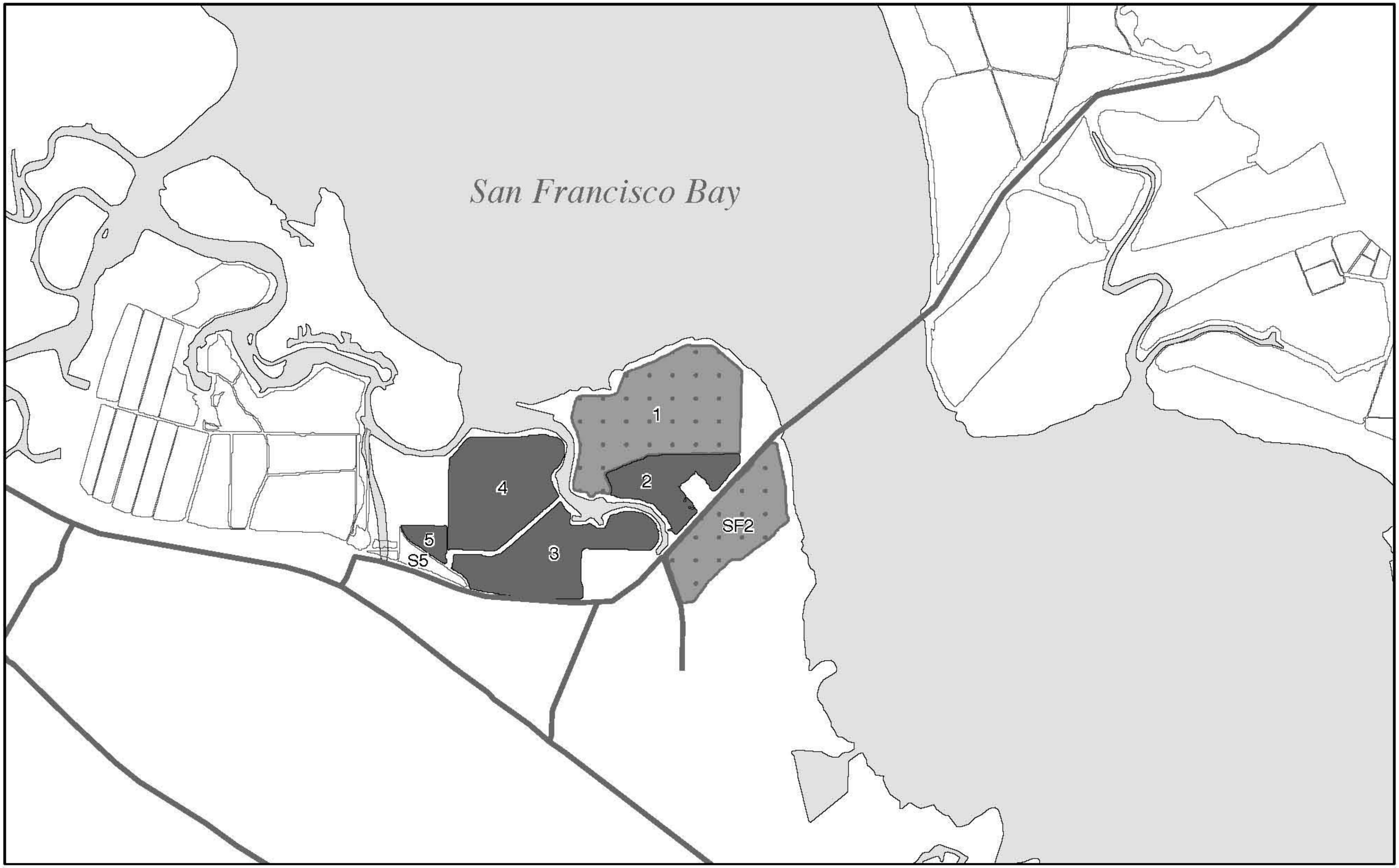
Notes:(1) The "type of pond" is based on average salinity. (2) The other ponds (not labeled as *B*, *T*, or *S*) are system ponds.

Figure 6-7

Cargill Salt Ponds

Proposed ISP Conditions

Alviso Ponds



LSA

Type of Pond
Low Salinity (0-60 ppt)
Medium Salinity (60-180 ppt)
High Salinity (Above 180 ppt)

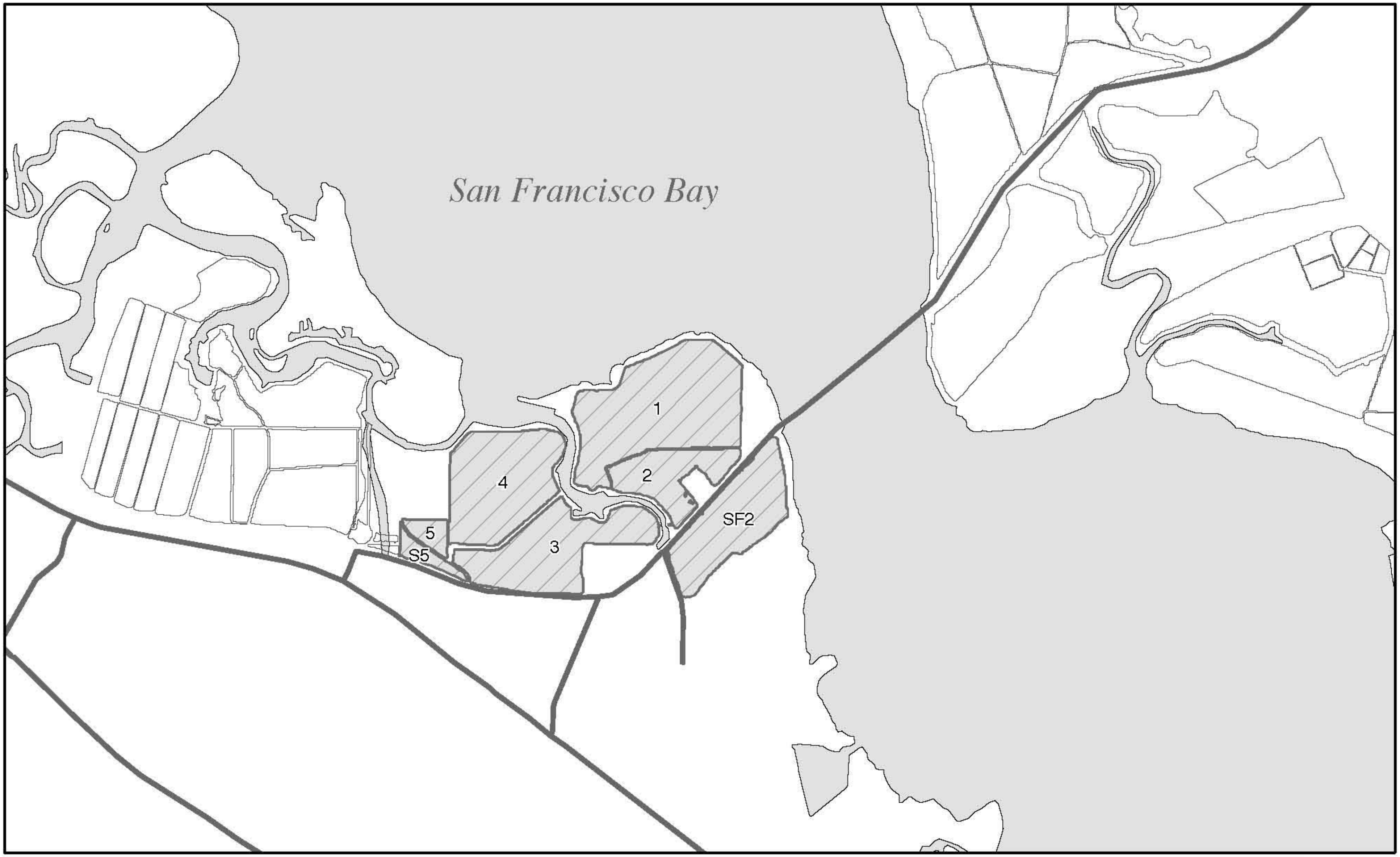
3 1.5 0 3 miles
1 inch equals 3.0 miles

Figure 6-8

Cargill Salt Ponds
Existing Conditions
West Bay Complex

Notes: (1)The "type of pond" is based on average salinity.
(2)All of these ponds are system ponds. (3)No salinity data is available for Pond S5.

I:/lsg230/gis/maps/Westbay_existing



LSA

Type of Pond
Low Salinity (0-60 ppt)
Medium Salinity (60-180 ppt)
High Salinity (Above 180 ppt)

Possible Alternative Operations
None proposed

3 1.5 0 3 miles

1 inch equals 3.0 miles

Figure 6-9

Cargill Salt Ponds
Proposed ISP Conditions
West Bay Complex

Notes: (1)The "type of pond" is based on average salinity. (2) All of these ponds are system ponds.

I:/lsg230/gis/maps/Westbay_proposed

6.4 Biological Resources—Fish and Macroinvertebrates

This section describes the fish and macroinvertebrate communities known to occur within the salt ponds, sloughs and creeks, open water, and the South Bay shoreline within the project area and the effect that project implementation may have on these communities. The section also addresses impacts to special status fish species within the project area. The existing condition and anticipated impacts to shrimp are addressed in Section 6.2, Benthic Invertebrates.

Site-specific fish surveys were not conducted for this project. However, information specific to the project area or to the region was available from a number of sources, including reports prepared for the Goals Project 2000, Woods (1984), Wild (1969), Lonzarich (1989), in addition to the extensive 1980-2002 California Department of Fish and Game (CDFG) San Francisco Bay-Delta fishery sampling data base (Baxter et al. 1999; CDFG unpublished data). The South Bay Dischargers Association (SBDA) 1982-1986 study (Kinnetics 1987) (was also used, as well as 1978-79 fish egg and larval sampling conducted by PG&E in the South Bay. These sources are cited below and full references are provided in Chapter 13.

6.4.1 Affected Environment

6.4.1.1 Regional Overview

San Francisco Bay provides habitat for a variety of fish species, which may inhabit the system year-round or on a seasonal basis. Fish species inhabiting the Bay include northern anchovy (*Engraulis mordax)*, Pacific herring (*Clupea pallasi)*, flatfish, surfperch, gobies, sharks and rays, smelt, Chinook salmon (*Oncorhynchus tshawytscha)* and steelhead (*Oncorhynchus mykiss)*, and a wide variety of other species (Baxter et al. 1999; Wang 1986).

In addition to the fish community, the Bay provides habitat supporting a diverse assemblage of benthic and epibenthic macroinvertebrates including clams, worms, crabs, and shrimp. Shrimp and crabs (macroinvertebrates) inhabit intertidal and subtidal areas similar to fish, have habitat requirements and preferences similar to many of the fish species (e.g., preferences for sandy substrate, rock outcroppings, etc.), and serve an important ecological role as key prey species for many of the fish inhabiting the South Bay. Shrimp and crabs, as with many of the fish species, also support recreational and/or commercial fisheries within the Bay and coastal waters and, hence, are an important element of the aquatic community to be considered when evaluating potential effects of the proposed project on habitat quality and availability, and the population dynamics of aquatic resources that may be effected by the proposed project.

Fish, shrimp, and crabs use habitats within San Francisco Bay for a number of functions including, but not limited to, adult and juvenile foraging, spawning, egg incubation and larval development, juvenile nursery areas, and as migratory corridors. Species composition, abundance, habitat use, and geographic distribution for many of these species vary seasonally and among years. Factors affecting species composition and geographic distribution within the Bay include salinity gradients; variation in water temperature, water depth, and substrate; and availability of foraging and cover habitat (e.g., pilings, rock outcroppings, submerged aquatic vegetation, and riprap).

The estuarine environment within the areas adjacent to the proposed South Bay salt pond sites is dynamic, varying in response to factors such as the magnitude of freshwater inflow from the Sacramento and San Joaquin river systems and other tributaries to the Bay and resultant changes in salinity gradients, the movement of marine waters from near-shore coastal areas into and out of the Bay on a tidal basis, wind- and tidally-driven current patterns, seasonal variation in water temperatures, and a variety of other physical and biological processes. The habitat use and functions of these intertidal and subtidal areas vary in response to these physical factors as well as to differences in life-history characteristics and habitat requirements for the Bay's wide variety of species.

The presence, abundance, and distribution of fish species in the Bay-Delta estuary are determined by numerous abiotic and biological factors (Moyle and Cech 2000). However, there are some general factors that exert a strong influence and explain much of the spatial and temporal variability in species abundance and distribution. In particular, physical and chemical factors such as temperature, salinity, water velocities and current patterns, substrate, habitat characteristics (e.g., rock outcroppings, emergent vegetation, etc.) and dissolved oxygen levels play important roles in determining the seasonal timing, habitat use, and spatial distribution of fish and macroinvertebrates (e.g., bay shrimp [*Crangon nigricauda]* and crabs) within various regions of San Francisco Bay and the Delta.

Baxter et al. (1999) described the geographic distribution of various fish, shrimp, and crab species inhabiting the Bay and their response to seasonal and geographic variation in salinity gradients and water temperature. The geographic distribution of many of these species within the Bay is determined, in large part, by salinity tolerance and preference. Within the Bay-Delta estuary, salinities range from freshwater within the river systems to marine, as influenced by tidal exchange with nearshore coastal waters. Within the Bay-Delta estuary, freshwater and saltwater mix, forming a highly dynamic and productive estuarine habitat characterized by a wide range of salinities, both geographically and seasonally. The geographic distribution and habitat usage patterns for the fish, shrimp, and crabs inhabiting the Bay, which may vary by different lifestages of the species, reflect in large part the response to these salinity conditions.

The general salinity range for various fish, shrimp, and crabs has been compiled by Baxter et al. (1999). The fish, shrimp, and crab species that use subtidal and intertidal habitat within the estuary typically tolerate mesohaline (5-18 parts per thousand [ppt]), polyhaline (18-30 ppt), and euhaline (>30 ppt) salinities (Baxter et al. 1999). The fluctuating and intermediate salinity typical of estuarine habitats is the factor that limits the penetration of both marine and freshwater species into the mixed waters in the interior of the estuary. Accordingly, the specific area of the estuary in which a species is found is determined largely by the species salinity tolerances (Baxter et al. 1999). Salinity within the estuary varies from freshwater within the creeks and rivers to full strength seawater in Central Bay near the Golden Gate. Within the South Bay, regional, localized, and seasonal variation in salinities affect the fish and macroinvertebrate species that would be present in the area of the proposed project.

The estuary supports a diverse assemblage of resident and migratory fish species and macroinvertebrates. Many of the species use the estuary on a seasonal basis (e.g., Pacific herring, northern anchovy, California halibut [*Paralichthys californicus]*, Dungeness crab [*Cancer magister]*), taking advantage of favorable conditions to complete their life cycles (Baxter et al. 1999). Other species, such as Chinook salmon and steelhead, utilize the Bay-

Delta estuary primarily as a migratory corridor between freshwater spawning and juvenile rearing areas within the creeks and rivers tributary to the estuary and the coastal marine waters.

A number of studies (Kinnetics 1987, Wild 1969) have demonstrated the importance of the sloughs around San Francisco Bay to provide food and habitat for developing fish. Some species (i.e., Pacific herring, northern anchovy) depend upon diatoms, phytoplankton and planktonic copepods for food, while other fish are predators on baitfish (striped bass [*Morone saxatilis]*, California halibut, leopard shark [*Triakis semifasciata]*). Other estuarine species, including the early life stages of many fish (i.e., shiner perch [*Cymatogaster aggregate*], speckled sanddab [*Citharichthys stigmaeus]*, white croaker [*Genyonemus lineatus]*) depend upon amphipods, other crustaceans and bivalves. Thus, there is a direct link between the benthic communities in South Bay sloughs that supply the food to support the fish populations found in the sloughs.

6.4.1.2 Anadromous Fish Inhabiting South Bay Creeks

Anadromous or migratory species move through the Bay-Delta estuary during passage to or from freshwater and coastal marine habitats. The vast majority of anadromous fish species, including Chinook salmon, steelhead, striped bass, American shad (*Alosa sapidissima)*, and sturgeon, migrate through the northern portion of San Francisco Bay (e.g., Central Bay, San Pablo Bay, and Suisun Bay) during their upstream and downstream migrations into the Sacramento and San Joaquin river systems. A substantially smaller proportion of anadromous fish populations migrate into the South Bay. Chinook salmon and steelhead are known to use South Bay tributaries as spawning and juvenile rearing habitat and have been the focus of several programs designed to improve habitat conditions and the abundance of both salmon and steelhead in these watersheds.

Steelhead and Chinook salmon produced in the South Bay tributaries would migrate through the estuary as both emigrating juveniles and immigrating adults. Although the migration routes for juvenile and adult salmon and steelhead within the South Bay are unknown, it is likely that these fish would occur seasonally in the general vicinity of the proposed project. Adult Chinook salmon migration typically occurs during the fall (September-November) with juvenile migration during the spring (February-May). Adult steelhead migration typically occurs during the winter and early spring (December-April) with juvenile migration primarily during the spring (February-May).

At least nine rivers and creeks flow into the South Bay that either have annual salmonid migrations or potential spawning habitat for Chinook or steelhead: San Leandro Creek, Alameda Creek, Coyote Creek, Upper Penitencia Creek, Alviso Creek, Guadalupe River, Stevens Creek, San Francisquito Creek, and possibly San Lorenzo Creek (Leidy 2000). Historically, all of these rivers and creeks may have supported annual runs of salmon and/or steelhead. Now salmonid numbers are greatly reduced, and only Coyote Creek, Guadalupe River, Stevens Creek, and San Francisquito Creek have consistent records of Chinook salmon and/or steelhead. Anadromous fish use of these four creeks and Alameda Creek are discussed below.

Alameda Creek. Access to Alameda Creek for returning adult Chinook salmon and steelhead has been completely blocked by a passage barrier located in the lower reaches of the creek (Gunther et al. 2000). Both adult Chinook salmon and steelhead have been observed downstream of the passage barrier in recent years (Hanson unpublished data). Restoration plans, including passage facilities, are currently being developed for Alameda Creek.

San Francisquito Creek. San Francisquito Creek is known to support a steelhead run of approximately 100 fish. Habitat surveys conducted along this system indicate that sufficient spawning habitat exists to support at least that many fish.

Stevens Creek. Stevens Creek has a relatively large population of resident rainbow trout (*Oncorhynchus mykiss*). These fish are mostly trapped (and thereby prevented from migrating downstream) by a series of passage impediments. Small numbers of steelhead do migrate in and out of the system, but their passage is severely impeded by barriers such as the L'Avenida drop structure, particularly during low-flow periods (Habitat Restoration Group 1994, 1995).

Coyote Creek. Coyote Creek originates at Anderson Reservoir, located 52 km upstream of Dixon Landing Road, and flows north into the South Bay. Streamflow is initially regulated by releases from Anderson Reservoir and further controlled by additional small dams and water diversion facilities located downstream.

Campbell and Cannon (1998) identified potential spawning and rearing habitats for Chinook and steelhead in the lower reaches of Coyote Creek. Adult Chinook salmon migrate upstream in the fall, when flow rates are relatively low, while adult steelhead migrate upstream in winter, when flow rates are usually higher. Historically, Coyote Creek was an important spawning stream for steelhead. Both steelhead and Chinook salmon have been observed spawning in upper Penitencia Creek, a tributary of Coyote Creek (Smith, pers. comm., cited in Habitat Restoration Group 1995). Plans are currently being developed to enhance habitat conditions and fish passage within the Coyote Creek system.

At present, Coyote Creek supports small runs of steelhead and Chinook salmon. It is estimated that annual runs of less than 100 of each species migrate in and out of the river. A number of surveys have been conducted along the lower reaches of the creek in recent years. In each case, the numbers of fish observed or captured have been small, usually less than 10 individuals of each species (Hsueh 1999; Habitat Restoration Group 1989, 1994, 1995). However, larger numbers of fish were caught by fyke netting in lower Coyote Creek in spring 1999: 159 steelhead and 171 Chinook smolts were recorded migrating downstream to the Bay, and 76 adult Chinook were observed migrating upstream to spawn in the fall of that year (Hsueh 2000).

Guadalupe River. Historically, steelhead existed throughout the Guadalupe River system (Skinner 1962). However, after the construction of Almaden and Guadalupe reservoirs in the mid 1930s and Lexington Reservoir in 1952, steelhead were restricted to tributary streams downstream of the dams (USACE 1998). Suitable spawning habitat has been identified in the upper reaches to support steelhead. Juvenile steelhead summer rearing may be limited by water temperature to upper portions of Guadalupe Creek. It is still unknown whether juvenile steelhead rear throughout the summer further downstream in Guadalupe River, where water temperatures in summer often exceed 70 F (USACE 1998).

Although no historical account of the abundance of Chinook salmon migrating and spawning in the Guadalupe River exists, small numbers of fall-run Chinook have been observed in the river within the last 10 years (Habitat Restoration Group 1994, 1995; USACE 1998). These fish may be an undocumented indigenous population or strays from wild or hatchery populations from the Sacramento-San Joaquin River system (Habitat Restoration Group 1994). A total of between 50 and 200 spawning adult fish was estimated to occur in the river in 1994 (Habitat Restoration Group 1994). It is now estimated that the river supports a moderate Chinook salmon run of approximately several hundred fish with a smaller steelhead run (fewer than 100 fish annually). Plans and projects are being developed to enhance habitat conditions and fish passage within the Guadalupe River watershed.

6.4.1.3 Other Fish in Project Area Tributaries

The composition of the fish communities in the five tributaries into which pond water will be circulated (i.e., Coyote Creek, Alviso Slough, Guadalupe Slough, Alameda Flood Control Channel, and Old Alameda Creek) can be estimated based on surveys performed in these and adjacent tributaries. In a five-year study (1982-86) performed for the South Bay Dischargers Association (SBDA) (Kinnetics 1987), fish were collected and identified from two locations in Coyote Creek (SJ2 and SJ4) and one location in Guadalupe Slough (SJ6). The results of this study indicate that these tributaries are inhabited by a number of estuarine fish species, including staghorn sculpin (*Leptocottus armatus*), northern anchovy, starry flounder, shiner perch, yellowfin goby (*Acanthogobius flavimanus*), threadfin shad (*Dorosma petenense*), and longfin smelt (*Spirinchus thaleichthys*).

A more recent study performed for the City of Palo Alto (Cressey 1997) confirmed that the fish species observed in the sloughs in the 1982-1986 were present at that time. In two tributaries to South Bay (i.e., San Francisquito Creek and the channel from the Palo Alto wastewater treatment plant to the bay), several fish species were collected, including northern anchovy and topsmelt (*Atherinops affinis*), yellowfin goby, staghorn sculpin, and threespine stickleback (*Gasterosteus aculeatus).*

Lonzarich (1989) conducted a fish survey within Alviso Slough, designed to characterize the species composition of the fish community. Species collected from Alviso Slough included bay goby (*Lepidogobius lepidus)*, English sole (*Parophrys vetulus)*, leopard shark, northern anchovy, shiner perch, and striped bass. Juvenile fish were collected indicating that the slough habitat supports rearing in addition to foraging and cover habitat for subadult and adult fish.

Wild (1969) sampled the fish community inhabiting Plummers Creek (a tributary to South San Francisco Bay in the vicinity of Alviso) between March and September 1966. Species inhabiting the tidally influenced creek included leopard shark, bat ray (*Myliobatis californica)*, American shad, Pacific herring, threadfin shad, northern anchovy, whitebait smelt (*Allosmerus elongates)*, Sacramento splittail (*Pogonichthys macrolepidotus)*, rainwater killifish (*Lucania parva)*, bay pipefish (*Syngnathus leptorhynchus)*, shiner perch, walleye surfperch (*Hyperprosopon anale)*, longjaw mudsucker (*Gillichthys mirabilis)*, arrow goby (*Clevelandia ios)*, cheekspot goby (*Ilypnus gilberti)*, bay goby, Pacific staghorn sculpin, jacksmelt (*Atherinopsis californiensis*), topsmelt, speckled sanddab (*Citharichthys stigmaeus)*, starry flounder, sand sole (*Psettichthys melanostictus)*, and plainfin midshipman (*Porichthys notatus)*. The most abundant fish (greater than 100 collected) included Pacific herring (107 collected), threespine stickleback (124), shiner perch (1338), cheekspot goby (106), and topsmelt (8915). Topsmelt, which were the most abundant fish species collected, were primarily juveniles that seasonally inhabit tidal sloughs and marshes as juvenile rearing areas. Results of this study reflect the diversity of resident and seasonal fish species that may inhabitant sloughs within the Bay.

6.4.1.4 Fish Communities in the South San Francisco Bay

Fish Sampling Data from South San Francisco Bay—The 1982-86 SBDA study (Kinnetics 1987) provides data on the likely composition of the fish communities in the waters of southern San Francisco Bay proper, in the vicinity of the proposed pond discharges. Based on this study, it appears that the fish species in the open water habitat of the South Bay are quite similar to those found in the sloughs and will include northern anchovy, staghorn sculpin, shiner perch, longfin smelt, white croaker, and striped bass. The results of this study are based on samples collected from two locations in South San Francisco Bay–one location is designated SB4 and is just north of the Dumbarton Bridge and the other location is designated SB5 and is midway between the Dumbarton Bridge and the mouth of Coyote Creek.

CDFG (Baxter et al. 1999; CDFG unpublished) has conducted an extensive fishery survey within the Bay-Delta estuary, which began in 1980 and continues to date. This is a long-term study with data collected monthly, primarily in deeper subtidal areas, using multiple gear types, including the otter trawl, midwater trawl, beach seine and plankton nets. This survey is useful as a long-term record on the regional occurrence of various species within the area and intra- and interannual variability in their abundance.

Based on the types of trawls and data available, CDFG sampling stations were chosen for analysis that would reflect the conditions of the South Bay that may be affected by the proposed project. Three open water stations, with data collected by otter and midwater trawls and plankton nets, are in the vicinity of the Alviso and Baumberg Complex Ponds: Stations 101, 102 and 140. Two beach seine stations in the general vicinity of the project ponds are Station 171 and 172. The most common fish, crab, and shrimp species at these five stations are presented in Table 6.4-1.

Fish Egg and Larval Data from South San Francisco Bay— Results of fish egg and larval sampling demonstrate that a variety of fish species use portions of South San Francisco Bay as spawning and larval rearing areas as evidenced by the occurrence of both fish eggs and larvae. Northern anchovy, Pacific herring, and gobies are most abundant in open water subtidal areas of the South Bay while species including topsmelt and jacksmelt are abundant in the shallow inshore habitats. The South Bay, in the vicinity of Alviso, also supports a small commercial bait fishery for bay shrimp.

As part of environmental studies conducted at the Potrero and Hunters Point Power Plants, located in the South Bay, extensive fish egg and larval sampling was conducted during 1978-1979 (PG&E 1980, 1982). Results of these studies are summarized below.

Results of fish egg and larval sampling conducted at the Hunters Point Power Plant (PG&E 1982) showed that the most abundant larval fish collected were gobies (totaling 62.7 percent of the larval fish collected), including Bay goby (1.7 percent), arrow goby (0.5 percent), yellowfin goby (less than 0.1 percent), and chameleon goby (*Tridentiger trigonocephalus)* (less than 0.1 percent). Pacific herring larvae were the second most abundant species collected (27.9 percent), followed by northern anchovy (2.6 percent). Other larval fish collected included plainfin midshipman, staghorn sculpin, white croaker, surfperch, silversides *(Artheriniformes*), smelt, bay pipefish *(Syngnathus leptorhynchus)*, striped bass, cabezon *(Scorpaenichthys marmoratus),* and English sole. Of the fish eggs collected, northern anchovy represented 20.1 percent, silversides represented less than 0.1 percent, and unidentified fish eggs represented 77.9 percent.

Fish egg and larval sampling conducted at the Potrero Power Plant (PG&E 1980) provided similar results. Pacific herring (50.4 percent) and gobies (40.4 percent) were the two most abundant larval fish taxa collected. Other larval fish collected at the plant included white croaker, staghorn sculpin, silversides, sculpin, kelpfish (*Clinidae*), rockfish *(Sebastes* sp.), smelt, bay pipefish, cabezon, starry flounder, plainfin midshipman, pricklebacks (*Cebidichthyidae*), greenlings (*Hexagrammidae*), English sole, and unidentified fish larvae. Northern anchovy eggs accounted for 69.8 percent of the eggs collected; the remaining 30.2 percent of the fish eggs were unidentified.

6.4.1.5 Fish Communities in Tidal Marshes

Tidal marshes provide habitat for fish and macroinvertebrate species that are residents, partial residents, tidal visitors (or tidal transients), and seasonal visitors (or seasonal transients). Residents are those species (e.g., killifish) that complete their entire life cycles in the marsh. Partial residents (e.g., inland silverside [*Menida beryllina*]) are found in the marsh as juveniles and may continue to inhabit the marsh throughout the year. Tidal visitors are typically larger fishes (e.g., jacksmelt, and flounders) that move into the marsh at high tide to feed on the abundant juvenile fish and invertebrates. Seasonal visitors are species that use the tidal marsh as spawning or nursery areas (e.g., sticklebacks) or as seasonal refuges from predators (e.g., Chinook salmon).

The broad range of environmental conditions in tidal marshes and sloughs in the San Francisco Bay Estuary leads to highly variable species composition and abundance. Single-event sampling can yield low species numbers (e.g., six species at Napa River Salt Marsh Pond 2A), whereas species occurrence over a year or several years can be quite high (e.g., 63 species reported at Bair Island marshes). Large fluctuations in species composition and numbers, as well as biomass, are typical of coastal wetland systems (Moyle and Cech 2000, Williams and Desmond 2001). Variability is caused not only by seasonal and tidal movements of fishes but also by differing responses of fishes to environmental stressors (e.g., salinity, temperature, abundance of prey, and predators). The spatial and temporal dynamics contribute to the importance of fish in the transport of nutrients and energy across habitats at multiple trophic levels in the estuarine food web (Allen 1982, Kneib 1997, Kwak and Zedler 1997, Williams and Desmond 2001).

The ecological benefits that vegetated tidal marsh offers to assemblages of fish species have been well documented (Kneib 1997). Fish migrate with the tides onto the marsh surface to feed and frequently exhibit a fuller gut at high or ebbing tides than at other times (Harrington and Harrington 1961, McIvor and Odum 1988, Rozas and LaSalle 1990, Rountree and Able 1992, Kneib 1997). A bioenergetics model of killifish has indicated that sporadic foraging on marsh surfaces, in conjunction with tidal cycles, enhances growth (Madon et al. 2001). Marsh vegetation is known to provide cover from predators for transient and resident fish species (Ryer 1988). Moreover, several transient visitors (mostly species from the silverside family *Atherinidae*, such as topsmelt) and resident species (e.g., killifish) spawn in marsh vegetation (Kneib 1997).

Woods (1984) sampled the fish community inhabiting a tidal marsh, the Hayward restoration site, located in the South Bay in the general vicinity of the proposed project (Baumberg Complex). Sampling was conducted at various locations within the restored marsh monthly from June 1980 through May 1981. Results of the sampling provide insight into the fish species utilizing tidal marsh habitat and the seasonal patterns in occurrence. During the study, a total of 20 fish species (6801 individuals) were collected. The five most abundant fish included the topsmelt (2,891 fish), Arrow goby (2,173), yellowfin goby (709), Pacific staghorn sculpin (578), and threespine stickleback (170). The highest abundance of fish within the marsh occurred during the summer (June-August) when juveniles were most common.

Open water areas adjacent to tidal marshes are important habitat for fishes such as white sturgeon (*Acipenser transmontanus*) and brown rockfish (*Sebastes auriculatus*) (Goals Project 1999). Deep water and channels also serve as migration corridors for anadromous fishes such as Chinook salmon and steelhead.

6.4.1.6 Listed and Fully Protected Species

Steelhead are the only fish species listed for protection under the California and/or federal ESA that occur in the South Bay in the general vicinity of the proposed project. Fall-run Chinook salmon, which are a candidate species under the federal act, also occur in the area. Other protected fish species that inhabitant the Bay-Delta estuary, including delta smelt (*Hypomesus transpacificus)*, winter-run Chinook salmon, spring-run Chinook salmon, coho salmon, and tidewater goby (*Eucyclogobius newberryi)*, have not been collected in the South Bay and are not expected to occur in the area or be adversely affected by the proposed project.

Based on discussions with staff from CDFG, NOAA Fisheries (formerly NMFS), and the San Francisco RWQCB, Chinook salmon and steelhead trout were identified as being of particular interest in locations where circulated pond waters would enter receiving water bodies during the ISP. The Central California Coast steelhead evolutionarily significant unit (ESU) has been listed as threatened under the ESA (62 FR 159), and the Guadalupe River (which discharges into Alviso Slough), is designated critical habitat for this species (65 FR 7764).

NOAA Fisheries considers the Chinook salmon in the project area to be part of the Central Valley fall-run and late fall-run Chinook salmon ESUs. NOAA Fisheries has determined that the Central Valley fall-run and late fall-run Chinook salmon ESU does not warrant listing, but the species is considered a candidate species (64 FR 50394). In addition, the Guadalupe River, Coyote Creek, and the Bay-Delta estuary are considered essential fish habitat (EFH) for Chinook (Pacific) salmon. (Note: The Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996 (PL 104-267), defines EFH as the waters and substrate necessary for managed fish to spawn, breed, feed, and grow to maturity.) The Bay-Delta estuary is also EFH for other managed species such as northern anchovy and Pacific herring.

Steelhead Trout – Steelhead trout is native in tributaries to South San Francisco Bay, using these streams for spawning and rearing of juveniles. Small runs of steelhead trout have been identified in Coyote Creek and Alviso Slough/Guadalupe River, with each run numbering approximately 100 to 300 individuals annually (personal communication: J. Abel, Santa Clara Water District; G. Stern, NMFS). The steelhead do not spawn in those sections of Coyote Creek and Alviso Slough/Guadalupe River which could potentially receive saline water circulated from the South Bay salt ponds during the ISP, but would use these sections as migration corridors to upstream spawning and rearing sites. According to M. Roper (CDFG), there is an effort to develop a steelhead run in Alameda Creek. Steelhead historically used Alameda Creek as spawning and juvenile rearing habitat, but are unable to do so now due to man-made physical blockages, which prevent upstream migration. Efforts have been made, primarily by local anglers, in recent years to collect and physically transport upstream migrating adult steelhead around these blockages so they can reach their spawning grounds.

Due to their life history, steelhead trout are only present in the potential circulation areas during limited portions of the year. Generally, adult steelhead migrate from the ocean to the South Bay tributaries from late December through early April, with the greatest activity in January through March. During this time frame, adult steelhead would be migrating through the potential circulation areas. Spawning occurs in the upper reaches of the Coyote Creek and Guadalupe River watersheds, well upstream of any elevated salinity plume. After either 1 or 2 years of rearing, juvenile steelhead migrate from their upstream rearing areas to the ocean. Most of this downstream migration of juveniles occurs between February and May, with the peak between March and April. During this period, the juveniles would pass through the potential circulation areas.

The steelhead remain in the ocean for 2 to 4 years until they reach reproductive condition. At that point, they migrate into the estuary and return to their South Bay tributaries to spawn. Once spawning has occurred, the adults swim downstream and return to the ocean. Each winter, for several successive years, these adults repeat their upstream migration to spawn and, subsequent, downstream migration to the ocean waters.

Chinook Salmon – Chinook salmon are known to spawn and rear in tributaries to South San Francisco Bay. Chinook salmon were first observed in South Bay tributaries in the early 1980s and, based on genetic analyses, are probably from Sacramento River hatchery stock (personal communication G. Stern, NOAA Fisheries). Small runs of this species have been identified in Coyote Creek and Guadalupe River, with each run numbering approximately 100 to 200 individuals annually (personal communication: J. Abel, Santa Clara Water District). The Chinook salmon do not spawn in those sections of Coyote Creek and Alviso Slough which could potentially receive saline water circulated from the South Bay salt ponds during the ISP, but would use these sections as migration corridors to upstream spawning and rearing sites. Due to their life history, Chinook salmon are only present in the potential circulation areas during limited portions of the year.

Generally, these fall-run adult Chinook salmon migrate from the ocean to the South Bay tributaries from late September through November. During this timeframe, adult fish would be migrating through the potential circulation areas. Spawning occurs in November through December in the upper reaches of the Coyote Creek and Guadalupe River watersheds, well upstream of any elevated salinity plume.

After a few months of rearing, juvenile Chinook salmon generally migrate from their upstream rearing areas to the ocean. Most of this downstream migration (smolts) occurs between mid-March and early May. However, during big winter storm events, these juvenile salmon (fry) could be carried downstream as early as late January or February. During this period, the juveniles would pass through the potential circulation areas. The Chinook salmon remain in the ocean for 2 to 4 years until they reach reproductive condition. At that point, they complete their life cycle by migrating into the estuary and returning to their South Bay tributaries to spawn. Unlike steelhead trout, the Chinook salmon adults spawn only once and die after their first and only upstream migration.

6.4.2 Criteria for Determining Significance of Effects

Impacts on fish were analyzed quantitatively and qualitatively. Criteria based on the *CEQA Guidelines* were used to determine the significance of fish impacts. The project would have a significant impact on fish if it would substantially:

- Reduce population abundance of fish or macroinvertebrate species inhabiting the Bay-Delta estuary
- Reduce the amount of aquatic habitat
- Remove spawning and rearing grounds for fish and macroinvertebrates within the Bay-Delta estuary
- Interfere with or prevent the movement or migration of any fish species
- Cause a temporary or long-term decline in growth rates, survival or reproductive success of special-status species (i.e. steelhead trout, Chinook salmon) within the Bay-Delta estuary
- Reduce or degrade the habitat of a state or federal special-status species

The term *substantial* reduction in a population, its habitat, or its range has not been quantitatively defined in CEQA. What is considered substantial varies with each species and with the particular circumstances pertinent to a particular geographic area.

For the purposes of this analysis, significance thresholds for fish or macroinvertebrates are based on short- and long-term impacts to the salinity of receiving waters under the Initial Release Period and Continuous Circulation Period of the ISP. For this analysis, a scale of salinity categories was developed that correspond to organism responses. The scale consists of the following categories: Ambient (<33ppt salinity), Drought (33-35 ppt), Stage 1 (36-38 ppt), Stage 2 (39-41 ppt), Stage 3 (42-45 ppt), and Stage 4 (>45 ppt). This scale and the organism responses that correspond approximately to each of the salinity categories are discussed in greater detail in Section 4.3.1.1 and Section 6.1.3.1.

6.3.3 Impacts and Mitigation Measures

This section addresses impacts to fish within the project area, including impacts to special-status fish species (steelhead trout and Chinook salmon). The section also presents proposed mitigation for impacts that are significant or potentially significant.

The project will have the potential to impact fish and macroinvertebrates through impacts to water quality, substrate, continuity, and habitat area and type. In general, the following types of project impacts are considered in this section:

- Impacts to fish and macroinvertebrates related to increased salinity

- Impacts to fish and macroinvertebrates related to other water quality changes
- Impacts to anadromous fish due to migration impedances
- Impacts to juvenile salmon related to their accidental entrainment

The No Action/No Project Alternative would result in potential impacts to fish and macroinvertebrates from increased salinity and water quality changes in receiving waters following the collapse of pond levees. Alternative 1, Seasonal Ponds would include levee and facility maintenance to minimize the potential for unplanned levee failures. Tidal management techniques and water quality monitoring proposed under Alternatives 2 and 3 would reduce these impacts to less than significant.

Both Alternatives 2 and 3 include the option to breach the Island Ponds, which would be expected to provide access to habitat for a variety of fish species. Woods (1984), sampling the Hayward Marsh after levee breaching and reestablishing tidal exchange with the South Bay, demonstrated habitat use by a diverse community of fish species. Increasing habitat access by levee breaching and reestablishing tidal exchange with the South Bay is identified as a beneficial impact of the project on fishery resources for both alternatives. The types of anticipated project impacts are discussed generally first and then in relationship to each of the proposed project alternatives below.

Increased Salinity

Fish respond to salinity through a number of physiological, behavioral, and ecological mechanisms that affect survival, growth, migration, and reproduction. Specific responses of fish to salinity in the South Bay and sloughs have not been investigated. Salinity in the South Bay and associated sloughs and creeks can vary substantially throughout the year and on a daily basis for any fixed location. Potential salinity impacts to fish and macroinvertebrates were assessed for the Initial Release Phase (IRP) and the Continuous Circulation Period (CCP) as discussed in Chapter 4.

Salinity outside the optimal range may affect the abundance of fish and macroinvertebrates through blockage of movement or migration, reduced egg viability, reduced survival of eggs to the larval stage, and reduced survival of rearing juveniles. Because numerous factors influence the response of fish to salinity regimes under natural conditions (e.g., fish size, temperature acclimation, food availability, genetic variation, water chemistry, predation, disease), a range of salinity tolerance, based on the salinities where various species have been collected from the Bay-Delta estuary (Baxter et al. 1999) was applied to assess generally whether the potential for an adverse or beneficial effect would exist, given a change in salinity from baseline conditions. Optimal salinities for estuarine and marine fish and macroinvertebrate species are typically within the range up to 33 ppt or less, although salinity tolerance may exceed 33 ppt for more tolerant species.

Fish and macroinvertebrates that occur in the South Bay and associated creeks and sloughs are resident and seasonally resident estuarine species and anadromous species that are currently subject to daily and seasonal changes in salinity levels. Estuarine and anadromous species must be able to tolerate environmental changes. Fish in salty water decrease their rate of water intake, and chloride cells in the gills remove excess salts back to the environment. What the chloride cells do not remove, the kidney will process, and saltwater fish will secrete urine high in salt. Fish in fresh water are exposed to an environment that has less salt than the organism. The fish must drink copious amounts of water to receive the necessary salts, and then produce highly dilute urine, once the salt has been removed from the water and taken into their bodies.

Because of the dynamic nature of their surrounding environment, estuarine and anadromous fish must be able to react to fresh water and saltwater. Most estuarine species are capable of surviving a wide salinity range. Estuarine and anadromous fish exposed to conditions less than optimal may move to areas with more suitable salinity.

Other Water Quality Variables

Other water quality elements, besides salinity, potentially affected by the project include DO, BOD, contaminants, water temperature, and suspended sediment (Section 4.3). The impact of water quality on fish habitat would be significant if implementation of the project would result in a substantial change in water quality that would physiologically stress sensitive fish species.

Impedance of Salmonid Migration

A special concern for impacts to salmonids arises from the fact that these species spawn in several of the tributaries to the South Bay and use a few of the proposed circulation areas as migration corridors to their upstream spawning grounds. Changes in the composition of water (i.e., percentage of upstream "natal-stream" water and salinity profiles) in the circulation areas during the ISP could disorient the salmonids and adversely affect the ability of (1) adult salmonids to reach their upstream spawning areas and (2) juvenile salmonids to successfully migrate downstream from their natal streams to the ocean. Each of these concerns is discussed below.

Upstream migrating adult steelhead trout and adult Chinook salmon are both thought to be following a chemical signal (olfactory cues) to their natal spawning areas. The exact nature of this signal is not known, but is thought to be associated with some mixture of waterborne chemical constituents, which are unique to the stream in which they were born and imprint as juveniles and to which they are returning as adults to spawn. It has been suggested that for upstream migration to be successful, there should be an increasing concentration of this chemical signal as one moves upstream in the sloughs and streams leading to the spawning areas. Since the exact chemical compounds that serve as signals for the upstream migration have not been identified, it is reasonable to assume that maintenance of a "natal-stream water" gradient (i.e., concentration of natal-stream water increases as one moves further upstream) may be a reasonable surrogate. If the circulation of pond water during the ISP interrupts this "natal-stream water" gradient, upstream migration of Chinook salmon and/or steelhead trout could be impaired.

It has also been hypothesized that a decreasing salinity gradient might be playing a role in guiding salmonids to their upstream spawning areas. Consequently, significant interruptions in these salinity gradients in the sloughs and creeks used by steelhead trout and Chinook salmon as migration corridors might impair their upstream migrations.

The downstream migration of steelhead trout and Chinook salmon juveniles occur primarily between February and May. However, since these juveniles are traveling towards the more saline waters of the South Bay and eventually the ocean, it does not seem likely that zones of elevated salinity would adversely affect their downstream migration behavior as long as the salinity was not high enough to cause mortality or other acute impacts.

Entrainment of Juvenile Salmonids

There is a potential that downstream migrating juvenile salmonids (both juvenile Chinook salmon and steelhead trout) would be entrained along with intake water into the salt ponds during the ISP. Any juvenile salmonids entrained into the salt ponds would likely be lost from the population.

6.4.3.1 No Project/No Action Alternative

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. Potentially significant impacts under this alternative are related to unplanned discharges of pond contents as a result the eventual collapse of pond levees. The impacts include elevated salinity levels and changes in water quality in receiving waters of the unplanned discharges. Although the timing of collapse is unknown and could take months or years to occur, if levees are not maintained, its eventual occurrence is inevitable.

> *FISH IMPACT-1:* Discharge of pond contents would increase salinity levels in the receiving waters in the immediate vicinity of discharges beyond normal tolerance ranges for fish and macroinvertebrates, resulting in direct impacts to these aquatic organisms and indirect impacts to fish impacts to their food source (macroinvertebrates).

Under the No-Project Alternative, there would be no management of the salt ponds by CDFG or USFWS. High salt conditions would continue to occur in the existing ponds closed to tidal influence. The pond levees would be subject to catastrophic failure or inundation of the ponds by high tide elevations in extreme storm events. Following a breach of the levees, the duration and magnitude of high salinity in the South Bay and associated creeks and sloughs near any levee breach would increase. It is likely that levees would remain breached and high-salinity water would be discharged for several weeks.

Typically, levees fail in the winter when there is a greater amount of fresh water flowing downstream. The greater amount of freshwater could dilute the salt in the inundated ponds, but the initial change in salt concentration could be substantial. Chinook salmon and/or steelhead may be migrating through the area during periods of high flow and may be exposed to elevated salinity resulting from a levee failure. If the breach were to occur when the flow of the surrounding sloughs was low, and the more sensitive life stages of fish were present (e.g., juveniles), the salinity changes in the South Bay and associated creeks and sloughs could cause substantial adverse impacts on the fish in the vicinity. The discharge associated with sudden levee failure could also adversely impact fish and macroinvertebrates (e.g. bay shrimp and others) inhabiting creeks and sloughs as well as the local intertidal and subtidal habitats in the area. Resident and seasonally resident fish and macroinvertebrates would potentially be affected directly by the pond discharge in addition to a reduction in habitat quality and availability until sufficient flushing had occurred to return local water quality conditions to suitable levels.

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

FISH IMPACT-2: Discharge of pond contents may impact other water quality variables (i.e., it may raise temperatures, decrease DO, and increase BOD) in the receiving waters in the immediate vicinity of discharges beyond normal tolerance ranges for fish.

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

6.4.3.2 Alternative 1 (Seasonal Pond Alternative)

This alternative minimizes impacts from uncontrolled discharge of pond contents into the South Bay. Maintenance of the levees and water control structures would prevent their deterioration and minimize the potential for accidental breaching of the ponds and release of pond contents to the Bay. 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 picivorous (fish-eating) birds. The alternative would involve construction activity required for levee maintenance and repair.

FISH IMPACT-3: Impacts from contaminants and/or suspended sediments could result from the mobilization of construction equipment to repair breached levee sites.

Contaminants (e.g., petroleum products, suspended sediments, etc.) 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.

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 (emergency response, routine maintenance activity, and preventative maintenance activities would be addressed in the plan) 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. Since this alternative will include development of operational plans to address potential impacts, no further mitigation would be required.

6.4.3.3-- Alternative 2 (Simultaneous March/April Initial Release)

Under the Alterative 2, the contents of most of the Alviso and Baumberg Ponds would be released simultaneously in March and April (Initial Release Phase; IRP). The ponds would then be managed as a mix of continuous circulation ponds, seasonal ponds and batch ponds. Management of some ponds could be altered through adaptive management during the Continuous Circulation Period (CCP). Higher salinity ponds in the West Bay Complex 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.

Potential impacts evaluated under Alternative 2 include:

- Direct impacts to fish and macroinvertebrates and indirect impacts to fish as a result of elevated salinities and other changes in water quality in waters receiving pond discharge.
- Impacts to fish and macroinvertebrates related to water quality impacts from the operation of construction equipment
- Impacts to fish (salmonid) migration through dilution of "natal stream" gradients and creation of salinity gradient reversals and exposure to localized elevated salinities affecting migration behavior
- Impacts to juvenile fish from entrainment in water control structures.

All impacts under this alternative are temporary and localized during the IRP and/or less than significant or are reduced to less than significant with the implementation of proposed mitigation measures.

During the Continuous Circulation Period elevated average salinities in the South Bay proper are expected to be virtually non-existent. 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. During the Continuous Circulation Period tidal management techniques would be used to control salinity levels within a pond or pond system prior to discharge. In addition, water quality measurements would be made within each pond, as part of individual pond management strategies to monitor water quality prior to discharge under Alternative 2.

> BENEFICIAL IMPACT –1: Breach Island Ponds resulting in tidal exchange and access for fish and macroinvertebrates to suitable habitat.

The Island Ponds (A19, A20, and A21) will be breached as part of the ISP, after the initial releases of the other ponds. The Island Pond breach effects would be the same for Alternatives 2 and 3. The existing pond bottoms are approximately 2 feet below mean higher high water. With large enough breach openings to allow full tidal range in the Island Ponds, the typical pond bottoms will only be inundated on higher high tides. 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. Based on the hydrodynamic model, it is predicted that the daily averaged salinities in Coyote Creek during the Continuous Circulation Period will increase by 4 ppt or less. These increases in salinity are unlikely to adversely impact the estuarine species, which are resident in Coyote Creek. The resident fish and macroinvertebrates inhabiting 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 flows from the San Jose WWTP, this long-term salinity increase would likely beneficially affect the estuarine aquatic 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.

Both Alternatives 2 and 3 include the option to breach the Island Ponds, which would be expected to provide access to habitat for a variety of fish species during high tide periods when the ponds are inundated. Woods (1984), sampling the Hayward Marsh after levee breaching and reestablishing tidal exchange with the South Bay, demonstrated habitat use by a diverse community of fish species. Increasing habitat access by levee breaching and reestablishing tidal exchange with the South Bay during the Continuous Circulation Period is identified as a beneficial impact of the project on fishery resources under Alternatives 2 and 3. Increased salinity in the immediate area of the pond breaches during the Initial Release Phase would be expected to result in temporary localized reductions in the abundance and local habitat use by sensitive fish and macroinvertebrate species. The temporary localized impact of pond breaching and the resulting increase in salinity during the Initial Release Phase is considered to be less than significant given the long-term beneficial impacts of increasing access to shallow-water habitat during the Continuous Circulation Period of the project.

Significance: Short-term impact (IRP) – less than significant

Long-term impact (CCP) - Beneficial impact

> *FISH IMPACT-1:* Discharge of pond contents would increase salinity levels or water quality conditions in the receiving waters in the immediate vicinity of discharges beyond normal tolerance ranges for fish and macroinvertebrates, resulting in direct impacts to these aquatic organisms and indirect impacts to fish impacts to their food source (macroinvertebrates).

In response to the elevated salinity levels, aquatic organisms may migrate out of the higher salinity segments of the sloughs and creeks during the Initial Release Period. Exposure of fish and macroinvertebrates to the elevated salinity levels has the potential to result in stress and reduced health and condition of these aquatic organisms within the receiving waters during the spring discharge period and may temporarily adversely affect localized movement patterns, habitat quality and availability within the immediate area of the pond discharges. Avoidance of the discharge area may result in a temporary, localized reduction in fish and macroinvertebrate abundance in the areas affected by the discharge.

March and April represent a seasonal period when a number of fish and macroinvertebrates are reproducing within the estuary (Baxter et al 1999, Wang 1986) and eggs and larvae may be exposed to the discharge. The spring also represents a period when juvenile steelhead and Chinook salmon would be migrating downstream through the creeks and sloughs and would be present in the South Bay and hence would potentially be exposed to elevated salinity levels within the receiving waters in the immediate area of the pond discharges. Therefore, simultaneous pond discharges during the Initial Release Phase under Alternative 2 would have a higher likelihood of adversely affecting juvenile Chinook salmon and steelhead when compared to initial discharges during the summer months.

Dilution and mixing of the discharge within the receiving waters would rapidly reduce salinity levels and thereby reduce the potential area where exposure to elevated salinity levels may occur. The potential impact would be temporary and localized to the immediate vicinity of the discharge. Finally, as discussed in the introduction to Section 6.4.3, fish and benthic macroinvertebrates inhabiting estuarine waters are typically characterized by having relatively high tolerance to salinity and other environmental conditions.

Initial release of the existing pond contents as part of project operations would result in the discharge of moderately to highly saline water that could lead to a deterioration of water quality and a reduction in aquatic habitat. There are no quantitative standards established for salinity discharges, but the San Francisco Bay RWQCB has a narrative standard that states that the allowable increase in salinity cannot adversely affect beneficial uses such as aquatic habitat. The specific water quality effects are described in Chapter 4, "Water Quality."

Additionally, bay shrimp use the sloughs into which saline pond water will be circulated during the ISP as rearing habitat. The potential impacts to bay shrimp are discussed in Section 6.1.3.

Refer to Chapter 4 (Water Quality) for a complete discussion of impacts to water quality affecting habitat values for aquatic organisms. Since significance thresholds for salinity impacts to water quality are based on impacts to benthic organisms, potentially significant and significant salinity impacts to water quality are, by definition, also potentially significant and significant impacts to fish and macroinvertebrates. In Chapter 4, short-term and long-term salinity impacts to water quality are addressed separately for each of the receiving water bodies. Other constituents could also affect the receiving waters and be toxic to aquatic organisms, degrading habitat and affecting populations. Water quality impacts from other constituents are also discussed in detail in Chapter 4.

As discussed in Chapter 4 (see Section 4.3), the following significant short-term water quality impacts may affect fish and macroinvertebrates:

- Short-term impacts to aquatic habitat are anticipated from elevated salinities in the following receiving water bodies:
- Alameda Flood Control Channel (Baumberg Complex)— See Water Quality (Salinity) Impact-7 for a complete discussion.
- Old Alameda Creek (Baumberg Complex)— See Water Quality [Salinity] Impact-8 for a complete discussion.
- Under some circumstances, total mercury in discharged water and receiving water will exceed total mercury WQOs and may have short-term impacts on water quality—See Water Quality (Metals) Impact-3 for a complete discussion.
- Increased algal activity in ponds leads may lead to decreased dissolved oxygen in receiving waters—See Water Quality (DO) Impact-1 for a complete discussion.
- Discharge of pond water at temperatures more than 5 degrees Fahrenheit above the temperature of the receiving water may adversely affect water quality and biota in

adjacent waterways—See Water Quality (Temperature) Impact-2 for a complete discussion.

Significance: Short-term impact—Significant
Long-term impact—Less than Significant

Implementation of mitigation measures proposed in Chapter 4 (Water Quality), in combination with Fish Mitigation Measure-1 below, would reduce this impact to less-than-significant level. Relevant mitigation measures in Chapter 4 are as follows (see Section 4.3 for details):

- WQ-Salinity Mitigation Measure 1A
- WQ- Salinity Mitigation Measure 1B
- WQ-Metals Mitigation Measure 1A
- WQ- Metals Mitigation Measure 1B
- WQ-DO Mitigation Measure 1A
- WQ- DO Mitigation Measure 1B
- WQ-Temperature Mitigation Measure 1A
- WQ- Temperature Mitigation Measure 1B
- WQ-pH Mitigation Measure 1A
- WQ- pH Mitigation Measure 1B

Fish Mitigation Measure-1: Assess and maintain salinity and other water quality parameters at levels protective of aquatic resources.

The data developed through WQ-Salinity Mitigation Measure 1A will be assessed relative to the salinity and other water quality requirements of aquatic communities. If the assessment of water quality, based on analysis of monitoring data, indicates a potential measurable effect on population abundance, measures could be implemented to minimize the water quality effects. The measures may include change in discharge magnitude, timing, and duration. The data would support real time operations that could minimize effects to all life stages.

Based on the water quality mitigation action, in combination with the localized and temporary changes in fish and macroinvertebrate abundance and distribution in the receiving waters in response to salinity changes, and the tolerance and ability of estuarine and marine fish inhabiting the area to behaviorally avoid adverse salinity conditions, it has been concluded that impacts resulting from IRP and CCP operations would be lees than significant. Temporary localized reductions in habitat use, particularly by sensitive species, would be expected in the immediate area of the pond discharges, with the greatest change occurring during the Initial Release Phase.

Post Mitigation Significance: Less than Significant

FISH IMPACT-4: Changes in water quality during the Continuous Circulation Phase of the ISP could disrupt adult salmonid migration though dilution of "natal stream" signal and/or imprinting by juvenile salmonids.

An evaluation was performed to determine whether the circulation of saline waters from the salt ponds during the Continuous Circulation Phase of the ISP would interfere with the "natal-stream" gradient in the sloughs and creeks used by salmonids as migration corridors to their upstream spawning areas. This evaluation was targeted to those sloughs and creeks actually used by salmonids (i.e., Alviso Slough, Coyote Creek, and Alameda Flood Control Channel) and to those times during which the peak upstream migrations actually occur (i.e., January-March for adult steelhead trout and September-November for adult fall-run Chinook salmon).

As noted previously, the Initial Release Period of the ISP (either April-May or July-August), when the highest salinity discharges will occur, is not considered in this evaluation because the adult salmon and steelhead do not migrate upstream during those months. In addition, it is believed that the discharge would have temporary and localized impacts that would not impact salmonid migration.

The evaluation consisted of three components. First, the three sloughs used by salmonids as migration corridors were each divided into 1-km segments. Second, using modeling techniques, the percentage of various types of water (i.e., upstream "natal" river water, bay water, saline pond water) in each segment was predicted under existing and ISP conditions. Third, a determination was made whether circulation of saline waters during the ISP would produce a break in the "natal-stream gradient" and, if so, whether adult salmon or steelhead migration would be adversely impacted.

The results of these evaluations clearly indicate that circulation of saline water during the ISP is not expected to disrupt the "natal-stream" gradients in the sloughs and creeks used by adult salmonids as migration corridors to their upstream spawning areas. In all cases examined, the salinity gradient within the receiving waters used as potential adult migration corridors will not decrease due to the addition of saline pond water, and adult steelhead trout and adult Chinook salmon should have a strong "natal stream" signal to follow to their spawning grounds.

Juvenile Chinook salmon and steelhead migrate downstream from freshwater tributaries into the Bay-Delta estuary and coastal waters during the late winter and spring (February -- May). During juvenile outmigration the fish imprint on chemical and olfactory characteristics of their natal stream, which are then used as migration cues for adult upstream migration. Discharges, including salt pond effluent, have the potential to alter chemical characteristics within the receiving waters that may affect imprinting by juveniles, and potentially result in increased straying by returning adults. During their downstream migration juvenile salmon and steelhead would be expected to pass through the tidally influence portions of the stream channels in relatively short period of time (hours or days), where they would also be exposed to a range of salinities and other environmental conditions. As a result of the anticipated short-duration of exposure of these juvenile downstream migrating salmon and steelhead to the salt pond effluent, in combination with the rapid dilution and localized area where the effluent may affect water quality conditions and imprinting, the potential impact of salt pond discharges on juvenile salmon and steelhead imprinting during spring months (April -- May) is considered to be less than significant. Since juvenile salmon and steelhead do not migrate during the summer months, and would not be expected to inhabit the area the proposed project during July -- August, pond discharges during summer months under Alternatives 2 and 3 would have no impact on juvenile salmon or steelhead.

Significance: Long-term impact (CCP) - Less than significant.

FISH IMPACT-5: Changes in water quality could disrupt fish migration though creation of salinity gradient reversals.

The salinity in a tidal slough generally increases in the downstream direction. Therefore, the salinity at any given point in a tidal slough is usually lower than the salinity at any point further downstream (toward the bay). Discharges from salt ponds during the ISP could lead to localized regions, near the salt pond system outlets, where there are maxima in salinity. When passing through such a local maxima, an upstream migrating adult or juvenile salmonid would experience a local "salinity gradient reversal" (i.e., lower salinity to higher salinity to lower salinity). The effect that such a local "salinity gradient reversal" would have on upstream migrating adult salmonids and downstream migrating juvenile salmonids is not known, but there is, at least theoretically, a possibility that it could confuse a fish and impede its migration.

It should be noted that salinity gradient reversals occur naturally in San Francisco Bay and do not appear to hinder the upstream migration of adult salmonids. Salinity data collected for the SBDA between December 1981 and November 1986 (Kinnetic Laboratories 1987) suggests that salinity reversals occur regularly and naturally in both Alviso Slough and Coyote Creek. In addition, the salinity observation data collected by the USGS for the South San Francisco Bay (Baylosis et al. 1997) demonstrate that there are reversals in the salinity gradient in the South Bay during periods of salmonid migrations. Since salmonids are known to navigate through the South Bay, Coyote Creek, and Alviso Slough during these periods, it is reasonable to assume that these natural reversals do not impede the migratory pathways of the salmonids.

Despite the uncertainty as to the importance of salinity gradients in salmon migratory behavior, an evaluation was performed to determine whether the circulation of saline waters from the salt ponds during the ISP might interrupt the salinity gradient in the sloughs and creeks used by salmonids as migration corridors to their upstream spawning areas. Similar to the evaluation of natal stream signal dilution under the ISP, this evaluation of salinity gradient reversals was targeted to those sloughs and creeks actually used by salmonids (i.e., Alviso Slough, Coyote Creek, and Alameda Flood Control Channel) and to those times during which the peak upstream migrations actually occur (i.e., January-March for adult steelhead trout and September- November for adult Chinook salmon).

As noted previously, the Initial Release Period of the ISP (either April-May or July-August), when the highest salinity discharges will occur, is not considered in this evaluation because the adult salmon and steelhead do not migrate upstream during those months.

The evaluation consisted of three components. First, for each slough and relevant time period, mathematical modeling techniques were used to predict salinity gradients under existing conditions (i.e., no pond circulation). Second, using the same models, salinity gradients were predicted under ISP conditions. Third, these existing condition and ISP condition gradients were compared to determine if discharge from the ponds during the ISP would produce significant salinity gradient reversals.

It should be noted that the identification of salinity gradient reversals is dependent upon the threshold that is used – i.e., how much more saline does the upstream water have to be in order for a gradient reversal to be considered reportable). In this evaluation, two threshold values were used, 3 ppt and 1 ppt. The 3 ppt threshold is considered representative of what might be reasonably detected by salmonids and might potentially influence their behavior (Emmett et al. 1991). The 1 ppt threshold is considered a very conservative prediction of a salinity gradient reversal and is unlikely to have an influence on salmonid migratory behavior.

It should also be noted that salinity gradient reversals presented in this evaluation are calculated based on depth-averaged salinities, which include reversals that only affect a portion of the water column. Salinity reversals are often due to a low salinity region near the slough bed, with no salinity reversal occurring closer to the water surface. In such cases, a zone of passage for upstream migrating adult salmonids exists in the upper portion of the water column in which the salinity gradient is intact.

The results of these evaluations indicate that continuous circulation of saline water during the ISP has the potential to disrupt salinity gradients in the sloughs and creeks used by adult salmonids as migration corridors to their upstream spawning areas. During the winter months when steelhead trout are migrating upstream, model predictions based on the 3 ppt threshold indicate that for the two streams currently used (i.e., Alviso Slough and Coyote Creek) and the one stream that could potentially be used (i.e., Alameda Flood Control Channel), salinity gradients would be intact for more than 99% of the time during the ISP. During the fall months when Chinook salmon are migrating upstream, model predictions indicate that for Coyote Creek, salinity gradients would be intact for 100% of the time during the ISP. For Alviso Slough, even though the modeling predicts a greater frequency and duration of salinity gradient reversals during this fall period, intact salinity gradients on a monthly basis are still predicted to exist for between 49 and 98% of the time. Salinity gradient reversal within Alviso Slough has the potential to disrupt and cause temporary impediments to adult salmon migration during fall months. The range of expected frequencies for salinity reversals within the slough suggests that under extreme conditions pond discharges have the potential to affect migration.

The actual dynamics of the water-quality and tidal hydraulics within the slough would affect the actual migration conditions for adult salmon on an hourly or daily basis that are beyond the resolution of the monthly model. The distribution of salinity within the slough water column and increase in salinity after dilution with receiving waters also affect the actual migration behavior of adult salmon. Field monitoring of the actual salinity gradient within the slough during discharge would be required to further evaluate the potential significance of project operations on adult salmonid migration. In the event that field monitoring demonstrates that the salt pond discharge would impact salmonid migration, alternative pond management strategies would be implemented to reduce and avoid adverse conditions to a less than significant level.

It should be noted that all predicted salinity gradient reversals were geographically limited to a relatively small area in each slough around the point of discharge from the salt pond. The model predictions indicate that during the ISP, salinity gradients are sufficiently intact to provide a consistent signal for upstream migration, if the steelhead trout and Chinook salmon actually follow such a signal.

Juvenile Chinook salmon and steelhead would be migrating downstream within Coyote Creek and Alviso Slough during the April-May period proposed for the initial discharge under Alternative 1. During downstream migration, the juvenile salmonids experience an increasing salinity gradient as they move from the freshwater rearing habitat within the creeks and rivers and enter the Bay and subsequently Pacific coastal waters. Prior to their downstream migration, both juvenile Chinook salmon and steelhead undergo a physiological transformation (smolting) that enables the fish to inhabit marine waters.

The juvenile salmonids migrating downstream would potentially be temporarily exposed to localized areas of increased salinity resulting from pond discharges. The short-duration exposure and rapid dilution of salinity within the receiving waters, in combination with their ability to tolerate higher salinity waters, would not be expected to result in adverse impacts to the downstream migrating juvenile steelhead or salmon. The increasing salinity gradient that naturally occurs along the migratory corridor and the localized increase in salinity in the immediate vicinity of the points of discharge would not be expected to block, disorient, or delay the downstream migration of juvenile salmonids during the Continuous Circulation Period. As a result of the temporary and localized affect of the salt pond discharges on receiving water quality conditions and salinity gradients, in addition to the physiological tolerance of juvenile salmon and steelhead smolts to respond to fluctuating salinity conditions, the effects of salt pond discharges on juvenile salmonid migration during the April-May Continuous Circulation Period under Alternative 2 is considered the less than significant. Exposure of juvenile salmonids to high salinity at the point of pond discharge would be expected to be of short duration (minutes or hours) and may result in physiological stress and/or behavioral avoidance or delayed migration during the April-May IRP. The short-term exposure to salinity during the IRP would occur over a small area within the receiving waters, have short duration, and rapid dilution which may result in increased stress or behavioral changes to juvenile salmonids but the magnitude of these effects is considered to be small and less than significant.

Significance: Short-term impacts (IRP) - Less than significant.
Long-term impacts (CCP) – Less than significant

FISH IMPACT-6: Installation of water control structures could lead to juvenile fish entrainment.

Water control structures would be constructed and operated to divert water from areas surrounding the ponds into the pond complex to control salinity levels of the waters prior to discharge during the Continuous Circulation Period. There is a potential that downstream migrating juvenile salmonids (both Chinook salmon and steelhead trout) would be entrained along with intake water into the salt ponds during the ISP. Juvenile salmon or steelhead entrained into the pond complex would be expected to experience 100% mortality. The magnitude of risk to juvenile salmonids as a result of entrainment, however, cannot be estimated in the absence of information on the seasonal timing, locations, ambient flow conditions within the creek and slough, and the corresponding density of juvenile salmonids vulnerable to entrainment.

In addition to juvenile Chinook salmon and steelhead, a number of resident and seasonally resident fish and macroinvertebrates inhabiting the area would potentially be vulnerable to entrainment into the water diversions. Many of these estuarine species would be expected to survive within the lower salinity pond cells. The survival of these individuals would depend on water quality within the ponds. The ability of these individuals to successfully move into and out of the ponds is unknown.

Significance: Short-term impacts (IRP)/Long-term impacts (CCP) -Potentially significant**.**

FISH MITIGATION MEASURE-2 Close intakes on salmonid migration routes during periods of juvenile migration.

As part of the ISP operation plan, intakes will be situated on Alviso Slough (into Pond A9), Coyote Creek (into Pond A17), and Alameda Flood Control Channel (into Pond 1C). To minimize any possibility of entrainment, it was decided in consultation with NOAA Fisheries to close the intakes on all salmonid creeks and sloughs from December 1 through April 30. This period encompasses the peak downstream juvenile migration period (March through April) as well as any early storm-induced juvenile washouts (late December through February). During the Initial Release Period (first year of discharge), this closure period may be shortened by one month (i.e., December 1 – March 31) for the Pond A9 intake from Alviso Slough in order to prevent higher than desired salinities in the Pond A14 discharge. During subsequent years, the Pond A9 intake will observe the December 1 through April 30 closure period. The Pond A9 intake is and existing facility and has operated in April in the past.

Post-mitigation Significance: Less than significant.

6.4.3.3.4-- Pond Management Alternative 3 (Phased Initial Discharge)

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.

Impacts to fish and macroinvertebrates due to salinity and water quality under Alternative 3 are essentially the same as those for Alternative 2. Mitigation proposed for Alternative 3 is identical to mitigation proposed for Alternative 2 and would reduce all identified water quality impacts to a less than significant level. A list of impacts and proposed mitigation for Alternative 3 is provided below.

As discussed in Chapter 4 (see Section 4.3.1.3), the following significant short-term water quality impacts may affect benthic organisms under Alternative 3:

- Short-term impacts to aquatic habitat are anticipated from elevated salinities in the following receiving water bodies:
- Guadalupe Slough (Alviso Complex)— See Water Quality (Salinity) Impact-6 for a complete discussion.
- Old Alameda Creek (Baumberg Complex)— See Water Quality (Salinity) Impact-8 for a complete discussion.
- Old Alameda Creek (Baumberg Complex)— See Water Quality (Salinity) Impact-8 for a complete discussion.
- Under some circumstances, total mercury in discharged water and receiving water will exceed total mercury WQOs and may have short-term impacts on water quality—See Water Quality (Metals) Impact-3 for a complete discussion.
- Increased algal activity in ponds leads may lead to decreased dissolved oxygen in receiving waters—See Water Quality (DO) Impact-1 for a complete discussion.
- Discharge of pond water at temperatures more than 5 degrees Fahrenheit above the temperature of the receiving water may adversely affect water quality and biota in

adjacent waterways—See Water Quality (Temperature) Impact-2 for a complete discussion.

Significance: Short-term impact—Significant
Long-term impact—Less than Significant

Implementation of mitigation measures proposed in Chapter 4 (Water Quality), in combination with Fish Mitigation Measure-1 below, would reduce this impact to less-than-significant level. Relevant mitigation measures in Chapter 4 are as follows (see Section 4.3 for details):

- WQ-Salinity Mitigation Measure 1A
- WQ- Salinity Mitigation Measure 1B
- WQ-Metals Mitigation Measure 1A
- WQ- Metals Mitigation Measure 1B
- WQ-DO Mitigation Measure 1A
- WQ- DO Mitigation Measure 1B
- WQ-Temperature Mitigation Measure 1A
- WQ- Temperature Mitigation Measure 1B
- WQ-pH Mitigation Measure 1A
- WQ- pH Mitigation Measure 1B

Fish Mitigation Measure-1: Assess and maintain salinity and other water quality parameters at levels protective of aquatic resources.

The data developed through WQ-Salinity Mitigation Measure 1A will be assessed relative to the salinity and other water quality requirements of fish and macroinvertebrate communities. If the assessment of water quality, based on analysis of monitoring data, indicates a potential measurable effect on population abundance, measures could be implemented to minimize the water quality effects. The measures may include change in discharge magnitude, timing, and duration. The data would support real time operations that could minimize effects to all life stages.

Post Mitigation Significance: Less than Significant

Operations under Alternative 3 would schedule initial discharges from some of the ponds into the receiving waters during the summer months (July -- August). The operational characteristics outlined for Alternative 2 would apply to the analysis and evaluation of potential impacts to fisheries and aquatic habitat within the receiving waters under Alternative 3. Rescheduling initial discharges from the ponds, having elevated salinity concentrations, until the summer months would avoid all potential adverse impacts to adult and juvenile Chinook salmon and steelhead. The seasonal occurrence of salmonids and their life cycle results in the species not being present in the proposed project area during summer months.

FISH IMPACT-4: Changes in water quality during the Continuous Circulation Phase of the ISP could disrupt adult salmonid migration though dilution of "natal stream" signal and/or imprinting by juvenile salmonids.

Fish Impact-4 for adult steelhead and Chinook salmon apply only to Continuous Circulation Period of Alternatives 2 and 3. These impacts do not apply to the Initial Release Period of the

ISP (either April-May or July-August), when the highest salinity discharges will occur, because the adult salmon and steelhead do not migrate upstream during those months. Exposure of juvenile steelhead and Chinook salmon migrating downstream during the spring months (April-May) may be exposed to elevated salinities that would affect migration behavior however the potential for adverse effects is considered to be localized and temporary as a result of effluent dilution within the receiving waters. Since juvenile steelhead and salmon do not migrate during summer months (July-August), and would not be in the vicinity of the pond discharges, there would be no adverse impact. Potential impacts for Alternative 3 would be similar to the estimated impacts for Alternative 2.

Significance: Long-term impact (CCP) - Less than significant.

FISH IMPACT-5: Changes in water quality could disrupt fish migration though creation of salinity gradient reversals.

Fish Impact-5 for adult steelhead and Chinook salmon apply only to Continuous Circulation Period of Alternatives 2 and 3. These impacts do not apply to the Initial Release Period of the ISP (either April-May or July-August), when the highest salinity discharges will occur, because the adult salmon and steelhead do not migrate upstream during those months. Exposure of juvenile steelhead and Chinook salmon migrating downstream during the spring months (April-May) may be exposed to elevated salinities that would affect migration behavior however the potential for adverse effects is considered to be localized and temporary as a result of effluent dilution within the receiving waters. Since juvenile steelhead and salmon do not migrate during summer months (July-August), and would not be in the vicinity of the pond discharges, there would be no adverse impact. Potential impacts for Alternative 3 would be similar to the estimated impacts for Alternative 2.

Significance: Short-term impacts (IRP) - Less than significant.
Long-term impacts (CCP) – Less than significant

FISH IMPACT-6: Installation of water control structures could lead to juvenile fish entrainment.

Water control structures would be constructed and operated to divert water from areas surrounding the ponds into the pond complex to control salinity levels of the waters prior to discharge during the Continuous Circulation Period. There is a potential that downstream migrating juvenile salmonids (both Chinook salmon and steelhead trout) would be entrained along with intake water into the salt ponds during the ISP. Juvenile salmon or steelhead entrained into the pond complex would be expected to experience 100% mortality. The magnitude of risk to juvenile salmonids as a result of entrainment, however, cannot be estimated in the absence of information on the seasonal timing, locations, ambient flow conditions within the creek and slough, and the corresponding density of juvenile salmonids vulnerable to entrainment.

In addition to juvenile Chinook salmon and steelhead, a number of resident and seasonally resident fish and macroinvertebrates inhabiting the area would potentially be vulnerable to entrainment into the water diversions. Many of these estuarine species would be expected to survive within the lower salinity pond cells. The survival of these individuals would depend on water quality within the ponds. The ability of these individuals to successfully move into and out of the ponds is unknown.

Potential impacts for Alternative 3 for the Continuous Circulation Period and the Initial Release Period for ponds to be included in the April initial release would be similar to the estimated impacts for Alternative 2. Juvenile Chinook salmon and steelhead do not inhabit the receiving waters where Initial Release Phase pond discharges may occur during the summer months (July-August) under Alternatives 2 and therefore would not be exposed to the pond discharge at this time of year.

Significance: Short-term impacts (IRP)/Long-term impacts (CCP) -Potentially significant**.**

FISH MITIGATION MEASURE-2 Close intakes on salmonid migration routes during periods of juvenile migration.

As part of the ISP operation plan, intakes will be situated on Alviso Slough (into Pond A9), Coyote Creek (into Pond A17), and Alameda Flood Control Channel (into Pond 1C). To minimize any possibility of entrainment, it was decided in consultation with NOAA Fisheries to close the intakes on all salmonid creeks and sloughs from December 1 through April 30. This period encompasses the peak downstream juvenile migration period (March through April) as well as any early storm-induced juvenile washouts (late December through February). During the Initial Release Period (first year of discharge), this closure period may be shortened by one month (i.e., December 1 – March 31) for the Pond A9 intake from Alviso Slough in order to prevent higher than desired salinities in the Pond A14 discharge. During subsequent years, the Pond A9 intake will observe the December 1 through April 30 closure period. The Pond A9 intake is and existing facility and has operated in April in the past.

Post-mitigation Significance: Less than significant.

7.0 CULTURAL RESOURCES

This chapter assesses the effects of the proposed project on cultural resources, including districts, sites, buildings, structures, and objects that contain evidence of past human activities.

7.1 Affected Environment

7.1.1 Prehistory

People inhabited the project area for at least 11,000 years prior to the arrival of Spanish explorers to California in the 16th century. Evidence suggests that Paleoindian (12,000 to 9,000 years before present (YBP) populations throughout California and elsewhere were small and the subsistence economies emphasized the capture of big game, including now extinct megafauna, such as mammoth and mastodon. Although Paleoindian sites are rare in California, when found, they are often near areas containing pluvial lakes and marshes.

During the Archaic Period (9,000 to 4,000 YBP), California prehistoric cultures, as elsewhere, lost their emphasis on large game hunting. Subsistence economies probably diversified somewhat, and Archaic people may have begun to use certain ecological zones, such as the coast littoral zone, more intensively than before. Advances in technology enabled more efficient use of certain plant foods, including grains and plants with hard seeds. Archaic sites are relatively rare throughout California. The earliest sites in the Bay Area are from the late Archaic Period (around 7,000 to 4,000 YBP). These sites contain large projectile points, milling stones, and a lack of high-density shell deposits that indicate the early inhabitants of the project area relied on hunting and gathering of terrestrial foods (Moratto 1984).

Population densities increased throughout the Pacific Period (4,000 to 150 YBP). Consequently, California populations sought to produce more food from available land and to locate more dependable food supplies. The Pacific period saw the human occupation and specialized use of virtually all ecological niches in California. Populations became increasingly sedentary and settled in larger villages. Increasing social stratification, ceremonialism, and long-distance trading activity is evident in the archaeological record (Chartkoff and Chartkoff 1984). In the Bay Area, many villages were established by 4,000 YBP. Village sites, commonly located near a stream, adjacent to resource-rich bayshore and marsh habitats, often had deep stratified deposits of shellfish and other remains from repeated occupations over time. Beginning around 1,700 YBP, there was an increasing complexity in artifact assemblages that seems to reflect an intensified hunting, gathering, and fishing adaptation. The introduction of the bow and arrow, harpoon, and the use of clam disk beads as currency for trade are just a few indications that populations were larger and more densely settled (Moratto 1984).

7.1.2 Ethnography

Inhabitants of the project area at the time of European contact were the Ohlone (as they presently refer to themselves) or Costanoan (from the Spanish “Costano” for coastal people). The term “Costanoan” refers to an ethnographic grouping of people who shared similar cultural and linguistic traits, and does not refer to a politically unified entity. The Ohlone occupied the Coast Ranges surrounding the San Francisco and Monterey Bays and probably arrived in central California sometime after 1,500 years ago (around 500 A.D.). Levy (1978) estimates the Ohlone population at about 10,000 at the time of European contact. The Spanish missionized the Ohlone people quickly and occupied nearly the entire coastal portion of the Ohlone territory in the latter part of the 18th century. Introduced diseases and lower birth rates drastically affected native population levels during this period. With mission secularization in 1821, Ohlone and other mission Indians left the missions to work in surrounding areas, mostly as manual laborers on ranchos (Levy 1978).

Ethnographic information on the pre-contact Ohlone is not available; ethnographic studies from the late 1800s and early 1900s were of a population whose culture had already been significantly altered by high-intensity contact with Europeans. Today, approximately 200 Ohlone descendants live in the San Francisco and Monterey Bay areas. They formed a corporate entity, the Ohlone Tribe, in 1971. There is presently no federally recognized Ohlone group.

7.1.3 History

Below is a brief historical overview of the project area, summarized from the *Final Cultural Resources Inventory Report for the Habitat Mitigation Planning Sites, San Francisco International Airport Proposed Runway Reconfiguration Program* (Jones & Stokes, 2001). Special attention is given to the history of the salt industry and the town of Drawbridge, which has relevance for the proposed South Bay Salt Ponds ISP.

San Francisco Bay has a long history of maritime activities that undoubtedly left material remains along the water's edge. Spanish exploration of northern California began around 1769 with the expedition of Gaspar de Portola. Juan Bautista de Anza led the first Spanish overland expedition into the San Francisco Bay region in 1776 and established the Mission Dolores and San Francisco Presidio. In 1777, Lieutenant Jose Joaquin Moraga and Father Tomas de la Pena led a party of settlers from Mission Dolores into the Santa Clara Valley to establish a mission there. Father Junipero Serra founded Mission Santa Clara de Asis that year. Early explorers in present-day Alameda County included Jose Francisco Ortega in 1769, Pedro Fages in 1770 and 1772 and Bautista de Anza and Moraga in 1776. However, the project area remained largely unsettled by Euroamericans until the founding of Mission San Jose near the present town of Fremont in 1797. Mission San Jose was one of the most prosperous and populous of the Spanish missions in California.

Mexico achieved independence from Spain in 1821 and the following year, California was declared a territory of the Mexican republic. In 1834, the Mexican government secularized the missions and divided their vast holdings into individual land grants, or ranchos, opening the way for the emergence of a new landed elite, who introduced large-scale cattle ranching in California. The project area includes portions several of these ranchos.

Commercial activity between the United States and California increased during the Mexican Period, and the region experienced an influx of overland trappers and mountain men in search of beaver and other fur-bearing animals. Tensions between the new arrivals and native Californians intensified and hostility between the U.S. and Mexican governments culminated in outbreak of the Mexican War in 1846. The conflict was marked by repeated American land and naval victories, and formally ended with the signing of the Treaty of Guadalupe Hidalgo in February 1848 and the cession of California to the United States.

Just over a week before the signing of the Treaty of Guadalupe Hidalgo, James Marwill discovered gold in the Sierra Nevada foothills while constructing a sawmill for John A. Sutter. Marwill's discovery led to a massive incursion of miners, prospectors, and settlers into California known as the Gold Rush (1848–1852). Although the gold seekers converged primarily on the interior mining country, the coastal regions attracted scores of merchants and settlers, who sought to take advantage of California's emerging maritime and agricultural economies. The lumber and fishing industries both boomed during the Gold Rush. The fishing industry also expanded in the 1870s following an increase in the immigration of fishermen from Italy, Greece, China, and Portugal. By the beginning of the 20th century, the staple yields of the fishing industry were salmon, crabs, cod, and oysters. Commercial oystering, which also began with the Gold Rush, was a major industry through the end of the 19th century in the willow waters and marsh areas surrounding the bay. From 1895 to 1904, oysters were the most valuable fishing product of the state. Production declined shortly thereafter, and oystering ended completely in the 1930s as a result of pollution in the San Francisco Bay (Hart 1978). The Gold Rush also fueled the growth of the salt industry in the Bay, discussed further below.

The importance of maritime shipping in the project vicinity continued throughout the Gold Rush and all succeeding historic periods and areas near major watercourses, estuaries, and nearby mudflats. Several large communities in the present South Bay area had their origins as ranchos and then grew into large agricultural centers later, facilitated by extensive transportation networks. The present-day cities of Union City, San Leandro, and Fremont originated from the consolidation of several farming communities and then grew into residential and manufacturing centers. Several fruit-growing communities, including the present city of Sunnyvale, followed a similar economic pattern.

The first roads sprang up across the South Bay in the mid-19th century to late 19th century to facilitate travel and the transportation of agricultural goods to market. The city of Mountain View in Santa Clara County originated as an agricultural community and the location of a stage stop along the road between San Jose and San Francisco in the early 1850s. Before the coming of the railroads, maritime transportation of agricultural products was an essential component in the economy of the San Francisco Bay Area. Various landings were established along the East Bay that served as vital commercial and travel links before the development of additional transportation facilities. The Port of Alviso, one of the oldest ports in the western United States, was created in the late 1840s by land speculators, to replace the Embarcadero de Santa Clara/Alviso, located 0.5 mile south of the city of Mountain View. The town of Alviso was surveyed in 1849. Alviso was the major commercial shipping depot in northern California during its heyday, but the town began to decline when the San Francisco to San Jose Railroad that bypassed Alviso was completed in 1864. In 1968, Alviso was annexed by the city of San Jose. Redwood City and Union City also emerged as important shipping centers in the South Bay. An association of farmers known as the Mt. Eden Company established a series of landings along Mt. Eden Creek in the Baumberg area in the 1850s. In 1855, Captain Richard Barron built numerous warehouses and wharves at Eden Landing. He built a salt works in the area in the late 19th century and operated at least two other landings in the area (Wood 1883).

In 1864, the Southern Pacific Railroad (SPRR) Company built a standard-gauge line from San Francisco to San Jose. The town of San Mateo grew up around this railroad. This San Francisco-San Jose line was extended to Gilroy in 1869. However, the SPRR line did not adequately serve the fruit growing regions of Santa Clara County. In 1876, Alfred C. “Hog” Davis purchased the bankrupt narrow-gauge Santa Clara Valley Railroad (SCVRR). The SCVRR had connected Alviso, San Jose, and Santa Clara, but had gone bankrupt trying to extend the line to Santa Cruz. Davis formed the South Pacific Coast Railroad (SPCRR), which later received some financial backing from Senator James G. “Slippery Jim” Fair. Davis and Fair envisioned a new town of Newark and a line that would extend from this town to Santa Cruz via the Santa Cruz Mountains. The SPCRR originally provided a ferry service from Newark to San Francisco, but the East Bay terminal was later moved to Alameda. The San Francisco to Santa Cruz service began in May 1880 and involved an 80-mile-long trip lasting 3 hours, 30 minutes. The line was leased to SPRR in 1887 and was recognized at the time as the most profitable railroad for its size in California (Dewey, 1989). SPRR later acquired the SPCRR (now Union Pacific Railroad). Alameda County experienced considerable industrial and economic growth with the coming of the San Francisco and Alameda Railroad in 1865. By 1869, the line extended along the East Bay from San Francisco to San Jose. This line was later absorbed into the Union Pacific system.

History of the Salt Industry in South Bay. The solar salt industry in San Francisco Bay began in the mid 1850s. The first operations were simple levees built around naturally occurring salt pans in Alameda County to increase their capacity. They were small family enterprises that used intensive hand labor for production and harvest. Nearly all of the salt produced in San Francisco Bay during this era was shipped to Nevada to be used for the processing of silver ore. By the late 1800s, an estimated 37 salt production facilities had been established throughout the South Bay. Most of these facilities were constructed by diking tidal marshes. The diked marshes were fitted with operator-controlled intake structures to capture seawater during high tides. The Baumberg ponds first came into production in the late 1800s. The Alviso ponds came into production in 1929 (Ver Planck 1958).

By the early 1900s, the quality of the salt produced in San Francisco Bay had increased significantly, and the market expanded to include fine or “table” salt. Between 1924 and 1941, many of the small plants consolidated. Following the consolidation, only Leslie and Oliver salt companies remained. The Leslie Salt Company was created in 1936 from the consolidation of 19 small operations (Jones & Stokes 2003). In that year, the Leslie Salt Company produced 300,000 to 325,000 tons of salt on roughly 12,500 acres. By 1946, the company produced 500,000 tons on 25,000 acres. In 1950, the company’s production was up to 750,000 tons and by 1959 production reached one million tons and included production in the North Bay (Siegel and Bachand 2002). By the 1950s, 85 percent of wetlands in the San Francisco Bay had been filled, dried out, or converted to salt ponds. By the 1960s, Leslie Salt owned 50,000 acres of salt ponds around the Bay. The Oliver Salt Company, located at the foot of the Hayward-San Mateo Bridge, ceased to operate in the 1970s. In 1979, Cargill bought Leslie and is now is the only solar salt producer in San Francisco Bay (San Francisco BCDC 1994, Jones & Stokes 2003).

In 1972, Congress created the San Francisco Bay National Wildlife Refuge (renamed the Don Edwards SFBNWR in 1995 in honor of the former congressman). In 1979, SFBNWR purchased 11,430 acres from Leslie Salt (now Cargill Salt). Cargill still retains the salt making rights on these lands. In 2000, Cargill Salt decided to consolidate its Bay Area salt operations and offered 19,000 acres of excess ponds in the North and South Bays (reduced to 16,500 acres in 2002) to the state and federal government. To date, there has been no formal NRHP eligibility evaluation of the South Bay salt works.

Historic Town of Drawbridge. Drawbridge is located on Station Island, between Coyote Slough on the north, Warm Springs Slough (now Mud Slough) on the south, and two salt ponds on the east and west. The SPCRR (now the Union Pacific Railroad; see railroad history above) built a narrow-gauge railroad bridge over Coyote Slough and a second over Mud Slough. The following history is summarized from the San Francisco Bay Wildlife Society's booklet *"Drawbridge: A Hand-Me-Down History"* (Dewey, 1989) and the website: www.sjunderbelly.com/ unbelly/ Draw/ draw9.html.

The first building on the island was a two-room cabin the SPCRR built in 1876 for the railroad bridge tender. At that time, the only access to the island was by rail or boat. The tidal marsh that covered the island presented some challenges to early builders. All buildings were elevated (built on pilings or sills) to avoid daily flooding and walkways between the buildings were also elevated. The railroad bed was sometimes called "Main Street" or "A Street." The SPCRR charged one dollar a year for setting a walkway on railroad property.

The area provided an abundance of waterfowl, fish and shellfish to attract Bay Area sportsmen, who began to flock to the area in the 1880s, following completion of the SPCRR line to Santa Cruz. Numerous duck hunter's cabins and blinds were built, the first of which was the Gordon Gun Club (built 1880), and Drawbridge became a popular stopover along the SPCRR line. The first permanent residence was built in 1894, SPCRR officially named the stop Drawbridge in 1897, and by the early 1900s, there were about 40 buildings on the island. The Sprung Hotel was built in 1902 and collapsed in the 1960s. By 1906, the town had two hotels (the Sprung and the Hunter's Home, or Sportsman's Hotel, also built in 1902) and 79 cabins (a mixture of private residences and duck clubs). The town experienced considerable damage during the earthquake of 1906.

Drawbridge peaked in popularity in the 1920s. By 1926, there were 90 cabins and 5 passenger trains came through town each day. Electricity came to the island in 1931. Most of the cabin owners were middle class professionals. A number of boat builders also took up residency on the island. Residents reported an ethnic division between the north and south ends of town and residents of the two ends apparently did not get along very well. Cabins were individually designed and the exterior and interior designs varied considerably. People also lived in dwellings called "arks"; houseboats pulled up on the marsh and hoisted onto pilings. A freshwater aquifer underlying the island supplied several wells.

By 1940, there were only about 50 cabins left. Several factors contributed to the decline of the town in subsequent decades. The island began to sink and buildings and structures on the island subsided as a result of groundwater pumping in nearby communities. Wildlife was impacted by pollution from raw sewage that was dumped by neighboring communities into the South Bay. The smell of sewage became a nuisance, wells were fouled, and swimming in the sloughs lost its attraction. Construction of railroads and highways led to a decline in maritime shipping and construction of salt ponds by Arden Salt and other companies also reduced the navigability of the sloughs in the area. The Depression probably also played an earlier role. Reports in local newspapers that Drawbridge had become a ghost town brought vandals and squatters to the town, accelerating its demise. By 1976, one resident and 24 taxed residences remained at Drawbridge. The last two residents, Nellie Irene Dollin and Charlie Luce, left in 1974 and 1979, respectively.

Drawbridge is now within the Don Edwards SFBNWR. Although suggestions for preserving the town were initially included in plans for the refuge, the current plan is to do nothing. None of the remaining structures at Drawbridge have been formally evaluated for eligibility to the NRHP.

7.1.4 Research Methods

A screening level analysis of cultural resources, consisting of archival research, review of historic maps, and contact with Native American organizations, was undertaken for this project. The layout of the ponds in the South Bay is not conducive to archaeological survey and intensive archaeological survey of the entire project area was not undertaken for this EIR/EIS.

Archival research was conducted at the Northwest Information Center (NWIC) of the California Historical Resources Information System (CHRIS), located at Sonoma State University, Rohnert Park in April of 2003. Research included a review of cultural resources and cultural resource surveys within 0.5-mile of the project area. The following lists were reviewed:

- National Register of Historic Places
- California Register of Historical Resources
- California Inventory of Historic Resources (State of California 1976)
- California Points of Historical Interest (State of California 1992)
- Historic Spots in California (Kyle et al. 1990)

USGS topographic maps and historical maps were also studied to determine where unrecorded historic structures were located and to understand details regarding the topography of the project area prior to extensive land alteration during construction of the salt ponds. Information from an effects assessment of cultural resources within the Eden Landing (Baumberg) Ecological Mitigation Tract was also used (Far Western Anthropological Research Group, Inc., Past Forward, Inc., Caltrans, 2001).

The California Native American Heritage Commission (NAHC) was contacted to incorporate the opinions and concerns of Native Americans in the project area. The NAHC consulted its Sacred Lands File for Native American burial sites and sacred places that could exist in the project area. The NAHC did not indicate the presence of Native American burial sites and sacred places in the project area, but cautioned that persons of Native American descent with an interest in the project area could have additional knowledge and/or concerns. The NAHC provided several Native American contacts for the project area. A list of the contacts supplied appears in Appendix H. Letters were mailed to these contacts in May 2003, informing them of the proposed project and soliciting their comments and concerns regarding the project (see Appendix I). A letter was received from Katherine Perez, representing the Ohlone Indian Tribe, indicating the project's potential to impact unknown burials and recommending that ground disturbance be minimized and monitored to minimize the potential for impacts to unknown sites. To date, no comments or concerns have been expressed by the other individuals/groups contacted.

A public scoping meeting to solicit comment on the environmental effects of the ISP and the scope and significant issues to be analyzed in the EIS/EIR was held on March 27, 2003. To date, no comments pertaining to cultural resource issues have been received.

7.1.5 Cultural Resources in the Project Vicinity

Based on the information provided during archival research and knowledge of the natural setting, the West Pond Complex is located in an area of low to moderate sensitivity for prehistoric archaeological sites, while the sensitivity of the Baumberg and Alviso ponds ranges from low to high.

Nearly all of the prehistoric tidal marsh in the South Bay was diked between the 1850s and 1950s. Almost all prehistoric marsh surfaces in the area are located in the interior side of dikes. Nearly all existing tidal marshes formed in sediments deposited after dikes were constructed. These tidal "fringing" or "strip" marshes outboard of dikes established in the positions of previously unvegetated historic tidal channel beds or mudflats (Atwater *et al*. 1979). Within the modern South Bay, prehistoric tidal marsh surface with the potential for relatively shallow-buried prehistoric archaeological sites are restricted to locations within (a) diked bayland interiors, and (b) rare, locally preserved, undiked, prehistoric tidal marshes. Ground disturbance under the ISP would not occur within these locations and would be restricted only to the levees.

Historic archaeological sites associated with maritime or fishery activities could be located where mudflat harbors and anchorages once existed, although the likelihood of discovering such remains has been reduced by infilling, diking, land reclamation, and other large-scale modifications of the bayshore landscape. Moreover, subsidence and sea-level rises have continued to accrete sediments in the project area. However, as discussed below, features of this modified landscape are now more than 50 years old and may themselves qualify as significant cultural resources.

Records at the NWIC indicate that portions of the project area have been surveyed for cultural resources. At fifteen of the Alviso ponds, accessible areas have been completely surveyed for archaeological resources. Less than 5 percent of the area of the remaining ponds has been surveyed, and many ponds have not been surveyed at all (J&S 2001). Surveys have been conducted within the Baumberg Complex in conjunction with the Eden Landing Ecological Reserve Project (Hope et al, 1996; Ananian 1985; and Far Western Anthropological Research Group, Inc., Past Forward, Inc., Caltrans, 2001).. Surveys within the project area are too numerous to list here, but are available for review by qualified individuals at the NWIC.

According to information available at the NWIC, there are 7 previously recorded archaeological sites within the project area (1 prehistoric and 6 historic), and 13 previously recorded archaeological sites (4 prehistoric, 8 historic, 1 prehistoric/historic) outside the project area, but within a 0.5-mile radius of the project. These resources are summarized by pond complex in Tables 7-1 and 7-2 below.

Table 7-1.
Recorded cultural resources within the project area

Pond complex	Trinomial site no.	Primary site no.	P/H	Description
Alviso Ponds	CA-SCL-810H	P-43-001110	H	Port of Alviso historic ship building facility
	CA-ALA-338	P-01-002057	P	Disturbed remnants of shell midden site
Baumberg Ponds	CA-ALA-494H	P-01-000210	H	Oliver Salt Co. piling and foundations
	CA-ALA-495H	P-01-000211	H	Location of former Rocky Point Saltworks (pre-1898, absorbed by Oliver Salt Company by 1909); no surface remains
	CA-ALA-496H	P-01-000212	H	Pilings and foundation of former Union Pacific Salt (ca. 1872-1927)
	CA-ALA-489H, -497H, -501H	P-01-000217	H	Eden Landing historic shipping station (warehouses, wharves, associated developments)
	CA-ALA-593H	P-01-002257	H	Small late-19^{th} century historic refuse scatter (on levee)

Table 7-2.
Recorded cultural resources within 0.5 mile of the project area.

Pond complex	Trinomial site no.	Primary site no.	P/H	Description
Alviso Ponds	CA-SCL-23	P-43-000043	P	Midden mound (occupation site)
Baumberg Ponds	CA-ALA-485	P-01-000201	P	Sparse marine shell deposit
	CA-ALA-487H	P-01-000203	H	Refuse scatter
	CA-ALA-492H	P-01-000208	H	Small, low density refuse scatter
	CA-ALA-493H	P-01-000209	H	Medium density refuse scatter
	CA-ALA-498H	P-01-000214	H	Location of former Nielsen Salt Works (no surface indication of site remains)
	CA-ALA-499H	P-01-000215	H	Stock shute, old fencing
	CA-ALA-500H	P-01-000216	H	Historic occupation area
	---	P-01-001791	H	Shipwreck
	CA-ALA-592H	P-01-002256	H	Small refuse scatter
West Bay Ponds	CA-SMA-248	P-41-000244	P	Lithic scatter
	CA-SMA-386H	P-41-002076	P/H	Lithic scatter/ two refuse dumps
	C-155 (reported find, not formally recorded)		P	unknown

Of these sites, only CA-ALA-338, the disturbed remnants of a prehistoric shell midden site, is within an area of potential construction. Construction of a new inlet is proposed at or near this location. The site was recorded in 1980 by D. Chavez. Extensive shell, powdery grey midden soil, and some charcoal were observed along the levee. Chavez noted the site was "greatly disturbed." No features, burials, or artifacts were located.

In addition to the recorded sites discussed above, the following structures of potential historic interest are noted within the project area:

- Levees and other structures associated with the South Bay salt works (all three complexes)
- Abandoned historic town of Drawbridge (Alviso Pond Complex)
- Historic SPCRR line, now Union Pacific Railroad (Alviso Pond Complex)

None of these resources have been formally evaluated for the CRHR or NRHP. As noted in the historical overview above, the salt industry dates back to the 1850s in the South Bay and the existing network of ponds is at least 50 years old. Given the social and economic significance of the salt industry in the South Bay, it is likely that the salt pond complexes would qualify as an historic district for the NRHP. A similar complex in San Diego County, the Western Salt Company Salt Works in Chula Vista, California, was evaluated by EDAW in 2001 and recommended eligible as an historic district for the NRHP and CRHR (Gustafson and Gregory, 2001).

The abandoned town of Drawbridge dates back to 1876 when the town was founded. The last resident left Drawbridge in 1979. Many of the remaining buildings are older than 50 years, but subsidence, flooding, and vandalism have taken their toll on the town and the integrity of most of these buildings is very poor.

The South Coast Pacific Railroad (now Union Pacific Railroad), which was constructed as a narrow-gauge railroad by James Fair and Alfred Davis, opened in 1880. Railroads in general, and this railroad in particular, played an important roll in the social and economic development of the area. It is not known whether portions of the original rail alignment remain.

No other structures of potential historic interest were noted in the ISP area. The Port of Alviso (listed as an historic district on the NRHP) and several duck cabins are also noted in proximity to the ISP area, but outside its area of impact.

7.2 Criteria for Determining Significance of Effects

7.2.1 Federal Significance Criteria

The National Historic Preservation Act (NHPA) of 1966 established the federal government's policy on historic preservation and the programs, including the National Register of Historic Places (NRHP), through which that policy is implemented. Under the NHPA, historic properties include "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places" (16 United States Code [USC] 470w (5)). The criteria used to evaluate the NRHP eligibility of properties affected by federal agency undertakings are contained in 36 CFR 60.4 and are as follows:

The quality of the significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

1. That are associated with events that have made a significant contribution to the broad patterns of our history;
2. That are associated with the lives of persons significant in our past;
3. That embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguished entity whose components may lack individual distinction; or
4. That has yielded or may be likely to yield information important in prehistory or history.

An historical property must also retain the integrity of its physical identity that existed during the resource's period of significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association.

An action is considered to have an effect on an historic property when the action has the potential to alter the characteristics of the property that may qualify the property for inclusion in the NRHP, including its location, setting, and use. The effect is considered adverse when it may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Pursuant to 36 CFR 800.9, adverse effects on historic properties include, but are not limited to, the following:

- Physical destruction or alteration of all or part of the property
- Isolation of the property from, or alteration of, the property's setting, when that character contributes to the property's qualifications for listing in the NRHP
- Introduction of visual, audible or atmospheric elements that are out of character with the property or that alter its setting
- Neglect of a property, resulting in its deterioration or destruction
- Transfer, lease, or sale of the property

Section 106 (16 USC 470f) of the NHPA requires federal agencies, prior to taking action to implement an undertaking, to take into account the effects of their undertaking on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment regarding the undertaking.

Specific regulations regarding compliance with Section 106 state that although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency (in this case, the USFWS) is ultimately responsible for ensuring that the Section 106 process is completed according to statute. The Section 106 process has four basic steps:

- Identify and evaluate historic properties.
- Assess adverse effects of the project on historic properties.
- Resolve any adverse effects of the project on historic properties in consultation with the State Historic Preservation Officer (SHPO)/Tribal Historic Preservation Officer (THPO), and other interested parties, resulting in a memorandum of agreement (MOA).
- Proceed in accordance with the MOA.

7.2.2 State Significance Criteria

A project may have a significant effect on the environment if the project could result in a substantial adverse change in the significance of an historical resource (California Code of Regulations (CCR) Section 15064.5[b]). The *CEQA Guidelines* (Section 10564.5[c]) also require consideration of potential project impacts to "unique" archaeological sites that do not qualify as historical resources. Impacts to resources that do not qualify as historical resources or "unique" archaeological sites are not considered significant, and need not be considered further in the CEQA process (Public Resources Code (PRC) Section 21083.2).

CEQA establishes statutory requirements for establishing the significance of archaeological sites in (PRC) Section 21083.2 and historical resources in PRC Section 21084.1. The two PRC sections operate independently to ensure that significant potential effects on archaeological and historical resources are considered as part of a project's environmental analysis. Section 21083.2 defines a "unique archaeological resource" as "...an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

- Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

- It has a special and particular quality such as being the oldest of its type or the best available example of its type.
- Is directly associated with a scientifically recognized important prehistoric or historic event.

Section 21084.1 defines historical resources as those listed on or eligible for listing on the California Register of Historical Resources (CRHR). The CRHR establishes 50 years as the period in which sufficient time has passed to allow a scholarly perspective in understanding the historic importance of a resource. An historical resource must be significant at the local, state, or national level under one or more of the following four criteria:

- It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States;
- It is associated with the lives of persons important to local, California, or national history;
- It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master or possesses high artistic values; or
- It has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.

An historical resource must also retain the integrity of its physical identity that existed during the resource's period of significance. Similar to the NRHP, integrity under the CRHR is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association.

As noted above, under CEQA, a project may have a significant effect on the environment if the project could result in a substantial adverse change in the significance of a resource, meaning the physical demolition, destruction, relocation, or alteration of the resource would be materially impaired. This would include any action that would demolish or adversely alter the physical characteristics of an historic resource that convey its historic significance and qualify it for inclusion in the CRHR or in a local register or survey that meets the requirements of PRC Section 5020.1(l) and 5024.1(g).

The following steps normally are taken in a cultural resources investigation to comply with CEQA:

- Identify cultural resources.
- Evaluate the significance of the cultural resources.
- Evaluate the effects of a project on all cultural resources.
- Develop and implement measures to mitigate the effects of the project on significant cultural resources.

CEQA and the *CEQA Guidelines* also recommend provisions be made for the accidental discovery of archaeological sites, historical resources, or Native American human remains during construction (PRC Section 21083.2(i) CCR Section 15064.5[d and f]).

7.3 Impacts

A screening level cultural resource investigation was conducted for this project. As discussed above, this consisted of a record search at the Northwest Information Center of the California Historical Resources Information System, additional background research and review of historical maps, and contact with Native American organizations including the Native American Heritage Commission. Pedestrian surveys were not conducted in conjunction with this project. As identified above, 7 archaeological sites have been recorded within the project area, and an additional 14 archaeological sites have been recorded within 0.5 mile of the project area.

Under Alternatives 2 and 3, ground disturbance and compaction from the use of heavy vehicles and machinery during construction of new water conveyance features (inlets and outlets) along the existing salt pond levees has the potential to impact recorded and unrecorded archaeological sites, as discussed below. A single prehistoric site (CA-ALA-338) is recorded at one of the proposed inlet locations at the Alviso Pond complex. This site could be directly impacted by ground disturbance for the new inlet construction. The site has not been formally evaluated. However, as noted above, the site has been greatly disturbed and probably does not retain sufficient integrity to qualify for listing on the NRHP or CRHR. None of the other previously recorded sites would be directly impacted by project-related construction. Ground disturbance would occur in areas with potential to contain unrecorded prehistoric and historical archaeological sites, or Native American human remains. Thus, Alternatives 2 and 3 could result in a substantial adverse change to such resources.

In addition, construction of new water conveyance features that would occur under Alternatives 2 and 3 could impact potentially significant features of the built environment, including the historic salt works infrastructure. Impacts to these resources would be addressed under the terms of an existing Programmatic Agreement (PA) between USFWS and the SHPO.

7.3.1 No Project/No Action Alternative

The No Project/No Action alternative would not cause any impacts to cultural resources from construction of water control structures because no such structures are proposed under this alternative. The following impacts have been identified for the No Project/No Action alternative:

> *CULTURAL RESOURCES IMPACT-1: Potentially significant archaeological sites or human remains could be exposed through erosion and evaporation.*

The existing infrastructure would not be maintained. Without maintenance, erosion of the levees into the ponds over time could expose potentially significant archaeological sites or human remains. There is potential for greater exposure of surface sites as the ponds dry down in the summertime; however, this is not likely to significantly impact sites.

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

CULTURAL RESOURCES IMPACT-2: *Accidental breaches of levees could result in impacts to surface archaeological sites and features of the built environment.*

Accidental breaches of levees that have served a flood control purpose in the past, but would not be maintained under this alternative, could impact surface sites and features of the built environment with historical significance (e.g., features of the historic salt works, the historic town of Drawbridge, and the South Coast Pacific RR).

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

In addition, drying of the ponds has the potential to create gypsum/salt-affected soil conditions (see Chapter 5.0, Sediments) and more acid conditions in some ponds. The specific impact of saline and low pH soils on archaeological sites is not known.

7.3.2 Alternative 1 (Seasonal Ponds Alternative)

Alternative 1 would not cause any impacts to cultural resources because no new water control structures are proposed and no new ground disturbance is anticipated. Levees would be maintained, so impacts to cultural resources from accidental breaches are not expected. The following impacts have been identified for Alternative 1:

CULTURAL RESOURCES IMPACT-1: *Potentially significant archaeological sites or human remains could be exposed through erosion and evaporation.*

The levees would be maintained, so erosion is less likely to impact sites. Ponds would be allowed to dry down in the summertime and archaeological sites could become more exposed at these times. However, as noted above for the No Project/No Action Alternative, this is not likely to significantly impact sites.

Significance: Less than significant.

Drying of the ponds has the potential to create gypsum/salt-affected soil conditions (see Chapter 5.0, Sediments) and more acid conditions in some ponds. The specific impact of saline and low pH soils on archaeological sites is not known.

7.3.4 Pond Management Alternative 2 (Simultaneous March-April Initial Discharge)

Impacts to cultural resources from Alternatives 2 and 3 are expected to be the same since the timing of initial discharge will not affect the nature or degree of the impacts. The following impacts have been identified for Alternative 2:

CULTURAL RESOURCE IMPACT-3: Ground-disturbing activities and use of heavy vehicles and machinery could damage known and unknown archaeological sites that meet the criteria for listing on the NRHP or CRHR.

Significance: Potentially significant, but mitigated.

CULTURAL RESOURCE MITIGATION-1A: Contractors and construction personnel involved in ground-disturbing activities will be advised of the possibility of encountering cultural resources (including, but not limited to, chipped or ground stone, historic debris, building foundations, and non-human bone) during construction work. If such resources are encountered or suspected, work within 100 feet of the discovery will be halted immediately and the USFWS (Alviso, West Pond complexes) or CDFG (Baumberg Pond complex) will be notified. A qualified professional archaeologist will be consulted, who will assess any discoveries and develop appropriate management recommendations for treatment of the resource. USFWS or CDFG will obtain concurrence from SHPO on measures to be implemented before allowing construction activities in the area of the find to resume. This procedure will be included on all construction plans and specifications.

CULTURAL RESOURCE MITIGATION-1B: USFWS/CDFG will pursue a strategy of avoiding impacts to cultural resources, where feasible. If avoidance of potentially significant resources is determined to be infeasible, USFWS/CDFG will conduct a controlled archaeological test excavation to determine archaeological site significance. If a resource that cannot be avoided is determined to be significant, USFWS/CDFG and SHPO will consult to develop a plan for data recovery excavation. Data recovery excavations will then be completed by a qualified professional archaeologist in accordance with the plan.

Post-mitigation Significance: Less than significant

CULTURAL RESOURCE IMPACT-4: Ground-disturbing activities and use of heavy vehicles and machinery could disturb or damage buried human remains not identified during field surveys. (Note that according to the California Health and Safety Code, six or more human burials at one location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052)).

Significance: Potentially significant, but mitigated**.**

CULTURAL RESOURCE MITIGATION-2: If bone is encountered and appears to be human, California law (PRC Section 7050.5) and federal law (the Native American Graves Protection and Repatriation Act, or NAGPRA) require that potentially destructive construction work in the vicinity of the find and in nearby areas reasonably suspected to overlie adjacent human remains is halted and the county coroner (in the county where the find occurs) is contacted. After contacting the coroner, steps will be taken to contact the appropriate Native American individual or tribe and to determine the appropriate disposition.

Post-mitigation Significance: Less than significant

CULTURAL RESOURCE IMPACT -5: Construction of new water control features could affect potentially significant features of the built environment.

The construction of new water control features could impact the historical integrity of the salt works, which have not yet been formally evaluated. The types of impacts that would occur would be similar to those which have occurred under Cargill operations and maintenance. However, since a federal agency (USFWS) would assume responsibility for the Alviso and West Bay ponds, actions on these ponds may be considered a federal undertaking under Section 106 of the NHPA and would be covered under an existing Programmatic Agreement (PA) between the USFWS and SHPO. Actions on the Baumberg ponds with the potential to impact potentially significant features of the built environment would be reviewed by CDFG.

Significance: Potentially significant, but mitigated**.**

CULTURAL RESOURCE MITIGATION-3: USFWS would review proposed construction projects within the Alviso and West Bay ponds under the terms of the existing PA between the USFWS and SHPO, and determine the level of work required to identify, evaluate, and conduct an assessment of effects to cultural resources within the construction area of potential impact. Actions on the Baumberg ponds with the potential to impact potentially significant features of the built environment would be reviewed by CDFG. If implementing the ISP would result in unavoidable effects on identified significant features of the built environment within the Alviso or West Bay ponds, the USFWS will determine the appropriate course of action in accordance with the PA. If implementing the ISP would result in unavoidable effects on identified significant features of the built environment within the Baumberg ponds, CDFG will determine the appropriate course of action.

Post-mitigation Significance: Less than significant

> CULTURAL RESOURCES IMPACT-6: *Planned breaches of the Island Pond levees could result in impacts to surface archaeological sites and features of the built environment.*

Under Alternatives 2 and 3, the Island Ponds (Alviso Ponds A19, A20, and A21) would be breached. This could cause scouring effects from increased velocities in Coyote Creek, which could erode and cause some damage to known and unknown archaeological sites and potentially to unknown human remains along the Coyote Creek levees. The breaching would also impact the integrity of the existing Island Pond levees, which have not been formally evaluated, but may have historical significance. The introduction of tidal waters to these ponds would not result in a significant change in water levels from the present and therefore is unlikely to significantly impact other features of the built environment, including the remnants of the historic town of Drawbridge and South Coast Pacific RR. USFWS would assume responsibility for Island Ponds and any actions on these ponds may be considered a federal undertaking under Section 106 of the NHPA and would be covered under an existing PA between the USFWS and SHPO.

Significance: Potentially significant

> CULTURAL RESOURCE MITIGATION-4: *Under the terms of the existing PA between the USFWS and SHPO, the USFWS would review the potential impact of breaching of the Island Pond levees and determine the appropriate course of action with respect to potential impacts to cultural resources.*

Post-mitigation Significance: Less than significant

7.3.5 Pond Management Alternative 3 (Phased Initial Release)

As noted above, the timing of initial release does not affect cultural resources. Therefore, impacts to cultural resources under this alternative would be identical to those under Alternative 2, above.

8.0 RECREATION, PUBLIC ACCESS, VISUAL RESOURCES AND PUBLIC HEALTH

This chapter provides the environmental and regulatory background necessary to analyze recreation, public access, and visual resources effects of the project. It also evaluates public health and safety issues for this project, focusing on issues associated with mosquitoes and diseases transmitted to humans by mosquitoes including West Nile Virus (WNV). This chapter includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. Sources of information used in this chapter include applicable City of Fremont and Alameda, San Mateo and Santa Clara County General Plans, the Bay Plan, the Bay Trail Plan, and literature on mosquito ecology and control methods.

8.1 Affected Environment

8.1.1 Recreation and Public Access

All the lands covered in this Initial Stewardship Plan are being used for salt production until Cargill completes its phase out activities and transfers management of the lands to USFWS and CDFG. Some of the ponds (Alviso Ponds A9-17, and West Bay Ponds 1 and 2) were purchased by USFWS in 1979 as part of the Don Edwards San Francisco Bay National Wildlife Refuge, and although Cargill retained the right to produce salt on these ponds, the levees have been open to public access since that time. Permitted public access activities on these ponds include wildlife observation, wildlife photography, interpretation, environmental education, hiking and bicycling, with waterfowl hunting allowed on West Bay ponds 1 and 2 only.

The remainder of the Alviso ponds, the West Bay ponds and all of the Baumberg ponds, were owned by Cargill in fee title and were closed to general public access, except for one open trail on Alviso pond A2W along Stevens Creek. However, Cargill leased the majority of its ponds for hunting activities, with approximately 400 hunters holding leases or subleases.

Since the Initial Stewardship Plan is intended to only cover interim management of the ponds until a long-term restoration and public access plan can be developed and implemented, few changes in existing public access are proposed at this time. Under the No Action and Seasonal Pond Alternatives, no new public access is proposed. For the two active pond management alternatives, proposals include scheduled docent-led tours to many ponds and some limited hunting activities on specific ponds. For the Baumberg Ponds, CDFG plans several lottery-based hunts per year. For the Alviso ponds, USFWS will distribute a draft hunting plan and environmental document for public comment under a separate cover.

The project sites adjoin or are near to bicycle and foot trails, shallow waterways used for recreational and public access, open space, other wildlife refuge lands, ecological reserves , and public parks. Proximal to the project sites (especially in Santa Clara and San Mateo counties) are several existing and planned parks. Recreation and public access in and around the project area are described in a variety of plans that include the Bay Trail Plan, Bay Plan, and city and county General Plans.

The table that follows shows some of the factors that influence public access and recreational use of the Alviso, Baumberg and West Bay complexes.

Table 8-1
Recreational Facilities in the Project Vicinity

Site	Parks	Reserves & Refuges	Other Recreational Facilities
Alviso Complex	• Mountain View Shoreline Park • Palo Alto Baylands Park • Sunnyvale Baylands Park • Northern Santa Clara County Shoreline Regional Park Complex* • Alviso Marina County Park • Dixon Landing Park*	• Don Edwards San Francisco Bay National Wildlife Refuge (NWR) • Palo Alto Baylands Nature Preserve • Stevens Creek Nature Study Area	• Bay Trail (existing trail adjacent or very near to A1, A2W,, , A8,-13; proposed trail adjacent or near to A18, A19, A2E, A3W, B2) • Stevens Creek Trail • San Tomas Aquino Creek Trail • Guadalupe River Trail • Coyote Creek Trail
Baumberg Complex	• Coyote Hills Regional Park • Hayward Regional Shoreline Park • Hayward Shoreline Interpretive Center • Mt. Eden Park*	• Eden Landing Ecological Reserve • Don Edwards San Francisco Bay NWR	• Bay Trail (existing trail adjacent or very near to 2, 4, 1C, 2C, 3C; planned trail adjacent or very near to 1, 6, 7) • Shoreline Trail • Bayview Trail
West Bay Complex	• Menlo Park Waterfront Park * • Bayfront Park (Menlo Park)	• Don Edwards San Francisco Bay NWR • Ravenswood Open Space Preserve	• Bay Trail (existing trail adjacent or very near to 2, SF2, 3, S5)

* Parks proposed in General Plans or other documents.

The newly acquired Alviso and West Bay ponds are located within the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge), which includes a number of existing public access facilities, including trails, a visitor center and an environmental education center. Ponds within the Baumberg Complex are being added to the Eden Landing Ecological Reserve. This Reserve is now undergoing major wetland restoration activities that will include development of a public access trail to connect with adjacent facilities.

In addition to the recreational facilities noted in Table 8-1, cities proximal to the project sites include Mountain View, Sunnyvale, San Jose, and Alviso (Alviso Complex); Union City and Hayward (Baumberg Complex); and East Palo Alto and Menlo Park (West Bay Complex). These cities may contain additional recreational facilities and populations within these cities will likely have an impact upon recreational use of and access to the project sites.

The Bay Trail passes through portions of Alviso and West Bay pond complexes, and skirts the north and east sides of the Baumberg complex. The Association of Bay Area Governments (ABAG) adopted The Bay Trail Plan in 1989 in support of the Bay Plan’s goal of increasing public access to the Bay and its shorelines. Once completed, the Bay Trail will be a 400-mile continuous recreation corridor around the Bay, linking nine counties and 47 cities..

Depending on the location of its segments, the Bay Trail consists of paved multi-use paths, dirt trails, bike lanes, sidewalks or city streets signed as bike routes. A description of existing portions of the Bay Trail within or in the vicinity of each of the three pond complexes is provided below.

Alviso Complex A portion of the Bay Trail consisting of off-street paved or gravel trail provides a large loop route around Alviso Ponds A9 through A13, which are located within the Refuge. Other portions of the Bay Trail, consisting of off-street paved or gravel trail, are adjacent to the Alviso ponds (including Ponds A1, A2W). An unimproved on-street portion of the Trail (no bike lanes and/or no sidewalks) leads from the Alviso Marina and Historic District (adjacent to Alviso Ponds A8 and A12), south toward San Jose and Highway 237. Another unimproved on-street portion of the Trail runs along the north side of Pond A22.

Baumberg Complex An off-street shared-use paved or gravel portion of the Bay Trail ends at the Point Eden bicycle/pedestrian bridge, just south of the Hayward Shoreline Interpretive Center and northeast of Baumberg Ponds 10 and 11. Off-street paved or gravel trails are located between Union City Boulevard and the San Francisco Bay on both sides of the Alameda Flood Control Channel (adjacent or very near to Baumberg Ponds 2, 4, 1C, 2C, and 3C). The southern of these two trails connects with the Shoreline and Bayview Trails that run south through the Refuge and Coyote Hills Regional Park.

West Bay Complex In San Mateo County, in the vicinity of the West Bay Complex, the Bay Trail follows the Dumbarton Bridge/Highway 84/Bayfront Expressway route (running adjacent to West Bay Ponds 2, SF2, 3, and S5, and loops through Bayfront Park, adjacent to Pond 5. These segments are off-street shared use paved or gravel paths and provide access to the Don Edwards San Francisco National Wildlife Refuge.

8.1.2 Visual Setting

The Project is set within the South San Francisco Bay region. The region is surrounded on the west, south, and east by the California Coastal Ranges and on the north by San Francisco Bay. Visual resources adjacent to the southern part of San Francisco Bay vary from rural to urban. Urban area visual resources include industrial, commercial and residential developments and associated infrastructure. Also, numerous creeks, sloughs, and rivers drain into south San Francisco Bay, adding a distinctive element to the region's visual character.

Although surrounded by urban development, the immediate visual setting of the project areas is primarily rural and consists of marsh, salt pond, and other undeveloped open space. The pond management alternatives would occur within salt ponds and be surrounded by associated creeks, sloughs, bayside mud flats, and parks or preserves with public access. Ground level public streets and trails (see Bay Trail discussion above) provide views of the pond system. Some of the ponds are also visible from major highways in the South Bay and all are highly visible to airline passengers in the approach patterns for San Francisco, Oakland, and San Jose airports. The ponds are striking land features, especially in early morning and late afternoon periods when the reflective quality of the ponds is increased. The colorful salt ponds make a strong first impression (not always favorable) of the South Bay from these views.

8.1.3 Public Health

Other than potential impacts from mosquitos, the proposed project is not expected to impact public health or safety. This section, therefore, focuses on public nuisances associated with mosquitoes and diseases transmitted to humans by mosquitoes, including West Nile Virus (WNV).

Mosquito-Borne Diseases—Compared with the historical levels of mosquito-borne diseases in humans, levels of mosquito-borne diseases now in California are extremely low. These diseases, including encephalitis and malaria, however, are still present or could be readily reintroduced. (Bohart and Washino 1978, Sacramento-Yolo County Mosquito Abatement and Vector Control District 1990.)

Most recently, the spread of West Nile Virus (WNV) has increased concern over mosquito abatement for the protection of wildlife, domestic animals, and humans. WNV is transmitted to humans and animals through a mosquito bite. Mosquitoes become infected when they feed on infected birds. The California Department of Health Services (CDHS), in collaboration with the University of California, Davis, California Department of Food and Agriculture, local mosquito and vector control districts and other state and local agencies, has launched a comprehensive surveillance program to monitor for WNV in California. WNV has been detected in animals in several southern California counties in 2003 and is anticipated to spread to northern California counties in 2004.

Mosquito Abatement Districts in the Project Area—The project area is in the jurisdictions of the Alameda and San Mateo County Mosquito Abatement Districts (MADs) and Santa Clara County Vector Control District. These districts are governmental organizations formed at the local level that are responsible for controlling specific disease vectors within their jurisdiction. MADs receive most of their revenue from property taxes and are primarily responsible for controlling mosquitoes as pest species and as disease vectors. In the project area, MAD mosquito abatement efforts are primarily focused on controlling mosquitoes that can transmit malaria, WNV and several types of encephalitis or cause a substantial nuisance in surrounding communities.

The decision to control mosquitoes as a nuisance to human populations is at the discretion of each local MAD. Factors influencing this decision may include the number of service calls received from a given locality, the proximity of mosquito sources to population centers, the availability of funds for abatement, the density of mosquito larvae present in a mosquito production source, and the number of adult mosquitoes captured per night in light traps (Jones & Stokes Associates 1995). Once a recurring mosquito production source has been identified, abatement schedules are often adopted and maintained for that source (Jones & Stokes Associates 1995).

Mosquito Species in the Project Area—The two primary pest mosquitoes produced in the project areas have long flight ranges and are very aggressive biters, though they are less likely to carry diseases than fresh or brackish marsh mosquitos: winter salt marsh mosquito (*Aedes squamiger*) and the salt marsh mosquito (*Aedes dorsalis*). Two additional mosquito species are associated with marsh habitats, but prefer fresh to brackish water, and cause more localized problems: winter marsh mosquito (*Culiseta inornata*) and encephalitis mosquito (*Culex tarsalis*). The control of these latter species is a high priority locally.

Favorable Environmental Conditions for Mosquitoes—All species of mosquitoes require standing water to complete their growth cycle; therefore, any body of standing water represents a potential mosquito breeding site. Areas that pond surface water but are flushed by daily tides are not stagnant for periods sufficient for mosquito larvae to mature; therefore, such areas are not likely to be mosquito production sources (Maffei pers. comm.). Similarly, ponds that are subject to constant wind-driven wave action are also unlikely to produce many mosquitoes.

Water quality affects the productivity of a potential mosquito-breeding site. Typically, greater numbers of mosquitoes are produced in water bodies with poor circulation, higher temperatures, and higher organic content (and therefore with poor water quality) than in water bodies having good circulation, lower temperatures, and lower organic content (Collins and Resh 1989). Irrigation and flooding practices may also influence the level of mosquito production associated with a water body. Typically, greater numbers of mosquitoes are produced in water bodies with water levels that slowly increase or recede than in water bodies with water levels that are stable or that rapidly fluctuate (Jones & Stokes Associates 1995). Additionally, the types of vegetation growing in standing ponds can have major effects on mosquito production. For instance, mosquitoes will not reproduce in areas with an abundance of California cordgrass, but they will reproduce in areas growing saltgrass and pickleweed (Maffei, Wes. Manager. Napa County Mosquito Abatement District. Napa, California. March 4, 2002—telephone conversation cited in Napa River Salt Marsh Restoration Project Draft Environmental Impact Report/Environmental Impact Statement, Jones & Stokes; February 2003).

Mosquitoes are adapted to breed during periods of temporary flooding and can complete their life cycles before water evaporates and predator populations become well established. Poor drainage conditions that result in ponding water and water management practices associated with the creation of seasonal wetlands for waterfowl use result in the types of flooding that can produce problem numbers of mosquitoes (Jones & Stokes Associates 1995). Permanent bodies of open water that have good water quality (good circulation, low temperatures, and low organic content) typically sustain stable nutrient content and support rich floral and faunal species diversity, including mosquito predators and pathogens. Wave action across larger bodies of water physically retards mosquito production by inhibiting egg-laying and larval survival (Jones & Stokes Associates 1995).

Conditions in the Project Area—Mosquito problems rarely occur in the project areas because of the lack of vegetation in the ponds, the high salinity levels, and the broad wind fetch in the ponds. When outbreaks do occur, they are usually associated with the marsh areas that run between and around the pond systems. For adjacent marshes, the goal is to maintain effective mosquito control with a minimum of pesticide treatments and the least vehicular intrusion into the salt marshes.

8.2 Criteria for Determining Significance of Effects

The impacts of the project on recreation and public access, visual setting, and public health and safety were analyzed qualitatively. Criteria based on the State CEQA Guidelines and professional judgment were used to determine the significance of impacts. Criteria used for each of the impact areas are presented below.

8.2.1 Recreation and Public Access

The proposed project would have a significant impact on recreation and public access if it would:

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.
- Substantially reduce existing public access to the Bay.

8.2.2 Visual Setting

The proposed project would have a significant impact on visual resources if it would:

- Have a substantial adverse effect on a scenic vista
- Substantially damage scenic resources, including, but not limited to, trees, outcroppings, and historic buildings within a scenic highway
- Substantially degrade the existing visual character or quality of the site and its surroundings
- Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area

8.2.3 Public Health and Safety

The project would be considered to have a significant impact if habitat changes would necessitate substantially increasing levels of mosquito abatement programs to maintain mosquito populations at pre-project levels. Habitat changes that could result in a substantial decline of available mosquito breeding habitat or greater efficiency of the three county's MAD's abatement program would be considered beneficial impacts.

8.3 Impacts and Mitigation Measures

Recreation and Public Access—All four alternatives under consideration would be consistent with existing recreational use and policies and plans pertaining to recreational use of the project area. Portions of the project will be annexed to the Refuge and to the Ecological Reserve regardless of the alternative selected. Proposed alignments of the Bay Trail are located along routes that traverse or pass by the project sites, as discussed in Section 6.1, and these proposed alignments would not be directly affected by any of the project alternatives. However, under the No Project/No Action Alternative, levees with existing public access would not be maintained. If these levees eroded and/or breached, public access to these levee segments, including the Bay Trail segments, would be lost.

Therefore, the impact of the No Project/No Action alternative is potentially significant.

Both pond management alternatives include a limited amount of additional public access to the project area, including docent-led tours and controlled waterfowl hunting in some ponds. This increase in public access is considered to be a beneficial impact.

The project alternatives would not promote an increase in the use of recreational facilities such that substantial physical deterioration of a recreational facility would occur or be accelerated.

The project alternatives would result in changes to wildlife habitat, which could have species-specific impacts on wildlife populations and concomitant mixed (beneficial and negative) impacts to wildlife-dependent recreational uses of the project areas (e.g., duck hunting and bird watching). The species-specific impacts will tend to cancel each other out in terms of significant recreational impacts, so that the impacts of wildlife changes to recreational use of the project areas can be said to be less than significant.

The three pond management alternatives (Alternatives 1-3) would cause temporary impacts to public access and recreation from changes in access during construction of proposed water control structures. However, because these impacts would be very limited in area and duration, they are deemed less than significant.

Visual Setting—The project alternatives would not cause an obstruction to any major viewsheds. The alternatives would all result in substantial changes to existing views from various locations; however, it cannot be clearly said whether these changes would be positive or negative. The color of some of the ponds, as viewed from an airplane, is expected to change from red or green to match the colors of bay waters. Those who enjoy the existing colors may be concerned about the change, while others will enjoy a more natural view of the Bay. To the extent that views of the project area are enhanced by the presence of an abundance and diversity of birds and other wildlife, alternatives that support an abundance and diversity of wildlife would have the least negative impact, and possibly a positive visual impact.

The two-pond management alternatives (Alternatives 2-3) would cause temporary impacts to the quality of project area views during construction of proposed water control structures. However, because these impacts would be very limited in area and duration, they are deemed less than significant.

Public Health— The proximity of human and animal activity to the project sites and the sites' potential as a vector for mosquito breeding is a potential concern for planning at these locations..

The project will not directly impact the numbers of people who come in contact with mosquitoes. Indirectly, incorporation of the project area into two publicly- managed sites (the Refuge and the Ecological Reserve), would likely boost the numbers of people who visit the project areas. However, this is likely to occur regardless of whether the No Project or one of the other project alternatives is selected. As discussed in Section 8.1, above, mosquito production is higher in water bodies with poor circulation, higher temperatures, and higher organic content. On the other hand, higher salinities can have the effect of inhibiting mosquito production. To the degree that the project alternatives maintain or improve water quality within the salt ponds, there would be less potential impacts to public health.

8.3.1 No-Project/No Action Alternative

RECREATION IMPACT-1. Recreational use and views of the project areas may be impacted from the loss of levee trail access..

Public access to the project areas could be affected by this alternative. Under this alternative, ponds would be expected to dry out and water structures would deteriorate, ultimately reducing USFWS' and CDFG's ability to manage water and salinity levels for wildlife. In the long term, if not maintained, the pond levees are likely to fail, with the result that levees presently open to public access will no longer be accessible.

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

> *RECREATION IMPACT-2.* Recreational use and views of the project areas may be impacted as a consequence of changes in wildlife populations.

Under this alternative, the ponds are expected to dry in the summer and fill with rainwater in the winter.. The result of anticipated short-term and long-term events is that habitat for some waterbirds would improve, while habitat for other waterbirds would deteriorate, as discussed in greater detail in Section 6.3, Wildlife. Impacts to wildlife-related recreation in the project areas, such as duck hunting and bird watching, would likewise be a mixture of positive and negative impacts.

Significance: Less than significant.

> *VISUAL IMPACT-1.* The quality of views of the project areas may be impacted as a consequence of changes in wildlife populations.

Under this alternative, when seasonal ponds dry down completely, they would likely support fewer species of birds and other wildlife than they currently do. Therefore, in the shorter term, there may be indirect impacts to the visual setting (to the degree that the presence of birds and wildlife enhance the visual setting). Note that in the long-term, lack of maintenance for levees would result in the levees being breached and ponds opened to tidal influence, creating conditions more favorable for some birds and wildlife. However, it is not known when this would occur. This impact is expected to be less than significant.

Significance: Less than significant.

> *PUBLIC HEALTH IMPACT-1.* As the seasonal ponds dry down, increased mosquito production may result from deterioration of pond water quality, requiring the MADs to undertake additional mosquito control and abatement efforts.

This alternative could produce more favorable conditions for mosquito production, at least in the short term. All the ponds would become unmanaged seasonal ponds. As they dry down, the seasonal ponds would have worse circulation, higher temperatures, and higher organic content; all favorable conditions for mosquitoes.. Since the water levels could not be managed under this alternative, no management responses to increased mosquito production could be made. Note that in the long-term, lack of maintenance for levees would result in the levees being breached and ponds opened to tidal influence, creating conditions less favorable for mosquitoes. However, it is not known when this would occur.

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

8.3.2 Seasonal Ponds Alternative

Under this alternative, the levees would continue to be maintained and existing public access would not be threatened. Impacts on recreational wildlife viewing under this alternative are expected to be similar to those under the No Project/No Action Alternative. In the long-term, the changes to wildlife habitat and wildlife will be different under this alternative since levees would be maintained and would not be allowed to deteriorate and become breached. However, this is not expected to change the magnitude of impacts to recreational use of the project areas or to visual impacts.. All the ponds would be allowed to become unmanaged seasonal ponds under this alternative.

PUBLIC HEALTH IMPACT-1. As the seasonal ponds dry down, increased mosquito production may result from deterioration of pond water quality, requiring the MADs to undertake additional mosquito control and abatement efforts.

Like the No Project/No Action alternative could produce more favorable conditions for mosquito production. As they dry down the seasonal ponds would have worse circulation, higher temperatures, and higher organic content; all favorable conditions for mosquitoes. Since water levels could not be managed under this alternative, no management responses would be possible.

Significance: Significant.

PUBLIC HEALTH MITIGATION MEASURE-1. Coordinate project activities with the county MADs.

USFWS and CDFG will coordinate with county MADs during the implementation, and operations phases of the project. Specifically, they will:

- Permit county MADs to have access to the project area to monitor or control mosquito populations.
- Consult with county MADs regularly to identify mosquito management problems, mosquito monitoring and abatement procedures
- Consult with the MADs to identify opportunities to share costs, obtain the necessary permits from the Corps, BCDC, the San Francisco Bay RWQCB, and USFWS, and otherwise participate in implementing mosquito abatement programs, if it is necessary for county MADs to increase mosquito monitoring and control programs beyond pre-project levels.

Post-Mitigation Significance: Potentially significant, since no water management options would be available under this alternative.

8.3.3 Alternative 2 (Simultaneous March-April Initial Release)

Under this alternative, a limited amount of additional public access would be available, included docent-led tours and waterfowl hunting,

There may be temporary and very minor impacts to recreational use of the project areas due to changes in access during construction of water control structures under this alternative. Construction would also temporarily change the quality of views of the project areas. Construction would be very limited in scope and duration; thus, impacts would be less than significant.

MADs in the project areas would experience positive impacts from this alternative since changes in pond hydrology and water quality would result in less favorable conditions for mosquito production. This is considered a beneficial public health impact.

BENEFICIAL RECREATION IMPACT -1. Additional public access will be available on previously closed private lands .

Since this is a beneficial impact, no mitigation is necessary.

> *RECREATION IMPACT-3.* Recreational use and views of the project areas may be impacted as a consequence of changes in wildlife populations.

Under this alternative, pond salinities would be reduced, with the result that habitat for some waterbirds would improve, while habitat for other waterbirds would deteriorate, as discussed in greater detail in Section 6.3, Wildlife. Impacts to wildlife-related recreation in the project areas, such as duck hunting and bird watching, would likewise be a mixture of positive and negative impacts and would be less than significant overall.

Significance: Less than significant.

> *RECREATION IMPACT-4*. Construction of proposed water control structures would have temporary effects on public access to and recreational use of the project areas.

Access restrictions during construction would be limited to specific areas surrounding the construction activities and would last for a period of days to months. There may be restricted access to parts of the Refuge during these times. The public would have access to the majority of the site and the Refuge during construction activities. Once the activities are completed, public access would resume as before.

Significance: Less than significant.

Although mitigation is not required for less-than-significant impacts, the following measure is proposed to further reduce the impact described above.

> *RECREATION MITIGATION MEASURE-1*. Prepare a Public Access Plan for project construction activities.

Before beginning construction, the contractor will develop, in consultation with the appropriate representative(s) of USFWS and/or CDFG, a plan indicating how public access to the Bay Trail and proximal roads, trails, paths, and park areas will be maintained during construction work. If needed, flaggers will be stationed near the construction activity areas to direct and assist members of the public around these areas while maintaining public access.

> *VISUAL IMPACT-1*. The quality of views of the project areas may be impacted as a consequence of changes in wildlife populations and in pond colors.

The project areas would continue to support an abundance and diversity of wildlife, including birds. Therefore, impacts to the quality of the visual setting, which relies to some extent on this diversity and abundance of wildlife, would be less than significant. Changes in pond colors may be seen as an improvement, while others will miss the visually striking reds and oranges. Since the project will return the pond colors to more natural conditions, the impacts would be less than significant.

Significance: Less than significant.

> *VISUAL IMPACT-2*. Construction of proposed water control structures would have temporary effects on the quality of views of the project areas.

Construction activity, such as the operation of heavy equipment and material storage, would temporarily change the visual character of the area; however, these effects would be temporary and the project is not located in a designated scenic area. It is anticipated that areas disturbed by construction activities would re-vegetate naturally. Therefore, construction would not cause a permanent effect on the visual quality of the area.

Significance: Less than significant.

In Alternative 2 , those ponds managed as seasonal ponds could produce more favorable conditions for mosquito production. As they dry down the seasonal ponds would have less circulation, higher temperatures, and higher organic content; all favorable conditions for mosquitoes.

> *PUBLIC HEALTH IMPACT-3*. As the seasonal ponds dry down, increased mosquito production may result requiring the MADs to undertake additional mosquito control and abatement efforts.

Several ponds are to be managed as seasonal ponds in this proposed alternative, with water added during winter and ponds drying by evaporation during the summer. The conditions created in seasonal ponds proposed under this alternative may be conducive to mosquito production in those ponds.

Significance: Potentially significant.

> *PUBLIC HEALTH MITIGATION MEASURE-2*. Coordinate project activities with the county MADs.

USFWS and CDFG will coordinate with county MADs during the implementation and operations phases of the project. Specifically, they will:

- Permit county MADs to have access to the project area to monitor or control mosquito populations.
- Consult with county MADs regularly to identify mosquito management problems, mosquito monitoring and abatement procedures, and opportunities to adjust water management practices in non-tidal wetlands to reduce mosquito production during problem periods.
- Consult with the MADs to identify opportunities to share costs, obtain the necessary permits from the Corps, BCDC, the San Francisco Bay RWQCB, and USFWS, and otherwise participate in implementing mosquito abatement programs, if it is necessary for county MADs to increase mosquito monitoring and control programs beyond pre-project levels.

Post-Mitigation Significance: Less than significant.

8.3.4 Alternative 3 (Phased Initial Release)

Impacts to recreation/public access, visual resources, and public health would be similar to Alternative 2. The timing of initial discharge would not change the nature or severity of these impacts.

9.0 AIR QUALITY

This chapter describes air quality in the San Francisco Bay area in general and in the project area specifically. It includes regulatory, regional, and project settings to provide a context for analyzing the effects of the project. The information presented in this section was compiled largely from information provided by the Bay Area Air Quality Management District (BAAQMD). References to other documents are provided as appropriate.

9.1 Affected Environment

9.1.1 Topography and Meteorology

The project areas are located in the San Francisco Bay Area Air Basin (SFBAAB). The SFBAAB is composed of the counties of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara, along with the southeast portion of Sonoma County and the southwest portion of Solano County. The SFBAAB covers an area of approximately 5,540 square miles.

Atmospheric conditions such as wind speed and direction, air temperature gradients, and local and regional topography influence air quality. The SFBAAB is affected by a Mediterranean climate of warm, dry summers and cool, damp winters. During the summer, maximum temperatures are about 64°F along the coast, and about 88°F farther inland. In winter, average minimum temperatures are in the low to mid-40s along the coast and in the low to mid-30s inland.

Topographical features, the location of the Pacific high-pressure system, and varying circulation patterns resulting from temperature gradients affect the speed and direction of local winds. The winds play a major role in the dispersion of pollutants. Strong winds can carry pollutants far from their source; a lack of wind will allow pollutants to concentrate in an area.

Air dispersion also affects pollutant concentrations. As altitude increases, air temperature normally decreases. Inversions occur when colder air becomes trapped below warmer air, restricting the air masses' ability to mix. Pollutants also become trapped, which promotes the production of secondary pollutants. Subsidence inversions, which can occur during the summer in the SFBAAB, result from high-pressure cells that cause the local air mass to sink, compress, and become warmer than the air closer to the earth. Pollutants accumulate as this stagnating air mass remains in place for 1 or more days.

9.1.2 Regulatory Setting

The project area is subject to major air quality planning programs required by both the federal Clean Air Act (CAA), which was last amended in 1990, and the California Clean Air Act of 1988. Both the federal and state statutes provide for ambient air quality standards (AAQS) o protect public health, timetables for progressing toward achieving and maintaining ambient standards, and the development of plans to guide the air quality improvement efforts of state and local agencies.

AAQS specify the concentration of pollutants to which the public can be exposed without adverse health effects. Individuals vary widely in their sensitivity to air pollutants, so standards are set to protect more sensitive populations (e.g., children and the elderly). The NAAQS and CAAQS are reviewed and updated periodically based on new health studies. CAAQS tend to be at least as protective as NAAQS and are often more stringent. The NAAQS and CAAQS for criteria pollutants that are a potential concern for the proposed project (ozone [O_3], carbon monoxide [CO], nitrogen oxides [NO_x], sulfur oxides [SO_x], and particulate matter less than 10 micrometers in diameter [PM_{10}]) are listed in Table 9-1.

The U.S. Environmental Protection Agency (USEPA) oversees state and local implementation of CAA requirements. It sets NAAQS for criteria air pollutants. USEPA also sets emission standards for mobile sources, which include on-road motor vehicles, off-road vehicles, and marine engines. Finally, USEPA sets nationwide fuel standards.

The CAA requires states to submit a State Implementation Plan (SIP) for review and approval by USEPA. The SIP must contain control strategies that demonstrate attainment with national ambient air quality standards (NAAQS) by deadlines established in the CAA. States that fail to submit a plan or to secure approval may be denied federal funding and/or be required to increase emission offsets for industrial expansion. In California, the state plan is called the Clean Air Plan (CAP) (BAAQMD 1997a). The CAP must show satisfactory progress in attaining state ambient air quality standards.

Under California law, the responsibility to carry out air pollution control programs is split between the California Air Resources Board (CARB), USEPA, and BAAQMD.

- BAAQMD can require stationary sources to obtain permits, and can impose emission standards, set fuel or material specifications, and establish operational limits to reduce air emissions.
- CARB shares the regulation of mobile sources with USEPA and sets the California Ambient Air Quality Standards (CAAQS) (see below). CARB has the authority to set emission standards for on-road motor vehicles and for some classes of off-road mobile sources that are sold in California. CARB also regulates vehicle fuels; it has set emission reduction performance requirements for gasoline (referred to as *California reformulated gasoline*) and has limited the sulfur and aromatic content of diesel fuel to make it burn cleaner (this is referred to as *California diesel* or *California red-dyed diesel*).

The CAA contains conformity provisions, which are designed to ensure that federal agencies contribute to efforts to achieve the NAAQS. A conformity analysis may be required for a project if emissions of reactive organic gases (ROG) and oxides of nitrogen (NOx) are above the conformity thresholds of 50 tons of ROG and 100 tons of NOx per year. The proposed project will not exceed these emissions thresholds; therefore, no conformity analysis is required for this project.

Table 9-1

National and California Ambient Air Quality Standards

			NAAQS	
Pollutant	**Averaging Time**	**CAAQS**	**Primary**	**Secondary**
Ozone (O_3)	1-hour	0.09 ppm	0.12 ppm	Same as primary standard
Carbon Monoxide (CO)	8-hour	9 ppm	9 ppm	—
	1-hour	20 ppm	35 ppm	—
	Annual		0.053 ppm	
Nitrogen Dioxide (NO_2)	Annual		0.25 ppm	Same as primary standard
	1-hour	0.25 ppm	—	—
Sulfur Dioxide (SO_2)	Annual	—	0.03 ppm	—
	24-hour	0.04 ppm	0.14 ppm	—
	3-hour	—	—	0.5 ppm
	1-hour	0.25 ppm	—	—
Suspended particulate matter (PM_{10})	Annual. (Geometric)	30 µg/m3	50 µg/m3	—
	Annual (arithmetic)	—	15 µg/m3	Same as Primary Standard
	24-hour		65 µg/m3	Same as Primary Standard

Notes:
ppm = parts per million
µg/m^3 = micrograms per cubic meter
µg/m^3 = milligrams per cubic meter

1. California standards for O_3, CO, SO_2 (1-hour and 24-hour), NO_2, PM_{10}, and visibility-reducing particles are not to be exceeded. The standards for sulfates, lead, hydrogen sulfide, and vinyl chloride are not to be equaled or exceeded.
2. National standards other than 1-hour O_3 and 24-hour PM_{10} and those based on annual averages are not to be exceeded more than once a year. The 1-hour O_3 standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one. The 24-hour PM_{10} standard is attained when the 3-year average of the 99th percentile 24-hour concentrations is below 150 µg/m^3.
3. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects from a pollutant.

9.1.3 SFBAAB Air Quality Attainment Status

Areas with monitored pollutant concentrations that are lower than ambient air quality standards are designated as *attainment areas* on a pollutant-by-pollutant basis. When monitored concentrations exceed ambient standards, areas are designated as *non-attainment areas*. An area that recently exceeded ambient standards, but is now in attainment is designated as a *maintenance area*. Areas are often designated as *unclassified* when data are insufficient to have a basis for determining the area's attainment status. Non-attainment areas are further classified based on the severity and persistence of the air quality problem as *moderate, serious*, or *severe*. Classifications determine the minimum pollution control requirements. In general, the more serious the air quality classification, the more stringent the control requirements that must be contained in the regional air quality plans (see discussion above of the SIP and CAP).

The SFBAAB is currently in attainment of the federal standards for NO_x and SO_x, in non-attainment for O_3 and CO (urbanized areas only), and unclassified for PM_{10} (California Air Resources Board 2001a). The urbanized areas of the SFBAAB are moderate non-attainment areas for CO.

CARB designates areas of the state as either in attainment or in non-attainment of the CAAQS. An area is in non-attainment if the CAAQS have been exceeded more than once in 3 years. At the present time, the SFBAAB is in non-attainment of the CAAQS for O_3 and PM_{10} and in attainment of the CAAQS for CO, NO_2, and SO_2 (California Air Resources Board 2001a). The SFBAAB is designated as a serious state non-attainment area for O_3.

Table 9-2 displays the estimated annual average air emissions for the SFBAAB in the year 2000 (CARB, 2001b). Mobile sources are one of the largest contributors to air pollutants in the SFBAAB. Mobile sources account for approximately 60% of the reactive organic gases (ROG), 93% of the CO, 81% of the NO_x, 39% of the SO_2, and 12% of the PM_{10} emitted in the SFBAAB.

Table 9-2
Year 2000 Estimated Annual Average Emissions for SFBAAB (tons/day)

Source Type/Category	ROG	CO	NO_x	SO_2	PM_{10}
Stationary Sources					
Fuel Combustion	2.8	33.4	77.4	10.7	3.9
Waste Disposal	7.1	0.1	0.1	0.0	0.0
Cleaning and Surface Coating	71.0	0.0	0.0	--	0.0
Petroleum Production and Marketing	33.3	1.2	8.7	36.5	1.2
Industrial Processes	11.0	0.7	3.0	7.5	12.2
Subtotal	125.2	35.4	89.2	54.7	17.3
Area wide Sources					
Solvent Evaporation	74.6	--	--	--	--
Miscellaneous Processes	15.6	169.0	17.1	1.4	130.1
Subtotal	90.2	169.0	17.1	1.4	130.1
Mobile Sources					
On-Road Motor Vehicles	255.1	2,149.6	273.6	4.9	8.5
Other Mobile Sources	63.7	513.3	178.1	31.4	12.4
Subtotal	318.8	2,662.9	451.7	36.3	20.9
Total for the Air Basin	534.2	2,867.3	558.0	92.4	168.3

9.1.4 Ambient Air Quality in the Project Area

The three nearest air quality monitoring stations to the project areas are Central San Jose, Fremont, and Redwood City. Table 9-3 shows ambient air quality data from the years 1997 to 2002 for the criteria pollutants, O_3, CO, and PM_{10}.

Table 9-3

Summary of Ambient Air Quality in the Vicinity of Redwood City and Mountain View, 1997 – 2002

			Days above standard					
Pollutant	**Time Standard**	**Monitoring Station**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
0_3	Federal 1-hour	Fremont	0	0	0	0	0	0
		San Jose Central	0	1	0	0	0	0
		Redwood City	0	0	0	0	0	0
	State 1-hour	Fremont	2	7	3	2	0	3
		San Jose Central	0	4	3	0	2	-
		Redwood City	0	0	0	0	1	0
	Federal 8-hour	Fremont	0	0	1	0	0	0
		San Jose Central	0	0	0	0	0	-
		Redwood City	0	0	0	0	0	0
CO	Federal 8-hour	Redwood City	0	0	0	0	0	0
		Fremont	0	0	0	0	0	0
		San Jose Central	0	0	0	0	0	0
PM_{10}	State 24-hour	Redwood City	2	0	3	1	4	1
		Fremont	1	1	2		3	1
		San Jose Central	2	3	5	7	4	2
	Federal 24-hour	Redwood City	0	0	0	0	0	0
		Fremont	0	0	0	0	0	0
		San Jose Central	0	0	0	0	0	0

Source: BAAQMD 1998, 1999, 2000 Internet Air Quality Data Summaries

Notes to Table 9-3:

ppm = parts per million;
pphm = parts per hundred million,
ppb = parts per billion

PM_{10} = particulate matter under 10 micrometers in diameter Pollutant standards listed as follows (state, federal): Ozone 1 hour peak (9pphm, 12 pphm); CO 8 hour (20 ppm, 35 ppm); NO_2 1 hour (25 pphm, na) annual (na, 5.3 pphm); SO_2 24 hour (40 ppb, 140 ppb); PM_{10} annual geometric mean (30 ppm, na) 24 hour (50 ppm, 150 ppm).

9.2 Criteria for Determining Significance of Effects

Criteria based on the *CEQA Guidelines* and federal, state, and local air pollution standards and regulations, as well as professional judgment, were used to determine the significance of air quality impacts. The project would have a significant impact on air quality if it would:

- Conflict with or obstruct implementation of applicable air quality plans;
- Increase ambient pollutant levels from below to above the NAAQS or CAAQS;
- Substantially contribute to an existing or projected air quality standard violation;
- Exceed the following thresholds that BAAQMD defines as significant under CEQA for project operation activities: total emissions greater than 80 pounds per day or 15 tons per year of ROG, NO_x, PM_{10}, or PM_{10} precursors, such as SO_x (BAAQMD 1996);
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

BAAQMD has not identified thresholds of significance for emissions from construction activities. Construction-related emissions are generally short-term in duration, but still may cause adverse air quality impacts. PM_{10} is generally the pollutant of greatest concern with respect to construction activities that disturb the ground surface (e.g., during installation of water conveyance features or levee repairs). Construction equipment emits CO and O_3 precursors; however, these emissions are included in the emission inventory that is the basis for regional air quality plans. These pollutants are therefore not expected to impede attainment or maintenance of the O_3 and CO standards in the Bay Area (BAAQMD 1996).

9.3 Impacts and Mitigation Measures

The baseline for comparison of air quality impacts is current conditions, which is the operation of the salt pond system for brine concentration. Current conditions involve movement of brine through the salt ponds, with infrequent drying of some of the salt ponds. Periodic levee maintenance is conducted by topping levees with mud from within the salt ponds, and disking and grading the levees once the mud has dried. Employees drive on the unpaved levee roads to maintain and monitor the salt pond system.

While current conditions are used as a baseline for comparison purposes, it is important to note that Cargill Salt no longer owns the property, and operation of the ponds to concentrate brine for salt production will not continue into the future. If the project is not approved, future conditions will more closely resemble the No Project alternative.

Impacts due to the salt ponds in their current condition can be broken down into three categories:

- Dust generation: Dust is generated as a result of driving on unpaved levee roads and from maintenance of levee roads.
- Combustion emissions: Combustion emissions are generated from routine vehicle use and from construction and maintenance related equipment.
- Odor emissions: Odor complaints have occasionally been received as a result of ongoing salt pond operations due to hydrogen sulfide from dredging pond mud, due to algae decomposition in ponds containing brine, or due to decomposition of organic material in mud at the bottom of ponds that have dried out.

9.3.1 No Project/ No Action Alternative

Under the No Action alternative the majority of pond waters/brines would be moved to the Cargill plant site and the remainder of the waters would be allowed to evaporate in the ponds. The ponds would then fill seasonally with rainwater in winter and dry through the evaporation process in summer. No new public access would be available. No action would be conducted by the agencies, including levee maintenance, and some levees would likely fail during this period.

Air Quality Impact 1: Increased dust generation due to exposed dry pond bottoms in seasonal ponds.

Under this alternative, all of the ponds would be seasonal ponds. The majority of the pond bottom areas would be dry during summer and fall. Fine materials and sediments on the dry pond bottoms may become airborne during windy periods.

Significance: Potentially significant

Air Quality Benefit 1: Decreased dust generation due to driving and levee maintenance.

Under this alternative, the amount of driving on unpaved levees would be decreased. The amount of levee maintenance conducted would be less than current levels.

Significance: Beneficial

Air Quality Benefit 2: Decrease in combustion emissions due to vehicles and equipment

Under this alternative, the amount of vehicle use for levee inspection and maintenance would be less than current levels.

Significance: Beneficial

Air Quality Impact 2: Generation of odors

Decomposition of algae, brine shrimp, and other biomass that grows and accumulates in the ponds can degrade and produce odors. There are two ways that odor can occur in the ponds. First, algae and other biomass that naturally grow in the ponds can accumulate in certain areas of the ponds. As the algae naturally decompose, hydrogen sulfide gas can be produced. Warm weather and very little wind, similar to the Bay Area Indian summer condition, can accelerate the decomposition in the ponds and aggravate the odor condition. Second, odors can develop as the ponds dry and the mud bottoms are exposed to air, especially in hot weather. These odors are caused by the exposure of algae or brine shrimp.

The occurrence of the odor depends to a large part on the number of degree-cooling days that occur in summer months. The potential for odor impacts is also dependant on prevailing winds and the proximity and location of downwind receptors.

The Baumberg ponds may have the greatest potential for odor impacts, due to proximity and downwind location of residences.

Transferring the ponds in a dry condition would lead to unmanaged wetting and drying cycles as the ponds accumulate rainwater and dry through natural evaporation. Any biomass produced while the pond contains water would be exposed as the pond dried.

This could potentially expose more areas to unmanaged drying, potentially during the warmest periods of the year. It could also potentially lead to ponds drying out that are either in close proximity to neighboring populations or have not dried out in the past, exposing neighboring residents to odors they have not experienced before.

Significance: Potentially significant

9.3.2 Alternative 1 – Seasonal Ponds

In Alternative 1, the majority of pond waters/brines would be moved to the Cargill plant site and the remainder of the waters would be allowed to evaporate in the ponds. The ponds would then fill seasonally with rainwater in winter and dry through the evaporation process in summer. The only action taken by the agencies would be to maintain the levees at their current standard of maintenance (i.e., salt pond maintenance, not for flood control).

> *Air Quality Impact 1:* Increased dust generation due to exposed dry pond bottoms in seasonal ponds.

Under this alternative, all of the ponds would be seasonal ponds. The majority of the pond bottom areas would be dry during summer and fall. Fine materials and sediments on the dry pond bottoms may become airborne during windy periods.

Significance: Potentially significant

> *Air Quality Benefit 1:* Decreased dust generation due to driving and levee maintenance.

Under this alternative, the amount of driving on unpaved levees would be decreased. The amount of levee maintenance conducted would be similar to current levels. However, current weekly pond visits for inspection and operation adjustments would not be required.

Significance: Benefit

> *Air Quality Benefit 2:* Decrease in combustion emissions due to vehicles and equipment

Under this alternative, the amount of driving on unpaved levees would be decreased. The amount of levee maintenance conducted would be similar to current levels. However, current weekly pond visits for inspection and operation adjustments would not be required.

Significance: Benefit

> *Air Quality Impact 2:* Generation of odors

For Alternative 1, the seasonal pond conditions would be same as for the No Action alternative.

Significance: Potentially significant

9.3.3 Alternative 2 – Simultaneous Marsh/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.

Air Quality Impact 1: Dust generation

Pond management alternative 1 will require the construction and installation of several structures for water management. Construction activities will temporarily result in an increase in traffic on unpaved levee roads, resulting in a temporary increase in dust generation.

Construction activities may also require the stockpiling of dirt, either from excavations or for use in construction. There may be some blowing of dirt from stockpiles.

Under pond management alternative 1, some ponds will be managed as seasonal ponds, and as a result they will be dry for part of the year. As discussed under the No Action Alternative, there is potential for dust generation due to dry ponds. The number of acres of dry ponds under this management alternative will be significantly less than under the No Action Alternative.

Significance: Less than significant

Air Quality Impact 2: Generation of odors

In Alternative 2, some ponds would be managed as seasonal ponds and the remaining ponds would intake, circulate and discharge brine. The potential odor impacts associated with the seasonal ponds under this alternative would be the same as those listed under the No Action Alternative, except that a significantly fewer number of ponds would be dry at any time.

Odor impacts associated with the ponds containing brine would be similar to impacts under the baseline scenario of current pond management. Algae and other biomass grows in the ponds and can accumulate in certain areas of the ponds and decompose, particularly in ponds that have remained stagnant for a long period of time and during hot weather.

The greatest odor impacts will be at the Baumberg ponds, due to the proximity and downwind location of residences within 500 yards of the edge of ponds subject to seasonal drying and the number of ponds that will become seasonal ponds under the various alternatives, including the No Project/No Action Alternative. At residences near the Baumberg ponds (within 500 yards) the odor will be noticeable after a succession of degree-cooling days. Table 9-4 shows the odor risk factors associated with the Baumberg ponds.

Table 9-4.
Odor Risk Factors Associated with the Baumberg Complex Ponds

Type	Pond(s)	Odor Risk Factor
System Intake	1, 1C, 5, 6, 4C, 9,	None
System Outlet	2, 2C, 5C	None
Winter System Pond; Summer Seasonal	4, 7, 8, 6B, 6A, 12, 13, 14	Possible
Winter System Pond; Summer Seasonal	6A	Probable

System Pond	6C, 5, 3C, 2C	None
Winter System Outlet/Summer Seasonal, tidally muted in borrow ditch	8A	None
Open tidal culvert do ditch-pond is seasonal	8X	Possible
Winter system intake; Summer intake and outlet	10, 11	None

The Alviso ponds are also located upwind of residential areas, but at a greater distance than the Baumberg Ponds. Odors from the Alviso Ponds will therefore be dispersed to a high degree resulting in little significant impact to residential and other receptors. In addition, fewer of the Alviso ponds are proposed to be managed as seasonal ponds, so overall odor production will be less than at the Baumberg ponds.

The West Bay ponds are located downwind from the nearest residential areas and seasonal management is not proposed for any of the West Bay ponds. Therefore, odor impacts from these ponds will be of minor significance.

Significance: Potentially significant (Baumberg Complex ponds only)

Air Quality Mitigation 1A: Drain the seasonal ponds early enough in the dry season so that any exposure of organic material is allowed to occur before the onset of particularly warm, still weather at the end of summer.

Air Quality Mitigation 1B: If odors result from biomass accumulating and stagnating in ponds containing brine, increase circulation through the ponds.

Post Mitigation Significance: Less than Significant

Air Quality Impact 3: Increase in combustion emissions

The construction of structures required by Alternative 2, may result in a temporary increase in combustion emissions from construction equipment. Construction-related air quality impacts were analyzed by comparing anticipated construction-generated concentrations of criteria pollutants to the appropriate federal and/or state ambient air quality standard. Inventories of construction-related emissions, used to evaluate construction impacts, included:

- Combustion emissions from equipment used in the installation of water conveyance equipment and its supporting equipment and levee repairs and upgrades
- Combustion emissions from all support and transport vessels (much of the equipment would have to be brought in by barge)
- Combustion emissions from landside vehicles used for worker commute trips and material delivery trips, and fugitive dust emissions from any ground disturbance or stockpiling activities

The evaluation of construction phase emissions also considers the following factors:

- Types and sizes of mobile equipment, vessels, and vehicles used;
- Daily hours of operation;
- Load factors of the engines;
- Type(s) of fuel used;
- Vessel and vehicle miles traveled;

- Area of disturbed land surface; and
- Schedule of activities (when the various activities would occur).

To the extent possible, these data were derived from the U.S. Army Corps of Engineering (Corps) engineering estimates for the project.

Emissions for all project alternatives are assumed to be less than the emissions for Cargill's past operation and maintenance permits, and right-of-way and easement operation and maintenance permits awarded to PG&E for its transmission lines; Southern Pacific Rail Road for its rail lines, and East Bay Waste Water management for its interceptor line. All vehicle emissions are below the thresholds under existing permits.

Significance: Less than significant

9.3.4 Alternative 3 – Phased 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.

The construction for Alternative 3, and long-term operations for Alternative 3 would be the same as for Alternative 2.

All air quality related impacts for Alternative 3 would be the same as for Alternative 2.

10.0 SOCIO-ECONOMIC RESOURCES

There are two resources addressed in this section: Mineral Resources consisting of Salt Production (Section 11.1) and Bay Shrimp harvest (Section 11.2).

10.1 Mineral Resources-Salt Production

10.1.1 Affected Environment

Cargill Salt Corporation began consolidation of its salt production at its Newark facilities. This decision to consolidate operations provides an opportunity to restore the evaporative ponds and surrounding levy system as a wetland, open-space wildlife preserve.

For more than four years, state and federal agencies worked with Minneapolis based agribusiness Cargill, Incorporated to buy thousands of acres of land and saltmaking rights in San Francisco's South Bay and Napa. The property was available because Cargill planned to focus salt production on 11,000 acres near its Newark plant site. The agencies pursued acquisition because restoration of this land presents an historic opportunity to:

- Increase the Bay's tidal wetlands by nearly 50 percent;
- Preserve open space;
- Improve water quality;
- Act as natural flood control;
- Prevent shoreline erosion;
- Provide critical habitat for endangered species; and
- Create opportunities for public access and environmental research and education in one of the most urbanized regions in the country.

The following table provides the background changes in Cargill's employment and salt production. These factors are pre-existing conditions in the project area.

Table 10-1
Employment and Production Changes Resulting from Consolidation of Cargill Salt Production

Factor	Before Consolidation	After Consolidation
Number of Employees	• 200 Full-Time Equivalent • 40 Seasonal	No Change
Tons of Salt Produced	1.3 million tons/year capacity	650 thousand tons/year

Personal Contact: Lori Johnson, 510-790-8157 Cargill Salt, Minneapolis, MN; 9-29-03

10.2 Commercial Harvest of Bay Shrimp

10.2.1 Affected Environment

The commercial fishery for bay shrimp in San Francisco Bay began in the early 1860s. By 1871, Chinese immigrants established fishing camps along the shores of the bay and exported large quantities of dried shrimp meal (dried heads and shells) to China. At the height of the fishery in the 1890s, as many as 26 fishing camps operated up to 50 nets each in San Francisco Bay with daily landings of 400 to 8,000 pounds of shrimp, and annual landings exceeding five million pounds. Studies were required by the California Fish and Game Commission between 1897 and 1911 to address concerns that many young fish, particularly striped bass, were killed in the shrimp nets. The results of these studies prompted a May to August season closure and a prohibition of Chinese shrimp nets in 1911. The legislature modified this decision in 1915 allowing Chinese shrimp nets to be used in south San Francisco Bay. About this time, beam trawl nets began to be used by commercial shrimp harvesters in northern San Francisco Bay and San Pablo Bay. Annual landings gradually increased over the next two decades and peaked at 3.4 million pounds in 1935. Following this period, landings steadily declined in response to a decline in demand for fresh and dried shrimp as food. By the early 1960s, average annual landings declined to 1,500 pounds, and in 1964 no shrimp were landed.

Since 1985, annual landings of bay shrimp have averaged 120,000 pounds and have ranged from 75,000 to 150,000 pounds. In 1999, 11 boats participated in the bay shrimp fishery; only three fished exclusively in south San Francisco Bay. However, the total weight of bay shrimp landed was almost twice as high in the south San Francisco Bay versus north San Francisco Bay due to higher catch per boat, and higher catch per hour trawled. Primary fishing locations are Alviso Slough and Redwood Creek in south San Francisco Bay. Fishing generally occurs in waters less than 20 feet deep in channels of the estuary's shallow reaches.

The absolute abundance of bay shrimp has not been estimated nor has the impact of commercial fishing on these populations. However, annual abundance indices of bay shrimp indicate that abundance can vary widely from year to year. Annual abundance indices of adult California and blacktail bay shrimp varied by more than a factor of 10 from 1980 to 1996. Studies indicate that the abundance of California bay shrimp increases with increased river inflow to the estuary, probably because of the increased low-salinity habitat which is favorable for the rearing of juveniles. In contrast, abundance of blacktail bay shrimp increased during years of low river inflow, although not to levels capable of replacing California bay shrimp in abundance.

The current lack of catch limits, closed seasons or restricted areas is based upon the assumption that limited demand for bay shrimp maintains effort at levels far below the level that would threaten long-term sustainability of the fishery. Data is not available to test this assumption. (DFG 2001)

In addition to the forgoing bay shrimp catches are impacted by the introduction since 1992 of the Asian Mitten Crab. Mitten crabs caught in large numbers in bay shrimp nets damage the shrimp catch. Mitten crabs are an invasive, migratory (into fresh water) species of crab that burrow into the shoreline between mean high and low tides. They have been known to burrow deep into levees and are cause for concern over the integrity of levees.

Current catch levels for bay shrimp will not be significantly affected by the proposed action in this Initial Stewardship Plan or the construction activities that will take place in initiating the proposed action at the start of the stewardship.

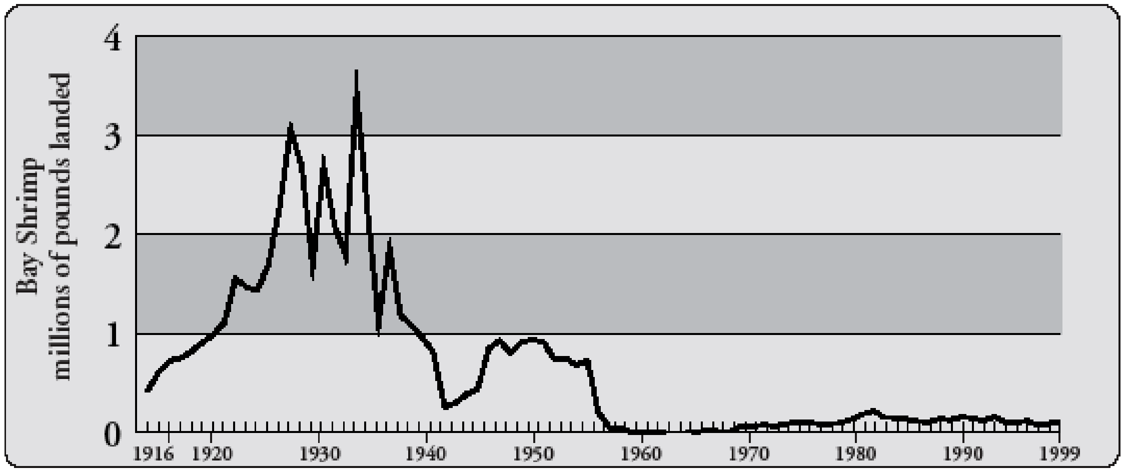


Figure 10-1
Commercial Landings 1916-1999, Bay Shrimp Data
Source: DFG Catch Bulletins, log books, and commercial landing receipts.

It is not known the extent to which increased salinity in outfalls from ponds will affect the migration of to fresh water or brackish water of juvenile Mitten Crabs, thus affecting the presence of Mitten Crabs in bay shrimp catches.

An evaluation was performed to determine if the altered salinity profiles in the sloughs during the Initial Stewardship Period would adversely impact the bay shrimp. The results of this evaluation indicate that salinity changes associated with the circulation are predicted to be relatively small and localized and are, therefore, not expected to adversely impact the long-term quality or quantity of habitat available to the bay shrimp. Any local decreases in habitat quality are predicted to be of short duration and limited to the first few months following the initial release of pond water. The evaluations upon which these conclusions are based are described in Section 6, and Appendix

10.3 Criteria for Determining Significance of Effects

As above: Social and economic effects are not considered significant effects under CEQA unless a chain of cause and effect can be established between the social or economic effect and an adverse effect on the physical environment. According to CEQA and the *CEQA Guidelines*, the following standards may be considered in determining whether the project would cause a significant socioeconomic impact:

- Would the project disrupt or adversely affect property of cultural significance to a community or ethnic or social group?
- Would the project induce substantial growth or concentration of population?
- Would the project cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system?
- Would the project displace a large number of people?
- Would the project disrupt or divide the physical arrangement of an established community?
- Would the project conflict with established recreational, educational, religious, or scientific uses of the area?

- Would the project convert prime agricultural land to non-agricultural use or impair the agricultural productivity of prime agricultural land?
- Would the project interfere with emergency response plans or emergency evacuation plans?

10.4 Impacts and Mitigation Measures

Employing the forgoing criteria it is determined that there are no significant environmental effects of the proposed project. This is true for the no project/no action option as well as the pond maintenance, the ISP and all measures and options under the ISP. All actions will provide benefit to the habitat and harvest of bay shrimp through the preservation of habitat and water flows through which the bay shrimp migrate.

Physical changes caused by the project are constrained to those construction elements designed to maintain the evaporative ponds as wetland, open space, and recreational use. Construction will be short-term and is considered to have no impact on the economic or social characteristics of the surrounding community and, subsequently, no impact on the environment as a result of changes in the socio-economic characteristics of the project area.

All elements of the alternative actions require coordination of operation and maintenance easements of utility services in the project areas. This coordination is not dissimilar from existing easement rights Cargill Salt maintains with utility providers. These utilities consist of power lines, a sewer connector line, and a rail line.

There are no mitigation measures proposed.

Significance: Less than significant.

11.0 LAND USE PLANNING

This chapter provides the environmental and regulatory background necessary to analyze land use effects associated with the proposed project. Applicable land use plans and policies were reviewed to identify any project-related incompatibilities with existing plans, policies, or surrounding land uses.

11.1 Affected Environment

The project area is in the South San Francisco Bay (made up of parts of Alameda, Santa Clara and San Mateo counties) and is part of a 12-county San Francisco Estuary planning area (the Estuary). The project sites include portions of the incorporated cities of San Jose, Alviso, and Fremont (Alviso Complex); Hayward (Baumberg Complex); and Menlo Park (West Bay Complex).

11.1.1 Existing Land Use in the Project Area

The project sites currently include the following land uses: bay shore mud flats, salt flats, salt marsh, salt evaporative ponds, creeks, flood control, rural land and wildlife interpretative areas, and open space areas, including existing parks and planned parks. In the recent past, the project sites were used for salt production by Cargill Corporation. Land uses surrounding the project sites include residential, commercial and light industry, public facilities, and heavy industry.

11.1.2 Regional Land Use Trends

The population of the San Francisco Estuary planning area is projected to increase by over one million people during the next two decades. This growth and the corresponding changes in land uses will have direct and indirect impacts on the health of the Estuary. Most notably, these impacts include increased pollutants from point and non-point sources and alteration of vital habitats, such as wetlands and streams.

Regional land use trends include the following (San Francisco BCDC, 2000):

- Development of urban uses along interstate and state highway corridors
- Acquisition of large rural areas by federal and state wildlife agencies for wildlife habitat
- Conversion of bay shore extraction facilities to wetland marsh and wildlife habitat

Until recently, opportunities for acquisition and restoration along the South Bay shoreline have been limited. The acquisition and proposed restoration of over 15,000 acres of Cargill salt production lands represents a unique opportunity to achieve some of the long-term regional goals for Bay shoreline, as described in various regional land use plans and policies (see Section 11.1.4 below)..

11.1.3 Regional Land Use Planning Authority

Local government has the primary authority to regulate land use and therefore has the potential to minimize impacts associated with land use change. Current California planning law and guidelines provide a framework that can be used to protect natural resources. However, there is no requirement that ensures that the San Francisco Estuary, its wetlands, and other associated natural resources be given any special protection.

The following represents the current state of regional land use planning for the Estuary:

- There is no state-legislated regional comprehensive land use planning and regulatory authority.
- The San Francisco Bay Conservation and Development Commission (BCDC) administers the state's federally approved management program for the San Francisco Bay segment of the California coastal zone and the Estuary. BCDC manages the open waters, tidal marshes, managed wetlands, salt ponds, and narrow shoreline band of the San Francisco Bay segment of the Estuary. BCDC is responsible for permitting new placement of dredged material or fill in the Bay and for implementing the policies of the San Francisco Bay Plan (discussed below). BCDC does not have jurisdiction over the diked lands that were historically part of the Bay, nor over the tributary streams that are hydrologically part of the Estuary.
- Although the San Francisco Bay and Central Valley Regional Water Quality Control Boards (RWQCBs) have regulatory control over discharges to the Estuary, they do not have comprehensive land use planning authority and cannot mandate specific land use development and management practices that would minimize pollutants entering the Estuary.
- The U.S. Army Corps of Engineers (the Corps) and the U.S. Environmental Protection Agency (USEPA) have regulatory authority over the open waters and adjacent wetlands (as defined by federal regulations). The Corps can require Best Management Practices (BMPs) as part of its Clean Water Act Section 404 permitting process, which is administered on a project-by-project basis.

None of these agencies have comprehensive land use planning authority to require specific land use development or management practices that would protect the Estuary. As discussed in the following section, regional land use planning efforts have stemmed largely from a number of regional plans and policies developed by interagency organizations.

11.1.4 San Francisco Bay Regional Plans and Policies

The San Francisco Bay Estuary is the nation’s second largest and perhaps the most biologically significant estuary on the Pacific Coast. Years of filling, pollution, and alien species invasions have taken a great toll on the ecosystem. As a result, the Estuary has become a major center for a regional habitat restoration planning and implementation, including wetlands restoration.

Efforts to protect and enhance wetlands in the Estuary are driven by the following beliefs:

- The ecological health of the region requires more wetlands of higher quality than currently exist.
- As urban development continues, the land area available for wetlands restoration decreases.
- A variety of types of wetlands is required to provide all the desired and necessary functions of wetlands.

Restoration work on the Estuary is being undertaken by diverse entities, including public agencies, conservation groups, landowners, corporate interests, local businesses, and citizen volunteers. These entities are guided in part by a number of regional plans and policies.

The following is a list of plans and policies developed by agencies and organizations with authority of interest over habitat restoration within the San Francisco Estuary planning area. These plans and policies are discussed in greater detail below.

- County-wide General Plans for Alameda, Santa Clara, and San Mateo counties
- BCDC San Francisco Bay Plan (Bay Plan)
- San Francisco Estuary Project (SFEP) Comprehensive Conservation Management Plan (CCMP)
- Baylands Ecosystem Habitat Goals Project Report (Goals Report)
- San Francisco Bay Joint Venture (SFBJV) Implementation Strategy
- San Francisco Bay Trail Plan (Bay Trail Plan)

Countywide General Plans California law provides the authority for local land use decision-making and establishes the framework for those decisions. First, the state constitution protects home rule authority. Second, each city and county must prepare a comprehensive General Plan containing state-specified elements oriented toward meeting local goals and needs. All local ordinances, development plans, and activities are required to be consistent with that plan. However, local plans are not required to be coordinated with plans for adjacent communities, nor are they required to meet regional or state goals and objectives for Estuary protection. Moreover, there is no consistent forum or standard for review of local plans.

A majority of local governments in the 12-county planning area have adopted General Plan policies that address wetland or stream environment protection. However, fewer than 15 percent have adopted specific ordinances or other regulations to carry out these policies intended to protect the Estuary. Each of the local governments in the planning area can, and often do, have differing goals, policies, and regulations concerning use and treatment of the Estuary. In addition, many of the Land Use and Open Space elements for the county and municipal General Plans are outdated. For these reasons, regional land use planning documents and programs often supercede the documents and programs of local jurisdictions with respect to planning, protection, and restoration of lands within the Estuary. These regional planning efforts are described below.

BCDC San Francisco Bay Plan (Bay Plan) The McAteer-Petris Act established the BCDC and mandated the preparation of a regional San Francisco Bay Plan to encompass a 12-county San Francisco Estuary planning area. Completed in 1969, the Bay Plan describes the values associated with the Bay and presents policies and planning maps to guide future uses of the Bay and surrounding shorelines. Under the Bay Plan, suitable uses for the Bay's waterfront and shorelines include port and water-related industry, airports, wildlife refuges, and water-related recreation. In addition, the Bay Plan supports extensive public access along the Bay's waterfront and shorelines via marinas, waterfront parks, and beaches. The Bay Plan designates the project sites as wildlife area and managed wetlands. BCDC is responsible for implementing the policies of the Bay Plan.

The San Francisco Bay Conservation and Development Commission provides the following policies and commission recommendations with regard to salt ponds in the south bay area (BCDC 2003):

- If not needed for salt production, ponds between Stevens Creek and Charleston

Slough should be wildlife area."

- **South Bay** - Enhance and restore valuable wildlife habitat. Bay tidal marshes and salt ponds may be acquired as part of Don Edwards San Francisco Bay National Wildlife Refuge and managed to maximize wildlife and aquatic life values. Salt ponds can be managed for the benefit of aquatic life and wildlife. Provide continuous public access to the Bay and salt ponds along levees if in a manner protective of sensitive wildlife.
- **Harbor Seal Haul-Out** - Protect harbor seal haul-out and pupping site where harbor seals rest, give birth and nurse their young. Projects allowed only if protective of harbor seals and other sensitive wildlife.
- **Regional Restoration Goal for South Bay** - Restore large areas of tidal marsh connected by wide corridors of similar habitat along the perimeter of the Bay. Several large complexes of salt ponds, managed to optimize shorebird and waterfowl habitat functions, should be interspersed throughout the region, and natural unmanaged salt ponds should be restored on the San Leandro shoreline. Natural transitions from tidal flat to tidal marsh and into adjacent transition zones and upland habitats should be restored wherever possible. See the Baylands Ecosystem Habitat Goals report for more information.

Commission Suggestions:

- If no longer needed for salt pond production, enhance area for wildlife and aquatic life.
- Alviso-San Jose - Provide continuous public access to slough frontage only at Alviso.

SFEP Comprehensive Conservation Management Plan (CCMP) The SFEP was established by USEPA in 1987 because of growing public concern related to the health of the Bay and the Delta. SFEP is jointly sponsored by USEPA and the State of California and is part of the National Estuary Program. In June of 1993, the SFEP developed the Comprehensive Conservation Management Plan (CCMP) for the Bay-Delta planning area.

The CCMP provides a thorough implementation strategy and 145 specific actions to restore and maintain the chemical, physical and biological integrity of the Bay and Delta. It seeks to achieve high standards of water quality; to maintain an appropriate indigenous population of fish, shellfish and wildlife; to support recreational activities; and to protect the beneficial uses of the Estuary. It includes the following land use goals:

- Establish and implement land use and transportation patterns and practices that protect, enhance, and restore the Estuary's open waters, adjacent wetlands, adjacent essential uplands habitat, and tributary waterways.
- Coordinate and improve planning, regulatory, and development programs of local, regional, state, and federal agencies to improve the health of the Estuary.
- Adopt and utilize land use policies that provide incentives for more active participation by the private sector in cooperative efforts that protect and improve the Estuary.

Ten program areas are identified in the CCMP. For each program area, the CCMP presents a problem statement, discusses existing management, identifies program area goals, recommends approaches, and states objectives and actions specific to the program.

With regard to wetlands, the CCMP focuses on the restoration and ultimate enhancement of ecological productivity and habitat value.

Baylands Ecosystem Habitat Goals Report The need to establish regional wetlands goals emerged initially from discussions among participants of SFEP in the early 1990s. SFEP's CCMP (discussed above) of June 1993 recommended the preparation of a regional wetlands management plan based on wetlands goals, and recommended that the San Francisco Estuary Institute (SFEI) coordinate the effort. Later that year, SFEI developed a proposal to help establish regional wetland goals and the proposal was approved by the California Resources Agency, the San Francisco Bay RWQCB, and the USEPA. Additional discussions were held in 1994 with CDFG, USFWS, and NOAA Fisheries (formerly NMFS) to improve interagency coordination and to forge a shared vision of the regional habitat requirements of fish and wildlife. In late 1994, representatives of these agencies began discussions with SFEI staff that ultimately led the development of the San Francisco Bay Area Wetlands Ecosystem Goals Project (Goals Project).

The geographic scope of the goals Project includes the following four primary subregions of the San Francisco Bay, downstream of the western boundary of the Sacramento-San Joaquin Delta at Broad Slough: Suisun Marsh and Bay, San Pablo Bay, and the South Bay. The current focus of the project is on the region's baylands, including mudflats, existing tidal marsh, tidal marsh cannels, and seasonal and other wetlands within diked historical tidal marshlands. Adjacent uplands and subtidal areas are involved only as needed to develop ecological goals for the baylands. Eventually, the Goals Project may expand to include in-stream, riparian, and terrestrial habitats of the Bay Area to facilitate watershed planning and comprehensive estuarine conservation efforts. Ultimately, it may develop wetlands goals for the Sacramento-San Joaquin Delta.

In 1999, the Goals Project compiled the *Baylands Ecosystem Habitat Goals: A Report of Habitat Recommendations* (Goals Report) to identify wetland restoration goals within the baylands. Recommendations in the Goals Report were developed through a consensus process with the input of more than 100 participants representing local, state, and federal agencies, academia, and the private sector. General goals include:

- Restore tidal marsh along the Bay edge and where the Bay's tributary streams enter the baylands.
- Restore continuous corridors of riparian vegetation along the tributary streams.
- Restore the salinity gradient of the estuary and its tributaries.
- Restore and enhance extensive areas of managed seasonal ponds.
- Re-establish natural transitions from tidal flat through tidal marsh to upland.
- Provide adequate buffer areas to protect restored habitats from disturbance.

The report recommends the types, areal extent, and distribution of habitats needed to sustain healthy wetlands ecosystems in the South Bay and identifies the Cargill salt ponds as a key area to restore in the South Bay.

San Francisco Bay Joint Venture (SFBJV) Implementation Strategy The SFBJV was formed in 1995 to bring together public and private agencies, conservation groups, development interests, and others seeking to collaborate in restoring wetlands and wildlife habitat within the San Francisco Bay Estuary. It is one of 13 similar habitat joint ventures formed in the United States. The primary goal of the SFBJV is to protect, restore, increase and enhance all types of wetlands, riparian habitat and associated uplands throughout the San Francisco Bay region to benefit waterfowl and other fish and wildlife populations" (www.sfbayjv.org/mission.html). The SFBJV is composed of a Management Board of 27 agencies and private organizations, and four Working Committees established to accomplish specific SFBJV objectives. These objectives include the following:

- Secure wetlands, riparian habitat and associated upaldns through fee or permanent easement acquisition.
- Restore and enhance wetlands, riparian habiatat and associated upaland son both public and private lands using non-regulatory techniques.
- Improve habitat management on publicly and privately owned wetland, riparian habitat and associated uplands through the use of cooperative management agreements and voluntary incentive programs.
- Strengthen existing and promote new funding sources for wetlands acquisition, restoration, enhancement and management programs.
- Support monitoring and evaluation of existing restoration projects, as well as pertinent research studies, to improve future restoration projects.

In 2001, SFBJV published a 20-year collaborative plan for the restoration of wetland and wildlife in the Bay region called *Restoring the Estuary: an Implementation Strategy for the SFBJV*. The Implementation Strategy builds on the science-based recommendations of the Goals Project and establishes specific acreage goals for wetlands, including bay habitats, seasonal wetlands, and creeks and lakes. The Implementation Strategy lays out programmatic and cooperative strategies for accomplishing these goals. Over the next two decades, the SFBJV partners have agreed to acquire and/or restore or enhance 260,000 acres of a variety of wetlands types located throughout the San Francisco Bay Estuary.

Along shoreline within the project vicinity, SFBJV activities will focus on restoring parcels already owned by the Don Edwards San Francisco Bay National Wildlife Refuge (Refuge), such as Mayhew's Landing and the Knapp Tract. Other SFBJV shoreline activities include developing partnerships for purchasing Cargill's salt ponds. Away from the Bay's edge, there are a number of watershed and riparian restoration efforts, such as the work being undertaken as part of the San Francisquito Coordinated Resource Management Plan. There are also ongoing projects involving the restoration of scores of miles of Coyote Creek and the Guadalupe River in San Jose, some of which have been underway for over a decade.

San Francisco Bay Trail Plan (Bay Trail Plan) The Bay Trail is a planned recreation corridor that will provide 400 miles of biking and hiking trails when completed. It will link nine counties, 47 cities, and 130 parks and recreation areas around San Francisco and San Pablo Bays. As mandated under Senate Bill 100, ABAG developed the Bay Trail Plan as a framework to provide guidance in the selection and implementation of the Bay Trail project. The main goal of the Bay Trail Plan is to provide public access to the Bay and its surrounding shorelines. Existing and planned segments of the Bay Trail are adjacent to the project sites. (For further discussion of the Bay Trail and Bay Trail Plan, see Chapter 8.0, *Recreational and Public Access, Visual Resources and Public Health.*)

11.2 Criteria for Determining Significance of Effects

Criteria based on the State CEQA Guidelines were used to determine the significance of land use and planning–related impacts. The project would have a significant impact on land use and planning if it would:

- Conflict or be incompatible with the land use goals, objectives, or guidance of applicable land use plans or regulations of an agency with jurisdiction over the project;
- Substantially alter present or planned land uses of a site or ???the surrounding area;
- Disrupt or divide the physical arrangement of a community; or
- Result in a substantial conversion of farmland.

The criteria for determining significance of effects relies on the congruence of alternatives with existing plans, policies, and easements as well as proposed land uses.

11.3 Impacts and Mitigation Measures

The proposed project will not conflict or be incompatible with the land use goals, objectives, or guidance of applicable land use plans or regulations. Nor will it disrupt or divide the physical arrangement of a community. None of the project sites are currently in agricultural production.

Under every alternative, including the No Project/No Action Alternative and Seasonal Ponds Alternative, there will be a land use conversion from existing use of the project sites for mineral extraction, open space, and recreation, to open space, habitat restoration, wildlife conservation and recreation uses. Although the ponds within the project sites will no longer be used for salt production, the land use setting, including its rural open space characteristics, will remain essentially unaltered. The proposed land use conversion is consistent with existing local and regional land use plans and policies, described above in Section 11.1.4.

To the extent that project alternatives incorporate options to manage the existing ponds for desired habitat values, the project will be instrumental in furthering the goals and objectives of the regional land use plans and policies. In this respect, the two pond management alternatives will provide a greater benefit than the no project alternative, which includes no management of project ponds.

To the extent that ponds become seasonal ponds (either managed under the pond management alternatives or unmanaged under the no project and seasonal pond alternatives), there may be objectionable odors from these ponds that are incompatible with nearby residential and commercial land uses. Impacts from objectionable odors are addressed in Chapter 9 (Air Quality).

11.3.1 No Project/No Action Alternative

Under this alternative, all 15,100 acres of salt ponds would be seasonal ponds without levee maintenance. Ponds would be expected to seasonally hold rainwater during the winter, and dry out during summer months. No levee maintenance would be conducted under this alternative. Eventually, without maintenance, the levees would be expected to breach and the ponds would be opened to tidal influence.

This alternative would reduce the agencies' ability to manage water and salinity levels for specific habitat values. However, the use of the project sites for open space, wildlife conservation, and recreation under this alternative would still be compatible with land uses identified for project area in the Bay Plan. The alternative would also be consistent with other regional plans and policies described in Section 11.1.4.

> *LAND USE IMPACT-1.* The unmanaged wetting and drying cycles in the seasonal ponds have the potential to produce objectionable odors. These odors would be incompatible with nearby residential and commercial land uses.

The potential of this alternative to generate pond odor impacts is addressed in Chapter 9 (*Air Quality)*. Leaving the ponds in a dry condition, with unmanaged wetting and drying cycles as the ponds accumulate rainwater and dry through natural evaporation, could result in exposure of biomass produced while the pond contained water. This alternative could potentially expose more areas to unmanaged drying, potentially during the warmest periods of the year. It could also potentially lead to ponds drying out that are either in close proximity to neighboring populations or have not dried out in the past, exposing neighboring residents to odors they have not experienced before.

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

11.3.2 Alternative 1 Seasonal Ponds

Impacts under this alternative are expected to be the same as those under the No Project/No Action Alternative.

11.3.3 Alternative 2 Simultaneous March-April Initial Release

In Alternative 2, the contents of most of the Alviso and Baumberg Ponds would initially 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.

As noted above, implementation of the ISP is consistent with existing local and regional land use plans and policies, described above in Section 11.1.4.

> *LAND USE IMPACT-2.* Management of the ponds has the potential to produce objectionable odors incompatible with nearby residential and comercial land uses.

The potential of this alternative to generate odor impacts is addressed in Chapter 9 (Air Quality). The potential odor impacts associated with the seasonal ponds under this alternative would be the same as those listed under the No Project Alternative, except that a significantly fewer number of ponds would be dry at any time.

Odor impacts associated with the ponds containing brine would be similar to impacts under the baseline scenario of current pond management. Algae and other biomass grows in the ponds and can accumulate in certain areas of the ponds and decompose, particularly in ponds that have remained stagnant for a long period of time and during hot weather.

Air Quality Mitigation-1 would mitigate the impacts from Land Use Impact-1 as follows (see also Chapter 9, *Air Quality*):

> *AIR QUALITY MITIGATION-1*: Mitigation for those ponds noted above where there is a possible risk of odor production in summer months consists of the following:
>
> *AIR QUALITY MITIGATION-1A*: Drain at-risk ponds by releasing all water to expose any organic material before the onset of warm weather during the summer.
>
> *AIR QUALITY MITIGATION-1B*: If odors result from biomass accumulating and stagnating in ponds containing brine, increase circulation through the ponds.

Post-mitigation significance: Less than significant

11.3.4 Alternative 3 Phased Initial Release

Impact under this management scenario would be the same as those listed under Alternative 2.

12.0 CUMULATIVE IMPACTS AND OTHER REQUIRED ANALYSES

12.1 Introduction to Cumulative Analysis

NEPA and CEQA require the analysis of cumulative impacts (Sections 12.1 and 12.2), irreversible and irretrievable commitments of resources (Section 12.3), the relationship between short-term uses of the environment and the maintenance and enhancement of long-term environmental productivity (Section 12.4), and growth-inducing effects (Section 12.5). NEPA also requires a consideration of impacts to environmental justice and the protection of children (Section 12.6). Finally, this chapter identifies any significant unavoidable adverse impacts that were identified during preparation of the EIR/EIS (Section 12.7).

Cumulative impacts are effects which result incrementally from an action or undertaking and other past, present, and reasonably foreseeable near-term future actions, taken together (regardless of the agencies or parties involved). In other words, significant cumulative impacts can result from the combination of effects within a given locality or region that are not individually significant.

For the purposes of this analysis, "past actions" are actions within the project region of influence (ROI) that occurred within the past 10 years. "Present actions" include (1) current operations within the ROI and (2) current resource management programs, land use activities and development projects that are being implemented by other governmental agencies and the private sector (where they can be identified) within the region. To avoid undue speculation about possible future projects that may contribute to cumulative effects, "reasonably foreseeable future actions" are those which have been approved for implementation by appropriate authorities and can be identified and defined with some respect to time frame and location.

For this project, the ROI is the South Bay; that is, approximately the portion of the Bay from the vicinity of the San Mateo Bridge (Highway 92) and to the south. In addition, the 9,456-acre Napa Restoration Project in the North Bay is included because of its scale and similar nature to the South Bay Salt Ponds Project, making it a likely contributor to cumulative impacts.

12.1.1 Methodology

The project specific effects of the alternatives were evaluated to assess the potential cumulative effects. Only those effects that were identified as permanent effects and that have the potential to be additive to the effects of other projects in the region are analyzed. The analysis focuses on the following resource categories:

- Hydrology
- Water-quality
- Sediments
- Biological resources—benthic organisms
- Biological resources—birds and other wildlife

- Biological resources—fish

Effects to the following resource categories discussed in detail in this EIR were found not to have the potential to contribute to cumulative impacts because effects are expected to be extremely minor, of very short duration, and/or to have no potential to be additive and therefore contribute to cumulative impacts:

- Cultural resources (see Chapter 7)— No significant impacts to cultural resources have been identified. The project will involve construction on the salt pond levees. The levees are historic features of the salt production industry in the South Bay, portions of which may be over 100 years old. Any disturbance to the levees will be similar in nature to disturbances that have been a routine part of Cargill's operations and maintenance activities at the ponds. The South Bay salt works have not been evaluated for National Register or California Register eligibility. However, the project will not impact the integrity of the salt works beyond the impacts that have already occurred under existing salt operations.
- Recreation and public access (see Chapter 8)— Although the No Project/No Action alternative could affect existing public access, all other project alternatives will maintain existing public access. The two pond management alternatives provide a modest increase in public recreation and access opportunities. In addition, none of the alternatives foreclose options for future development of public access facilities, which are being planned under the Long Term Salt Pond Restoration Plan.
- Air quality (see Chapter 9)— Impacts from pond odors in ponds that are managed seasonally are limited to the immediate project area, are similar to existing conditions, and are therefore not considered subject to cumulative impacts. Construction of the water control structures proposed under the ISP would involve very limited production of fugitive dust and emissions from construction vehicles. This would be insignificant compared to impacts from other construction projects and from motor vehicle emissions on highways and streets in the project area.
- Socio-economic resources (see Chapter 10)— The project would not contribute to significant loss of jobs, movement of people, or loss of taxes or other revenue; therefore, the project would not contribute to cumulatively socio-economic impacts.
- Land use planning (see Chapter 11)— Implementation of the ISP is part of a long-range strategy to convert land use of the project sites from mixed industrial/wildlife conservation/recreation to a focus on wildlife conservation/recreation uses. This change is consistent with existing local and regional plans and policies and is considered an overall positive land use impact.

In addition, the following resource categories were eliminated from detailed discussion in this EIR (see explanation in Section 1.6.1):

- Agriculture
- Indian trust assets
- Navigation and navigation safety
- Noise
- Population and housing

- Soils, geology and geologic hazards
- Transportation, traffic and roadway safety
- Public services and utilities

The project would have a significant cumulative impact if it, in conjunction with other projects, would exceed the significance criteria established for a resource topic.

The methodology used to analyze the cumulative impacts associated with the key resource topics identified above included:

1. Developing a list of past-present and reasonably foreseeable future projects in the vicinity of the project area (see Section 12.1.2 below)
2. Reviewing concerns recently expressed by a scientific panel about the cumulative impacts of bay-wide restoration and mitigation efforts
3. Reviewing the general plans of local counties
4. Qualitatively evaluating the cumulative impacts of past, present, and future projects

12.1.2 Projects Addressed in the Cumulative Impacts Analysis

Past, ongoing, and reasonably projects in the South San Francisco Bay region that could result in cumulative impacts are summarized in Table 12-1. Most of these are wetlands restoration, enhancement, and creation projects, representing a total of approximately 6,409 wetland acres (including tidal wetlands, muted tidal wetlands, managed marsh, perennial and seasonal non-tidal wetlands) in the South Bay.

The Napa Restoration Project in the North Bay is not included in Table 12-1, but is also included in the cumulative impacts analysis because of its scale and similarity to the South Bay Salt Ponds Project. This project is not included in Table 12-1, but is discussed further below. The Lower Guadalupe Flood Control Project does not include any plans for wetlands restoration, enhancement, or creation, but its scale and location upstream of the Alviso project ponds makes it a potential contributor to cumulative impacts. This project is also excluded from Table 12-1, but is discussed further below.

Together with the 15,100 acres of Cargill salt ponds being considered in this EIR, and the 9,456-acre Napa Restoration Project, the total area of completed and planned wetlands that are subject to cumulative impacts under the proposed project is 30,965 acres.

Table 12-1
Past, ongoing, and reasonably foreseeable future projects in the project region of influence (ROI), subject to cumulative impacts.

Project/Component Projects	County[1]	Acreage[2]	Status
Completed Projects			
Bair Island SFO Mitigation	SM	220.16	Completed 2000
Bayside Business Park, Phase II	A	40.6	Completed 2002
Cargill Mitigation Marsh (Baumberg)	A	49.16	Completed 1998
Charleston Slough	SC	101.32	Completed 1996
Cooley Landing	SM	118.43	Completed 2002
Harvey Marsh	SC	52.01	Completed 1994
Hayward Shoreline Enhancement Project	A	72.07	Completed 2002
KGO Towers	A	1.27	Completed 1996
La Riviere Marsh	A	141.22	Completed 1987
Oro Loma Mitigation Marsh	A	12.87	Completed 2000
Oro Loma Restoration	A	316.74	Completed 1997
Pacific Commons	A	878.66	Completed 2002
Pacific Shores Deep Water Slough	SM	113.67	Completed 2000
Palo Alto Harbor	SC	14.29	Completed 1994-1997
Plummer Creek Mitigation	A	26.94	Completed 1998
Ravenswood Triangle	SM	3.03	Completed 2001
San Carlos Airport North Clear Zone	SM	0.37	Completed 1997
Sanchez Creek Wetland	SM	3.12	Completed 1987
Seal Slough	SM	47.19	Completed 1983
Triangle Marsh, Hayward Shoreline	A	8.69	Completed 1990
Triangle Marsh, Refuge Entry	A	9.37	Completed 2001
Planned Projects			
Bair Island, USFWS	SM	1,385.22	Planned
Coyote Creek Flood Control Project	SC	77.28	Planned
Eden Landing	A	854.00	Under construction
Perry Gun Club (at Eden Landing)	A	62.04	2002
Foster City Marsh	SM	29.15	Planned
Hayward Shoreline Enhancement Project – Oliver Salt Ponds	A	134	Planned 2004
Moseley Tract	SM	60.99	Planned
Pond A4	SC	306.43	Planned
Pond A18	SC	855.56	Planned
San Mateo Shoreline Parks	SM	13.1	Planned
Warm Springs Pasture	A	295.41	Planned

Source: San Francisco Estuary Institute's website: dev.sfei.org

[1] Counties: A=Alameda, SC=Santa Clara, SM=San Mateo

[2] Where different mapped and reported acreages were provided, the mapped acreage was selected for this table.

Primary Contributors to Cumulative Impacts

Additional information is provided below on several projects that, due to their scale, location, and/or relationship to the proposed South Bay Salt Ponds Project, are expected to be the primary projects contributing to cumulative impacts.

CDFG Eden Landing Ecological Reserve—The CDFG Eden Landing Ecological Reserve was established in May 1996 to restore former salt ponds and crystallizers to tidal salt marsh and seasonal wetlands. Restoration was initiated in 2001 and is ongoing.

Lower Guadalupe River Flood Protection Project—The Santa Clara Valley Water District (SCVWD) is in the process of obtaining permits to implement the Lower Guadalupe River Flood Protection Project, which will accommodate the 17,000 cfs 100-year flood capacity of the Guadalupe River Flood Control Project currently under construction. The Guadalupe River Project is located upstream of the Lower Guadalupe River Flood Protection Project and is scheduled to go on line in spring 2004.

As currently designed, the Lower Guadalupe River Flood Protection Project would affect the magnitude and duration of flooding downstream of the project at the Cargill Salt Ponds, and in Alviso. Currently, when flood flows in the lower Guadalupe River exceed 6,800 cfs, Alviso Slough downstream of the Union Pacific Railroad crossing will over-top its west bank at Pond A8W. The flood control project would increase lower Guadalupe River channel capacity at the railroad crossing to 17,000 cfs and therefore increase the potential for flooding conditions in the downstream salt ponds. During flood conditions, estimated depths in ponds A5, A7, A8D and A8W would increase by up to 1 foot compared to current conditions. Flood volumes would increase from 15 to 21% and duration of flooding would increase by 12 to 30%. Without pumping or other evacuation methods, it would take months, even years for the floodwaters to evaporate under current conditions.

To reduce the potential for flooding and duration of flooding in the ponds, addition mitigation measures to be implemented include constructing an Alviso Slough Overflow Weir at Pond A8W and hardening of the Pond A6 levee. Continuing flood flows into ponds A5, A6, A7, A8, and A8D via the Alviso Weir would allow adequate storage of flood waters to minimize over-banking in Alviso Slough.

Alviso Pond A4—Alviso Pond A4 will be used by the SCVWD to restore wetland and riparian habitats to mitigate for losses resulting from construction of the Lower Guadalupe River Flood Protection Project.

Pond A5 includes an existing siphon under Guadalupe Slough from Pond A4. Pond A4 has been acquired by the SCVWD for a proposed restoration project. Based on the proposed schedule for the long-term restoration of pond A4 there may be a requirement for interim management of the pond during the initial stewardship period for the CDFG and USFWS ponds. One or more alternatives being considered by the SCVWD for interim management may include operation of Pond A4 as a batch pond with periodic outflows through the siphon to Pond A5. If SCVWD and USFWS agree that flows from A4 are appropriate, the flows would be restricted to time periods and salinity levels that would not have a significant effect on flow rates or discharge salinities from Pond A7. SCVWD would be responsible for preparation of a suitable operation plan for interim management of Pond A4 in coordination with the operation of System A7.

Alviso Pond A18—The City of San Jose recently purchased Alviso Pond A18 from Cargill. Plans for the 855.56 acres that comprise this pond have not yet been developed.

Napa-Sonoma Marshes Restoration Project—Salt marsh habitat restoration efforts are ongoing at the 9,456-acre Napa River Unit of the Napa-Sonoma Marshes Wildlife Area (NSMWA). This site consists of 7,190 acres of salt ponds and levees and 2,266 acres of fringing marsh and slough. This project is in the planning phase. The DEIR/EIS for this project was circulated in April 2003 and the comment period has closed.

12.2 CUMULATIVE ANALYSIS

The impacts of the proposed South Bay Salt Ponds ISP and other wetlands restoration, enhancement, and creation projects in the Bay can generally be considered cumulatively beneficial. These projects will result in a long-term net increase in habitat suitable for sensitive plant communities and special-status plant species. They will provide improved habitat for fish in the Bay. In the long-term, they will result in improvements to water quality by sediment filtering and other mechanisms by which wetlands can improve water quality.

Although the proposed South Bay Salt Ponds ISP will have some initial impacts from increased salinity in receiving waters following initial pond discharges, these impacts are considered to be short-term and are not subject to cumulative effects. Following the short-term impacts during the Initial Release Period, longer-term impacts are expected to be the same for the two Pond Management alternatives. Since cumulative impacts are generally limited to the longer-term impacts, cumulative impacts are also expected to be the same for the two Pond Management alternatives. The No Project Alternative may also be subject to cumulative impacts in a few resource categories and these cases are explained below. Generally, mitigation proposed for significant impacts of each of the Project alternatives will also serve to mitigate any potential contribution these alternatives would have to cumulative effects.

12.2.1 Hydrologic and Hydraulic Conditions

The No Project alternative could result in increased flood risk for the ponds and adjacent property from some levee erosion and unplanned levee failures. Alternative 1, Seasonal Ponds, would include maintenance of existing levees and facilities and would not change the existing risk of flooding. For both the No Project alternative and Alternative 1, the water levels in the ponds would be lower than existing conditions and would increase the available storage within the ponds to contain potential overflows from adjacent creeks or sloughs.

For Alternatives 2 and 3, the existing levees and facilities would be maintained and the existing risk of flooding due to unplanned levee failures would not be affected. In general, water levels in the ponds would be similar to existing conditions and would not affect the available storage within the ponds to contain potential overflows from adjacent creeks or sloughs. The proposed Lower Guadalupe River Flood Control Project would include flood overflows in large flood events (greater than a 10-year flood) into Pond A8 and the A7 system. The proposed water levels in Ponds A5 and A7 would be similar to existing conditions. Pond A8 would be a seasonal pond with winter water levels lower than existing conditions. The ISP project would not reduce the existing available storage in the ponds. The Lower Guadalupe River Flood Control Project also identified a smaller overflow into Pond A12 in the A14 system. The A14 system includes two ponds (A9 and A10) with water levels which would increase during the ISP. The estimated overflow volume during the 100-year design flood would not exceed the existing pond system capacity. In addition, inflow to the A14 system would be stopped during the winter to protect salmonids. Therefore, the winter water levels in the system could be maintained a levels similar to existing conditions. The potential for increased flooding would be less than significant.

Discharge of ISP pond waters would only occur at low tides when water levels in the creek or slough are low. The ISP discharges would not occur during flood events when channel water levels are high. Therefore, the ISP discharges would not affect the peak flow conditions considered in the design of the lower Guadalupe River channel capacity, and would not increase potential channel impacts from erosion, scour, re-suspension of sediments, and deposition into receiving waters.

12.2.2 Water Quality

The reintroduction of tidal influence to the project site and other restoration projects in the region would generally improve water quality in San Francisco Bay. Implementation of the ISP could result in some potentially significant temporary water quality impacts; however, these impacts would be limited in scope and duration and are unlikely to contribute to cumulative water quality impacts in the Bay or any of its tributaries. Operation of construction equipment during construction of proposed water control structures under the Pond Management alternatives could result in minor releases of contaminants and minor erosional impacts that would not contribute significantly to cumulative impacts. Likewise, potentially significant water quality impacts from saline discharges from project ponds into Alviso Slough, Guadalupe Slough, the Alameda Flood Control Channel, and Old Alameda Creek are expected to be limited to a 3- to 5-week period and would not, therefore, contribute to cumulative water quality impacts in these waters or in the Bay to which they discharge.

Differences in conventional constituents (e.g., pH, temperature, TSS, DO, BOD and biostimulatory nutrients [nitrogen and phosphorus] between the project ponds and background receiving waters are relatively low, compared to the differences in salinities in the ponds and receiving waters. Therefore, careful management of salinity during ISP implementation should result in small changes in conventional constituents in the receiving waters. Project impacts from heavy metals are limited to exceedances of the nickel water quality objectives (WQOs) at the pond discharge points. The limited scope of this impact exempts it from cumulative impact analysis.

In the long-term, the impact of the project and other wetlands restoration, enhancement, and creation projects, is expected to be positive since wetlands are generally acknowledged to provide favorable water quality improvement mechanisms, such as filtration, settling and entrapment of sediment, photodegradation, adsorption, and enhanced biological activity (uptake, chemical transformation, degradation). The project would also have a specific beneficial impact in Coyote Creek, where the discharge of saline pond water would mitigate impacts in the creek from the release of fresh water from the San Jose Wastewater Treatment Plant, located upstream of the ISP ponds.

Results from data collection efforts at the project sites will be shared with regional natural resource managers who are evaluating habitat conditions within the San Francisco Bay as a whole and with planners who are developing the Long Term Salt Pond Restoration Plan. Information on the relationship between water quality and impacts to biological organisms may be gained from monitoring included as a part of the project or as project mitigation. By shedding additional light on this issue and providing the opportunity to respond to problem areas, the project may be considered to have an overall beneficial impact. If the project is not implemented, the opportunity of monitoring and responsive adaptive management would be lost.

12.2.3 Sediments

Project impacts, including increases in the mobility and bioavailability of contaminants in sediments, formation of salt/gypsum-affected soils, and changes in pond water levels resulting in greater potential exposure of wildlife to contaminants in pond sediments, are largely limited in scope to the ponds themselves. However, these changes could cause indirect cumulative impacts to birds and other wildlife that may be exposed to mercury, nickel, and other contaminants at other locations, as well as at the South Bay Salt Ponds project area. On the other hand, information on the relationship between the mobility and bioavailability of contaminants in sediments and impacts to biological organisms may be gained from monitoring included as a part of the project or as project mitigation. By shedding additional light on this issue and providing the opportunity to respond to problem areas, the project may be considered to have an overall beneficial impact. If the project is not implemented, the opportunity of monitoring and responsive adaptive management would be lost.

There is some concern that, with the scale of wetland restoration projects being undertaken around the San Francisco Bay, there may not be adequate local sediments available for the restoration projects. Many of the proposed sites are subsided and would require substantial sedimentation before restoration could proceed. In addition, there is a concern that these large-scale projects could alter the sediment balance in the Bay and result in a reduction in mudflat/shallow water habitats. Implementation of the ISP only involves marsh restoration on the Island Ponds site. This area involves a relatively small acreage and higher elevation ponds, and is therefore not expected to be a major sedimentation “sink”, Consequently, the project is not expected to contribute to cumulative impacts to the sediment balance in the Bay.

12.2.4 Biological Resources-

Potentially significant adverse cumulative impacts to biological resources include the spread of invasive plant species, such as invasive cordgrasses; conversion of open water habitat favored by some shorebirds to habitat favoring tidal marsh-dependent bird species; and the overall loss of medium- to high-salinity pond waters with resulting impacts to water birds.

Benthic Organisms

Impacts to benthic organisms are tied largely to impacts to the quality of the water they inhabit. As noted above (see Section 12.2.2), water quality impacts from the proposed project are anticipated to be of short duration and scope and are therefore not considered subject to cumulative effects. The primary impacts of the project to benthic organisms would be from increased salinity in waters that receive initial pond discharges. Potentially significant elevations in salinity in receiving waters would be limited to 3- to 5-weeks following the Initial Release Period. This may result in some mortality of benthic organisms and some shifts in location of sessile benthic organisms. For example, the major change for bay shrimp as a result of the initial high saline discharges would probably be a shift in their preferred habitat to locations upstream. After the Initial Release Period, juvenile and adult shrimp in receiving sloughs and creeks will not be significantly impacted by continuous circulation of relatively low salinity pond water.

Benthic organisms in the Bay Area have in the past shown a remarkable resiliency to ecosystemic disturbances, including changes in water salinity. Although the benthic community in the South Bay will likely exhibit such resiliency in response to the short-term changes in salinity and other water quality constituents immediately following the initial discharge of project ponds, continued challenges to these communities could, over time, weaken their ability to rebound. However, other projects in the vicinity are not expected to have similar impacts to water quality. Therefore, cumulative impacts to benthic organisms from the proposed project are not anticipated.

Vegetation and Wetlands

Implementation of ISP is part of a long-term strategy to re-create a complex mosaic of wetlands habitats in the San Francisco Bay area. The installation or replacement of water control structures would remove or disturb small areas containing jurisdictional wetland vegetation and pickleweed cover (significant because it provides habitat for the state- and federally-listed endangered salt marsh harvest mouse and because there is so little existing vegetation at the project sites). The total area of disturbance at all three pond complexes (Alviso, Baumberg, and West Bay) would be approximately 2.91 acres of jurisdictional wetlands, including 1.99 acres of areas with a greater than 25% pickleweed cover. However,, the overall cumulative impact of the project on marsh and wetland vegetation will be positive.

The project presents the opportunity to restore sensitive wetlands vegetation communities on over 15,000 acres of lands in the South Bay. Some actions proposed in the ISP would contribute directly to the cumulative beneficial impacts of other restoration projects in the Bay Area. Specifically, breaching the Island Ponds under Pond Management Alternatives 1 and 2 would allow the establishment of transitional salt marsh and brackish marsh plant communities within an area of 475 acres, contributing to other efforts to restore, enhance, or create these types of plant communities in the Bay Area. Although the ISP does not include proposals for wetlands restoration (other than the tidal wetland restoration that would naturally occur following the proposed breaching of the Island Pond levees), it should be viewed as part of a long-range plan for habitat restoration on the over 15,000 acres of the South Bay Salt Ponds.

The project may contribute to negative cumulative impacts related to the invasion of aggressive non-native plant species. The project, along with other proposed or reasonably foreseeable tidal restoration projects would expand tidal habitat suitable for the rapid invasion and dominance by non-native cordgrasses (*Spartina alterniflora, S. densiflora, S. patens*) and other aggressive exotic plant species. Smooth cordgrasses and other non-native invasive species are aggressive colonizers of open, unvegetated habitats typical of early tidal marsh restoration projects.

As discussed in Section 6.2, if left unabated, *S. alterniflora* could become a dominant salt marsh plant species in the South Bay, changing important ecosystem functions such as sedimentation dynamics and detrital production. Once established in the San Francisco Bay Estuary, invasive cordgrasses could rapidly spread to other estuaries along the California coast through seed dispersal on the tides, potentially resulting in a variety of long-term cumulative impacts to existing plants and wildlife throughout the California coast.

The number of restoration projects planned in the area increases the availability of suitable habitat for colonization. Several restoration projects along San Francisco Bay have been degraded because non-native, smooth cordgrass has out-competed native

California cordgrass. Concerning the proposed South Bay Salt Ponds ISP, the proposed breaching of the Island Ponds could create conditions favorable for establishment of invasive cordgrass species and their hybrids on approximately 475 acres. Monitoring by the San Francisco Estuary Invasive *Spartina* Project found that non-native *Spartina* species had spread to dominate nearly 500 acres of tidal marsh, predominantly in the South and Central Bay, by the year 2000 (CSCC and USFWS, 2003). Additional cordgrass colonization on the 475 acres made suitable by the Island Pond breaching would be a significant contribution to this cumulative impact.

The ability to successfully control the cumulative effects and spread of exotic species of cordgrass and other plants requires a region-wide effort and the willingness of resource agencies to fund bay-wide control programs. The ISP includes provisions for monitoring and control of exotic pest plant species within the restored marsh and adjacent tidal marshes. USFWS will coordinate with the SCVWD to ensure that existing clusters of *S. alterniflora* in the vicinity of the Island Ponds are removed prior to breaching the ponds. USFWS and CDFG will also coordinate the ISP implementation with the Invasive *Spartina* Project, a region-wide program to control non-native *Spartina* in the San Francisco Estuary.

Birds and Other Wildlife

Implementation of the project in conjunction with other projects envisioned in the area would result in an overall increase in the availability, and ultimately the quality, of marsh fringe aquatic habitats throughout the San Francisco Bay area. Nursery habitat for many birds and other wildlife species would be greatly enhanced by the implementation of this and other restoration efforts. Changes in water levels in some of the ISP project ponds could result in impacts to nesting colonies of certain water birds in the South Bay from increased predator access and/or flooding. However, wetlands restoration, enhancement, and creation projects in the South Bay would generally provide a cumulative benefit to nesting birds. In addition, monitoring of impacts to bird species is included in the project alternatives or mitigation measures.

Impacts to birds and other wildlife from increased mobility and bioavailability of contaminants in sediments are discussed in Section 12.2.3. As stated there, these impacts are not expected to contribute to cumulative impacts and the impacts would be largely mitigated by monitoring measures included in the project alternatives or in mitigation measures. Any potential impacts from avian botulism would also be reduced to less than significant by monitoring and adaptive actions, and would not be subject to cumulative effects.

Restoration of tidal action to the 475-acre Island Pond area, following the proposed breaching of the Island Ponds, would result in a substantial long-term increase in lower marsh and middle marsh habitats. These habitats are suitable for various endangered species and species of special concern, including the California clapper rail, California black rail, salt marsh harvest mouse, salt marsh wandering shrew, northern harrier, and salt marsh common yellowthroat.

Although the ISP does not include proposals for wetlands restoration (other than the tidal wetland restoration that would naturally occur following the proposed breaching of the Island Pond levees), it should be viewed as part of a long-range plan for habitat restoration on the over 15,000 acres of the South Bay Salt Ponds. Cumulatively, habitat restoration efforts in the South Bay would result in greater habitat complexity, diversity, and productivity.

Impacts to Waterbirds from Loss of Medium- and High-Salinity Ponds— Under the No Project/No Action and Seasonal Pond Alternatives, 100% of the Medium and High Salinity Ponds in the project area (5,702 acres) would be lost. From a regional perspective (including the ISP project area and the remaining active salt ponds in Fremont and Newark), the acreage of medium or high salinity ponds would be reduced from 10,402 acres to 4,700 acres (a 49% decrease).

Under the Pond Management Alternatives, the total number of medium- or high-salinity ponds would be reduced from 24 to 3 (Alviso Ponds A12, A13, and A15) (Table 2-1), which represents a decrease from 5,702 to 827 acres (an 85 percent decrease). From a regional perspective (including the ISP project area and Cargill's Newark ponds), the acreage of medium- or high-salinity ponds would be reduced from 10,402 to 5,527 acres (a 47 percent decrease). These habitat changes would substantially reduce the amount of available foraging habitat in the South Bay for waterbird species that favor medium- and high-salinity ponds.

However, under various adaptive management strategies, the following ponds could be managed as medium-salinity batch ponds rather than low-salinity ponds, if the ISP manager determines such alternative operations are necessary: Alviso Ponds A2E, A3N, and A8 and Baumberg Ponds 4, 7, 1C, 5C, 12, 13, and 14. As a result, the area of medium- and high-salinity habitat would be reduced from 5,702 to 1,872 acres (67 % decrease) . Thus, under the Pond Management alternatives, the reduction in medium to high salinity ponds in the project area could range between 67% and 85%. From a regional perspective (including the ISP project area and the remaining active salt ponds in Fremont and Newark), the acreage of medium- and high-salinity ponds would be reduced from 10,402 to 6,572 acres (a 37 percent decrease), compared to the 47 percent decrease without adaptive management).

Note: please see Section 6.3.1.1 (Habitat Conditions) for the definitions of salinity categories, which differ from those in other sections of the EIR/EIS.

Impacts to Shorebirds and Waterfowl from Loss of Open Water Habitat—The potential large-scale conversion of salt ponds and other types of seasonal wetland habitats to tidal habitats could have a long-term adverse impact on shorebird and waterfowl populations and use in the Bay. A cumulative change in open water habitats used by migratory shorebirds and waterfowl is expected over the next 20 to 50 years. This change could result in either an increase or decrease of open –water habitat, depending on which restoration/mitigation projects are implemented.

Under the No Project/No Action and Seasonal Pond alternatives, all 15,000 acres of salt ponds would be dry in the summer and ponded with shallow water in wet years during winter. This would result in loss of open water habitat year round for waterbirds that use deep water habitat (diving ducks and piscivorous birds) and during summer and fall for shorebirds that use shallow ponds. However, these unmanaged seasonal ponds would provide additional habitat for the threatened Western Snowy Plover.

Implementation of the Managed Pond alternatives would contribute much less to a cumulative loss of open water habitat. Approximately 475 acres of open waters within the Island Ponds would be converted to tidal habitat and the area of managed seasonal ponds within the project area would increase from 715 to at least 3,233 acres..

Since San Francisco Bay is one of only a few sites in North America that regularly support shorebirds in the hundreds of thousands, the loss of such habitat could have significant impacts on regional shorebird populations, especially for the shorebird species noted above. San Francisco Bay is also a critically important site for wintering and migrating water birds in the Pacific Flyway and the project could contribute to cumulative impacts on water bird populations throughout the Pacific Flyway.

The San Francisco Bay Ecosystems Goals Project (1999) has attempted to address this issue and develop recommendations for goals for key habitats in different regions in the Bay. In the South Bay subregion, the habitat goal recommendations are to increase tidal marsh habitats from the approximately 9,000 acres to 25,000 or 30,000 acres and managing 10,000 to 15,000 acres of salt pond habitat. This equates to a rough ratio of 2 to 2.5 acres of tidal marsh to 1 acre of managed salt pond habitat. Implementation of the ISP would contribute approximately 475 acres of tidal marsh restoration and during the interim project period it would contribute approximately 14,500 acres of managed salt pond/panne habitat to these broad, long-term goals.

Cumulative impacts to migratory shorebirds and waterfowl could be mitigated to some degree by the availability of numerous foraging and refuge areas throughout the Bay. Migratory shorebirds and waterfowl would likely re-distribute among available habitats in the South Bay, such as the existing salt ponds at Don Edwards National Wildlife Refuge, the Cargill Salt Ponds, and the open waters of the Eden Landing Ecological Reserve and Outer Bair Island.

Impacts to Special Status Species Habitat—Implementation of the ISP would result in the short-term loss of existing salt marsh harvest mouse habitat (SMHM), a state- and federally-listed endangered species and California species of special concern. This loss of this habitat could also impact other endangered species and species of special concern, including the California clapper rail, California black rail, salt marsh wandering shrew, northern harrier, and salt marsh common yellowthroat. This loss (approximately 1.99 acres of >25% pickleweed cover) is very small in comparison to habitat loss that has occurred or is expected to occur as a result of other past, present, or future foreseeable tidal restoration and development projects, and is not likely to contribute to cumulative impacts to SMHM or other special status species. Overall, the project is likely to provide a very significant beneficial effect to SMHM with the potential for a significant increase in SMHM habitat within the 475-acre Island Pond area, following breaching of the Island Ponds. This, together with improvement in SMHM habitat resulting from other habitat projects, would contribute to a cumulative benefit by improving long-term habitat viability and expanding and connecting existing habitat areas as part of the recovery strategy for the species.

It should be noted that the cumulative acreage of impacted SMHM habitat is not a good measure of the significance of the impact to the species. This is because SMHM populations tend to be confined to small, disjunct marsh areas. The populations are typically genetically isolated and the long-term survival of these individual populations is dependent on the ability to maintain viable numbers of individuals within the specific habitat area. The significance of impacts to the species is based on the ability to sustain these separate populations. Impacts of habitat loss or gain would only be cumulatively significant if the loss or gain reduced, eliminated, or improved the ability of a site to sustain or expand the population at that site.

Construction-related impacts to other special status wildlife species would be extremely minor and/or of short duration and are not likely to contribute to significant cumulative effects.

Fish

Implementation of the project in conjunction with other projects envisioned in the area could result in an overall increase in the availability, and ultimately the quality, of marsh fringe aquatic habitats throughout the San Francisco Bay area. Juvenile and rearing habitat for many species of fish would be greatly enhanced by the implementation of this and other restoration efforts. Restoration of the tidal marshes in the project area would result in a substantial long-term increase in lower marsh and middle marsh habitats. Cumulatively, restoration efforts would result in greater habitat complexity, diversity, and productivity and contribute to the overall re-establishment of tidal marsh habitats throughout the Bay.

The installation of water control structures required by the project could lead to juvenile fish entrainment. This would be a potentially significant impact for anadromous fish only. Other fish that become entrained in the project ponds would readily adapt to the in-pond habitat. Following the initial saline discharges from these ponds, the ponds would provide significantly improved habitat for non-anadromous fish. To mitigate any potentially significant impacts to anadromous fish, the inlet structures located on migration corridors will be closed during periods of juvenile fish migration.

The Lower Guadalupe Flood Control Project proposes to use Pond A8 during flood events to reduce flooding. Following implementation of the flood control project, juvenile fish may be entrained in Pond A8 during flood events, which in combination with impacts to anadromous fish under the proposed ISP, could cause cumulative impacts to anadromous fish. However, since the pond inlet structures along Alviso Slough (Guadalupe River) will be closed during the period flooding is likely to occur,, it is not expected to cause significant cumulative impacts.

12.3 Irreversible and Irretrievable Commitment of Resources

The project would require a relatively small and insignificant, but irretrievable commitment of fossil fuels and other energy sources to construct water control features at the ponds. Discharge of pond waters to receiving waters and the proposed breaching of the Island Ponds are actions that could theoretically be reversed at some point in the future.

12.4 Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term uses of the environment that would occur with restoration include the impacts on existing wetlands and habitat and those from construction-related activities. However, in the long term, the site is expected to be substantially more productive for habitat and wildlife values.

12.5 Growth-Inducing Impacts

Section 15162.2(d) of the State CEQA Guidelines requires that an EIR address the potential growth-inducing impacts of a proposed project. Specifically, the EIR shall "discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing either directly or indirectly, in the surrounding environment."

Implementation of the ISP would not foster economic or population growth or the construction of additional housing, and therefore would not have a growth-inducing impact.

12.6 Environmental Justice and Protection of Children

For NEPA purposes, developments or population/housing changes that cause impacts in terms of environmental justice are considered significant. On February 11, 1994, President Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low Income Populations*. The purpose of the order is to avoid the disproportionate placement of adverse environmental, economic, social, or health impacts from federal actions and policies on minority and low-income populations that might be affected by implementation of the proposed action or alternatives.

On April 21, 1997, the President issued Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. Each federal agency must, according to this order, address disproportionate risks to children resulting from environmental health risks or safety risks in all policies, programs, activities, and standards.

Implementation of the ISP would not result in environmental justice impacts; that is, it would not result in disproportionate placement of adverse environmental, economic, social, or health impacts from federal actions and policies on minority and low-income populations. Nor would it cause disproportionate environmental health or safety risks to children.

12.7 Significant Unavoidable Adverse Impacts

The impact to waterbirds from the loss of medium- and high-salinity ponds under the project alternatives is a significant impact. Measures are proposed to mitigate this impact (see Section 6.3.3.2), but the impact remains potentially significant even with these measures. All other impacts identified in this EIR/EIS are expected to be less than significant with the implementation of proposed mitigation measures.

12.0 CUMULATIVE IMPACTS AND OTHER REQUIRED ANALYSES

12.1 Introduction to Cumulative Analysis

NEPA and CEQA require the analysis of cumulative impacts (Sections 12.1 and 12.2), irreversible and irretrievable commitments of resources (Section 12.3), the relationship between short-term uses of the environment and the maintenance and enhancement of long-term environmental productivity (Section 12.4), and growth-inducing effects (Section 12.5). NEPA also requires a consideration of impacts to environmental justice and the protection of children (Section 12.6). Finally, this chapter identifies any significant unavoidable adverse impacts that were identified during preparation of the EIR/EIS (Section 12.7).

Cumulative impacts are effects which result incrementally from an action or undertaking and other past, present, and reasonably foreseeable near-term future actions, taken together (regardless of the agencies or parties involved). In other words, significant cumulative impacts can result from the combination of effects within a given locality or region that are not individually significant.

For the purposes of this analysis, "past actions" are actions within the project region of influence (ROI) that occurred within the past 10 years. "Present actions" include (1) current operations within the ROI and (2) current resource management programs, land use activities and development projects that are being implemented by other governmental agencies and the private sector (where they can be identified) within the region. To avoid undue speculation about possible future projects that may contribute to cumulative effects, "reasonably foreseeable future actions" are those which have been approved for implementation by appropriate authorities and can be identified and defined with some respect to time frame and location.

For this project, the ROI is the South Bay; that is, approximately the portion of the Bay from the vicinity of the San Mateo Bridge (Highway 92) and to the south. In addition, the 9,456-acre Napa Restoration Project in the North Bay is included because of its scale and similar nature to the South Bay Salt Ponds Project, making it a likely contributor to cumulative impacts.

12.1.1 Methodology

The project specific effects of the alternatives were evaluated to assess the potential cumulative effects. Only those effects that were identified as permanent effects and that have the potential to be additive to the effects of other projects in the region are analyzed. The analysis focuses on the following resource categories:

- Hydrology
- Water-quality
- Sediments
- Biological resources—benthic organisms
- Biological resources—birds and other wildlife

- Biological resources—fish

Effects to the following resource categories discussed in detail in this EIR were found not to have the potential to contribute to cumulative impacts because effects are expected to be extremely minor, of very short duration, and/or to have no potential to be additive and therefore contribute to cumulative impacts:

- Cultural resources (see Chapter 7)— No significant impacts to cultural resources have been identified. The project will involve construction on the salt pond levees. The levees are historic features of the salt production industry in the South Bay, portions of which may be over 100 years old. Any disturbance to the levees will be similar in nature to disturbances that have been a routine part of Cargill's operations and maintenance activities at the ponds. The South Bay salt works have not been evaluated for National Register or California Register eligibility. However, the project will not impact the integrity of the salt works beyond the impacts that have already occurred under existing salt operations.
- Recreation and public access (see Chapter 8)— Although the No Project/No Action alternative could affect existing public access, all other project alternatives will maintain existing public access. The two pond management alternatives provide a modest increase in public recreation and access opportunities. In addition, none of the alternatives foreclose options for future development of public access facilities, which are being planned under the Long Term Salt Pond Restoration Plan.
- Air quality (see Chapter 9)— Impacts from pond odors in ponds that are managed seasonally are limited to the immediate project area, are similar to existing conditions, and are therefore not considered subject to cumulative impacts. Construction of the water control structures proposed under the ISP would involve very limited production of fugitive dust and emissions from construction vehicles. This would be insignificant compared to impacts from other construction projects and from motor vehicle emissions on highways and streets in the project area.
- Socio-economic resources (see Chapter 10)— The project would not contribute to significant loss of jobs, movement of people, or loss of taxes or other revenue; therefore, the project would not contribute to cumulatively socio-economic impacts.
- Land use planning (see Chapter 11)— Implementation of the ISP is part of a long-range strategy to convert land use of the project sites from mixed industrial/wildlife conservation/recreation to a focus on wildlife conservation/recreation uses. This change is consistent with existing local and regional plans and policies and is considered an overall positive land use impact.

In addition, the following resource categories were eliminated from detailed discussion in this EIR (see explanation in Section 1.6.1):

- Agriculture
- Indian trust assets
- Navigation and navigation safety
- Noise
- Population and housing

- Soils, geology and geologic hazards
- Transportation, traffic and roadway safety
- Public services and utilities

The project would have a significant cumulative impact if it, in conjunction with other projects, would exceed the significance criteria established for a resource topic.

The methodology used to analyze the cumulative impacts associated with the key resource topics identified above included:

1. Developing a list of past-present and reasonably foreseeable future projects in the vicinity of the project area (see Section 12.1.2 below)
2. Reviewing concerns recently expressed by a scientific panel about the cumulative impacts of bay-wide restoration and mitigation efforts
3. Reviewing the general plans of local counties
4. Qualitatively evaluating the cumulative impacts of past, present, and future projects

12.1.2 Projects Addressed in the Cumulative Impacts Analysis

Past, ongoing, and reasonably projects in the South San Francisco Bay region that could result in cumulative impacts are summarized in Table 12-1. Most of these are wetlands restoration, enhancement, and creation projects, representing a total of approximately 6,409 wetland acres (including tidal wetlands, muted tidal wetlands, managed marsh, perennial and seasonal non-tidal wetlands) in the South Bay.

The Napa Restoration Project in the North Bay is not included in Table 12-1, but is also included in the cumulative impacts analysis because of its scale and similarity to the South Bay Salt Ponds Project. This project is not included in Table 12-1, but is discussed further below. The Lower Guadalupe Flood Control Project does not include any plans for wetlands restoration, enhancement, or creation, but its scale and location upstream of the Alviso project ponds makes it a potential contributor to cumulative impacts. This project is also excluded from Table 12-1, but is discussed further below.

Together with the 15,100 acres of Cargill salt ponds being considered in this EIR, and the 9,456-acre Napa Restoration Project, the total area of completed and planned wetlands that are subject to cumulative impacts under the proposed project is 30,965 acres.

Table 12-1
Past, ongoing, and reasonably foreseeable future projects in the project region of influence (ROI), subject to cumulative impacts.

Project/Component Projects	County[1]	Acreage[2]	Status
Completed Projects			
Bair Island SFO Mitigation	SM	220.16	Completed 2000
Bayside Business Park, Phase II	A	40.6	Completed 2002
Cargill Mitigation Marsh (Baumberg)	A	49.16	Completed 1998
Charleston Slough	SC	101.32	Completed 1996
Cooley Landing	SM	118.43	Completed 2002
Harvey Marsh	SC	52.01	Completed 1994
Hayward Shoreline Enhancement Project	A	72.07	Completed 2002
KGO Towers	A	1.27	Completed 1996
La Riviere Marsh	A	141.22	Completed 1987
Oro Loma Mitigation Marsh	A	12.87	Completed 2000
Oro Loma Restoration	A	316.74	Completed 1997
Pacific Commons	A	878.66	Completed 2002
Pacific Shores Deep Water Slough	SM	113.67	Completed 2000
Palo Alto Harbor	SC	14.29	Completed 1994-1997
Plummer Creek Mitigation	A	26.94	Completed 1998
Ravenswood Triangle	SM	3.03	Completed 2001
San Carlos Airport North Clear Zone	SM	0.37	Completed 1997
Sanchez Creek Wetland	SM	3.12	Completed 1987
Seal Slough	SM	47.19	Completed 1983
Triangle Marsh, Hayward Shoreline	A	8.69	Completed 1990
Triangle Marsh, Refuge Entry	A	9.37	Completed 2001
Planned Projects			
Bair Island, USFWS	SM	1,385.22	Planned
Coyote Creek Flood Control Project	SC	77.28	Planned
Eden Landing	A	854.00	Under construction
Perry Gun Club (at Eden Landing)	A	62.04	2002
Foster City Marsh	SM	29.15	Planned
Hayward Shoreline Enhancement Project – Oliver Salt Ponds	A	134	Planned 2004
Moseley Tract	SM	60.99	Planned
Pond A4	SC	306.43	Planned
Pond A18	SC	855.56	Planned
San Mateo Shoreline Parks	SM	13.1	Planned
Warm Springs Pasture	A	295.41	Planned

Source: San Francisco Estuary Institute's website: dev.sfei.org

[1] Counties: A=Alameda, SC=Santa Clara, SM=San Mateo

[2] Where different mapped and reported acreages were provided, the mapped acreage was selected for this table.

Primary Contributors to Cumulative Impacts

Additional information is provided below on several projects that, due to their scale, location, and/or relationship to the proposed South Bay Salt Ponds Project, are expected to be the primary projects contributing to cumulative impacts.

CDFG Eden Landing Ecological Reserve—The CDFG Eden Landing Ecological Reserve was established in May 1996 to restore former salt ponds and crystallizers to tidal salt marsh and seasonal wetlands. Restoration was initiated in 2001 and is ongoing.

Lower Guadalupe River Flood Protection Project—The Santa Clara Valley Water District (SCVWD) is in the process of obtaining permits to implement the Lower Guadalupe River Flood Protection Project, which will accommodate the 17,000 cfs 100-year flood capacity of the Guadalupe River Flood Control Project currently under construction. The Guadalupe River Project is located upstream of the Lower Guadalupe River Flood Protection Project and is scheduled to go on line in spring 2004.

As currently designed, the Lower Guadalupe River Flood Protection Project would affect the magnitude and duration of flooding downstream of the project at the Cargill Salt Ponds, and in Alviso. Currently, when flood flows in the lower Guadalupe River exceed 6,800 cfs, Alviso Slough downstream of the Union Pacific Railroad crossing will over-top its west bank at Pond A8W. The flood control project would increase lower Guadalupe River channel capacity at the railroad crossing to 17,000 cfs and therefore increase the potential for flooding conditions in the downstream salt ponds. During flood conditions, estimated depths in ponds A5, A7, A8D and A8W would increase by up to 1 foot compared to current conditions. Flood volumes would increase from 15 to 21% and duration of flooding would increase by 12 to 30%. Without pumping or other evacuation methods, it would take months, even years for the floodwaters to evaporate under current conditions.

To reduce the potential for flooding and duration of flooding in the ponds, addition mitigation measures to be implemented include constructing an Alviso Slough Overflow Weir at Pond A8W and hardening of the Pond A6 levee. Continuing flood flows into ponds A5, A6, A7, A8, and A8D via the Alviso Weir would allow adequate storage of flood waters to minimize over-banking in Alviso Slough.

Alviso Pond A4—Alviso Pond A4 will be used by the SCVWD to restore wetland and riparian habitats to mitigate for losses resulting from construction of the Lower Guadalupe River Flood Protection Project.

Pond A5 includes an existing siphon under Guadalupe Slough from Pond A4. Pond A4 has been acquired by the SCVWD for a proposed restoration project. Based on the proposed schedule for the long-term restoration of pond A4 there may be a requirement for interim management of the pond during the initial stewardship period for the CDFG and USFWS ponds. One or more alternatives being considered by the SCVWD for interim management may include operation of Pond A4 as a batch pond with periodic outflows through the siphon to Pond A5. If SCVWD and USFWS agree that flows from A4 are appropriate, the flows would be restricted to time periods and salinity levels that would not have a significant effect on flow rates or discharge salinities from Pond A7. SCVWD would be responsible for preparation of a suitable operation plan for interim management of Pond A4 in coordination with the operation of System A7.

Alviso Pond A18—The City of San Jose recently purchased Alviso Pond A18 from Cargill. Plans for the 855.56 acres that comprise this pond have not yet been developed.

Napa-Sonoma Marshes Restoration Project—Salt marsh habitat restoration efforts are ongoing at the 9,456-acre Napa River Unit of the Napa-Sonoma Marshes Wildlife Area (NSMWA). This site consists of 7,190 acres of salt ponds and levees and 2,266 acres of fringing marsh and slough. This project is in the planning phase. The DEIR/EIS for this project was circulated in April 2003 and the comment period has closed.

12.2 CUMULATIVE ANALYSIS

The impacts of the proposed South Bay Salt Ponds ISP and other wetlands restoration, enhancement, and creation projects in the Bay can generally be considered cumulatively beneficial. These projects will result in a long-term net increase in habitat suitable for sensitive plant communities and special-status plant species. They will provide improved habitat for fish in the Bay. In the long-term, they will result in improvements to water quality by sediment filtering and other mechanisms by which wetlands can improve water quality.

Although the proposed South Bay Salt Ponds ISP will have some initial impacts from increased salinity in receiving waters following initial pond discharges, these impacts are considered to be short-term and are not subject to cumulative effects. Following the short-term impacts during the Initial Release Period, longer-term impacts are expected to be the same for the two Pond Management alternatives. Since cumulative impacts are generally limited to the longer-term impacts, cumulative impacts are also expected to be the same for the two Pond Management alternatives. The No Project Alternative may also be subject to cumulative impacts in a few resource categories and these cases are explained below. Generally, mitigation proposed for significant impacts of each of the Project alternatives will also serve to mitigate any potential contribution these alternatives would have to cumulative effects.

12.2.1 Hydrologic and Hydraulic Conditions

The No Project alternative could result in increased flood risk for the ponds and adjacent property from some levee erosion and unplanned levee failures. Alternative 1, Seasonal Ponds, would include maintenance of existing levees and facilities and would not change the existing risk of flooding. For both the No Project alternative and Alternative 1, the water levels in the ponds would be lower than existing conditions and would increase the available storage within the ponds to contain potential overflows from adjacent creeks or sloughs.

For Alternatives 2 and 3, the existing levees and facilities would be maintained and the existing risk of flooding due to unplanned levee failures would not be affected. In general, water levels in the ponds would be similar to existing conditions and would not affect the available storage within the ponds to contain potential overflows from adjacent creeks or sloughs. The proposed Lower Guadalupe River Flood Control Project would include flood overflows in large flood events (greater than a 10-year flood) into Pond A8 and the A7 system. The proposed water levels in Ponds A5 and A7 would be similar to existing conditions. Pond A8 would be a seasonal pond with winter water levels lower than existing conditions. The ISP project would not reduce the existing available storage in the ponds. The Lower Guadalupe River Flood Control Project also identified a smaller overflow into Pond A12 in the A14 system. The A14 system includes two ponds (A9 and A10) with water levels which would increase during the ISP. The estimated overflow volume during the 100-year design flood would not exceed the existing pond system capacity. In addition, inflow to the A14 system would be stopped during the winter to protect salmonids. Therefore, the winter water levels in the system could be maintained a levels similar to existing conditions. The potential for increased flooding would be less than significant.

Discharge of ISP pond waters would only occur at low tides when water levels in the creek or slough are low. The ISP discharges would not occur during flood events when channel water levels are high. Therefore, the ISP discharges would not affect the peak flow conditions considered in the design of the lower Guadalupe River channel capacity, and would not increase potential channel impacts from erosion, scour, re-suspension of sediments, and deposition into receiving waters.

12.2.2 Water Quality

The reintroduction of tidal influence to the project site and other restoration projects in the region would generally improve water quality in San Francisco Bay. Implementation of the ISP could result in some potentially significant temporary water quality impacts; however, these impacts would be limited in scope and duration and are unlikely to contribute to cumulative water quality impacts in the Bay or any of its tributaries. Operation of construction equipment during construction of proposed water control structures under the Pond Management alternatives could result in minor releases of contaminants and minor erosional impacts that would not contribute significantly to cumulative impacts. Likewise, potentially significant water quality impacts from saline discharges from project ponds into Alviso Slough, Guadalupe Slough, the Alameda Flood Control Channel, and Old Alameda Creek are expected to be limited to a 3- to 5-week period and would not, therefore, contribute to cumulative water quality impacts in these waters or in the Bay to which they discharge.

Differences in conventional constituents (e.g., pH, temperature, TSS, DO, BOD and biostimulatory nutrients [nitrogen and phosphorus] between the project ponds and background receiving waters are relatively low, compared to the differences in salinities in the ponds and receiving waters. Therefore, careful management of salinity during ISP implementation should result in small changes in conventional constituents in the receiving waters. Project impacts from heavy metals are limited to exceedances of the nickel water quality objectives (WQOs) at the pond discharge points. The limited scope of this impact exempts it from cumulative impact analysis.

In the long-term, the impact of the project and other wetlands restoration, enhancement, and creation projects, is expected to be positive since wetlands are generally acknowledged to provide favorable water quality improvement mechanisms, such as filtration, settling and entrapment of sediment, photodegradation, adsorption, and enhanced biological activity (uptake, chemical transformation, degradation). The project would also have a specific beneficial impact in Coyote Creek, where the discharge of saline pond water would mitigate impacts in the creek from the release of fresh water from the San Jose Wastewater Treatment Plant, located upstream of the ISP ponds.

Results from data collection efforts at the project sites will be shared with regional natural resource managers who are evaluating habitat conditions within the San Francisco Bay as a whole and with planners who are developing the Long Term Salt Pond Restoration Plan. Information on the relationship between water quality and impacts to biological organisms may be gained from monitoring included as a part of the project or as project mitigation. By shedding additional light on this issue and providing the opportunity to respond to problem areas, the project may be considered to have an overall beneficial impact. If the project is not implemented, the opportunity of monitoring and responsive adaptive management would be lost.

12.2.3 Sediments

Project impacts, including increases in the mobility and bioavailability of contaminants in sediments, formation of salt/gypsum-affected soils, and changes in pond water levels resulting in greater potential exposure of wildlife to contaminants in pond sediments, are largely limited in scope to the ponds themselves. However, these changes could cause indirect cumulative impacts to birds and other wildlife that may be exposed to mercury, nickel, and other contaminants at other locations, as well as at the South Bay Salt Ponds project area. On the other hand, information on the relationship between the mobility and bioavailability of contaminants in sediments and impacts to biological organisms may be gained from monitoring included as a part of the project or as project mitigation. By shedding additional light on this issue and providing the opportunity to respond to problem areas, the project may be considered to have an overall beneficial impact. If the project is not implemented, the opportunity of monitoring and responsive adaptive management would be lost.

There is some concern that, with the scale of wetland restoration projects being undertaken around the San Francisco Bay, there may not be adequate local sediments available for the restoration projects. Many of the proposed sites are subsided and would require substantial sedimentation before restoration could proceed. In addition, there is a concern that these large-scale projects could alter the sediment balance in the Bay and result in a reduction in mudflat/shallow water habitats. Implementation of the ISP only involves marsh restoration on the Island Ponds site. This area involves a relatively small acreage and higher elevation ponds, and is therefore not expected to be a major sedimentation "sink", Consequently, the project is not expected to contribute to cumulative impacts to the sediment balance in the Bay.

12.2.4 Biological Resources-

Potentially significant adverse cumulative impacts to biological resources include the spread of invasive plant species, such as invasive cordgrasses; conversion of open water habitat favored by some shorebirds to habitat favoring tidal marsh-dependent bird species; and the overall loss of medium- to high-salinity pond waters with resulting impacts to water birds.

Benthic Organisms

Impacts to benthic organisms are tied largely to impacts to the quality of the water they inhabit. As noted above (see Section 12.2.2), water quality impacts from the proposed project are anticipated to be of short duration and scope and are therefore not considered subject to cumulative effects. The primary impacts of the project to benthic organisms would be from increased salinity in waters that receive initial pond discharges. Potentially significant elevations in salinity in receiving waters would be limited to 3- to 5-weeks following the Initial Release Period. This may result in some mortality of benthic organisms and some shifts in location of sessile benthic organisms. For example, the major change for bay shrimp as a result of the initial high saline discharges would probably be a shift in their preferred habitat to locations upstream. After the Initial Release Period, juvenile and adult shrimp in receiving sloughs and creeks will not be significantly impacted by continuous circulation of relatively low salinity pond water.

Benthic organisms in the Bay Area have in the past shown a remarkable resiliency to ecosystemic disturbances, including changes in water salinity. Although the benthic community in the South Bay will likely exhibit such resiliency in response to the short-term changes in salinity and other water quality constituents immediately following the initial discharge of project ponds, continued challenges to these communities could, over time, weaken their ability to rebound. However, other projects in the vicinity are not expected to have similar impacts to water quality. Therefore, cumulative impacts to benthic organisms from the proposed project are not anticipated.

Vegetation and Wetlands

Implementation of ISP is part of a long-term strategy to re-create a complex mosaic of wetlands habitats in the San Francisco Bay area. The installation or replacement of water control structures would remove or disturb small areas containing jurisdictional wetland vegetation and pickleweed cover (significant because it provides habitat for the state- and federally-listed endangered salt marsh harvest mouse and because there is so little existing vegetation at the project sites). The total area of disturbance at all three pond complexes (Alviso, Baumberg, and West Bay) would be approximately 2.91 acres of jurisdictional wetlands, including 1.99 acres of areas with a greater than 25% pickleweed cover. However,, the overall cumulative impact of the project on marsh and wetland vegetation will be positive.

The project presents the opportunity to restore sensitive wetlands vegetation communities on over 15,000 acres of lands in the South Bay. Some actions proposed in the ISP would contribute directly to the cumulative beneficial impacts of other restoration projects in the Bay Area. Specifically, breaching the Island Ponds under Pond Management Alternatives 1 and 2 would allow the establishment of transitional salt marsh and brackish marsh plant communities within an area of 475 acres, contributing to other efforts to restore, enhance, or create these types of plant communities in the Bay Area. Although the ISP does not include proposals for wetlands restoration (other than the tidal wetland restoration that would naturally occur following the proposed breaching of the Island Pond levees), it should be viewed as part of a long-range plan for habitat restoration on the over 15,000 acres of the South Bay Salt Ponds.

The project may contribute to negative cumulative impacts related to the invasion of aggressive non-native plant species. The project, along with other proposed or reasonably foreseeable tidal restoration projects would expand tidal habitat suitable for the rapid invasion and dominance by non-native cordgrasses (*Spartina alterniflora, S. densiflora, S. patens*) and other aggressive exotic plant species. Smooth cordgrasses and other non-native invasive species are aggressive colonizers of open, unvegetated habitats typical of early tidal marsh restoration projects.

As discussed in Section 6.2, if left unabated, *S. alterniflora* could become a dominant salt marsh plant species in the South Bay, changing important ecosystem functions such as sedimentation dynamics and detrital production. Once established in the San Francisco Bay Estuary, invasive cordgrasses could rapidly spread to other estuaries along the California coast through seed dispersal on the tides, potentially resulting in a variety of long-term cumulative impacts to existing plants and wildlife throughout the California coast.

The number of restoration projects planned in the area increases the availability of suitable habitat for colonization. Several restoration projects along San Francisco Bay have been degraded because non-native, smooth cordgrass has out-competed native

California cordgrass. Concerning the proposed South Bay Salt Ponds ISP, the proposed breaching of the Island Ponds could create conditions favorable for establishment of invasive cordgrass species and their hybrids on approximately 475 acres. Monitoring by the San Francisco Estuary Invasive *Spartina* Project found that non-native *Spartina* species had spread to dominate nearly 500 acres of tidal marsh, predominantly in the South and Central Bay, by the year 2000 (CSCC and USFWS, 2003). Additional cordgrass colonization on the 475 acres made suitable by the Island Pond breaching would be a significant contribution to this cumulative impact.

The ability to successfully control the cumulative effects and spread of exotic species of cordgrass and other plants requires a region-wide effort and the willingness of resource agencies to fund bay-wide control programs. The ISP includes provisions for monitoring and control of exotic pest plant species within the restored marsh and adjacent tidal marshes. USFWS will coordinate with the SCVWD to ensure that existing clusters of *S. alterniflora* in the vicinity of the Island Ponds are removed prior to breaching the ponds. USFWS and CDFG will also coordinate the ISP implementation with the Invasive *Spartina* Project, a region-wide program to control non-native *Spartina* in the San Francisco Estuary.

Birds and Other Wildlife

Implementation of the project in conjunction with other projects envisioned in the area would result in an overall increase in the availability, and ultimately the quality, of marsh fringe aquatic habitats throughout the San Francisco Bay area. Nursery habitat for many birds and other wildlife species would be greatly enhanced by the implementation of this and other restoration efforts. Changes in water levels in some of the ISP project ponds could result in impacts to nesting colonies of certain water birds in the South Bay from increased predator access and/or flooding. However, wetlands restoration, enhancement, and creation projects in the South Bay would generally provide a cumulative benefit to nesting birds. In addition, monitoring of impacts to bird species is included in the project alternatives or mitigation measures.

Impacts to birds and other wildlife from increased mobility and bioavailability of contaminants in sediments are discussed in Section 12.2.3. As stated there, these impacts are not expected to contribute to cumulative impacts and the impacts would be largely mitigated by monitoring measures included in the project alternatives or in mitigation measures. Any potential impacts from avian botulism would also be reduced to less than significant by monitoring and adaptive actions, and would not be subject to cumulative effects.

Restoration of tidal action to the 475-acre Island Pond area, following the proposed breaching of the Island Ponds, would result in a substantial long-term increase in lower marsh and middle marsh habitats. These habitats are suitable for various endangered species and species of special concern, including the California clapper rail, California black rail, salt marsh harvest mouse, salt marsh wandering shrew, northern harrier, and salt marsh common yellowthroat.

Although the ISP does not include proposals for wetlands restoration (other than the tidal wetland restoration that would naturally occur following the proposed breaching of the Island Pond levees), it should be viewed as part of a long-range plan for habitat restoration on the over 15,000 acres of the South Bay Salt Ponds. Cumulatively, habitat restoration efforts in the South Bay would result in greater habitat complexity, diversity, and productivity.

Impacts to Waterbirds from Loss of Medium- and High-Salinity Ponds— Under the No Project/No Action and Seasonal Pond Alternatives, 100% of the Medium and High Salinity Ponds in the project area (5,702 acres) would be lost. From a regional perspective (including the ISP project area and the remaining active salt ponds in Fremont and Newark), the acreage of medium or high salinity ponds would be reduced from 10,402 acres to 4,700 acres (a 49% decrease).

Under the Pond Management Alternatives, the total number of medium- or high-salinity ponds would be reduced from 24 to 3 (Alviso Ponds A12, A13, and A15) (Table 2-1), which represents a decrease from 5,702 to 827 acres (an 85 percent decrease). From a regional perspective (including the ISP project area and Cargill's Newark ponds), the acreage of medium- or high-salinity ponds would be reduced from 10,402 to 5,527 acres (a 47 percent decrease). These habitat changes would substantially reduce the amount of available foraging habitat in the South Bay for waterbird species that favor medium- and high-salinity ponds.

However, under various adaptive management strategies, the following ponds could be managed as medium-salinity batch ponds rather than low-salinity ponds, if the ISP manager determines such alternative operations are necessary: Alviso Ponds A2E, A3N, and A8 and Baumberg Ponds 4, 7, 1C, 5C, 12, 13, and 14. As a result, the area of medium- and high-salinity habitat would be reduced from 5,702 to 1,872 acres (67 % decrease) . Thus, under the Pond Management alternatives, the reduction in medium to high salinity ponds in the project area could range between 67% and 85%. From a regional perspective (including the ISP project area and the remaining active salt ponds in Fremont and Newark), the acreage of medium- and high-salinity ponds would be reduced from 10,402 to 6,572 acres (a 37 percent decrease), compared to the 47 percent decrease without adaptive management).

Note: please see Section 6.3.1.1 (Habitat Conditions) for the definitions of salinity categories, which differ from those in other sections of the EIR/EIS.

Impacts to Shorebirds and Waterfowl from Loss of Open Water Habitat—The potential large-scale conversion of salt ponds and other types of seasonal wetland habitats to tidal habitats could have a long-term adverse impact on shorebird and waterfowl populations and use in the Bay. A cumulative change in open water habitats used by migratory shorebirds and waterfowl is expected over the next 20 to 50 years. This change could result in either an increase or decrease of open –water habitat, depending on which restoration/mitigation projects are implemented.

Under the No Project/No Action and Seasonal Pond alternatives, all 15,000 acres of salt ponds would be dry in the summer and ponded with shallow water in wet years during winter. This would result in loss of open water habitat year round for waterbirds that use deep water habitat (diving ducks and piscivorous birds) and during summer and fall for shorebirds that use shallow ponds. However, these unmanaged seasonal ponds would provide additional habitat for the threatened Western Snowy Plover.

Implementation of the Managed Pond alternatives would contribute much less to a cumulative loss of open water habitat. Approximately 475 acres of open waters within the Island Ponds would be converted to tidal habitat and the area of managed seasonal ponds within the project area would increase from 715 to at least 3,233 acres..

Since San Francisco Bay is one of only a few sites in North America that regularly support shorebirds in the hundreds of thousands, the loss of such habitat could have significant impacts on regional shorebird populations, especially for the shorebird species noted above. San Francisco Bay is also a critically important site for wintering and migrating water birds in the Pacific Flyway and the project could contribute to cumulative impacts on water bird populations throughout the Pacific Flyway.

The San Francisco Bay Ecosystems Goals Project (1999) has attempted to address this issue and develop recommendations for goals for key habitats in different regions in the Bay. In the South Bay subregion, the habitat goal recommendations are to increase tidal marsh habitats from the approximately 9,000 acres to 25,000 or 30,000 acres and managing 10,000 to 15,000 acres of salt pond habitat. This equates to a rough ratio of 2 to 2.5 acres of tidal marsh to 1 acre of managed salt pond habitat. Implementation of the ISP would contribute approximately 475 acres of tidal marsh restoration and during the interim project period it would contribute approximately 14,500 acres of managed salt pond/panne habitat to these broad, long-term goals.

Cumulative impacts to migratory shorebirds and waterfowl could be mitigated to some degree by the availability of numerous foraging and refuge areas throughout the Bay. Migratory shorebirds and waterfowl would likely re-distribute among available habitats in the South Bay, such as the existing salt ponds at Don Edwards National Wildlife Refuge, the Cargill Salt Ponds, and the open waters of the Eden Landing Ecological Reserve and Outer Bair Island.

Impacts to Special Status Species Habitat—Implementation of the ISP would result in the short-term loss of existing salt marsh harvest mouse habitat (SMHM), a state- and federally-listed endangered species and California species of special concern. This loss of this habitat could also impact other endangered species and species of special concern, including the California clapper rail, California black rail, salt marsh wandering shrew, northern harrier, and salt marsh common yellowthroat. This loss (approximately 1.99 acres of >25% pickleweed cover) is very small in comparison to habitat loss that has occurred or is expected to occur as a result of other past, present, or future foreseeable tidal restoration and development projects, and is not likely to contribute to cumulative impacts to SMHM or other special status species. Overall, the project is likely to provide a very significant beneficial effect to SMHM with the potential for a significant increase in SMHM habitat within the 475-acre Island Pond area, following breaching of the Island Ponds. This, together with improvement in SMHM habitat resulting from other habitat projects, would contribute to a cumulative benefit by improving long-term habitat viability and expanding and connecting existing habitat areas as part of the recovery strategy for the species.

It should be noted that the cumulative acreage of impacted SMHM habitat is not a good measure of the significance of the impact to the species. This is because SMHM populations tend to be confined to small, disjunct marsh areas. The populations are typically genetically isolated and the long-term survival of these individual populations is dependent on the ability to maintain viable numbers of individuals within the specific habitat area. The significance of impacts to the species is based on the ability to sustain these separate populations. Impacts of habitat loss or gain would only be cumulatively significant if the loss or gain reduced, eliminated, or improved the ability of a site to sustain or expand the population at that site.

Construction-related impacts to other special status wildlife species would be extremely minor and/or of short duration and are not likely to contribute to significant cumulative effects.

Fish

Implementation of the project in conjunction with other projects envisioned in the area could result in an overall increase in the availability, and ultimately the quality, of marsh fringe aquatic habitats throughout the San Francisco Bay area. Juvenile and rearing habitat for many species of fish would be greatly enhanced by the implementation of this and other restoration efforts. Restoration of the tidal marshes in the project area would result in a substantial long-term increase in lower marsh and middle marsh habitats. Cumulatively, restoration efforts would result in greater habitat complexity, diversity, and productivity and contribute to the overall re-establishment of tidal marsh habitats throughout the Bay.

The installation of water control structures required by the project could lead to juvenile fish entrainment. This would be a potentially significant impact for anadromous fish only. Other fish that become entrained in the project ponds would readily adapt to the in-pond habitat. Following the initial saline discharges from these ponds, the ponds would provide significantly improved habitat for non-anadromous fish. To mitigate any potentially significant impacts to anadromous fish, the inlet structures located on migration corridors will be closed during periods of juvenile fish migration.

The Lower Guadalupe Flood Control Project proposes to use Pond A8 during flood events to reduce flooding. Following implementation of the flood control project, juvenile fish may be entrained in Pond A8 during flood events, which in combination with impacts to anadromous fish under the proposed ISP, could cause cumulative impacts to anadromous fish. However, since the pond inlet structures along Alviso Slough (Guadalupe River) will be closed during the period flooding is likely to occur,, it is not expected to cause significant cumulative impacts.

12.3 Irreversible and Irretrievable Commitment of Resources

The project would require a relatively small and insignificant, but irretrievable commitment of fossil fuels and other energy sources to construct water control features at the ponds. Discharge of pond waters to receiving waters and the proposed breaching of the Island Ponds are actions that could theoretically be reversed at some point in the future.

12.4 Relationship Between Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

Short-term uses of the environment that would occur with restoration include the impacts on existing wetlands and habitat and those from construction-related activities. However, in the long term, the site is expected to be substantially more productive for habitat and wildlife values.

12.5 Growth-Inducing Impacts

Section 15162.2(d) of the State CEQA Guidelines requires that an EIR address the potential growth-inducing impacts of a proposed project. Specifically, the EIR shall "discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing either directly or indirectly, in the surrounding environment."

Implementation of the ISP would not foster economic or population growth or the construction of additional housing, and therefore would not have a growth-inducing impact.

12.6 Environmental Justice and Protection of Children

For NEPA purposes, developments or population/housing changes that cause impacts in terms of environmental justice are considered significant. On February 11, 1994, President Clinton issued Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low Income Populations*. The purpose of the order is to avoid the disproportionate placement of adverse environmental, economic, social, or health impacts from federal actions and policies on minority and low-income populations that might be affected by implementation of the proposed action or alternatives.

On April 21, 1997, the President issued Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*. Each federal agency must, according to this order, address disproportionate risks to children resulting from environmental health risks or safety risks in all policies, programs, activities, and standards.

Implementation of the ISP would not result in environmental justice impacts; that is, it would not result in disproportionate placement of adverse environmental, economic, social, or health impacts from federal actions and policies on minority and low-income populations. Nor would it cause disproportionate environmental health or safety risks to children.

12.7 Significant Unavoidable Adverse Impacts

The impact to waterbirds from the loss of medium- and high-salinity ponds under the project alternatives is a significant impact. Measures are proposed to mitigate this impact (see Section 6.3.3.2), but the impact remains potentially significant even with these measures. All other impacts identified in this EIR/EIS are expected to be less than significant with the implementation of proposed mitigation measures.

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15.0 LIST OF RECIPIENTS

Agencies/Organizations/Individuals	Public Notice	CD ROM	Hardcopy
Alameda County Flood Control		X	
Alameda County Mosquito Abatement District		X	
Alameda County Public Works	X		
Alameda County Water District		X	
Alameda Creek Alliance	X		
Aquatic Outreach Institute	X		
Association of Bay Area Governments			X
Audubon San Francisco Bay Restoration Program	X		
Bay Area Audubon Council	X		
Bay Area Open Space Council	X		
Bay Planning Coalition	X		
Bell, Joseph	X		
California Coastal Conservancy			X
California Department of Fish and Game			X
California State Lands Commission			X
California State Parks Commission	X		
California State Water Resources Control Board			X
California Waterfowl Association	X		
Caltrans		X	
Cargill Salt			X
Citizens Committee to Complete the Refuge			X
City of Hayward			X
City of Menlo Park			X
City of Mountain View			X
City of Palo Alto			X
City of Palo Alto, Palo Alto Baylands			X
City of San Jose			X
City of Sunnyvale			X
City of Union City			X
Communities for a Better Environment		X	
Congressman Mike Honda	X		
Congressman Pete Stark	X		
Congresswoman Anna Eschoo	X		
Council of Bay Area RCDs	X		
County of Alameda			X
County of San Mateo			X

County of Santa Clara			X
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Defenders of Wildlife	X		
DeJager, Bill	X		
Ducks Unlimited	X		
Earth Justice		X	
East Bay Regional Park District			X
Golden Gate Audubon	X		
Hayward Shoreline Planning Agency		X	
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Mid Peninsula Open Space District			
NASA – Moffett Field		X	
National Audubon – Bay Area	X		
National Fish and Wildlife Foundation	X		
Ohlone Audubon Society	X		
PG&E Corporation		X	
Point Reyes Bird Observatory		X	
Port of Oakland	X		
Regional Water Quality Control Board, SF Bay Region		X	X
Romberg Tiburon Center of Env. Science	X		
San Francisco Bay Joint Venture (Beth Huning)	X		
San Francisco Baykeeper		X	
San Francisco Estuary Institute		X	
San Francisco Estuary Project	X		
San Jose Environmental Services Dept (WWTP)			X
San Mateo County Mosquito Abatement District		X	
San Mateo County Parks	X		
Santa Clara County Open Space Authority	X		
Santa Clara County Vector Control Agency		X	
Santa Clara Valley Audubon Society	X		
Santa Clara Valley Water District			X
Save San Francisco Bay Association		X	
Senator Barbara Boxer	X		
Senator Diane Feinstein	X		
Sequoia Audubon Society	X		
SF Bay Bird Observatory			X

SF Bay Conservation & Development Commission			X
SF Bay Don Edwards NWR		X	X
SF Public Utilities Commission		X	
Shoreline at Mountain View	X		
Siegel, Siegel	X		
Sierra Club	X		
Silicon Valley Manufacturing Group	X		
Silicon Valley Toxics Coalition		X	
Spartina Control Project		X	
Stevens Creek Watershed Group	X		
The Bay Institute	X		
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U.S. Army, Corps of Engineers, San Francisco District			X
U.S. Department of Agriculture – Natural Resources Conservation Service		X	
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Fisheries Service			X
U.S. Department of Interior, Bureau of Indian Affairs	X		
U.S. Department of Interior, Bureau of Land Management	X		
U.S. Department of Interior, Bureau of Reclamation	X		
U.S. Department of Interior, Fish and Wildlife service			X
U.S. Department of Interior, Geological Survey, Biological Resources Division		X	
U.S. Department of Interior, Minerals Management Service	X		
U.S. Department of Interior, National Park Service	X		
U.S. Department of Interior, Office of Environmental Policy and Compliance			X
U.S. Department of Interior, Office of Surface Mining	X		
U.S. Department of Transportation, Coast Guard			X
U.S. Environmental Protection Agency			X
U.S. Navy, BRAC - Moffett Field		X	
Union Pacific Railroad			X
Wildlife Conservation Board	X		

16.0 ABBREVIATIONS AND ACRONYMS

AAQS	Ambient Air Quality Standards
ABAG	Association of Bay Area Governments
ACHP	Advisory Council on Historic Preservation
Action Plan	Revised South Bay Action Plan
ADWEF	Average Dry Weather Effluent Flow
AFCC	Alameda Flood Control Channel
BAAQMD	Bay Area Air Quality Management District
BACWA	Bay Area Clean Water Agency
BAPPG	Bay Area Pollution Prevention Group
Basin Plan	Water Quality Control Plan, San Francisco Bay Region
BASMAA	Bay Area Stormwater Management Agencies Association
Bay	San Francisco Bay
Bay Trail	San Francisco Bay Trail
Bay Trail Plan	San Francisco Bay Trail Plan
BCDC	San Francisco Bay Conservation and Development Commission
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
California ESA	California Endangered Species Act
CAP	Clean Air Plan
CAR	Coordination Act Report
CARB	California Air Resources Board
CBS	Clean Bay Strategy
CCMP	Comprehensive Conservation Management Plan
CCP	Continuous Circulation Phase
CDFG	California Department of Fish and Game
CEP	Clean Estuary Partnership
CEQ	Council on Environmental Quality

CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CHRIS	California Historical Resources Information System
CNDDB	California Natural Diversity Database
CNPPA	California Native Plant Protection Act
COC	Constituents of Concern
Corps	United States Army Corps of Engineers
CRHR	California Register of Historic Resources
CTR	California Toxins Rule
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DFG	California Department of Fish and Game
DO	Dissolved Oxygen
DWR	Department of Water Resources
EBRPD	East Bay Regional Parks District
EFH	Essential Fish Habitat
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
ER-L	Effects Range-Low
ER-M	Effects Range-Median
ESA	Endangered Species Act
ESD	Environmental Services Department
FAS	Flow Audit Study
FWCA	Fish and Wildlife Coordination Act
FY	Fiscal Year
GWI	Groundwater Infiltration
IBA	Important Bird Area
IPM	Integrated Pest Management
IRP	Initial Release Phase
ISP	Initial Stewardship Project for the South Bay Salt Ponds in South San Francisco Bay, California.
IU	Industrial User

IWRP	Integrated Water Resources Plan
JPA	Joint Powers Authority
LSI	Life Science!, Inc.
LTMS	Long-term Management Strategy
MAD	Mosquito Abatement Districts
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MBTA	Migratory Bird Treaty Act
MHHW	Mean Higher High Water
MLLW	Mean Lower Low Water
MMP	Mitigation and Monitoring Plan
MMRP	Mitigation Monitoring and Reporting Program
MOA	Memorandum of Agreement
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSMWA	Napa-Sonoma Marshes Wildlife Area
NTU	Nephelometric Turbidity Units
NWIC	Northwest Information Center
P2	Pollution Prevention
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenols
PMP	Pollutant Prevention and Minimization Program
POTW	Publicly Owned Treatment Works
RAQCB	Regional Air Quality Control Board

Refuge	Don Edwards San Francisco Bay National Wildlife Refuge
Regional Board	California Regional Water Quality Control Board, San Francisco Bay Region
RMP	Regional Monitoring Program
RMS	Root Mean Square
ROD	Record of Decision
ROG	Reactive Organic Gases
ROI	Region of Influence
ROWD	Report of Waste Discharge
RWQCB	Regional Water Quality Control Board
S&W	Schaaf and Wheeler
SAP	Sampling and Analysis Plan
SBWR	South Bay Water Recycling
SCVRR	Santa Clara Valley Railroad
SCVWD	Santa Clara Valley Water District
SFBAAB	San Francisco Bay Area Air Basin
SFBJV	San Francisco Bay Joint Venture
SFBNWR	San Francisco Bay National Wildlife Refuge
SFBRWQCB	San Francisco Bay Regional Water Quality Control Board
SFEI	San Francisco Estuary Institute
SFEP	San Francisco Estuary Project
SFSU	San Francisco State University
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJWWTP	San Jose Waste Water Treatment Plant
SMHM	Salt Marsh Harvest Mouse
SMWS	Salt Marsh Wandering Shrew
SOP	Standard Operating Procedure
South Bay	San Francisco Bay, South of Dumbarton Bridge
SPCRR	South Pacific Coast Railroad
SPRR	Southern Pacific Railroad
SSFB	South San Francisco Bay

SSO	Site Specific Objective
State Board	California State Water Resources Control Board
SVOC	Semi-Volatile Organic Compounds
SWANCC	Solid Waste Agency of Northern Cook County
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
Tributary Agencies	Cities and Agencies Tributary to the Plant: San José; Santa Clara; Milpitas; Cupertino Sanitary District; West Valley Sanitary District – Campbell, Los Gatos, Monte Sereno, and Saratoga; County Sanitation Districts 2 and 3, and Sunol and Burbank Sanitary Districts
TSS	Total Suspended Solids
U.S. EPA	United States Environmental Protection Agency
ULFT	Ultra-Low Flush Toilet
UPRR	Union Pacific Railroad line
Urban Runoff Program	Santa Clara Valley Urban Runoff Pollution Prevention Program
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WDR	Waste Discharge Requirements
WEP	Water Efficiency Program
WET	Water Efficient Technologies
WNV	West Nile Virus
WQO	Water Quality Objective
WTP	Waste Treatment Plant
YBP	Years Before Present