flow from Pond E13 to E14 through existing water control structures at the southwest corner of Pond E13. High salinity water would be discharged from Pond E14 to Pond E9 for dilution before it would be discharged to OAC through the existing water control structure in Pond A8A.

In the summer months, and during dry winters when high salinity discharges to Pond E9 are not practical, Ponds E12 and E13 would operate as seasonal ponds. The existing pump to Pond E13 would not be operated and the ponds would be allowed to dry-down. Salinity in the ponds would not be controlled and would fluctuate based on residual salt in the ponds, rainwater and evaporation.

If funding is available for pump O&M, CDFG would continue to operate Ponds E12 and E13 as high salinity ponds in the winter. However, if funding is not available to maintain or operate the pump, the ponds would become seasonal ponds year round. The levees around Ponds E12 and E13 have a high risk of failure or overtopping, and once breached, the levees would not be repaired. Tidal action would be restored to the ponds in an unplanned and uncontrolled manner. The levees around Ponds E8A, E9 and E14 could also erode and fail, thereby restoring tidal action to Ponds E12 and E13 from the south.

Because Ponds E12 and E13 are relatively high in the tide frame, salt marsh vegetation would likely begin to colonize shortly after the unplanned tidal conversion commences. However, the breaches would not be planned to optimize the reoccupation of remnant tidal channels and encourage the re-establishment of the historic tidal drainage system. The majority of tidal flows would be captured by the ponds' borrow ditches, possibly inhibiting the formation of higher-order tidal channels that provide nesting habitat for California clapper rails and serve as intra-marsh refugia for salt marsh harvest mice, rails, and other species.

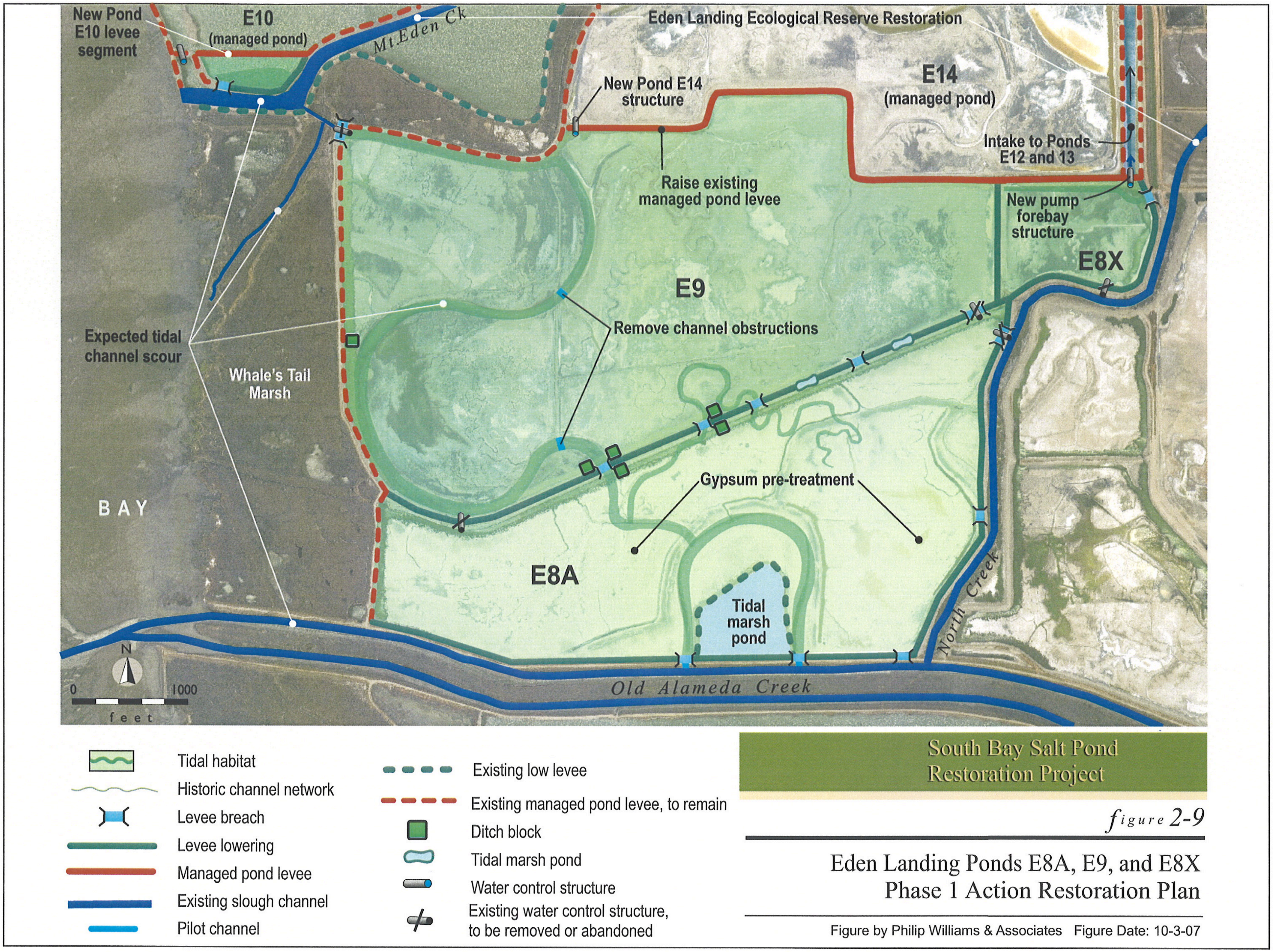
No public access and recreation access currently exists at Ponds E12 and E13, and no new public access or recreational facilities would be constructed under this alternative.

Phase 1 Restoration Actions

Ponds E8A, E9 and E8X

Introduction. Eden Landing Ponds E8A, E9 and E8X would be restored to tidal action to create approximately 730 acres of tidal salt marsh and tidal channel habitat (see Figure 2-9). As specified in the Adaptive Management Plan (see Section 2.3 and Appendix D of this EIS/R) and described in the Ponds E8A, E9 and E8X Adaptive Management section below, the Ponds E8A, E9 and E8X restoration would test the effectiveness of restoration techniques to create tidal marsh pond habitat and pre-treat the gypsum layer in Pond E8A. The restoration would also test the influence of marsh restoration on flood hazards, the rates and effects of marsh sedimentation within the ponds on existing outboard tidal habitats, and the ecological value of tidal marsh ponds as applied studies.

Restoration Plan. Ponds E8A, E9 and E8X would be restored to tidal habitat by: breaching and lowering the outboard and inboard levees; improving the levee between Pond E14 and Ponds E9 and E8X; excavating pilot channels through the fringe marsh outboard of the breaches; constructing ditch blocks in the borrow ditches; maintaining existing and constructing new pond/panne habitats; and reconfiguring culvert connections (see Figure 2-9).



South Bay Salt Pond Restoration Project

figure 2-9

Eden Landing Ponds E8A, E9, and E8X
Phase 1 Action Restoration Plan

Figure by Philip Williams & Associates Figure Date: 10-3-07

Although Ponds E8A, E9 and E8X have been diked for salt production, minimal subsidence has occurred. Existing bed elevations range from approximately 5.2 ft North American Vertical Datum (NAVD) (1.6 m NAVD) to 6.2 ft NAVD88 (1.9 m NAVD), or about 2 to 3 ft above the MTL. Because typical bed elevations of Ponds E8A, E9, and E8X are relatively high in the tide frame, the restoration action would likely initiate salt marsh vegetation colonization and reoccupation of remnant tidal channels shortly after levee breaching. Over time, tidal sedimentation and the accumulation of plant biomass would raise the marshplain to the elevation of adjacent mature marshes (approximately MHHW). The gypsum layer in Pond E8A may inhibit vegetation establishment and would therefore be pre-treated as discussed below.

Levee breaches. Tidal inundation would be restored to Ponds E8A, E9 and E8X by excavating six breaches through the perimeter levees to OAC, North Creek, and the historic Mt. Eden Creek channel. Most of the breaches would be located at the mouths of relict tidal channels to encourage the re-establishment of the natural drainage system. The historic systems of sinuous branching channels are expected to provide quality habitat for fish and wildlife, including the endangered California clapper rail.

Three breaches would reconnect Pond E8A to OAC. Two additional breaches would restore tidal connectivity between Ponds E8A and E8X and North Creek. A sixth breach at the location of the existing Pond E9 water control structure would restore tidal action between Pond E9 and Mt. Eden Creek. The levee breaches would be sized to provide full tidal exchange between the restored ponds and adjacent tidal sloughs.

Downstream of the Pond E9 breach, Mt. Eden Creek is expected to scour and widen in response to restored tidal flows. The restoration would include measures to allow Mt. Eden Creek to scour and widen without eroding or breaching the Pond E10 levee along the north bank of Mt. Eden Creek. For example, the segment of the Pond E10 levee downstream of the Pond E9 breach could be relocated approximately 360 ft (110 m) to the north of its current location as shown in Figure 2-9. The existing Pond E10 levee could also be reinforced and Mt. Eden Creek could be enlarged as part of the restoration. Specific measures for improvement to the Pond E10 levee and Mt. Eden Creek would be specified in the design phase.

The internal levees between Ponds E8A, E9 and E8X would be breached in several locations to restore the historic tidal channel system and improve tidal drainage, and circulation. The breaches along the interior levee between Ponds E8A and E9 would reconnect relict historic tidal channels and improve tidal drainage to the entire Pond E8A, E9 and E8X area. The internal levee between Ponds E9 and E8X would be breached to allow drainage along the existing borrow ditch. All breaches across internal levees would be constructed to the approximate width and depth of the historic channels.

Pilot channels. Pilot channels would be excavated from the outboard levee breaches to the tidal sloughs through the existing vegetated marsh. Pilot channels would facilitate tidal exchange through the breaches by removing erosion-resistant marsh vegetation and providing an initial drainage channel that would gradually enlarge through tidal scour. Constructed pilot channels would be narrower than the breach excavations in order to minimize costs and impacts to existing marsh. Material excavated from the pilot channels would either be used to construct the borrow ditch blocks or cast to the side on the marsh adjacent to the pilot channels. This material would likely erode as the pilot channel banks scour.

A portion of Mt. Eden Creek may be excavated to enlarge the channel and improve tidal exchange through Mt. Eden Creek and the Pond E9 breach. The existing pilot channel connecting the Pond E9 water control structure to Mt. Eden Creek may also be enlarged. Enlarging these channels would also reduce the time for the channels to scour.

Levees. Perimeter levees along OAC and North Creek and the internal levees between Ponds E9 and E8A and Ponds E9 and E8X would be lowered to approximately MHHW (7.0 ft NAVD or 2.1 m NAVD). Lowering of the outboard levee would create pickleweed salt marsh habitat around the perimeter of the restoration site, which is expected to provide escape cover for the endangered salt marsh harvest mouse. Lowering the levee would restore the hydrologic connectivity between the adjacent sloughs and the restored marsh areas during the highest tides.

The bayfront levee between Whale's Tail Marsh and Ponds E8A and E9 would not be lowered in order to reduce the potential for wave action and overtopping of this levee from the Bay, and subsequent overtopping into Ponds E14 and Ponds E12 and E13. This bayfront levee would be allowed to degrade over time while tidal marsh establishes in Ponds E8A and E9.

The levee between Ponds E9 and E8X and Pond E14 would be raised to prevent frequent tidal inundation into Pond E14. The elevation of the levee would be raised by approximately one to 4 ft. Material generated from levee lowering would be used to raise and widen the levee cross-section. A gentle slope would be created on the outboard (tidal) side of the levee to provide upland-transition habitat in Ponds E9 and E8X as well as wind-wave dissipation to reduce levee maintenance needs.

The levee between Ponds E8X and E14 would be extended a short distance to the east across the narrow northern extension of Pond E8X (along the eastern edge of Pond 14), connecting to the levee between Pond E8X and North Creek. A water control structure would be installed in this new levee segment. This would allow the northern extension of Pond E8X to be managed as a forebay for the intake pump to the Phase 1 action reconfigured managed pond at Ponds E12 and E13 (see Ponds E12 and E13 section below).

As discussed above, the restoration would include measures to allow Mt. Eden Creek to scour and widen without eroding or breaching the Pond E10 levee along the north bank of Mt. Eden Creek.

Borrow ditch blocks. Borrow ditch blocks would be constructed to block flow in the borrow ditches and promote re-establishment of the historic tidal drainage system in Ponds E8A, E9 and E8X. The existing borrow ditches were excavated along perimeter and interior levees, and are expected to remain features in the marsh landscape over the long term. Ditch blocks would inhibit flow through the borrow ditch and direct tidal scour through relict historic channels. Ditch block locations were selected to provide complete drainage of the borrow ditch at low tide to avoid potential fish trapping. Borrow ditch blocks would be constructed across the borrow ditch with material obtained from levee lowering. Additional material excavated from the lowered levees may be placed along the edge of the borrow ditch to create additional marsh habitat. In these locations, the borrow ditch would not be blocked and the conveyance of tidal flows in the borrow ditch would be maintained. Certain portions of the borrow ditches would not be blocked to facilitate drainage, such as the borrow ditches draining to the Pond E9 and Pond E8X breaches.

Marsh ponds. Marsh pond habitat would be created by constructing shallow depressions along the top of the lowered internal levee between Ponds E9 and E8A. At the locations of the restored marsh ponds, the levee would be lowered to elevations varying from MHHW to slightly above MHHW to test the sustainability of marsh ponds at different elevations as a restoration technique (see the Ponds E8A, E9, and E8X Adaptive Management section below). The restored marsh ponds would be inundated during high tides and would pond water during periods of lower tides. Prolonged inundation and concentration of salts would be expected to inhibit vegetation establishment in the ponds and maintain open water in the pond. Bird use in the marsh ponds would be monitored to test their ecological value as an applied study.

The existing low internal berm that forms a pond within Pond E8A along its southern edge would remain intact. This area is expected to become a large tidal marsh pond after restoration. This marsh pond would also be monitored to test the sustainability and ecological value of this type of pond.

Water control structures. The existing water control structures would be abandoned or removed, as they would not be needed once Ponds E8A, E9 and E8X are restored to tidal action. New water control structures would be installed between Ponds E9 and E14 and between Pond E8X and the northern extension of Pond E8X. These passive water control structures would be used to manage water levels and flows in Pond E14 and the pump forebay in the northern extension of Pond E8X. Gravity flows through the water control structures would be driven by the tides in Ponds E8A, E9, and E8X.

Gypsum pre-treatment. Portions of the existing gypsum layer across the Pond E8A bed would be mechanically disturbed prior to restoration to break up this hard layer. The gypsum layer could inhibit vegetation establishment and delay habitat development until the gypsum layer dissolves and degrades over time. The dissolution of the gypsum would depend on environmental factors, which include the density of gypsum, water exchange rates, surface flow velocities, water chemistry and inundation periods (Siegel and Bachand 2001). The Pond E8A bed and gypsum layer are above the elevation at which marsh vegetation colonizes emerging mudflats and within the elevation range where plant roots grow, and may block root growth (Siegel & Bachand 2001). Construction equipment or other techniques would be used to disturb the gypsum layer. The gypsum would be treated only in certain locations, and not in others, to test the effectiveness of this restoration technique (see the Ponds E8A, E9 and E8X Adaptive Management section below).

Adaptive Management. Adaptive management for the Phase 1 action at Ponds E8A, E9 and E8X would include applied studies and restoration techniques as specified in the Adaptive Management Plan (see Section 2.3 and Appendix D).

Applied Studies. Phase 1 experiments at Ponds E8A, E9 and E8X would test:

1. Relative influence of slough scour and marsh restoration on flood hazards.

2. Rates of marsh sedimentation.

3. Effects of pond sedimentation on existing outboard intertidal habitat.

- Relative Influence of Slough Scour and Marsh Restoration on Flood Hazards. Tidal restoration at Ponds E8A, E9 and E8X is expected to enlarge reaches of OAC and Mt. Eden Creek downstream of breaches in the perimeter levee by increasing tidal current velocities. These potential changes in slough geometry would increase the ability to convey flood flows and lower upstream water levels when the large amounts of runoff from the watershed is routed to the creek. However, modifications of the tides in the slough (*i.e.*, increasing water levels at low tide) may lead to short-term adverse impacts to existing flood hazards. The Phase 1 tidal restoration at Ponds E8A, E9 and E8X would provide an opportunity to assess the changing flood conveyance along OAC and determine if flood hazards are decreased over both the short- and long-term. Monitoring data of slough scour and the tidal regime would provide the necessary information to examine changes to baseline flood hazards. If it is determined that the backwater elevation increases upstream of the breached ponds as a result of tidal habitat restoration, different approaches to levee breaching may be incorporated in subsequent phases.
- Rates of Marsh Sedimentation. Tidal restoration at Ponds E8A, E9 and E8X would set in motion accretionary sedimentary processes that would raise the bed elevations over time. Natural sedimentation within the ponds would depend upon the sediment supply for local tributaries, transport of estuarine sediment from the bay and sloughs, and deposition and retention of sediment in the ponds. Flood tides carry in suspended estuarine sediments that deposit in the slack waters. Ebb tidal currents are insufficient to resuspend deposited muds and silts, except in the locations of nascent tidal channels. As mudflats in the restored ponds rise in elevation, changes to the period of inundation would decrease and the rate of sedimentation would decline. Once mudflats reach a high enough elevation relative to the tidal frame, pioneer plant colonization would occur. Monitoring data collected at Ponds E8A, E9, and E8X would provide information on sedimentation rates of ponds relatively high in the tidal frame and help to improve robust predictive models of pond accretion. Sedimentation rates measured inside the restored ponds would also determine the sediment demand of this Phase 1 action and help explain observed changes to the adjacent tidal sloughs and outboard mudflats.
- Effects of Pond Sedimentation on Existing Outboard Intertidal Habitat. Tidal restoration rests on the assumptions that suspended sediments transported into the ponds on flood tides would be deposited when tidal current velocities decrease at slack tide and that colonization by marsh vegetation would follow. The South Bay contains regions that tend to be more depositional and regions that tend to be more erosional on a seasonal or annual basis. When ponds are breached near regions that are currently depositional, it is likely that the breached ponds would be filled with sediment that would have formerly been deposited on accreting South Bay mudflats. It remains unclear, however, if the sediment supply in these depositional regions would be great enough to prevent the formerly accreting mudflats from eroding. When ponds are breached near regions that are currently erosional, it is unclear from where the sediment source for filling the ponds would come.

Restoration Techniques. The Phase 1 action at Ponds E8A, E9 and E8X would test the effectiveness of restoration techniques for the creation of marsh pond/panne habitat and gypsum pre-treatment.

- Creation of Marsh Pond/Panne Habitat. Marsh ponds, as discussed above, are typical, but not ubiquitous, features of historic and mature salt marshes that provide important habitat for certain bird species. Marsh ponds would be constructed at various elevations above MHHW to study their general constructability as well as the relationship between marsh pond sustainability and marsh pond elevation above MHHW. The internal levee between Ponds E9 and E8A would be lowered throughout most of its length to MHHW. A portion of the levee would be lowered to variable elevations above MHHW. Small depressions would be constructed within the portions of the levee which would presumably fill with water seasonally after precipitation or on spring tides. Seasonal field surveys of vegetation cover, soil salinities, bird use and erosion along the margins of the graded ponds would be conducted and the data compiled to compare the relative sustainability and use of marsh ponds at different elevations above MHHW. If applicable, the optimal elevation or range of elevations would then be applied to tidal restoration in future stages of the Project.
- Gypsum pre-treatment. The hard layer of gypsum deposited over the bed of Pond E8A when it was operated for salt production may delay or impair marsh plant community development, which is central to the biological functions of a wetland ecosystem. Pre-treatment would disturb or fracture the gypsum layer in select locations, while the layer would be left intact in other locations. The thickness of the gypsum layer would be measured across the pond prior to restoration, and would be considered in selecting areas for pre-treatment. Once restored, vegetation establishment (overall and by species) in treated areas of Pond E8A would be compared with monitoring data from areas where the gypsum layers are intact.

Restoration Monitoring. Monitoring (summarized in Table 2-3) would include physical and vegetative processes and ecological and species response for the purposes of adaptive management (*i.e.*, applied studies) and evaluating Project performance (*i.e.*, for any permit requirements). Low-tide aerial photographs, possibly supplemented with annual ground surveys, would provide information on channel and marsh development to assess the performance of restoration techniques. For example, the aerial photos and ground surveys could be used to track the development of low, medium and high marsh zones, which provide different habitat values for the California clapper rail and salt marsh harvest mouse. Once suitable vegetated marsh habitat develops in Ponds E8A, E9, and E8X, surveys of California clapper rail and salt marsh harvest mouse would be performed to track the progress of these endangered species towards recovery, in accordance with Section 7 of the Endangered Species Act. Invasive plant monitoring and control would be coordinating with existing control efforts, such as the Invasive Spartina Project, as discussed in the Introduction (Chapter 1), and under the SBSP Long-term Alternatives B and C (see Sections 2.4.3 and 2.4.4, respectively).

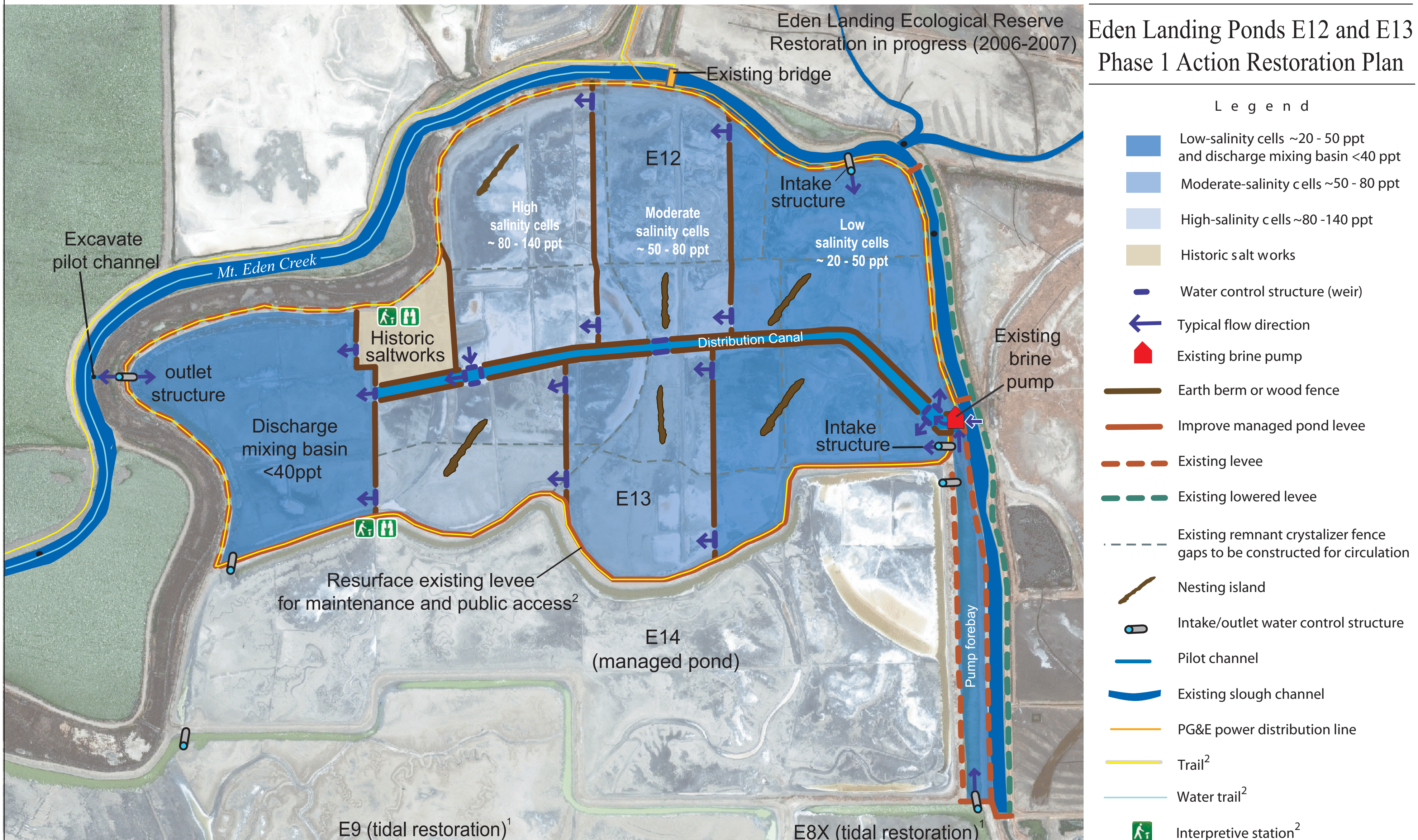
Ponds E12 and E13

Introduction. The Eden Landing Ponds E12 and E13 would be reconfigured to create shallow water foraging habitat for migratory shorebirds, with a range of salinities, and a limited number of islands for nesting bird habitat (see Figure 2-10). As specified in the Adaptive Management Plan (see Section 2.3 and Appendix D), the Ponds E12 and E13 restoration would test the extent to which focused management of shallow water habitats can increase migratory shorebird densities, the importance of salinity on the density of foraging shorebirds and their prey as applied studies, and techniques for vegetation

South Bay Salt Pond Restoration Project

figure 2-10

Eden Landing Ponds E12 and E13 Phase 1 Action Restoration Plan



[1]See Figure 2-8 for Ponds E9, E8X and E8A restoration plan.

[2]See Figure 2-10 for Eden Landing Phase 1 Actions public access and recreation features.

Figure by Philip Williams & Associates
Figure Date: 1-25-07

#1750/phase1/basemaps/concept plans/tidal ponds/Pond E12 & E13_1-25-07.ai management, predator management, and water and salinity management. Recreation and public access features for the Ponds E12 and E13 restoration are described in the Eden Landing Recreation and Public Access Actions section below.

Restoration Plan. Ponds E12 and E13 would each be divided into three cells (six total) with progressively increasing salinity levels in each cell (see Figure 2-10). Of the six cells, two cells would be managed to maintain low salinity levels (approximately 20 to 40 ppt) similar to Bay salinity levels; two cells would be managed to maintain moderate salinity levels (approximately 40 to 80 ppt); and the remaining two cells would be managed to maintain high salinity levels (approximately 80 to 120 ppt) during the dry season. The water depths within each cell would be managed to provide optimal shallow water habitat for shorebird foraging. One island would be constructed in each of the six cells to create habitat for nesting birds. Consistent with the adaptive management approach of the SBSP Restoration Project, this Phase 1 action allows for multiple flow paths and management flexibility.

Water management. Water levels and flows in Ponds E12 and E13 would be managed using passive water control structures, such as culverts and/or weirs with gravity flows driven by the tides, and supplemental pumping as needed. The elevation of the ponds gently slopes from east to west and averages 5.7 ft (1.7 m) NAVD, which is approximately 1.3 ft (0.4 m) below MHHW. As Ponds E12 and E13 are high in elevation relative to the tides, the potential for gravity flows into the ponds is limited, especially during neap tides when high tides are below MHHW. Gravity flows would occur through new intake structures located between Mt. Eden Creek and Pond E12, and between the northern extension of Pond E8X and Pond E13. Mt. Eden Creek and the ELER Restoration Project Area has been restored to tidal action in the fall of 2006 under a separate project. Pond E8X would be restored to tidal action as part of the Phase 1 action at Ponds E8A, E9 and E8X (see description above). The narrow northern extension of Pond E8X (along the eastern edge of Pond 14) would connect Ponds E12 and E13 to North Creek. The existing brine pump would be used to pump water into Ponds E12 and E13 from the narrow northern extension of Pond E8X and the ELER marsh area to the east to supplement gravity as needed. The northern extension of Pond E8X would likely silt in and become vegetated if restored to tidal action; therefore, a new culvert with tide gates would be installed between Pond E8X and the northern extension to create a managed forebay. This pump forebay would limit tidal sedimentation and provide storage for both passive flows into Pond E13 and pumping into Ponds E12 and E13.

Pond E14, located immediately south of Pond E13, may be used to provide additional storage for gravity flows and pumping into Ponds E12 and E13. Pond E14 is currently managed as a seasonal pond and is connected to Pond E13, the northern extension of Pond E8X, and Pond E9 by existing culverts. As part of the Phase 1 actions at Eden Landing, the existing culverts would be replaced with new culverts with adjustable tide gates. Pond E14 may be managed to provide seasonal or year-round pond habitat.

Within Ponds E12 and E13, earth berms (or similar structures) would be constructed to separate the ponds into six cells. Passive water control structures, such as flashboard weirs, would be used to maintain water depths ranging from approximately 2 inches (5 cm) to 1 ft (30 cm), with an average depth of less than 6 inches (15 cm), to provide shorebird foraging habitat. The shallowest areas would support smaller *Calidris* sandpipers and the deeper areas would support larger shorebirds. Gaps would be excavated through the existing remnant structures (wood fences separating former salt crystallizer cells) to improve circulation within the cells.

The restoration plan includes a water distribution canal between Ponds E12 and E13, with water control structures connecting the canal to each of the six cells. This distribution canal would allow bay salinity water to be pumped directly into any cell in order to dilute the higher salinity water as needed to maintain salinity targets. The canal would be created by constructing a new earth berm (or similar structure) south of the existing borrow ditch between Ponds E12 and E13 and rebuilding the remnant levee north of the borrow ditch as needed.

Salinity management. Bay water (with a salinity level of approximately 20 to 30 ppt) would flow into the low salinity cells from the adjacent sloughs. During the dry season (approximately May to September), evaporation would cause salinity levels to increase in each of the cells (*i.e.*, by removing water and concentrating salt). Water in the low salinity cells would range in salinity from approximately 20 to 50 ppt. Water from the low salinity cells would flow into the moderate salinity cells. This would further concentrate salt and raise salinity levels to approximately 50 to 80 ppt in the moderate salinity cells. Moderate salinity water would flow into the high salinity cells, progressively increasing salinities to approximately 80 to 140 ppt in the high salinity cells. High salinity cells would be managed to keep salinities below approximately 140 ppt to reduce the potential for gypsum and other less soluble salts to precipitate and deposit in the pond. The effectiveness of different water and salinity management approaches would be tested as part of the Adaptive Management Plan. Appendix G of this EIS/R (Eden Landing Ponds E12 and E13 Water and Salt Balance Modeling) documents hydrologic modeling performed to assess the feasibility of water and salinity management in Ponds E12 and E13.

During the wet season (approximately October to April), rain would dilute saline water in the cells. To accommodate rain water inputs to the cells, the water control structures would be adjusted to reduce flows into the ponds and maintain target shallow water depths in the cells. At the end of the wet season, the structures would be adjusted to drain rain water, fill the cells with Bay water, and increase salinity levels to target levels.

Discharge mixing basin. A discharge mixing basin would be created in the western end of Pond E13 to dilute high salinity water before discharging it back into Mt. Eden Creek. The bed elevation of the mixing basin would be approximately 5.0 ft (1.5 m) NAVD, which is approximately 2 ft (0.6 m) below MHHW and slightly lower than the rest of Ponds E12 and E13. Water from the high salinity cells would flow into the mixing basin where it would mix with bay salinity water (approximately 20 to 30 ppt in the summer) from Mt. Eden Creek before discharging to Mt. Eden Creek. Water would flow between the mixing basin and Mt. Eden Creek through a new outlet structure, such as several 24-inch or 48-inch culverts with adjustable tide gates. Water would flow both in and out of the outlet structure to allow mixing and discharge. The water discharged back to Mt. Eden Creek would meet water quality discharge requirements for salinity of less than 44 ppt and DO of greater than 5.0 mg/L. The discharge would either be passively managed by allowing muted tidal flow in and out of the mixing basin through the new culvert or actively controlled by discharging water less frequently. Water from the discharge mixing basin could also flow into Pond E14 to dilute or store high salinity water as needed. Appendix G of this

EIS/R (Eden Landing Ponds E12 and E13 Water and Salt Balance Modeling) documents a technical feasibility assessment of the Pond E13 discharge mixing basin.

Nesting islands. One island would be graded in each of the six cells to provide nesting bird habitat. Nesting islands are expected to be used by snowy plovers, Caspian and Forster's terns, American avocets, and black-necked stilts. Each island would be approximately 3 ft (1 m) high, 300 ft long, and 50 ft wide. The islands would be constructed using fill material (on-site borrow) excavated from the windward side of the islands. Water depths would be deeper on the windward side and shallower on the leeward side of the islands to provide shallow water foraging habitat that is sheltered from the wind. The islands would be located at least 300 ft (90 m) from the edge of the pond to provide a buffer between nesting birds and mammalian predators and to minimize disturbances to threatened and endangered nesting birds by human activity on the levee (*e.g.*, recreation associated with public access trails). The islands would be located at least 600 ft (180 m) from any focal areas for human use, such as viewing platforms, benches and the historic salt works.

Levees. The existing managed pond levee between Pond E13 and Pond E14 would be improved and resurfaced to create a maintenance road and public access trail. The existing levee around the rest of Ponds E12 and E13 would remain as is.

Historic salt works. The historic salt works in Pond E12 would be preserved for recreation and public access (see Eden Landing Recreation and Public Access Actions section below for a description of these recreation and public access features). An earth berm would separate the historic salt works from the rest of Ponds E12 and E13. A new water control structure, such as a culvert or weir, would be installed in the berm to connect the historic salt works to the discharge mixing basin. The historic salt works would wet and dry seasonally due to rainfall and evaporation. The new water control structure would allow water levels in the historic salt works to be managed as needed.

Infrastructure. The existing PG&E power distribution lines and poles would remain to provide power to the existing brine pump located at the eastern corner of Pond E13 as shown on Figure 2-10.

Adaptive Management. Adaptive management for the Phase 1 action at Ponds E12 and E13 would include both an applied study and restoration techniques, as specified in the Adaptive Management Plan (see Section 2.3 and Appendix D of this EIS/R).

Applied Studies. Phase 1 experiments at Ponds E12 and E13 would test the effects of salinity on shorebird species composition and density, on foraging behavior by these birds, and on the species composition and density of the prey on which these shorebirds feed.

Several shorebird species, particularly Wilson's and Red-necked Phalaropes, have long been known to occur in the South Bay primarily within higher-salinity ponds. These species generally forage in high-salinity ponds throughout the tidal cycle. In addition, studies by PRBO and others have demonstrated that some species that typically forage on intertidal habitats during low tide, such as Western sandpipers and dunlin, show an affinity for higher-salinity (vs. lower-salinity) ponds at high tide, and that many individuals of these species forage in higher-salinity ponds at high tide. However, very high densities of shorebirds have also been observed foraging in South Bay ponds that do not have high salinities, but do have optimal foraging depths for small shorebirds. The Ponds E12 and E13 experiment would assess whether foraging shorebirds prefer low, moderate, or high salinity levels (and the associated prey types) in cells with similar shallow water depth habitat. The results of the Ponds E12 and E13 experiment would determine the need for ponds with elevated salinity levels for foraging by migratory shorebirds in future phases of the Project within the Adaptive Management Plan.

The nesting islands may provide some information regarding nesting bird use at the different salinity levels in the pond; however, this would not be the focus of the Ponds E12 and E13 applied study.

Phase 1 applied studies would also include research on the effect of trail use on shorebirds using the Pond E12 and E13 foraging habitats. Recreational access, especially where the public directly approaches birds, could potentially have impacts on shorebird behavior and numbers. Studies both before and after trail use is initiated at a particular site would provide more complete data about shorebird responses to trail use. Ponds E12 and E13 would provide for such a study regarding the effects of trail use on shorebirds.

Restoration techniques. The Phase 1 action at Ponds E12 and E13 would test the effectiveness of management approaches for:

1. Water and salinity management
2. Vegetation management.

- Water and salinity management. The effectiveness of different water and salinity management approaches for high salinity cells and discharge water quality would be tested. Two potential water and salinity management approaches would be tested to allow either periodic or continuous flow between the cells. For periodic flows, the water control structures would be opened approximately every ten days to allow water to flow into the low salinity cells and between each of the cells. The water control structures would then be closed. Evaporation would decrease water depths and increase salinity levels in the cells until the structures were opened again to refill the cells. Water depths would fluctuate by approximately 2 inches (five cm) and salinity levels would vary within the ranges described above. For continuous flow between cells, the water control structures would be adjusted to allow flows that balance evaporation and result in target salinities. Flows, water levels, and salinities, would be relatively constant compared to the periodic flows and fluctuations. Similarly, the effectiveness of both periodic and continuous mixing and discharge of high salinity outflows into the discharge mixing basin would be tested.
- Vegetation management. Vegetation management on the nesting islands would also be tested as a restoration technique to assess the effectiveness of high salinity in discouraging vegetation growth.

Restoration Monitoring. Restoration monitoring would be performed at Ponds E12 and E13 to evaluate restoration performance, as part of some applied studies, and test restoration techniques. Inspections related to O&M are addressed in Section 2.5.6.

- Water and salinity management. As discussed in the O&M section in Section 2.5.6, water levels and salinity would be routinely monitored on a weekly basis (approximate) to evaluate pond operation. During periods when different restoration techniques would be tested, water level and salinity monitoring would likely be more frequent (approximately daily observations).
- Vegetation management. Vegetation encroachment on the nesting islands and pond bed would be monitored to test elevated salinity levels as a vegetation management technique. Vegetation monitoring would be performed as discussed for Alviso Pond A16 (see Section 2.5.3 below).

Phase 1 Recreation and Public Access Actions

The Phase 1 public access and recreation plan for Eden Landing would occur in the northern portion of the pond complex (see Figure 2-11). Both year-round and seasonal trails would link to the Bay Trail Spine segment that would be constructed as part of the ELER Restoration Project, a separate project which borders the northern perimeter of the pond complex. This segment connects the Bay Trail spine from the north along SR 92 and the Hayward Regional Shoreline to the east and south towards Union City and Coyote Hills Regional Park.

In total, 3.8 miles of new trail would be constructed along existing levees as part of the Phase 1 public access plan at Eden Landing and 1.6 miles of water trail would be provided at Mt. Eden Creek. These trails along with the kayak and boat launching site, the viewing platforms and interpretive stations would provide an opportunity for a wide range of visitors. The proposed features would provide a diversity of recreational opportunities, including walking, cycling, kayaking/boating, fishing, waterfowl hunting, learning about the history of the area, and viewing of surrounding habitat and wildlife.

Most of the trails proposed at Eden Landing for the Phase 1 plan would be 6 ft wide on an existing managed pond levee, and would have firm and stable, hardened surfacing to allow for hikers, wheelchairs and cyclists. Dogs are permitted at the reserve for waterfowl hunting and as per CDFG regulations. Currently the managed pond levees provide firm and compacted surfaces so paving would not be required; however for ADA compliance some re-surfacing may be necessary. In some instances, such as the loop trail on the levee between Ponds E13 and E14, the levee would need to be re-graded, leveled and re-surfaced to allow for safe access and maintenance operations. The trails would be open to the public during typical hours of operation, from sunrise to sunset and would include amenities along the trail such as seating. Fencing may be required along certain portions of the trails to prevent human disturbance to adjacent habitat areas. Under the Phase 1 actions, one seasonal trail is proposed within the Eden Landing pond complex from the northeast corner of pond E12 south and westerly between ponds E13 and E14. Typically, the bird nesting season occurs between the months of March through August. See Eden Landing Phase 1 Map for a plan of Phase 1 actions (Figure 2-11).

The kayak/boat launch, located north of Pond E12 and on the north side of Mt. Eden Creek would be accessible year-round from the existing levee road that leads from the staging area to the Mt. Eden bridge and designed for ADA compliance. The staging area would support 58 vehicles and would be built as part of the restoration plan for the northern 835 acres of ELER, a separate action currently underway. The launch would be approximately 8 to 10 ft wide and 20 ft long to accommodate non-motorized boats (*e.g.*, kayaks and canoes) and small motorized boats for hunting and operations. Additionally, this area can be used to launch small motorized boats for management and operations and waterfowl hunting access to certain designated areas of the pond complex. Mt. Eden Creek was restored to tidal action in 2007. Figure 2-12 shows a sketch of the launching area. With construction of a kayak launch as part of the SBSP Restoration Project, kayakers can travel 1.6 miles from the launch point to the Bay. Other amenities at the launch/staging area would include seating areas and interpretive information. Future, nearby restroom facilities may be constructed as part of the field office near the staging area as defined in the program-level alternatives. However, in the short-term, chemical toilets would be provided when the Bay Trail Spine project is completed. The inclusion of a kayak/boat launch and associated water trail could become part of the San Francisco Bay Area Water Trail, which is being planned as a network of landing and launch sites to allow a continuous paddling experience for the enjoyment of the historic, scenic and environmental resources of San Francisco Bay.

The historic Oliver Salt Works (also known locally as the Rock Island Salt Works) currently consists of remnants of the old salt production / harvesting-related facilities (*e.g.*, pilings, foundations). Under the proposed Phase 1 actions, the saltworks would be accessible to the public by a new accessible trail, and would be open year-round. Depending on seasonal water flow through this area, visibility of the remnants vary. An interpretive station would be designed to tell the history of the salt works at this location, explain how salt is produced, and explain the saltwork's cultural, economical, and social linkage to the greater San Francisco Bay Area. The interpretive station would be placed along the trail in the central portion of the remains. Figure 2-13 shows a sketch of how this area would look and the placement of the interpretative station. Two additional viewing areas would be developed along with site-specific interpretive information. One would be between Ponds E13 and E14 along the levee loop trail and looks out over the remains of historic Archimedes screws as well as provides opportunities to see the managed pond habitats and learn about species-related experiments that would take place in adjacent ponds. Figure 2-14 shows a sketch of this location. This site would be accessible year round from the loop trail approaching from the west and seasonally from another trail segment approaching from the east. The viewing area would also provide seating to be a resting stop along the trail loop. The other viewing area at Eden Landing would be at the terminus of the shoreline trail where it would be part of the existing levee along Pond E9 and near where Mt. Eden Creek and Whale's Tail Marsh meets the Bay's open water edge.

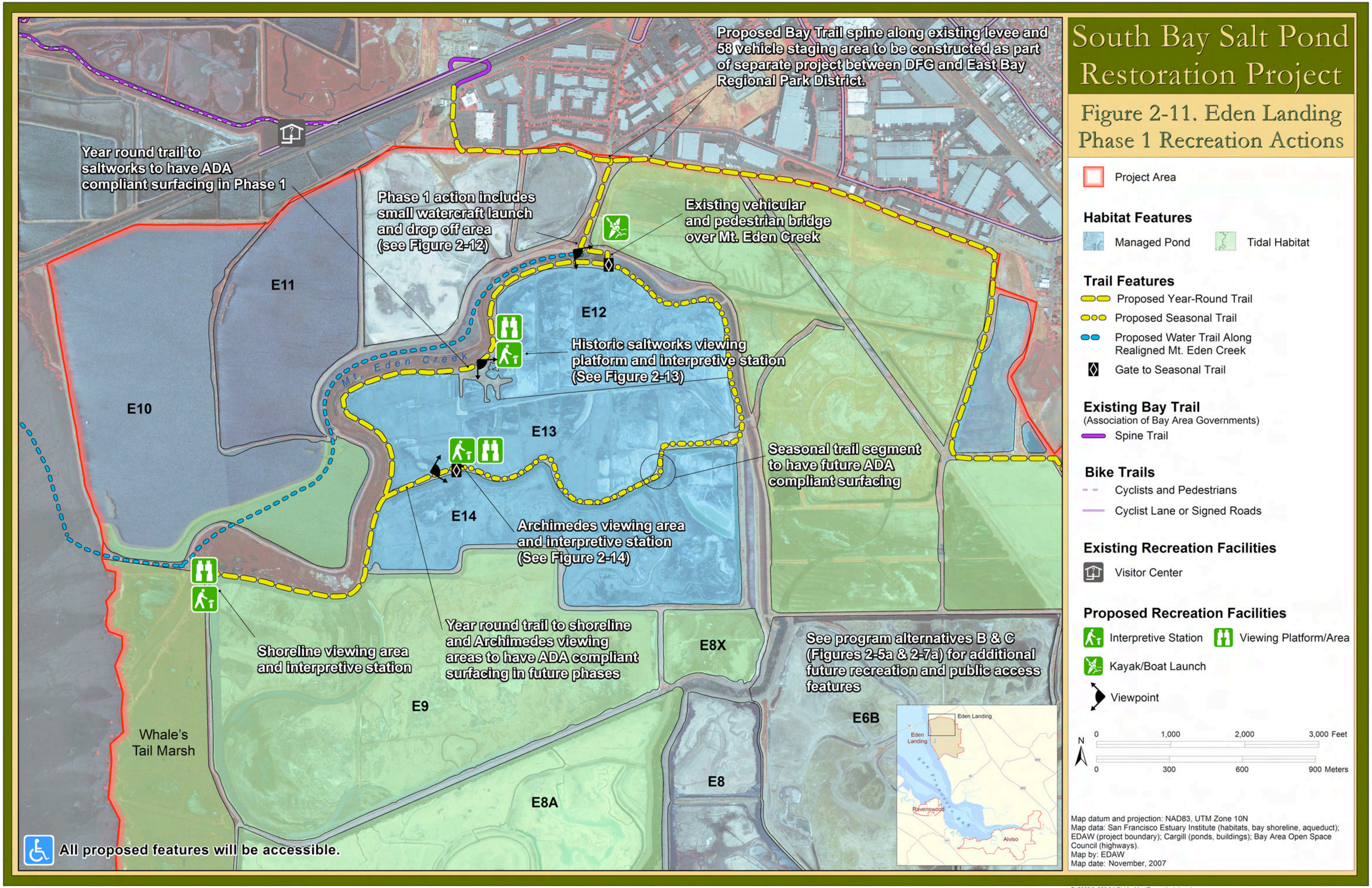
2.5.3 Alviso Pond Complex

Phase 1 actions in the Alviso pond complex would include tidal habitat restoration in Pond A6, reversible tidal restoration in Pond A8, a reconfigured managed pond restoration at Pond A16, and recreation and public access actions at Pond A16 and near Ponds A2E and A3W.

Phase 1 No Action

Pond A6

In the absence of a Phase 1 action at Pond A6, USFWS would continue to operate and maintain Pond A6 under its current management, although ongoing O&M activities would be scaled back based on available



P:\2003\3s056.01\Gis\ArcMap\Recreation\phaseI

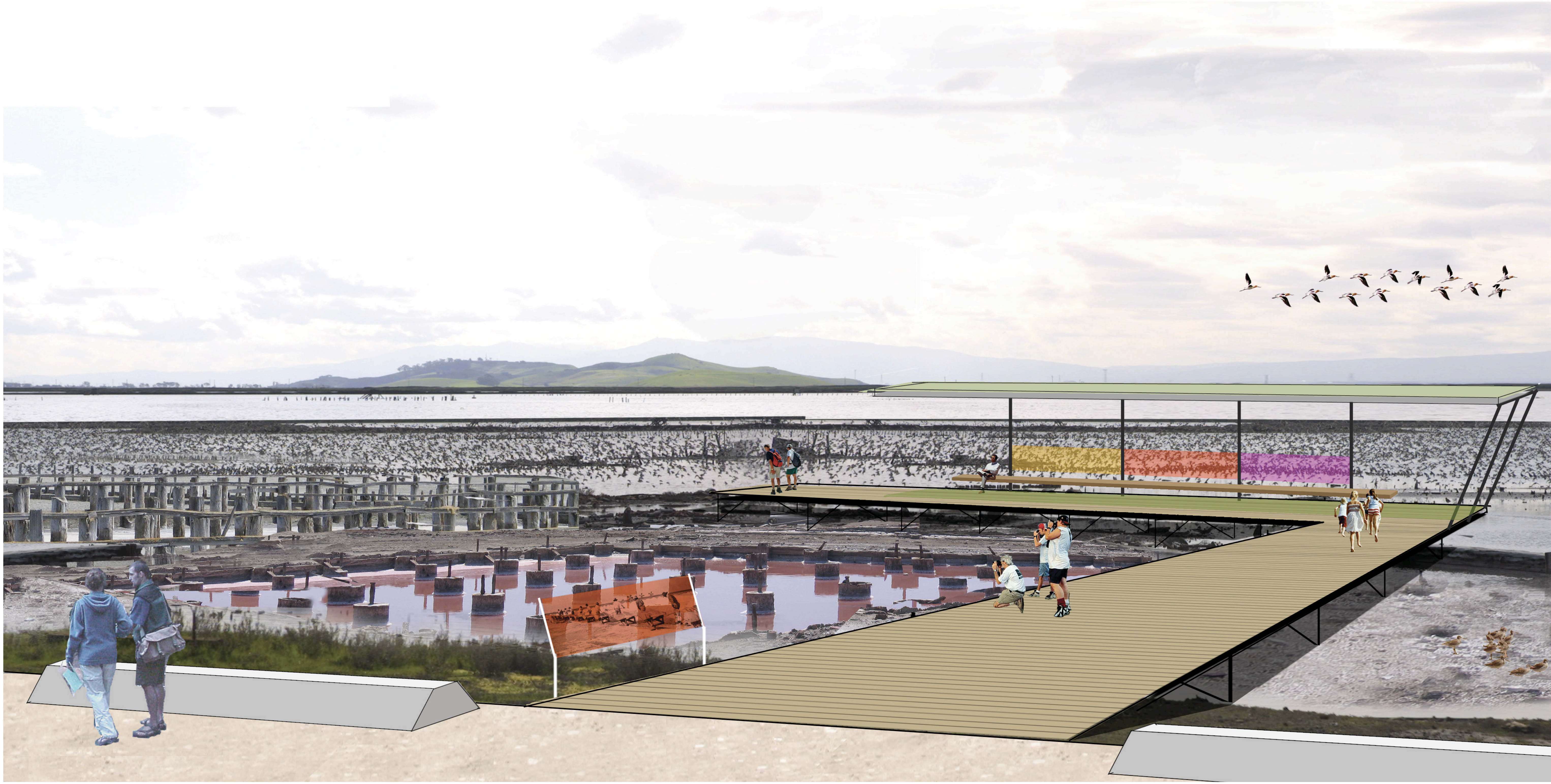
South Bay Salt Pond Restoration Project

Eden Landing – Kayak Launch and Trailhead

Figure 2-12

EDAW | AECOM

March 2007



Eden Landing – Historic Salt Works Viewing Platform and Interpretive Station

South Bay Salt Pond Restoration Project

Figure 2-13

EDAW | AECOM

March 2007

Eden Landing – Archimedes Screw Loop Trail

Figure 2-14

South Bay Salt Pond
Restoration Project

EDAW | AECOM

March 2007

funding (see Section 1.4.4 and Figure 2, Appendix B of this EIS/R). Pond A6 operates as a seasonal pond with no direct hydraulic connection to the Bay or Ponds A5 and A7. Pond A6 would continue to fill with rainwater or high groundwater during winter and allowed to dry-down in the summer through evaporation. Salinity would not be controlled and would fluctuate due to residual salt in the pond, rainwater inflows and seasonal evaporation.

The northern segment of the outboard levee of Pond A6 adjacent to Coyote Creek and the Bay, referred to here as the bayfront levee, is actively eroding. To protect its existing facilities in Pond A6, PG&E replaced the eleven existing transmission towers with nine new towers and reconductored two of the three transmission lines. In addition, PG&E has previously replaced its boardwalk that it uses to service the transmission towers and lines in Pond A6. Upon levee failure, Pond A6 would convert to tidal action in an unplanned and uncontrolled manner.

Since the time Pond A6 was leveed to create a salt pond, it has subsided by approximately 5 ft (1.5 m) to an average elevation of 2.3 ft NAVD (0.70 m NAVD). The elevation of Pond A6 is below MTL and below the elevation at which marsh vegetation colonizes. Therefore, sediment accumulation would be required to raise pond bottom elevations so that salt marsh vegetation could establish. However, erosion of the bayfront levee would likely prevent significant sediment accumulation, particularly in the more exposed northern reaches of Pond A6. Wind-waves generated across the Bay would have the potential to limit sedimentation, vegetation colonization, and potentially erode the emerging mudflats within the pond. Therefore, in the long term, the unplanned tidal conversion of Pond A6 would likely create a mix of open Bay, intertidal mudflat and vegetated emergent marsh habitat within Pond A6.

The levee along the southern border of Pond A6, between Pond A6 and Ponds A5 and A7 was reinforced by Cargill in the 1990s. During extreme flood events in Alviso Slough, flood storage in Ponds A8, A5 and A7 may overtop this levee and flow into Pond A6. With the unplanned tidal conversion of Pond A6, the overflow from Ponds A5 and A7 would flow directly into tidal water. The unplanned tidal conversion would also increase the erosive forces along the levee between Pond A6 and A5 and A7. This levee would likely not be maintained by USFWS and Ponds A5 and A7 would eventually convert to tidal action in an unplanned manner. The levee along the east side of Pond A8 would be raised to prevent frequent tidal overtopping into Ponds A8 and 8S. Existing flood detention storage would be maintained in Pond A8 and A8S, but not in Ponds A5, A6 and A7. This loss of flood detention storage has the potential to raise water surface elevations at the mouth of Guadalupe River/Alviso Slough and reduce flood protection. USFWS would coordinate with SCVWD to complete the necessary hydraulic assessment to determine the most effective method for compensating for the loss of flood storage and maintaining flood hazard management at its current level.

No public access and recreation access currently exists at Pond A6, and no new public access or recreational facilities would be constructed under this alternative.

Pond A8

In the absence of a Phase 1 action at Pond A8, USFWS would continue to operate and maintain the pond in a manner similar to the ISP (Life Science! 2003), although ongoing O&M activities would be scaled back based on available funding (see Section 1.4.4 and Figure 2, Appendix B of this EIS/R). Pond A8 operates as a seasonal or high salinity pond depending on conditions. As a seasonal pond, Pond A8 would be allowed to fill with rainwater during the winter and draw-down in the summer through evaporation. Salinity would not be controlled and would fluctuate due to residual salt in the pond, rainwater inflows and seasonal evaporation. As a high salinity pond, water would either be diverted from Pond A7 to A8, or water would be pumped from Pond A8 to A7 as needed to control water levels and salinity. If funding is not available to continue operating and maintaining the existing pump, Pond A8 would be operated as a seasonal pond year round.

Pond A8 also contains an overflow weir, and during flood events greater than a 10-year flood in the lower Guadalupe River/Alviso Slough, overflows into Pond A8 would occur and Ponds A5, A6, A7 and A8 would initially be used for flood storage. In the absence of the Phase 1 action at Pond A6, the pond would continue to provide flood storage during large rainfall events. In the long-term, Ponds A5, A6, and A7 would likely convert to tidal action, thereby reducing the available flood detention storage. This loss of storage has the potential to raise water surface elevations in Guadalupe River/Alviso Slough and Guadalupe Slough, and possibly reduce flood protection. It would require hydraulic assessment to determine the most effective method for compensating for the loss of flood storage and restoring flood hazard management to the current level, if needed. The levees surrounding Ponds A8 and A8S would be maintained in order to provide a portion of the existing flood storage capacity, and the levee along the west side of Pond A8 would be raised to prevent frequent tidal overtopping into Ponds A8 and 8S.

The scenario depicted in Figure 2-4 and described above is considered the most likely outcome in the absence of the SBSP Restoration Project. However, a range of No Action outcomes is possible. In the Pond A8 vicinity, for example, it is possible that additional funding could be available to the Refuge, allowing the Refuge to maintain the Pond A5, A7, and A8 perimeter levees, and forego improvements to the Pond A8 west levee. Alternately, SCVWD could maintain the levee along Guadalupe Slough/Pond A5 (where they have an existing easement for levee maintenance) and the Refuge could then focus its limited funds on maintaining the Alviso Slough/Pond A7/Pond A8 levee and the Pond A6 south levee.

No public access and recreation access currently exists at Pond A8, and no new public access or recreational facilities would be constructed under this alternative.

Pond A16

In the absence of a Phase 1 action at Pond A16, USFWS would continue to operate and maintain the pond in a manner similar to the ISP (Life Science! 2003), although ongoing O&M activities would be scaled back based on available funding (see Section 1.4.4 and Figure 2, Appendix B of this EIS/R). Under the ISP, USFWS operates Pond A16 as a managed pond in combination with Pond A17. Water flows through the existing intake structure from Coyote Creek into Pond A17, through an existing gap between Ponds A16 and A17, and from Pond A16 into Artesian Slough through the existing outlet structure. In order to meet DO discharge requirements, the existing intake and outlet structures are opened to their fullest extent and the flows are essentially muted tidal. In the winter, the flow through the system is reversed in order to minimize the entrainment of migrating salmonids in Coyote Creek. Pond A16 also operates as a dilution pond, receiving high salinity water through an existing siphon from Pond A15.

In the long-term, the levees surrounding Pond A16 would be maintained or repaired upon failure and USFWS would maintain or repair the water control structures as necessary to continue managed pond operations. No new public access or recreational facilities would be constructed under this alternative. An existing recreational trail surrounds Pond A16 and the trail would be maintained or repaired along with the pond levees, therefore maintaining the existing public access and recreational value.

Phase 1 Restoration Actions

Pond A6

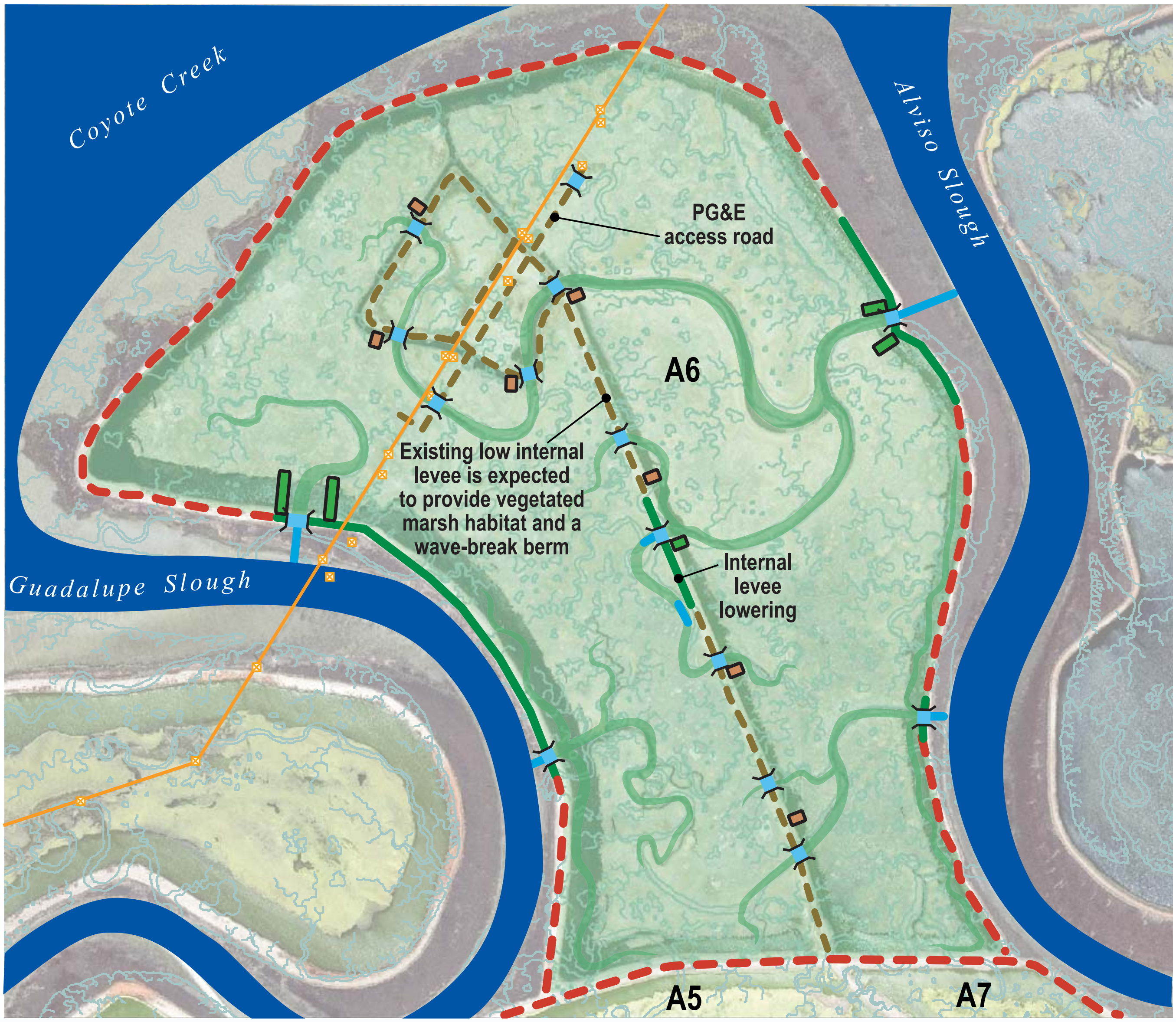
Introduction. Alviso Pond A6 would be restored to tidal action to create approximately 360 acres of tidal salt marsh and tidal channel habitat (Figure 2-15). As specified in the Adaptive Management Plan (see Section 2.3 and Appendix D of this EIS/R), the Pond A6 restoration would test the effectiveness of borrow ditch blocks and wave-break berms as restoration techniques (see the Pond A6 Adaptive Management section below). The Pond A6 restoration would not include recreation or public access features.

Restoration Plan. Pond A6 would be restored to tidal habitat by breaching and lowering the outboard levee, excavating pilot channels through the fringe marsh outboard of the breaches, and constructing ditch blocks in the perimeter borrow ditch (Figure 2-15). Since the time Pond A6 was leveed to create a salt pond, it has subsided by approximately 5 ft (1.5 m) to an average elevation of 2.3 ft NAVD (0.70 m NAVD). The elevation of Pond A6 is below MTL (3.3 ft NAVD or 1.0 m NAVD) and below the elevation at which marsh vegetation colonizes emerging mudflats. The Pond A6 restoration would initially create large areas of emergent mudflat habitat. Over time, tidal channel and vegetated salt marsh habitats are expected to develop in Pond A6 as tidal channels reform and as sediment accumulates and vegetation establishes on the emerging mudflats.

Levee breaches. Tidal inundation would be restored to Pond A6 by excavating four breaches through the outboard levee. The breaches would be located at the mouths of remnant historic tidal channels in Pond A6 to encourage the re-establishment of the natural historic tidal channel system. The historic systems of sinuous branching channels are expected to provide quality habitat for fish and wildlife, including the endangered California clapper rail. Two breaches would reconnect historic tidal channel systems to Guadalupe Slough, located to the west of Pond A6. Two additional breaches would restore the historic tidal channels to Alviso Slough to the east. The levee breaches would be sized to provide full tidal exchange between the sloughs and the restored marsh area.

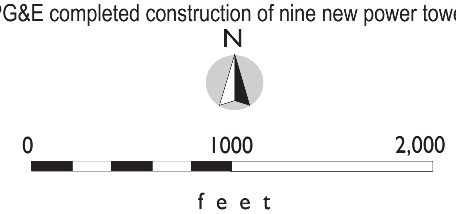
The internal levee bisecting Pond A6 and surrounding the former duck club pond in the middle of Pond A6 would be breached in several locations. These internal levee breaches would reconnect remnant historic tidal channels across the levee and provide full tidal drainage in the former duck club pond. The internal levee breaches would be constructed to the estimated width and depth of the historic channels.

Pilot channels. Pilot channels are small excavated channels that facilitate tidal exchange between the breached pond and the adjacent slough. The required length of the pilot channel depends on the width of existing vegetated fringe marsh (if any) between the outboard pond levee and the slough. The pilot



- Tidal Habitat
- Historic channel network
- Levee breach
- Levee lowering
- Existing low internal levee/berm, to remain
- Existing levee, to remain
- Pilot channel
- Borrow ditch block
- Fill placement
- PG&E power transmission line and power towers[1]

[1]PG&E completed construction of nine new power towers in Pond A6 in 2007.



South Bay Salt Pond
Restoration Project

figure 2-15

Alviso Pond A6
Phase 1 Action Restoration Plan

Figure by Philip Williams & Associates
Figure Date: 6-7-07

PWA Ref# 1750 phase1/basemaps/concept plans/pondA6_6-07-07.cdr channels would be narrower than the breach excavations in order to minimize impacts to existing marsh and minimize construction costs. The pilot channels are expected to widen over time as restored tidal flows scour the pilot channel banks. Pilot channels would be excavated from the outboard levee breaches to the sloughs through the existing vegetated fringe marsh outboard of the levee. Material excavated from the pilot channels would either be used to construct the borrow ditch blocks, placed within the pond, or cast on the marsh adjacent to the pilot channels. The casted material would likely erode as the pilot channel banks scour.

Levees. Along Guadalupe and Alviso Sloughs, portions of the outboard levee would be lowered to the elevation of MHHW (approximately 7.5 ft NAVD or 2.3 m NAVD). Lowering of the outboard levee would create pickleweed salt marsh habitat around the perimeter of the restoration site, which is expected to provide escape cover for the endangered salt marsh harvest mice. Lowering the levee would restore the hydrologic connectivity between the adjacent sloughs and the restored marsh areas during the highest tides.

The bayfront levee would remain to limit the propagation of waves from the Bay into Pond A6, minimize potential disturbances to California clapper rail that may forage in the bayfront fringe marsh, and reduce the extent and cost associated with levee lowering. If the bayfront levee were removed, wind-waves generated across the Bay would have the potential to limit sedimentation and vegetation colonization and erode the emergent mudflats in Pond A6. Leaving the bayfront levee in place is expected to limit wave action from the Bay while the emergent mudflats develop into vegetated marsh in the pond. Over time, the bayfront levee is expected to erode, exposing tidal habitat in Pond A6 to wave action; however, the bayfront levee would benefit marsh development in the short term.

The levee between Pond A6 and Ponds A5 and A7 would remain in place to limit the potential for coastal flooding in Ponds A5 and A7. Cargill reinforced this levee in the 1990s by placing rip-rap on the north (Pond A6) side of the levee and covering the rip-rap with bay mud (Mapelli 2007 pers. comm.). The levee is expected to be overtopped and subject to erosion during storm events because the minimum levee crest elevation is at the two-year return period still water level in the Bay (PWA and H.T. Harvey & Associates 2007). The levee would be inspected after storm events and maintained as needed to limit the potential for unintentional levee breaching. Any breach would be repaired to prevent tidal inundation of Ponds A5, A7, and A8. The levee may be improved as part of the restoration design or as part of future levee maintenance to reduce maintenance requirements and the risk of coastal overtopping, erosion, and breaching. Levee improvements could consist of raising low points along the levee crest, armoring the back side of the levee slope, and/or constructing an engineered overflow structure (*e.g.*, weir). During extreme flood events in Alviso Slough, flood storage in Ponds A8, A5, and A7 may overtop this levee and flow into Pond A6. With the restoration of Pond A6, overflow from Ponds A5 and A7 would flow directly into tidal water.

The internal levee bisecting Pond A6 would not be lowered and would act as a wave-break across the site. The elevation of the internal levee in Pond A6 (4.6 ft NAVD or 1.4 m NAVD) is intertidal and cordgrass is expected to establish on the levee soon after restoration, forming a low vegetated wave-break berm. This berm is expected to break waves generated during high tides within Pond A6 by predominant winds from the northwest. As described in the Adaptive Management section below, the effectiveness of this wave-break in increasing marsh sedimentation and vegetation development would be tested as a restoration technique. A short portion of the internal levee would be lowered as part of this test and to provide borrow material to create a borrow ditch block in the borrow ditch adjacent to the internal levee.

Borrow ditch blocks. Borrow ditch blocks would be constructed at the north breaches to encourage the re-establishment of the historic tidal channel system in Pond A6. The borrow ditch blocks are expected to inhibit flow through the borrow ditch, direct flow into the remnant historic tidal channels, and promote scour of the silted-in remnant channels. The locations of the borrow ditch blocks would allow for complete drainage of the borrow ditch, avoiding the potential to trap fish at low tide. Borrow ditch blocks would be constructed across the borrow ditch with material excavated from the levee breaches and lowered levees. Additional material excavated from the lowered levees may be placed along the edge of the borrow ditch to create additional marsh habitat. In these locations, the borrow ditch would not be blocked and the conveyance of tidal flows in the borrow ditches would be maintained.

To test the effectiveness of borrow ditch blocks as a restoration technique, borrow ditch blocks would not be constructed at the south breaches (see the Adaptive Management section below). One additional borrow ditch block would be constructed in the internal borrow ditch adjacent to the internal levee. This internal borrow ditch block is expected to enhance the re-establishment of the historic tidal channel system across the internal levee.

Infrastructure. To protect its existing facilities in Pond A6, PG&E replaced the eleven existing transmission towers with nine new towers and reconductored two of the three transmission lines. PG&E previously replaced its boardwalk that it uses to service the transmission towers and lines in Pond A6. PG&E's previous access routes to its facilities in Pond A6 would be eliminated by the planned breaches of the levees. Therefore, PG&E's existing boardwalk would be extended and a platform would be constructed to allow for the delivery of heavy equipment (via helicopter) needed for certain O&M activities. In addition, for more routine O&M activities, the boardwalk would be extended through the marsh outside the levee to connect with the existing boat dock.

Adaptive Management. Adaptive management for the Phase 1 action at Pond A6 would include applied studies similar to those for Alviso Pond A8 and Eden Landing Ponds E8A, E9, and E8X (see Section 2.5.2) and restoration techniques as specified in the Adaptive Management Plan (see Section 2.3 and Appendix D of this EIS/R).

Applied Studies. Phase 1 experiments at Pond A6 would test:

1. Relative influence of slough scour and marsh restoration on flood hazards.

2. Wildlife response to increased exposure of mercury (MeHg).

3. Effects of California gulls on nesting birds.

4. Rates of marsh sedimentation.

5. Effects of pond sedimentation on existing outboard intertidal habitat.

- Relative Influence of Slough Scour and Marsh Restoration on Flood Hazards. Tidal restoration at Pond A6 is expected to enlarge the downstream reaches of Alviso and Guadalupe Sloughs by increasing tidal prism. These potential changes in slough geometry would increase the ability to convey flood flows and lower water levels when large amounts of runoff from the watershed is routed to the sloughs. However, tidal restoration of Pond A6 would also eliminate the flood storage provided by this pond under existing conditions. The Phase 1 action at Pond A6 provides an opportunity to determine if flood hazards are decreased over the short- and long-term. Monitoring data of slough scour and tidal regime would provide the necessary information to examine changes to baseline flood hazards. This applied study would be coordinated with that carried out for the Phase 1 action at Pond A8 (see below). If it is determined that the backwater elevation increases upstream of breaches due to the Phase 1 action at Pond A6, different approaches to levee breaching at bayfront ponds may be incorporated at subsequent phases.
- Wildlife Response to Increased Exposure of MeHg. The production of MeHg, its uptake into food webs, and its bioaccumulation vary within and among species and habitats. Additionally, threshold concentrations of MeHg toxicity are not well known for most wildlife species. Led by the San Francisco Estuary Institute (SFEI), the South Baylands Mercury Project has been designed to estimate how much legacy Hg is contained in the sediments of different habitats along Alviso Slough, how readily Hg is converted to MeHg, and how effectively MeHg is incorporated into local food webs. The ecological risks of mercury toxicity in wildlife would be assessed by monitoring Hg in 'biosentinel' wildlife species that represent the baylands. Coupling such a monitoring effort to studies of MeHg production and uptake is essential to improve the understanding of how the risk of Hg bioaccumulation can be reduced, and thus develop effective management options. Although the focus of the South Baylands Mercury Project is Pond A8 and its environs, the evolving tidal marsh at Pond A6 would provide an opportunity to expand future monitoring of biosentinel species.
- Effects of California gulls on nesting birds. Although they did not nest in the Bay before the early 1980s, nesting California gulls now number more than 20,000, and their population is growing exponentially. Nearly all these birds nest in Pond A6. When this pond is restored to tidal habitat, this huge gull colony would be displaced and the birds would seek alternate nesting sites. This one species has the potential to displace many other nesting species from the Project Area, including avocets, stilts, and terns. California gulls may dominate the new nesting islands the Project would develop in Pond A16 (see below), islands that are meant to support the other South Bay nesting species. Applied studies in Phase 1 would document the current impacts of California gulls on other nesting species, investigate the causes of gull population growth, and attempt to understand the likely responses of the gulls to the loss of Pond A6 as a nesting site.

The applied studies at Pond A6 to test rates of marsh sedimentation, and effects of pond sedimentation on existing outboard intertidal habitat would replicate the applied studies described for Ponds E8A, E9, and E8X (see the Ponds E8A, E9, E8X Adaptive Management section in Section 2.5.2).

Restoration Techniques. The Phase 1 action at Pond A6 would test the effectiveness of wave-break berms and borrow ditch blocks as restoration techniques.

- Wave-break berms. Wind blowing across open expanses of water, such as low restoration sites at high tide, can generate waves that are sufficient to inhibit sediment deposition and resuspend previously deposited material. These effects can slow or possibly prevent the development of vegetation on the restored marsh plain. The wind fetch length and wave exposure would vary on either side of the wave-break berm and in different areas of the pond. The rate of sedimentation and vegetation development would be compared for areas with varying wind-wave exposures to evaluate the effectiveness of this restoration technique.
- Borrow ditch blocks. In previous salt pond restorations, large borrow ditches captured tidal flows and became the major tidal channels, limiting the re-establishment of a more natural channel system. The complexity of natural historic tidal channels is expected to provide improved habitat compared with the oversized, straighter borrow ditches. The borrow ditch blocks adjacent to the north breaches are expected to block flow directly from the borrow ditch to the breaches. North of these borrow ditch blocks, the severed borrow ditch is expected to drain through the upstream ends of the remnant channel systems. The severed borrow ditch would drain directly to the south breaches; however, the north borrow ditch blocks are expected to limit the marsh area drained by the borrow ditch to the south. The rate and extent of channel formation in the north and south channel systems would be compared to evaluate the effectiveness of these two approaches.

Restoration Monitoring. The Pond A6 restoration would be monitored to evaluate restoration performance, inform adaptive management, and to meet any permit requirements. O&M inspections are discussed in the Operations and Maintenance section in Section 2.5.6.

Physical processes and habitat development in Pond A6 would be evaluated by monitoring tides, sedimentation, channel development, and vegetation development. Monitoring would consist of ground surveys and ground and aerial photography at intervals ranging from one to several years. For example, the aerial photos and ground surveys could be used to track the development of low, medium and high marsh zones, which provide different habitat values for the California clapper rail and salt marsh harvest mouse. Once suitable vegetated marsh habitat develops in Pond A6, surveys of California clapper rail and salt marsh harvest mouse would be performed to track the progress of these endangered species towards recovery, in accordance with Section 7 of the Endangered Species Act.

Monitoring would also be performed to test the effectiveness of the wave-break berm and borrow ditch blocks as restoration techniques. For the wave-break berm restoration technique, sedimentation rates would be measured at various locations within Pond A6 to track the effects of fetch length on the ability of wind-wave action to retard sediment accretion. For the borrow ditch restoration technique, annual ground surveys would be collected to track channel formation. Low-tide aerial photographs would provide information on channel development throughout Pond A6.

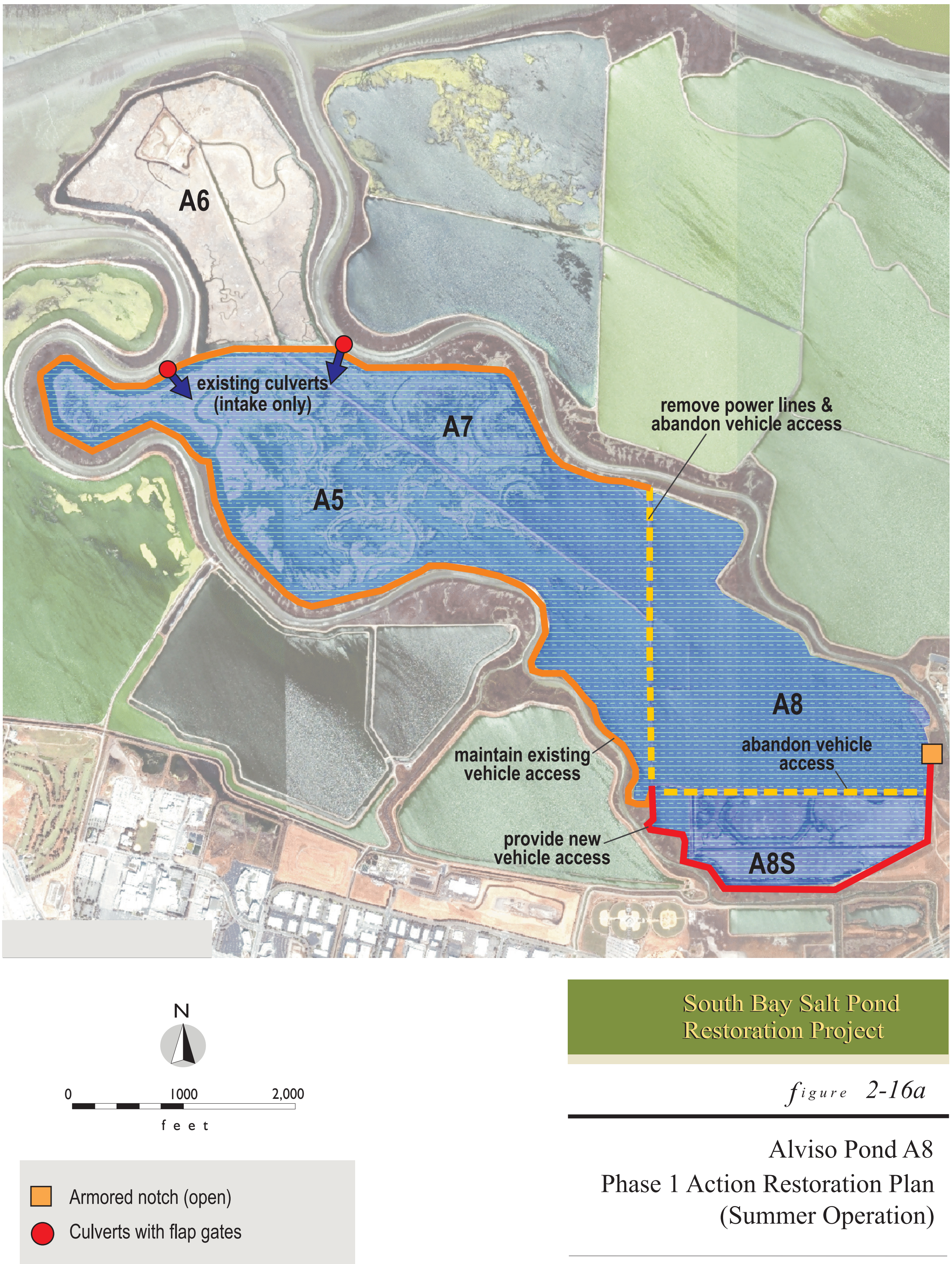
Invasive plant monitoring and control would be coordinating with existing control efforts, such as the Invasive Spartina Project, as discussed in the introduction (Chapter 1), and under the SBSP Long-term Alternatives B and C (see Sections 2.4.3 and 2.4.4, respectively).

Pond A8

Introduction. Implementation of a Phase 1 action at Pond A8 would introduce limited tidal exchange to create approximately 400 acres of muted subtidal habitat in Pond A8 and modify water depths in about 1,000 acres of existing shallow water habitat in Ponds A5 and A7 (Figures 2-16a and 2-16b). Restoration of tidal action at Pond A8 is designed to be adaptable and reversible so that in the event that unacceptable ecological impacts begin to occur, tidal exchange to Pond A8 can be modified or eliminated to prevent long-term adverse impacts and water management at Ponds A5 and A7 can revert to ISP operations. Water exchange would be limited and tidal range within the three ponds would be muted during the dry summer and fall months, and even with a fully open notch, water level fluctuation in the ponds over a tidal cycle would be small (approximately 0.5 ft) compared to the range of tidal change in the slough (over 8 ft). Initially, water level fluctuation in the ponds would be less as the notch would be only partially open. Water levels in Pond A8 (409 acres) would exceed elevations of internal levees and spill into adjacent Ponds A8S, A5 and A7 (1,023 acres) and modify the existing hydrologic regime in these ponds as well. Water levels would fluctuate over the tidal cycle evenly across the area of all the ponds but depths would vary due to differences in bed elevations. Depths would exceed those at which the ponds are presently managed (<1 ft) over the majority of the 1,400 acres most of the time. Prior to implementation of Phase 1 actions at Pond A8, water depths in other ponds would be lowered to replace the loss of shallow water foraging habitat presently offered in Ponds A5 and A7 (possible candidate ponds include: Ponds A1 and A2W; A9 and A11; AB1 and AB2; and A3N).

Partial restoration of tidal prism in these ponds would promote channel scour and increase salinity along Alviso Slough. The expected potential increases in channel width and salinity would improve navigation access in a sustainable fashion – a key objective of the Alviso Slough Restoration Project. Exchange between Pond A8 and Alviso Slough would be managed as needed during the wet season to avoid fish trapping and maintain existing levels of flood protection by either reducing the notch width or completely eliminating tidal exchange during this period. Initially, the notch would be closed from February through May unless the fish trapping applied study (see below) indicates that the open notch does not pose an unacceptable risk to migrating fish. Implementation of the Phase 1 action at Pond A8 would provide the opportunity to test scientific uncertainties related to the effects of tidal restoration on slough scour and the uptake of MeHg into the food web. Applied studies designed to address these uncertainties are part of the Adaptive Management Plan (see Pond A8 Adaptive Management section below and Appendix D of this EIS/R).

Restoration Plan. Restoration features are described below and shown in Figures 2-16a and 2-16b. These elements have been selected to allow for a muted tidal connection from adjacent sloughs to Ponds A8, A8S, A5, and A7 that can be blocked if there is evidence of adverse ecological impact. Water exchange would be limited and tidal range within the ponds would be muted, so that the change in water level in the ponds over a tidal cycle would be small (0.5 to 1 ft) compared to the range of tidal change in the slough (over 8 ft). Appendix G (Alviso Pond A8 Hydrodynamic Modeling and Geomorphic Analysis of this EIS/R) documents hydrodynamic modeling and other technical analysis of the Pond A8 restoration.



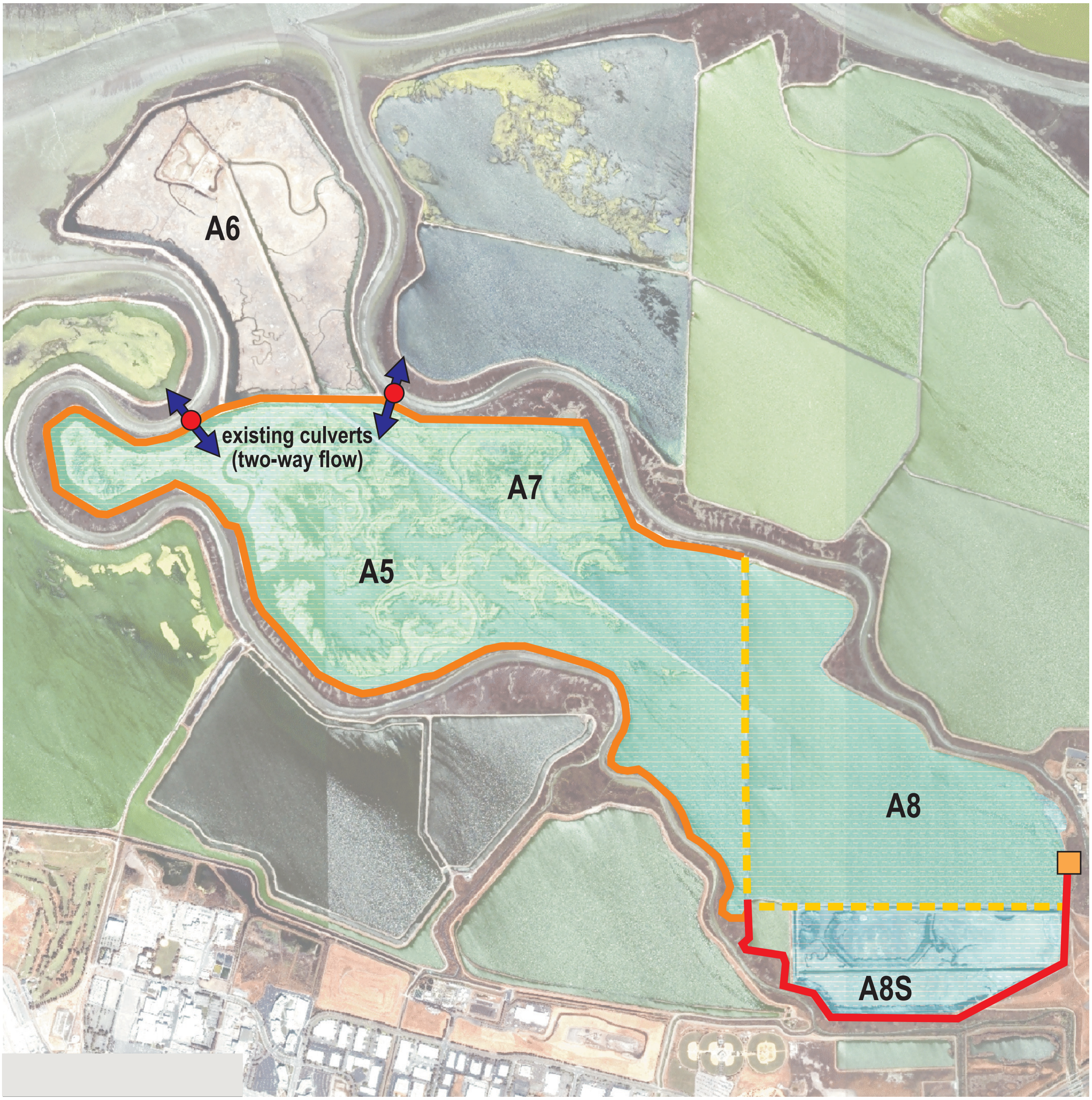
South Bay Salt Pond
Restoration Project

figure 2-16a

Alviso Pond A8
Phase 1 Action Restoration Plan
(Summer Operation)

Map by: **PWA**
Map date: August 8, 2007

PWA Ref# 1750/Task7/Final_Draft/Revised_Section2/Section2_fig/ pondA8__8_6_07.cdr



Armored notch (closed)

Culverts with flap gates

South Bay Salt Pond Restoration Project

figure 2-16b

Alviso Pond A8
Phase 1 Action Restoration Plan
(Winter Operation)

Map by: PWA
Map date: August 8, 2007

PWA Ref# 1750/Task7/Final_Draft\Revised_Section2\Section2_fig/ pondA8__8_6_07.cdr

Armored Notch. Muted tidal connection would be provided by construction of an armored notch through the perimeter levee that separates Pond A8 and upper Alviso Slough. Earth excavated to construct the notch would be placed within Pond A8 or used for maintenance of nearby levees. Notch width would be adjustable up to approximately 40 ft. The depth of the notch would extend to approximately 1 ft above the average bed elevation of Pond A8 (-0.5 ft NAVD88). The size of this structure has been selected to maximize the potential volume of water exchanged between the slough and the pond while controlling water levels within the pond. Due to structural considerations, the notch would likely consist of multiple 'bays' that can be opened and closed independently. This would allow tidal exchange between the Pond A8 and Alviso Slough to be adjusted based on monitoring data. Initially, the notch would be operated with only one bay open. Additional bays would be opened if monitoring data confirm that slough widening does not threaten downstream levees, in particular the levees along the east side of Alviso Slough (perimeter levees to Ponds A11 and A12). Flow through the notch would occur during both flood and ebb tides. In combination with the ebb only culverts, the notch would enable ebb dominated tidal asymmetry within the ponds to limit water levels within the ponds while maximizing the enhancement of tidal prism in Alviso Slough. Concrete armoring would be required to prevent unintentional widening and/or deepening of the notch.

Although much of the land that comprises Ponds A8, A5 and A7 was sold to USFWS as part of the SBSP Restoration Project land acquisition, Cargill retains ownership of the section of the Pond A8 perimeter levee along the Lower Guadalupe River Flood Protection Project overflow weir including the location of the proposed Phase 1 notch. SCVWD has an easement to maintain the overflow weir and is in discussions with Cargill to purchase the remaining land. It is expected that either the District would acquire ownership of this parcel prior to construction, and/or that USFWS would acquire an easement or other appropriate right-of-way suitable for pre-construction, construction, and post-construction activities. Alternatively, if the District acquires the property, the District and USFWS may work out another mutually agreeable arrangement for conducting the Project.

Outboard Pilot Channel. An approximately 475-ft-long pilot channel would be excavated through the fringe marsh of Alviso Slough immediately outboard of the armored notch. Excavated earth would be placed within Pond A8, or trucked to an upland landfill if testing indicates soil contamination exceeds allowable levels for wetland foundation. This channel would facilitate tidal exchange through the notch by providing a flow path between Pond A8 and Alviso Slough. The top width and area of the constructed pilot channel would approximately match its maximum expected equilibrium dimensions to limit the amount of sediment eroded by tidal flows once operation of the notch begins.

Infrastructure. Under existing conditions, power lines suspended by wooden piles provide electricity to the Pond A8/A7 pump. These piles and transmission lines would be removed under restoration actions since the Pond A8-A5/A7 interior levee would be overtopped on a daily basis. The Pond A8/A7 pump would be salvaged for other purposes since no electricity would be available (power lines along the Pond A8-A5/A7 levee would be removed). In the event that the Phase 1 implementation were reversed and pumping required for water management in Pond A8, new power lines would have to be installed. Vehicular access along the Pond A8-A5/A7 and Pond A8/A8S interior levee would not be maintained under these restoration actions and would be limited to the perimeter levees of Ponds A8S, A5 and A7.

In addition to modification of the power lines and Pond A8/A7 pump, the expected 1-ft increase in water depths may require improvements to the small levee around the sump inlet pond (a.k.a., 'donut') in Pond A4. The SCVWD periodically uses this sump to convey water from Pond A4 to Pond A5 via a siphon under Guadalupe Slough. Under baseline conditions, freeboard in the Pond A4 sump inlet pond is minimal, and increasing the elevations of the receiving water in Pond A5 may require the levee surrounding the sump to be increased up to one ft. The need for this potential improvement would be assessed during subsequent design phases. The SCVWD monitoring well in the northeast corner of Pond A7 would be decommissioned prior to implementation of the Phase 1 action.

Periodic inspection and maintenance of restoration infrastructure, such as water control structures and pond levees would be required to ensure that the pond is operating as intended. More frequent inspection and maintenance of water levels and water quality (including salinity and DO), would be necessary to ensure that the appropriate amount of tidal connectivity is achieved so that scouring occurs in Alviso Slough, and to meet water quality requirements. Detailed O&M Plans would be developed for each Phase 1 action by USFWS.

Adaptive Management. Adaptive management for the Phase 1 action at Pond A8 would include applied studies as specified in the Adaptive Management Plan (see Section 2.3 and Appendix D).

Applied Studies. The Phase 1 experiments at Pond A8 would test wildlife response to increased exposure of MeHg, the relative influence of slough scour and changes in storage on flood hazards, and the potential for fish entrapment in Pond A8.

- <u>Wildlife Response to Increased Exposure of MeHg.</u> The production of MeHg, its uptake into food webs, and its bioaccumulation vary within and among species and habitats. Additionally, threshold concentrations of MeHg toxicity are not well known for most wildlife species. Led by SFEI, the South Baylands Mercury Project has been designed to estimate how much legacy Hg is contained in the sediments of different habitats along Alviso Slough, how readily Hg is converted to MeHg, and how effectively MeHg is incorporated into local food webs. The ecological risks of mercury toxicity in wildlife would be assessed by monitoring Hg in 'biosentinel' wildlife species that represent the baylands. Coupling such a monitoring effort to studies of MeHg production and uptake is essential to improve the understanding of how the risk of Hg bioaccumulation can be reduced, and thus develop effective management options. The expected channel scour along Alviso Slough associated with the Phase 1 action at Pond A8 would provide an opportunity to investigate if the selected biosentinel species are sensitive to increases of mercury into the food web. Testing of the Alviso Slough sediments show concentrations of total Hg ranging from 0.08 to 2.83 with a median concentration of 0.80 ug/g (Marvin-DiPasquale, 2007). These concentrations are generally higher than ambient Bay levels of contamination due to the legacy of historic mercury mining in the Guadalupe watershed.
- <u>Relative Influence of Slough Scour and Changes in Storage on Flood Hazards</u>. Restoration of muted tidal action at Pond A8 is expected to deepen and widen the channel along the upper (landward) portion of Alviso Slough due to substantial increases in the slough tidal prism. The magnitude of tidal current velocities and associated slough scour would be related to the size of the notch opening, with less deepening and widening occurring with fewer open bays. These

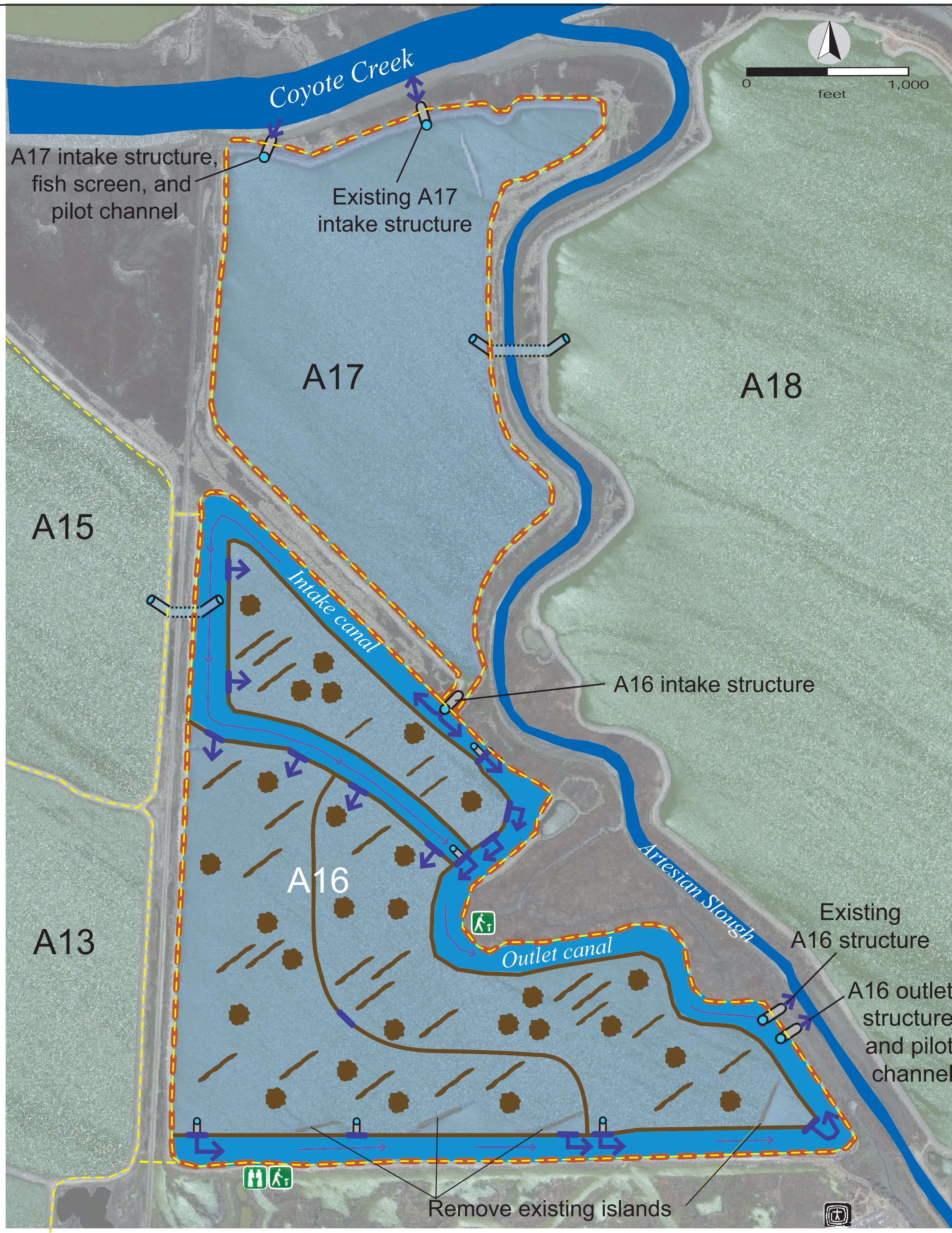
potential changes would increase the ability of the slough channel to convey flood flows and lower water levels associated with large rainfall-runoff events on the Guadalupe River. However, restoration of muted tides in Ponds A8, A7 and A5 during the rainy season would also reduce the amount of flood storage provided by these ponds and possibly result in higher maximum water elevations along Guadalupe Slough (see Figure 25 in Appendix G-5). The Phase 1 action at Pond A8 would provide an opportunity to assess the changing flood conveyance along Alviso Slough and determine if flood hazards are decreased over the both the short- and long-term. Monitoring data of slough scour and tidal regime would provide the necessary information to examine changes to baseline flood hazards, and would be coordinated with the applied study carried out for the Phase 1 action at Pond A6 (see above). If it is determined that changes in channel conveyance always compensate for losses of flood storage, seasonal management of the Phase 1 notch could be modified.

- Potential for Fish Entrainment. There is some potential for fish, possibly including anadromous salmonids and estuarine species, to enter Pond A8 through the notch and become trapped within the pond, because they are unable to find their way out. An applied study would be conducted to evaluate salmonid entrainment during the first 2 to 5 years of the Project. The specific study design is being developed, but discussions with NMFS involve establishing an acoustic monitoring array that is integrated with other acoustic monitoring being conducted in the central and north bay. Acoustic-tagged, hatchery raised juvenile Chinook salmon would be released in Alviso Slough and in the Pond A5/7/8 complex and monitored using stationary and mobile (boat-based) hydrophones. The study would be designed to determine if the salmon in the slough are attracted to the notch and/or move through it, and whether they can easily find their way back out to the slough. The work would be done in mid-May, just after the notch is opened after the seasonal closure. Results of this study would determine whether seasonal closure of the notch is even necessary to avoid impacts to salmonids, or whether seasonal closure is insufficient to minimize impacts, in which case additional measures (*e.g.*, fish screens) may be necessary on this and other ponds along salmonid streams. The results also could indicate that fish screens are not necessary in other ponds.

Restoration Monitoring. The Pond A8 restoration would be monitored to evaluate restoration performance and to meet any permit requirements. Also, continuous water level recording would be collected in Ponds A8, A5 and A7 and Alviso Slough at discrete periods during the summer months (at least four weeks) to confirm tidal regime inside the ponds and characterize any effects on slough tidal levels. Cross sections along Alviso Slough would be collected to determine changes in channel geometry. These surveys would occur on a seasonal basis (before and after notch closure). This information would be used to update flood models and assess changes in flood hazards on a regular basis. Salinity measurements along Alviso Slough would be collected to characterize the longitudinal gradient from the Bay to Gold Street Bridge. Surveys of channel widening in the immediate vicinity of the notch would also be performed to assess improvements to navigation at the Alviso Marina.

Pond A16

Introduction. The Alviso Pond A16 managed pond would be reconfigured to create islands for nesting birds and shallow water habitat for shorebird foraging (Figure 2-17). As specified in the Adaptive Management Plan (see Section 2.3 and Appendix D of this EIS/R) and described in the Pond A16



Cell intake/outlet water control structure:
- weir
- culvert with weir
- Typical flow direction
- Earth berm
- Existing levee
- Existing trail
- Interpretive station
- Existing slough channel
- Nesting island-linear
- Nesting island-circular
- Pond intake/outlet water control structure (culverts with gates)
- Existing siphon
- Viewing platform
- Existing Environmental Education Center

South Bay Salt Pond Restoration Project

figure 2-17

Alviso Pond A16 Phase 1 Action Restoration Plan

Figure by Philip Williams & Associates
Figure Date: 5-31-07

Adaptive Management section below, the Pond A16 restoration would test bird use for different island configurations as an applied study. The Pond A16 restoration would also test restoration techniques for vegetation management, predator management, and water quality management as part of the Adaptive Management Plan. Recreation and public access features for the Pond A16 restoration are described in the Alviso Recreation and Public Access Actions section below.

Restoration Plan. Pond A16 would be reconfigured to create islands for nesting birds and shallow water habitat for shorebird foraging (Figure 2-17). Three cells would be created within Pond A16. Nesting islands would be constructed in each cell. Water levels in each cell would be managed using water control structures to provide optimal depths for shorebird foraging. Water would flow into Pond A16 from Coyote Creek through Alviso Pond A17. Circulation through each cell in Pond A16 would be adaptively managed to meet water quality targets. Outflow from Pond A16 would discharge to Artesian Slough.

Nesting islands. Nesting islands would be constructed by grading the bottom of Pond A16. These islands are expected to be used for nesting by Forster's terns, American avocets, Caspian terns, black-necked stilts and snowy plovers. Different island shapes and densities would be created as an applied study (see the Pond A16 Adaptive Management section below). Each island would be approximately 3 ft (one m) high and have a surface area of approximately 15,000 square (sq) ft (1,400 sq m). The islands would be constructed using fill material excavated from the windward side of the islands. The islands would be located at least 300 ft (90 m) from the pond levees to provide a buffer between nesting birds and mammalian predators and to minimize disturbances by human activity on the levee (*e.g.*, passive recreation associated with the Refuge EEC). The islands would be located at least 600 ft (180 m) from any focal areas for human use, such as viewing platforms, benches, and the historic salt works. The existing islands along the southern edge of Pond A16 would be removed because these islands are close to the pond levee and proposed berm.

Berms. Cells would be created in Pond A16 by constructing low "check" berms around the cells, ranging in height from approximately 2 to 6 ft (0.6 to 2.0 m). The berms would be constructed by excavating fill material on-site. Pond bottom elevations vary from approximately 1 to 5 ft NAVD (0.3 to 1.5 m NAVD) and slope towards the southwest corner of the pond. Berms would be placed to: separate higher elevation areas from lower elevation areas, allow water levels to vary between different cells, and create cells with similar shallow water depths over the sloping pond bottom. Water depths in each cell would range from approximately 2 inches (five cm) to 1 ft (0.3 m) to provide foraging habitat for smaller and larger shorebirds.

Water management. The current water management plan for the Pond A16 restoration includes features to allow management flexibility and design redundancy. Using adaptive management, different water management approaches would be tested at Pond A16 to assess the effectiveness of providing optimal shallow water habitat and meeting water quality objectives (see the Pond A16 Adaptive Management section below).

Water would flow into Pond A16 through a new water control structure, such as one or more 48-inch culverts with adjustable tide gates. The new intake structure would be installed in the existing opening (levee gap) between Pond A16 and Pond A17. The existing culvert with tide gates connecting Pond A17 to Coyote Creek (existing Pond A17 structure) would be opened to allow muted tidal action in Pond A17 and flow into Pond A16. In addition, a new intake water control structure, such as one or more 48-inch culverts with adjustable tide gates, would be installed between Pond A17 and Coyote Creek to increase the flow from Coyote Creek to Ponds A17 and A16. A pilot channel would be excavated through the existing vegetated fringe marsh between the new Pond A17 intake structure and Coyote Creek. If required by NOAA Fisheries, one or more fish screens would be installed on the new Pond A17 intake structure to prevent the entrapment of salmonid fish from Coyote Creek in Ponds A16 and A17 during the winter season (November through April). The existing Pond A17 structure could be closed during the winter season to prevent salmonid entrapment.

Intake and outlet canals would be created in Pond A16 to convey flow in and out of individual cells. The canals would be located around the perimeter of the cells in portions of the deep existing borrow ditch and remnant tidal channels in Pond A16. Water control structures, such as flashboard weirs, would be installed in the berms to regulate flow into and out of the cells. During low tides, water in the outlet canal would flow into Artesian Slough through the existing Pond A16 structure with tide gates between Pond A16 and Artesian Slough and a new outlet structure. The new Pond A16 outlet structure would consist of one or more 48-inch culverts with adjustable tide gates. A pilot channel would be excavated through the existing vegetated fringe marsh between the new Pond A16 outlet structure and Artesian Slough.

Water would be circulated through the cells in Pond A16 at rates sufficient to meet water quality objectives. The water quality objectives for Pond A16 would be to maintain adequate DO levels, salinity, and pH for habitat in the cells and to meet discharge requirements at the outlet structure. To test water management approaches within the Adaptive Management Plan, flows would be varied to assess the effects on DO levels and bird prey (see the Pond A16 Adaptive Management section below).

Flow through one of the cells could be modified without affecting the management of the other cells. Similarly, one cell could be completely drained of water for vegetation management (see the Pond A16 Adaptive Management section below) while other cells continue to provide shallow water habitat for shorebird foraging. Alternatively, water levels in Pond A16 could be periodically raised to inundate the nesting islands as a vegetation management technique. Raising water levels to inundate the island would also inundate the berms and water control structures and reduce the area of shallow water habitat.

Alviso Pond A15, which is part of the Alviso Pond A9 System (Ponds A9 through A15), is currently connected to Pond A16 by a siphon with a gate. High salinity water in Pond A15 can either flow into Pond A16 or back into the Pond A9 system through Pond A14. If Pond A16 is reconfigured, the existing siphon would be maintained, but high salinity water in Pond A15 would typically flow into Pond A14. The siphon could be opened to allow high salinity water to flow from Pond A15 into Pond A16 if water management or vegetation management call for higher salinity water.

Appendix G of this EIS/R (Alviso Pond A16 Hydraulic Modeling) documents hydraulic modeling performed to assess the feasibility of water management at Pond A16. The SBSP Nutrient and Contaminant Analysis Report (Appendix H) includes a water quality assessment for Pond A16.

Adaptive Management. Adaptive management for the Phase 1 action at Pond A16 would include both applied studies and restoration techniques, as specified in the Adaptive Management Plan (see Section 2.3 and Appendix D).

Applied Studies. Phase 1 experiments at Pond A16 would test:

1. The effects of island spacing and shape on nesting use and reproductive success.
2. The effects of vegetation type, density and distribution on island use by nesting birds.
3. The effects of nearby human activities on island use or nesting success.

Various nesting bird species may respond differently to contrasting island shapes. For example, terns may benefit more from circular islands while shorebirds such as black-necked stilts, American avocets, and snowy plovers may benefit from long, linear islands. In addition to contrasting shapes, it is important to understand the effect of island density on habitat value. For example, high-density islands may reduce foraging area between islands and increase aggressive interactions among family groups of American avocets and black-necked stilts. Vegetation also plays an important role in nesting success, as different birds species have varying vegetation tolerances or requirements. Snowy plovers typically avoid vegetated areas for nesting, and avocets usually nest in bare or sparsely vegetated areas. While some South Bay tern colonies are located in areas with little or no vegetation, other tern colonies, as well as many black-necked stilt nests, are located in areas having some vegetation, which may also provide shade and cover from predators for chicks. Nesting waterfowl are likely to nest almost exclusively in vegetated areas. Although human activity in the vicinity of Pond A16 would be expected to be limited to non-motorized recreation (*i.e.*, walking or biking around the outer levee of the pond) and O&M (see Section 2.5.6), it is unknown whether this level of activity would affect island use or nesting success by birds.

The experimental studies designed for Pond A16 would provide an important model for island design, provide an understanding of the vegetation requirements, and determine an acceptable level of human activity for reproductive success of bird species using this pond. This understanding would help inform and guide the design of optimal pond configurations that would be used at other locations in the South Bay.

- *Island spacing and shape*. Varying densities of islands would be created within Pond A16 to study the effects on bird nesting. There would be two island shapes: circular and linear (much longer than wide) to determine whether various nesting bird species respond differently to contrasting island shapes.
- *Vegetation type, density, and distribution*. Vegetation is expected to establish on some of the islands after one or more years. At that point, the vegetation can either be controlled or vegetation can be manipulated by planting or selective removal, to determine the effects of vegetation type, density, and spatial distribution on nesting use and reproductive success of bird populations. The species composition, type of vegetation, and vegetation distribution would be manipulated by planting or selective control/removal to conduct studies to determine the effects and distribution of vegetation on nesting success. The decision regarding which plant species

would be used in actual experiments would be determined by monitoring which vegetation types colonize (and thus can be expected to survive on the islands) during the first few years following island construction.

- Human activity. To determine whether human activities affect nesting birds at Pond A16, a portion of the trail (*e.g.*, along the entire northeastern side of the pond) could be closed during the breeding season every other year. The number of nests, nest success and fledging success would be determined for each island to determine whether the number and breeding success of birds on islands near the closed levee differs with full human access versus limited human access, and whether in years of limited human access the nesting bird populations vary substantially.

Restoration Techniques. Three restoration techniques would be tested in the Phase 1 actions at Pond A16:

1. Management of water to meet regulatory standards and creation of high quality bird habitat;

2. Management of vegetation growth in the pond and on islands;

3. Management of predators;

- Water management. Water in Pond A16 would be managed to maintain water quality to meet regulatory standards. Dissolved oxygen (DO) is an important water quality parameter in managed pond environments. DO concentrations are influenced by factors such as water temperature, phytoplankton abundance, mixing, and hydraulic residence time. Maintaining adequate DO concentrations in other managed ponds has been problematic during certain periods, such as warm summer months. At Pond A16, it may be necessary to increase flows and decrease residence times in the pond during warmer months to maintain adequate DO concentrations. Residence time may affect the abundance and productivity of invertebrates or fish, due to predation by birds nesting within the pond. The water control structures at Pond A16 would be adjusted to vary flow rates and study relationships between residence time, DO, phytoplankton abundance, and invertebrate productivity. In addition, other techniques to maintain DO concentrations may be tested, such as mechanically mixing pond water to induce re-aeration, re-aerating the discharge, or importing material to fill portions of the deep borrow ditches that have shown to be problematic for DO during ISP operations (May and Abusaba 2007).
- Vegetation management. While vegetation on nesting islands may benefit some bird species, vegetation management is expected to be necessary to maintain habitat for species averse to nesting in vegetation (*e.g.*, snowy plovers and American avocets) and to prevent dense, tall vegetation from encroaching on islands, and in shallow water foraging areas. Experimentation with various methods of vegetation management would be conducted to determine the methods that are most effective, and most cost-effective, in controlling vegetation. These methods would be implemented primarily during the non-breeding season. Methods that may be implemented to control vegetation on islands include maintaining substrate types for long-term effectiveness, mechanical control of vegetation by cutting, disking or raking, herbicide use, burning, spraying with highly saline water, or periodically raising water levels in Pond A16 to inundate the islands. Salvaged and recycled gypsum may be experimentally used as a vegetation-restricting measure

on roosting or nesting islands. Access and equipment for vegetation management may include trucks, boats, low-pressure construction equipment, and/or other equipment.

- Predator management. Predation would likely be an important factor limiting the number and success of nesting birds using the islands in Pond A16. Mammalian predation is not expected to be a problem, given the distance of the nesting islands from the pond edge and the ongoing predator control being employed by the Refuge. Avian predation is expected to be a concern. Predator management approaches would vary depending on the type of predator involved, and may vary depending on whether or not predators are nesting within the pond (*e.g.*, gulls on islands). As a result, specific experiments to control predators would be designed once the nature and magnitude of predation is observed. Methods of reducing the effects of avian predation on nesting islands could include: hazing and removal of nest starts; provisions for vegetative or artificial cover (*e.g.*, chick shelters); trapping and relocation of predators within or near Pond A16; or lethal removal of individual problem avian predators if live capture is not successful.

Restoration Monitoring. Restoration monitoring would be performed to evaluate restoration performance and inform adaptive management, including the applied studies and restoration techniques. O&M inspections are discussed in the Operations and Maintenance section in Section 2.5.6.

- Island spacing and shape. Weekly surveys would be conducted throughout the breeding season to determine the number of nesting bird pairs/species on each island, and surveys at least once per week on a sample of islands would determine nesting success (proportion of nests that hatch at least one young) and fledging success. Surveys would be conducted from the levee around Pond A16, and from the interior of the pond as needed, by an observer using a spotting scope.
- Vegetation. Data on the percent cover, height, and density of vegetation (overall and by species) in random cells of a grid on each island would be collected.
- Predator management. Data would be collected on nest and fledging success of nesting terns and shorebirds on nesting islands, predation attempts and predation success on selected islands or in cells with different predator management treatments.
- Water management. During the late summer (after nesting has been completed), the flow rate would be varied to adjust the residence time of water within the pond. DO, water temperature, water depth, and salinity would be measured, and invertebrates would be sampled at 10 locations within each of the four cells on a weekly basis. Water levels would be managed to reduce the risk of low DO levels, so as to avoid fish kills, but evidence of any fish kills would be noted. The relationships between flow rate, air temperature, water temperature, and water depth on DO would be determined, and the relationships between these variables, DO, and salinity on invertebrate abundance would be determined.

Phase 1 Recreation and Public Access Actions

The recreational features within the Alviso pond complex would be managed by USFWS as part of the current public access program at the Refuge. The public access and recreation plan for the Phase 1 actions at the Alviso pond complex would occur in three principal locations near Ponds A16 and near Ponds A2E and A3W. See Figures 2-18 through 2-20 for plans that highlight recreation and public access in these locations.