PRELIMINARY DESIGN MEMORANDUM

ALVISO-ISLAND PONDS

South Bay Salt Pond Restoration Project

MEMORANDUM

TO: Members of the South Bay Salt Pond Restoration Project Management Team

FROM: URS

DATE: September 15, 2014

RE: **Alviso-Island Ponds A19, A20, and A21 Restoration Preliminary Design**

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1. INTRODUCTION

This memorandum documents the preliminary design of the South Bay Salt Pond (SBSP) Restoration Project's Phase 2 actions at the Alviso pond complex's Ponds A19, A20, and A21. These ponds are also referred to as the Alviso-Island Ponds, the Island Ponds cluster, or simply the Island Ponds. This memorandum provides technical information for the CEQA and NEPA clearance, regulatory agency permitting processes, and a basis for the next, more detailed design phase.

1.1 Project Background

The Alviso pond complex consists of 25 ponds on the shores of the South Bay in Fremont, San Jose, Sunnyvale and Mountain View, in Santa Clara and Alameda counties. The pond complex is bordered on the west by the Palo Alto Baylands Nature Preserve and Charleston Slough, on the south by commercial and industrial land uses as well as NASA Ames Research Center and Sunnyvale Baylands Park, and on the east by Coyote Creek in San Jose and Cushing Parkway in Fremont. U.S. Fish and Wildlife Service (USFWS) owns and manages the 8,000-acre Alviso pond complex (EDAW 2007).

The Phase 2 Island Ponds restoration preliminary design, along with the rest of the SBSP Restoration Project, is managed by the SBSP Project Management Team (PMT), which includes the State Coastal Conservancy (SCC), USFWS, California Department of Fish and Wildlife (CDFW), Santa Clara Valley Water District (SCVWD), Alameda County Flood Control and Water Conservation District (ACFCWCD), and others.

The Programmatic EIS/R for the SBSP Restoration Project (EDAW et al. 2007) prescribed the initial framework under which restoration would proceed. In that document, program-level alternatives range from a restoration design of 50/50 tidal habitat/managed pond habitat mix (Programmatic Alternative B) to a 90/10 tidal habitat/managed pond habitat mix (Programmatic Alternative C) (see Appendix A, Figures A-6 and A-7). Programmatic Alternative C was selected and used as a foundation for project-level planning. Phase 1 of the project has since been completed, restoring clusters of ponds at all three pond complexes: Ravenswood, Alviso, and Eden Landing. As part of the Initial Stewardship Plan, which was prior to the Programmatic EIS/R, five levee breaches were constructed at the Island Ponds; however, since sediment accretion and vegetation establishment in Pond A19 (and to a lesser extent in A20) has been slower and less well-distributed than expected, the Island Ponds were included the in Phase 2 actions to evaluate additional restoration activities to increase habitat complexity and improve the distribution of sedimentation and vegetation establishment.

A design charrette was held May 13, 2010 to discuss conceptual restoration design ideas. Ideas proposed in the charrette document were further refined in coordination with the PMT to develop memoranda that described the opportunities and constraints associated with the construction or implementation of design ideas (URS Corporation 2012). From this, three conceptual designs were developed, which varied in the location and size of various restoration components, such as levee breaches and levee lowering or removal.

This set of three alternatives was developed for conceptual design and inclusion for comprehensive analysis in the site-specific Public Draft EIS/EIR. Following the public comment period, a preferred alternative that best meets the project objectives while providing a cost-efficient design would be selected for implementation as part of Phase 2. This memorandum describes the design work conducted as part of the conceptual level (approximately 10 percent) design.

1.2 Organization and Scope

This memorandum presents the conceptual (approximately 10%) design for the Island Ponds restoration. It also briefly documents the design constraints and considerations specific to Ponds A19, A20, and A21 that formed the basis for the conceptual design.

The preliminary design memorandum is organized as follows:

- Section 2: objectives, design constraints, and considerations
- Section 3: preliminary design analyses, including hydraulic modeling, salinity/water quality management, and topography and geotechnical data
- Section 4: preliminary design including restoration components and construction implementation

1.3 Limitations

This memorandum describes the preliminary design based on available information and our professional judgment pending future engineering analyses. Future design decisions or additional information may change the findings, the mix of design components included in the alternatives themselves, or the corresponding professional judgments presented in this report. Additional engineering will be necessary prior to construction. In the event conclusions or recommendations based on the information in this memorandum are made by others, such conclusions are not the responsibility of URS, or its subconsultants, unless we have been given an opportunity to review and concur with such conclusions in writing.

2. OBJECTIVES, DESIGN CONSTRAINTS, AND CONSIDERATIONS

Objective for the Island Ponds under Phase 2 relates to restoration actions. There are no flood protection or recreation/public access objectives for this pond cluster. The objective is summarized below.

- *To improve habitat connectivity and sediment distribution*. The southern levees along Coyote Creek were breached in 5 locations in 2006: two each along A21 and A19, and one in A20. The existing breaches allow and promote the healthy growth of pickleweed and other salt marsh vegetation. According to the 2011 and 2012 Self-Monitoring Program Annual Report, these ponds – particularly A20 and A21 – are accreting sediment and developing vegetated habitat faster than expected. Pond A19 lags behind A20 and A21 in accretion rate and subsequent vegetation establishment but is filling and draining with every tidal cycle. The main goal of action alternatives at the Island Ponds is therefore to increase the connectivity of the Island Ponds with the surrounding waterways and other nearby marshes. This will also improve the spatial distribution of the sediment accretion. The net effect will be to increase the complexity of the marsh habitat that is forming in these ponds.

The restoration preliminary design summarized in this memorandum was developed taking into account several design constraints and considerations. Design constraints are limiting factors that must be considered while developing the design. Design considerations are issues that contribute to design formulation, but are not limiting factors. These design constraints and considerations will continue to influence the design throughout the process as more data become available.

2.1 Design constraints

- *Hydrology*. The hydrologic dynamics are complex and can be somewhat unpredictable as they are driven by storm surges and complicated by tidal action. Breaches may have unanticipated consequences such as, slowing velocity in Mud Slough or increasing channel scour.

- *Special status species*. A CNPS List 4 species, *Eleocharis parvula*, has been identified along the levees of Pond A19. While this species is not protected by law, its status under CNPS List 4 (Plants of Limited Distribution) leads to strong encouragement that it be avoided. Permitting agencies may be less willing to permit a project with effects to sensitive species such as this one. Other listed wildlife may also occur in the area and need to be considered during construction design. Heavy construction equipment needed to create breaches may disturb wildlife.

- *Sediment quality*. The quality and quantity of the sediment being delivered to the Island Ponds has been evaluated as part of the Adaptive Management Program since their previous breaching. Monitoring would continue under additional breaching or lowering.

- *Fisheries*. The status of the fisheries in the Island Ponds has improved since their southern margins were breached. Any action to breach the northern levee or other otherwise modify the local hydrology and sediment accretion rates would need to avoid adversely affecting this trend.
- *Recreation*. Recreation or public access options are not being considered for the Island Ponds. The low tides are difficult in these sloughs, and there is a risk of temporary stranding of small boats. Increased water-based recreation and visitation could disturb fish and other aquatic wildlife. Foot trails are not considered because connectivity with existing trail routes is not available.

2.2 Design considerations

- *Sedimentation*. Additional levee breaches could increase sedimentation in A19, which would provide a higher surface elevation for vegetation establishment and sea level rise resilience.
- *Material from levee lowering*. Lowering the levee between A19 and A20 would provide material that could be used for raising the bottom elevation of the ponds or of filling the borrow ditches around the interiors of the pond levees. This material could be placed in the interior of A19 to raise the elevation in the area where sedimentation is expected to occur last; although, constructability would be more difficult for this placement location. The material could also be used to created topographic variety in the pond bottoms that could be designed to further trap sediment and speed accumulation. Material could also be used to create islands, fill borrow ditches, or create ditch blocks.
- *Western snowy plover*. Supplemental habitat for western snowy plover could be provided by adding shells and/or salt mounds along existing levees that would remain after breaching. The Island Ponds' relative isolation from human activities makes them a good location for plover, if suitable nesting habitat can be provided.
- *Breaching timing/sequencing*. Pond A19 could be breached first and then monitored for a year or more to determine whether or not additional breaches to the other two ponds are necessary. However, this would complicate the construction access.

3. AVAILABLE DATA AND PRELIMINARY DESIGN ANALYSES

The preliminary design was prepared based on the following information and analyses. A hydrodynamic analysis of the proposed restoration alternatives was undertaken to determine how the new breaches would change the hydraulics of the ponds. As described below, a one-dimensional HEC-RAS model of Coyote Creek, Mud Slough and the Island Ponds was developed to predict water levels and inflows and outflows from existing and proposed breaches.

Analyses were performed on the two action alternatives (Alternatives Island B and C). These Alternatives are graphically depicted in Appendix A on Figures A-3 and A-4, and key components are listed in **Table 3.1**.

Table 3.1. Key Components of Action Alternatives

Alternative Island B	Alternative Island C
A19 Northwest Breach	A19 Northwest Breach
A19 Northeast Breach	A19 Northeast Breach
	Widen A19 Southeast Breach
	Widen A19 Southwest Breach
	A20 North Breach
	A21 North Breach
Lower A19 North Levee	Lower A19 North Levee
Lower Portion of A19 South Levee	Lower Portion of A19 South Levee
Remove A19 West Levee	Remove A19 West Levee
Remove A19 East Levee	Remove A19 East Levee
	Lower Portion of A20 North Levee
	Lower Portion of A20 South Levee
	A19 Southeast Breach Pilot Channel
	A19 Southwest Breach Pilot Channel

3.1 Site Topography and Project Datum

The available site topography is from USGS (2010) which developed a surface elevation dataset derived from high-accuracy Light Detection and Ranging (LiDAR) technology for the USGS San Francisco Coastal LiDAR project area (San Francisco, Marin, Solano, Contra Costa, Alameda, San Mateo, Santa Clara counties, California). The LiDAR data were processed by USGS to a bare-earth digital terrain model (DTM). USGS developed detailed breaklines and bare-earth DEMs and data were formatted according to tiles with each tile covering an area of 1500 m by 1500 m. A total of 712 tiles were produced for the entire survey area encompassing approximately 610 sq. miles. The horizontal spatial reference system for the USGS San Francisco Coastal LiDAR Project is NAD83, UTM Zone 10N, meters and North American Vertical Datum of 1988 (NAVD88), meters.

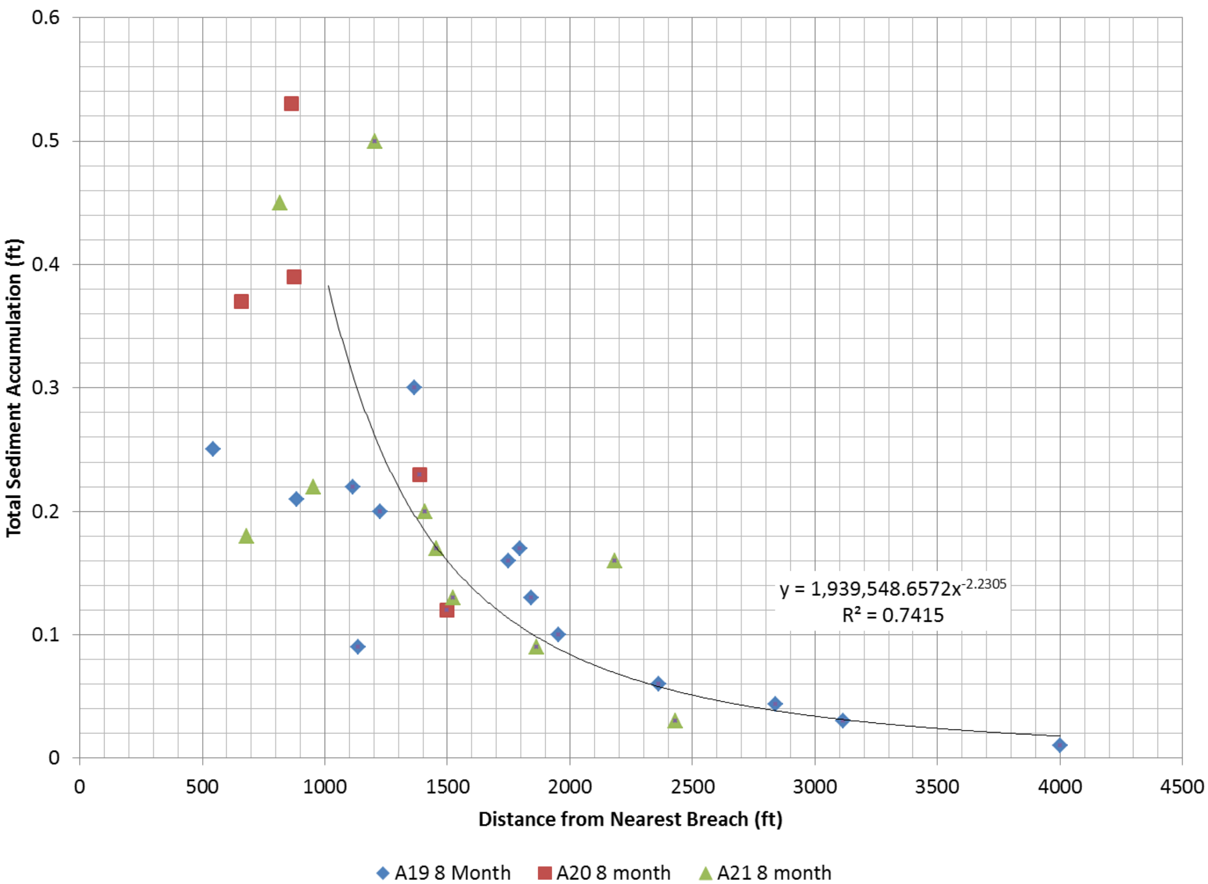
The bathymetry data for Coyote Creek and Mud Slough were obtained from two sources. Bathymetry for the lower part of Mud Slough and Coyote Creek were obtained from the 2010 U.S. Geological Survey (USGS) Coastal and Marine Geology Program cruises to map the bathymetry of the main channel and shallow intertidal mudflats in the southernmost part of South San Francisco Bay. Three surveys were conducted and the results were merged to generate comprehensive maps of Coyote Creek from Calaveras Point east to the railroad bridge (including parts of Mud Slough) and Alviso Slough (from the Bay to the Town of Alviso). The bathymetry surveys were conducted using the state-of-the-art research vessel R/V Parke Snavely outfitted with an interferometric sidescan sonar for swath mapping in extremely shallow water. The bathymetry datasets are provided at 1 m and 2m resolution (USGS 2014). Data on the upper parts of Mud Slough and Coyote Creek were obtained from USGS (2007). The data were from an acoustic hydrographic survey of South San Francisco Bay (South Bay) conducted in 2005. A single-beam, 200-kHz depthfinder was used to collect depths at a nominal spacing of 0.15 m along and 100 m between tracklines. Nearshore soundings were collected during extreme high tides and captured elevations of +0.3 m Mean Lower Low Water (MLLW) or higher in order to overlap topographic lidar data. Tracklines are generally oriented perpendicular to the channel.

3.2 Effects of Initial Stewardship Plan Actions

The Island Ponds were originally breached in March 2006 by cutting five breaches connecting the ponds to Coyote Creek (two each in ponds A19 and A21 and one in A20). Sediment has been accreting in the ponds since then with most accretion occurring near the breaches (southern portions) and center and diminishing towards the north. Accretion rates are higher in Ponds A20 and A21 than in Pond A19 (SCVWD 2010). Water levels in the ponds closely correspond to water levels in Coyote Creek.

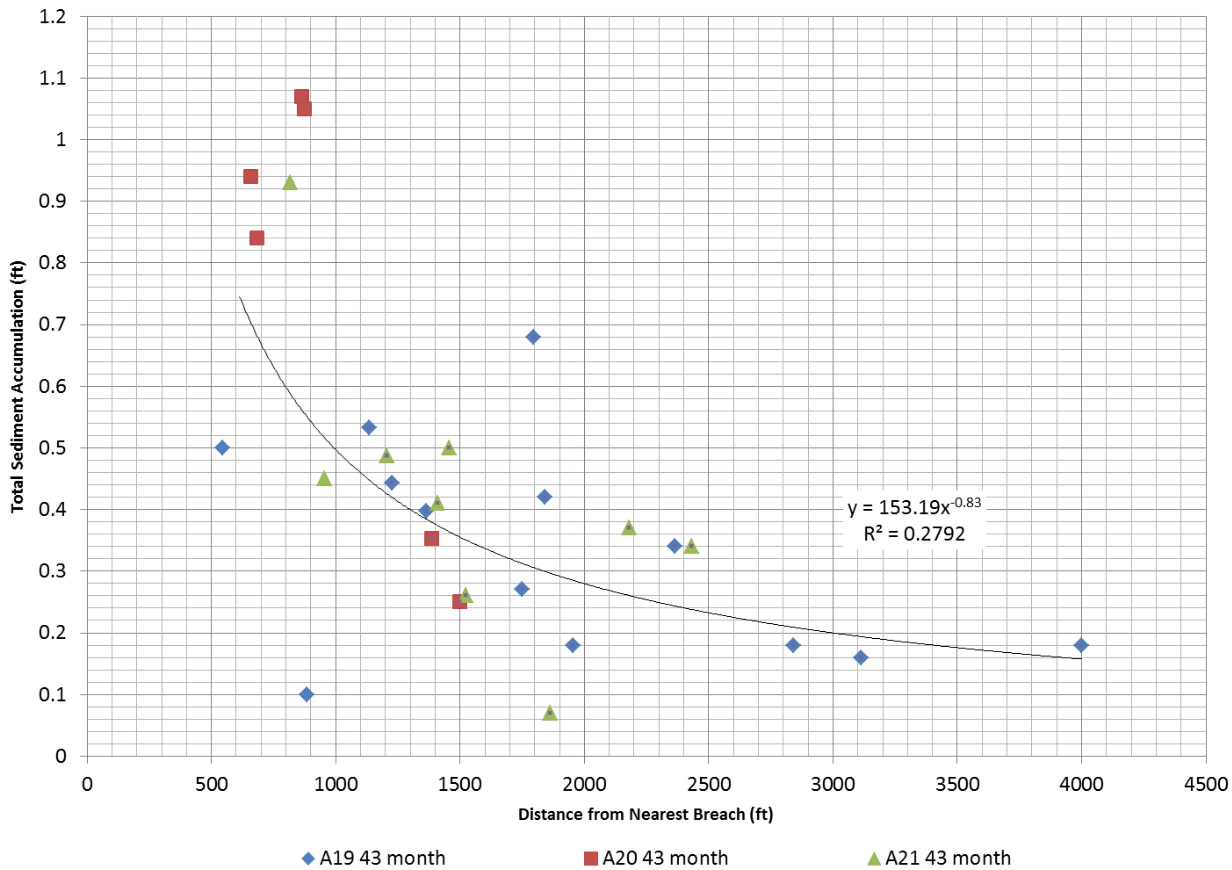
Most of the original breaches have widened since they were originally constructed; however, the rate of widening has slowed or stopped. (SCVWD 2010) This indicates that the breaches have reached an equilibrium size relative to the tidal prism of the ponds. Further, the easternmost of the two breaches on Pond A19 has not widened at all.

Detailed sedimentation measurements were collected in Ponds A19, 20 and 21 in Years 1 through 4 after breaching. The data showed significant accretion in the ponds especially near the breaches with sedimentation decreasing farther from the breaches. **Figure 3.1** shows the total accumulation in the ponds with distance from the nearest breach for data collected 8 months after breaching the levees. **Figure 3.2** shows the sediment accumulation with distance from the nearest breach 43 months after breaching. Each figure also includes an exponential curve to provide perspective on how sediment accumulation decreases with distance. For distances greater than about 1,000 to 2,000 feet from the nearest breach, the accumulation of sediment varies much less with distance than it does closer than about 1,000 feet. The rate at which the accumulation of sediment decreases with distance is indicated by the exponent of the equations shown on **Figure 3.1** and **Figure 3.2** (the closer the exponent is to 0 the more uniform the accumulation of sediment is with distance from the nearest breach). For example, a comparison between the line in **Figure 3.1** to the line in **Figure 3.2** shows the line in **Figure 3.2** has a flatter slope indicating the accumulation with distance is more uniform in **Figure 3.2** (43 months) than it is in **Figure 3.1** (8 months). This is consistent with the data collected 12 months and 30 months after breaching, which show a decrease in the difference in sediment accumulation with distance over time (i.e., the accumulation of sediment is becoming more uniform with distance over time). **Table 3.1** shows the exponent of an exponential fit to the data farther than 1,000 feet from a breach for data collected 8, 12, 30 and 43 months after breaching. Note the closer the exponent is to 0, the more uniform the sedimentation is with distance. The data show that over time, the variability in the sedimentation depths with distance from the breach is becoming more uniform (exponent getting closer to zero), which means that the more sediment deposits, the more evenly it deposits across the distance from the breach. As time passes, the sedimentation in the Island Ponds, which has in the past been concentrated near the breaches, will in the future gradually become more even across the ponds and may alleviate the need for additional breaches.



Notes: The data show a clear decrease in sedimentation with distance. A fit to the data collected farther than 1000 feet from the nearest breach is shown to provide perspective.

Figure 3.1 Total sedimentation with distance measured 8 months after breaching



Notes: The data show a clear decrease in sedimentation with distance. A fit to the data collected farther than 1000 feet from the nearest breach is shown to provide perspective.

Figure 3.2 Total sedimentation with distance measured 43 months after breaching

Table 3.1 Exponent of relationship for the sedimentation accumulation with distance from nearest breach for combined data from all Island Ponds

Months Since Breach	Exponent
8	-2.23
12	-1.43
30	-0.909
43	-0.818

Note: Exponents closer to zero indicate the sedimentation is more uniform with distance

Pond A6 may provide a model for how the Island Ponds will behave after adding additional breaches. Pond A6 was breached on both Alviso Slough and Guadalupe Slough, two breaches on each slough. Sedimentation data were collected at 10 points six times between 4 and 28 months after breaching. A relationship between sedimentation and distance was not observed in the data. Since there are breaches on both sides of the pond, most of the sediment data collection points were less than 1,000 feet from a breach and only 1 point was greater than 2,000 feet; this may explain the lack of a relationship between sediment accumulation and distance from a breach. In contrast, the Island Ponds had 6 points greater than 2,000 feet from a breach and most points were greater than 1,000 feet from a breach. With additional breaches on Mud Slough, most of the points would be within 1,000 feet of a breach, and no points would be as much as 2,000 feet from a breach. If the sedimentation follows the same pattern as Pond A6, there should be a more uniform deposition of sediment with the additional breaches.

Since sediment accumulation at Island Ponds appears to be a function of distance from the breach, creating breaches on Mud Slough would decrease the distance to a breach for many points, and therefore, would more evenly distribute the sedimentation.

3.3 Model Selection and Setup

The Island Ponds were modeled using the U.S. Army Corps of Engineers' Hydraulic Engineering Center's River Analysis System (HEC-RAS). HEC-RAS is a one-dimensional flow modeling system that simulates steady and unsteady flow in river or tidal systems where stratification and the horizontal variations in velocity are small. It can also model the effects of obstructions such as bridges, culverts, dams, weirs or other structures (USACE, 2010). Inputs to the model include bathymetry, inflow at the upstream boundary of the model, and tidal elevations at the downstream boundary. Manning's n is used to represent friction in the channels.

Coyote Creek was represented as a series of channel cross-sections, and the Island Ponds are represented as storage areas defined by a stage-storage curve. The cross-sections and stage-storage curves were developed from the topography data in the ponds, Coyote Creek, Mud Slough, and the adjacent Bay. **Figure 3-3** shows the bathymetry and cross-section locations used in the HEC-RAS model.

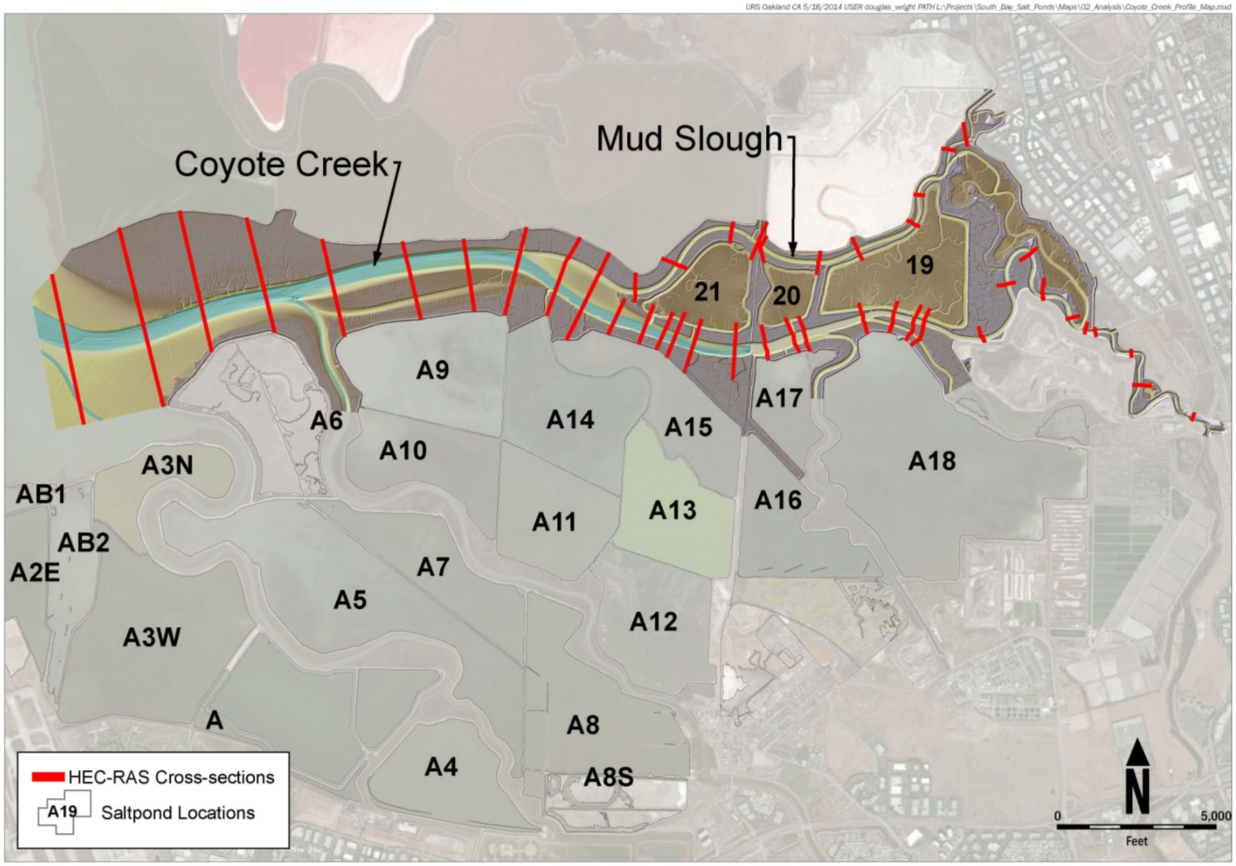


Figure 3.3 Storage area and cross-section locations used in HEC-RAS model

Coyote Creek was represented using 39 cross-sections cut from the bathymetry data; nineteen cross-sections were cut for Mud Slough and 7 for Warm Springs Marsh. At some locations additional cross-sections were interpolated between these cross-sections. The distance between cross-sections varied from about 100 feet to over 2,000 feet with more closely spaced cross-sections generally located near the breaches. Manning's n value of 0.035 was used for channels.

The breaches in the levees were represented in the model as openings in lateral structures located along the right bank (looking downstream) of Coyote Creek and along the left bank (looking downstream) of Mud Slough for Alternatives Island B and C. For the existing condition, the openings in the model lateral structures on Coyote Creek were based on the topography obtained from the LiDAR data.

3.4 Hydrologic Data

Estimates of the tides in San Francisco Bay are required at the mouth of Coyote Creek and flows in the Creek are required at the upstream boundary for the model. Tidal water surface elevations were obtained from the Coyote Creek tide gauge near the mouth of Coyote Creek (NOAA gauge 9414575) and were used as the boundary condition in the HEC-RAS model. This gauge is roughly 2 miles downstream from the first breach in Pond A21. The time series has an increment of 6 minutes and the tide elevation varies between -2.6 feet (-0.8 meters) and 8.9 feet (2.7 meters) during the selected two-week modeling period. The modeling period contains typical spring and neap tide conditions. The daily tide prediction was obtained from National Oceanic Atmospheric Administration's Tides and Currents website and converted to NAVD88 with data available on the SBSP monitoring tide gauge data webpage. **Figure 3.4** shows the tide data used in the analysis and **Figure 3.5** shows the average tide elevations for the Coyote Creek station.

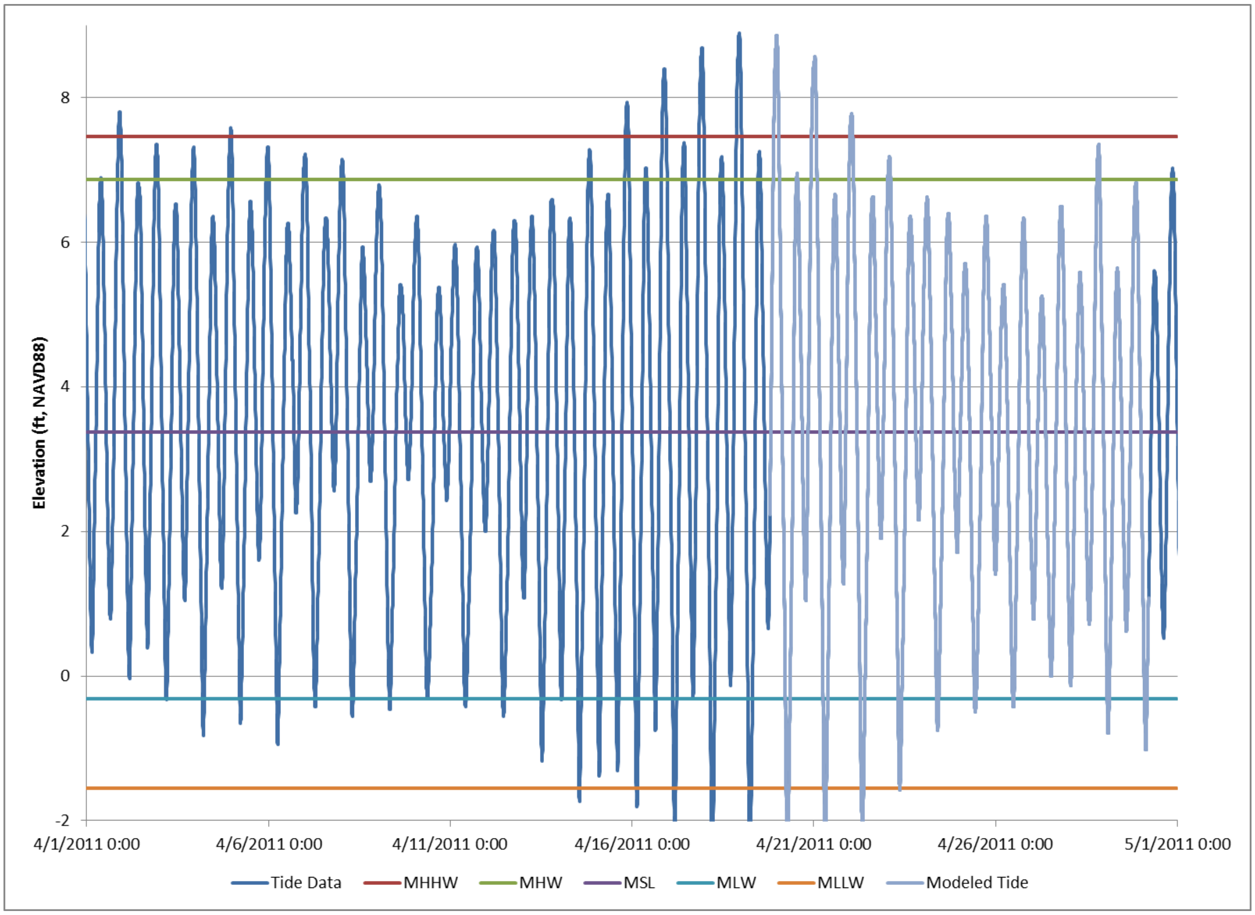
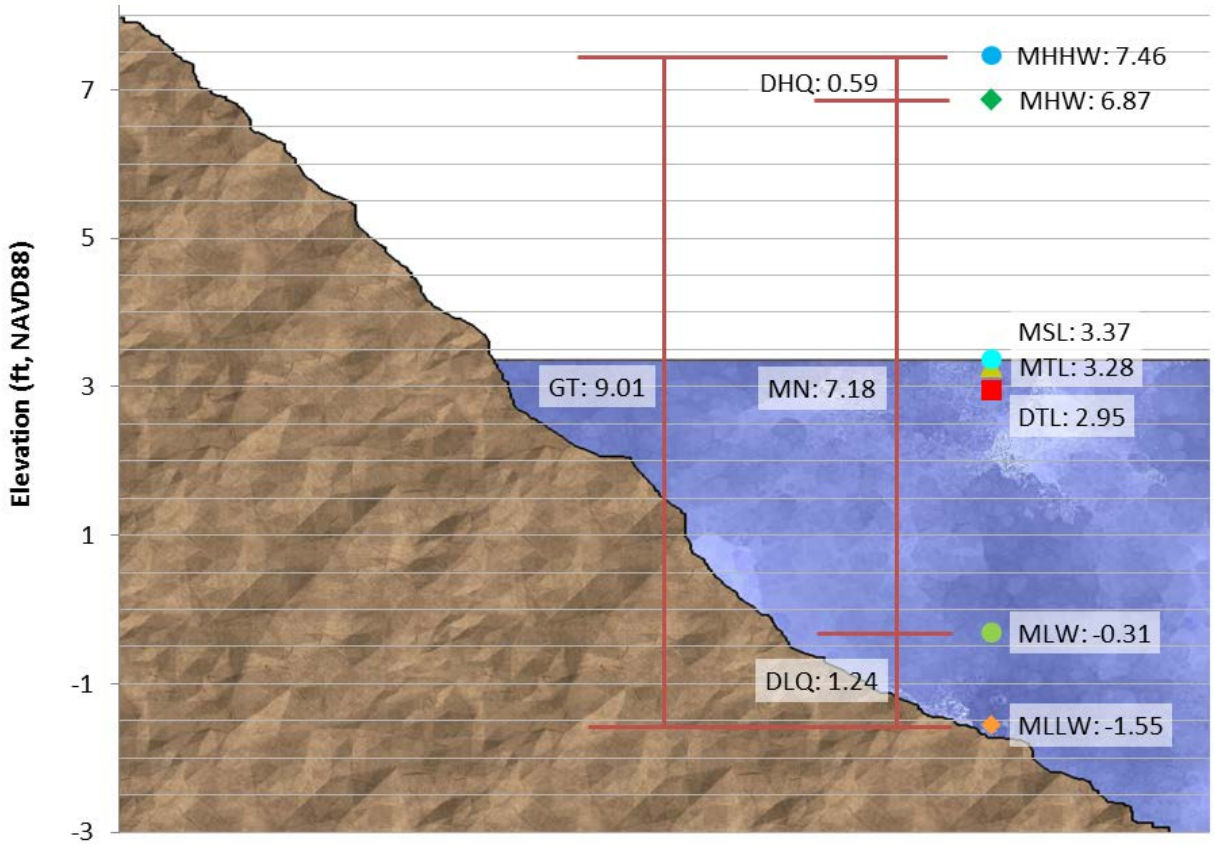


Figure 3.4 Tide data used for model studies



Note: All elevations in feet, NAVD88 Source: NOAA 2013; SBSP 2013

Key: MHHW (mean higher high water), MHW (mean high water), MSL (mean sea level), MTL (mean tide level), DTL (mean diurnal tide level), MLW (mean low water), MLLW (mean lower low water), GT (great diurnal range), DHQ (mean diurnal high water inequality), MN (mean range of tide), DLQ (mean diurnal low water inequality)

Figure 3.5 Coyote Creek gauge average tide elevations

Upstream inflow data were obtained from the USGS gague 11172175, Coyote Creek above Highway 237, located about 5.5 miles upstream of Pond A19. Data were obtained from the USGS National Water Information System. Data consisted of daily average flow rates for the same period as the tide data. Lower Penitencia Creek discharges into Coyote Creek about 2.3 miles below the Coyote Creek Gauge and 3.2 miles above Pond A19. Lower Penitencia Creek has only recently been gauged and only high flow data are measured, so data are not available for this study. However, since the project is primarily concerned with tidal flows rather than fluvial flows, neglecting Penitencia Creek should not affect the analysis.

3.5 Hydraulic Design Results

The HEC-RAS model described above was used to simulate flows in Coyote Creek, Mud Slough and Ponds A19, A20 and A21. The model provides information on how the hydraulics in the pond system will change with the addition of new breaches and the widening of some existing breaches.

There are three alternatives proposed for the Alviso Island Ponds. Alternative Island A is existing conditions or no action. Alternative Island B would have two new breaches in Pond A19 located on Mud Slough, and the A19 levees along Mud Slough and a portion of Coyote Creek would be lowered to MHHW. Ponds A19 and A20 would be joined together by removing the levees that separate them by lowering the levees to marsh plain elevation. For the purposes of the model this was assumed to be elevation 0.0 ft NAVD88.

Alternative Island C would include the same breaches and levee modifications as Alternative Island B with the addition of breaches in Ponds A20 and A21 along Mud Slough, and portions of the A20 levees along Mud Slough and Coyote Creek would be lowered to MHHW.

All new breaches were assumed to be 50 feet wide with a bottom elevation of 0.0 ft NAVD88. The existing breaches in Pond A19 were enlarged to 150 feet and a bottom elevation of -2.0 ft NAVD88 in Alternative Island C.

The comparison between alternatives is shown in **Table 3.2** and **Table 3.3** for Ponds A21 and the combined A19 and A20, respectively. The results for Ponds A19 and A20 are combined since in both Alternatives Island B and C the levees separating them are removed creating essentially a single pond. The comparison between alternatives is made by comparing the flow through the existing breaches for existing conditions to the flow through the Coyote Creek and Mud Slough breaches for each alternative.

Table 3.2 Total Volume of Flow into and out of Pond A21 during a Spring-Neap Cycle

<table>
<tr><th rowspan="2"></th><th>Existing</th><th>Alternative Island B</th><th colspan="3">Alternative Island C</th></tr>
<tr><th>Coyote Creek</th><th>Coyote Creek</th><th>Coyote Creek</th><th>Mud Slough</th><th>Total</th></tr>
<tr><td>Flow in (AF)</td><td rowspan="2">7692</td><td>7759</td><td>10876</td><td>4976</td><td>15852</td></tr>
<tr><td>% existing flow in</td><td>101%</td><td>141%</td><td>65%</td><td>206%</td></tr>
<tr><td>Flow out (AF)</td><td rowspan="2">-7753</td><td>-7814</td><td>-12808</td><td>-3139</td><td>-15947</td></tr>
<tr><td>% existing flow out</td><td>101%</td><td>165%</td><td>40%</td><td>206%</td></tr>
<tr><td rowspan="2">Net Flow (AF)</td><td rowspan="2">-61</td><td rowspan="2">-56</td><td>-1932</td><td>1837</td><td rowspan="2">-95</td></tr>
<tr><td colspan="2">-95</td></tr>
<tr><td>Net Flow (% difference between in flow and outflow)</td><td>-0.8%</td><td>-0.7%</td><td colspan="2">-0.6%</td><td>-0.6%</td></tr>
</table>

Table 3.3 Total Volume of Flow into and out of Ponds A19 and A20 during a Spring-Neap Cycle

<table>
<tr><th rowspan="2"></th><th>Existing</th><th colspan="3">Alternative Island B</th><th colspan="3">Alternative Island C</th></tr>
<tr><th>Coyote Creek</th><th>Coyote Creek</th><th>Mud Slough</th><th>Total</th><th>Coyote Creek</th><th>Mud Slough</th><th>Total</th></tr>
<tr><td>Flow in (AF)</td><td rowspan="2">22,674</td><td>23,549</td><td>4,499</td><td>28,049</td><td>21,366</td><td>5,562</td><td>26,928</td></tr>
<tr><td>% existing flow in</td><td>104%</td><td>20%</td><td>124%</td><td>94%</td><td>25%</td><td>119%</td></tr>
<tr><td>Flow out (AF)</td><td rowspan="2">-22,674</td><td>-26,479</td><td>-1,577</td><td>-28,055</td><td>-22,813</td><td>-3,922</td><td>-26,736</td></tr>
<tr><td>% existing flow out</td><td>117%</td><td>7%</td><td>124%</td><td>101%</td><td>17%</td><td>118%</td></tr>
<tr><td rowspan="2">Net Flow (AF)</td><td rowspan="2">0.7</td><td>-2,930</td><td>2,922</td><td rowspan="2">-6.2</td><td>-1,447</td><td>1,640</td><td rowspan="2">193</td></tr>
<tr><td colspan="2">-8</td><td colspan="2">193</td></tr>
<tr><td>Net Flow (% difference between in flow and outflow)</td><td>0.0%</td><td colspan="2">0.0%</td><td>0.0%</td><td colspan="2">0.7%</td><td>0.7%</td></tr>
</table>

Table 3.2 and **Table 3.3** show that under Alternatives Island B and C there will be an increase in flow through the Island Ponds. For Pond A21 in Alternative Island C the flow into the pond is about double what it is under existing conditions. For Ponds A19/20 the flow increases by about 20% above existing conditions. The increased flow is not due to an increase in tidal prism within the ponds, as the ponds currently fill and drain completely on each tide cycle, but it is due to the lag in the tide rising and

falling in Mud Slough relative to Coyote Creek. The model shows the tide in Mud Slough lags Coyote Creek by about 10 minutes. The water level in the ponds follows the water level in Coyote Creek, so during a rising tide there is flow from Coyote Creek into and through the ponds then into Mud Slough. During a falling tide the flow is reversed and is from Mud Slough through the ponds and into Coyote Creek. The lag is due to the distance from the junction of Mud Slough and Coyote Creek to the breaches and the size of each channel. Coyote Creek is about 4 times the size of Mud Slough. The combination of the shorter distance and a larger channel result in the model predicting that the tide in Coyote Creek precedes the tide in Mud Slough.

However, the lag is small and within the error of the model, so it is possible that the flow through the ponds is less than predicted. The small lag time should not have an adverse effect on the sedimentation or cause erosion or scour in the ponds beyond the expected effects from the new breaches (i.e., some scour in channels and deposition in the marsh plain). Based on the one-dimensional hydraulic modeling tool, the breaches should have nearly negligible effects on overall sedimentation rates. Stage data collected in Coyote Creek, Mud Slough and the ponds, and potentially two-dimensional hydraulic and sediment modeling, would be needed to understand if additional breaches would change sedimentation rates.

3.6 Salinity and Water Quality Management

The Island Ponds are currently tidally influenced and have no salinity or water quality management issues. The ponds would continue to be tidal under Alternatives Island A, B, or C, so no additional management is required.

3.7 Geotechnical Analysis

Geotechnical data for the South Bay Salt Ponds Restoration Project was provided by the U.S. Army Corps of Engineers (Corps) and was collected as part of their South San Francisco Bay Shoreline Study (AMEC and Geomatrix Consultants 2007, AMEC Geomatrix Inc. 2009, USACE 2011a, USACE 2011b). The available data include soil borings, cone penetrometer tests (CPTs), and geotechnical data from laboratory tests performed on samples taken from the soil borings. Data is available for the Alviso complex pond levees. While no data was collected along the Island Pond levees, data was collected along the southern levee of Pond A23 which is across Mud Slough from Ponds A19 and A20.

3.7.1 Subsurface Data

A limited set of the geotechnical data was provided by the Corps for review by this project. Two files were provided which contained only the appendices from two reports by AMEC GeoMatrix, Inc – the body of the report was not made available. The titles and dates of the full reports were also not made available. Each of the provided files contains three appendices – one each for soil borings, cone penetrometer tests (CPTs), and geotechnical data from laboratory test performed on samples taken from the soil borings.

Each of the AMEC documents reference a boring location figure which was not available for review. There was, however, a USACE figure provided that is dated June 15, 2011 which showed the location of “subsurface investigations”. The same marker was used throughout, though a note states that there are both CPTs and soil borings shown on the figure. Although it is not stated explicitly, these subsurface investigations are presumed to relate to the AMEC reports.

The USACE figure was marked up to show the boring and CPT logs which were available from the AMEC appendices (see Appendix B). In some cases, CPTs and borings were apparently conducted in the same location with the same boring designation; if this is the case, the locations are marked as borings in Appendix B.

The following boring locations are on the southern exterior levee of the Pond A23 across Mud Slough from Ponds A19 and A20:

- Soil borings: A6, A7
- CPTs: A4, A4A, A5, A6, A6A, A7, A8, A9

The boring logs along the A23 south levees (A6 and A7) show that the borings were drilled between 31 and 33 feet beneath the ground surface and encountered soft bay mud with organics and shell fragments. There is some marginal increase in stiffness at a depth of about 25 feet beneath the ground surface. The CPTs show similar results.

There is no subsurface data for the levees of the Island Ponds.

The AMEC appendices also present laboratory tests that were performed on selected samples from the borings. **Table 3.1** lists the tests that were performed for the borings associated with the Pond A23 south levee (A6, A7).

Table 3.1. Laboratory Tests for Borings on A23 South Levee

Boring Designation	Tests performed
A6	Moisture-Density-Porosity
	Particle Size Distribution
	Liquid and Plastic Limits
	Triaxial Consolidated Undrained
	Consolidation
A7	Moisture-Density-Porosity
	Specific Gravity
	Unconfined Compressive Strength
	Unconsolidated Undrained Triaxial
	Triaxial Consolidated Undrained
	Consolidation

3.7.2 Seepage and Stability

The Corps also provided a figure called "Estimated Geotechnical Performance Combining Stability and Seepage" (see Appendix B) which presents a rating for selected levees in the Alviso Pond Complex. The rating is meant to represent the seepage and stability risks for the selected levees. The levees are rated on a 1 to 5 scale, with 1 being the best rating. The method used to develop these ratings was not described on the figure and no other documentation was provided. Due to the locations of the rated levees, it is clear that the subsurface investigations described above were used to develop the ratings.

Ratings are given for the Pond A23 south levee. This levee has seven ratings of level 0, and one rating of level 3. Since the rating scale is described as "5 = worst, 1 = best" on the map, it is unknown what a rating of 0 means.

3.7.3 Future Data Collection

During future design phases, additional geotechnical data may need to be collected along the Island Pond levees to assess their ability to support construction equipment, where applicable.

4. PRELIMINARY DESIGN

The preliminary design of elements in the alternatives for the Island Ponds are discussed in the sections below. Where the elements differ between the alternatives, those differences are noted. Figures illustrating these alternatives are presented in Appendix A.

4.1 Preliminary Design Components

4.1.1 Levee Removal or Lowering

Portions of the levees bordering Mud Slough and Coyote Creek would be lowered to a few inches lower than Mean High Water (MHW) elevation, which is 6.9 feet NAVD88, to elevation 6.6 feet NAVD88 and the levees separating Ponds A19 and A20 would be lowered to match the adjacent marsh plain elevation.[1] By lowering the levee height in these areas, tidal waters would overtop the levees at least once per day on average in order to meet the Habitat Connectivity and Sediment Distribution Objective in Section 2. Over time, tidal overtopping is expected to promote additional levee erosion, allowing for improved hydraulic and habitat connectivity in the ponds. Levees to be lowered include:

- Approximately 3,400 feet along the north levee of Pond A19 (Alternatives Island B and C)
- Approximately 1,600 feet along the south levee of Pond A19 (Alternatives Island B and C)
- Approximately 1,600 feet along the west levee of Pond A19 (Alternatives Island B and C)
- Approximately 1,600 feet along the east levee of Pond A20 (Alternatives Island B and C)
- Approximately 900 feet along the north levee of Pond A20 (Alternative Island C)
- Approximately 600 feet along the south levee of Pond A20 (Alternative Island C)

Design Criteria

- Top elevation (levee lowering): portions of A19 and A20 north and south levees would be lowered to elevation 6.6 feet NAVD88 (just below MHW)
- Top elevation (levee removal): A19 west and A20 east levees would be removed to marsh plain elevation

Typical cross-sections of the proposed levee removal and lowering are shown in **Figure 4.1** and **Figure 4.2**.

[1] The available LiDAR data does not appear to represent the marsh plain topography accurately where vegetation is present. LiDAR elevations in the marsh between Ponds A19 and A20 are between elevation 8.0 and 9.0 feet NAVD88, which is above MHHW of 7.5 feet NAVD88. It is unlikely that the marsh plain is above the tidal range, so these elevations are likely representative of the top of vegetation. For the purposes of preliminary design costs and volumes, the levee removal was assumed to go to elevation 6.6 feet NAVD88. The A19 and A20 pond bottom elevations in the LiDAR data (ignoring borrow ditches) are between 4.0 and 5.0 feet NAVD88 and have not fully reached marsh plain elevation.

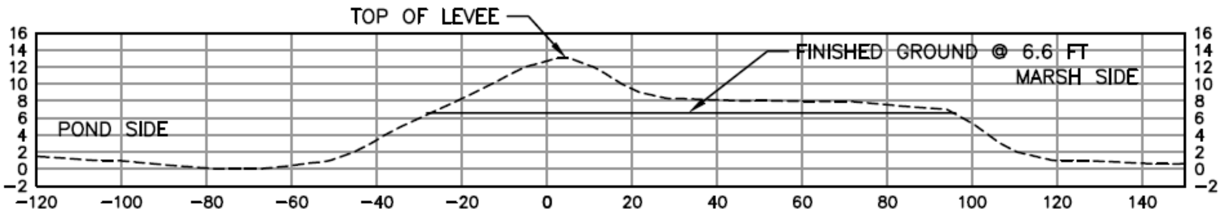


Figure 4.1. Proposed Levee Lowering – Typical Section

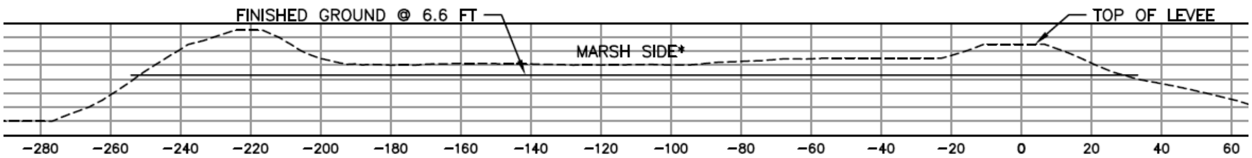


Figure 4.2. Proposed Levee Removal – Typical Section

4.1.2 Levee Breach

Two or four new breaches would provide connections to Mud Slough in Alternatives Island B and C, respectively, in order to meet the Habitat Connectivity and Sediment Distribution Objective in Section 2. Based on the preliminary modeling results, it is estimated that approximately 2,170 acre-feet of tidal volume currently exchanges per day in the Island Ponds. Several new or widened breaches are proposed.

Breach descriptions and locations are listed below:

- A19 north breaches: two (2) levee breaches between Pond A19 and Mud Slough (Alternatives Island B and C)
- A19 south breaches: widen two (2) existing levee breaches between Pond A19 and Coyote Creek (Alternative Island C)
- A20 north breach: levee breach between Pond A20 and Mud Slough (Alternative Island C)
- A21 north breach: levee breach between Pond A21 and Mud Slough (Alternative Island C)

Breaches would not be armored and are expected to evolve naturally with erosion or deposition from incoming and outgoing tidal flows. Therefore, the side slopes for these breaches are recommended for construction stability only.

Design Criteria:

- Bottom width and breach invert (new breaches): 50 feet with an invert elevation of 0.0 feet NAVD88
- Bottom width and breach invert (breach widening): 200 feet with an invert elevation of 0.0 feet NAVD88
- Side Slope: All breaches would have side slope ratios of 3:1 (h:v)

Typical cross-sections of the new breach and breach widening are shown on **Figure 4.3** and **Figure 4.4**.

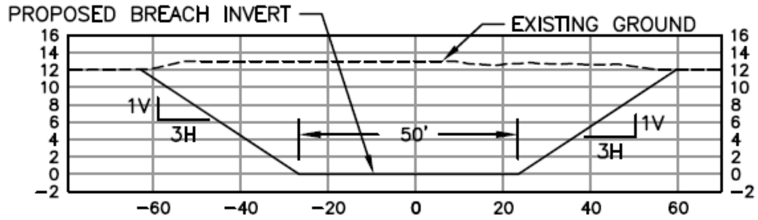


Figure 4.3. Proposed New Breach – Typical Section

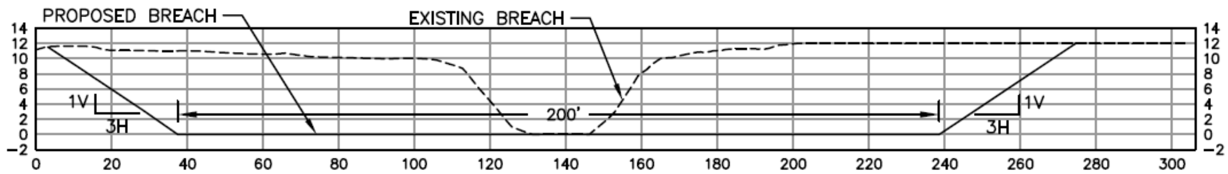


Figure 4.4. Proposed Breach Widening – Typical Section.

4.1.3 Pilot Channel

The pilot channels would facilitate drainage, sediment delivery and flooding in Pond A19 in Alternative Island C. The channel alignments would be designed to improve hydrologic connection to more distal locations from the Pond A19 southern levee breaches in order to meet the Habitat Connectivity and Sediment Distribution Objective in Section 2. The channel alignment would be excavated through the existing pond bed.

Design Criteria:

- Length: approximately 1,500 feet (western alignment) and 1,100 feet (eastern alignment)
- Invert: Match the invert elevation of the existing Coyote Creek, approximately 0.0 feet NAVD88
- Bottom width: Match breach width (200 feet) at the breach and gradually decrease to roughly 20 feet at the far end within the pond
- Side Slope: The channel side slopes would be excavated at 3:1 (h:v)

A typical cross-section of the proposed pilot channel is shown in **Figure 4.5.**

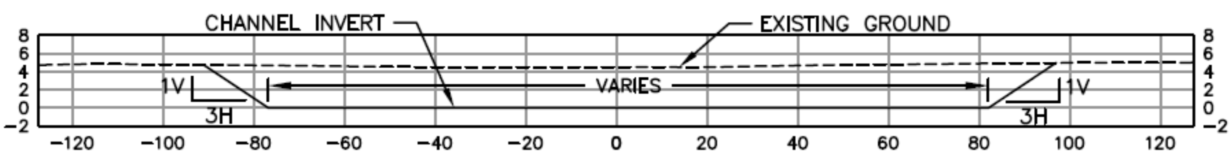


Figure 4.5. Proposed Pilot Channel – Typical Section

4.2 Construction Implementation

Construction would be implemented by procuring the services of a general contractor with experience in performing restoration activities and working within and near tidal waters. Site access information along with a preliminary analysis of the schedule and cost estimate to complete the construction activities are discussed in this section.

4.2.1 Access

Land access to the Island Ponds could be from Fremont Blvd., which is a named exit from I-880, and via Landing Road to an unnamed levee road to the northeast corner of Pond A19. Access within the Island Ponds would be along the levee crests. This access route (Appendix A, Figure A-5) assumes that the existing levees and bridge crossings on the unnamed access road are capable of handling heavy construction equipment. More likely, ponds would be accessed from the water side either through Mud Slough or Coyote Creek, and for this access method, it is assumed that the existing Union Pacific railroad[2] crossings over Coyote Creek and/or Mud Slough are capable of passing barges loaded with heavy construction equipment. Heavy vehicles would avoid crossing structures if the vehicle exceeds the weight-bearing capacity. If this is not possible, engineer-approved precautions would be taken to avoid damaging the structure. All heavy equipment access and load bearing capacities would need to be confirmed by the contractor prior to construction.

Construction crews would typically consist of three to five people. The pond cluster would likely be accessed by construction crews via the same land route as described above.

4.2.2 Schedule

Construction schedule would be driven by the habitat windows, weather conditions, and volume of earthwork quantities to be moved.

4.2.2.1 <u>Habitat Windows</u>

Construction activities would be limited by the following habitat windows that are applicable to the Island Ponds. The dates provided were developed based on permits obtained during previous project phases. Future permits for this project could have different construction limitations.

- Bird Nesting Window – From February 1 through August 31 (work may likely continue within this window in the presence of biological monitor)
- In-channel work – From April 15 to October 15
- Steelhead could be present in the pond from December 15 to April 30. In-channel work April 15-April 30 should have an approved biological monitor present
- Longfin smelt and sturgeon could be present year round. In-channel work should have an approved biological monitor present

4.2.2.2 <u>Construction Schedule</u>

Based on the preliminary design, estimated volumes of earthwork proposed for the Island Pond alternatives are shown in **Table 4.1**.

Table 4.1. Preliminary earthwork volumes

Alternative	Estimated Earthwork Volume (cy)	
	Cut	Fill
Island A	--	--
Island B	109,600	--
Island C	202,600	--

[2] The Union Pacific railroad right-of-way runs north-south between Ponds A20 and A21 adjacent to the ghost town of Drawbridge, CA.

Construction is expected to begin in the summer of 2016. Assuming best case scenario and a construction window of May 1 through November 15, a preliminary estimate of the duration of construction is shown in **Table 4.2**. A comprehensive summary of the construction equipment, means and methods is shown in Appendix C.

Table 4.2. Preliminary construction durations

Alternative	Duration (months)*	Construction Season
Island B	16	2
Island C	19	2

*Duration is from initiation of mobilization to final demobilization and includes seasonal down time.

4.2.3 Preliminary Estimate of Construction Quantities and Probable Implementation Costs

Table 4.3 and **Table 4.4** contain preliminary cost estimates for the Island Pond alternatives based on the Island Ponds Restoration Preliminary Design Details (Appendix D). Quantities were measured manually from the drawings or within the AutoCAD Civil3D software utilized in preparation of the drawings. Earthwork quantities were typically calculated based on terrain models of the existing and proposed ground surfaces and using the grid method in Civil3D.

Unit costs were developed based on a combination of previous, similar URS project experience, unit construction costs from a construction contractor experienced in salt marsh restoration construction, the R.S. Means estimate guide, and vendor quotes.

Table 4.3. Preliminary Cost Estimate for Island Ponds – Alternative Island B

Item	Description	Quantity	Units	Unit Price	Extended Price
1	Mobilization & Demobilization	1	LS	25%	$188,000
2	Lower A19 South Levee	26,300	CY	$6.20	$164,000
3	Lower A19 North Levee	27,700	CY	$6.20	$172,000
4	Remove A19 West Levee	24,600	CY	$6.20	$153,000
5	Remove A20 East Levee	24,600	CY	$6.20	$153,000
6	A19 Northwest Breach	3,600	CY	$17.00	$62,000
7	A19 Northeast Breach	2,800	CY	$17.00	$48,000
	Subtotal				$940,000
	Design & Unit Cost Contingency			25%	$235,000
	Total Direct Construction Cost				$1,175,000
	Construction Contingency			30%	$353,000
	Total				**$1,528,000**

Notes: LS = lump sum; CY = cubic yard

Table 4.4. Preliminary Cost Estimate for Island Ponds – Alternative Island C

Item	Description	Quantity	Units	Unit Price	Extended Price
1	Mobilization & Demobilization	1	LS	25%	$584,000
2	Lower A19 South Levee	26,300	CY	$6.20	$164,000
3	Lower A19 North Levee	27,700	CY	$6.20	$172,000
4	Lower A20 North Levee	12,000	CY	$6.20	$75,000
5	Lower A20 South Levee	14,300	CY	$6.20	$89,000
6	Remove A20 East Levee	24,600	CY	$6.20	$153,000
7	Remove A19 West Levee	24,600	CY	$6.20	$153,000
8	A19 Northwest Breach	3,600	CY	$17.00	$62,000
9	A19 Northeast Breach	2,800	CY	$17.00	$48,000
10	A21 North Breach	7,200	CY	$17.00	$123,000
11	A20 North Breach	5,700	CY	$17.00	$97,000
12	Excavate A19 Pilot Channels	46,900	CY	$23.00	$1,079,000
13	Expand A19 Southeast Breach	2,500	CY	$17.00	$43,000
14	Expand A19 Southwest Breach	4,400	CY	$17.00	$75,000
	Subtotal				$2,917,000
	Design & Unit Cost Contingency			25%	$730,000
	Total Direct Construction Cost				$3,647,000
	Construction Contingency			30%	$1,095,000
	Total				**$4,742,000**

Notes: LS = lump sum; CY = cubic yard

Assumptions:

The following assumptions were made in developing this preliminary cost estimate.

- The estimates include a design and unit cost contingency of 25 percent to cover changes to the design assumptions and components and uncertainty in material unit costs.
- The estimates include a construction contingency of 30 percent to cover changes to the project costs during construction.
- The contingencies do not include costs for engineering design, environmental documentation, permits, or contract and construction administration.

5. REFERENCES

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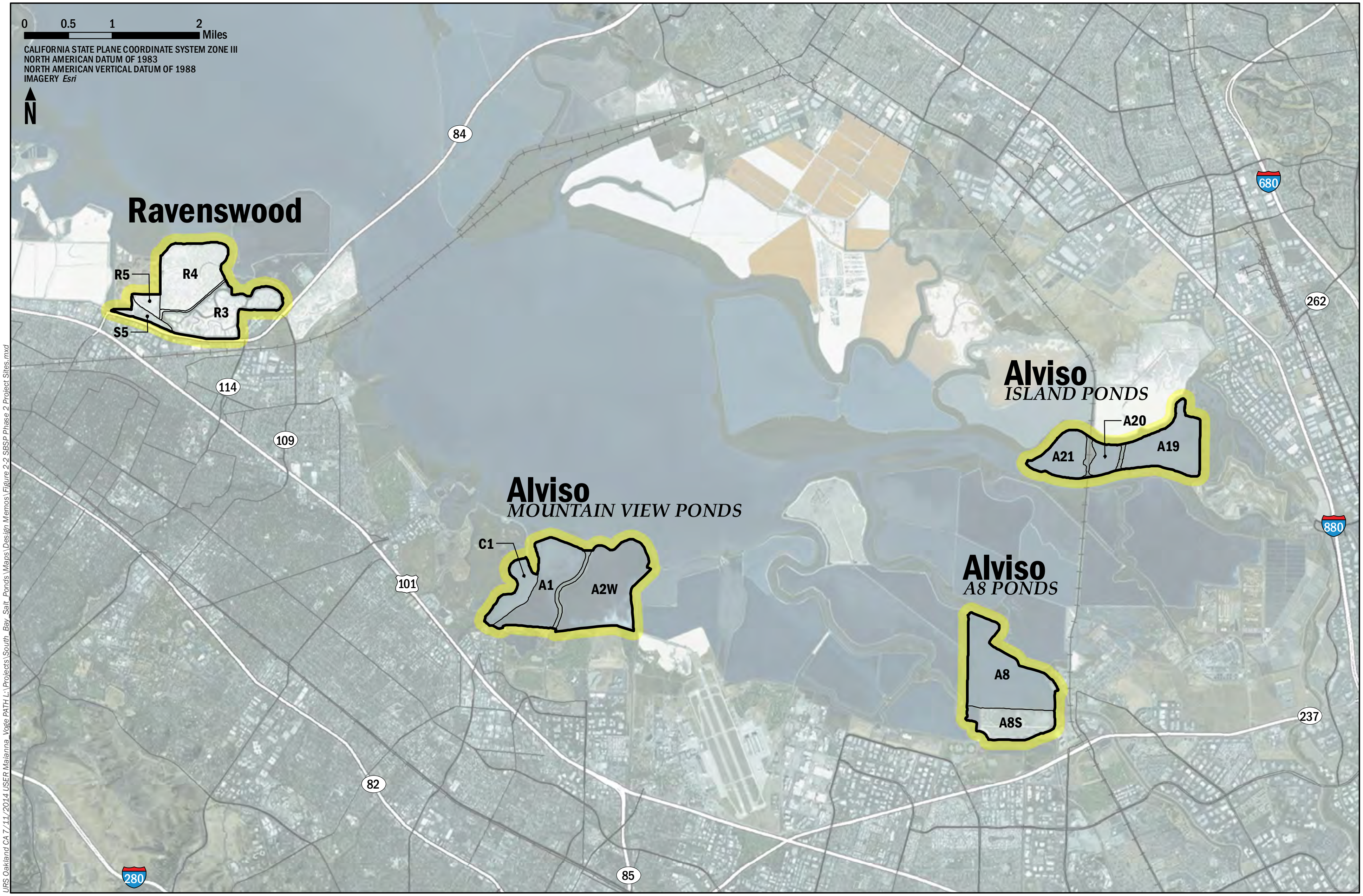
APPENDIX A – ALTERNATIVES AND ASSOCIATED FIGURES

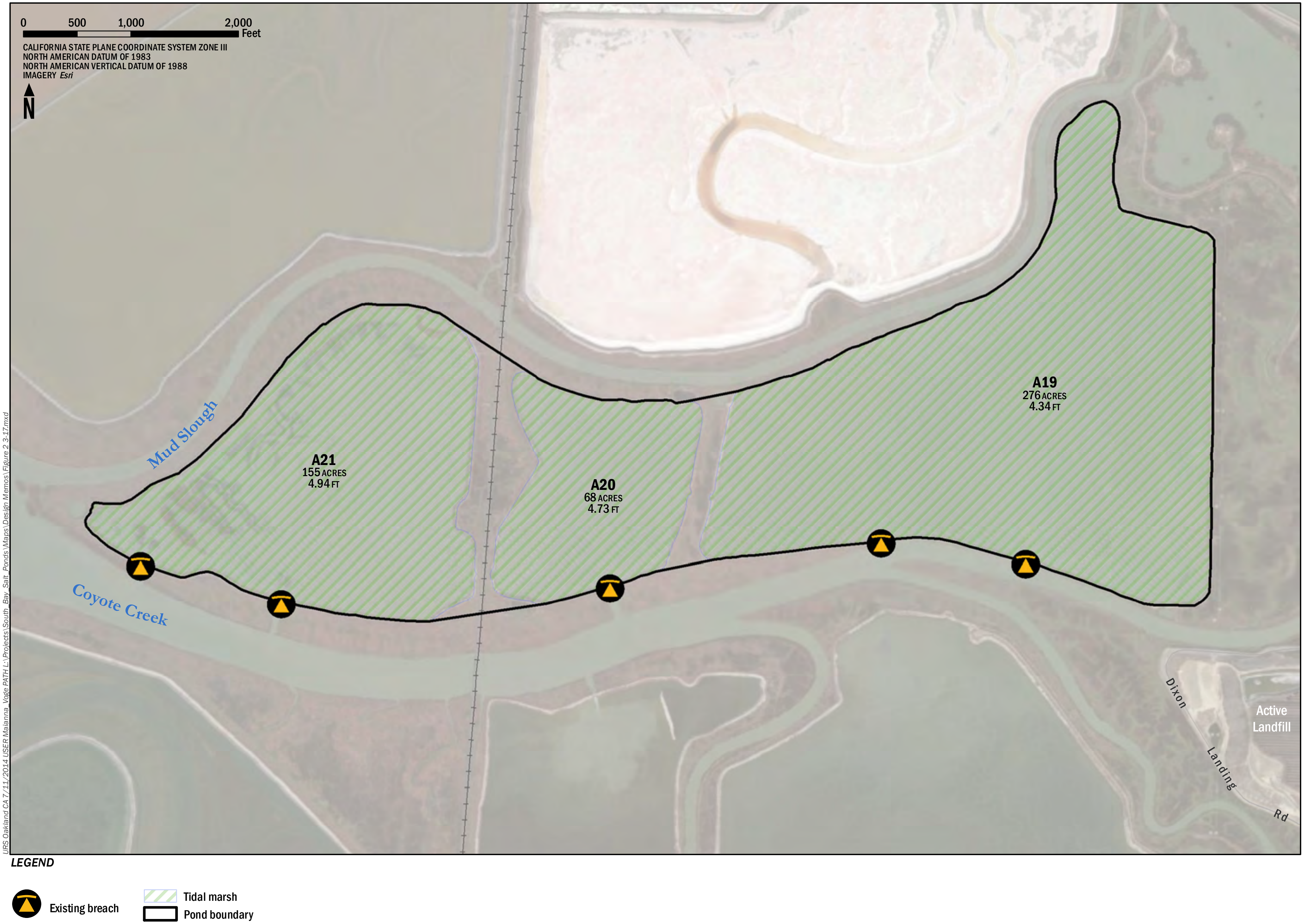


LEGEND

Phase 2 Project Area

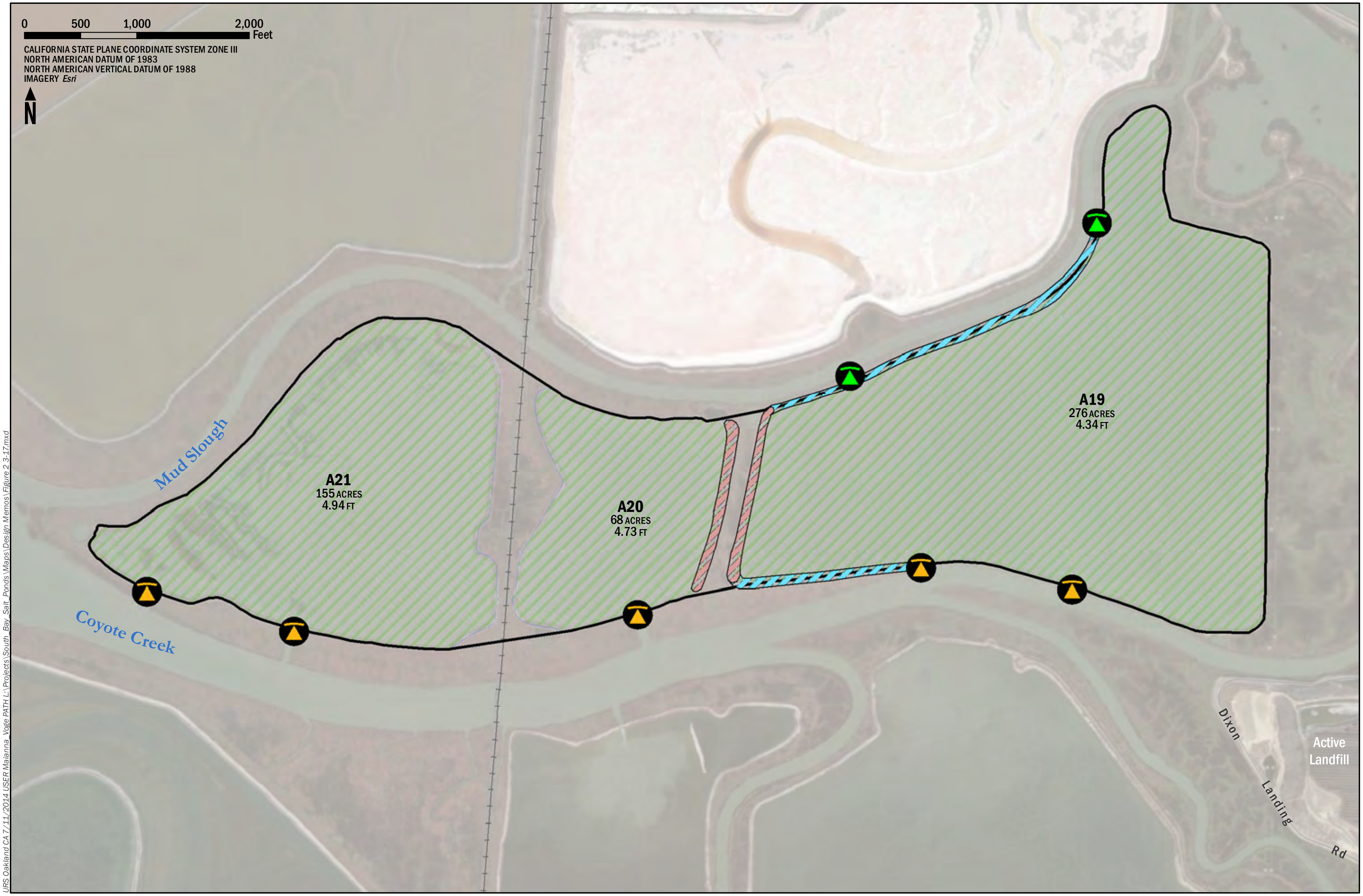
URS
South Bay Salt Pond Restoration Project

Figure A-1
SBSP Phase 2 Project Sites



URS
South Bay Salt Pond Restoration Project

Figure A-2
Alternative Island A



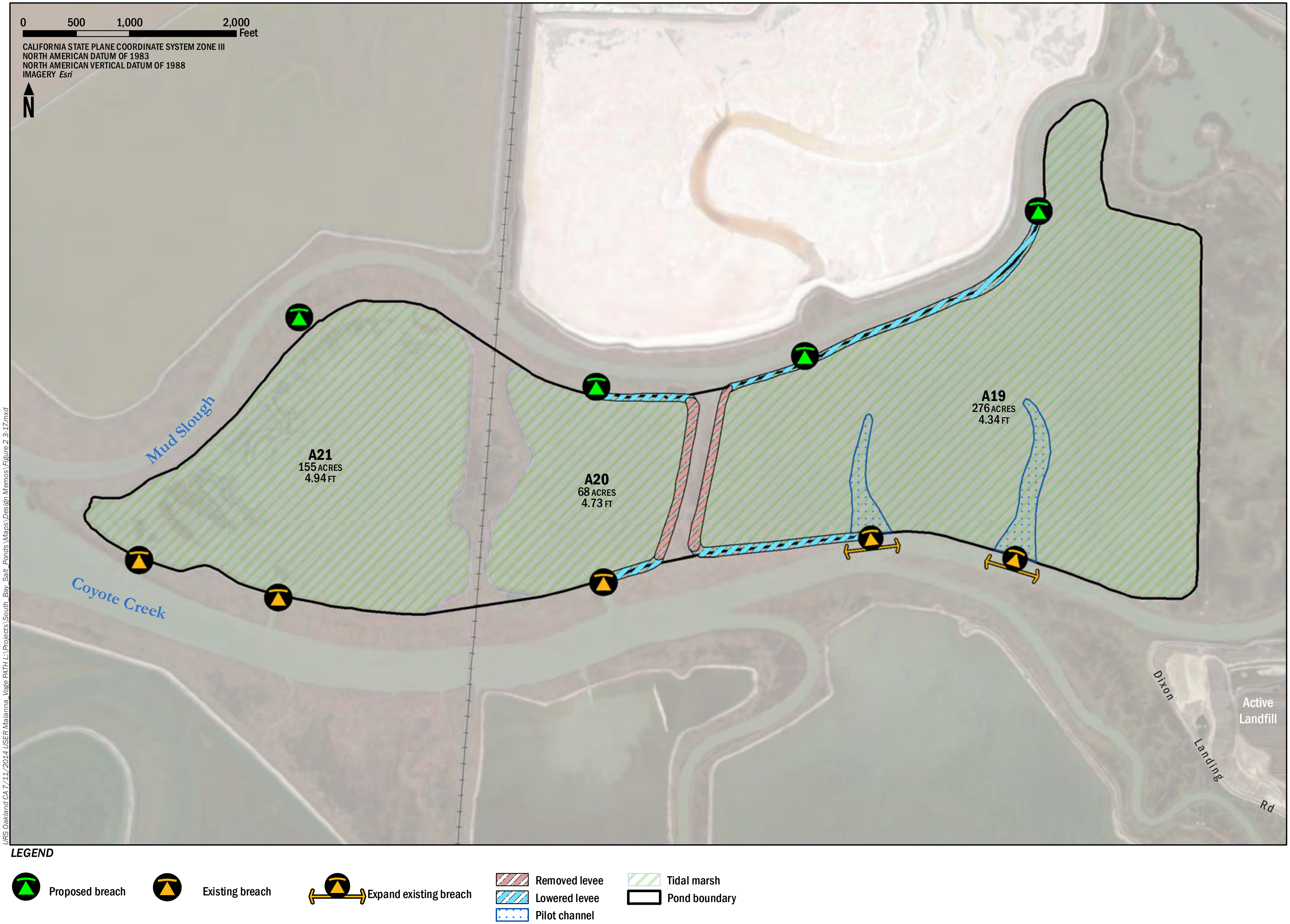
URS Oakland CA 7/11/2014 USER Maianna_Voge PATH L:\Projects\South_Bay_Salt_Ponds\Maps\Design Memos\Figure 2 3-17.mxd

LEGEND

Proposed breach
Existing breach
Removed levee
Lowered levee
Tidal marsh
Pond boundary

URS
South Bay Salt Pond Restoration Project

Figure A-3
Alternative Island B



URS
South Bay Salt Pond Restoration Project

Figure A-4
Alternative Island C

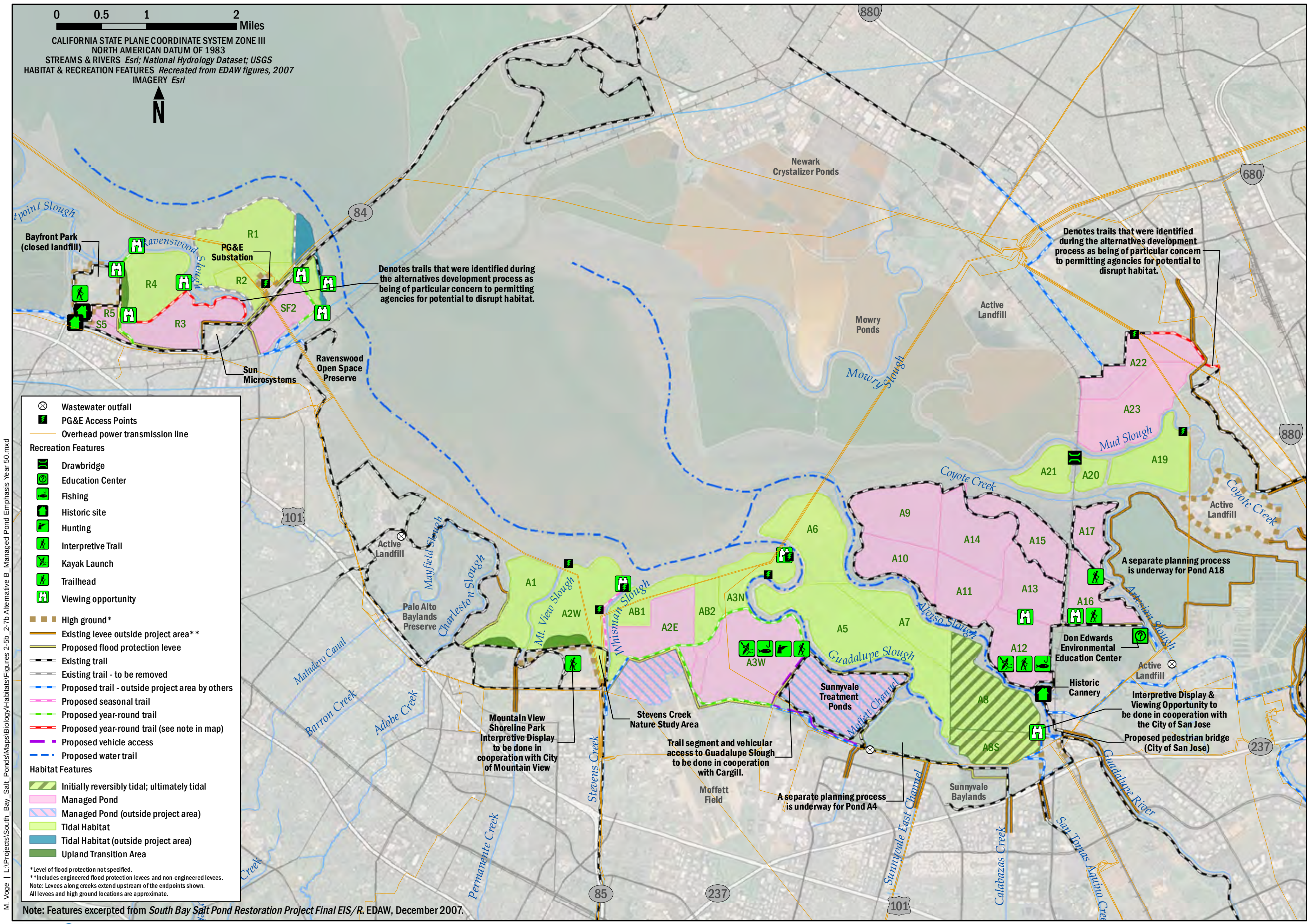
1/27/2014 **User** Maianna_Voge | **Map location** L:\Projects\South_Bay_Salt_Ponds\Maps\Design Memos\Access_Route_Alviso Island.mxd

URS
South Bay Salt Pond Restoration Project

Access Route
Phase II Project Areas

FIGURE A-5

Alviso Island Access Route

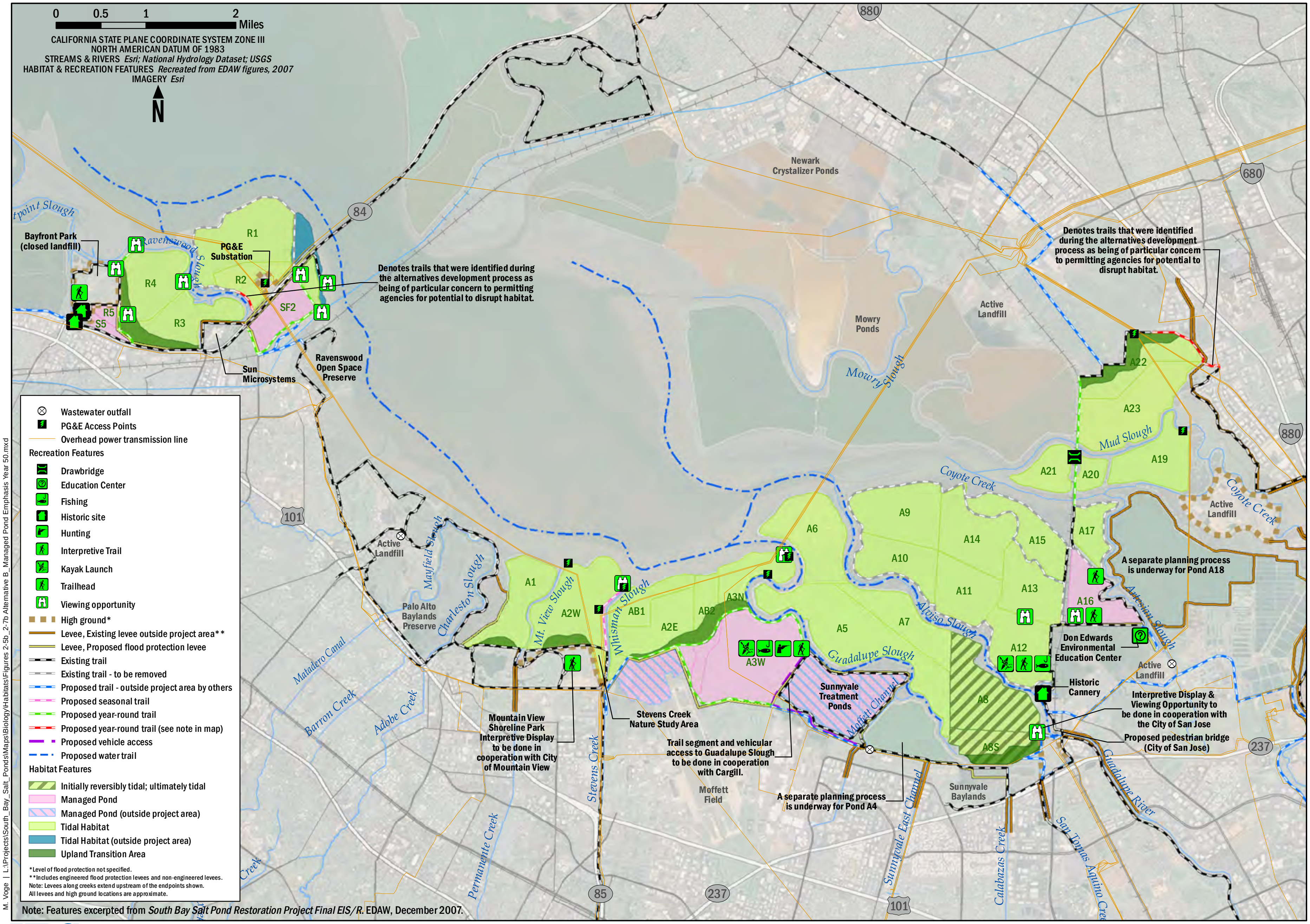


URS

South Bay Salt Pond Restoration Project

FIGURE A-6

Alternative B: Managed Pond Emphasis



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URS

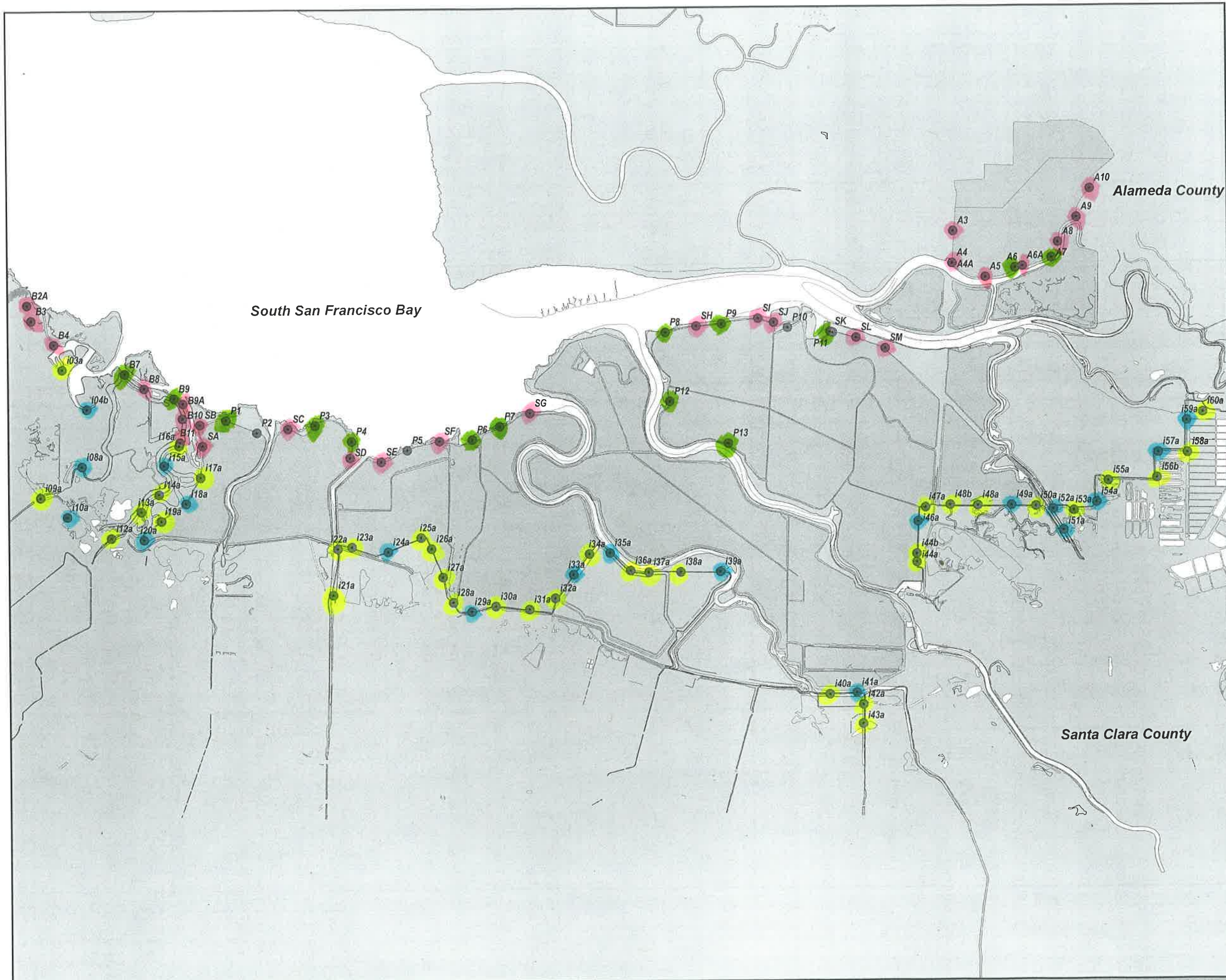
South Bay Salt Pond Restoration Project

FIGURE A-7

Alternative C: Tidal Habitat Emphasis

APPENDIX B – PRIOR GEOTECHNICAL INVESTIGATION SELECTED FIGURES

AMEC Borings (11/2006 – 4/2007)
AMEC CPTs (11/2006 – 4/2007)
AMEC Borings (8/2009)
AMEC CPTs (11/2008)



United States Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, California 94103

Map of Subsurface Exploration Logs

Map Prepared for:
United States Fish and Wildlife Service
Levee Maintenance Support

15 June 2011

USACE San Francisco
Geo-Sciences Section

Notes:
Subsurface investigation data are a product of geotechnical investigations performed in support of the Corps of Engineers South San Francisco Bay Shoreline feasibility study. Explorations include a combination of Cone Penetrometer Testing and Rotary Wash Borings. Exploration locations are approximate.

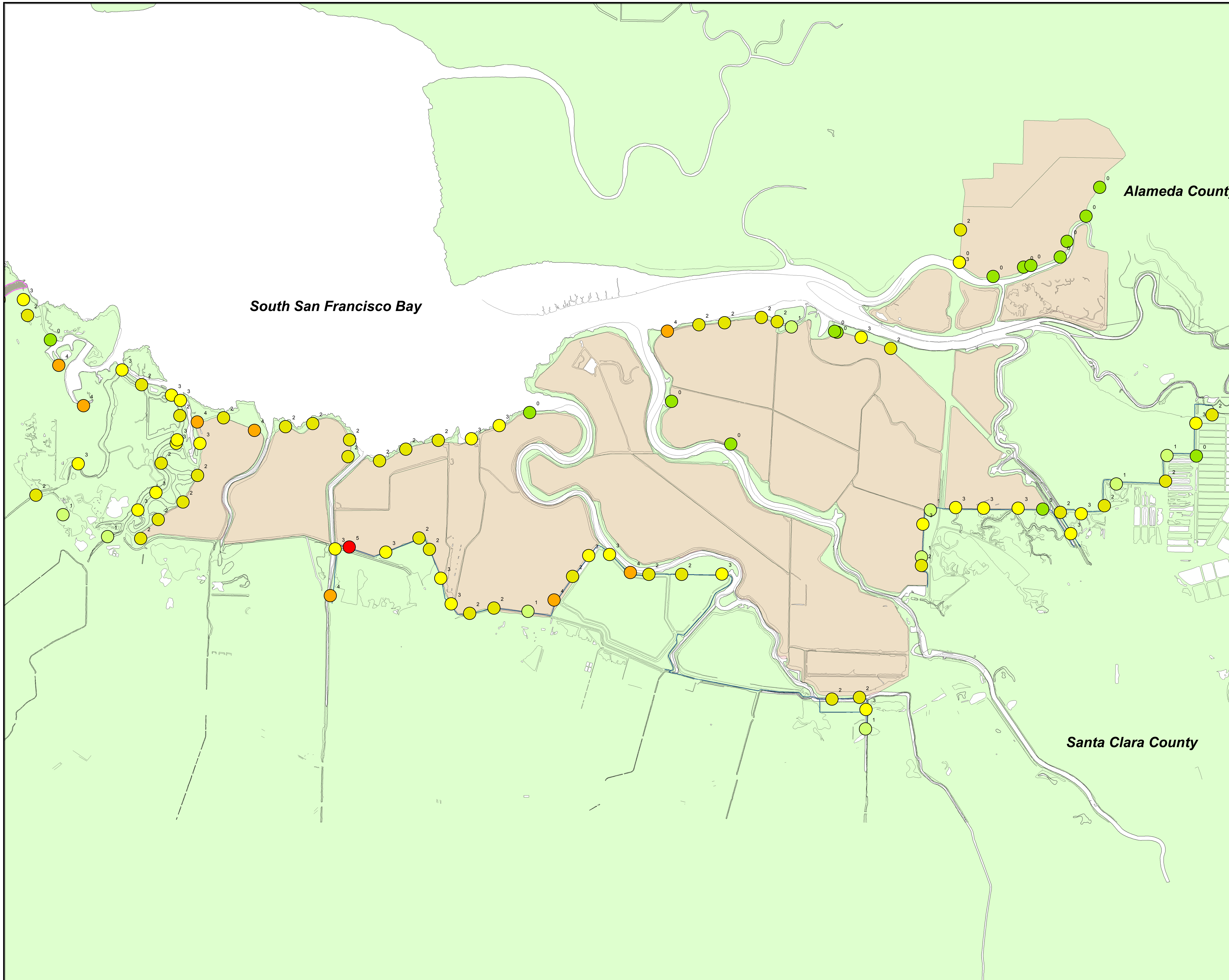
N

Legend

Subsurface Explorations

0 2,000 4,000 8,000

Feet



United States Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, California 94103

Estimated Geotechnical Performance Combining Stability and Seepage

Map Prepared for:
United States Fish and Wildlife Service
Levee Maintenance Support

15 June 2011

USACE San Francisco
Geo-Sciences Section

Legend
5=worst
1=best

- <all other values>
- 5
- 4
- 3
- 2
- 1
- 0

N

Notes:
Subsurface investigation data are a product of geotechnical investigations performed in support of the Corps of Engineers South San Francisco Bay Shorline feasibility study. Explorations include a combination of Cone Penterometer Testing and Rotary Wash Borings. Exploration locations are approximate.

0 2,000 4,000 8,000
Feet

APPENDIX C – MEANS AND METHODS

Attachment B

Anticipated Means, Methods and Durations for the Island Ponds

Preliminary Design (10 Percent Design Level)

Island - Alternative B

Basis of Review

1. Excavated material can be side cast into the pond interior and used to flatten interior levee side slopes
2. It is assumed that the bottom of Pond A19 consists of a hard gypsum layer overlain with eighteen inches of very soft silt.
3. Superintendent, fuel service, maintenance service, personal vehicles, small tools and small equipment are not included in the list of Resources. Equipment hours are operated hours.

Sequence	Component	Scope	Means & Methods	Resources	Quantity	Total Equip. Hours	Total Labor Hours
1	Mobilization	Develop submittals, staging areas and other facilities. Mobilize and demobilize equipment and labor to and from the site.	Equipment will be mobilized to the site by land to the levee system at the northeast corner of Pond A19. Equipment will access A19 by crossing the marsh on mats at low tide. A fuel barge will be mobilized to the site via Coyote Creek through the UPRR swing bridge and moored with spuds in the project vicinity. Note: Heavy equipment could potentially be mobilized to the site via barge through the UPRR swing bridge on Coyote Creek or by portable barge from the landfill on Mud Slough (need to investigate slough width/depth)	Lowbed Truck Fuel Barge Skiff Deckhand	1 1 1 2	16 16 16	16 16 16 16
2	Lower A19 S Levee	Lower levee to intertidal elevation.	A long reach excavator would walk counter-clockwise around Pond A19 to the existing southwest breach. Working from the levee top, material would be excavated and side cast into the pond as the excavator worked its way west along the levee.	Long reach excavator Deckhand	2 1	260	260 130
3	Remove A20 E Levee	Lower levee to marsh plain.	An excavator would cross the marsh at low tide on mats and work its way north lowering and side casting material into Pond A20	Long reach excavator Deckhand	2 1	460	460 230
4	Remove A19 W Levee	Lower levee to marsh plain.	Excavator would cross the marsh at low tide on mats and move to the south end of the Pond A19 west levee. It would work its way north lowering and side casting material into Pond A19	Long reach excavator Deckhand	2 1	620	620 310
5	Lower A19 N Levee (west portion)	Lower levee to intertidal elevation.	Excavator would start lowering at the western extents of the work, side casting material into the pond.	Long reach excavator Deckhand	2 1	140	140 70
6	Construct A19 NW Breach	Excavate breach.	Excavator would work out on mats until it can reach the edge of perimeter marsh. Material will be excavated and passed south to a second excavator located near the levee that would place material on the inside of the levee. Pilot channel material would be moved laterally down the levee as necessary for disposal in the pond. The Breach would then be excavated from west to east.	Long reach excavator Deckhand	2 1	320	320 160
7	Lower A19 N Levee (middle portion)	Lower levee to intertidal elevation.	Long reach excavator would lower the levee from west to east, side casting material into the pond.	Long reach excavator Deckhand	2 1	580	580 290
8	Construct A19 NE Breach	Excavate breach.	Excavator would work out on mats until it can reach the edge of perimeter marsh. Material will be excavated and passed south to a second excavator located near the levee that would place material on the inside of the levee. Pilot channel material would be moved laterally down the levee as necessary for disposal in the pond. The Breach would then be excavated from west to east.	Long reach excavator Deckhand	2 1	320	320 160
9	Demobilize	Demobilize equipment and Labor.	Same as mobilization.	Lowbed Truck Fuel Barge Skiff Deckhand	1 1 1 2	16 16 16	16 16 16 16

Island - Alternative C

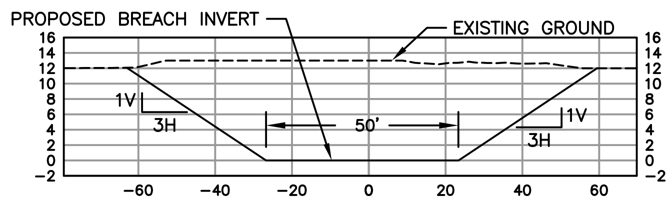
Basis of Review

1. Excavated material can be side cast into the pond interior and used to flatten interior levee side slopes
2. It is assumed that the bottom of Pond A19 consists of a hard gypsum layer overlain with eighteen inches of very soft silt.
3. Superintendent, fuel service, maintenance service, personal vehicles, small tools and small equipment are not included in the list of Resources. Equipment hours are operated hours.

Sequence	Component	Scope	Means & Methods	Resources	Quantity	Total Equip. Hours	Total Labor Hours
1	Mobilization	Develop submittals, staging areas and other facilities. Mobilize and demobilize equipment and labor to and from the site.	Equipment will be mobilized to the site by land to the levee system at the northeast corner of A19. Equipment will access A19 by crossing the marsh on mats at low tide. A fuel barge will be mobilized to the site by Coyote Creek through the UPRR swing bridge and moored with spuds in the project vicinity. Note: Heavy equipment could potentially be mobilized to the site via barge through the UPRR swing bridge on Coyote Creek or by portable barge from the landfill on Mud Slough (need to investigate slough width/depth)	Lowbed Truck Fuel Barge Skiff Deckhand	1 1 1 2	16 16 16	16 16 16 16
2	Excavate A19 Pilot Channels	Excavate two pilot channels in Pond A19.	An amphibious excavator would be used to excavate the pilot channels and side cast material within the pond. Excavator would work its way into to the furthest extent on one side of the pilot channel and then back out on the other. Material would be side cast on both sides leaving gaps for water flow. Depending on the quantity of material excavated additional passes may be required to dispose of the material.	Amphibious Excavator Skiff Deckhand	2 1 1	380 190	380 190 190
3	Expand A19 SE Breach	Widen the existing breach.	An amphibious excavator would be used to widen the breach following excavation of the pilot channels. Material would be placed on the inside slope of the perimeter levee	Amphibious Excavator Skiff Deckhand	2 1 1	100 50	100 50 50
4	Expand A19 SW Breach	Widen the existing breach.	An excavator would widen the breach towards the west, working from the levee top and side casting excavated material into Pond A19.	Long reach excavator Deckhand	2 1	180 90	180 90
5	Lower A19 S Levee	Lower levee to intertidal elevation.	Working from the levee top an excavator would lower the levee and side cast material into the pond as it worked its way along the levee.	Long reach excavator Deckhand	2 1	260	260 130
6	Lower A20 S Levee	Lower levee to intertidal elevation.	Excavator would cross the marsh at low tide on mats and work its way to the south breach. Material would be excavated and placed into the pond as the excavator worked its way back out.	Long reach excavator Deckhand	2 1	80	80 40
7	Remove A20 E Levee	Lower levee to marsh plain.	Excavator would cross the marsh at low tide on mats and work its way north lowering and side casting material into Pond A20	Long reach excavator Deckhand	2 1	460	460 230
8	Construct A 21 N Breach	Excavate perimeter marsh and levee to form breach.	Excavator would walk along the north levee system crossing marsh at low tide on mats. The excavator would use mats to cross the UP railroad tracks. It would work out on mats until it can reach the edge of perimeter marsh. Material will be excavated and passed south towards the levee until it could be placed within the pond. Once the pilot channel is constructed the excavators would move the material laterally down the levee as necessary for disposal into the pond. The Breach would then be excavated from west to east.	Long reach excavator Deckhand	2 1	580	580 290
9	Construct A20 N Breach	Excavate perimeter marsh and levee to form breach.	Excavator would work out on mats until it can reach the edge of perimeter marsh. Material will be excavated and passed south to a second excavator located near the levee that would place material on the inside of the levee. Once the pilot channel is constructed the excavators would move the material laterally down the levee as necessary for disposal into the pond. The Breach would then be excavated from west to east.	Long reach excavator Deckhand	2 1	580	580 290
10	Lower A20 N Levee	Lower levee to intertidal elevation.	Working from the levee top a long reach excavator would remove and side cast material into the pond as it moved from west to east.	Long reach excavator Deckhand	2 1	160	160 80
11	Remove A19 W Levee	Lower levee to marsh plain.	Excavator would cross the marsh at low tide on mats and move to the south end of the Pond A19 west levee. It would work its way north lowering and side casting material into Pond A19	Long reach excavator Deckhand	2 1	620	620 310
12	Lower A19 N Levee (west portion)	Lower levee to intertidal elevation.	Excavator would start lowering at the western extents of the work, side casting material into the pond.	Long reach excavator Deckhand	2 1	140	140 70

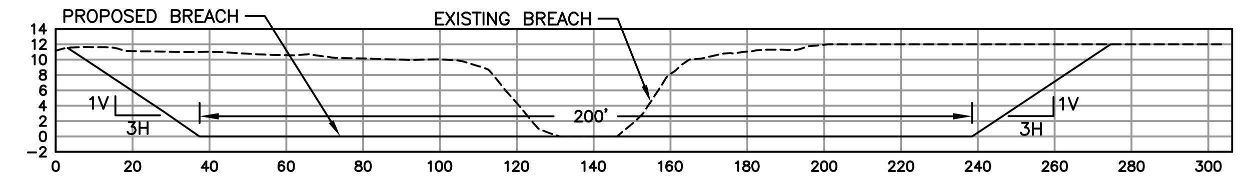
Sequence	Component	Scope	Means & Methods	Resources	Quantity	Total Equip. Hours	Total Labor Hours
13	Construct A19 NW Breach	Excavate breach.	Excavator would work out on mats until it can reach the edge of perimeter marsh. Material will be excavated and passed south to a second excavator located near the levee that would place material on the inside of the levee. Once the pilot channel is constructed the excavators would move the material laterally down the levee as necessary for disposal into the pond. The Breach would then be excavated from west to east.	Long reach excavator Deckhand	2 1	320	320 160
14	Lower A19 N Levee (middle portion)	Lower levee to intertidal elevation.	Long reach excavator would lower the levee from west to east, side casting material into the pond.	Long reach excavator Deckhand	2 1	580	580 290
15	Construct A19 NE Breach	Excavate breach.	Excavator would work out on mats until it can reach the edge of perimeter marsh. Material will be excavated and passed south to a second excavator located near the levee that would place material on the inside of the levee. Once the pilot channel is constructed the excavators would move the material laterally down the levee as necessary for disposal into the pond. The Breach would then be excavated from west to east.	Long reach excavator Deckhand	2 1	320	320 160
16	Demobilize	Demobilize equipment and Labor.	Same as mobilization	Lowbed Truck Fuel Barge Skiff Deckhand	1 1 1 2	16 16 16	16 16 16 16

APPENDIX D – DESIGN SECTIONS



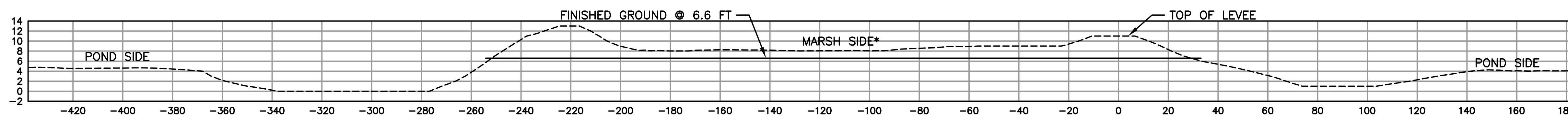
BREACH – TYPICAL SECTION (1/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



BREACH WIDENING – TYPICAL SECTION (2/-)

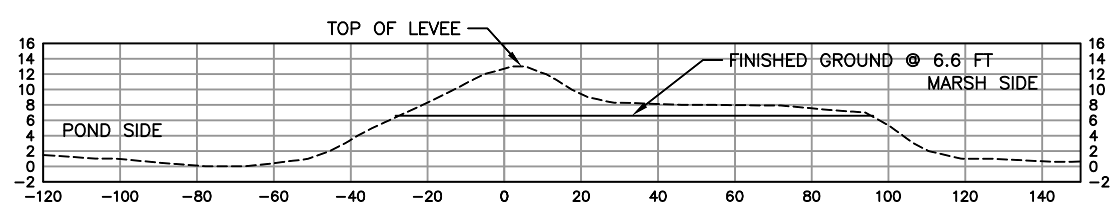
HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



LEVEE REMOVAL – TYPICAL SECTION (3/-)

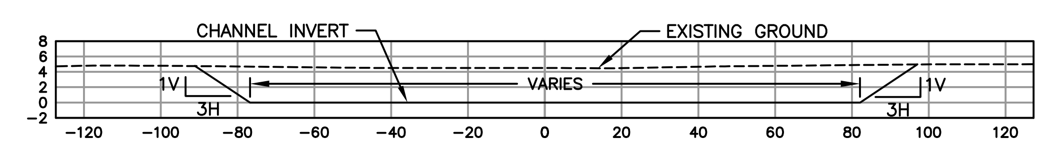
HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'

* NOTE: SHOWN EXISTING GROUND ELEVATIONS ON THE MARSH SIDE ARE LIKELY TOP OF VEGETATION AND NOT BARE-EARTH ELEVATIONS.



LEVEE LOWERING – TYPICAL SECTION (4/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'



PILOT CHANNEL – TYPICAL SECTION (5/-)

HORIZONTAL SCALE: 1"=50'
VERTICAL SCALE: 1"=25'

REV	DESCRIPTION OF REVISION	BY	DATE

CALIFORNIA STATE COASTAL CONSERVANCY
1330 BROADWAY
OAKLAND, CA 94612

URS
1333 BROADWAY, SUITE 800
OAKLAND, CA 94612
PHONE: (510) 893-3600
FAX: (510) 874-3268

DESIGNED	SS
DRAWN	SS/VD
CHECKED	SL
PEER REVIEWED	SG
PROJECT MANAGER	TC/DH
DATE	05/06/2014

ALVISO ISLAND PONDS
DETAILS

REVISION
PROJECT 26818349
DRAWING
SHEET 1 OF 1

May 05, 2014 – 5:39pm
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