ISLAND PONDS MITIGATION MONITORING AND REPORTING YEAR 3 - 2008

Prepared by

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January 2009

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EXECUTIVE SUMMARY

The Santa Clara Valley Water District (District) and the U.S. Fish and Wildlife Service Don Edwards National Wildlife Refuge (Refuge) implemented the Island Ponds Restoration Project to fulfill two goals: 1) to initiate ecological restoration activities as described in the South Bay Salt Pond Initial Stewardship Plan (ISP), and 2) to satisfy the tidal marsh mitigation needs of both the Refuge for the ISP, and the District for the Stream Maintenance Program and the Lower Guadalupe River Project.

Breaching of the Island Ponds A19, A20, and A21 occurred in March 2006. Five breaches were cut to allow tidal waters to inundate the ponds and begin the process of restoration. In the Restoration and Mitigation Monitoring Plan for the Island Pond Restoration Project (RMMP), the District and the Refuge agreed to conduct monitoring to track the progress of the restoration. This report presents the Year 3 (2008) monitoring results for both the District and the Refuge.

The following is a summary of the monitoring results:

Sediment is continuing to deposit on the surface of all 3 ponds. Rates of accretion vary between ponds and across the surface of each pond. Accretion rates are higher in Ponds A20 and A21 than in Pond A19. In general, accretion is greater at the southern end or center of each pond and diminishes at the northern end. In Ponds A20 and A21, over 50% of the sediment monitoring stations are accreting sediment at rates greater than the 0.2 ft/yr originally predicted. Pond A19 which was on track with this prediction for the first year sediment accrual rate, is now slightly behind with only 1/3 of its monitoring stations reaching the 0.4 ft predicted accretion rate in year 2.

Aerial photographs show that the excavated outboard tidal channels have widened since breaching. Levee breach widths have also widened, but there is marked variability in the amount of scour between breaches. A small amount of both scour and accretion has occurred along portions of the fringing marshes on both sides of Coyote Creek, resulting in the loss of approximately 0.69 acres and a gain of approximately 0.40 acres of marsh from 2006 through 2008. As in previous years, no signs of scour have been detected in any of the levees opposite the breaches at Ponds A15, A17, and A18.

Although there appears to be a small increase in scour around the uppermost piles of the railroad bridge, the scour is very limited in extent. It is important to note that our observations are only of the visible piles on both sides of the channel at low tide. Our observations do not include the subtidal piles in the center of the channel where scour is more likely to occur. As follow up to last year's report recommendations, railroad personnel were contacted to discuss the need for more detailed bridge monitoring. The railroad staff ensured us that they inspect the bridge twice a year and that their inspections are confidential and for internal use only. They also informed us that they had not documented any signs of scour at this bridge.

Both Ponds A19 and A20 showed an increase in channel network development in Year 3, however, no new channels developed in A21.

Native vegetation increased 34% at the ponds in 2008. The majority of this vegetation was pickleweed (*Sarcocornia pacifica*) growing adjacent to the levees, along the borrow ditches as well as a few areas within the pond interiors. No invasive plant species were found within the Island Ponds, however, seven patches of invasive *Spartina alterniflora* hybrids were treated by the ISP along the south-western outboard levee of Pond A21 using helicopter broadcast spraying.

Since the breaching of the Island Ponds in March 2006, overall waterbird use has increased in almost all guilds of birds with the exception of eared grebes (*Podiceps nigricollis*). The decline in numbers of eared grebes is likely due to a loss of foraging habitat as the ponds turned less saline. Many bird species are now utilizing these ponds for foraging and roosting habitat. After an initial increase in the use of the ponds by gulls, there now appears to be a slow down although ponds A19 and A21 still have more use by gulls than before the breach occurred.

INTRODUCTION

1.1 PROJECT BACKGROUND

In March 2006 the Santa Clara Valley Water District (District) and U.S. Fish and Wildlife Service (USFWS) Don Edwards National Wildlife Refuge (Refuge) restored tidal inundation to the 475-acre Island Pond Complex (the ponds). Five breaches were cut by an amphibious excavator along the south side of the ponds to allow tidal waters to inundate the ponds and begin the process of restoration. Two breaches (west and east) were cut in Pond A19 on March 7, 2006. A single breach was cut in Pond A20 on March 13, 2006. Two breaches (west and east) were cut in Pond A21, on March 21 and March 29, 2006, respectively. This restoration approach is a minimally engineered, passive design, which relies on natural sedimentation processes to restore the ponds to tidal marsh habitat to meet the project goals and objectives.

Restoration of the Island Ponds is a component of the Initial Stewardship Plan (ISP) for the larger South Bay Salt Pond Restoration Project (Life Science!, 2003). The District and the Refuge implemented the Island Ponds Restoration Project to fulfill two goals:

1. To initiate ecological restoration activities as described in the South Bay Salt Pond ISP
2. To satisfy the tidal marsh mitigation needs of both the Refuge for the ISP and the District for the Stream Maintenance Program (SMP) and Lower Guadalupe River Project (LGRP).

In the Restoration and Mitigation Monitoring Plan for the Island Pond Restoration Project (RMMP), the District and the Refuge agreed to conduct long-term monitoring to track the progress of the restoration and to evaluate whether there are adverse effects from the project (USFWS et al., 2006). Mitigation monitoring activities are anticipated to continue for 15 years. This report presents the Year 3 (2008) monitoring results.

1.2 PROJECTS WHICH REQUIRED MITIGATION

1.2.1 Initial Stewardship Plan

The ISP was created as an interim step to manage the ponds while a long-term plan is developed for the entire South Bay Salt Pond area. The main objectives of the ISP are to:

- cease commercial salt operations,
- introduce tidal hydrology to the ponds where feasible,
- maintain existing high quality open water and wetland wildlife habitat, including habitat for migratory and resident shorebirds and waterfowl,
- assure ponds are maintained in a restorable condition to facilitate future long-term restoration,
- minimize initial stewardship management costs,

- meet all regulatory requirements, especially discharge requirements to maintain water quality standards in the South Bay.

Taking into account the environmental effects of implementing the ISP based on the assessment in the EIR/EIS (Life Science!, 2004) and the associated permit requirements, the Refuge has agreed to restore unimpeded tidal inundation to approximately 475 acres at the Island Ponds and restore nine acres of tidal marsh specifically at Pond A21.

The permit file number for ISP activities which requires tidal wetland mitigation is San Francisco Bay Regional Water Quality Control Board - Order # R2-2004-0018.

1.2.2 Stream Maintenance Program

The SMP allows the District to implement routine stream and canal maintenance projects to meet the District's flood protection and water supply mandates in a feasible, cost-effective, and environmentally-sensitive manner. This program is also intended to assist the District in obtaining multi-year permits for these activities, which have currently been issued through 2012. The SMP applies to all of the District's routine stream maintenance, including three major types of activities: sediment removal, vegetation management, and bank protection. SMP activities commenced soon after the District received its final SMP permit in August 2002.

The SMP compensatory mitigation package includes mitigation for impacts to 30 acres of tidal wetlands; 29 acres from sediment removal activities and one acre from vegetation management activities. Taking into account the assessment in the EIR/EIS and the associated permit requirements, the District has agreed to restore 30 acres within the Island Ponds to tidal marsh habitat as mitigation for implementation of the SMP.

Permit file numbers for SMP activities which require tidal wetland mitigation are:

- San Francisco Bay Regional Water Quality Control Board - Order # R2-2002-0028
- U.S. Army Corp of Engineers - Permit # 22525S
- California Department of Fish and Game – 1601 Lake and Streambed Alteration Agreement # R3-2001-0119
- U.S. Fish and Wildlife Service – Biological Opinion 1-1-01-F-0314

1.2.3 Lower Guadalupe River Project

The LGRP was constructed to convey design flood flows in the lower Guadalupe River between Interstate 880, in downtown San Jose, and the Union Pacific Railroad Bridge in Alviso. The project was designed to balance the needs for flood-control structures and channel maintenance with the goal of protecting and enhancing environmental conditions and public access. LGRP construction began in April 2003.

The LGRP compensatory mitigation package includes mitigation for both temporary and permanent impacts to wetland vegetation. Taking into account the assessment in the EIR/EIS and the associated permit requirements, the District has agreed to restore 35.54 acres to tidal marsh within the Island Ponds to mitigate for LGRP impacts.

Permit file numbers for LGRP activities which require tidal wetland mitigation are:

- San Francisco Bay Regional Water Quality Control Board - Order # R2-2002-0089
- U.S. Army Corp of Engineers - Permit # 24897S
- California Department of Fish and Game – 1601 Lake and Streambed Alteration Agreement # R3-2002-0732

1.3 ISLAND PONDS MITIGATION SITE

1.3.1 Site Description

The Island Ponds (Ponds A19, A20, and A21) are located at the extreme southern extent of the San Francisco Bay within Coyote Creek. The ponds are in Alameda County immediately north of the Santa Clara County line, in the City of Fremont (Figure 1). These ponds are part of a larger 25-pond system known as the Alviso Complex. Prior to their 2006 breaching, this complex contained 7,364 acres of pond habitat, 420 acres of saltmarsh outboard of the pond levees, 896 acres of brackish marsh in the adjacent sloughs and creeks, as well as associated upland (levee) and subtidal habitats (HTH et al., 2005).

Solar salt production began at the Alviso Complex in 1929 and continued until the ponds were purchased by State and Federal Agencies in 2003. The Island Ponds were middle stage salt evaporator ponds with intermediate salinity levels. In March 2006, the District and the Refuge cut five breaches on the south side of the ponds to permit full tidal inundation and allow the ponds to passively restore to tidal marsh habitat.

1.3.2 Mitigation Monitoring

The District and the Refuge agreed to conduct a long-term monitoring program to track the progress of the Island Ponds restoration. The RMMP details the monitoring activities, which are designed to track mitigation performance over a 15-year period (USFWS et al., 2006). The monitoring data will be compared from year to year to determine trends with respect to meeting performance criteria, permit requirements, and provide data for adaptive management actions, if necessary.

Table 1-1 describes the monitoring schedule for the Island Ponds, including monitoring duration, frequency and timing. Table 1-1 also depicts the division of monitoring responsibilities between the District and the Refuge.

Table 1-1. Mitigation Monitoring Schedule for the Island Ponds – Responsible Party, Monitoring Duration, Frequency and Timing.

Responsible Party	Monitoring Activity	Year(s) for Each Monitoring Activity [1]	Frequency	Seasonal Timing
On-Site Monitoring				
District	Inundation regime	Years 1, 2, 3, 5, 10, and 15 (or until two monitoring cycles indicate that full tidal exchange has been achieved)	Completed Task (2006 & 2007)	---
	Substrate development	a) Years 1 and 2	Semiannual	Apr, Oct
		b) Years 3 to 5	Annual	Oct
		c) Year 6 to 30 acres of vegetation	Biennial	Oct
	Levee breach and outboard marsh channel geometry[3]	Years 1, 2, 3, 5, 10, and 15	Annual	With aerial
	Aerial photo	a) Year 1 to 5, 10, and 15	Annual	Jul - Aug
		b) Year 7, 9, 11 … to end	Biennial	Jul - Aug
Refuge	Channel network evolution[3]	Years 1, 2, 3, 5, 10, and 15	Annual	With aerial
	Vegetation mapping[3]	Until mitigation achieved	Biennial	Jul - Aug[2]
	Ground-based quantitative vegetation sampling	Once 30 acres of vegetated area is established until 75 acres of 75% vegetation cover is achieved	Biennial	Jul - Aug[2]
	Invasive *Spartina* monitoring and control	Year 1 to 75% native vegetation cover	Annual	Sept - Nov
	Wildlife use (CLRA)	Begin when 30 acres native vegetation to detection	Annual	Jan - Apr 15
	Wildlife use (SMHM)	Begin at five acres contiguous suitable habitat, end at SMHM detected	Once every 5 years	Jun - Aug
	Wildlife use (shorebirds & waterfowl)	Years 1 to 5	Quarterly	Win, Spr, Sum, Fall

Off-Site Monitoring				
District	Rail bridge pier scour	a) Years 1 to 5	Quarterly	Win, Spr, Sum, Fall
		b) Years 1 to 5	Once per 10-yr storm event	
		c) Begin at implementation of corrective measures, end five years after	Quarterly	Win, Spr, Sum, Fall
	Fringing marsh scour in Coyote Creek[3]	a) Years 1 to 5, Final year	Annual	With aerial
	Scour of levees opposite breaches[3]	a) Years 1 to 3	Annual	With aerial
		b) If outboard marsh retreats to levees opposite breach, then three additional years from occurrence	Annual	Jul - Sep
	Rail line erosion	a) Years 1 to 5	Annual	Apr - Jun
		b) Years 1 to 5	Once per 10-yr storm event	
	Deterioration of Town of Drawbridge structures	a) Years 1 to 5	Annual	Apr - Jun
Refuge	Water Quality	a) Adjacent to breaches – Year 1	Completed Task (2006)	---
		b) Upstream & downstream of ponds – Year 1	Completed Task (2006)	---

[1] Projected time estimates to achieve performance criteria. Actual duration is dependent upon performance criteria and may vary.

[2] If CLRA are detected, on-site vegetation monitoring is only allowed from Sept 1 to Jan 31.

[3] Monitoring to use annual aerial photograph.

This report presents the monitoring results collected during the Year 3 (2008) monitoring period. The data are presented in detail and are compared to pre-breach and Year 1 results as well as the overall project performance criteria identified in the RMMP (USFWS et al., 2006). Since the District and the Refuge divided the responsibility for the monitoring activities, the District's results and conclusions are presented in the main body of this report (and Appendices B & C), while the Refuge's results and conclusions are attached as Appendix A.

1.3.3 Performance Criteria

The performance criteria for the Island Ponds are specific to the mitigation needs of the Refuge and the District.

The performance criteria for the ISP mitigation are:

- Restore unimpeded tidal action to approximately 475 acres,
- Restore nine acres of vegetated tidal marsh located within a larger marsh area in Pond A21,
- Vegetation covers no less than 75% of the nine acres,

- Plant species composition consists of native tidal marsh species appropriate to the salinity regime,
- Targets achieved within 15 years following levee breach.

The performance criteria for the SMP mitigation are:

- Restore 30 acres of vegetated tidal marsh located within a larger marsh area on the three Island Ponds,
- Vegetation covers no less than 75% of the 30 acres,
- Plant species composition consists of native tidal marsh species appropriate to the salinity regime,
- Presence of California clapper rail at the Island Ponds as detected by a positive response to rail call counts using USFWS Endangered Species Office approved survey protocols. This performance criterion for the clapper rail mitigation requirement was established by the District through negotiations with the USFWS Endangered Species Office in December 2005,
- Targets achieved within 15 years following levee breach.

The performance criteria for the LGRP mitigation are:

- Restore 35.54 acres of vegetated tidal marsh located within a larger marsh area on the three Island Ponds,
- Vegetation covers no less than 75% of the 35.54 acres,
- Plant species composition consists of native tidal marsh species appropriate to the salinity regime,
- Targets achieved within 15 years following levee breach.

1.4 CONTACTS

The District contact is Lisa Porcella, Santa Clara Valley Water District, 5750 Almaden Expressway, San Jose, CA 95118-3686. Tel: (408) 265-2607 x2741.

The Refuge contact is Cheryl Strong, Don Edwards San Francisco Bay National Wildlife Refuge, 9500 Thornton Ave., Newark, CA 94560. Tel: (510) 792-0222.

2.0 MONITORING METHODS (DISTRICT ACTIVITIES)

This section describes the methods used to carry out the Year 3 monitoring activities for the District. The monitoring responsibilities of the Refuge are described in Appendix A rather than being reported here.

2.1 ON-SITE MONITORING

2.1.1 Substrate Development/Sedimentation

To meet the project objective of restoring tidal marsh, sedimentation must occur within the Island Ponds. Estuarine sediment deposition will form the substrate that is essential for plant colonization and growth, and will provide the environment required by benthic organisms.

Prior to breaching in 2006, a total of 30 sedimentation pins were installed in the three ponds (15, 5, and 10 pins for Ponds A19, A20, and A21, respectively). The pins, made of 2-inch diameter, Schedule 80 PVC, were disbursed throughout each pond to measure sediment deposition in various locations. Each pin was tagged with a unique ID number. The tag number and pin coordinates are presented in Appendix C.

The Year 1 and 2 sediment monitoring activities showed that the "Depth Probe" method (i.e., sampling the average sediment depth adjacent to each pin) provided a more accurate picture of accretion than taking a single measurement at each sediment pin. In addition, sediment modeling efforts attempted in Year 2 were not as accurate as anticipated. Therefore, the Year 3 sediment monitoring activities utilized the "Depth Probe" sampling method at all sediment pin locations.

This technique is based upon similar sampling performed at Pond A21 by Scientist's Dr. John Callaway from the University of San Francisco and Lisa Schile from San Francisco State University. The method involves taking multiple measurements of sediment thickness approximately 1 meter away from each sediment pin and sampling in a circular fashion around each pin. Sediment depth is measured by inserting a finely scaled ruler through the fresh mud until the hard gypsum layer is encountered. Eight measurements are taken around each pin to achieve a representative average of the sediment depth in each location.

Per the timeline in the RMMP, the annual sediment monitoring for Year 3 took place from October 3rd through the 7th, 2008.

Data generated from the sampling events are presented in both map and graphical form. Eight month, 12 month, and 30 months post-breach data are compared to show sediment accretion rates, across each pond, over time.

2.1.2 Levee Breach and Outboard Channel Geometry

The levee breaches and channels through the outboard marsh are expected to erode in response to tidal scour, until equilibrium conditions are achieved. The breach monitoring documents the response of breach width to either tidal scour or sedimentation to aid management decisions regarding breach maintenance.

The width of erosion at each of the five levee breaches and the total area of the outboard tidal channels were measured in ArcView GIS using the 2008 aerial photographs. Section 2.1.4 below provides details about the aerial photographs. The width of each levee breach was measured from east bank to west bank at the centerline of each levee and the results were field verified. The area of each outboard tidal channel was digitized by delineating along the marsh edge.

Additionally, per the RMMP, both sides of the outboard tidal channel at Pond A20 were inspected for the presence of perennial pepperweed and any remnant side-cast material.

2.1.3 Aerial Photography

Aerial photographs were obtained for use in the Year 3 monitoring activities at the Island Ponds. Photographs were taken by an airplane-mounted and calibrated camera to achieve a scale of six inch resolution. Images were captured during the mid-day hours, at low tide on July 7, 2008. The photos were timed to capture peak vegetation production, minimize shadows and glare from sunlight, and maximize visibility of vegetation and tidal channels. Photographs were orthorectified and geo-referenced to ensure spatial comparability from year to year. Images were taken in both color and infrared. The spatial extent of the images included all three Island Ponds as well as the northern side of Coyote Creek and the majority of the southern side of the creek. The remainder of the southern edge of Coyote Creek that was not covered by the aerial photograph was digitized in the field in order to complete the monitoring tasks which involved the south bank of Coyote Creek.

2.2 OFF-SITE MONITORING

2.2.1 Railroad Bridge Scour

The EIR/EIS (Life Science!, 2003) identified scour at the railroad bridge crossing of Coyote Creek as a possible impact of the Island Ponds restoration. Previous modeling of the breaches at the Island Ponds (Gross 2003) predicted erosion of approximately two to three feet in depth at the piers. The bridge is oriented north to south across Coyote Creek and is supported by a series of bents each comprising three piles oriented west to east. For the purposes of this monitoring the bents on the south bank are designated 1S, 2S, 3S, etc, in a south to north direction. The bents on the north bank are designated 1N, 2N, 3N, etc, in a north to south direction. The piles in each bent are designated as A (west pile), B (central pile), and C (east pile).

On November 29, 2006, a set of nine photographs were taken of the railroad bridge piles from control points adjacent to the bridge to evaluate for signs of scour. The photographs comprised four general shots of the bridge piles across Coyote Creek and five close-up photographs to provide more detail of the mudflats around the pile bases. In the absence of pre-breach scour measurements, the November 29, 2006 (Year 1) data is used as the baseline for future monitoring.

The Year 3 monitoring consisted of photographs taken from the same stations on May 9, August 20, October 7, and December 8, 2008. All visual inspections were conducted at low tide above the water surface (i.e., not a diver inspection). As in previous years, only the bases of six piles (three on the north

bank; 1N-A, 1N-B, and 1N-C, and three on the south bank; 1S-A, 1S-B, 1S-C) located in the intertidal zone on each side of the bridge were visible.

As follow up to the Year 2 report recommendations, Union Pacific railroad personnel were contacted to discuss whether a more detailed inspection of the bridge piers was necessary.

2.2.2 Fringe Marsh Scour in Coyote Creek/Scour of Levees Opposite the Breaches

In the RMMP, it was predicted that the larger tidal prism and associated increased velocities created by the breaches at the Island Ponds could result in scour of the fringing marsh along the margins of Coyote Creek and cause erosion of the levees adjacent to the creek. This monitoring task investigated the spatial changes in fringing marsh area and changes in the position of the fringing marsh-mudflat boundary, as well as the integrity of the levees at ponds A15, A17, and A18.

The extent of scour of the outboard fringe marsh along Coyote Creek was investigated by comparing the post-breach aerial imagery from Years 1 and 3. The analysis covered Coyote Creek from the eastern end of Pond A19 to the western end of Pond A21 and included marsh on both sides of the creek and approximately 200 feet of marsh upstream in Artesian Slough and the Coyote Creek Bypass Channel. Similar to the 2007 photos, the 2008 imagery did not cover a portion of the south bank of Coyote Creek. This missing section in the 2008 photo was hand digitized in the field to map the marsh edges.

ArcMap (an ArcView GIS product) was utilized to delineate and depict the marsh edges along Coyote Creek. The 2008 delineation was superimposed over the 2006 delineation to highlight any changes in post-breach marsh boundaries. These changes in marsh boundaries were then calculated using ArcMap.

The levees opposite the breaches at ponds A15, A17, and A18 were evaluated by visual inspection and by comparing the 2006 and2008 aerial images to evaluate the extent of any changes.

2.2.3 Rail Levee Erosion

On May 9, 2008, a Civil Engineer from the District visually inspected the railway levee and took a series of photographs of the adjacent Pond A20 western levee and Pond A21 eastern levee. These photographs were compared to the Year 1 (2006) photographs to evaluate whether scour is occurring at the pond levees or along the railway levee.

2.2.4 Accelerated Deterioration of the Town of Drawbridge

The RMMP states that Deterioration of the Town of Drawbridge will be assessed visually and that any evidence of accelerated erosion will be reported. The monitoring activities undertaken for this requirement consisted of monitoring the deterioration of the pond levees adjacent to the Town of Drawbridge structures. The western levee of Pond A20 and the eastern levee of Pond A21 were monitored to detect any signs of levee erosion which could potentially lead to an undermining of the historical structures.

On May 9, 2008, a Civil Engineer from the District walked the Pond A20 and Pond A21 levees adjacent to the Town of Drawbridge, inspecting them for signs of erosion. Similar to Year 1, photographs were taken of any area with visible erosion. These Year 3 photographs are compared to the Year 1 photographs.

Per the Year 2 report recommendations, on December 8, 2008, a benchmark and location stakes were installed in the south-southeast corner of Pond A21 to enable more accurate tracking of erosion advancement along this levee due to wave action and levee overtopping.

An elevation was assigned to the benchmark which references the northwest abutment of the Coyote Creek railroad bridge. The top of the benchmark is 4.55 ft lower than the bridge abutment. The location stakes were installed to form a series of 8 cross sections along the top of the levee. Baseline elevations were gathered immediately adjacent to each stake. Future site visits will be conducted to obtain elevations at each of these stakes and any changes will be reported in next year's report.

3.0 MONITORING RESULTS (DISTRICT ACTIVITIES)

This section describes the results of the District's monitoring activities. The results of the Refuge's monitoring activities are described in Appendix A rather than being reported here.

3.1 ON-SITE MONITORING

3.1.1 Substrate Development/Sedimentation

Sedimentation data has been collected at the Island Ponds on 8, 12, 16, and 30-month post-breach intervals. These results are compared to each other to estimate sediment accretion over that period and discern trends within and between ponds (Appendix C). The data are visually presented in the following ways:

1. A map of the ponds depicting the sediment monitoring locations and the average sediment depth 8, 12 and 30-months post-breach at each location (Figure 3).
2. Graphs depicting average sediment accretion, based on the "Depth Probe" method, plotted against the distance from the nearest breach (Figures 4 to 6)

In general, Pond A19 has shown the lowest sediment accretion of the three ponds. Utilizing the average accretion values for each sampling location (i.e., the average of the 8 measurements taken at each sediment pin) only two of the fifteen locations (13%) met the predicted sedimentation rate for the second year of 0.4 feet (Figure 4). Utilizing the maximum accretion values for each location (i.e., the maximum of the 8 measurements taken at each sediment pin) five of the fifteen sampling stations (33%) met the predicted sedimentation rate.

Of the ten stations, which are deficient with regard to the sediment projections, four are located at the extreme northern end of the pond, furthest from the breaches. These locations have still not met the first year sediment prediction of 0.2ft/yr. The remaining 6 stations which did not meet the second year sediment predictions are located at the southern end of the pond, closest to the breaches (Figure 3). Four of these six locations, the ones closest to the breaches, have shown signs of scour between 0.09 ft and 0.16 ft less accumulation than the prior year's measurements.

With regard to sediment accretion extremes in Pond A19, the minimum amount of sediment, 0.03 feet, was recorded at the pin closest to the western breach (~477 ft away) which is located on the edge of a large channel which is actively scouring. The maximum, 0.54 feet, accrued in the center of the pond (~1795 ft from the nearest breach). General trends across the pond show higher sediment deposition in the center of the pond, scour in the southern portion of the pond, and minimal accrual at the northern end of the pond.

Pond A20 has shown the highest averages in sediment deposition of the three ponds. Three of the five sampling stations (60%) surpassed the predicted sedimentation rate of 0.4ft (Figure 5). The remaining two sampling stations are located furthest from the breach at the north end of the pond. One of these two stations achieved maximum accretion values above the 0.4 ft/yr predicted rate, but the other (the one

furthest from the breach) is underperforming and has not yet accrued enough sediment to meet the first year sediment prediction of 0.2ft/yr.

The minimum amount of sediment, 0.10 ft, accrued at the northwestern corner of Pond A20, furthest from the breach (1500 ft). The maximum amount of sediment, 1.03 ft, accumulated near the midline of the pond on the western side. General trends across the pond show higher sediment deposition in the center and southern portion of the pond.

Pond A21 performed similarly to Pond A20 in relation to sediment deposition. However, Pond A21 displayed the highest accretion values of all three ponds with over 1.17 ft accruing at one station. Using the average accretion values for each sampling location, 50% of the Pond A21 sites (5 of 10 sites) met the predicted sedimentation rate for the second year of 0.4 ft (Figure 6). Utilizing the maximum accretion values for each location, 70% of the sampling stations met the predicted sedimentation rate. The three sites that did not achieve the predicted sedimentation rate are located at the northern end of the pond and are furthest away from the breaches.

With regard to sediment accretion extremes in Pond A21, the minimum amount of sediment, 0.07 feet, was recorded in the northeastern portion of the pond while the maximum, 1.17 feet, accrued in the southeastern corner of the pond. General trends across Pond A21 show higher sediment deposition in the lower 2/3 of the pond with particularly high accumulation in the southeastern and southwestern corners.

In summary, rates of accretion vary between the ponds and across the surface of each pond. Accretion rates are higher in Ponds A20 and A21 than in Pond A19 (Figure 3). In general, accretion is greater at the southern end or center of each pond and diminishes at the northern end.

An accretion rate of 0.4 ft was predicted by HTH and PWA (2005) for the second year. Average sediment depths at each monitoring location indicate that 33% of the monitoring stations are accreting sediment at rates greater than predicted, while maximum sediment depths at each location indicate that 53% of the sampling locations are above the predicted rate. These results indicate that the project, as a whole, is on track to meeting the performance criteria for accretion.

3.1.2 Levee Breach and Outboard Channel Geometry

The excavated breaches in the levees and outboard marshes were designed to have the same top width (40 feet), bottom width (6 feet), and invert elevations (2.7 feet NAVD88). Side slopes were variable due to large height differences between the top of the levee and the design invert (average difference of 7.0 feet), as well as smaller height differences between the top of the marsh and the design invert (average difference of 2.5 feet) (SCVWD, 2006a, b).

For the purposes of the levee breach monitoring, the 2008 aerial photographs were analyzed and the current width of each breach was compared to the 2006 channel widths. In addition, all breach widths were field verified. The outboard marsh channels were similarly analyzed by delineating the edge of the marsh along each channel and comparing them to the 2006 delineation. The results are shown in Tables 3-1 and 3-2, and in Figures 7-11.

Pond A19 East - Breached on March 7, 2006. The width of the erosion within the former levee footprint at the Pond A19 East breach in July 2008 was 140 feet. Therefore, approximately 18 feet of scour has occurred within the past year, and 30 feet of scour has occurred since the original August 2006 measurements. The outboard marsh lost due to breaching activities was 0.02 acres. Subsequent scour of the outboard tidal channel resulted in 0.03 acres of marsh loss in 2006, with an additional 0.01 acres of scour occurring in 2007, and no additional scour was observed in 2008. Total outboard marsh loss and scour three years post-breach is approximately 0.06 acres (Figure 7).

Pond A19 West - Breached on March 7, 2006. The width of the erosion within the former levee footprint at the Pond A19 West breach in July 2008 was 32 feet. Therefore, approximately 4 feet of scour has occurred within the past year, and 10 feet of scour has occurred since the original August 2006 measurements. Similar to last year, the levee at this western breach is not eroding at the same rate as the eastern breach. The outboard marsh loss due to breaching activities was 0.03 acres. Subsequent scour of the outboard tidal channel resulted in 0.02 acres of marsh loss in 2006, with an additional 0.01 acres of scour occurring in 2007, and similar to the east breach, no additional scour was observed in 2008. Total outboard marsh loss and scour three years post-breach is approximately 0.06 acres (Figure 8).

Pond A20 - Breached on March 13, 2006. The width of the erosion within the former levee footprint at the Pond A20 breach in July 2008 was 89 feet. Therefore, approximately 7 feet of scour has occurred within the past year, and a total of 13 feet of levee scour has occurred since the original August 2006 measurements. The outboard marsh loss due to breaching activities was inaccurately reported in the previous 2 years reports as 0.72 acres. Actual scour which occurred due to breaching activities in March 2006 was 0.55 acres. Since breaching an additional 0.02 acres of scour has occurred from 2006 to 2008. Total outboard marsh loss and scour three years post-breach is approximately 0.57 acres (Figure 9).

During construction of the Pond A20 breach channel, excavated material was piled two-feet high on the east side of the breach channel and three-feet high on the west side (i.e., side-cast berms). The 2007 and 2008 aerial photographs indicate that all of this material has scoured and the side-cast materials have been actively redistributed. In addition, no evidence of perennial peppergrass was observed adjacent to the Pond A20 tidal channel during field visits in 2008.

Pond A21 East - Breached on March 29, 2006. The width of the erosion within the former levee footprint at the Pond A21 East breach in July 2008 was 45 feet. Therefore, approximately 8 feet of scour has occurred within the past year, and a total of 13 feet of levee scour has occurred since the original August 2006 measurements. The outboard marsh loss due to breaching activities was 0.28 acres. Subsequent scour of the outboard tidal channel resulted in 0.05 acres of marsh loss in 2006, with an additional 0.06 acres of scour occurring in 2007, and no additional scour was observed in 2008. Total outboard marsh loss and scour three years post breach is approximately 0.39 acres (Figure 10).

Pond A21 West - Breached on March 21, 2006. The width of the erosion within the former levee footprint at the Pond A21 West breach in July 2008 was 95 feet. Therefore, approximately 16 feet of scour has occurred within the past year and a total of 19 feet of levee scour has occurred since the original August 2006 measurements. The outboard marsh loss due to breaching activities was 0.11 acres.

Subsequent scour of the outboard tidal channel resulted in 0.14 acres of marsh loss in 2006, with an additional 0.01 acres of scour occurring in 2007, and an additional 0.01 acres of scour occurring in 2008. Total outboard marsh loss and scour three years post breach is approximately 0.27 acres (Figure 11).

Continued widening of the five levee breaches was observed between 2006, 2007, and 2008 (Table 3-1). Total marsh loss from 2006 through 2008 associated with scour of the outboard tidal channels totaled 0.12 acres (Table 3-2). Total marsh loss to date at the five breaches, including marsh loss associated with construction impacts, totaled 1.35 acres (Table 3-2).

Table 3-1. Breach Widths (feet)

Breach	Breach Widths 2006*	Breach Widths in 2007	Breach Widths in 2008	Breach Widening 2006-2008
A19 East	110	122	140	30
A19 West	22	28	32	10
A20	76	82	89	13
A21 East	32	37	45	13
A21 West	76	79	95	19

*number inclusive of constructed width and subsequent breach widening, 6 months post-breach in 2006

Table 3-2. Marsh Loss from Scour of Outboard Channels (acres)

Breach	Marsh Scour 2006*	Total Marsh Scour to Date	Incremental Marsh Scour 2006-2008
A19 East	0.05	0.06	0.01
A19 West	0.05	0.06	0.01
A20	0.55	0.57	0.02
A21 East	0.33	0.39	0.06
A21 West	0.25	0.27	0.02
Totals	**1.23**	**1.35**	**0.12**

*number inclusive of construction impacts and marsh scour, 6 months post- breach in 2006

3.2 OFF-SITE MONITORING

3.2.1 Railroad Bridge Scour

The 4 sets of 2008 photographs were compared to each other and the November 29, 2006 photographs to document changes at each of the photo locations. The photographs from November 2006 and December 2008 are provided in Appendix B-1. The May, August and October 2008 photographs can be made available on request.

A comparison of photographs between December 8, 2008 and November 29, 2006 show that small scour holes around the visible piles have persisted. The scour continues to be more pronounced on the piles on the north side of the bridge where the intertidal substrate is soft mud than on the south side where the substrate is firmer (a mix of mud, sand, and gravel).

There are no structural criteria to assess the significance of observed scour relative to pile function. However, the amount of scour at the base of all the piles appears to be less than one foot deep and is probably within the design allowance.

As follow up to last year's report recommendations, railroad personnel were contacted to discuss the need for more detailed bridge monitoring. Russell Young, Manager of Bridge Maintenance for the Union Pacific Railroad (UPR), confirmed that UPR staff inspect the bridge twice a year and that their inspections are confidential and for internal use only. He indicated that additional in depth monitoring of the bridge was not warranted, as they have not documented any signs of scour at this bridge.

3.2.2 Fringe Marsh Scour in Coyote Creek/Scour of Levees Opposite the Breaches

The fringing marshes adjacent to the island ponds, along the margins of Coyote Creek, are showing signs of both scour and accretion (Figures 2, 7-11). Total marsh loss was calculated at 0.69 acres, and total marsh accretion was calculated at 0.40 acres. The north bank is showing more marsh gain than loss, with 0.29 acres of accretion and 0.26 acres of scour. Collectively the north bank has gained 0.03 acres of marsh from 2006 to 2008. The south bank on the other hand has lost more marsh than it has gained, with only 0.11 acres of accretion and 0.43 acres of scour. Therefore, the south bank has collectively lost 0.32 acres of marsh from 2006 to 2008. The majority of the scour which has occurred in these marshes is east of Pond A20, while the majority of accretion has occurred west of Pond A19 (Figure 2).

The breaches appear to be having no localized effect on the levees opposite the island ponds. Ponds A15, A17, and A18 levees were evaluated by both visual inspection and by comparing the 2006 and 2008 aerial images. The outboard marshes adjacent to these levees are providing a buffer from any scour that could potentially undermine these existing levees. Future monitoring events will continue to document any progression of sediment dynamics over time.

3.2.3 Rail Levee Erosion

The May 9, 2008 field inspection revealed no apparent signs of rail levee erosion or erosion of the adjacent Pond A20 levee. Similar to the 2007 monitoring, there was evidence of levee overtopping occurring along the southeast corner of the Pond A21 levee. Appendix B-2 provides a comparison of the 2006 and the 2008 photographs of the rail levee and the adjacent Pond A20 and A21 levees.

3.2.4 Accelerated Deterioration of the Town of Drawbridge

As mentioned above in Section 3.2.3, in both 2007 and 2008, it was observed that overtopping had occurred on the southeast levee of Pond A21 (Appendix B-3). Wave action during high tide is the most likely culprit as this condition has deposited a line of debris atop the southeast corner of the Pond A21 levee. This levee is adjacent to the Town of Drawbridge however, since the erosion is minimal at this time, no structures appear to be in imminent danger.

In addition, the 2006 monitoring revealed one particular area of concern with regard to levee erosion. This eroded section is in the south-southeast corner of Pond A21, approximately 100 feet from two existing Town of Drawbridge structures and approximately 70 feet from the remnants of a previously collapsed

structure. We have continued to monitor and photo-document this location. Based on a comparison of the 2006 and 2008 photographs, minimal new erosion has occurred at this location (Appendix B-3). While the erosion appears to have slightly increased in size, the levee is still a barrier between the pond and the outboard marsh. At this time, it appears that there is no evident deterioration of any drawbridge structures due to the breaching of the salt ponds. A comparison of the 2006 and 2008 photographs are included in Appendix B-3.

Per the Year 2 report recommendations, on December 8, 2008, a benchmark and location stakes were installed in the south-southeast corner of Pond A21 to enable more accurate tracking of erosion advancement along this levee from wave action and levee overtopping.

4.0 DISCUSSION (DISTRICT ACTIVITIES)

4.1 LESSONS LEARNED

4.1.1 Activities on Target

There were no major problems encountered during the sediment measurements in Year 3, however mudders needed to access several locations within Ponds A20 and A21. Sediment is continuing to accumulate in all 3 ponds and, as a result, salt marsh vegetation is beginning to appear on the surface of each pond. Accretion rates are higher in Ponds A20 and A21 than in Pond A19. Over 50% of the sampling stations in Ponds A20 and A21 are accreting sediment at rates greater than original predictions (0.2 ft/yr), with the highest accretion rate of 1.17 feet in Pond A21. Pond A19 which was on track with the prediction for the first year sediment accrual rate, is now slightly behind with only 1/3 of its monitoring stations reaching the 0.4 ft predicted accretion rate in year 2. In general, sediment accretion rates appear to be on target to achieve vegetation colonization. Next year, sediment accretion will again be sampled using the "Depth Probe" method as described in Section 2.1.1.

Aerial photographs show that all of the levee breaches have continued to widen since breaching. Pond A19 and Pond A21, where two breaches were constructed, continue to have one breach significantly wider than the other. However, in general all levee breaches have widened a minimum of 10 feet (Breach A19W) and a maximum of 30 feet (Breach A19E) since March 2006. Scour along the outboard tidal channels has begun to slow down with 3 of the 5 breaches exhibiting no additional scour in 2008 and only minimal scour at the remaining two breaches (0.01 acres).

No scour has been detected along the rail levee or along the Pond A18, A17, and A15 levees opposite the breaches. Limited scour has been observed at the base of the railroad bridge piers for the past 2 years. However, it is unknown whether this scour occurred pre-breach or post-breach, as there are no photographs or measurements to verify the pre-breach conditions of the piers. Union Pacific Railroad staff confirmed that they inspect the bridge twice a year and their results are confidential. They indicated that additional in depth monitoring of the bridge was not warranted, since they have not yet documented any signs of scour at this location.

4.1.2 Activities Needing Further Investigation

The flight line for both the 2007 and 2008 aerial photographs was off by a small margin and therefore portions of the south bank of Coyote Creek were omitted in both years' photographs. The two monitoring tasks, fringe marsh scour in Coyote Creek and scour of levees opposite the breaches, which rely on these aerials needed to be supplemented to fill in the gaps in the photos. This situation is not ideal and will need to be rectified for the 2009 photos and beyond. District staff intends to meet directly with the aerial flight company in 2009 and lay out the necessary flight lines so the entire site as specified in section 2.1.3 will be captured.

The fringe marsh on both sides of Coyote Creek is beginning to show signs of both scour and accretion in various locations. This phenomenon will continue to be monitored using the annual aerial photographs and any increases or decreases in fringe marsh size will be reported in the annual monitoring report.

In both 2007 and 2008, it was observed that overtopping had occurred on the southeast levee of Pond A21. As a result, in December 2008, a benchmark and location stakes were installed along this levee to enable more accurate tracking of the erosion. The elevations of these stakes will be monitored in future years, in relation to the benchmark, to document any changes in the levee elevations.

4.2 ADAPTIVE MANAGEMENT RECOMENDATIONS

- The railroad bridge pier photographs taken for the past 3 years only document the 6 piles located at the highest intertidal edge of Coyote Creek. Since the largest increase in tidal velocity, due to an increase in upstream tidal prism, would likely take place through the deepest part of the channel, the current method of collecting photographs above the waterline is inadequate to assess the condition of the subtidal piles.

  District staff contacted Union Pacific Railroad staff to discuss performing additional monitoring at the bridge. The railroad staff ensured us that they inspect the bridge twice a year and that their inspections are confidential and for internal use only. They indicated that additional in depth monitoring of the bridge was not warranted, since they have not yet documented any signs of scour at this location. Based on the railroads response and the lack of useful information this current monitoring task is producing, District staff would like to discontinue the quarterly bridge pier monitoring two years ahead of schedule. If the railroad determines at a future date that they need assistance with this monitoring task, then the District and the Refuge can discuss the issue at that time.

5.0 REFERENCES

Gross, E. 2003. Alviso Island Pond Breach Initial Stewardship Plan Study. Appendix K of the Environmental Impact Report/Environmental Impact Statement for the South Bay Salt Ponds Initial Stewardship Plan. Report to Cargill Salt, December, 2003.

HTH (H.T. Harvey & Associates) and PWA (Philip Williams & Associates, Ltd.). 2005. Island Ponds (Ponds A19, A20, A21) Tidal Marsh Establishment Projections. Report to the Santa Clara Valley Water District, January, 2005.

HTH (H.T. Harvey & Associates), PWA, EDAW, and Brown & Caldwell. 2005. South Bay Salt Pond Restoration Project. Biology and Habitats Existing Conditions Report. Report to California State Coastal Conservancy, U.S. Fish & Wildlife Service, and California Department of Fish and Game, March 2005.

Life Science! 2003. South Bay Salt Ponds Initial Stewardship Plan. Report to the U.S. Fish & Wildlife Service and California Department of Fish and Game, March, 2003.

Life Science! 2004. Environmental Impact Report/Environmental Impact Statement for the South Bay Salt Ponds Initial Stewardship Plan. Report to the U.S. Fish & Wildlife Service and California Department of Fish and Game, March, 2004

SCVWD (Santa Clara Valley Water District). 2006a. Tidal Wetland Mitigation/ Restoration (Island Ponds) Cross Sections Pond A19 & A20 Design Plans. February 8, 2006.

SCVWD (Santa Clara Valley Water District). 2006b. Tidal Wetland Mitigation/ Restoration (Island Ponds) Cross Sections Pond A21 Design Plans. February 8, 2006.

USFWS (U.S. Fish & Wildlife Service), Don Edwards National Wildlife Refuge, and Santa Clara Valley Water District. 2006. Restoration and Mitigation Monitoring Plan for the Island Ponds Restoration Project.

6.0 LIST OF PREPARERS

This report was prepared by the following staff:

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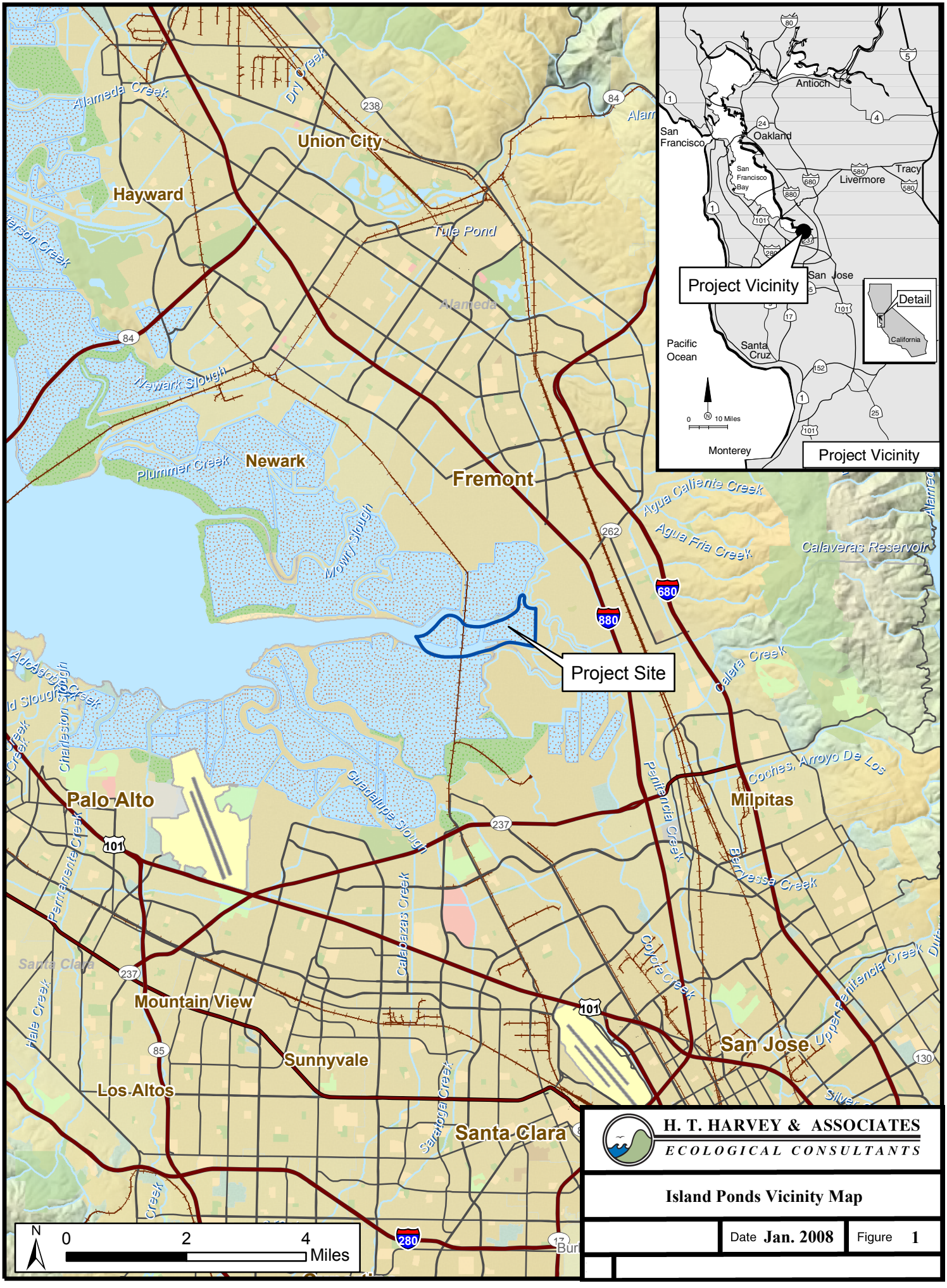
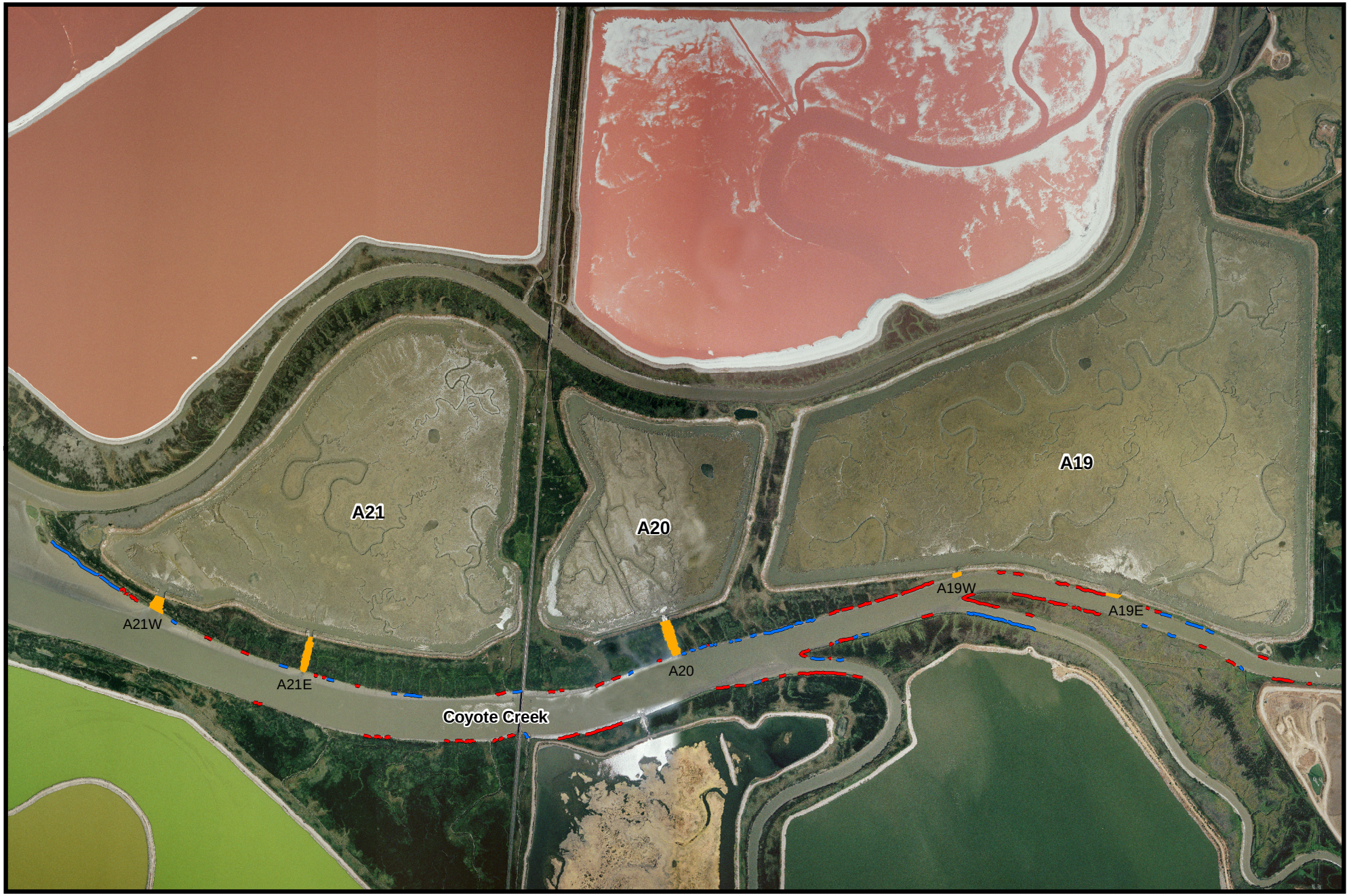
7.0 FIGURES



H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Island Ponds Vicinity Map

Date **Jan. 2008** | Figure **1**



Legend

- Fringe Marsh Gain 2006-2008
- Fringe Marsh Loss 2006-2008
- Breach Scour 2006-2008

0 700 1,400 2,800 Feet

Figure 2. Breach and Fringe Marsh Scour

Santa Clara Valley Water District

Legend

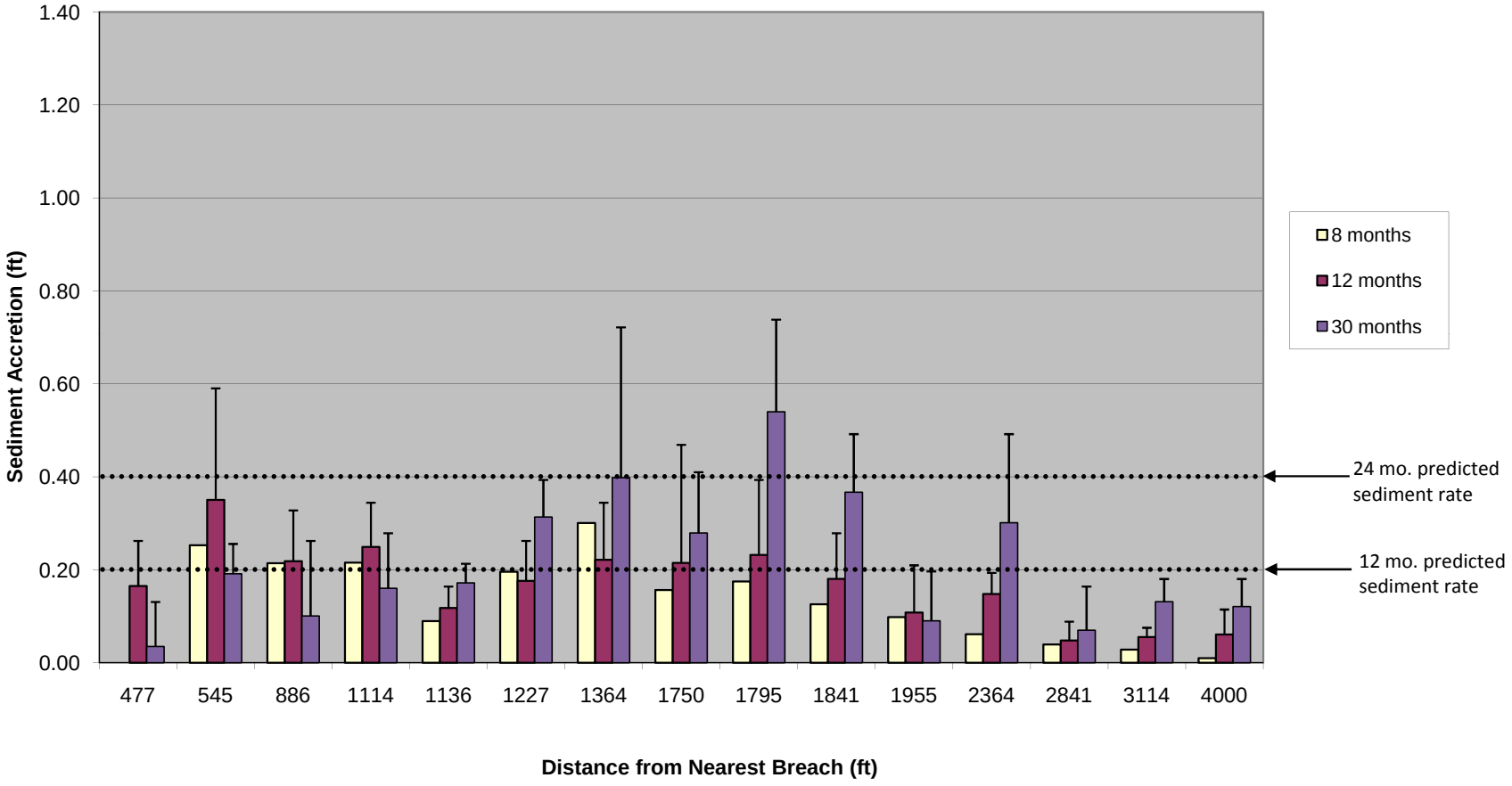
(Sediment Monitoring Location
Average sediment depths (ft) are listed in the following order:
8 Months
12 Months
30 Months

0 700 1,400 2,800 Feet

Figure 3. Average Sediment Depths 8, 12, and 30 Months Post-Breach

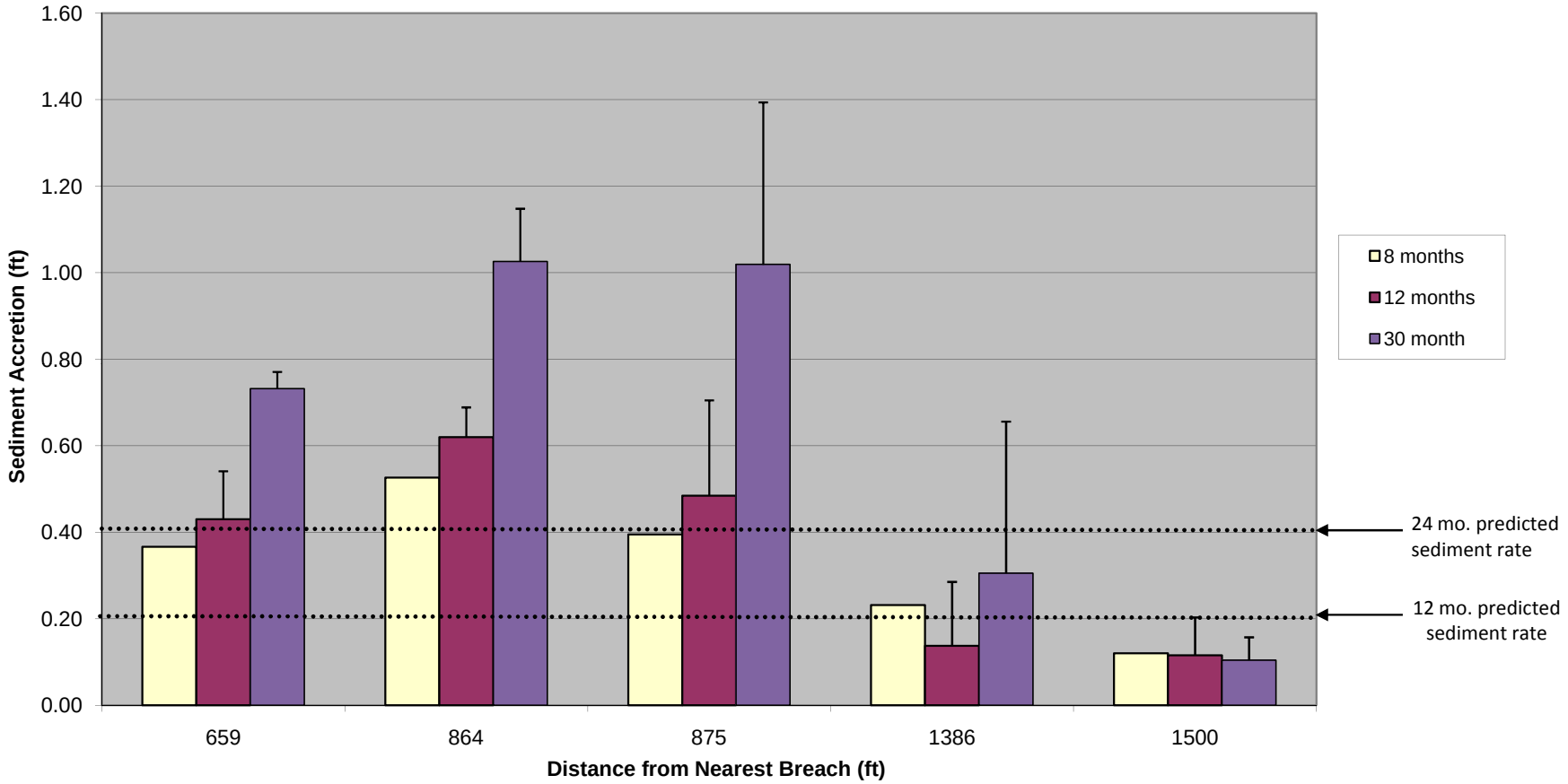
Santa Clara Valley Water District

Figure 4 - Pond A19 Sediment Accretion 8, 12 and 30 Months Post-Breach Based on Depth Probe Data



Note:
8 month data is an average of 3 depth probes.
12 and 30 month data is an average of 8 depth probes.
Error bars represent the maximum values recorded at the 12 and 30 month measurements.

Figure 5 - Pond A20 Sediment Accretion 8, 12 and 30 Months Post-Breach Based on Depth Probe Data



Note:
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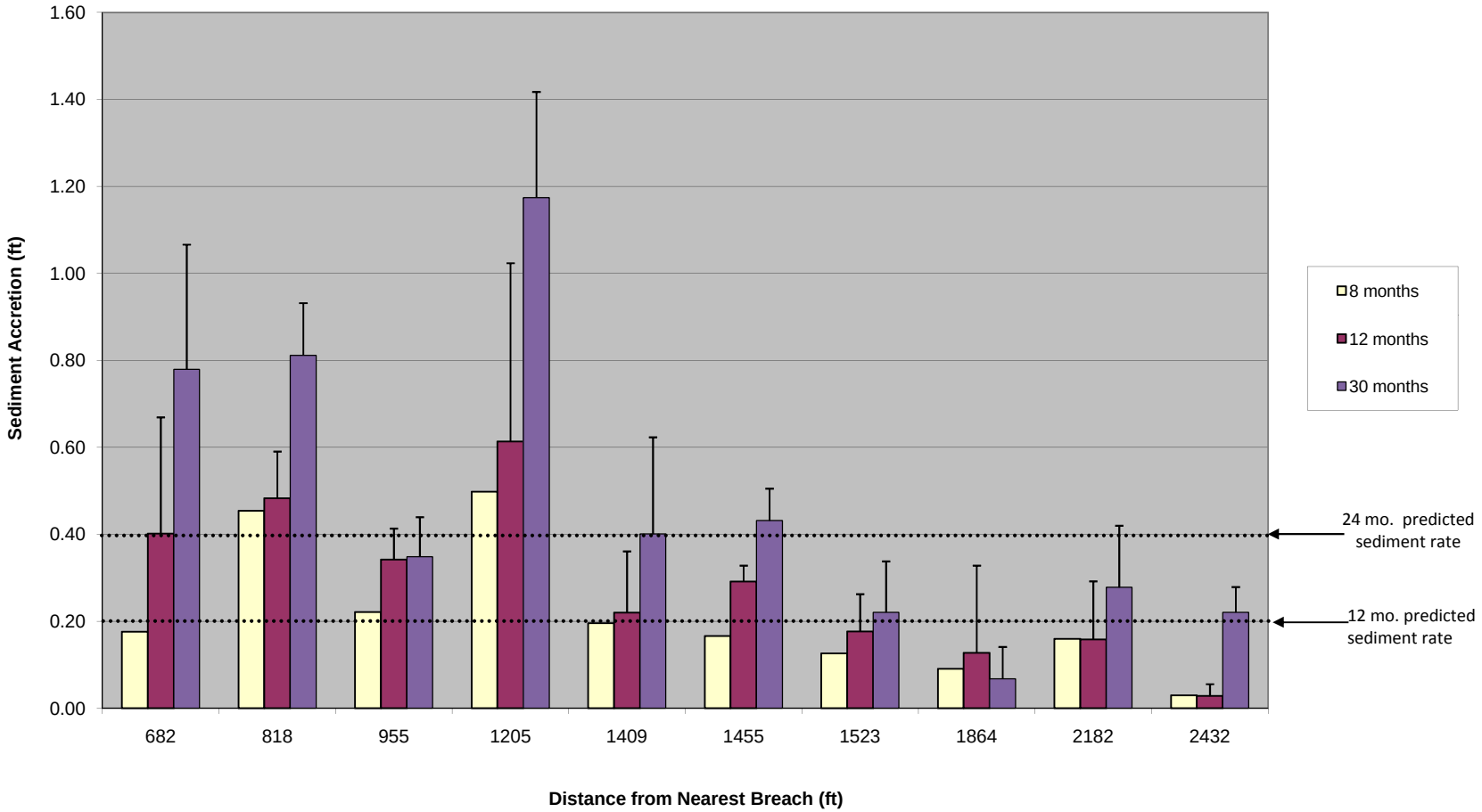
Figure 6 - Pond A21 Sediment Accretion 8, 12 and 30 Months Post-Breach
Based on Depth Probe Data



Note:
8 month data is an average of 3 depth probes.
12 and 30 month data is an average of 8 depth probes.
Error bars represent the maximum values recorded at the 12 and 30 month measurements.

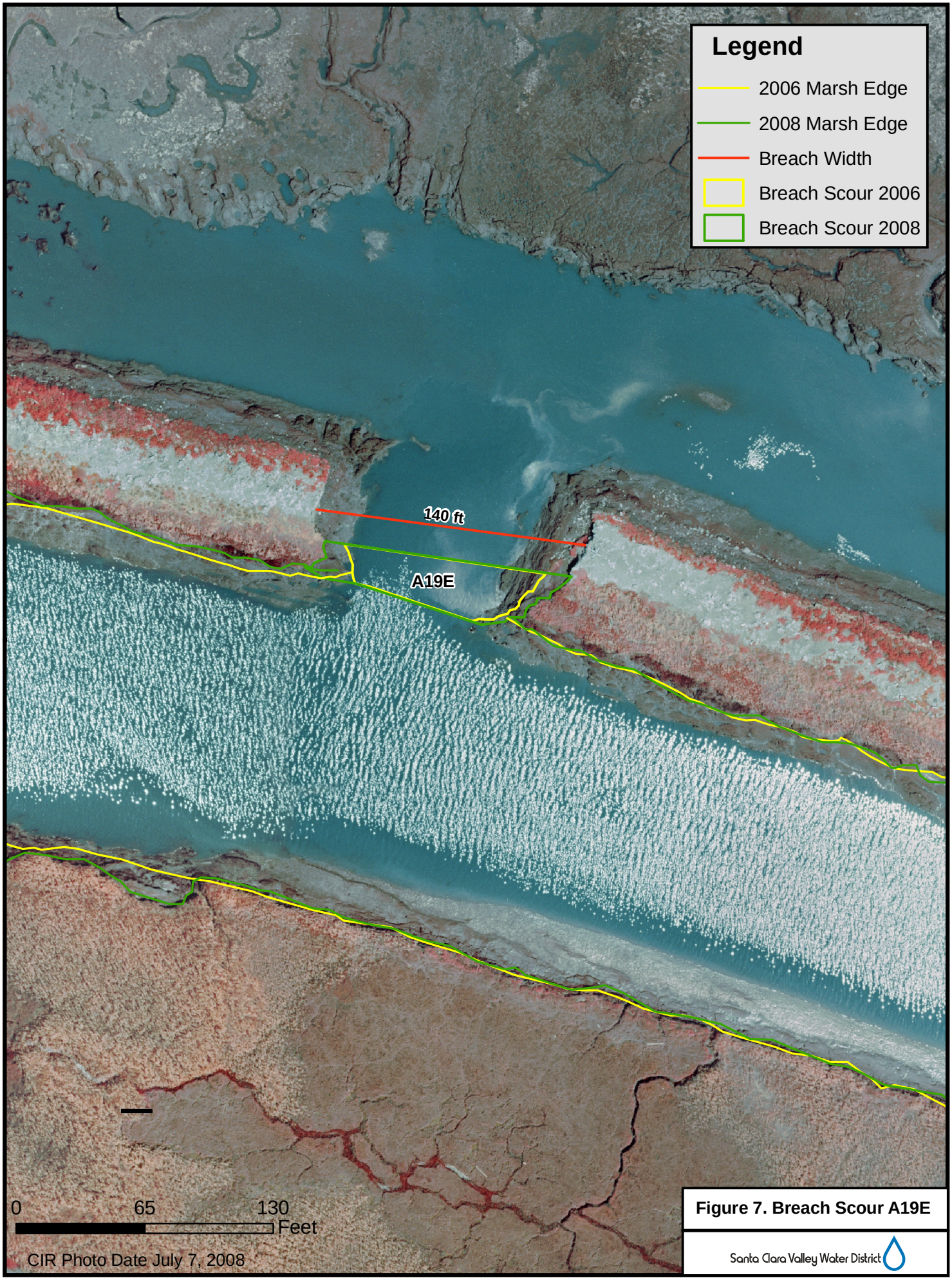


Figure 7. Breach Scour A19E

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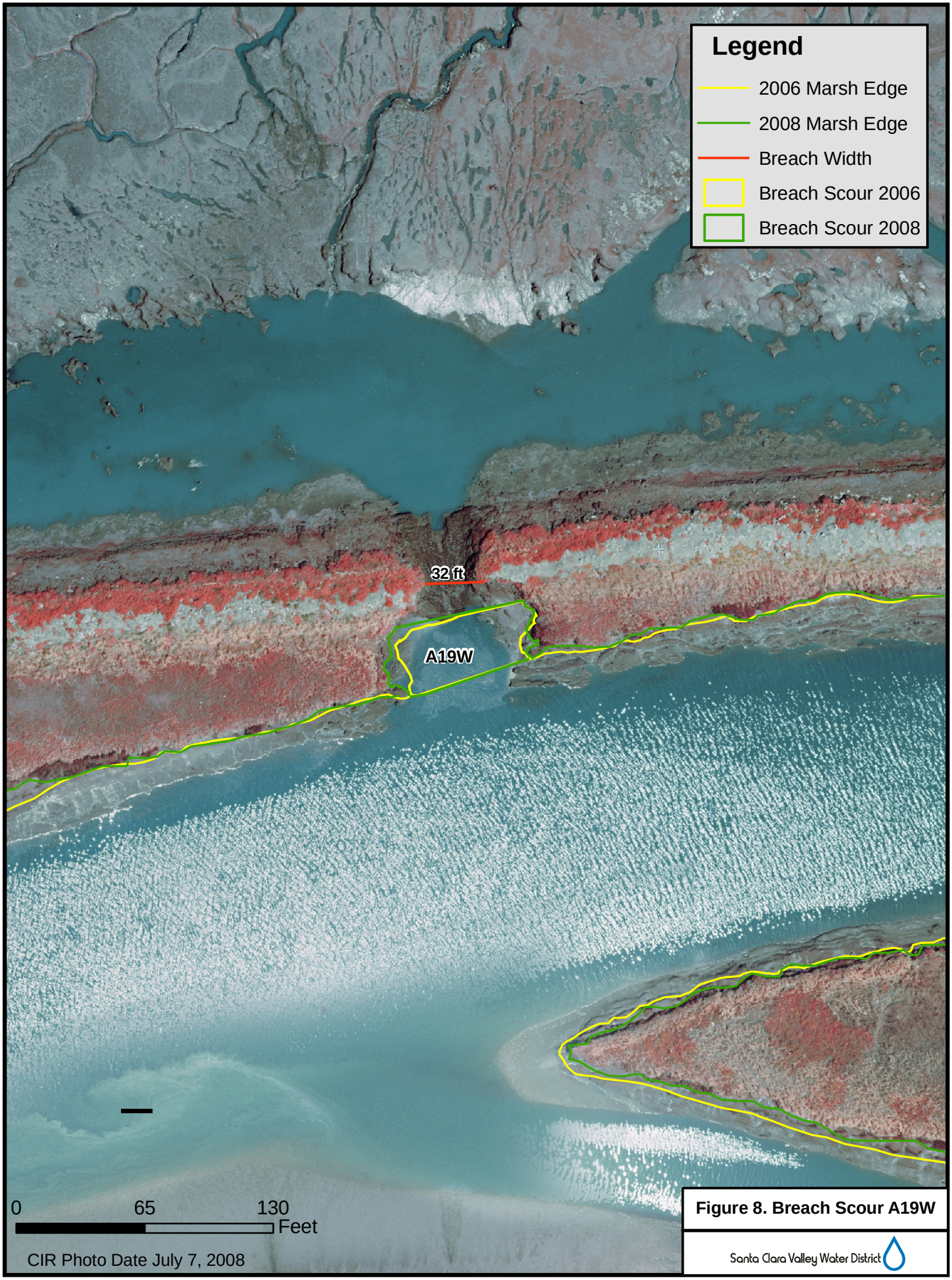

Figure 8. Breach Scour A19W

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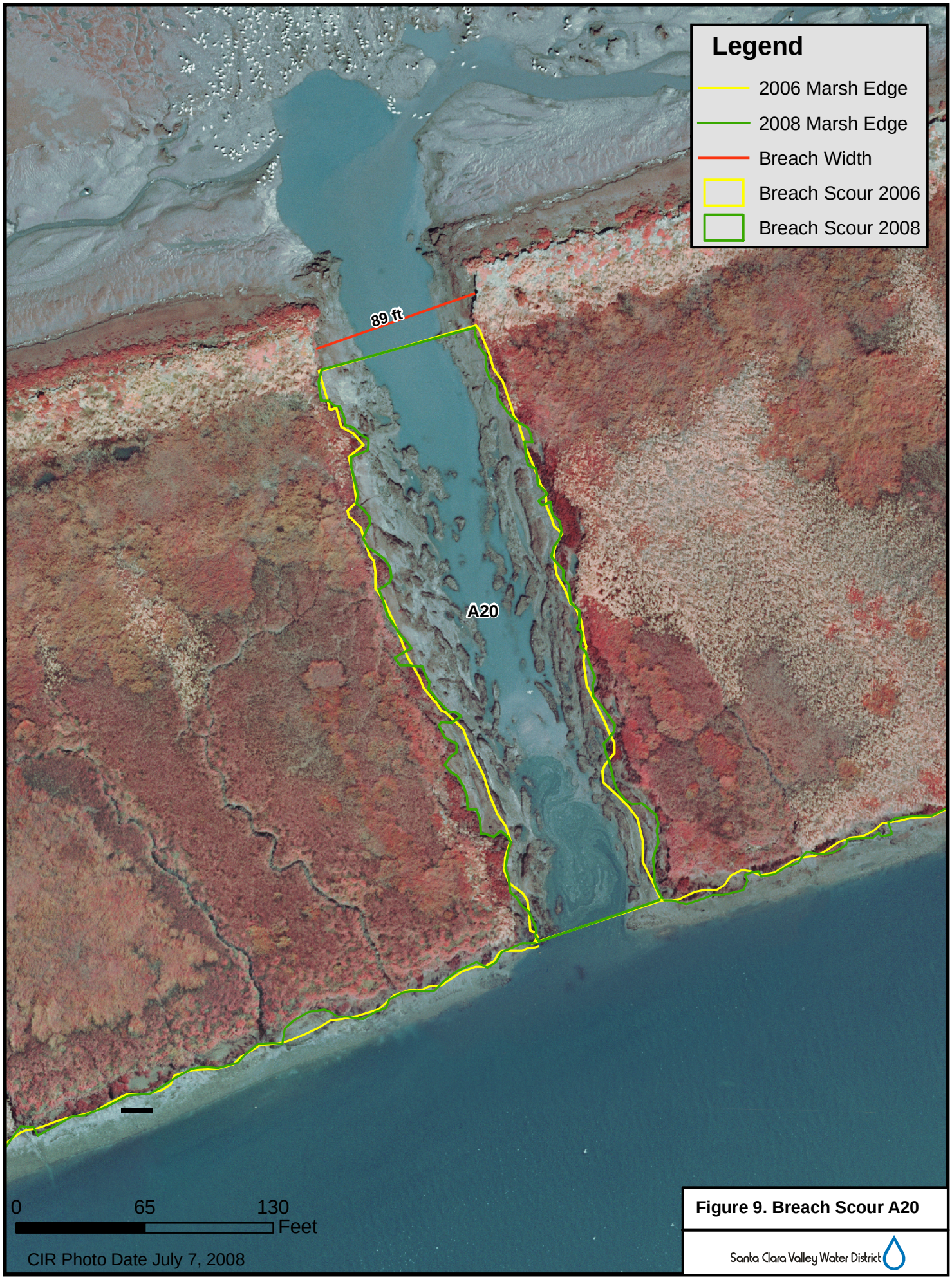

Figure 9. Breach Scour A20

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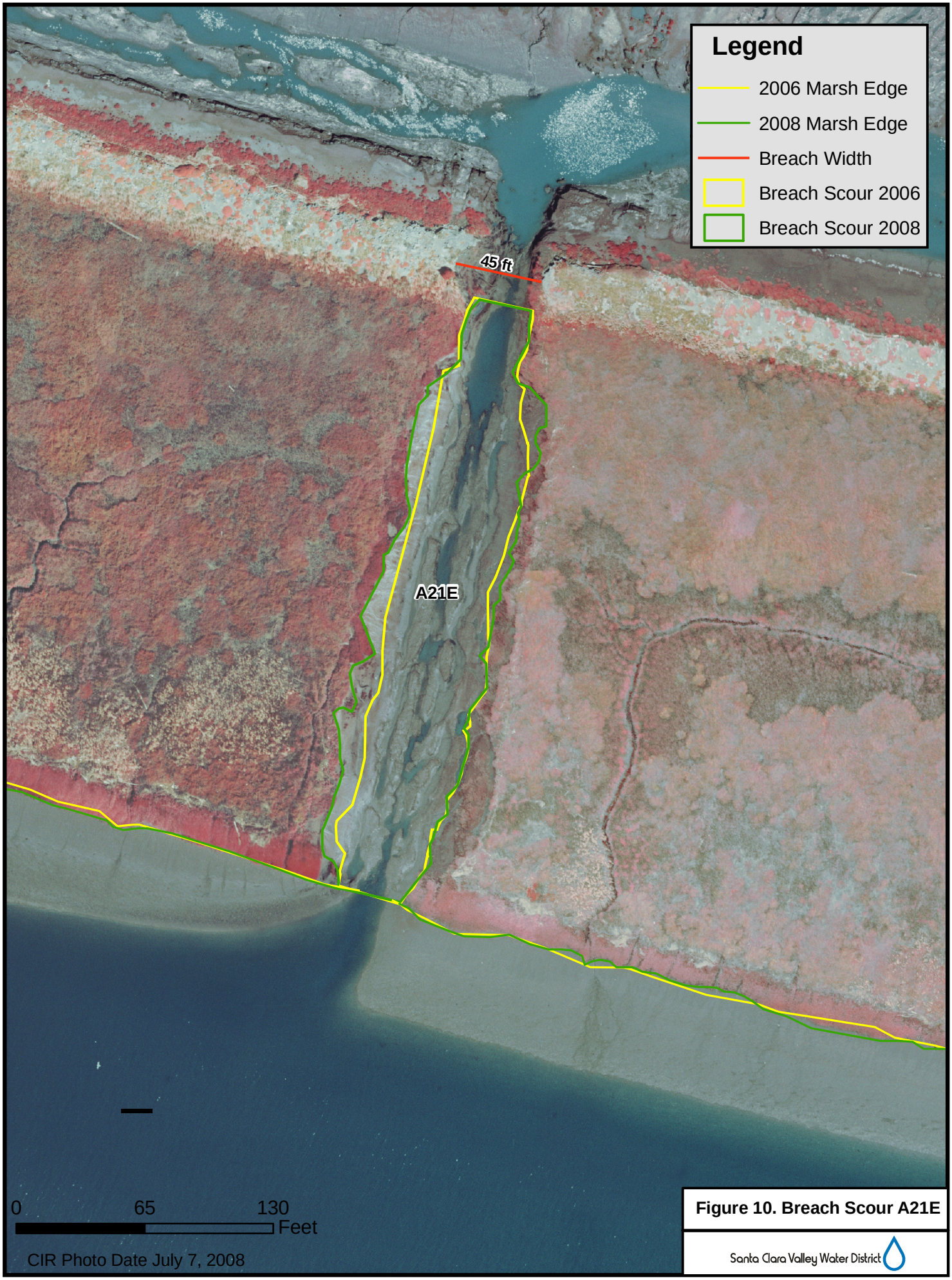

Figure 10. Breach Scour A21E

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Figure 11. Breach Scour A21W

Santa Clara Valley Water District

APPENDIX. A.
REFUGE MONITORING

APPENDIX A

DON EDWARDS SAN FRANCISCO BAY NWR MONITORING REQUIREMENTS FOR ISLAND PONDS TIDAL WETLAND RESTORATION

San Francisco Bay NWR Monitoring Requirements for Island Ponds Tidal Wetland Restoration Year 3

Contact: Cheryl Strong, cheryl_strong@fws.gov

Summary of Tasks

During Year Three (Y3) of the Island Ponds Tidal Wetland Restoration program, Tasks 5.2.3, 5.2.4, 5.2.6, and 5.2.7 in the MMP were conducted. The following provides a brief description of these tasks and their Y3 results.

Task 5.2.3: Since the breaching of the Island Ponds, ponds A19 and A20 have both shown an increase in channel development in Y3. No new channels have developed in A21.

Task 5.2.4: During Y3 of native vegetation development monitoring in the Island Ponds, the amount of native vegetation increased 34%. Pickleweed development is mostly along the borrow ditches as well as in a few areas of the pond interiors.

Task 5.2.6: Invasive Spartina Project (ISP) treated seven patches of invasive *Spartina alterniflora* hybrids along the south-western outboard levee of pond A21, using helicopter broadcast spraying

Task 5.2.7: Not enough acreage of marsh vegetation has developed to monitor for the California Clapper Rail or the Salt Marsh Harvest Mouse. However, monitoring of shorebirds and waterfowl on the Island Ponds indicates that many bird species are utilizing these ponds for foraging and roosting habitat.

Task 5.2.3 – Channel Network Evolution Monitoring

The Channel Network Evolution Monitoring Task (Task 5.2.3) for the Island Ponds is described in the Mitigation and Monitoring Plan (MMP) as follows: "Monitoring will consist of extracting channel planform morphology from the aerial photographs collected periodically and rectified to ensure spatial comparability from photo to photo (see Aerial Photography, Section 5.2.8). Evolution of channel networks will be measured over time. Parameters to be measured include total surface area of channels and areas of expansion and loss. Monitoring results will be incorporated into a table showing, for each pond, the total pond acreage, total channel coverage, and percent of pond as channel. Maps will show the channel network in each year, the change from prior year that an aerial image was taken, and the change from the baseline."

Island Pond channels were similar to past years. However, in 2008, several new channels were added to ponds A19 and A20. Pond A21 remains unchanged (Table 1). Figures 1-3 show the GIS generated channels from 2006/2007 along with the new channels added in 2008.

Table 1: Channel networking development in the Island Ponds, 2006-2008.

Year	Pond	Pond Acreage	Total Channel Acreage	Percent Pond as Channel	% Change in Acreage from Previous Year
2006	A19	265	8.74	3.30	
	A20	63	0.85	1.35	
	A21	147	3.02	2.05	
2007	A19	265	8.74	3.30	0
	A20	63	0.85	1.35	0
	A21	147	3.02	2.05	0
2008	A19	265	9.06	3.42	3.64
	A20	63	1.01	1.60	18.52
	A21	147	3.02	2.05	0

Figure 1: Channel networking development in pond A19 during 2008.

Appendix A: Don Edwards San Francisco Bay NWR Monitoring

Figure 2: Channel networking development in pond A20 during 2008.

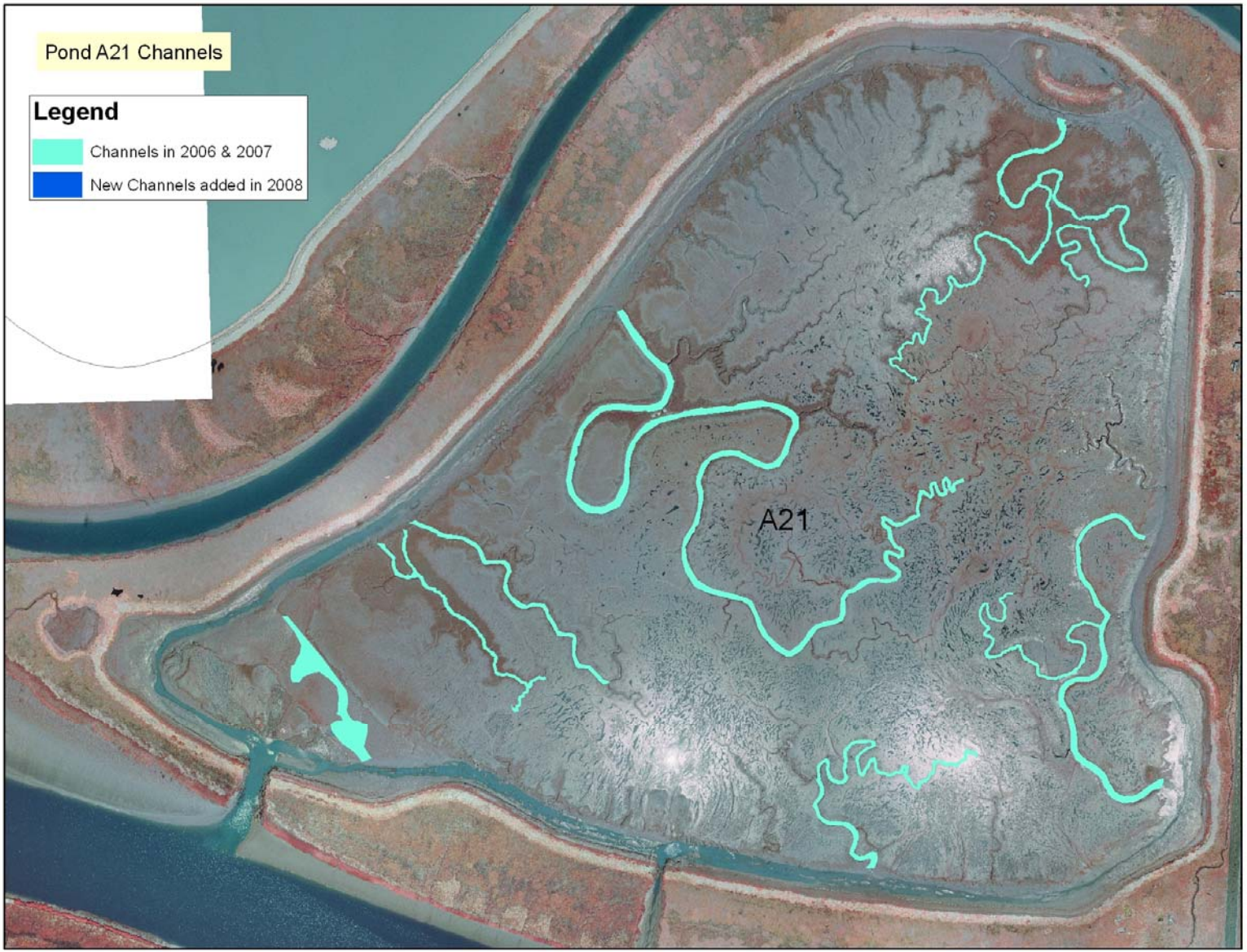

Figure 3: Channel networking development in pond A21 during 2008.

Task 5.2.4 – Native Vegetation Development

The Native Vegetation Development Task (Task 5.2.4) for the Island Ponds is described in the MMP as an evaluation of the "progress in achieving the success criteria for tidal marsh restoration." To do so, vegetation establishment is monitored using aerial photographs and field sampling.

Before the breaching in 2006, the Island Ponds had no established vegetation as 99% of the total area was covered with a hard salt crust gypsum layer (H.T. Harvey & Associates 2004). The Island Pond Complex had also become subsided since the creation of the levees, so plant colonization cannot occur until sedimentation reaches appropriate marsh plain elevation.

In 2008, native salt marsh vegetation was mapped by digitizing from the color infrared photos. Total native vegetation was 13.3 acres and has shown rapid expansion from the baseline acreage of 5.75 acres in 2006 (Table 2). In 2007, vegetation increased approximately 73% and in 2008 it increased approximately 34%. In 2008, native vegetation was also seen in a few areas of the pond interiors in addition to the borrow ditches (Figures 4-6). Ground monitoring is not required until there are at least 30 acres of vegetation, which will likely occur within a few years.

Table 2: Native vegetation development in the Island Ponds, 2006-2008.

Year	Pond	Acreage of Native Salt Marsh Vegetation	Percent Change in Acreage from Previous Year
2006	A19	2.99	
	A20	1.56	
	A21	1.20	
	total	5.75	
2007	A19	5.10	70.57
	A20	2.20	41.03
	A21	2.65	120.83
	total	9.96	73.22
2008	A19	6.07	19.02
	A20	2.93	33.18
	A21	4.29	61.89
	total	13.30	33.53

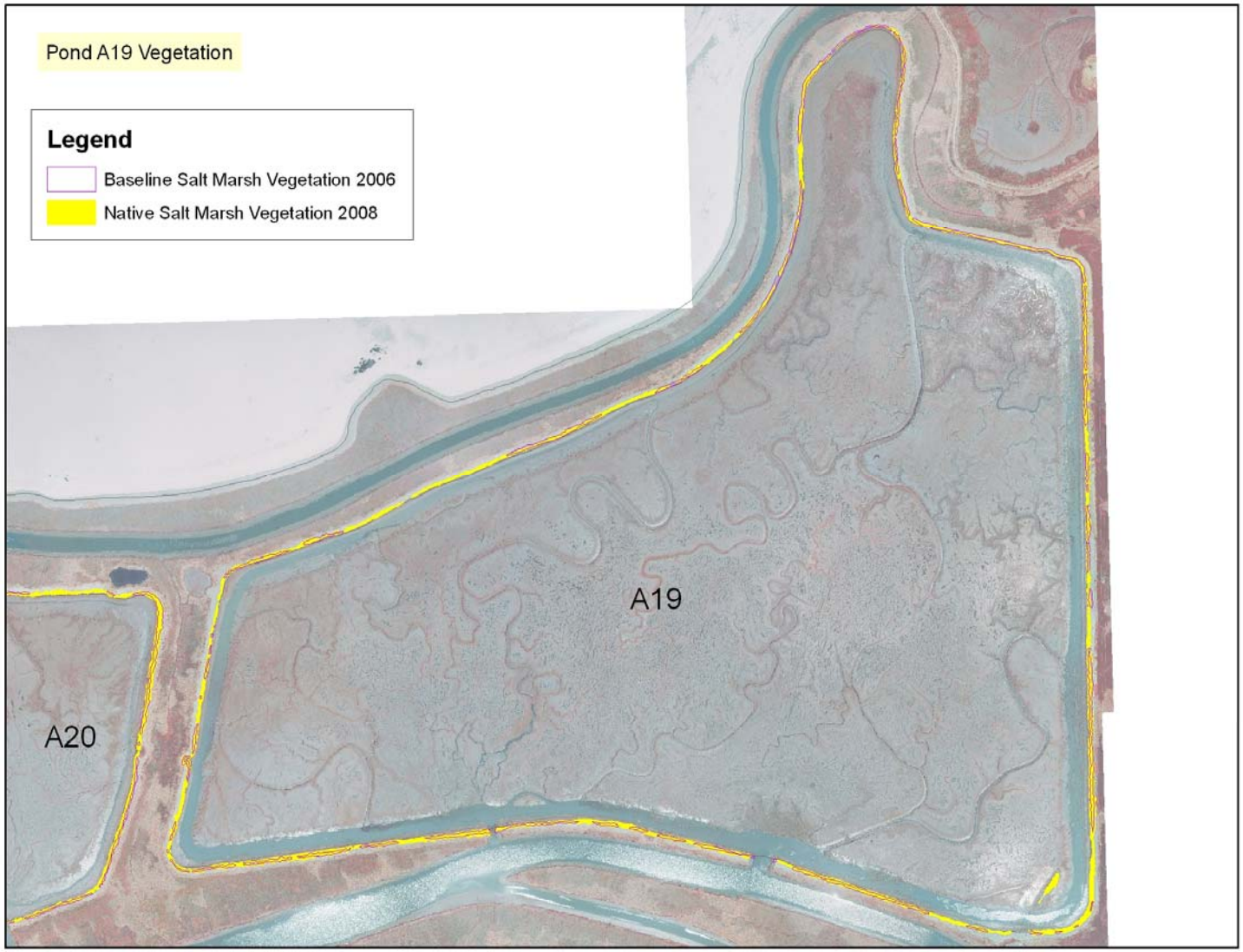

Figure 4: Native vegetation development in pond A19 during 2008.

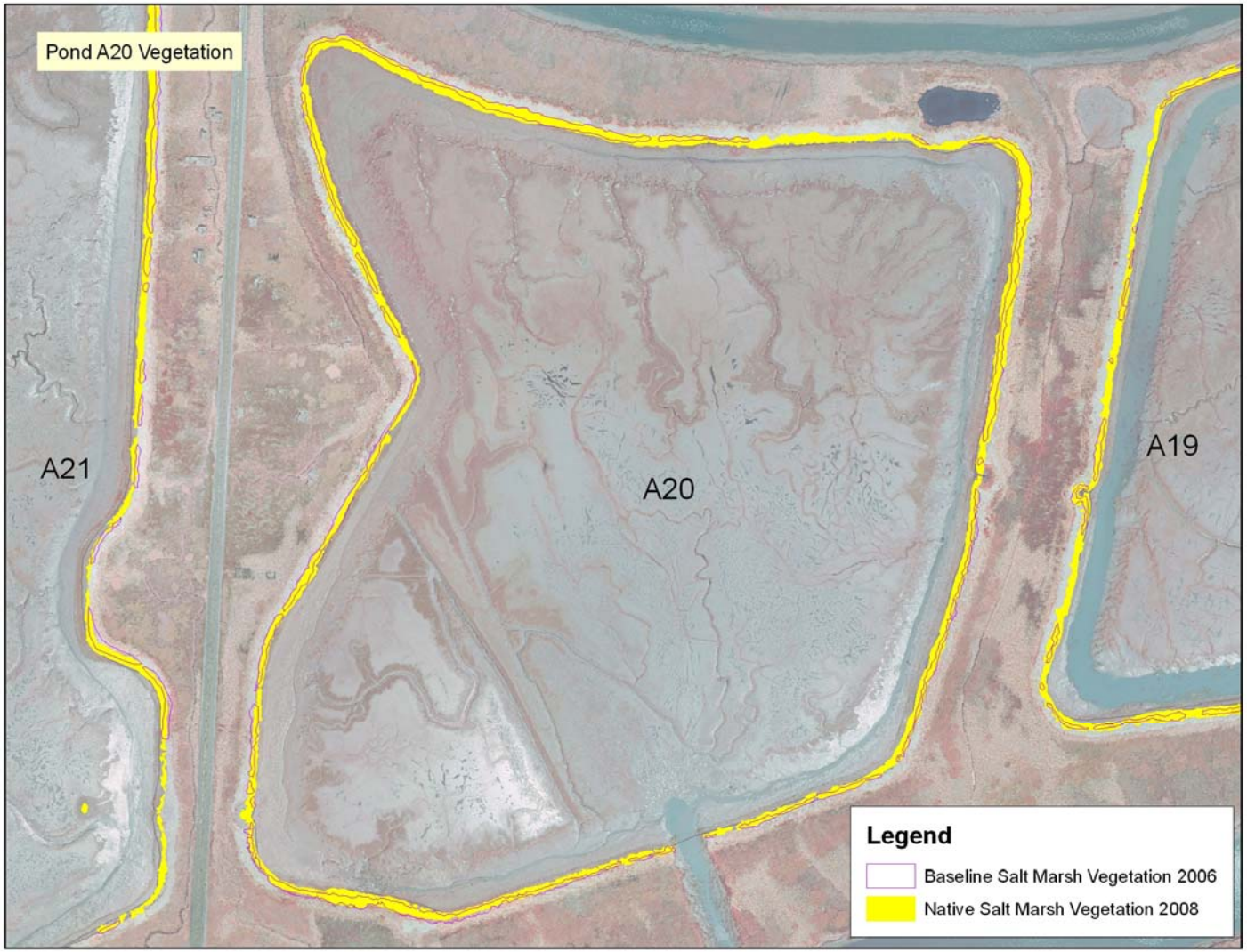

Figure 5: Native vegetation development in pond A20 during 2008.

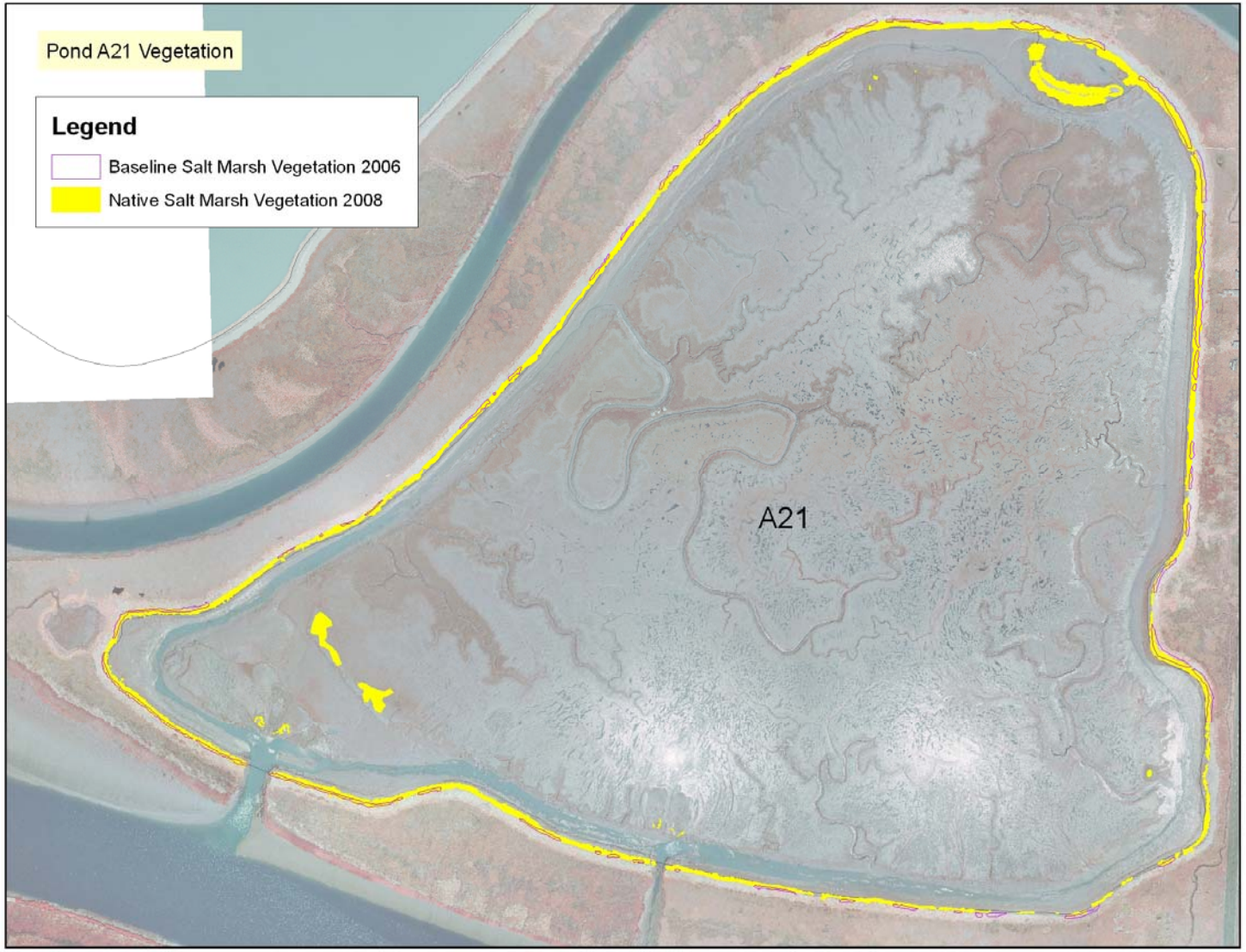

Figure 6: Native vegetation development in pond A21 during 2008.

Task 5.2.6 – Invasive Plant Species Establishment

The Invasive Plant Species Establishment Task (Task 5.2.6) is described in the MMP as follows: "Colonization of the Island Ponds restoration site by non-native invasive species would jeopardize the success of the island ponds mitigation and restoration. Many of the important ecological benefits of restored tidal marsh vegetation will not be provided by invasive species. In particular, invasive non-native plant species may prevent establishment of native tidal marsh vegetation. Annual monitoring for invasive smooth cordgrass and its hybrids will occur for the duration of the mitigation project (i.e., until vegetation covers 75% of 75 acres). This effort will provide early detection and trigger prompt control efforts, before invasive cordgrass can dominate any portion of the Island Ponds. Other non-native plant species that may occur with increasing frequency in high marsh zones include Perennial Peppergrass, Russian thistle (*Salsola soda*), and New Zealand spinach (*Tetragonia tetragonioides*). Observations of these and other non-native species will be recorded during the aerial photo monitoring and field-truthing, conducted under the native vegetation development section (see Section 5.2.4)."

On September 15, 2008 the ISP treated seven patches of invasive *Spartina alterniflora* hybrids along the south-western outboard levee of pond A21, using helicopter broadcast spraying. During this control effort, some native *Spartina foliosa* adjacent to the invasive patches was also sprayed to ensure kill of any native cordgrass plants potentially pollinated by the *Spartina alterniflora* hybrids. Genetic samples taken in 2007 from the interior of the island ponds, Mud Slough, and Coyote Creek east of pond A21 were all determined to be native. One clone of invasive *Spartina alterniflora* documented in Triangle Marsh (directly south of pond A21) near the railroad tracks was also sprayed in 2008. Results from one sample taken from pond A19 in 2008 are still pending, but are likely native (Ingrid Hogle - ISP, pers. comm.). While there are invasive species such as *Lepidium latifolium* (Perennial Pepperweed) atop the levee and the outboard marshes, no invasive species were confirmed inside the Island Ponds during Y3.

Task 5.2.7 – Wildlife Monitoring

The Wildlife Monitoring Task (Task 5.2.7) for the Island Ponds is described in the MMP as follows: "The ISP (Initial Stewardship Project) anticipates that restoration of the Island Ponds to tidal marsh will provide long-term ecological benefits to native birds (particularly California clapper rail) and mammal species (particularly SMHM) [Salt Marsh Harvest Mouse]. In addition, the District [SCVWD] has chosen presence of California clapper rail as a performance criterion to measure success of their SMP mitigation requirements. Although there are no performance criteria or success criteria associated with the presence of other wildlife species, the project partners agreed it was prudent to incorporate a wildlife component into this monitoring program. Monitoring for bird and mammal species will reveal whether restoration of tidal exchange at the Island Ponds produce the anticipated benefits to native wildlife species."

A) California Clapper Rail Monitoring – The Refuge will monitor for California clapper rail with in the Island Ponds as soon as 30 acres of native vegetation develop. As of Y3, there was no suitable habitat available for the California clapper rail.

B) SMHM Monitoring – The Refuge will monitor for SMHM in the Island Ponds as soon as five acres of contiguous suitable habitat develop. As of Y3, there was no suitable habitat available for the SMHM.

C) Waterfowl and shorebird species – USGS has been counting waterbirds at the Island Ponds monthly since October 2002 (with the exception of September 2005) and will continue to do so until five years after the first breach. Before the ponds were breached, their standard protocol was to conduct counts within three hours of high tide when bird numbers in ponds would be at their peak (Takekawa et al. 2005, 2006). After the Island Ponds were breached in March 2006, USGS conducted monthly low tide surveys in addition to the high tide surveys to document changes in bird-use coincident with changing water levels and habitat evolution (Takekawa et al. 2006).

Birds were identified to species with the exception of some similar species that cannot be readily distinguished in the field (e.g. dowitchers and scaup). To facilitate analysis of bird species with similar habitat requirements, USGS assigned species to foraging guilds (Takekawa et al. 2005, 2006). These included: 1) dabbling ducks – e.g. northern shovelers (*Anas clypeata*); 2) diving ducks – e.g. ruddy ducks (*Oxyura jaimaicensis*); 3) eared grebes (*Podiceps igricollis*); 4) fish eaters – e.g. double-crested cormorants (*Phalacrocorax auritis*); 5) gulls – e.g. ring-billed gulls (*Larus delawarensis*); 6) herons – e.g. great egrets (*Ardea alba*); 7) medium shorebirds – e.g. marbled godwits (*Limosa fedoa*); 8) phalaropes – e.g. Wilson's phalaropes (*Phalaropus tricolor*); and 9) small shorebirds – e.g. western sandpipers (*Calidris mauri*).

Since the breach of the Island Ponds in March 2006, overall waterbird use has increased in almost all guilds of birds with the exception of eared grebes (Figures 7-10). The decline in eared grebe use can be attributed to a loss of high-salinity foraging areas when the Island Ponds were changed from salt making ponds into tidal ponds. Use of the Island Ponds by dabbling ducks, and small and medium shorebirds has increased steadily since the breach in 2006 (Figure 11). While many of these birds may be using the ponds as a high tide roost area, shorebirds are also using this area for foraging during low tide (Figure 10). In addition diving ducks may be foraging for fish in the developing channels. After an initial increase in the use of the ponds by gulls, there now appears to be a slow down although ponds A19 and A21 still have more use by gulls than before the breach occurred (Figure 7-9, 11). California gulls make up the majority of all of the gulls identified during surveys; they are using the Island Ponds primarily as a roosting site as the ponds are adjacent to landfills where gulls forage.

Tables 3 and 4 document the monthly totals of waterbird use at the Island Ponds during high and low tide surveys from January to December 2008.

Monitoring for waterfowl and shorebird use on the Island Ponds will continue to be an important indicator to show how the Island Ponds progress from former salt making ponds to tidal ponds with increased foraging potential for many waterbirds.

Figure 7. Average numbers of birds during high tide surveys at pond A19, pre and post breach (+/- SE).

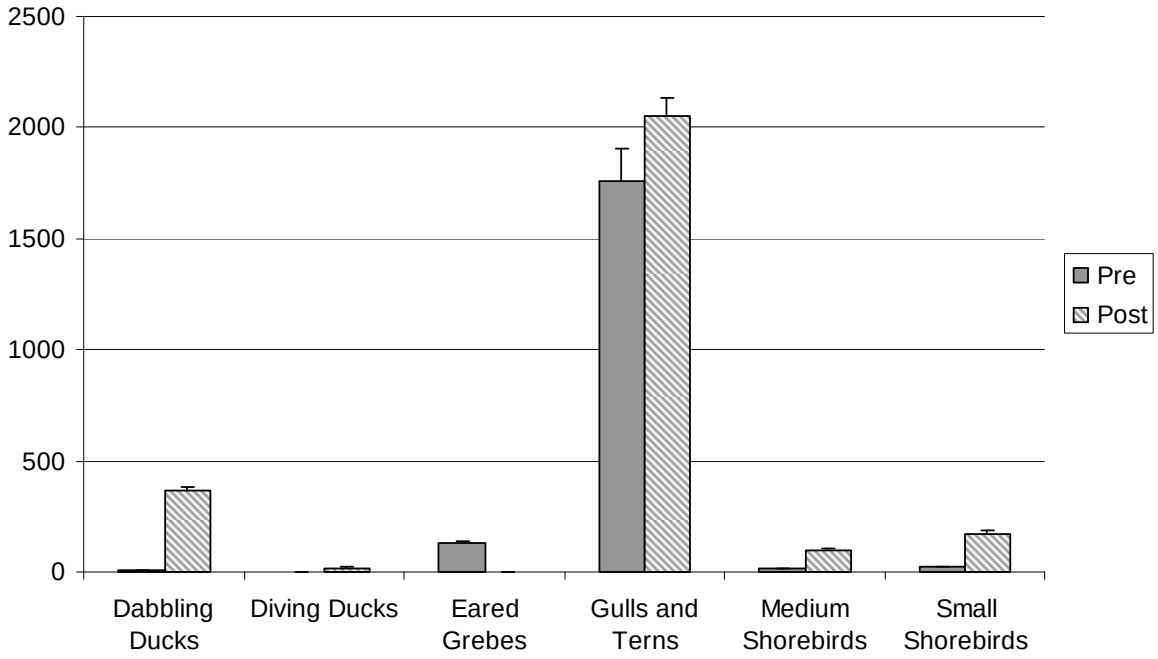

Figure 8. Average numbers of birds during high tide surveys at pond A20, pre and post breach (+/- SE).

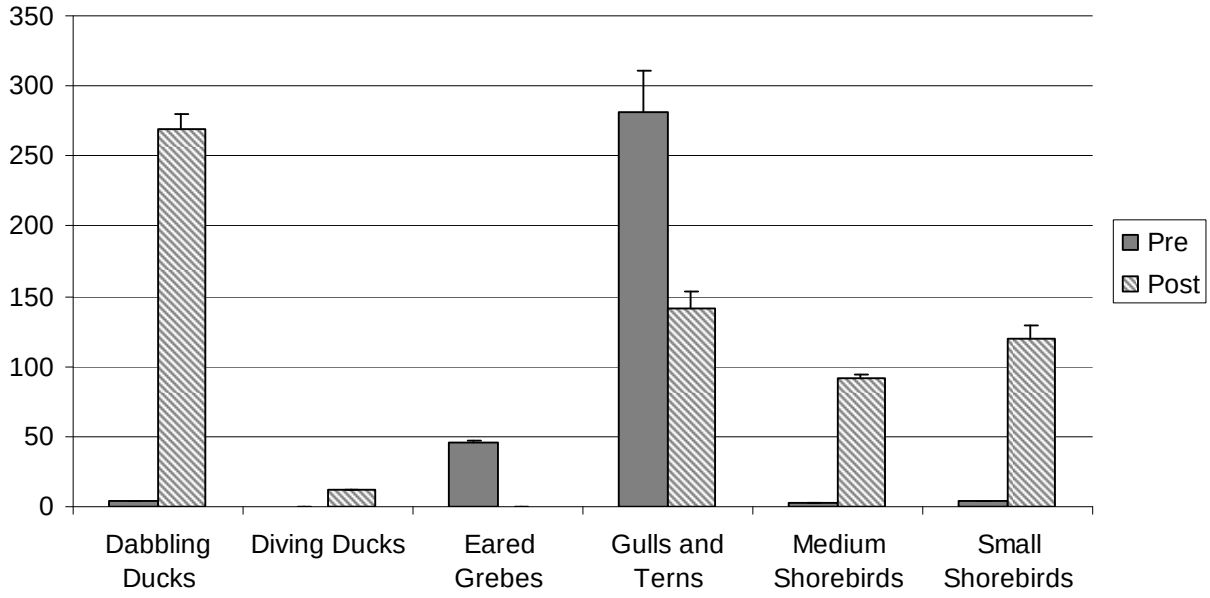

Figure 9. Average numbers of birds during high tide surveys at pond A21, pre and post breach (+/- SE).

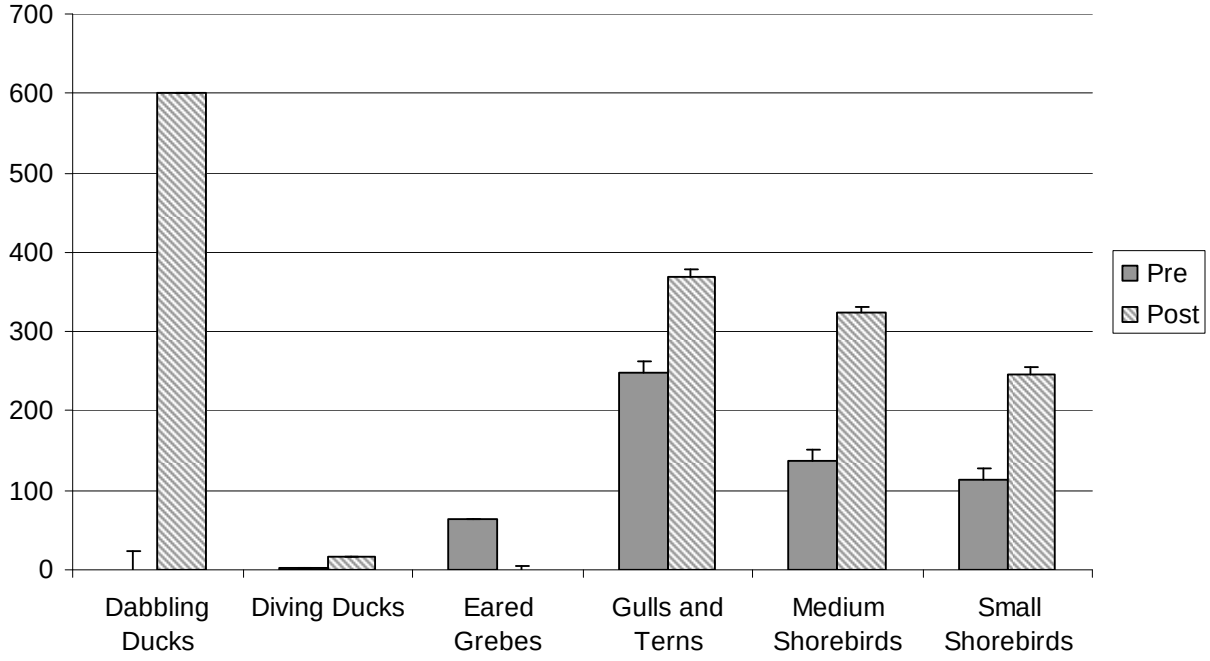

Figure 10. Maximum counts of shorebirds at the Island Ponds during low tide surveys, post breach.

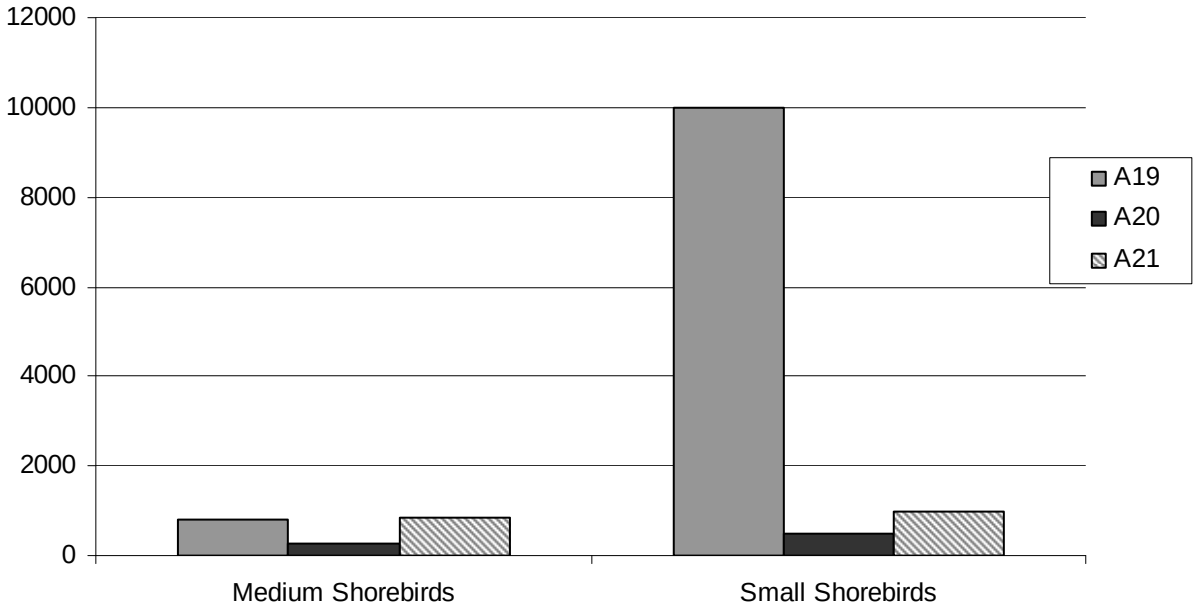

Figure 11. Average numbers of waterbirds counted on the Island Ponds, 2003-2008. Breach occurred in March 2006.

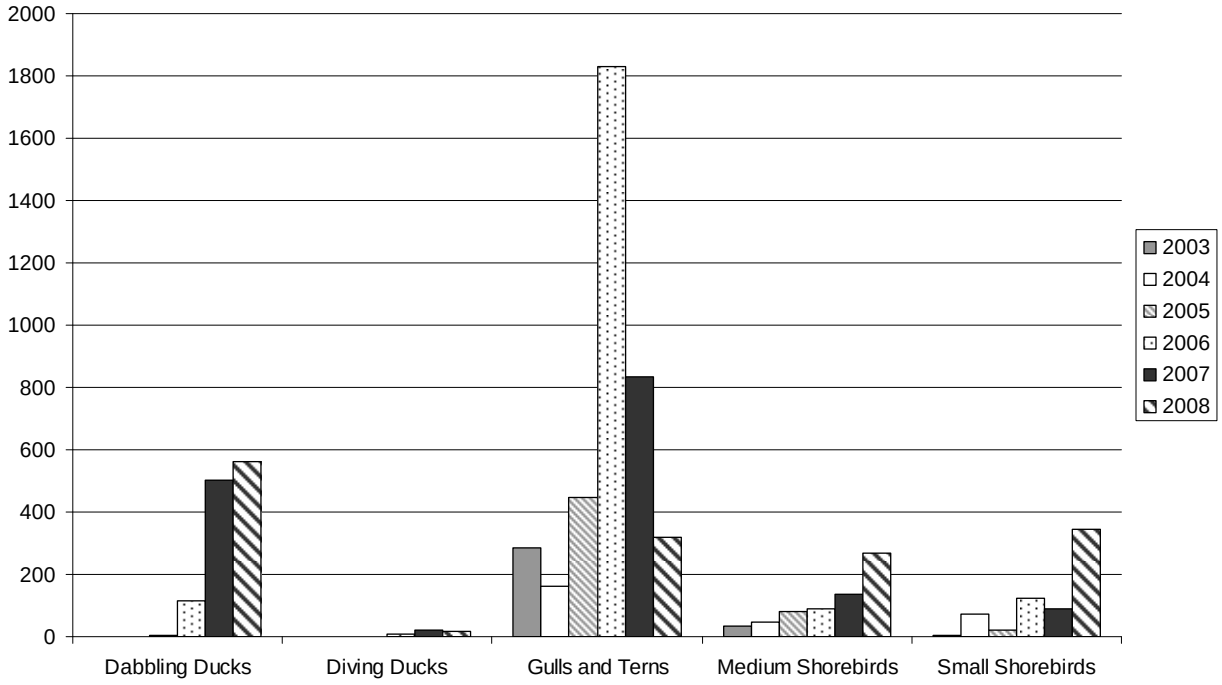

Table 3: Monthly totals of waterbird-use during high tide surveys at the Island Ponds, 2008.

Month-Year	Pond #	Dabbling Ducks Total	Diving Ducks Total	Eared Grebes Total	Fish-Eaters Total	Geese Total	Gulls & Terns Total	Herons Total	Medium Shorebirds Total	Phalaropes Total	Small Shorebirds Total	Monthly Species Richness	Grand Total
Jan-08	A19	264	15	2	4	47	2081	4	211	0	81	19	2709
	A20	406	8	0	0	2	9	0	69	0	1879	21	2375
	A21	318	3	0	0	16	443	1	151	0	317	19	1253
Feb-08	A19	647	88	2	0	28	1479	3	409	0	159	24	2815
	A20	200	14	0	2	3	214	0	57	0	480	17	970
	A21	876	79	0	2	16	540	1	220	0	512	24	2249
Mar-08	A19	55	2	0	0	3	860	0	3	0	0	11	925
	A20	666	0	0	0	0	5	0	400	0	0	12	1071
	A21	1005	8	0	0	16	298	2	499	0	5	20	1834
Apr-08	A19	65	19	0	30	2	428	0	22	0	3185	16	3752
	A20	118	15	0	0	4	0	0	92	0	601	15	830
	A21	38	3	0	0	3	2	5	17	0	296	14	366
May-08	A19	56	1	0	0	6	1089	0	30	0	0	7	1196
	A20	20	0	0	0	2	1	5	57	0	0	8	85
	A21	75	0	0	0	16	59	4	96	0	0	11	250
Jun-08	A19	116	0	0	555	0	191	2	322	0	0	9	1186
	A20	13	0	0	0	0	7	0	0	0	0	5	20
	A21	35	0	0	0	0	130	5	76	0	0	10	247
Jul-08	A19	12	1	0	0	0	1084	1	60	0	1	10	1160
	A20	0	3	0	2	0	1	0	0	0	0	3	6
	A21	0	0	0	0	0	12	0	205	0	10	3	227
Aug-08	A19	6	1	0	0	0	309	0	0	0	0	5	316
	A20	0	3	0	0	0	0	0	0	0	0	1	3
	A21	0	0	0	1	1	27	3	357	0	1	10	390
Sep-08	A19	1360	97	0	4	0	2	5	130	0	29	18	1627
	A20	74	0	0	0	0	0	1	0	0	0	5	77
	A21	912	1	0	11	0	9	4	1	0	6	12	946
Oct-08	A19	757	4	0	1	0	184	2	0	0	0	11	949
	A20	1345	0	0	0	0	23	0	80	0	0	7	1448
	A21	927	0	0	0	0	403	6	788	0	2070	20	4195
Nov-08	A19	986	2	0	1	0	214	0	0	0	0	8	1203
	A20	410	115	0	0	0	37	0	88	0	0	10	650
	A21	1605	59	0	0	0	167	3	1793	0	1484	27	5114
Dec-08	A19	2047	26	0	0	0	1054	15	914	0	690	23	4746
	A20	932	21	0	0	0	8	0	417	0	420	14	1798
	A21	3908	42	0	0	0	168	3	2069	0	190	18	6380

Table 4: Monthly totals of waterbird-use during low tide surveys at the Island Ponds, 2008.

Month-Year	Pond #	Dabbling Ducks Total	Diving Ducks Total	Eared Grebes Total	Fish-Eaters Total	Geese Total	Gulls & Terns Total	Herons Total	Medium Shorebirds Total	Phalaropes Total	Small Shorebirds Total	Monthly Species Richness	Grand Total
Jan-08	A19	89	0	0	0	38	5496	0	128	0	50	12	5801
	A20	285	0	0	0	3	88	1	48	0	0	11	427
	A21	21	0	0	0	11	108	0	43	0	0	10	188
Feb-08	A19	0	2	0	0	34	2463	0	37	0	76	7	2612
	A20	25	0	0	0	0	0	0	1	0	0	3	27
	A21	4	0	0	0	22	145	0	11	0	0	8	184
Mar-08	A19	223	0	0	0	15	1345	1	226	0	8	15	1824
	A20	43	0	0	0	2	61	0	35	0	0	11	141
	A21	148	0	0	0	19	119	0	10	0	0	13	300
Apr-08	A19	3	0	0	0	4	444	0	1	0	0	6	453
	A20	0	0	0	0	0	0	0	0	0	5	1	5
	A21	6	0	0	1	10	0	0	0	0	28	7	48
May-08	A19	16	0	0	0	0	585	0	7	0	0	5	609
	A20	19	0	0	0	0	32	0	53	0	7	6	111
	A21	64	0	0	0	0	55	0	20	0	0	7	142
Jun-08	A19	39	0	0	33	0	297	1	109	0	0	6	479
	A20	0	0	0	0	0	71	1	3	0	0	4	75
	A21	7	0	0	0	0	214	1	16	0	0	8	238
Jul-08	A19	3	0	0	2	0	1616	1	168	0	2630	12	4425
	A20	0	0	0	0	0	24	1	157	0	100	12	290
	A21	0	0	0	9	0	33	0	502	0	8	11	552
Aug-08	A19	0	0	0	0	0	2331	1	643	0	73	13	3050
	A20	0	0	0	0	0	5	0	158	0	165	10	328
	A21	0	0	0	0	0	70	0	370	0	484	12	924
Sep-08	A19	87	1	0	0	0	149	6	360	0	290	21	895
	A20	0	0	0	0	0	5	1	96	0	33	12	137
	A21	70	0	0	0	0	4	1	847	0	119	13	1042
Oct-08	A19	1074	0	0	0	0	229	1	698	0	838	16	2840
	A20	33	0	0	0	0	157	3	70	0	421	18	684
	A21	184	0	0	0	0	1250	3	396	0	171	20	2004
Nov-08	A19	103	0	0	0	0	548	1	269	0	13	15	934
	A20	7	0	0	0	0	443	0	49	0	0	10	499
	A21	91	0	0	0	0	1307	0	699	0	0	13	2098
Dec-08	A19	0	0	0	0	0	1528	0	157	0	1	12	1687
	A20	36	0	0	0	0	201	0	224	0	0	10	462
	A21	0	0	0	0	0	618	0	153	0	0	9	773

References:

H.T. Harvey & Associates. 2004. Island Ponds (Ponds A19, A20, A21) Tidal Marsh Establishment Projections draft Report. San Jose, CA. 16pp.

Takekawa, J. Y., A. K. Miles, D. H. Schoellhamer, B. Jaffe, N. D. Athearn, S. E. Spring, G. G. Shellenbarger, M. K. Saiki, and F. Mejia. 2005. South Bay Salt Ponds Restoration Project Short-term Data Needs, 2003-2005. Unpubl. Final Report, U. S. Geological Survey, Vallejo, CA. 267 pp.

Takekawa, J. Y., N. D. Athearn, B. Hattenbach, and A. K. Schultz. 2006. Bird Monitoring for the South Bay Salt Pond Restoration Project. Unpubl. Final Prog. Rep., U. S. Geological Survey, Vallejo, CA. 85pp.

APPENDIX B.
PHOTOGRAPHS

APPENDIX B-1.
RAILROAD BRIDGE SCOUR PHOTOGRAPH COMPARISONS

APPENDIX B-1
RAILROAD BRIDGE SCOUR PHOTO COMPARISON
2006 vs. 2008

Photo 1. East Side of Bridge Looking South. Pile 1N-C in foreground – 11/29/06

Photo 2. East Side of Bridge Looking South. Pile 1N-C in foreground –12/8/08

Photo 3. West Side of Bridge Looking South. Pile 1N-A in foreground – 11/29/06

Photo 4. West Side of Bridge Looking South. Pile 1N-A in foreground – 12/8/08

Photo 5. West Side of Bridge Looking North. Pile 1S-A in foreground – 11/29/06

Photo 6. West Side of Bridge Looking North. Pile 1S-A in foreground – 12/8/08

Photo 7. East Side of Bridge Looking North. Pile 1S-C in foreground – 11/29/06

Photo 8. East Side of Bridge Looking North. Pile 1S-C in foreground – 12/8/08

Photo 9. Close-up of pile 1S-A – 11/29/06

Photo 10. Close-up of pile 1S-A – 12/8/08

Photo 11. Close-up of piles 1S-C (foreground), 1S-B (centre), and 1S-A – 11/29/06

Photo 12. Close-up of piles 1S-C (right), 1S-B (centre), and 1S-A (left) – 12/8/08

Photo 13. Close-up of pile 1N-A – 11/29/06

Photo 14. Close-up of pile 1N-A – 12/8/08

Photo 15. Close-up of pile 1N-B (looking west) – 11/29/06

Photo 16. Close-up of pile 1N-B (looking west) – 12/8/08

Photo 17. Close-up of pile 1N-C – 11/29/06

Photo 18. Close-up of pile 1N-C – 12/8/08

APPENDIX B-2.
RAIL LEVEE PHOTOGRAPHS

APPENDIX B-2
RAIL LEVEE PHOTOGRAPHS
2006 VS. 2007

Photo 1. Pond A21 Levee near Rail Levee, view looking north - July 13, 2006.

Photo 2. Same location as above – May 9, 2008.

Photo 3. Pond A21 Levee near Rail Levee, view looking south – July 13, 2006.

Photo 4. Same location as above – May 9, 2008.

Photo 5. West Rail Levee neat Pond A21, view looking north – July 13, 2006.

Photo 6. Same location as above – May 9, 2008.

Photo 7. West Rail Levee near Pond A21, view looking south – July 13, 2006.

Photo 8. Same location as above – May 9, 2008.

Photo 9. Pond A20 Levee near Rail Levee – July 13, 2007.

Photo 10. Same location as above – May 9, 2008.

Photo 11. Pond A20 Levee near Rail Levee, view looking south – July 13, 2006.

Photo 12. Same location as above – May 9, 2008.

Photo 13. East Rail Levee near Pond A20, view looking north – July 13, 2006.

Photo 14. Same location as above – May 9, 2008.

Photo 15. East Rail Levee near Pond A20, view looking south – July 13, 2006.

Photo 16. Same location as above – May 9, 2008.

APPENDIX B-3.
TOWN OF DRAWBRIDGE PHOTOGRAPHS

APPENDIX B-3

TOWN OF DRAWBRIDGE PHOTOGRAPHS

Possible Deterioration Threats

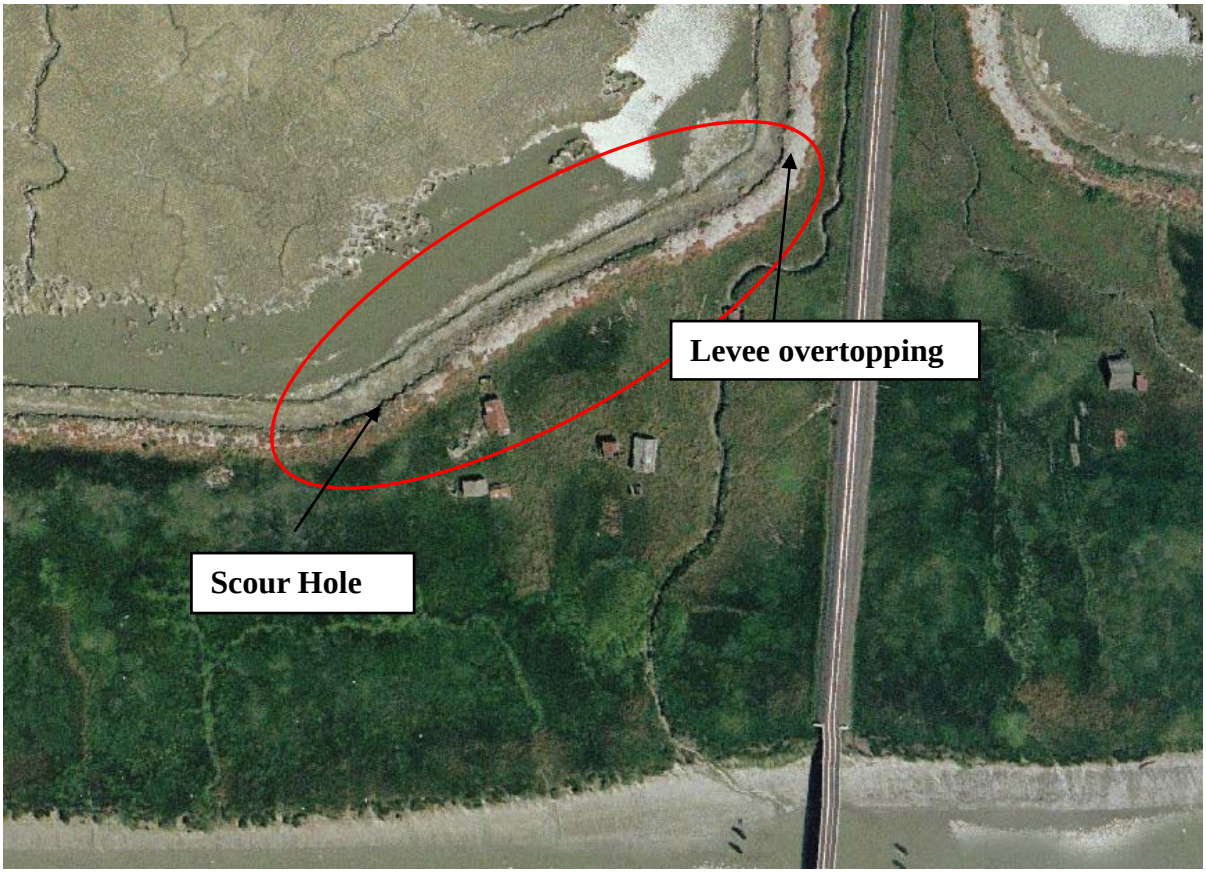

Photo 1. Aerial view of railroad and Town of Drawbridge. The red circle (southeast levee of Pond A21) depicts the area which is eroding.

Photo 2. Close up of scour hole in the southeast corner of Pond A21, view looking west – August 10, 2006.

Photo 3. Same location as above – May 9, 2008.

Photo 4 . Southeast corner of Pond A21, looking northerly, newly installed benchmark to be used to monitor elevation changes in the levee where overtopping and wave action have been documented – December 8, 2008

Photo 5 . Southeast corner of Pond A21, looking southerly, installation of markers to track top of levee erosion/scour from wave action and levee overtopping– December 8, 2008

APPENDIX C.
SEDIMENTATION DATA

APPENDIX C
Summary of Sediment Accretion at the Island Ponds

Pond	Sediment Pin ID	Distance from Nearest Breach (feet)	8 Months Post-Breach Accretion (feet) *	12 Months Post-Breach Accretion (feet) **	16 Months Post-Breach Accretion (feet) ***	30 Months Post-Breach Accretion (feet) **
A19	A1912	477	0.00	0.16	0.08	0.03
A19	A1913	545	0.25	0.35		0.19
A19	A1914	886	0.21	0.22		0.10
A19	A1915	1114	0.22	0.25		0.16
A19	A1911	1136	0.09	0.12		0.17
A19	A1909	1227	0.20	0.18		0.31
A19	A1910	1364	0.30	0.22		0.40
A19	A1908	1750	0.16	0.21		0.28
A19	A1906	1795	0.17	0.23		0.54
A19	A1907	1841	0.13	0.18	0.20	0.37
A19	A1905	1955	0.10	0.11		0.09
A19	A1904	2364	0.06	0.15	0.16	0.30
A19	A1903	2841	0.04	0.05		0.07
A19	A1902	3114	0.03	0.05	0.04	0.13
A19	A1901	4000	0.01	0.06		0.12
A20	A2005	659	0.37	0.43	0.51	0.73
A20	A2004	864	0.53	0.62	0.74	1.03
A20	A2003	875	0.39	0.48		1.02
A20	A2002	1386	0.23	0.14		0.31
A20	A2001	1500	0.12	0.12	0.13	0.10
A21	A2109	682	0.18	0.40	0.62	0.78
A21	A2108	818	0.45	0.48		0.81
A21	A2107	955	0.22	0.34	0.33	0.35
A21	A2110	1205	0.50	0.61		1.17
A21	A2106	1409	0.20	0.22		0.40
A21	A2105	1455	0.17	0.29		0.43
A21	A2104	1523	0.13	0.18		0.22
A21	A2103	1864	0.09	0.13		0.07
A21	A2102	2182	0.16	0.16		0.28
A21	A2101	2432	0.03	0.03	0.12	0.22

* 8 month data is an average of 3 depth probes.
** 12, 16, and 30 month data is and average of 8 depth probes.
***Data was only collected at a select number of pins during the 16 month sampling event.