

ISLAND PONDS MITIGATION MONITORING AND REPORTING: YEAR 9—2014



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TABLE OF CONTENTS

	Page
1. EXECUTIVE SUMMARY	1
1.1. Introduction.....	2
1.2. Project Background.....	2
1.3. Projects Which Required Mitigation Initial Stewardship Plan (ISP).....	2
1.4. Island Ponds Mitigation Site Site Description	4
1.5. Contacts	7
2. MONITORING METHODS	8
2.1. ON-SITE MONITORING	8
2.1.1. Aerial Photography (District)	8
2.1.2. Biennial Aerial Photography Vegetation Mapping (Refuge).....	8
2.1.3. Ground-Based Quantitative Vegetation Sampling (District)	8
2.1.4. Wildlife Monitoring (Refuge).....	9
2.2. OFF-SITE MONITORING.....	9
2.2.1. Accelerated Deterioration of the Town of Drawbridge (District)	9
3. MONITORING RESULTS	10
3.1. ON-SITE MONITORING	10
3.1.1. Biennial Aerial Photography Vegetation Mapping (Refuge).....	10
3.1.2. Ground-Based Quantitative Vegetation Sampling (District)	11
3.1.3. Wildlife Monitoring (Refuge).....	13
3.2. OFF-SITE MONITORING.....	13
3.2.1. Accelerated Deterioration of the Town of Drawbridge (District)	13
4. DISCUSSION	14
5. REFERENCES	15
6. LIST OF PREPARERS	16
7. FIGURES	17

FIGURES

Figure 1: Vegetation Development in Pond A21 for 2014.....	18
Figure 2: Vegetation Development in Pond A20 for 2014.....	19
Figure 3: Vegetation Development in Pond A I9 for 2014.	20
Figure 4: Location of clapper rail call count stations along the levee at Pond A21.....	21

Figure 5: Location of Ridgway Rail observation in Pond A21, July 2014.	22
Figure 6 and 7: Pond A21 marsh plain.	23
Figure 7 and 8: Pond A20, pond surface and establishing marsh plain.	23

TABLES

Table 1-1: Mitigation Monitoring Schedule for the Island Ponds – Responsible Party, Monitoring Duration, Frequency and Timing.	5
Table 3-2: Quantitative Vegetation Sampling for 2014.	13

APPENDIX A

Pond A21 Levee Erosion Data & Photographs

1. 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:

- a. to initiate ecological restoration activities as described in the South Bay Salt Pond Initial Stewardship Plan (ISP); and
- b. 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 (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 9 (2014) monitoring results for both the District and the Refuge.

Nine years after breaching, sediment is continuing to accumulate and consolidate to form acceptable substrate for vegetation colonization in all three Ponds. Vegetation growth has shown a rapid expansion; currently 145 acres of marsh vegetation has collectively established in the three ponds, which represents a 132% increase from 2012. Ponds A19 and A20, while not yet exhibiting any qualifying vegetation patches 2 acres in size or larger on the pond surfaces, still show a substantial increase in marsh vegetation establishment since 2012.

Vegetation sampling at Pond A21 indicates that an abundance of marsh vegetation has established on the marsh plain since the last mapping and sampling effort in 2012. At approximately 110 acres of vegetated pond surface and an average of 71.4% total percent vegetation cover, Pond A21 is now very close to meeting the final success criteria for the mitigation project (75 acres at 75% vegetative cover). There are no longer separate patches of vegetation on the pond surface but rather a generally continuous mosaic of marsh vegetation interspersed with mud flat of varying topography and side slough channels.

Vegetation composition on the marsh plain of all three ponds continues to be dominated by several native species, including perennial pickleweed and California cordgrass, and to a lesser extent, annual pickleweed. Vegetation on pond levee shorelines was more mixed; with perennial pickleweed and California cordgrass as well as some areas showing establishment of nonnative *Salsola* and small amounts of perennial pepperweed. As sediment accretion continues, management of nonnative vegetation may need to become a priority to prevent establishment of these or other invasive species on the marsh plain.

The levee shoreline of Pond A19 still contains a population of dwarf spikerush, a California Rare Plant Rank 4. This population was first noted in 2012.

No California clapper rails (Ridgway's rail) were detected near Pond A21 during the Refuge's spring call-count surveys. However, one Ridgway rail was detected within Pond A21 in July by staff from the Invasive *Spartina* Project.

Data collected from 2008 through 2014 indicates that deterioration along the inboard slope of the southeast levee of Pond A21 is still occurring. At this time, the levee doesn't appear to be at

risk of failure however, future evaluations and measurements are planned until the data indicates that the levee width has stabilized.

1.1. INTRODUCTION

1.2. 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 the natural sedimentation processes to restore the ponds to tidal marsh habitat and meet the project goals and objectives. The overall restoration goal is to successfully reestablish vegetation, promote re-colonization by benthic organisms and provide habitat for various wildlife species.

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:

- a. To initiate ecological restoration activities as described in the South Bay Salt Pond ISP
- b. 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 were adverse effects from the project (USFWS et al., 2006). Mitigation monitoring activities were anticipated to continue for 15 years. This report presents the Year 9 (2014) monitoring results.

1.3. PROJECTS WHICH REQUIRED MITIGATION- Initial Stewardship Plan (ISP)

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

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

- e. minimize initial stewardship management costs; and
- f. 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 require tidal wetland mitigation is the San Francisco Bay Regional Water Quality Control Board - Order # R2-2004-0018.

Stream Maintenance Program (SMP)

The SMP allowed 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 was also intended to assist the District in obtaining multi-year permits for these activities, the permit term of which was initiated in 2002 and culminated in 2012. The first SMP permit (2002-2012) applied to all of the District's routine stream maintenance, including three major types of activities: sediment removal, vegetation management, and bank protection, and commenced soon after the District received the permit in August 2002.

The SMP compensatory mitigation package included 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:

- a. San Francisco Bay Regional Water Quality Control Board - Order # R2-2002-0028;
- b. U.S. Army Corp of Engineers - Permit # 22525S;
- c. California Department of Fish and Game – 1601 Lake and Streambed Alteration Agreement # R3-2001-0119; and
- d. U.S. Fish and Wildlife Service – Biological Opinion 1-1-01-F-0314 Lower Guadalupe River Project (LGRP)

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:

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

1.4. ISLAND PONDS MITIGATION SITE -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 allow full tidal inundation and permit the ponds to passively restore to tidal marsh habitat.

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 if the project is meeting performance criteria, permit requirements, and to 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	Completed Task 2006-2007	---
		b) Years 3 to 5	Completed Task 2010	---
		c) Year 6 to 30 acres of vegetation	30 acres of Vegetation Established in 2010-Task complete	---
	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 (SCVWD agreed to perform this sampling in 2012 and 2014)	Once 30 acres of vegetated area is established until 75 acres of 75% vegetation cover is achieved	Biennial	Jul - Aug ²
	Invasive <i>Spartina</i> 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	Completed Task 2010	---
Off-Site Monitoring				
District	Rail bridge pier scour ⁴	a) Years 1 to 5	Completed Task 2006-2008	---
		b) Years 1 to 5	Completed Task 2010	---
		c) Begin at implementation of corrective measures, end five years after	N/A	---

Responsible Party	Monitoring Activity	Year(s) for Each Monitoring Activity ¹	Frequency	Seasonal Timing
	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	Completed Task 2006 – 2008	---
		b) If outboard marsh retreats to levees opposite breach, then three additional years from occurrence	N/A	---
	Rail line erosion	a) Years 1 to 5	Completed Task 2010	---
		b) Years 1 to 5	Completed Task 2010	---
	Deterioration of Town of Drawbridge structures	a) Years 1 to 5	Completed Task 2010	---
Refuge	Water Quality	a) Adjacent to breaches – Year 1	Completed Task 2006	---
		b) Upstream & downstream of ponds – Year 1	Completed Task 2006	---

* (Grayed out tasks above are considered complete)

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 aerial photograph.
4. Bridge pier scour will continue to be monitored twice a year by the Union Pacific Railroad staff instead of additional monitoring being performed by this Project. (See Year 3-2008 monitoring report for additional details.)

This report presents the monitoring results collected during the Year 9 (2014) monitoring period. The data are presented in detail and are compared to the prior years' results as well as the overall project performance criteria identified in the RMMP (USFWS et al., 2006).

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; and
- 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); and
- 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; and
- Targets achieved within 15 years following levee breach.

1.5. CONTACTS

The District contact is:

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2. MONITORING METHODS

This section describes the methods used to carry out the Year 9 monitoring activities for both the District and the Refuge.

2.1. ON-SITE MONITORING

2.1.1. Aerial Photography (District)

Per the Adaptive Management Teams recommendations from 2010, satellite photographs were obtained for use in the Year 9 monitoring activities. The images were taken using the Pleiades 1 satellite from Apollo Mapping Services, which captures high resolution, commercial satellite imagery with a geo-referenced horizontal accuracy of <10 m. The satellite achieves this accuracy by simultaneously acquiring 50 cm panchromatic and 2-meter 4-band multispectral imagery. Images were captured at approximately 10:30 am at low tide on August 15, 2014. Images were acquired in both color and infrared. The spatial extent of the images included all three Island Ponds as well as the northern and southern banks of Coyote Creek. For 2014, these images were used exclusively for the aerial photography vegetation mapping task (see Section 2.1.2 below).

2.1.2. Biennial Aerial Photography Vegetation Mapping (Refuge)

The RMMP states, "Vegetation monitoring will solely consist of biennial examinations of ortho-rectified aerial photographs until a minimum of 30 acres of vegetation has established in the project area." This biennial requirement was last done in 2010 (Year 5) when > 30 acres of vegetation was mapped within the Ponds. For Years 7 and 9 (2012 and 2014), quantitative ground based vegetation sampling was initiated in addition to the aerial photo mapping (see Section 2.1.3 below).

Satellite photography utilized for this task was captured in August 2014 (see section 2.1.1 above). Color infrared photographs were examined by Refuge staff using GIS software to delineate and digitize the locations of plant colonization at the Island Ponds.

2.1.3. Ground-Based Quantitative Vegetation Sampling (District)

The RMMP states, "Once a minimum of 30 acres of vegetation establishes in the study area, biennial quantitative sampling will be initiated coincident with the aerial photo mapping". The Year 5 (2010) results showed that > 30 acres of vegetation had established within the ponds. Since Year 7 (2012) the Refuge has continued the aerial photo mapping and the District has conducted ground based vegetation sampling to further refine the techniques discussed in the RMMP. Year 9 (2014) represents the second aerial photo mapping and ground based vegetation sampling effort.

The RMMP states that sampling will occur in native-dominated vegetation patches of 2 acres in size or larger with a minimum of 50% total vegetative cover (referred to as "qualifying patches"). A reconnaissance level survey of the Island Ponds prior to initiating the quantitative vegetation sampling effort indicated that by 2014 an abundance of marsh vegetation had established in

Pond 21 on the marsh plain and there are no longer separate patches of vegetation but rather a generally continuous mosaic of vegetation interspersed with mud flat of varying topography and side slough channels. Therefore, rather than identifying and sampling qualifying patches, a representative range of locations on the pond surface were selected and then randomly sampled. Quantitative sampling in 2014 was conducted in the south west, west central, south east and north east sections of Pond 21. There were no qualifying patches located in Ponds 19 or 20. Quantitative vegetation sampling of the levees in all three ponds followed a similar methodology to Year 7 (2012).

Sampling was performed at low tide using a 1 meter square quadrat in October 2014. Total vegetative cover was measured and relative cover of each species present was documented to the nearest 5% cover category within each quadrat. Maximum vegetation height, percent bare soil and percent litter were also measured.

According to the RMMP, ground based vegetation monitoring is anticipated to continue on a biennial schedule until the success criterion is met (i.e., 75 acres at 75% vegetative cover) or sooner if, as the marsh develops, the sampling is deemed unnecessary (e.g., the aerial mapping is accurate enough), unsafe, or infeasible by the adaptive management team.

2.1.4. Wildlife Monitoring (Refuge)

The Wildlife Monitoring Task (Task 5.2.7) for the Island Ponds is described in the Mitigation Monitoring Plan (RMMP) as follows: “The 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 rails) and mammal species (particularly salt marsh harvest mice). In addition, the Santa Clara Valley Water 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 (now known as Ridgway’s rail) monitoring – The Refuge monitored for Ridgway’s rail within the Island Ponds in the spring of 2014 since more than 30 acres of native vegetation had developed within the Ponds. Call-count surveys were performed using USFWS protocol from levees surrounding Pond A21.
- B. Salt marsh harvest mouse monitoring – The Refuge will monitor for salt marsh harvest mice in the Island Ponds as soon as five acres of contiguous suitable habitat develops. However, due to logistical constraints and concerns over impacts to these endangered mice, the Refuge has decided not to pursue salt marsh harvest mouse trapping at this time.
- C. Waterfowl and shorebird species – The avian monitoring task has been completed. Quarterly avian monitoring began in Year 1 (2006) and continued through Year 5 (2010).

2.2. OFF-SITE MONITORING

2.2.1. Accelerated Deterioration of the Town of Drawbridge (District)

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 task consist of monitoring the integrity of the pond levees adjacent to the Town of Drawbridge. This requirement was anticipated to be completed in Year 5 (2010), however, monitoring of the eastern levee of Pond A21 has annually detected signs of levee erosion in this location. Therefore, it was agreed that monitoring in this location would continue until the erosion had stabilized.

In 2008, a benchmark and location stakes were installed in the southeast corner of Pond A21 to enable more accurate tracking of erosion advancement along this levee which has been seemingly caused by 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.) Location stakes were installed to form a series of eight cross sections along the top of the levee and baseline elevations were gathered immediately adjacent to each stake. Annual site visits obtain elevations at each stake and document any changes.

In December, 2014, a Civil Engineer from the District performed the surveying work discussed above to collect surface elevation data at the eight cross section locations along the Pond A21 levee.

3. MONITORING RESULTS

This section describes the results of both the District and Refuge's 2014 (Year 9) monitoring activities.

3.1. ON-SITE MONITORING

3.1.1. Biennial Aerial Photography Vegetation Mapping (Refuge)

The Native Vegetation Development Task (Task 5.2.4) for the Island Ponds is described in the RMMP 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. This is a biennial requirement and was last done in 2012.

Before the breaching in 2006, the Island Ponds had no established vegetation due to 99% of the total area covered with a hard salt crust gypsum layer (H.T. Harvey & Associates 2004). The Island Pond Complex had also become subsided since diking, so plant colonization could only occur when sedimentation reached the appropriate marsh plain elevation. Vegetation quickly established at the Ponds, although Pond A21 was the first to document a substantial increase in marsh vegetation. Elevation and sedimentation levels in both Pond A21 and Pond A20 are now ideal for marsh vegetation establishment.

In 2014, native salt marsh vegetation was mapped by digitizing from color infrared photos. Total native vegetation was 144 acres and continues to show rapid expansion from the baseline of 5.75 acres in 2006. In 2007, vegetation increased 73%, in 2008 it increased 33%, in 2010 it increased 135%, in 2012 it increased by 100%, and finally in 2014 it increased by 132%. A21 continues to have the highest native vegetation acreage. Once again, acreage of vegetation has more than doubled in two years. The majority of the pond acreage in A21 is now vegetated. In Pond A20, conditions for marsh vegetation establishment appear ideal, and the pond showed a very rapid and substantial 330% increase in vegetated acreage. Much of the interior area of the

pond is vegetated (per the satellite photo), with large coverage in the southern half, and vegetation along channels in the northern half. Finally, Pond A19 had a more modest 46% growth but it also included small patches throughout most of the interior of the pond.

Table 3-1: Comparison of Established Marsh Vegetation at the Island Ponds from 2006 – 2014.

Year	Pond	Acreage of Native Salt Marsh Vegetation	Percent Change in Acreage from Previous Year Mapped
2006	A19	2.99	
	A20	1.56	
	A21	1.20	
	TOTAL	5.75	
2007	A19	5.10	70.6
	A20	2.20	41.0
	A21	2.65	120.8
	TOTAL	9.96	73.2
2008	A19	6.07	19.0
	A20	2.93	33.2
	A21	4.29	61.9
	TOTAL	13.29	33.4
2010	A19	6.42	5.77
	A20	3.18	8.53
	A21	21.59	403.3
	TOTAL	31.19	134.7
2012	A19	8.65	34.74
	A20	5.21	63.84
	A21	48.39	124.13
	TOTAL	62.25	99.58
2014	A19	12.63	46.01
	A20	22.40	329.94
	A21	109.45	126.18
	TOTAL	144.48	132.10

See Figures 2-4 of the ponds to illustrate the dramatic increase in vegetative cover.

3.1.2. Ground-Based Quantitative Vegetation Sampling (District)

The vegetation success criteria for the Island Ponds states that “74.54 acres of vegetated tidal marsh habitat must be restored to satisfy the mitigation requirements of the District and the

Refuge.” In addition it is specified that vegetation should cover no less than 75% of the 74.54 acres and the plant species composition should consist of native tidal marsh species.

The vegetated interior of the Island Ponds site is overwhelmingly dominated by native vegetation therefore, the term total cover below refers to total native vegetative cover. A total of 133 quadrats were sampled across all three ponds in 2014; of which 64 were located on levee slopes and 69 on the marsh plain (pond surface) of Pond A21 (Table 3-2). Average total vegetation cover was high (>70%) in all areas which were quantitatively sampled.

Pond A21

A range between 10 and 20 quadrats were sampled in 2014 in each of the selected marsh plain areas of Pond A21, for a total of 69 quadrats on the pond surface (Table 3-2). Average total cover for Pond A21 was 71.4%, just below the final vegetation success criteria identified in the RMMP (see also Figures 7 and 8). This represents an increase of 66% from Year 7 (2012) in vegetation cover on the pond surface, where total cover was 43% (SCVWD et al. 2013; 2012 totals were a grand average). Average percent bare soil was 28.6% in 2014, a decrease of 48% from 2012 (55%). There was no litter recorded in any quadrat in 2014 on the pond surface.

Dominant species on the pond surface/marsh plain included perennial pickleweed (*Salicornia pacifica*; former name: *S. virginica*) and California cordgrass (*Spartina foliosa*). Generally perennial pickleweed was the dominant species in the western portion of Pond A21, while California cordgrass was the dominant species on the eastern portion of the pond surface/marsh plain. Where one species was dominant, the other was usually a close sub-dominant and in some areas the two species were co-dominant. Annual pickleweed (*Salicornia depressa*; former name: *S. europaea*) was a sub-dominant and occasional dominant on the eastern portion of the pond surface/marsh plain. Average maximum vegetation height was 37.1 inches (Table 3-2).

A total of 21 quadrats were sampled on the Pond A21 levees, for an average total cover of 88.6% (Table 3-2). Dominant species on the levees were California cordgrass and perennial pickleweed. Bare soil averaged 11.4% and average maximum vegetation height was 29.4 inches.

Pond A19 and A20

There were no qualifying patches of vegetation located on the pond surface in Ponds A19 or A20 in 2014; therefore, quadrat sampling in these ponds was limited to the levee slopes. Qualitative observations of both ponds in the field indicated that there are patches of California cordgrass establishing on the surface of Pond A20, with some areas of perennial pickleweed (estimated at approximately 15-20% total vegetative cover on pond surface; Figures 9 and 10); while Pond A19's pond surface is still mostly unvegetated (estimated at approximately 3-5% total vegetative cover on pond surface; Figure 11).

A total of 15 quadrats were sampled on the levee slopes of Pond A20; average total percent cover was 89% and bare soil was 8.3% (Table 3-2). A total of 28 quadrats were sampled on the Pond A19 levee slopes; average total percent cover was 82.5%, with bare soil at 8.7% and litter at 9.4%. Average maximum vegetation height was 36.4 inches in Pond A20 and 28.5 inches in Pond A19. Dominant species on the Pond A20 levee slopes were perennial pickleweed and the nonnative salsola (*Salsola soda*), while Pond A19 levee slopes were dominated by perennial pickleweed and California cordgrass. As in 2012, the special status plant (California Rare Plant

Rank 4) dwarf spikerush (*Eleocharis parvula*) was found on the mud shore of the northwest levee of Pond A19 (Figures 12 and 13).

Table 3-2: Quantitative Vegetation Sampling for 2014.

Location	Number of Quadrats	Average Total % Cover	Average % Bare Soil	Average % Litter	Average Max Vegetation Height (inches)
Pond A21 – Pond Surface Vegetation	69	71.4	28.6	0	37.1
Pond A21- levee slopes	21	88.6	11.4	0	29.4
Pond A20- levee slopes	15	89	8.3	0	36.4
Pond A19- levee slopes	28	82.5	8.7	9.4	28.5
Total & Averages, Pond Surface and Levee Slopes	133	82.9	14.3	2.4	32.9
Total and Averages, Levee Slopes Only	64	86.7	9.5	3.1	31.4

3.1.3. Wildlife Monitoring (Refuge)

Ridgway's rail monitoring – The Refuge monitored for Ridgway's rail within Pond A21 in the spring of 2014 (Figure 5). Call-count surveys were performed using USFWS protocol from levees surrounding the pond on the following dates: 14 February, 14 March, and 10 April. No rails were heard during these surveys within Pond A21 or in the surrounding outboard marshes. One Ridgway rail however, was detected within Pond A21 in July by staff from the Invasive Spartina Project (Figure 6).

3.2. OFF-SITE MONITORING

3.2.1. Accelerated Deterioration of the Town of Drawbridge (District)

In 2008, field inspectors noted large amounts of debris and litter on top of a section of the Pond A21 levee in the southeast corner, mostly along the marsh vegetation and outboard slope interface. At that time, inspection staff interpreted the deposition of litter and debris as a sign that wave action and wind related run-up had caused floating trash to transfer from the pond area onto the levee surface. To establish an ability to accurately monitor the changes, in December 2008 a surveyed benchmark was installed to assist with collecting surveying measurements at this levee location.

In December 2014, District staff performed basic surveying work to collect surface elevation data at the 8 cross sections previously identified in December 2008. The data collected are shown in Appendix B-1.

A comparison of the data collected in December 2014, October 2011 and December 2008 shows minor, yet consistent degradation of the height of levee surface, averaging less than 1 inch of lost levee material. Lateral measurements taken at this location show continued loss of earthen material along the inboard slope of Pond A21. This inboard levee slope consists of a vertical edge, approximately 2 - 3 feet in height, with debris, slumped material, and newly growing pickleweed along the toe. The offset measurements taken in this location show an

overall reduction in total levee width of a couple of inches to two feet at one cross section during the last twenty eight months. The total loss of levee width at the eight survey locations since 2008 ranges from two feet to over 4 feet at two of the cross sections.

These measurements confirm the trend shown in previous surveys that the width of the pond levee is decreasing over time, with most locations experiencing more than two feet of lost girth since 2008. At this time, the levee doesn't appear to be at risk of failure, but future evaluations should continue until the data indicates the situation is stable

4. DISCUSSION

Both aerial photography vegetation mapping and quantitative vegetation sampling in 2014 indicate that an abundance of marsh vegetation has established on the Pond A21 marsh plain since the last mapping and sampling effort in 2012. Not only has the total vegetated extent of the pond surface increased substantially, but vegetative cover has become much denser as well. There are no longer separate patches of vegetation but rather a generally continuous mosaic of marsh vegetation interspersed with mud flat of varying topography and slough channels. With approximately 110 acres of vegetated pond surface and an average of 71.4% total percent vegetation cover, Pond A21 is now very close to meeting the final success criteria for the mitigation project (75 acres at 75% vegetative cover).

Across all three ponds, sediment is continuing to accumulate and consolidate to form acceptable substrate for vegetation colonization. Ponds A19 and A20, while not yet exhibiting any qualifying vegetation patches 2 acres in size or larger, still show a substantial increase in marsh vegetation establishment on the pond surfaces since 2012. Currently 145 acres of marsh vegetation has collectively established in the three ponds, which represents a 132% increase from 2012.

Vegetation composition on the marsh plain of all three ponds continues to be dominated by several native species, including perennial pickleweed and California cordgrass, and to a lesser extent, annual pickleweed. Vegetation on pond levee shorelines was more mixed; with perennial pickleweed and California cordgrass as well as some areas showing establishment of nonnative *Salsola* and small amounts of perennial pepperweed (*Lepidium latifolium*). As sediment accretion continues, management of nonnative vegetation may need to become a priority to prevent establishment of these or other invasive species on the marsh plain. There is one vegetation patch on the south east end of the marsh plain in Pond A19 which contains a small amount of perennial pepperweed.

Although Ridgway rails were not detected during the spring surveys, one rail was detected within Pond A21 in July by staff from the Invasive Spartina Project.

Data collected from 2008 to 2014 indicates that deterioration along the inboard slope of the southeast levee of pond A21 is still occurring. While the inboard slope lost over 4 feet of girth in two locations and more than 2 feet on average in other locations, the total levee width is more than 12 feet wide at its narrowest location. Levee height measurements, however, have not changed greatly since 2009, indicating that the top of levee isn't experiencing rapid change. At this time, the levee doesn't appear to be at risk of failure, however, future evaluations and measurements are planned until the data indicates that the width of the levee has become stable.

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Island Ponds Vicinity Map

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Date Jan. 2008 Figure 1

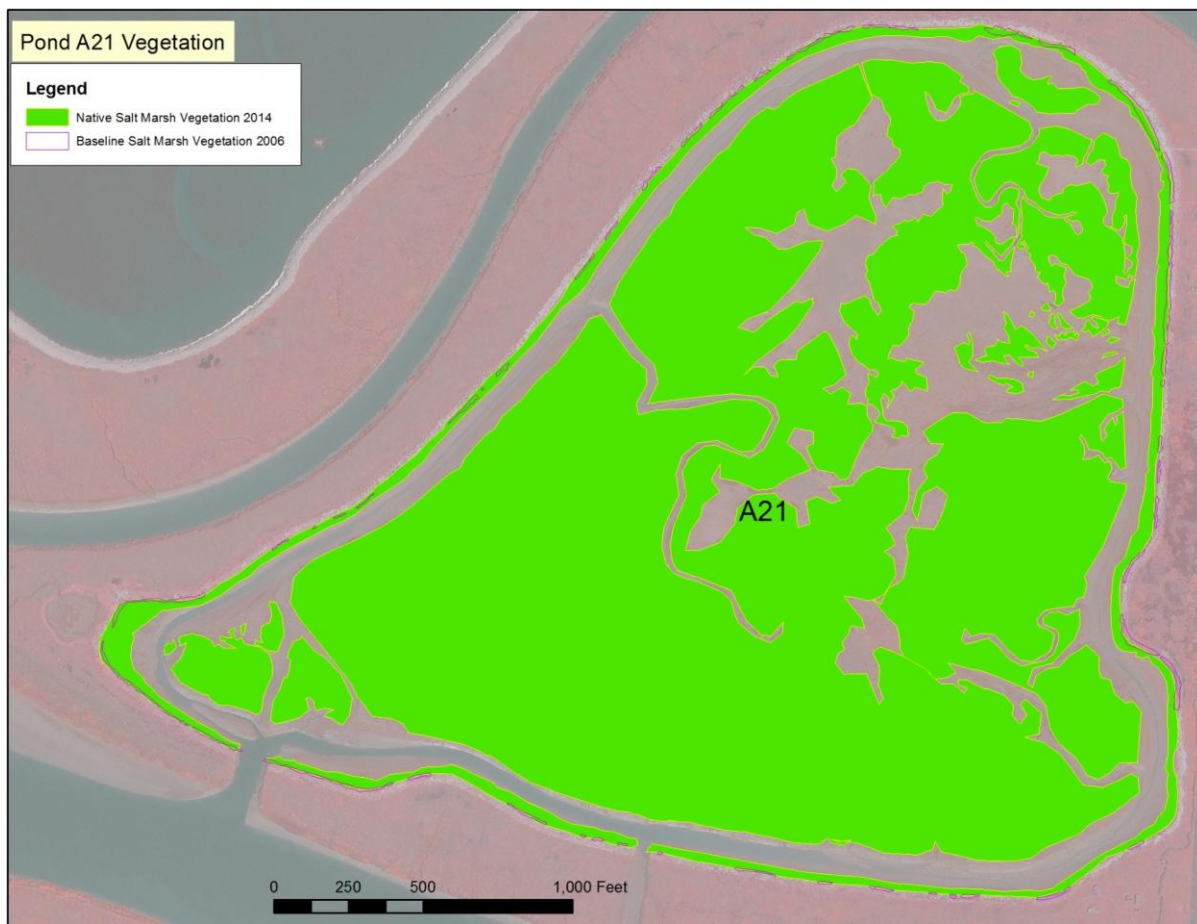


Figure 1: Vegetation Development in Pond A21 for 2014.



Figure 2: Vegetation Development in Pond A20 for 2014.

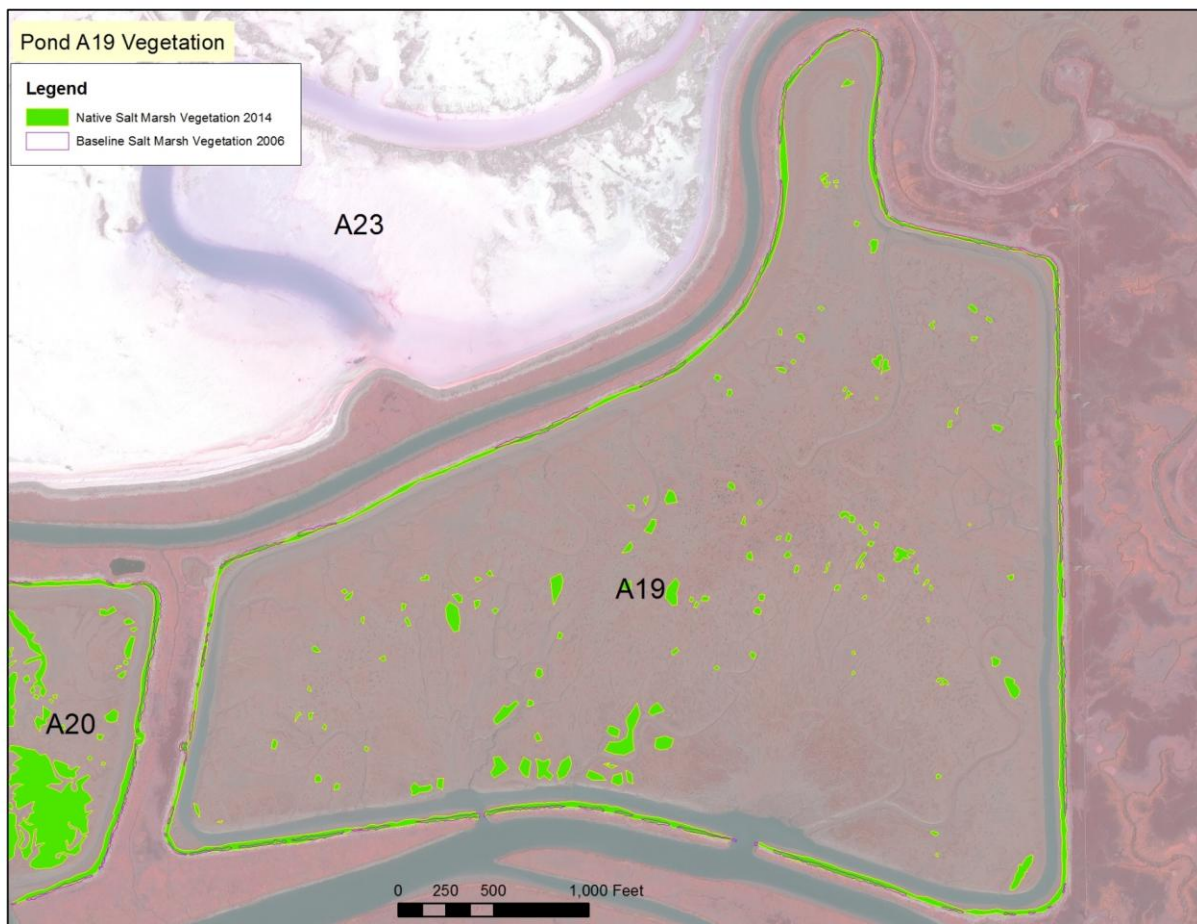


Figure 3: Vegetation Development in Pond A 19 for 2014.

Clapper Rail Call Count Stations
A21 #1-3



Figure 4: Location of clapper rail call count stations along the levee at Pond A21.

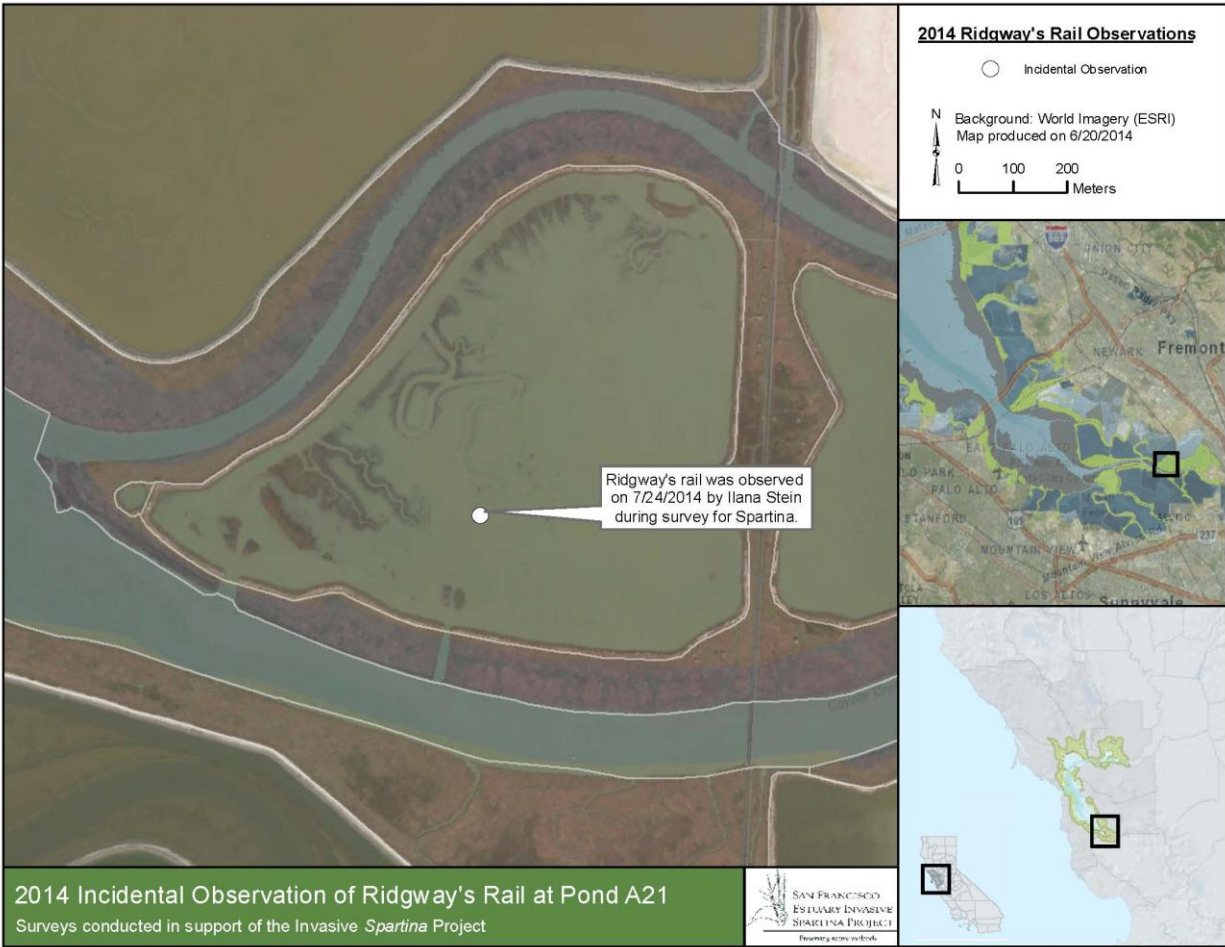


Figure 5: Location of Ridgway Rail observation in Pond A21, July 2014.



Figure 6 and 7: Pond A21 marsh plain.



Figure 7 and 8: Pond A20, pond surface and establishing marsh plain.



Figure 9: Pond A19, vegetated higher elevation patch at SE end of marsh.



Figure 10: Pond A19, dwarf spikerush (*Eleocharis parvula*), on levee shoreline. Rare Plant Rank 4.

APPENDIX A

POND A21 LEVEE EROSION DATA & PHOTOGRAPHS

Island Ponds Tidal Mitigation Project

Date of offset survey 12/01/2014. Survey data by: S. Katric, L. Porcella, R. Kaur

Notes:

1. spreadsheet represents elevations taken to monitor Pond 21 levee height where wave action appears to be overtopping southeastern corner of pond
2. Eight sections are being monitored, all within 100 +/- feet of each other
3. Wooden stakes (usually 2, 3 at one location) were installed at each section where elevations adjacent to the stakes were taken
4. Measurements were taken between stakes and the pond side edge of levee in order to monitor how quickly the pond side of the levee is eroding.
5. Photos of each section were taken to identify stake locations and section numbers.
6. A benchmark was installed using a metal "T" stake.
7. The T-stake elevation was established by surveying an "X" on the northwest railroad bridge abutment, calling the abutment elevation 10.00 (ten)
8. If RR abutment is elev 10.0, then T-stake benchmark elevation is 5.41 feet

Field Data:

Height measured at bridge (from tripod location 1) = 3.65feet
Height measured at T-stake (from tripod location 1) = 8.24feet
Calculated elevation at T-stake = 5.41feet
Height measured at T-stake (from tripod location 2) = 6.7feet

Section #	2014 Ground Surface Reading Adjacent Stake Near Pond (From Tripod Location 2)	2014 Offset Between Pond And Stake Nearest Pond (Inches)	2014 Ground Surface Reading Adjacent Stake Near Marsh (From Tripod Location 2)	2014 Offset Between Pond And Stake Nearest Marsh (Inches)
1	5.79	16.00	6.49	158
2	5.82	36.00	6.48	194
3	5.78	97.00	6.5	207
4	5.73	28.00	6.69	220
5				
6	5.70	14.00	6.6	176
7	5.58	41.00	6.58	165
8	5.35	39.00	6.67	199

Section #	2008 ground surface elevation adjacent stake near pond	2014 ground surface elevation adjacent stake near pond	change in elevation between 2008 and 2013 for stake near pond	2008 offset between pond and stake nearest pond (ft)	2014 offset between pond and stake nearest pond (ft)	change in offset between 2008 and 2013 for stake near pond	2008 ground surface elevation adjacent middle stake	2014 ground surface elevation adjacent middle stake	change in elevation between 2008 and 2013 for middle stake	2014 offset between pond and middle stake (ft)	2008 ground surface elevation adjacent stake near marsh	2014 ground surface elevation adjacent stake near marsh	change in elevation between 2008 and 2013 for stake near marsh	offset between pond and stake nearest marsh (ft)
1	6.53	6.32	(0.21)		1.33						5.69	5.62	(0.07)	13.17
2	6.31	6.29	(0.02)		3.00						5.61	5.63	0.02	16.17
3	6.32						6.43	6.33	(0.10)	8.08	5.54	5.61	0.07	17.25
4	6.39	6.38	(0.01)		2.33						5.44	5.42	(0.02)	18.33
5	6.39	12.11	5.72		0.00						5.5	12.11	6.61	0.00
6	6.44	6.41	(0.03)		1.17						5.45	5.51	0.06	14.67
7	6.68	6.53	(0.15)		3.42						5.58	5.53	(0.05)	13.75
8	6.94	6.76	(0.18)		3.25						5.49	5.44	(0.05)	16.58

NOTES/OBSERVATIONS:

1. all elevations were slightly lower indicating very minor changes in top of levee elevations
2. most offsets indicate additional loss of levee material on pond side with max loss of 1.16 feet at station 1 during the past 10 months
3. we should expect offsets between first stake and pond to continue to decrease from erosion
4. pond stake in section 5 is missing
5. marsh stake in section 6 is missing



**2008 photos of Benchmark "T-stake"
location looking northerly**



**2008 photos of Benchmark "T-stake"
location looking westerly**



2014 photo looking westerly



2014 photo looking northerly