TASMAN WETLAND MITIGATION SITE
YEAR-2 MONITORING REPORT

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EXECUTIVE SUMMARY

PERMIT NUMBERS

- United States Army Corps of Engineers (USACE) File #18881S
- Regional Water Quality Control Board (RWQCB) File #2188.07(JRW); Site No. 02-43-C0116
- California Department of Fish and Game (CDFG) Notification No. 0101-97

BACKGROUND

The Tasman Wetland Mitigation Site provides mitigation for impacts to U. S. Army Corps of Engineers (USACE) and California Department of Fish and Game (CDFG) jurisdictional areas resulting from the extension of the light rail line across several creeks and drainages, including Calabazas Creek, Stevens Creek, Sunnyvale East channel, and Sunnyvale West channel and from the construction of a levee and other features at the mitigation site. The impacts to USACE jurisdiction included 0.55 acres (ac) due to LRT construction and 0.18 ac due to the new levee for a total USACE impact of 0.73 ac, as described in the *Tasman Corridor Mitigation and Monitoring Plan* (H. T. Harvey & Associates 1997) (MMP). Impacts to RWQCB jurisdiction and associated mitigation were the same as that described for the USACE. The impacts to CDFG jurisdiction included 0.55 ac of wetland impacts plus 1.25 ac of ruderal and bare bank areas due to LRT construction. An additional 0.02 ac of CDFG jurisdiction was impacted at the mitigation site where sack concrete slope protection was placed around the culvert inlets on the inboard levee of the Guadalupe River for a total CDG impact of 1.82 ac.

To mitigate for these impacts, the USACE permit calls for the restoration of 3.2 ac of tidal wetlands at the Tasman Wetland Mitigation Site. This 3.2 ac includes 2.27 ac of ruderal uplands and 0.93 ac of non-tidal aquatic habitat (a brackish water pond). The restoration effort involves the conversion of 2.27 ac of uplands to tidal wetlands and the conversion of 1.0 ac of non-tidal aquatic habitat to tidal wetland habitat. This represents a 4.3:1 mitigation ratio (3.2 ac of wetland restoration: 0.73 ac of wetland impact). The RWQCB required the creation of a minimum of 1.46 ac of new jurisdictional wetlands to compensate for 0.73 ac of impacts to U.S. Army Corps of Engineers jurisdiction. However, due the time lapse between the LRT construction and mitigation implementation, the RWQCB subsequently required 2.22 ac of mitigation, changing the mitigation ratio from 2:1 to 3:1. The VTA's 3.2-ac site will accommodate this required acreage. The project resulted in 1.82 ac of impacts to CDFG jurisdictional areas and the MMP called for the restoration of 4.8 ac of new CDFG jurisdictional area (wetlands and uplands on levee slopes). The total area of the mitigation site is 4.8 ac and meets the CDFG jurisdictional mitigation requirements (H. T. Harvey & Associates 1999).

The goal of the wetland mitigation is to restore a fully-tidal brackish marsh similar in structure and function to the adjoining habitat along the Guadalupe River. The wetland mitigation site will be monitored annually for a period of 6 years or until attainment of the success criteria described in the MMP. An as-built plan was previously prepared after the site was constructed (H. T. Harvey & Associates 1999). Monitoring results will be compared annually to determine whether the site is meeting its performance criteria. A wetland delineation will be conducted in

Year-3. This Year-2 report summarizes the results of our biological monitoring as prescribed in the MMP.

RESULTS

The Year-2 monitoring results of the hydrologic monitoring (including sedimentation monitoring) and wetland vegetation monitoring are summarized in Table 1 and in the individual sections that follow.

Table 1. Tasman Wetland Mitigation Site Monitoring Requirements and Year-2 Results

Monitoring Parameter	Method	Final Success Criterion	Year-2 Success Criteria	Year-2 Criteria Met/Not Met	Remedial Action Required
Hydrology	Topographic Surveys	Target elevation of 4.5 feet (ft) NGVD by Year-6	None	n/a	None
	Water level datasondes	Slightly muted tides compared to Guadalupe marsh plain; tidal elevations within 0.5 ft of Guadalupe marsh plain	Slightly muted tides compared to Guadalupe marsh plain; tidal elevations within 0.5 ft of Guadalupe marsh plain	Tides are muted; not yet meeting tidal elevation criterion; elevations vary more than 0.5 ft	None
Sedimentation	Topographic surveys and feldspar plots	The majority of the site's marsh plain will aggrade to the target elevation of 4.5 ft NGVD by Year-6 by natural sedimentation processes.	Sedimentation within 15% of predicted sedimentation rate of ~0.25 ft/yr	Sedimentation is occurring but overall site-wide rates are less than 0.25 ft/yr	None
Wetland Vegetation Monitoring	Quadrat Sampling	85% cover native wetland plant species	15% cover native wetland plant species	Not met in Year-2 (0.1%)	None

Hydrologic and Sedimentation Monitoring

Hydrologic monitoring shows that the wetland mitigation site is experiencing tidal flushing twice daily and on a cycle similar to the adjacent Guadalupe River site. However, tidal amplitude within the mitigation site is muted in comparison to the Guadalupe River site. Although it remains uncertain as to how soon the tidal regime within the mitigation site will more closely approximate that in the Guadalupe River, we expect it to become more similar over time.

Topographic surveys show that the elevation of the marsh surface has increased in some locations, but not in others (i.e., surface elevation change of 0.0 to 1.4 feet [ft]). Overall, the feldspar marker horizons support the changes in elevation observed via the topographic surveys, especially those locations where increases have occurred. Interestingly, greater sediment accretion occurred in the Guadalupe River marsh in Year-2 compared to accretion within the mitigation site (where accretion rates were greater in Year-1). Within the mitigation site, the greatest sediment accretion rates were found in the northwest section of the site in the vicinity of the northern inlet channel.

Topographic surveys and feldspar sedimentation plots both show that sedimentation is occurring within the mitigation site. Although sediment accretion rates are increasing, they are not yet on the trajectory necessary to be within 15% of the rate of sedimentation specified in the MMP (i.e., 0.25 ft or 3 inches per year).

Wetland Vegetation Monitoring

Wetland vegetation monitoring continued to show little to no natural recruitment by native wetland plants in Year-2. We expect the percent cover of native wetland plants to develop as sedimentation increases and the marsh surface attains an elevation suitable for wetland plant establishment. Around the periphery of the site, it appears that the lack of native wetland vegetation may also be associated with other factors (e.g., herbivory). In partially-impounded wetlands such as the Tasman mitigation site, it is typical for wetland vegetation to establish in the inter-tidal zone (and in particular at the high tide mark where seeds and vegetative fragments strand). The fact that this has not been observed suggests that other factors, in addition to hydrology, may be responsible. Large numbers of waterfowl, particularly geese, frequent the site, and grazing by these species may inhibit the seedling establishment in the inter-tidal zone (including areas of the marsh plain and around the periphery of the basin). Perennial pepperweed (*Lepidium latifolium*) eradication was also conducted during Year-2

MANAGEMENT RECOMMENDATIONS

It is highly recommended that the area between the top and toe-of-slope of the perimeter levees continue to be monitored and managed for the presence of non-native, invasive plant species (e.g., perennial pepperweed [*Lepidium latifolium*]) and that any detected non-native species should continue to be controlled..

The mitigation site is not currently meeting the sedimentation criterion predicted in the MMP of approximately 3 inches per year (with a predicted aggradation of 1.0 ft during the first 3 years), and relatively little sedimentation is occurring over most of the marshplain. In addition, there has been no native wetland vegetation establishment over the marshplain during the first 1.5 years since the opening of the tide gates. The site was opened to tidal action in May 2009, so at the time of the Year-2 monitoring, it had only been open to tidal action for about a year and a half. It may be possible that the site just needs more time to equilibrate. It is unclear whether plant establishment is limited by hydrologic factors, grazing by avian species, or limited seed dispersal of native freshwater wetland plant species into the site. We recommend planting approximately 50- 100 trial plantings of native hardstem bulrush (*Schoenoplectus acutus*) and California tule (*Schoenoplectus californicus*) along an elevational gradient within the mitigation wetland to determine whether there is some elevation within the site at which the target freshwater wetland vegetation may successfully establish. If these plantings are successful, we then recommend jump-starting the vegetation establishment at the site by planting native wetland species at the appropriate elevations.

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REPORT COMPILATION & FIELD PERSONNEL

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INTRODUCTION

BACKGROUND

The Tasman Corridor Project, sponsored by the Santa Clara Valley Transportation Authority (VTA), involved the construction of a light rail public transit line extending from east San Jose to the City of Mountain View in Santa Clara County, California. Impacts to U. S. Army Corps of Engineers (USACE) and California Department of Fish and Game (CDFG) jurisdictional areas resulted from extension of the light rail line across several creeks and drainages, including Calabazas Creek, Stevens Creek, Sunnyvale East channel, and Sunnyvale West channel. The light rail project also crossed Coyote Creek, but was permitted separately as part of another project.

A Mitigation and Monitoring Plan (MMP) was prepared to compensate for impacts to USACE and CDFG jurisdictional areas (H. T. Harvey & Associates 1997). The MMP included a design for the restoration of approximately 3.2 ac of tidal brackish marsh and 1.6 ac of grass and ruderal ground cover along the constructed levee slopes adjacent to the west side of the Guadalupe River in northern San Jose. The goal of the wetland mitigation is to restore a fully-tidal brackish marsh similar in structure and function to the adjacent marsh along the Guadalupe River.

The mitigation site is located immediately north of State Route 237 and just west of the Guadalupe River (Figure 1). The site was previously part of the Guadalupe River before being filled with concrete rubble/soil and separated from the river by construction of a levee. The restoration design called for excavation and removal of the concrete rubble and soil to 3.0 feet (ft) NGVD, installation of four 48-inch culverts through the existing levee at an invert elevation of 0.0 ft NGVD, construction of inlet channels, and construction of a setback levee approximately 1,300 ft long connecting to the Guadalupe River levee (H. T. Harvey & Associates 1997) (Figure 2).

Wetland mitigation site excavation, culvert installation, inlet channel excavation, and rear levee construction were completed in October 1998 (H. T. Harvey & Associates 1998). However, the tide gates were initially not opened pending completion of a maintenance agreement for the new levee between the Santa Clara Valley Water District (SCVWD) and a determination that the new levee met Federal Emergency Management Agency (FEMA) and USACE requirements for flood protection. The SCVWD/VTA levee maintenance Memorandum of Understanding was completed on 18 December 2001. In 2009, an assessment was conducted to determine if the new levee met FEMA and USACE flood protection requirements (Schaaf & Wheeler 2009).

The Guadalupe levees upstream (south) of State Route 237 are certified by FEMA as protective levees against the 100-year riverine flood. However, the levee evaluation determined that the existing levees downstream of State Route 237, including the new mitigation site levee, cannot be certified by FEMA, since these levees were not designed to provide 100-year protection from coastal flooding. However, these levees do protect against the 100-year riverine flood. Since FEMA's regulations cannot be met for the existing SCVWD levees or the VTA mitigation site, the USACE criteria was used as the basis of determining adequacy of the VTA levee.

The levee evaluation determined that the VTA levee meets the USACE geotechnical requirements (Schaaf & Wheeler 2009). It is anticipated that with the tide gates open, the VTA levee will take the place of the Guadalupe River levee for providing flood protection to the neighboring properties. The studies indicate that the protection provided will equal or exceed the protection provided by the Guadalupe River levee. VTA opened the culvert screw gates introducing tidal action to the site on 28 May 2009 immediately following the results of the levee evaluation.

BASIS OF DESIGN AND ECOLOGICAL MONITORING

Basis of Design

The mitigation design called for the installation of culverts at 2 locations through the Guadalupe River levee to introduce tidal flows and sediment transport to the site and thereby restore abiotic conditions suitable for the establishment of tidal brackish marsh habitat. The site was intentionally excavated to approximately 1.6 ft below expected, equilibrium marsh plain elevations to remove imported fill and debris and to allow sedimentation processes to naturally build a suitable marsh plain for wetland vegetation establishment. The average as-built elevations of the site were 2.9 ft NGVD29 and the marsh plain is expected to accrete to approximately 4.5 ft NGVD29, comparable to marsh plain elevations within the adjacent Guadalupe River which average 5.0 NGVD 29 (H. T. Harvey & Associates 1997). Accretion to target marsh plain elevations is expected to take approximately 6 years given the suspended sediment loads within the Guadalupe River (H. T. Harvey & Associates 1997). The ecological monitoring program summarized below is tailored to test the assumptions of the basis of design and determine if the mitigation goal to restore high quality tidal brackish marsh habitat is achieved.

Ecological Monitoring

The wetland mitigation site will be monitored annually for a period of 6 years or until attainment of the success criteria described in the MMP. Monitoring results will be compared annually to determine whether the site is meeting its performance criteria. A biological as-built report was prepared after the site was constructed (H. T. Harvey & Associates 1999).

Ecological monitoring requirements include hydrologic monitoring, vegetation monitoring, and avian surveys. Hydrologic monitoring comprises a visual assessment of the slough channels, topographic surveys, sedimentation monitoring using feldspar plots, and water-level monitoring. Vegetation monitoring includes a quantitative assessment of average percent cover of native wetland species, natural recruitment, and an assessment of the presence of invasive species. Avian monitoring comprises surveys to quantify species richness and abundance and an assessment of bird community similarity between the mitigation site and the adjacent tidal wetlands within the Guadalupe River. Baseline avian monitoring was conducted in Year-1 and follow-up surveys will be conducted in Years 3 and 6. The following report describes the Year-2 hydrologic and vegetation monitoring.

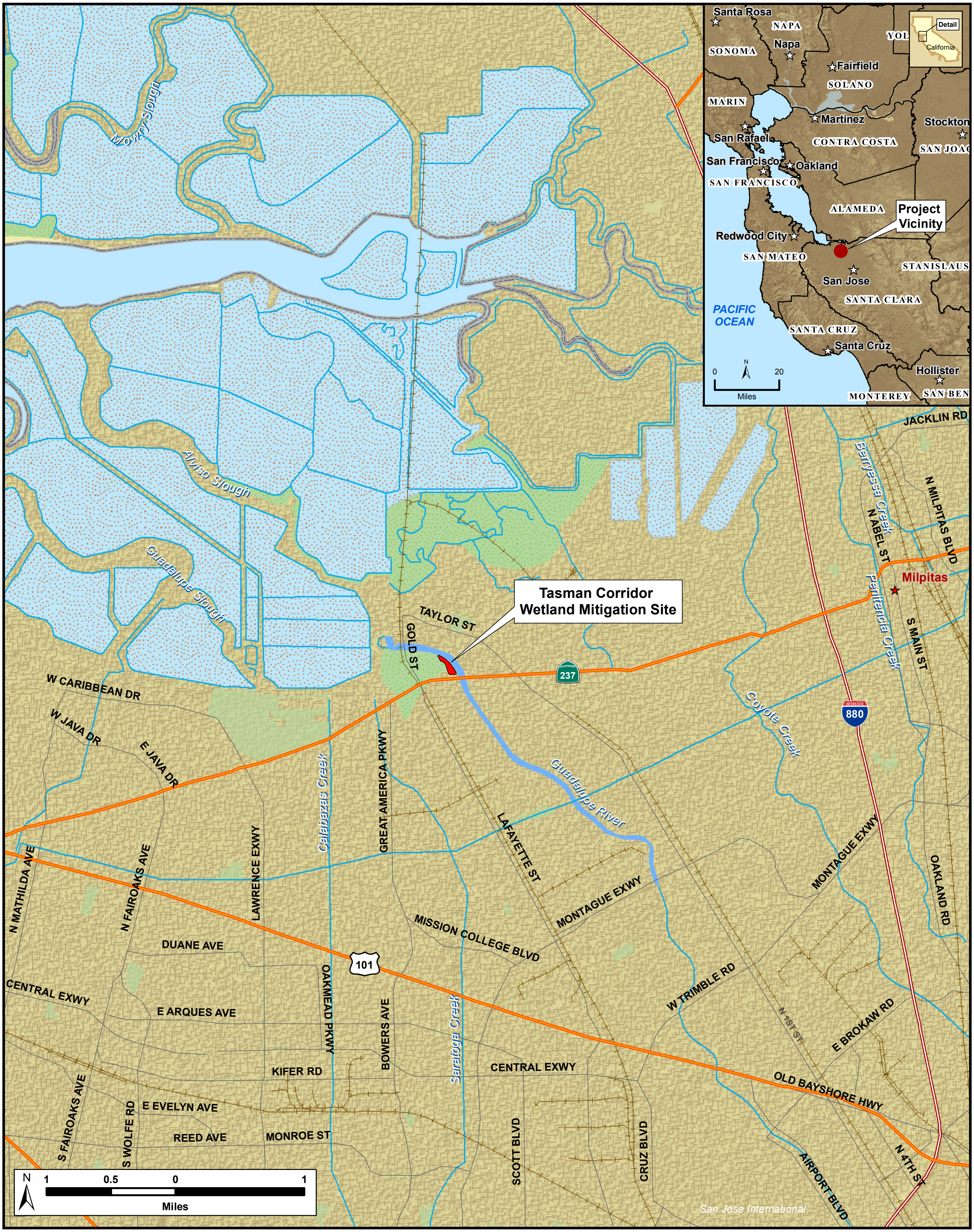

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Figure 1: Vicinity Map
Tasman Corridor Wetland Mitigation Project - Year-1 Monitoring Report (2506-10)
June 2011

N:\Projects\2506-10\Reports\MMP Report

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Figure 2: Site Map

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METHODS

HYDROLOGIC MONITORING

Hydrologic monitoring included a general hydrologic inspection, topographic surveys, water level monitoring, and sedimentation monitoring using feldspar plots. Methods for each of these monitoring elements are described below.

General Hydrology Inspection

Low tide inspections of the constructed inlet channels were made during visits to the site to collect topographic surveys, water level data, and wetland vegetation data. The channels were inspected for areas of sedimentation, slumping, or areas of significant erosion.

Feldspar Marker Horizon Plot Monitoring

H. T. Harvey & Associates installed sedimentation monitoring plots at the mitigation site in 2009 (Figure 3). Feldspar marker horizon plots (0.25 square meters [m^2]) were installed to measure short-term vertical accretion (Cahoon and Turner 1989; Ball 2005). On 2 September 2009, seven feldspar plots were established within the wetland mitigation site and three sites were established in the natural marsh adjacent to the Guadalupe River. These sites were added as an additional monitoring measure to determine whether differences in sedimentation patterns exist between the 2 marshes. Measurements were taken at these sites at 1, 2, 3, 9, and 12 months.

Topographic Surveys

On 14 January 2011, topographic surveys were conducted by E. Mayence and C. Jensen along longitudinal transects within the wetland mitigation site and along each of the 2 inlet channels. Six cross-sections were surveyed within the site, and a longitudinal profile and 3 cross-sections were surveyed at each inlet channel (Figure 3). The start and end of each cross-section was marked with previously installed t-posts or PVC poles, and a measuring tape was pulled taut between these 2 points. Elevations were measured using a laser level and stadia rod along the tape at the start and end of each transect, at the toe-of-slopes, the edge and centerline of channels, and at grade breaks. On cross-sections 1, 2, and 3, there were inundated areas where the water depth precluded the use of a laser level and stadia rod. For these areas, the laser level and stadia rod were used to survey a point at the water's edge to determine the water level elevation. Then water depth readings were measured at 10-ft intervals from a boat using a measuring tape with a weighted bottom. The water depth readings were then subtracted from the water level elevation to determine the sediment surface elevation at each point along the inundated portion of each transect. All of the surveys were tied into local benchmarks provided by RJA & Associates and translated into NGVD29. These surveys were compared to past results to document sedimentation and/or scour within the site or along the constructed inlet channels during the first year after the tide gates were opened.

Water Level Monitoring

Water level data was collected to determine the difference in hydrologic function between the wetland mitigation site and the Guadalupe River. Water level monitoring was conducted utilizing 2 continuous water level recording YSI datasondes (Model 6920) over a 9-day period from 10 June to 18 June 2010. The datasonde locations are shown on Figure 3; the surveyed elevations of the ground surface for each datasonde are included in Table 2.

Table 2. Surveyed Elevation of the Ground Surface for the Datasondes

STATION	ELEVATION (FT) (NGVD 29)
Station 1 Tasman Wetland Mitigation Site	-3.80
Station 2 Guadalupe River Site	-1.01

Datasondes. Two YSI datasondes (Model #6920) were installed by H. T. Harvey & Associates wetland ecologists D. Ball and B. Cleary on 10 June 2010 on a low tide of -1.02 ft NGVD29; one at the wetland mitigation site and one on the Guadalupe River site. The datasondes were removed on 18 June 2010 and the data downloaded. This time interval was chosen because it represented a typical summer tidal series in contrast to the spring tidal series chosen in Year-1. The datasondes utilize a differential strain gauge transducer to measure pressure with one side of the transducer exposed to water. On 18 June 2010, the elevation of transducer of each datasonde was surveyed to NGVD 29. The datasondes *in situ* data logging capacity allows for the downloading of data via a cable, which is located inside a protective enclosure, above the highest water level. The data logger was programmed to record one measurement every 10 minutes.

As in Year-1, one datasonde was installed at the interior of the mitigation site (Station 1), and the other near the adjacent Guadalupe River marsh under the State Route 237 bridge (Station 2) (Figure 3). These station locations were selected to compare water level fluctuations within the mitigation site to the Guadalupe River, and to discern the level of muting, if any, of the tidal amplitude by the site's culverts/inlet channels. The datasondes were installed using the same hardware and methodology described in the Year-1 Monitoring Report (H. T. Harvey & Associates 2010), and all elevation data were converted to NGVD 29 to compare to survey elevation data for the mitigation site and the Guadalupe River site.

WETLAND VEGETATION MONITORING

H. T. Harvey & Associates wetland ecologists D. Ball and E. Mayence conducted vegetation monitoring on 8 September 2010, near the end of the growing season. Percent cover of native wetland species was quantitatively evaluated in the mitigation wetland.

Percent Vegetative Cover of Native Wetland Species

The average percent cover by plant species was estimated within the wetland using the quadrat method (Bonham 1989). Six permanent transects were randomly established within the wetland mitigation area. Sampling was conducted using a 1 m^2 quadrat placed at random locations along these 6 permanent transects using a stratified-random design. Vegetation transect locations are shown in Figure 4.

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Figure 3: Sedimentation and Water Level Monitoring Locations

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Figure 4: Photo Points and Vegetation Transects Map

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Approximately 0.5% of the mitigation site surface (quadrat number n = 70) was sampled. Percent vegetative cover of each species observed was visually estimated within each quadrat to the nearest 1%. Total vegetative percent cover, percent cover of each species, and percent cover of bare ground and litter were collected. Slough channels were not included in the percent cover calculations, as these areas were originally designed to support little or no vegetation. Following data collection, the relationship between cumulative average percent cover and quadrat number was evaluated to determine if the sample size was adequate (Kershaw 1973). Plant species encountered within the quadrats were identified to species using *The Jepson Manual* (Hickman 1993).

Natural Recruitment

Qualitative surveys were conducted throughout the wetland mitigation site, along the channels, and along the upland/wetland interface to detect naturally recruiting plant species. The plant species and approximate locations of natural recruitment were noted.

Presence of Invasive Plant Species

Surveys were conducted throughout the wetland mitigation site to determine the presence of invasive plant species.

PHOTO-DOCUMENTATION

Photographs were taken from 12 fixed photo-documentation points on 8 September 2010 using a digital camera. Photos were taken during a low tide event. Figure 4 shows locations of the photo-documentation points.

AVIAN MONITORING

Wildlife monitoring is intended to determine if the site is functioning as a healthy and productive seasonal wetland. The MMP specified that avian surveys would be conducted each year during winter, spring, summer, and fall. Based on a request from VTA, a reduced level of avian surveys was proposed for Years 1, 3, and 6. To augment the less frequent monitoring schedule and to compare function within the restored marsh to a reference marsh, avian surveys in the adjacent Guadalupe River marsh were conducted in Year 1 and will be conducted in Years 3 and 6. Therefore, no avian monitoring was conducted in Year 2.

RESULTS AND DISCUSSION

HYDROLOGIC MONITORING

General Hydrology Inspection

The mitigation site and both inlet channels were inspected for erosion and/or bank slumping. No significant erosion or slumping was observed within the mitigation site. Considerable slumping and channel reshaping has occurred, however, in the inlet channels connecting the mitigation site and the Guadalupe River. Such slumping and reshaping is expected as each of the inlet channels matures and takes on a more natural morphology. The extent of reshaping of the inlet channels is reflected in the topographic survey data in Appendix B (Figures B1 – B12).

Feldspar Marker Horizon Plot Sampling

The feldspar sedimentation plots clearly show that sedimentation is occurring both within the mitigation site and along the Guadalupe River. Within the mitigation site, an average of 13.4 millimeters (mm) (0.52 in) of sediment has accumulated over the past 12 months (Table 3). The average of 22.2 mm (0.87 in) observed along the Guadalupe River outside the mitigation site over the past 12 months was greater than that observed within the mitigation site (Table 3). Considerable variation in sedimentation between feldspar plots was observed within both the mitigation and Guadalupe River sites.

Within the mitigation site, the greatest sediment accumulation continued to occur in the vicinity of the northern/downstream inlet channel (i.e., feldspar plots 1, 2, 3, and 7); the least sediment accumulation is associated with plot 6 in the southwest corner of the site (Figure 3). The higher sedimentation in plots 1, 2, 3, and 7 generally correspond to slight increases in elevation in these areas as noted in the topographical surveys (Appendix B; Figures B1 – B12). Differences in the results between the feldspar marker horizon plot results and the topographic survey results can be attributed to the fact that there are fewer feldspar marker horizon plots, and that each of these plots measures sediment accumulation in a discrete location, whereas the topographic surveys measure elevation along a transect of considerable horizontal distance.

For the Guadalupe River plots, sediment accumulation was also greater in the vicinity of the northern inlet channel (i.e., plots 8 and 10) compared to plot 9, which is located near the southern inlet channel (Figure 3). These differences are not only similar to the geographic pattern of sediment accumulation observed within the mitigation site (i.e., greater near the northern inlet channel), but are suggestive of greater tidal flushing (and scouring) for the northern compared to the southern inlet channel.

Table 3. Feldspar Sedimentation Results for the Tasman Wetland Mitigation Site

LOCATION	SEDIMENTATION (AT SPECIFIC MONITORING TIMES; UNITS OF MM)							
	Month 1	**Month 2**	**Month 3**	**Month 9**	**Month 12**	**Average in Year 2 (for 12 month period)**	**Average in Year 1 (for 6 month period)**	**Difference Between Year 1 and Year 2**
Tasman Plots								
1	0.7	14.0	17.0	5.0	11.0	9.5	10.6	-1.1
2	0.0	10.0	17.3	15.8	23.5	13.3	9.1	4.2
3	0.8	12.8	7.0	16.0	12.5	9.8	6.9	2.9
4	0.7	17.0	2.8	11.0	9.5	8.2	6.8	1.4
5[1]	no reading	no reading	no reading	trace	no reading	N/A	n/a	n/a
6	0.5	4.0	4.0	11.0	4.8	4.9	2.8	2.1
7	0.5	16.5	21.3	13.5	19.0	14.2	12.8	1.4
Average of all Tasman feldspar plots (total average is based on the average of the all readings at Month 12).						**13.4 (0.52 in)/ 12 mo.**	**11.6 (0.43 in)/ 6 mo.**	**1.8**
Guadalupe River Plots								
8	0.1	7.3	6.5	21.5	24.3	11.9	**4.6**	7.3
9	0.0	2.0	2.0	22.3	17.0	8.7	**1.3**	7.4
10	0.1	9.3	Site not found[2]	21.5	25.5	14.1[3]	**4.7**[2]	9.43
Average of Guadalupe River Plots						**22.2 (0.87 in)/ 12 mo.**	**3.4 (0.13 in)/ 6 mo.**	**18.8**

[1] Sedimentation plot 5 was submerged; no data was collected.
[2] Dense vegetation precluded site from being located.
[3] This average is based on only 2 samples.

Topographic Surveys

The results of the topographic surveys for the wetland mitigation site and the inlet channels are shown in Appendix B (Figures B1 – B6). Year-2 topographic surveys show that the wetland mitigation site is demonstrating varying degrees of elevation gain across the marsh plain, with change ranging from 0.0 to increases of 1.4 ft between 2009 and 2011. Sedimentation is particularly evident in the constructed tidal channel in the vicinity of cross-sections 3, 4, and 5. The elevation of the center of the channel has increased 1.16 ft since the opening of the tide gates in 2009. There was also an elevation gain of approximately 1 ft in the depressions on the eastern ends of cross-sections 1 and 3 between 2009 and 2011. In contrast, slight elevation loss is evident at various points along cross-sections 1 and 2. It should be noted, however, that such decreases in elevation could stem from slight deviations in the sampling method, as these areas are inundated too deep to perform the topographic surveys with a laser level and stadia rod. As a result, the surveys for these cross-sections were performed by taking water depth readings from a small boat.

The upstream and downstream inlet channels transmit tidal outflows from the mitigation site culverts to the Guadalupe River. These inlet channels were initially excavated during mitigation site construction, but were almost completely refilled with naturally deposited sediment between 1998 and the opening of the tide gates in 2009. The inlet channel surveys show substantial natural scour and enlargement of these slough channels from 2009 to 2010 and again from 2010 to 2011 (Appendix B; Figures B7 – B12). This trend in Year-2 (2010-2011) is most noticeable in the upstream inlet channel where all 3 cross-sections show substantial channel scouring and slumping (Appendix B; Figures B10 – B12. The observed inlet channel enlargement process is anticipated as the channel geometry equilibrates to the tidal outflows from the mitigation site.

The performance criterion for overall sedimentation at the site states that sedimentation should be within 15% of the sedimentation predicted in Figure D-9 of Appendix D of the MMP (H. T. Harvey & Associates 1997). This would target a sedimentation rate of approximately 0.25 ft or ~3 inches (76.2 mm) per year, with a predicted aggradation of 1.0 ft during the first 3 years. Despite localized sediment accumulation in excess of the 0.25 ft/yr sedimentation goal (e.g., 0.3 – 1.5 ft increase in the main creek channel), much of the marsh plain shows relatively little sediment accumulation. In some cases, there has actually been a slight loss of sediment from the marsh plain. Some sediment accumulation is occurring in the slough channels, but this may be the result of sediment transport from the marsh plain into these channels on outgoing tides. (Appendix B, Figures B-1–B6). It may also be possible that the current tidal regime is not sufficiently robust for the sediments to be transported from the creek channel onto the marsh plain within the mitigation site.

During the topographic surveys, elevation data were randomly sampled within the mitigation site and the adjacent Guadalupe River marsh. The average elevation of these random sampling areas within the mitigation site ranged from -0.18 ft NGVD29 to 3.43 ft NGVD 29, with an average elevation of 2.42 ft NGVD29 (n = 11). The average elevation within the Guadalupe River marsh ranged from 2.39 ft NGVD29 to 4.84 ft NGVD29, with an average elevation of 3.95 ft NGVD29 (n = 7). Based on the spot surveys, the average elevation of the wetland mitigation site is approximately 1.5 ft below that of the adjacent Guadalupe River marsh.

In addition to the random sampling survey areas, the average elevation was calculated for the survey data collected during the topographic surveys. The elevation of all points collected from the topographic surveys (excluding the ponded areas and the slough channels) were averaged for each of the years that the surveys have been performed. The 2009 average is the average before the tide gates were opened. The average of these monitoring surveys shows an approximate elevation of the site of 1.9 ft NGVD29 (Table 4). The as-built elevation for the mitigation site was reported as 2.9 ft NGVD29 (H. T. Harvey & Associates 1999). It is unclear if this difference is due to survey error during annual monitoring or during the initial surveys. The annual monitoring appears to be consistent between years, so the difference may be due to interpretation of the initial survey data or benchmarks. Despite this difference between the reported as-built elevation and the topographic survey data, the topographic data shows the site generally maintaining a consistent average elevation of the entire site between the opening of the tide gates in 2009 and the early spring surveys in 2011 and that significant elevation change is not occurring at the site.

Table 4. Annual Average of Topographic Survey Data (2009-2011)

2009 AVERAGE OF TOPOGRAPHIC SURVEY DATA FOR THE ENTIRE SITE (FT NGVD 29)	2010 AVERAGE OF TOPOGRAPHIC SURVEY DATA FOR THE ENTIRE SITE (FT NGVD 29)	2011 AVERAGE OF TOPOGRAPHIC SURVEY DATA FOR THE ENTIRE SITE (FT NGVD 29)
1.95	1.87	1.90

Water Level Monitoring Using Datasondes

Water levels were calculated in NGVD29 based on the surveyed elevations. The results of water levels for both Station 1 (Tasman Wetland Mitigation Site) and Station 2 (Guadalupe River site) in NGVD29 are shown in Figure 5.

The MMP's performance criterion specifies that tides within the mitigation site should only be slightly muted compared to tides on the Guadalupe River marsh plain. It also stipulates that high tide water surface elevation in the mitigation area should not deviate from that in the Guadalupe River by more than 0.5 ft (H. T. Harvey & Associates 1997). As is visible in Figure 5, the mitigation site has yet to achieve either performance criterion. The elevation at the lower end of the tidal range increased from approximately -0.5 ft in 2009 to approximately 0.0 ft in 2010. This increase is attributed to sediment accumulation in the channel where the datasonde was positioned (refer to Appendix B; Figures B-4 and B-5). As a result, the tidal signature continues to be muted, particularly at low tide. The criterion also states that the tidal elevations should not vary by more than 0.5 ft. In 2010, tidal elevations exceeded the 0.5 ft similarity criterion.

The 2010 water level results demonstrate that the mitigation site (Station 1) experiences daily tidal flushing via 2 high and 2 low tides each day. The results also show that the tidal range of the mitigation site differs from the Guadalupe River site (Station 2) (Figure 5). The tidal amplitude within the mitigation site is muted in comparison to the Guadalupe River site, particularly during the lower high tide event each day. The truncated lower tide water levels at the Guadalupe site indicate that the channel is fully drained at low tide, whereas channels within the wetland mitigation site do not fully drain at low tide (Appendix A; Photo A-14). However, Figure 5 indicates a higher water level in the Tasman site compared to the Guadalupe River site. This is unlikely, and the discrepancy is probably due to a survey error during the datasonde installation; the sediment in the channel where the datasonde is highly unconsolidated, making it difficult to accurately position the stadia rod to determine the channel bottom elevation.

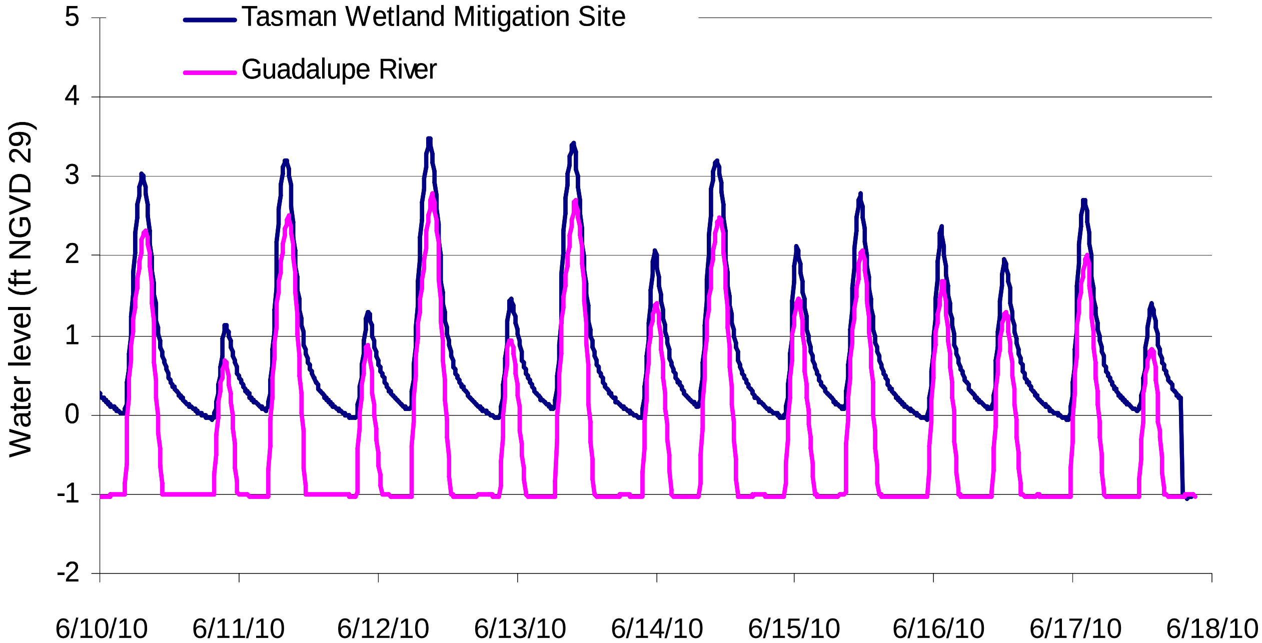

Figure 5. Continuous Water Level Measurements (NGVD 29) - Comparison of the Tasman Wetland Mitigation and Guadalupe River (Reference) Sites.

WETLAND VEGETATION

Percent Cover of Native Wetland Vegetation

No native wetland plants fell within the sampling quadrats (Table 5) during Year-2 vegetation monitoring. Total percent cover of vegetation in Year-2 was 2.9% and was composed of non-native vegetation. Curly dock (*Rumex* sp.), a non-native wetland indicator species (Reed 1998), was one of the few live plants observed within the mitigation site.

The site's final success criteria specify that the wetland mitigation site is required to achieve 85% cover by obligate, facultative wetland, and facultative wetland species by Year-6 and that the 85% cover should be dominated by native species. The percent cover performance criterion for Year-2 is 15% cover by native wetland vegetation (H. T. Harvey & Associates 1997). The wetland mitigation site falls well short of the Year-2 percent cover criterion, as no native wetland vegetation was observed within the monitoring quadrats (0.1% cover). The percent cover of wetland vegetation in Year-2 is lower than Year-1, but this can be attributed to the removal of non-native pepperweed between Years 1 and 2.

Based on the degree of tidal flushing and the proximity of native vegetation immediately outside the inlet channels along the Guadalupe River, it is surprising how little vegetation has successfully established within the mitigation site. The lack of cover of native wetland plants in Year-2 is likely attributed to several factors including: 1) the site's low elevation with respect to the tidal range of the site, 2) the season when the tide gates were opened, which likely had a greater effect in Year-1 but may still be partially influential, and 3) seed and seedling herbivory by resident waterfowl, notably geese, and other non-resident waterfowl which frequent the site.

Although the site is lower in the tidal range compared to the reference marsh on the Guadalupe River flood plain, only the channels and deeper pools remain flooded at low tide. While it is possible that the level of flooding could preclude vegetation from becoming established on the marsh plain, it would not necessarily prevent vegetation from becoming established along the levee slopes within the site in the approximate vicinity of the high tide mark. The area in the vicinity of the high tide mark is generally one of the first areas to vegetate in partially-impounded wetlands because the hydroperiod is suitable for wetland plant establishment and this is the location where seeds and vegetative fragments are most likely to strand. The fact that no vegetation exists in the vicinity of the high tide mark suggests that herbivory, may be in part responsible for the lack of native wetland plant establishment. Despite the slow start, we expect native wetland plant cover to increase in future years assuming that the marsh plain accumulates sediment to elevations suitable for wetland plant establishment. Increased vegetation establishment may also assist in long-term sediment accumulation.

Table 5. Average Percent Cover by Species Vegetation Occurring in the Tasman Wetland

COMMON NAME	SCIENTIFIC NAME	WETLAND INDICATOR STATUS[2]	NATIVE OR NON-NATIVE	2009 AVERAGE PERCENT COVER OF ALL VEGETATION (YEAR-1)	2010 AVERAGE PERCENT COVER OF ALL VEGETATION (YEAR-2)
Ruderal[1]	n/a	n/a	n/a	1.4	2.8
Smilo grass	*Piptotherum milaeceum*	n/a	Non-native	0.1	0.0
Dock	*Rumex crispus*	FACW-	non-native	0.7	0.1
Perennial pepperweed	*Lepidium latifolium*	FACW	non-native	8.9	0.0
Dead/thatch	n/a	n/a	n/a	20.0	0.8
Mud	n/a	n/a	n/a	48.8	77.3
Water	n/a	n/a	n/a	20.1	19.0
Total Average Percent Cover of all Vegetation (does not include dead vegetation, mud, or water)				**11.1**	**2.9**
Total Average Percent Cover Wetland Species (as described by the Wetland Indicator Status)				**9.6**	**0.1**

[1] Ruderal includes a mix of weedy plants with each species in amounts too small to quantify.
[2] Wetland indicator status taken from Reed (1988). FACW = facultative wetland plant.

Natural Recruitment

No natural recruitment of native wetland plant species was noted during Year-2 vegetation monitoring.

Invasive Species

In contrast to the 9% cover of perennial pepperweed (*Lepidium latifolium*) (an invasive wetland plant species) documented in Year-1, invasive plant species including perennial pepperweed occurred at a very low abundance in Year-2 (Table 4). Perennial pepperweed was sprayed at the site in July and August. Isolated populations of pepperweed continue to exist around the periphery of the mitigation site and along the Guadalupe River and will continue to serve as source populations for introduction to the mitigation site. Therefore, continued active management to limit extensive colonization by this species will be necessary.

The MMP (H. T. Harvey & Associates 1997) includes a final success criterion of 85% cover of wetland vegetation, dominated by native plant species. It also states that,

> "an evaluation of the establishment of exotic pest plants such as giant reed and perennial pepperweed. Recommendation for eradication of undesirable vegetation will be included in the annual monitoring report if the pest plants threaten the habitat values of the site."

Although perennial pepperweed has been controlled this year within the mitigation site, its presence should be monitored closely because it is a heavy seed producer and highly adapted to wetland settings. In the event it is encountered, it should be controlled on the marsh plain and levee slopes via a combination of weed whacking and herbicide treatment. A certified pest control advisor should be contacted to provide specific recommendations on the treatment of this and similar species.

Site Maintenance

Site maintenance was good in Year-2. Invasive wetland plant species should, however, continue to be monitored and controlled to ensure the successful establishment of the desired native wetland plant community.

PHOTO-DOCUMENTATION

Selected photos taken during monitoring are included in Appendix A.

MANAGEMENT RECOMMENDATIONS

The Project's MMP requires that recommendations for removal of undesirable vegetation be included in the annual monitoring report if the pest plants threaten the habitat values of the site (H. T. Harvey & Associates 1997). Because the site is largely devoid of vegetation, the potential is high for rapid colonization by non-native, invasive plant species. To prevent this from occurring, and to increase the potential for colonization by native wetland species, the mitigation site should be periodically monitored and maintained in Year-3 to preclude non-native, invasive species establishment. In the event that non-native, invasive species such as perennial pepperweed are observed, a certified pest control advisor should be contacted to provide specific treatment recommendations.

The mitigation site is not currently meeting the sedimentation criterion predicted in the MMP of approximately 3 inches per year (with a predicted aggradation of 1.0 ft during the first 3 years), and relatively little sedimentation is occurring over most of the marshplain. In addition, there has been virtually no native wetland vegetation establishment over the marshplain during the first 1.5 years since the opening of the tide gates. It is unclear whether this lack of vegetation establishment is due to hydrologic factors or other factors such as grazing by bird species. The site was opened to tidal action in May 2009, so at the time of the Year-2 monitoring, it had only been open to tidal action for about a year and a half. It may be possible that the site just needs more time to equilibrate. It is unclear whether plant establishment is limited by hydrologic factors, grazing by avian species, or limited seed dispersal of native freshwater wetland plant species into the site. We recommend planting approximately 50- 100 trial plantings of native hardstem bulrush (*Schoenoplectus acutus*) and California tule (*Schoenoplectus californicus*) along an elevational gradient within the mitigation wetland to determine whether there is some elevation within the site at which the target freshwater wetland vegetation may successfully establish. If these plantings are successful, we then recommend jump-starting the vegetation establishment at the site by planting native wetland species at the appropriate elevations.

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APPENDIX A.
Photo-Documentation Taken on 8 September 2010
During a Low Tide Event

May 2009 | September 2009 | September 2010



A-1. Photopoint 1

May 2009 | September 2009 | September 2010



A-2. Photopoint 2

May 2009 | September 2009 | September 2010



A-3. Photopoint 3

May 2009 | September 2009 | September 2010



A-4. Photopoint 4

May 2009 September 2009 September 2010

A-5. Photopoint 5

May 2009 September 2009 September 2010

A-7. Photopoint 6

May 2009 September 2009 September 2010

A-8. Photopoint 7

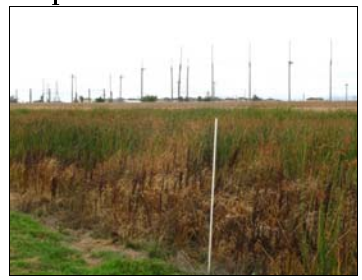
May 2009 September 2009 September 2010

A-9. Photopoint 8

May 2009

September 2009

September 2010



A-10. Photopoint 9

May 2009

September 2009

September 2010

A-11. Photopoint 10

May 2009

September 2009

September 2010

A-12. Photopoint 11

May 2009

September 2009

September 2010

A-13. Photopoint 12

APPENDIX B
Topographic Cross-Section
Survey Results

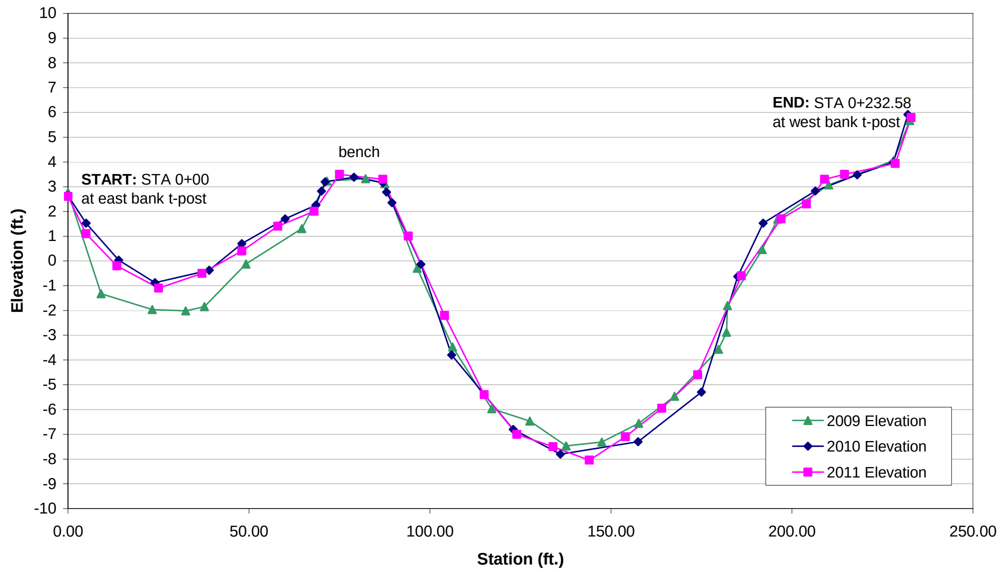


Figure B-1. Wetland Mitigation Levee; Cross-Section 1

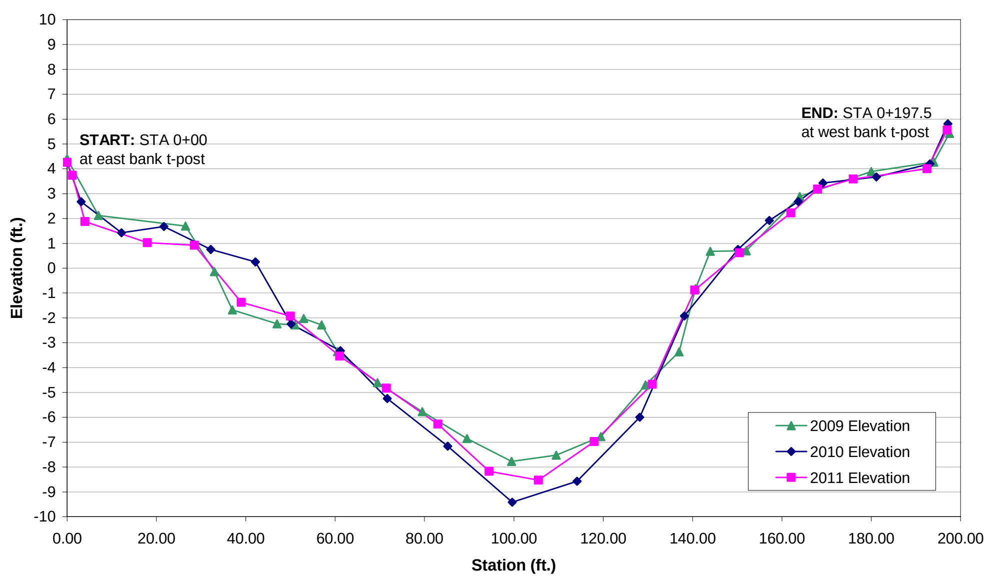


Figure B-2. Wetland Mitigation Levee; Cross-Section 2

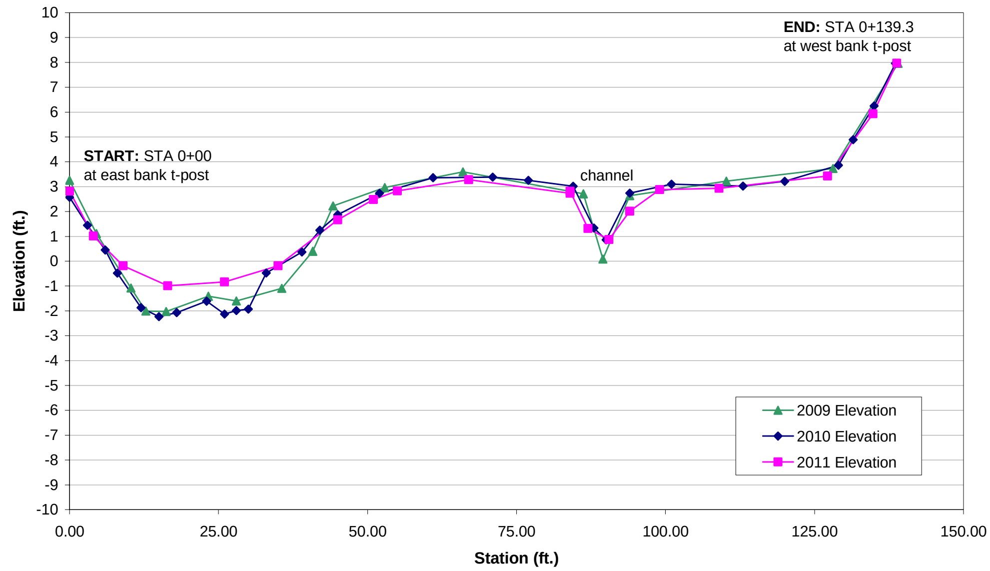


Figure B-3. Wetland Mitigation Levee; Cross-Section 3

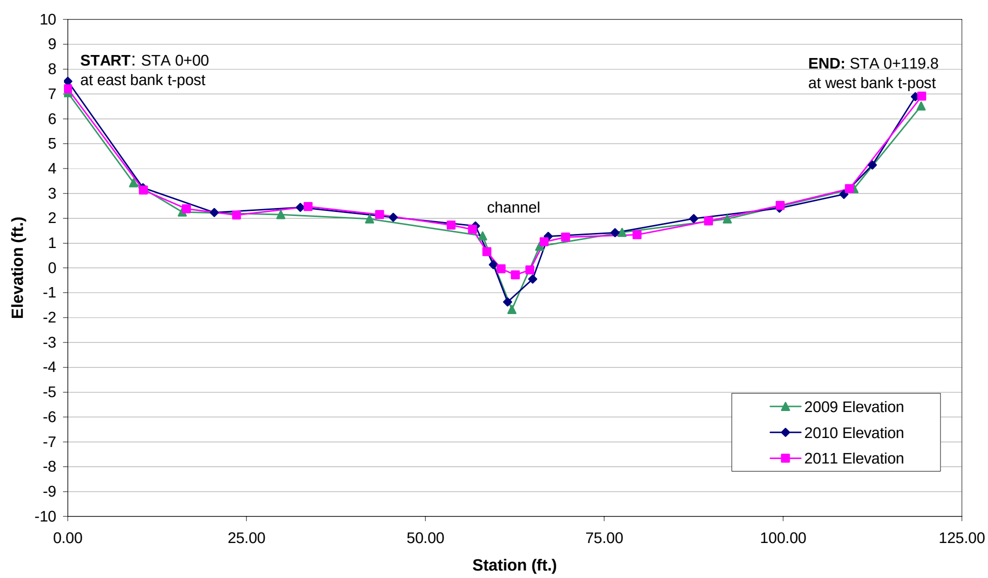


Figure B-4. Wetland Mitigation Levee; Cross-Section 4

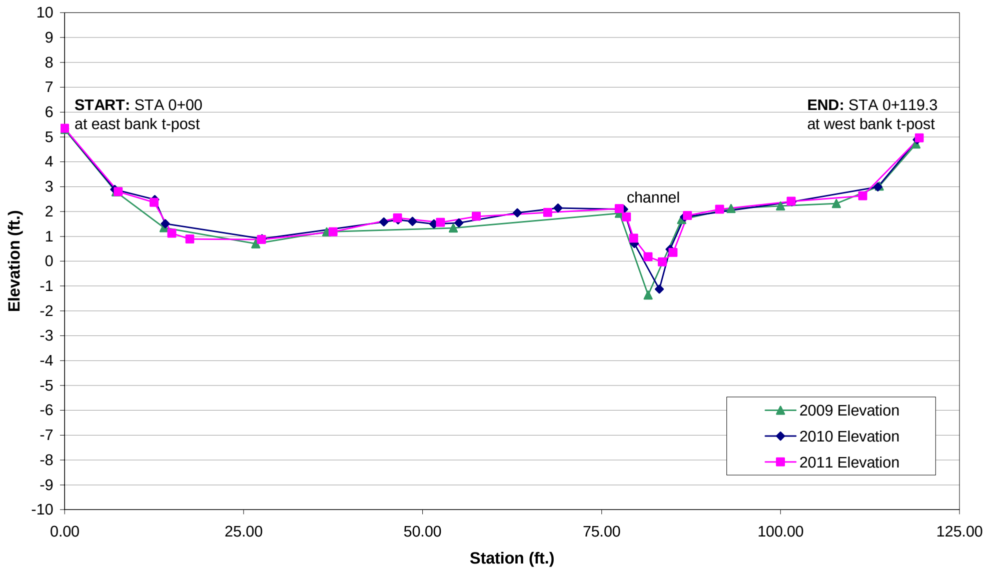


Figure B-5. Wetland Mitigation Levee; Cross-Section 5

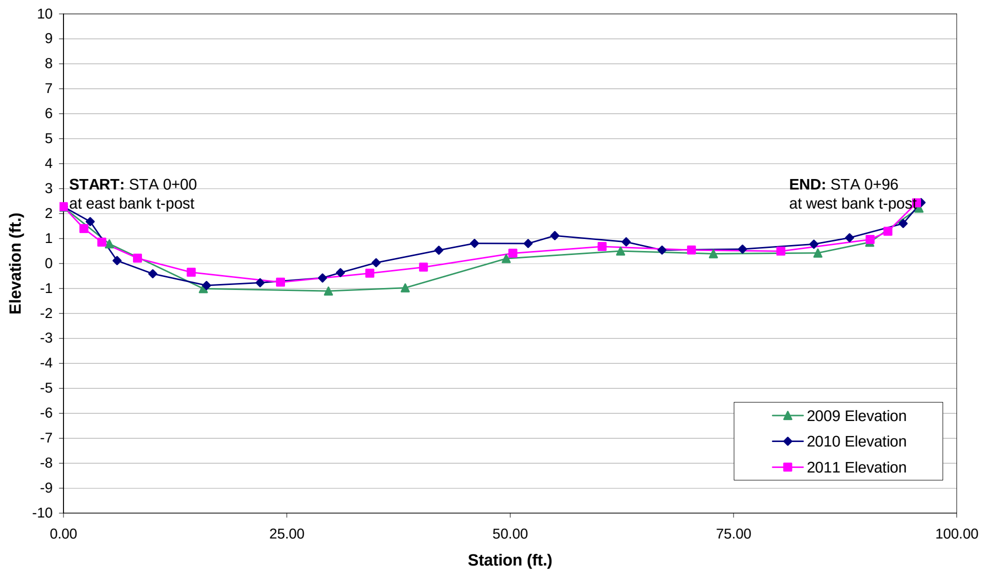


Figure B-6. Wetland Mitigation Levee; Cross-Section 6

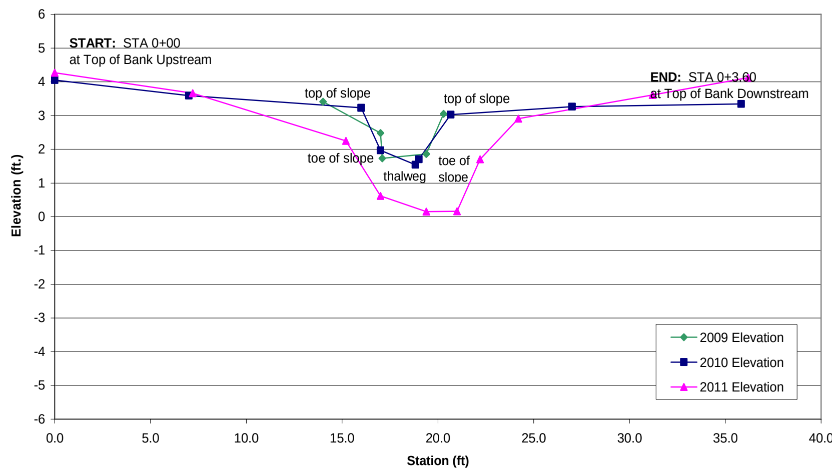


Figure B-7. Upstream Pilot Channel; Cross-Section 7

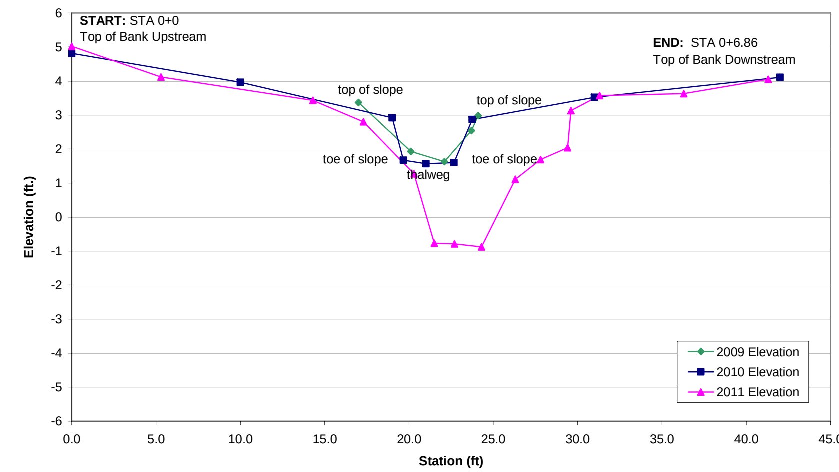


Figure B-8. Upstream Pilot Channel; Cross-Section 8

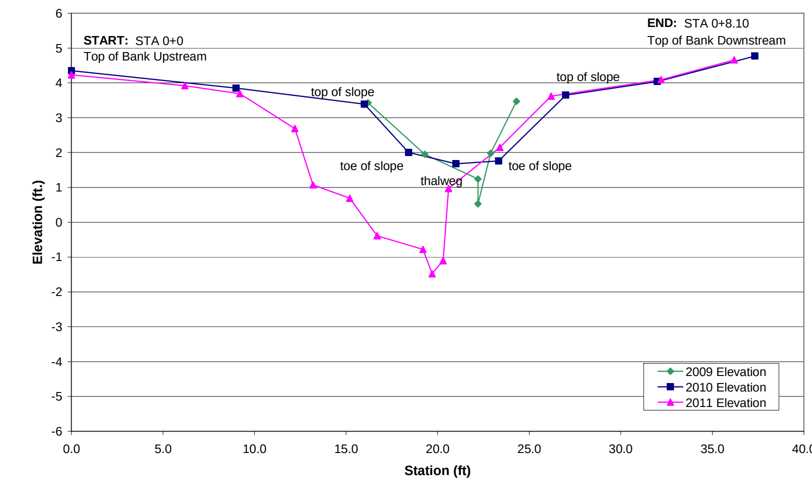


Figure B-9. Upstream Pilot Channel; Cross-Section 9

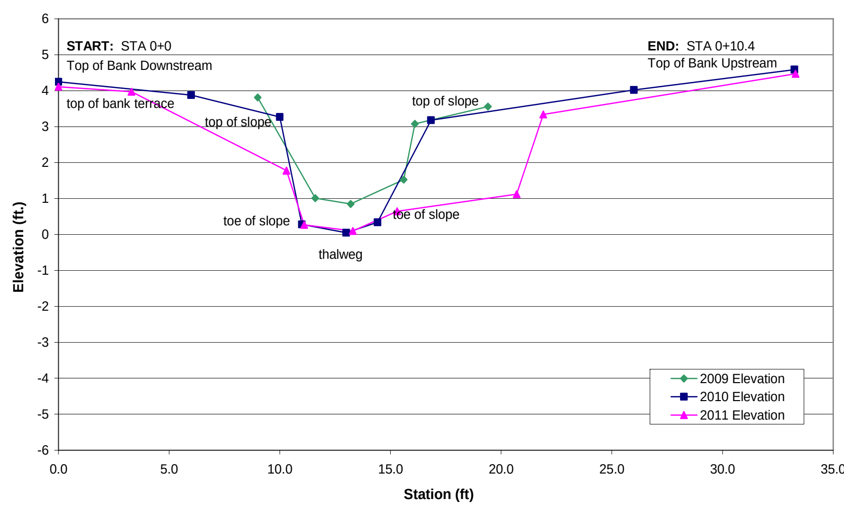


Figure B-10. Downstream Pilot Channel; Cross-Section 10

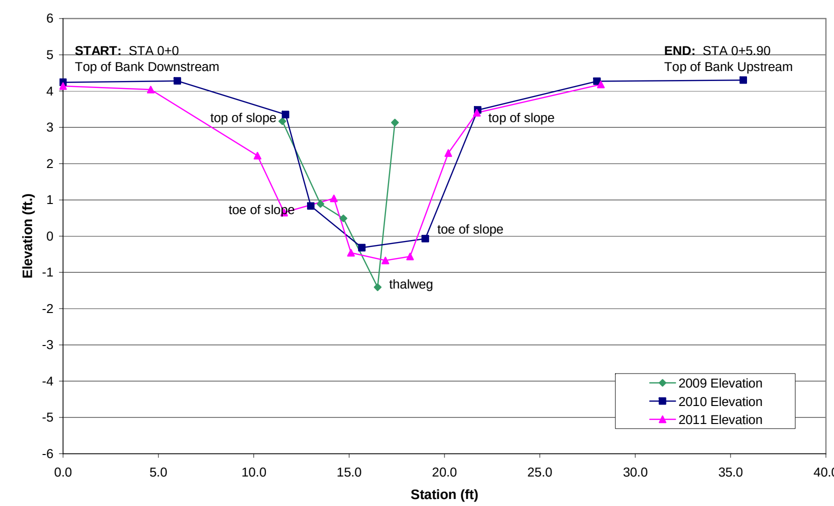


Figure B-11. Downstream Pilot Channel; Cross-Section 11

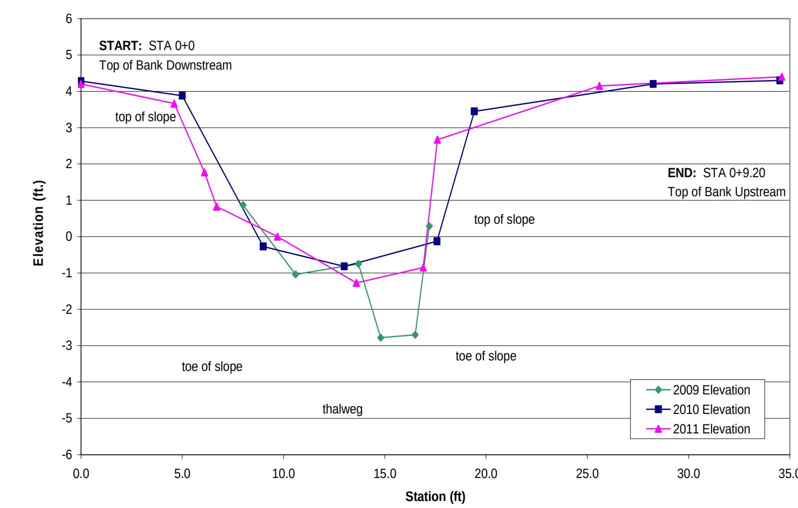


Figure B-12. Downstream Pilot Channel; Cross-Section 12