H. T. HARVEY & ASSOCIATES

Ecological Consultants

Tasman Corridor Wetland Mitigation Site

Year-6 Monitoring Report

Project # 2995-10

Prepared for:

Santa Clara Valley Transportation Authority
Environmental Programs and
Resources Management
3331 North First Street
Building B, Second Floor
San Jose, CA 95134-1927
Attn: Ann Calnan

Prepared by:

H. T. Harvey & Associates

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983 University Avenue, Building D • Los Gatos, CA 95032 • Ph: 408.458.3200 • F: 408.458.3210

List of Contributors

Report Compilation and Field Personnel

Daniel Stephens, B.S.	Vice President, Principal, Restoration Ecology
Max Busnardo, M.S.	Project Manager, Principal, Restoration Ecology
Gavin Archbald, M.S.	Restoration Ecologist
Kaitlin Schott, M.S.	Restoration Ecologist
Evyan Borgnis, M.S.	Restoration Ecologist
James Merk, M.A.	Technical Editor

Executive Summary

Permit Numbers

- U.S. 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 Notification No. 0101-97

Background

The goal for the Tasman Corridor Wetland Mitigation Site (Tasman site) is to restore a fully tidal brackish marsh similar to the wetland habitat adjacent to the Tasman site along the Guadalupe River. The Tasman site provides mitigation for impacts on 0.73 acre (ac) of USACE and RWQCB jurisdictional wetlands and 1.82 ac of California Department of Fish and Wildlife (CDFW) jurisdictional areas that resulted from extension of the Valley Transportation Authority (VTA) light rail and from the construction of the Tasman site. The USACE and the RWQCB require 1.46 ac and 2.20 ac of new jurisdictional wetlands, respectively, and the CDFW requires 4.80 ac of new CDFW jurisdictional areas to mitigate for these impacts. Restoration of the Tasman site is expected to accommodate these acreages.

To verify that the Tasman site meets its mitigation goals, the project's permits require the VTA to monitor habitat evolution on the Tasman site for 6 years or until attainment of the project success criteria, as described in the *Tasman Corridor Mitigation and Monitoring Plan* (MMP).

Results

This section compares Year 6 monitoring results with the final success criteria.

Hydrology/Sedimentation Monitoring

Hydrology. High tides were similar between the Tasman site and the Guadalupe River in Year 6. The average high tide was 0.08 feet (ft) lower in the Tasman site then the Guadalupe River in Year 6. As in all previous monitoring years, the Tasman site met the 0.5-ft hydrologic similarity criterion established in the MMP (Table ES-1). The site functions as a natural hydrologic extension of the Guadalupe River and, therefore, meets the hydrology final success criterion identified in the MMP.

Sedimentation. Habitat elevation measurements found that the Tasman site marsh plain increased in elevation by 0.09 ft between Year 5 and Year 6. Sediment accumulation was greatest in portions of the marsh plain situated lowest in elevation. The average annual sedimentation rate on the marsh plain over 6 years was 0.16 ft per year and below the MMP's predicted rate of 0.25 ± 0.04 ft per year. The average marsh plain

elevation was 2.91 ft National Geodetic Vertical Datum 1929 (NGVD) in Year 6, below the final success criterion of 4.5 ft NGVD.

The average annual sedimentation rate in feldspar plots over 6 years of monitoring was 0.04 ft per year. Feldspar plots are situated at relatively high elevations on the marsh plain. The sedimentation rate observed in feldspar plots is similar to the rate seen in the habitat elevation measurements at relatively high elevations on the marsh plain.

Salinity. Salinity has increased between Year 1 and Year 6 at the Tasman Site by 212%, from about 4 parts per thousand (ppt) to about 12 ppt. Salinity was highest (18.3 ppt) in the spring of Year 6 (2014). This is the same time during which 1000 California bulrush plantings were installed. The relatively high salinity in the spring of 2014 is likely the main reason these plantings have not established and spread.

Table ES-1. Tasman Wetland Mitigation Site Monitoring Requirements and Year 6 Results

Monitoring Parameter	Method	Final Success Criterion	Final Success Criterion Met?	Recommended Action
Hydrology/ sedimentation	Water level datasondes	Site will function as natural hydrologic extension of existing Guadalupe River marsh. Site will have slightly muted tidal action.	Yes. Average high tide water level on the Tasman site was comparable to that on the Guadalupe River in Year 6.	6 years of monitoring has shown that the site's hydrology functions as intended. Therefore, cease hydrology monitoring.
	Habitat elevation measurements	Marsh plain[1] elevation will be 4.5 feet NGVD by Year 6.	No. The average marsh plain elevation in Year 6 was 2.91 feet NGVD.	The marsh plain is at an elevation suitable to support tidal marsh plants. Therefore, cease habitat elevation monitoring.
	Feldspar plots	No success criterion was identified.	N/A. Sedimentation rate was 0.04 foot per year in feldspar plots.	Cease feldspar plot monitoring.
Vegetation	Quadrat sampling	Site will achieve 85% absolute cover of wetland vegetation, dominated by native species.	No. Site achieved 16.8% absolute average cover of wetland vegetation dominated by native species in Year 6.	Discuss final vegetation cover criterion with regulatory agencies in light of salinity fluctuations.
	Wetland delineation using USACE protocol	Site will have 2.2 acres of new USACE jurisdictional wetland habitat.	No wetland delineation was conducted.	Discuss timing of wetland delineation with regulatory agencies
Wildlife monitoring	Avian wildlife monitoring	No success criterion was identified.	N/A. No final avian wildlife monitoring was conducted.	Discuss timing/need for avian wildlife monitoring with regulatory agencies

Notes: N/A = not applicable; NGVD = National Geodetic Vertical Datum 1929; USACE = U.S. Army Corps of Engineers.

[1] The term *marsh plain* refers to the excavated portion of the marsh plain as documented in the project's as-built plan.

Vegetation Monitoring

Percent Cover. Wetland vegetation cover decreased slightly, from 17.7% to 16.8%, between Year 5 and Year 6 and remained below the final success criterion of 85% cover. In Year 6, 94.0% of the vegetation was composed of native wetland plant species and therefore met the final success criterion that vegetation be dominated by native wetland plants. The slight reduction in vegetation cover in the mitigation site between Year 5 and Year 6 can be attributed to abnormally high water salinity observed on the Tasman site in spring 2014, which likely reduced germination of the annual species that established on the marsh plain in Year 5. Brackish marsh vegetation continued to spread on the marsh plain in Year 6, including California bulrush (*Schoenoplectus californicus*) and alkali bulrush (*Bolboschoenus maritimus*).

Invasive Species. Perennial pepperweed (*Lepidium latifolium*) recruited along the high-tide line of the Tasman site in Year 6. Perennial pepperweed should be controlled to prevent its spread onto the marsh plain. Two other invasive plants, Bermuda grass (*Cynodon dactylon*) and creeping bent grass (*Agrostis stolonifera*), remain present at the margin of the marsh plain in Year 6. Both are more sensitive to inundation and salinity stress than pepperweed and therefore are likely to remain restricted to the upper margins of the Tasman site and do not currently warrant control.

California Bulrush Planting and Installation of Herbivore Deterrent. VTA installed 500 California bulrush plantings at the Tasman site in Year 4 (2012) and 1000 California bulrush plantings in Year 5. Herbivore deterrents (posts and string) were installed to protect the plantings. No plantings were installed in Year 6. Vegetation monitoring in Year 6 found that average percent vegetation cover was higher on the marsh plain where plantings were installed and protected from herbivores (19.6% cover) than in sections that received no plantings or protection (15.3% cover). This difference was not statistically significant ($P = 0.27$; student's t-test).

Wetland Delineation. The project MMP calls for a wetland delineation in Year 3 to identify the acreage of USACE jurisdictional habitat created at the Tasman site. However, vegetation cover was too low to meet the USACE wetland definition (at least 5% cover) in the northern portion of the site in Years 3–6. Therefore, we did not conduct the wetland delineation in Years 3–6. We expect that this northern, lower elevation portion of the marsh plain will become vegetated in the next few years.

Wildlife Monitoring

Wildlife monitoring is required by the MMP to compare avian use of the Tasman site and the Guadalupe River. Wildlife was monitored in Years 1 and 3. Final wildlife monitoring scheduled in the MMP for Year 6 was postponed because vegetation cover on the Tasman site is considerably lower than on the Guadalupe

River and, therefore, avian use between the two locations is likely to differ substantially. We suggest discussing the need for final wildlife monitoring with the project regulatory agencies.

Management Recommendations

- The Tasman site MMP calls for habitat monitoring for 6 years or until the site meets its final success criteria. The Tasman site has met the hydrology success criterion but not the final sedimentation or vegetation cover success criteria. However, the success of experimental wetland plantings and natural wetland plant colonization has shown that marsh plain elevations on the site are largely suitable for establishing a diverse brackish tidal marsh plant community. Therefore, we recommend that VTA cease hydrology and sedimentation monitoring but continue to monitor vegetation cover to meet the ultimate goal of restoring a fully tidal brackish marsh similar to the wetland habitat along the Guadalupe River. The timing of the wetland delineation and timing/need for wildlife monitoring should be determined in conversation with the regulatory agencies.

We recommend the following site maintenance actions:

- **Control perennial pepperweed.** We recommend that VTA treat perennial pepperweed on the slopes of the Tasman site with an herbicide in March and May annually until the weed has been eradicated. The herbicide type and application rate should be based on a recommendation from a certified pest control advisor. The herbicide should be approved by the U.S. Environmental Protection Agency for use in and adjacent to aquatic environments. We recommend that the VTA's pest control advisor consider the use of imazapyr. Mature pepperweed seed heads, if present, should be clipped, bagged, and removed from the site before the herbicide is applied.

- **Maintain herbivore deterrents.** We recommend that VTA maintain herbivore deterrents in the configuration installed on the marsh plain in Year 5 to facilitate natural recruitment of vegetation.

- **Monitor Bermuda grass and creeping bent grass.** We recommend that VTA monitor the spread of Bermuda grass and creeping bent grass during annual vegetation surveys. If either species begins to substantially invade the marsh plain (qualitative observation), the VTA should seek a recommendation to control these species from a certified pest control advisor.

Agency Requests

In a memo dated February 13, 2014 to regulatory agency staff, VTA proposed to install an additional 1000 California bulrush plantings and extend monitoring beyond Year 6 (2014/2015). The bulrush planting were installed in March 2014; however, they did not establish as well as expected, which is likely attributable to the abnormally high salinity levels in 2014. Therefore, VTA requests a site visit with the regulators and further discussion of future monitoring requirements and success criteria required to meet the ultimate goal of

restoring a fully tidal brackish marsh similar to the wetland habitat along the Guadalupe River. It should be noted that the site appears to be adapting to changed environmental conditions, with natural recruitment of pickleweed (*Salicornia pacifica*) on the marsh plain (Photo 1).

Photo 1. Pickleweed (*Salicornia pacifica*) on the marsh plain in June 2015

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Section 1.0 Introduction

1.1 Permit Numbers

- U.S. 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 Notification No. 0101-97

1.2 Background

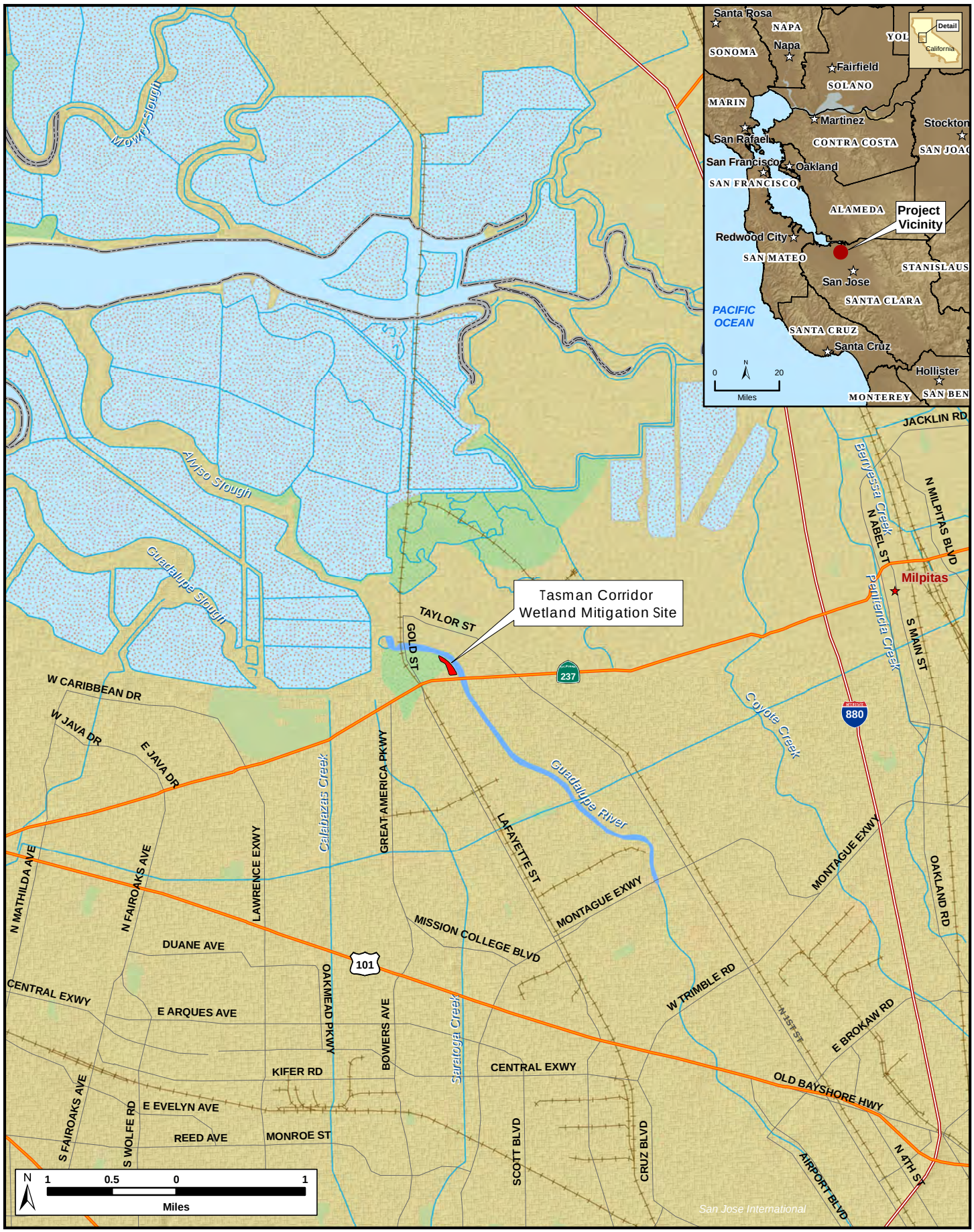
The Tasman Corridor Project, sponsored by the Santa Clara Valley Transportation Authority (VTA), involved the construction of a light rail public transit line from east San José to the city of Mountain View in Santa Clara County, California. Impacts on USACE, RWQCB, and California Department of Fish and Wildlife (CDFW) jurisdictional areas resulted from extending the light rail line across the following creeks and drainages: Calabazas Creek, Stevens Creek, the Sunnyvale East channel, and the Sunnyvale West channel.

A mitigation and monitoring plan (MMP) was prepared to compensate for impacts on USACE, RWQCB, and CDFW jurisdictional areas through creation of the Tasman Corridor Wetland Mitigation Site (hereafter, the Tasman site) (H. T. Harvey & Associates 1997). The Tasman site is located north of State Route 237 and on the west side of the Guadalupe River, in northern San Jose (Figure 1). Initially, both the RWQCB and USACE required the creation of a minimum of 1.46 acres (ac) of new jurisdictional wetlands to compensate for 0.73 ac of impacts on RWQCB and USACE jurisdictional wetlands (H. T. Harvey & Associates 1997). However, because of the time lapse between project construction and implementation of mitigation, the RWQCB subsequently required 2.20 ac of wetland mitigation, changing the mitigation ratio from 2:1 to 3:1 (Appendix A). The CDFW required that 4.80 ac of new CDFW jurisdictional areas (bed and banks) be created to compensate for 1.82 ac of impacts (H. T. Harvey & Associates 1997). These impacts and mitigation requirements are summarized in Table 1.

Table 1. Impacts and Mitigation Requirements by Permitting Agency

Permitting Agency	Impact (acres)	Mitigation Required (acres)	Regulated Habitat Type
U.S. Army Corps of Engineers	0.73	1.46	Jurisdictional wetlands
Regional Water Quality Control Board	0.73	2.20 [1]	Jurisdictional wetlands
California Department of Fish and Wildlife	1.82	4.80	Wetlands, open water, and ruderal habitats(on levee slopes)

[1] The Regional Water Quality Control Board requires 2.20 acres of jurisdictional wetland mitigation, composed of 1.46 acres (in accordance with the mitigation and monitoring plan) and 0.74 acre (for additional temporal loss [see Appendix A]).



N:\Projects\2995-02\10\Reports\MMR Year 6\Fig 1 Vicinity Map.mxd

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Figure 1: Vicinity Map

Tasman Corridor Wetland Mitigation Site
Year 6 Monitoring Report (2995-10)
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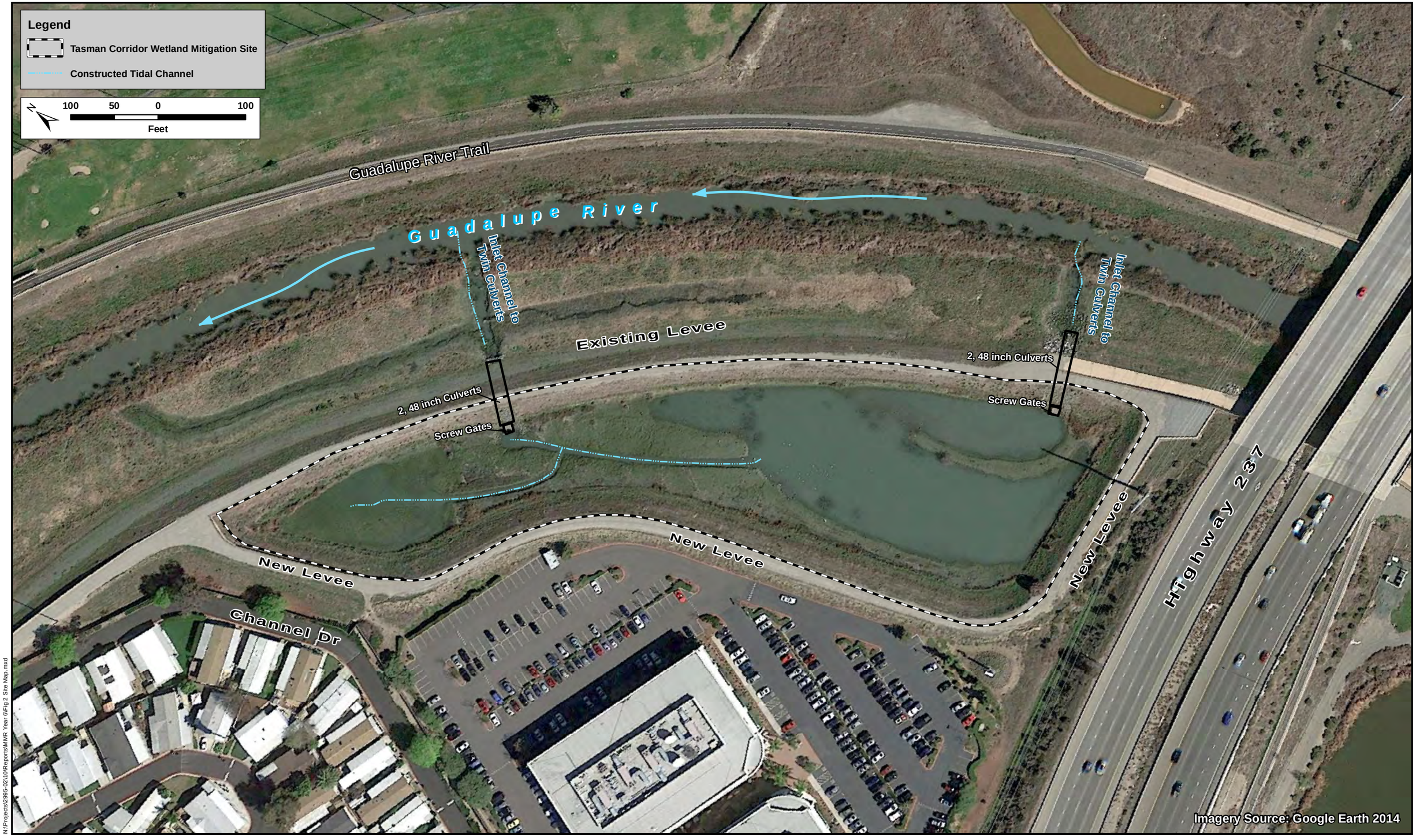
Before construction, the 3.2-ac Tasman site was composed primarily of ruderal upland habitat established on imported fill. It also included 0.57 ac of preexisting jurisdictional other waters habitat and 0.36 ac of jurisdictional wetland habitat (0.93 ac total) that were not subsequently affected by Tasman site construction (H. T. Harvey & Associates 1997). Therefore, to meet RWQCB regulatory permit requirements, the Tasman site must contain at least 2.56 ac of jurisdictional wetlands (2.20 ac of new jurisdictional wetlands + 0.36 ac of preexisting wetlands) and 0.57 ac of jurisdictional wetlands or other waters.

The Tasman site restoration design called for the excavation and removal of concrete rubble and soil from within the ruderal upland habitat to lower elevations to 3.0 feet (ft) National Geodetic Vertical Datum 1929 (NGVD) and to convert uplands to jurisdictional wetlands. The design also included the installation of four 48-inch culverts through the existing levee (two paired culverts at two locations), construction of inlet channels, and construction of a setback levee approximately 1300 ft long connecting to the Guadalupe River levee (Figure 2). The culvert invert elevations were built between 0.0 and 0.2 ft NGVD on the Tasman site side and 0.4 to 0.5 ft NGVD on the Guadalupe River side. Pilot slough channels in the Tasman site were excavated to -1.1 to -1.5 ft NGVD (H. T. Harvey & Associates 1999).

Tasman site excavation, culvert installation, inlet channel excavation, and rear levee construction were completed in October 1998 (H. T. Harvey & Associates 1999). However, opening of the tide gates was delayed until a maintenance agreement for the new levee between the Santa Clara Valley Water District (SCVWD) and VTA was completed and a determination was made 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 whether 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 Tasman 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 VTA's Tasman site levee, the USACE criteria was used as the basis of determining adequacy of the Tasman site levee.

The levee evaluation determined that VTA's Tasman site levee meets the USACE geotechnical requirements (Schaaf & Wheeler 2009) and provides protection equal to or exceeding the protection formerly provided by the Guadalupe River levee. On 28 May 2009, immediately following the results of the levee evaluation, VTA opened the culvert screw gates, introducing tidal action to the Tasman site.



N:\Projects\2995-02110\Reports\MMR Year 6\Fig 2 Site Map.mxd

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Figure 2: Site Map
Tasman Corridor Wetland Mitigation Site Year 6 Monitoring Report (2995-10)
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1.3 Basis of Design and Ecological Monitoring

1.3.1 Final Success Criteria

Final success criteria identified in the project's MMP are presented in Table 2.

Table 2. Tasman Wetland Mitigation Site Monitoring Requirements

Monitoring Parameter	Method	Final Success Criteria
Hydrology/ sedimentation	Water level datasondes	Site will function as natural hydrologic extension of existing Guadalupe River marsh with slightly muted tidal action.
	Habitat elevation measurements	Marsh plain[1] elevation will be 4.5 feet NGVD by Year 6.
	Feldspar plots	None.
Vegetation	Quadrat sampling	Site will achieve 85% absolute cover of wetland vegetation, dominated by native species.
	Wetland delineation using USACE protocol	Site will have 2.2 acres of new U.S. Army Corps of Engineers jurisdictional wetland habitat.
Wildlife	Avian wildlife monitoring	None.

[1] The term *marsh plain* refers to the excavated portion of the marsh plain as documented in the project's as-built plan (H. T. Harvey & Associates 1999).

1.3.2 Basis of Design

The Tasman site's long-term habitat mitigation goal is to restore at least 2.2 ac of ruderal upland habitat to high-quality tidal freshwater/brackish marsh (H. T. Harvey & Associates 1997). The mitigation design called for the installation of culverts at two 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 elevation of the marsh plain was 2.9 ft NGVD, and the marsh plain is expected to accrete to approximately 4.5 ft NGVD, comparable to marsh plain elevations in the adjacent Guadalupe River, which average 5.0 NGVD (H. T. Harvey & Associates 1997, 1999). For the purpose of this report, the term *marsh plain* refers to the excavated portion of the marsh plain as documented in the project's as-built plan (H. T. Harvey & Associates 1999). Accretion to target marsh plain elevations was expected to take approximately 6 years given the suspended sediment loads in the Guadalupe River at the time of the design (H. T. Harvey & Associates 1997). The ecological monitoring program is tailored to test the assumptions of the basis of design and determine

whether the site is on a trajectory to ultimately attain the long-term mitigation goal to restore high-quality tidal brackish marsh habitat.

1.3.3 Ecological Monitoring

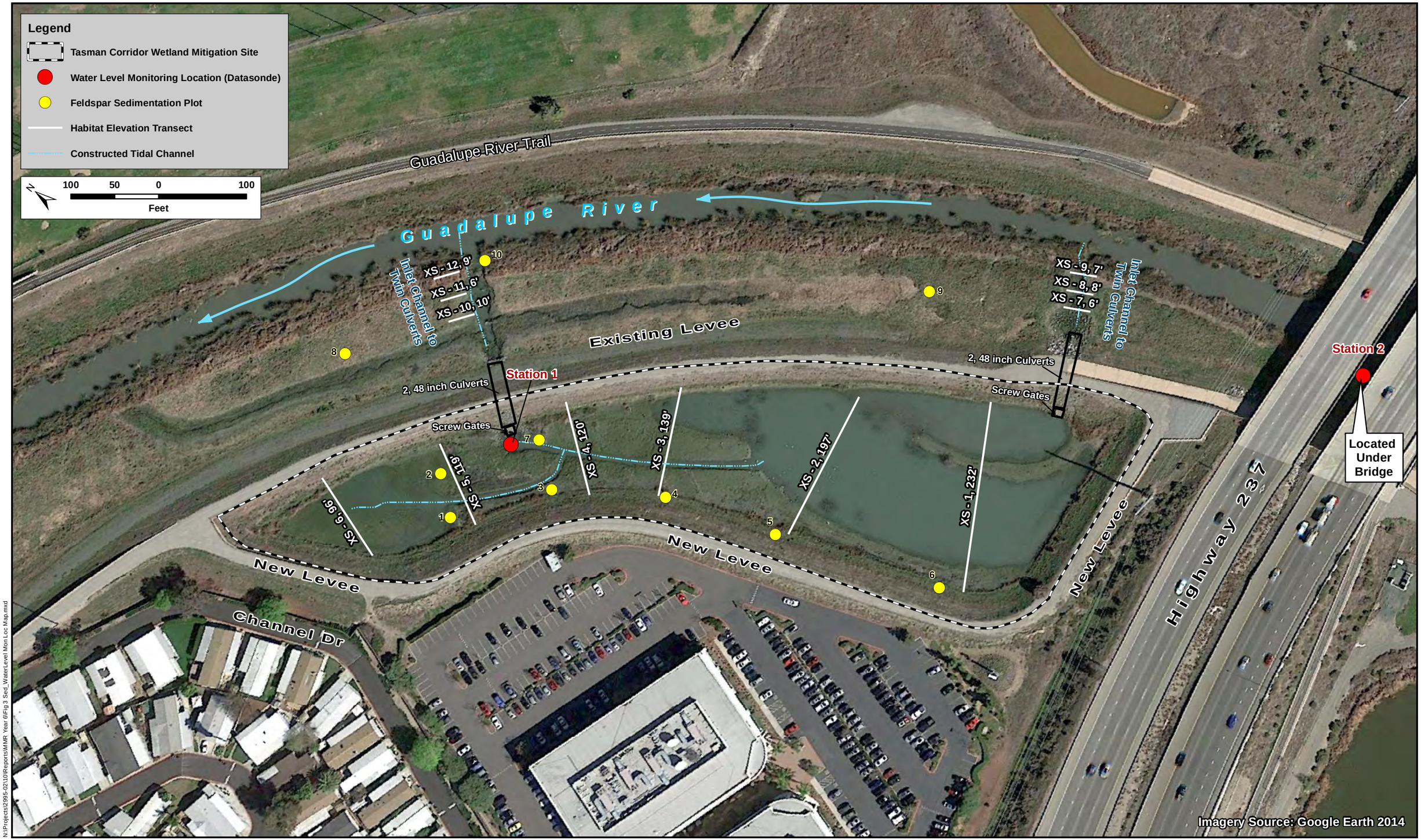
The MMP requires that the Tasman site be monitored annually for a period of 6 years or until its final success criteria are met. Ecological monitoring requirements in the MMP address hydrology/sedimentation, vegetation, and wildlife (Table 2). Hydrology/sedimentation monitoring involves conducting a visual assessment of the slough channels, water level monitoring, habitat elevation measurements along fixed transects, and sedimentation monitoring using feldspar plots. Vegetation monitoring involves conducting a quantitative assessment of average percent cover of native wetland species, making natural recruitment observations, assessing the presence of invasive species, and performing a wetland delineation to determine whether the minimum required mitigation acreage of restored USACE jurisdictional habitat is achieved. Wildlife monitoring consists of conducting surveys to quantify avian species richness and abundance and assessing the similarity of the bird communities on the Tasman site and the adjacent tidal wetlands in the Guadalupe River.

1.3.4 California Bulrush Planting and Installation of Herbivore Deterrents

H. T. Harvey & Associates observed in Year 2 (2010) that vegetation was establishing more slowly at the Tasman site than predicted in the MMP (H. T. Harvey & Associates 1997, 2012a). Therefore, the VTA directed H. T. Harvey & Associates to experimentally transplant 60 plugs of California bulrush (*Schoenoplectus californicus*) along habitat elevation transect XS-5 at the Tasman site to investigate ways to accelerate plant establishment (Figure 3). Experimental plantings were installed in 2011 (Year 3). During subsequent visits, H. T. Harvey & Associates observed avian species (e.g., Canada goose [*Branta canadensis*]) grazing on the marsh plain in the vicinity of the plantings, and the planted California bulrush appeared to have been heavily grazed by birds.

In response, H. T. Harvey & Associates established lines of string supported by T-posts above the experimental plantings during monitoring Year 3 (2011) to deter herbivores (following Lowney 1993). Protected from herbivores, the California bulrush plantings resprouted and expanded on the marsh plain through vegetative growth during Year 4 (2012). During topography monitoring in Year 4, California bulrush was measured growing between 1.86 ft and 3.70 ft NGVD at the Tasman site, a range that encompasses nearly all the Tasman site marsh plain (H. T. Harvey & Associates 2013; XS-1 through XS-6 in Appendix B). Furthermore, natural recruitment of wetland plants increased under the string. On the basis of these findings, H. T. Harvey & Associates concluded that grazing pressure by herbivores was a dominant factor slowing plant establishment on the marsh plain.

In Year 4 (2012), H. T. Harvey & Associates recommended installation of 500 additional California bulrush plantings with herbivore protection to increase the rate of establishment of native, emergent wetland vegetation cover on the Tasman site (H. T. Harvey & Associates 2012b). This recommendation is based on



N:\Projects\2995-0210\Reports\MMR Year 6\Fig 3 Sed_WaterLevel Mon Loc Map.mxd

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Figure 3: Sedimentation and Water Level Monitoring Locations
Tasman Corridor Wetland Mitigation Site Year 6 Monitoring Report (2995-10)
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the prediction that California bulrush plantings will spread through lateral rhizomatous growth and become naturally resistant to goose herbivory as patches increase in size. Permitting agencies and VTA agreed to this action at a site meeting (23 July 2012), and VTA installed 500 California bulrush plugs protected by herbivore deterrents on the marsh plain in winter (January and February) of Year 4 (2012) (H. T. Harvey & Associates 2013). A few months after installation, H. T. Harvey & Associates observed that approximately 80–90% of the 500 installed California bulrush plugs survived transplanting and began to spread on the marsh plain, and herbivore posts and wire appeared to effectively protect the plantings from herbivores.

In Year 5 (2013), VTA proposed planting another 1000 California bulrush plugs, again protected by herbivore deterrents. The planting plan was presented in a memorandum to permitting agencies dated 13 February 2014 (H. T. Harvey & Associates 2014a). Plants and herbivore deterrents were installed in March and April 2014.

Section 2.0 Methods

2.1 Hydrology/Sedimentation Monitoring

Hydrology/sedimentation monitoring included qualitative observations of sedimentation and erosion, quantitative water level monitoring, habitat elevation measurements along fixed transects, and sedimentation monitoring using feldspar plots. The methods are described in the following sections.

2.1.1 Qualitative Observations

H.T. Harvey & Associates restoration ecologists inspected the Tasman site and the culvert inlet channels for areas of substantial sedimentation and erosion during low tides on 12 and 16 February 2015.

2.1.2 Quantitative Water Level Monitoring

We collected water level data to determine the difference in hydrologic function between the Tasman site and the Guadalupe River. Two YSI datasondes (Model #6920), which recorded water levels continuously, were installed by H. T. Harvey & Associates restoration ecologists G. Archbald and E. Borgnis at low tide on 12 February 2015: one on the Tasman site near the northern culverts (Station 1) and one in the Guadalupe River below the State Route 237 bridge (Station 2) (Figure 3). The datasondes recorded water levels from 12 February through 26 February 2015 (a 14-day period) during a spring tide series. They were installed using the hardware and methodology described in the Year 1 monitoring report (H. T. Harvey & Associates 2010). The elevation of the pressure transducer in each datasonde was surveyed during installation and retrieval relative to a local, fixed benchmark installed by RJA & Associates (Schaaf & Wheeler 2009) to allow depth measurements to be converted to feet NGVD (Table 3).

Table 3. Surveyed Elevation of Datasonde Pressure Transducers in Year 6

Location	Elevation (feet NGVD)
Tasman Corridor Wetland Mitigation Site	0.60
Guadalupe River	0.26

Note: NGVD = National Geodetic Vertical Datum 1929.

Following data retrieval, we calculated the average difference during high tides between the depth of the pressure transducer on the Tasman site and the depth of the pressure transducer in the Guadalupe River. The average difference in high-tide depth was used to assess whether the tidal range on the Tasman site above the culvert inlet was within 0.5 ft of the tidal range on the Guadalupe River marsh plain.

2.1.3 Habitat Elevation Measurements

H. T. Harvey & Associates restoration ecologists G. Archbald and E. Borgnis measured habitat elevations on the Tasman site and inlet channels on 12 February and 26 February 2015. Surveys were carried out relative to the local benchmark installed by RJA & Associates (Schaaf & Wheeler 2009). We surveyed along six fixed transects on the Tasman site and three fixed transects at each inlet channel (Figure 3). Measurements were made along a transect tape established between previously installed T-posts. Elevations were measured using a laser level and stadia rod. The start and end of each transect, the toe-of-slopes, the edge and centerline of channels, and substantive elevation breaks were measured. In locations where these features were not encountered, elevations every 5 ft across the mudflat surface were measured. Where the water depth precluded the use of a laser level and stadia rod (portions of XS-1 and XS-2), we collected depth readings at 10-ft intervals from a boat using a measuring tape with a weighted bottom. We then subtracted water depth readings from the water level elevation to determine the sediment surface elevation.

We graphed habitat elevation results from 2015 relative to prior results (2009–2014) to visualize sedimentation patterns on the marsh plain at the Tasman site and scour patterns along the constructed inlet channels (Appendix B). We determined the average marsh plain elevation on the Tasman site by averaging habitat elevation measurements collected on the excavated marsh plain surface excluding points measured in marsh channels, in depressions, and on levee slopes above the high-tide line. We assessed the average Year 6 Sedimentation Rate as = [(Average Year 6 Marsh Plain Elevation – Average Year 5 Marsh Plain Elevation)/(1 Year)]. We assessed the overall Average Annual Sedimentation Rate as = [(Average Marsh Plain Elevation Year 6 – Average Marsh Plain Elevation Year-0)/(6 Years)].

2.1.4 Monitoring of Feldspar Marker Horizon Plots

As an additional monitoring measure, H. T. Harvey & Associates installed sedimentation monitoring plots (Figure 3) at the Tasman site on 2 September 2009, 4 months after culvert screw gates were opened to allow tidal inundation. Feldspar marker horizon plots (0.25 square meter) were installed to measure short-term vertical accretion (Cahoon and Turner 1989; Ball 2005). Seven feldspar plots were established on the Tasman site's excavated marsh plain, and three sites were established in the marsh adjacent to the Guadalupe River to determine whether differences in sedimentation patterns exist between the two areas. We measured sediment accumulation in feldspar plots several times during monitoring Year 1 (at 1, 2, 3, and 9 months after plot installation) and annually thereafter (during Years 2–6). Sedimentation monitoring results are summarized for Years 2–6.

2.1.5 Salinity Monitoring

In 2014, we observed the following indications of heightened salinity at the Tasman site: (1) lower seedling recruitment and fewer annual plants on the marsh plain relative to past years and (2) die-off of vegetation with low salinity tolerance at the edge of the Tasman site (e.g., creeping bent grass [*Agrostis stolonifera*]). To investigate possible shifts in salinity, we compiled water conductivity data from the Tasman site (collected with datasondes from 2009–2015), and during site visits in 2014 and 2015, we collected site water salinity

samples at the Tasman site using a hand-held refractometer. The purpose of this salinity monitoring was to determine whether the Tasman site experienced unusually high salinity during 2014 and, if so, whether the high-salinity condition persisted into 2015.

2.2 Vegetation Monitoring

H. T. Harvey & Associates restoration ecologists G. Archbald and K. Schott monitored vegetation near the end of the growing season, on 30 October 2014. Percent cover of native wetland species was quantitatively evaluated on the Tasman site to allow comparison with the final success criterion.

2.2.1 Percent Cover

Average percent cover of plant species was estimated using the quadrat method (Bonham 1989). Vegetation was sampled on the Tasman site marsh plain at stratified-random locations using a 1-square-meter quadrat along six permanent transects (Figure 4). In each sample location, absolute percent cover of each species was estimated to the nearest 1%. Plants were identified to species using *The Jepson Manual* (Baldwin et al. 2012). Approximately 0.5% of the Tasman site tidal marsh surface (quadrat number n = 70) was sampled.

2.2.2 California Bulrush Planting and Installation of Herbivore Deterrents

We assessed the effect of California bulrush plantings and herbivore deterrents installed in Year 4 (500 plugs) and Year 5 (1000 plugs) on the percent cover of vegetation on the Tasman site in Year 6 (2014). To conduct this assessment, we noted whether each quadrat sampled (described above) was located inside or outside of the herbivore deterrents. Twenty-six of the quadrats were located inside herbivore deterrents, and 44 were located outside of the deterrents. We compared average percent cover of vegetation inside versus outside of the deterrents and tested whether there was a statistically significant increase in cover under the herbivore deterrents using a one-tailed student's t-test (alpha = 0.05).

2.2.3 Natural Recruitment

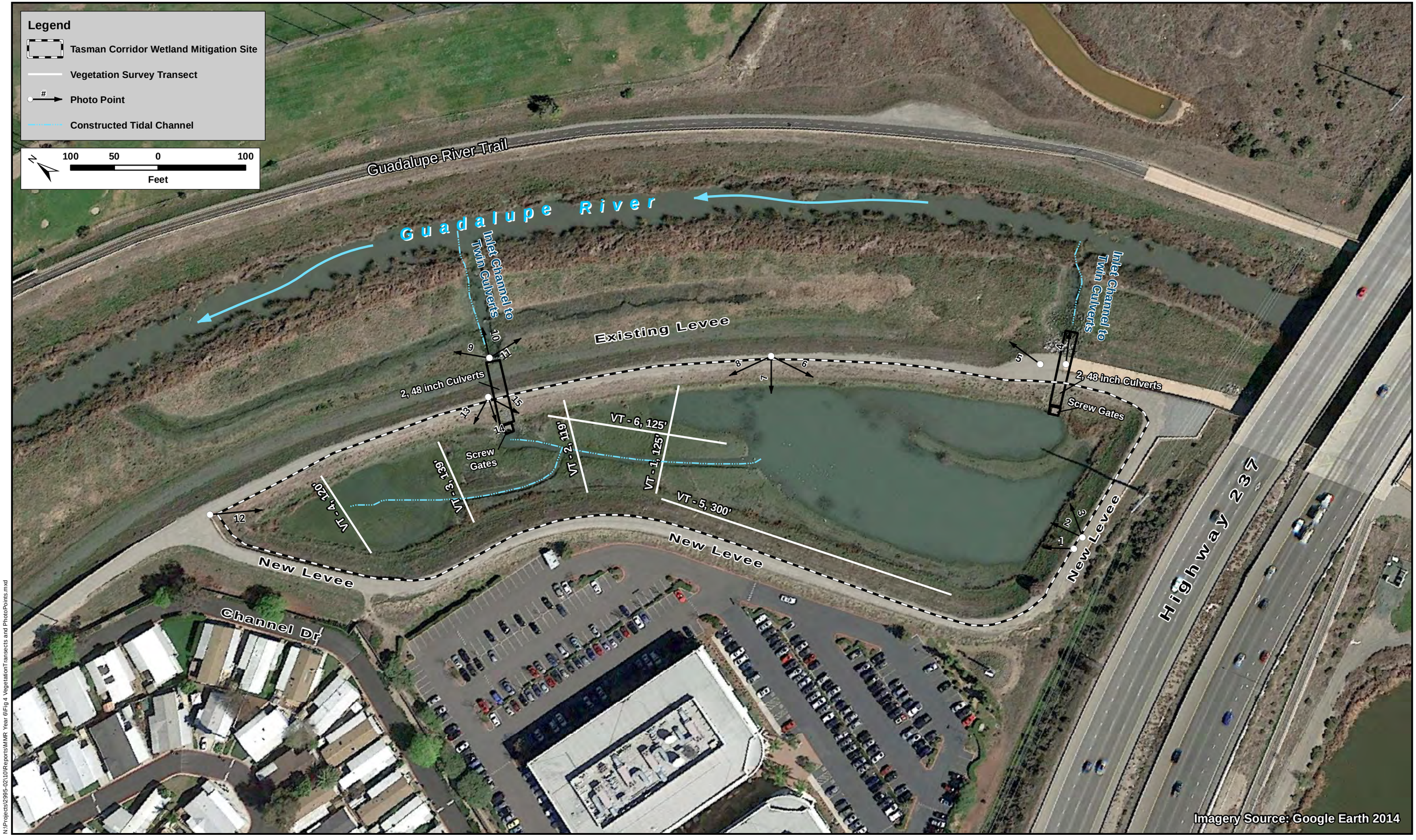
Qualitative surveys were conducted throughout the Tasman site to detect naturally recruiting plant species during site visits on 5 September 2014, 30 October 2014, 12 February 2015, 26 February 2015, and 12 March 2015. Plant species not encountered by vegetation transects were noted.

2.2.4 Invasive Plant Species and Site Maintenance

We inspected the Tasman site for invasive and native plant colonization, culvert/pilot channel function, trash, and other general maintenance issues during site visits.

2.2.5 Wetland Delineation

The project's MMP calls for a wetland delineation in Year 3 to identify the acreage and type of habitat created on the Tasman site. However, in Years 3–6, vegetation cover was below 5% on the northern portion of the marsh plain (portions of XS-6; Appendix B). In this lower elevation area, cover was too low to meet



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H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 4: Photo Points and Vegetation Transects Map

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the USACE's definition of wetland (USACE 2008), although California bulrush had begun to spread into this area from the site's edge, and we anticipate that this area will become vegetated. The timing of the final wetland delineation will be determined in consultation with regulatory agency staff.

2.2.6 Photodocumentation

Photographs were taken from 15 photodocumentation points during low tide. Figure 4 shows the locations of the photodocumentation points. The photographs are presented in Appendix C.

Section 3.0 Results and Discussion

This section presents the results of the Year 6 annual monitoring. Subsections entitled "Comparison to Final Success Criterion" are included below to describe whether the results meet the final success criteria identified in the MMP.

3.1 Hydrology/Sedimentation Monitoring

3.1.1 Qualitative Observations

No substantive erosion was observed on the Tasman site in channels or along the side slopes (Appendix B; Figures B1–B6). Minor erosion near the high-tide line was seen along the eastern and southern edges of the site. This erosion is likely the result of minor wind waves. By contrast, as noted in previous monitoring years, substantial erosion has occurred in the two inlet channels on the Guadalupe River side (Appendix B; Figures B7–B12). The inlet channels were expected to reshape through erosion to accommodate the tidal prism of the Tasman site.

3.1.2 Water Level Monitoring

As in previous monitoring years, water level measurements show that the Tasman site received mixed semidiurnal tidal flushing through two high and two low tides each day during the monitoring period (Figure 5). High tide water surface elevations were nearly identical between the Guadalupe River reference site (station 2) and the Tasman site (station 1) (Figure 3). The marsh plain on the Tasman site was inundated by two high tides each day during the monitoring period, which occurred during a typical spring tide series. By contrast, the Guadalupe River marsh plain was inundated once or twice per day because it is situated approximately 1 ft higher in the tidal frame relative to the Tasman site. The Tasman site drains to within a few inches above culvert inverts during low tide (Figure 6).

Comparison to Final Success Criterion. One of the MMP's final success criteria is that the Tasman site should "function as a natural hydrologic extension of the existing marsh bordering the Guadalupe River. It will be open to slightly muted tidal action." The performance criteria specify that "reduced tidal elevations should not deviate from those in the Guadalupe River by more than 0.5 ft." This language refers to the portion of the tidal range that is above the site's culvert bottom (invert) elevation. The results of annual hydrology monitoring over a 6-year period show that high tides on the Tasman site are consistently within 0.5 ft of high tides along the Guadalupe River and that the site typically drains to within 0.5 ft of the culvert invert elevations (H. T. Harvey & Associates 2010, 2011, 2012a, 2013, 2014b) (Figures 5 and 6). Therefore, the Tasman site meets the final success criterion for hydrology.

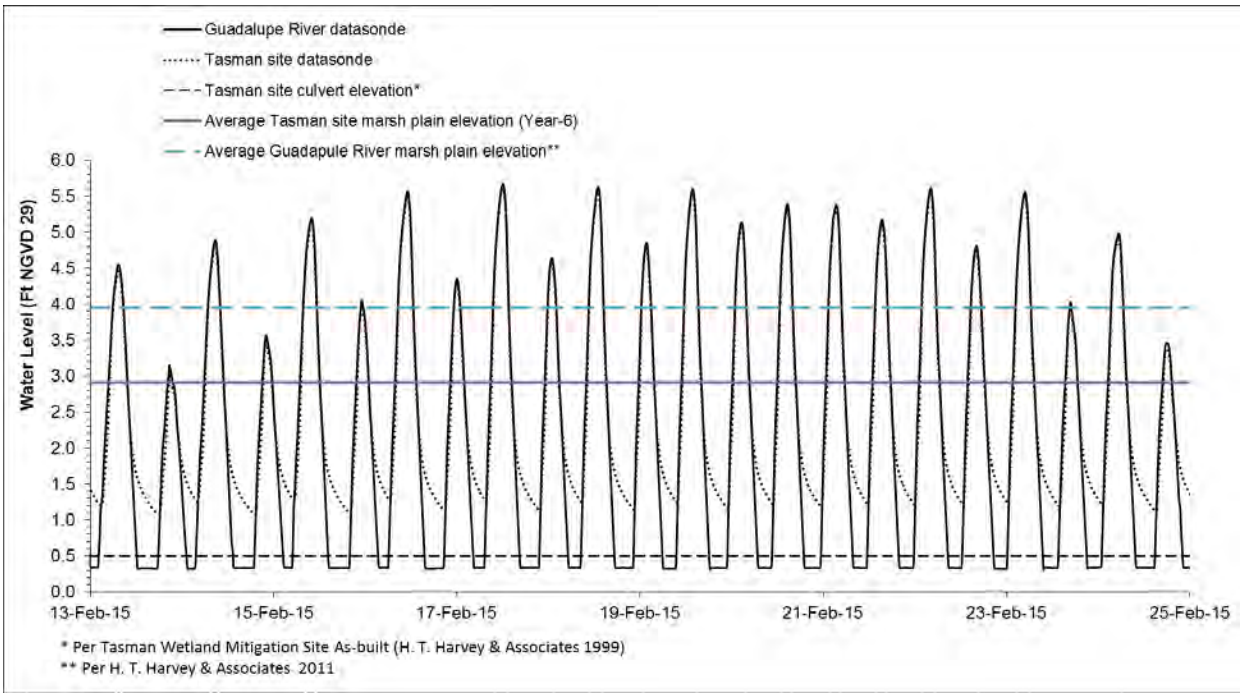

Figure 5. Continuous Water Level Measurements Comparing the Tasman and Guadalupe River (Reference) Sites

Figure 6. Tasman Site during Low Tide (Photo of Northern Culverts on 12 March 2015)

3.1.3 Habitat Elevation Measurements

Appendix B provides the habitat elevation measurements for the Tasman site and the inlet channels connecting the site to Guadalupe River in Year 6 relative to data from prior years.

Marsh Plain. In Year 5 and Year 6, the average elevation of the marsh plain on the Tasman site increased by approximately 0.1 ft. Since culverts were opened in 2009, the average elevation of the marsh plain at the Tasman site has increased 0.3 ft (Table 4), or 0.05 ft per year. By contrast, the predicted rate of sedimentation was 0.25 ft per year (H. T. Harvey & Associates 1997). The average marsh plain elevation in Year 6 was 2.91 ft NGVD.

Table 4. Annual Habitat Elevation Measurement Data from Tasman Wetland Mitigation Site (2009–2015)

	Monitoring Year							
	As-built (1998)	**Prior to Culvert Opening (2009)**	**Year 1 (2010)**	**Year 2 (2011)**	**Year 3 (2012)**	**Year 4 (2013)**	**Year 5 (2014)**	**Year 6 (2015)**
Average marsh plain elevation (feet) (NGVD)	2.9	2.61	2.51	2.51	2.66	2.68	2.82	2.91
Elevation Change (feet) from previous measurement	Not applicable	-0.29	-0.10	0.00	+0.15	+0.02	+0.20	+0.09

Note: NGVD = National Geodetic Vertical Datum 1929.

Variation in Sedimentation. Lower intertidal elevations in marshes are subject to more frequent inundation than higher elevation areas and therefore typically accumulate sediment more rapidly (Williams and Orr 2002; Callaway et al. 2013). This explains why sediment has accumulated most rapidly in subtidal depressions and lower-elevation portions of the marsh plain on the Tasman site. For example, since 2010, over 4 ft of sediment have accumulated (or 0.8 ft per year) along the portion of XS-2 where the site was initially deepest. Sediment has also accumulated quickly in other (less deep) subtidal areas, such as along the eastern end of XS-1 and XS-3 (approximately 2 ft of sedimentation since 2009, or 0.3 ft per year). Portions of the marsh plain, too, have accumulated sediment more rapidly than the average marsh plain sediment accumulation rate. For example, along the eastern half of XS-6, where the average marsh plain elevation in 2009 was approximately 1.5 ft below the average marsh plain elevation on the Tasman site, the elevation of the marsh plain has increased approximately 1.5 ft between Year 1 and Year 6 (or 0.25 ft per year). By contrast, little sediment has accumulated where marsh plain elevations were initially relatively high (e.g., above 3 ft NGVD along XS-3).

Tidal Channels. The tidal channels on the Tasman site have resized slightly since the site was opened to tides, becoming slightly wider (due to scour) and shallower (due to sediment accumulation) in 2015 than they were in 2009.

Inlet Channels. Since the Tasman site was opened to tides, the inlet channels connecting the Tasman site to the Guadalupe River have continued to increase in width and depth relative to previous years. This trend continued in Year 6 (Appendix B, Figures B7–B12). Erosion in the downstream inlet channel (XS-10, XS-11, and XS-12) has been greater than in the upstream inlet channel (XS-7, XS-8, and XS-9). This indicates that the tidal prism (volume of water between draining from the site between high and low tides) draining out of the downstream culverts is greater than that draining out of the upstream culverts. The inlet channels were expected to widen as the result of tidal action.

Comparison to Final Success Criterion. One of the project's final success criteria is that the Tasman site marsh plain naturally accumulates sediment to reach an equilibrium marsh plain elevation of approximately 4.5 ft NGVD after 6 years (H. T. Harvey & Associates 1997). In Year 6, the average marsh plain elevation at the Tasman site was 2.91 ft.

The results of 6 years of sedimentation monitoring have shown that marsh plain elevations above 3 ft NGVD have accumulated little sediment (Appendix B, Figures B1–B6). These results suggest that the equilibrium elevation of the marsh plain on the Tasman site may be lower than the predicted equilibrium elevation of 4.5 ft NGVD. Our habitat elevation cross-sections show that the marsh plain in the adjacent Guadalupe river reference area is situated between 4.0 and 4.5 ft NGVD (Appendix B7–B12).

Although the elevation of the marsh plain on the Tasman site remains below 4.5 ft NGVD, the elevation is appropriate for the establishment of the MMP's target wetland habitat. We have measured California bulrush growing between 1.86 ft and 3.70 ft NGVD on the Tasman site (H. T. Harvey & Associates 2014b). Most of the Tasman site falls within this elevation range (e.g., the marsh plain along XS-1, XS-2, XS-3, XS-4, XS-5). Only a small portion of the marsh plain along the eastern half of XS-6 (at the northern end of the site) is below this range (at 1.6 ft NGVD). However, this northern area is rapidly accreting sediment (0.25 ft per year) and will likely reach the low end of California bulrush's vertical elevation range in 1–2 years.

3.1.4 Monitoring of Feldspar Marker Horizon Plots

On average, 0.18 ft of sediment has accumulated in feldspar plots over 5 years (Table 5). The average annual sedimentation rate on the marsh plain measured by feldspar plots was 0.04 ft per year for the 5 years of sediment accumulation data (Years 2–6). This rate is consistent with the lower rate of sedimentation seen at higher elevations on the marsh plain in the habitat elevation measurements. Some erosion has occurred at feldspar plot 6 (Table 5). However, the results of habitat elevation measurements indicate that this section of the marsh plain remains stable overall (Appendix B, XS-1).

The depth of sediment on the marsh plain along the Guadalupe River has increased and decreased annually, suggesting alternating years of deposition and scour. This has resulted in little net change in the elevation of the marsh plain along the Guadalupe River and suggests that the Guadalupe River marsh plain has reached an equilibrium elevation (approximately 4.0–5.0 ft NGVD).

No success criteria are associated with the sampling of feldspar marker horizon plots.

Table 5. Sedimentation above Feldspar Markers

Plot Location	Sediment Depth (ft) in Each Monitoring Year[1]					Annual Sedimentation Rate (ft/year)
	Year 2 (2010)	Year 3 (2011)	Year 4 (2012)	Year 5 (2013)	Year 6 (2014)	
Tasman Site Plots						
1	0.04	0.13	0.15	0.14	0.20	0.04
2	0.08	0.14	0.15	0.16	0.13	0.03
3	0.04	*	0.11	0.12	0.20	0.04
4	0.03	0.10	0.12	0.15	0.18	0.04
5	*	*	*	*	*	*
6	0.02	0.11	0.11	0.13	0.06	0.01
7	0.06	0.12	0.13	0.11	0.29	0.06
Tasman site plot average	0.04	0.12	0.13	0.14	0.18	0.04
Guadalupe River Plots						
8	0.08	*	*	*	*	*
9	0.06	0.01	0.09	0.04	0.13	0.03
10	0.08	*	*	*	*	*
Guadalupe River plot average	0.07	0.01	0.09	0.04	0.13	0.03

[1] The first year of feldspar sedimentation data was collected in Year 2; therefore, no Year 1 data (collected 1, 2, 3, and 9 months after installation) are included.

* indicates plots could not be located during feldspar plot monitoring.

3.1.5 Salinity Monitoring

Salinity on the Tasman site has increased substantially over the past several years at the Tasman site (Table 6). From Year 1 to Year 6, salinity increased overall by 212%, an approximate 4 fold increase. The greatest year-over-year increase occurred from Year 4 to Year 5, when salinity doubled (from 7.1 parts per thousand[ppt] to 14.4 ppt). Salinity then increased an additional 27.1% from Year 5 to Year 6. The maximum salinity measured was 18.3 ppt in March of Year 6 (2014).

California bulrush occurs mostly in the south San Francisco Bay tidal marshes where water column salinities are relatively low (water column salinities of ~0-5 ppt) (H. T. Harvey & Associates 2005). California bulrush is also found in brackish marshes where salinity in the summer generally does not exceed 18 ppt for more than a few weeks (Baye 2007). Therefore, the poor performance of California bulrush plantings installed in March 2014 (see Section 3.2.4) is likely attributable to high salinity levels in 2014. Heightened salinity on the Tasman site likely was caused (primarily) by persistent drought conditions, which have decreased freshwater flow into the Guadalupe River and increased the salinity of San Francisco Estuary water brought onto the

Tasman site by tides. In addition, beginning in June of 2011, the South Bay Salt Pond Restoration Project opened a tidal connection between Pond A8 and Alviso Slough (SBSPRP 2013). The Pond A8 connection was anticipated to heighten salinity in Alviso Slough (EDAW et al 2007) and, therefore, may also have increased salinity at the Tasman site, which is located less than 1 mile upstream along the Guadalupe River from the Pond A8 connection to Alviso Slough. Heightened salinity continued on the Tasman site into 2015, although salinity levels were lower than measured in spring 2014.

Table 6. Water Salinity on the Tasman Site, 2009–2015, Relative to California Bulrush Planting

Monitoring Year	Monitoring Month	Water Salinity (ppt)	Collection Method	Revegetation Action and Response
Year 1 (2009)	October	4.0	Datasonde	None
Year 2 (2010)	June	1.8	Datasonde	None
Year 3 (2011)	N/A	N/A	N/A	60 experimental California bulrush plantings installed
Year 4 (2012)	September	7.1	Datasonde	Experimental California bulrush plantings spread after installation of herbivore deterrents
Year 5 (2013)	July	14.4	Datasonde	500 California bulrush were plantings installed and rapidly spread
Year 6 (2014)	March and April	18.3	Refractometer	1000 California bulrush plantings installed and remained dormant
Year 6 (2015)	February	12.5	Datasonde	California bulrush planted in 2011 and 2013 spread. California bulrush planted in 2014 spread somewhat

Notes: N/A = not available; ppt = parts per thousand

3.2 Wetland Vegetation

3.2.1 Percent Cover

Percent cover of wetland vegetation decreased slightly, from 17.7% to 16.8%, between Years 5 and 6 (Table 7). This reduction was driven primarily by a decrease in cover of two species that began to spread onto the marsh plain in previous years: creeping bent grass, an invasive grass, declined in cover from 3.2% to 0.9%, and eastern annual saltmarsh aster (*Symphyotrichum subulatum*), a native annual plant, declined in cover from 8.0% to 0.7%. Declines in cover of these species were likely the result of elevated salinity on the Tasman site

during spring 2014 (see Section 3.1.5). Creeping bent grass, a perennial species, has low salinity tolerance and we observed that it died back around the edge of the Tasman site and on the marsh plain in 2015. Eastern annual saltmarsh aster recruits annually by seed, and the higher salinity in spring 2014 may have reduced seedling germination relative to conditions in 2014.

In spite of the higher salinity, alkali bulrush and California bulrush, native brackish species continued to spread from established patches growing on the marsh plain. Alkali bulrush increased in cover by 4.5% and California bulrush increased by 3.4% between Year 5 and Year 6, suggesting that both species were able to grow even with the heightened salinity. In Year-6, California bulrush was the most common plant on the marsh plain, followed by alkali bulrush (Table 7).

Table 7. Average Percent Cover of Vegetation

Common Name or Habitat Type	Scientific Name	Native or Nonnative	Wetland Indicator Status[1]	Average Percent Cover					
				Year 1 (2009)	Year 2 (2010)	Year 3 (2011)	Year 4 (2012)	Year 5 (2013)	Year 6 (2014)
Creeping bent grass	*Agrostis stolonifera*	Nonnative	FACW	0.0	0.0	0.0	3.0	3.2	0.9
Spearscale/fat hen	*Atriplex prostrata*	Nonnative	FACW	0.0	0.0	0.1	1.2	<0.1	0.0
Sea beet	*Beta vulgaris*	Nonnative	NI	0.0	0.0	0.0	0.1	0.0	<0.1
Alkali bulrush	*Bulboschoenis maritimus*	Native	OBL	0.0	0.0	0.0	<0.1	0.2	4.7
Brass buttons	*Cotula coronopifolia*	Nonnative	OBL	0.0	0.0	0.0	0.7	0.5	<0.1
Tall flatsedge	*Cyperus eragrostis*	Native	FACW	0.0	0.0	0.0	0.1	0.0	0.0
Bristly ox tongue	*Helminthotheca echioides*	Nonnative	FACU	0.0	0.0	0.3	<0.1	0.1	0.0
Bermuda grass	*Cynodon dactylon*	Nonnative	FACU	0.0	0.0	0.0	0.0	0.0	0.1
Fleshy jaumea	*Jaumea carnosa*	Native	OBL	0.0	0.0	0.0	0.0	0.0	<0.1
Perennial pepperweed	*Lepidium latifolium*	Nonnative	FAC	8.9	0.0	0.0	0.1	0.0	0.0
California loosestrife	*Lythrum californicum*	Native	OBL	0.0	0.0	0.7	0.0	0.0	<0.1
Threebracted loosestrife	*Lythrum tribracteatum*	Nonnative	OBL	0.0	0.0	0.0	1.2	0.0	0.0
Mallow	*Malva* spp.	N/A	N/A	0.0	0.0	<0.1	0.0	0.0	0.0
Water parsley	*Oenanthe sarmentosa*	Native	OBL	0.0	0.0	0.0	0.5	<0.1	0.0
Broadleaf plantain	*Plantago major*	Nonnative	FAC	0.0	0.0	0.1	0.3	0.1	0.0
Dock	*Rumex crispus*	Nonnative	FAC	0.7	0.2	0.2	0.2	0.1	<0.1
Perennial pickleweed	*Salicornia pacifica*	Native	OBL	0.0	0.0	0.0	0.0	0.0	0.3
Common tule	*Schoenoplectus acutus*	Native	OBL	0.0	0.0	0.0	0.0	0.0	0.6
California bulrush	*Schoenoplectus californicus*	Native	OBL	0.0	0.0	0.1	1.6	5.7	9.1
Smilograss	*Stipa miliaceum*	Nonnative	NI	0.1	0.0	0.1	0.0	0.0	0.0
Eastern annual saltmarsh aster	*Symphyotrichum subulatum*	Native	OBL	0.0	0.0	0.0	2.0	8.0	0.7
Cattail	*Typha angustifolia*	Native	OBL	0.0	0.0	0.0	0.0	0.0	0.3
Mixed ruderal[2]	N/A	N/A	N/A	1.4	2.8	0.0	0.0	0.0	0.0
Dead/thatch	N/A	N/A	N/A	20.0	0.8	0.0	5.0	0.0	1.8

Common Name or Habitat Type	Scientific Name	Native or Nonnative	Wetland Indicator Status[1]	Average Percent Cover					
				Year 1 (2009)	Year 2 (2010)	Year 3 (2011)	Year 4 (2012)	Year 5 (2013)	Year 6 (2014)
Mud	N/A	N/A	N/A	48.8	77.3	87.4	81.2	79.3	71.3
Water	N/A	N/A	N/A	20.1	18.9	11.0	2.9	2.8	10.1
Total absolute percent cover of wetland vegetation[3]				9.6	0.2	1.3	10.9	17.7	16.8
Total absolute percent cover of native wetland vegetation[3]				0	0	0.8	4.2	13.9	15.8
Relative percent cover of native wetland vegetation[3]				0	0	61.5	38.5	78.3	94.0
Wetland vegetation[3] dominated by native species?				No	No	Yes	No	Yes	Yes

Note: N/A = not applicable.

[1] Wetland indicator status taken from Lichvar et al. (2014).

[2] Ruderal includes a mix of weedy plants with each species in amounts too small to quantify.

[3] Wetland vegetation includes OBL, FACW, and FAC species.

Native species were far more abundant in the plant community on the Tasman site in Year 6 than nonnative species. The relative cover of native species was 94.0%. Creeping bent grass was the most abundant nonnative species present.

Comparison to Final Success Criterion. One of the final success criteria is that the Tasman site marsh plain achieve 85% cover by obligate, facultative wetland, and facultative wetland species and be dominated by native species. In Year 6, the Tasman site had 16.8% cover by obligate, facultative wetland and facultative wetland species and therefore did not meet the final success criterion. However, native species made up more than 50% of the relative cover of the wetland vegetation. Therefore, the criterion that most of the site be dominated by native wetland vegetation was met.

3.2.2 Natural Recruitment

As in previous years, California bulrush and alkali bulrush continued to establish on the marsh plain, particularly along the high-tide line. Both bulrush species also expanded laterally through rhizomatous growth toward lower elevations on the marsh plain. Native salt marsh plants established on the marsh plain, including perennial pickleweed, fleshy jaumea (*Jaumea carnosa*), saltgrass (*Distichlis spicata*), and alkali heath (*Frankenia salina*). These species are indicative of the higher salinities observed in 2013-2015.

A small patch of common reed (*Phragmites australis*) was observed in spring 2014 and persisted in 2015. *The Jepson Manual* lists common reed as native, but the species is divided into two native subspecies and "a third naturalized entity whose taxonomic identity has yet to be determined" (Baldwin et al. 2012). Nonnative common reed genotypes have caused the species to become invasive on the East and Gulf coasts, but the California Invasive Plant Council rates common reed as having a "limited" impact on native ecosystems in California (Calflora 2014). In spring 2015, we assessed the morphological traits associated with the native and nonnative genotypes and determined that the common reed on the Tasman site is native.

Mixed ruderal species continue to be the primary colonizers of the upland slopes around the site. The nonnative field marigold (*Calendula arvensis*) continued to expand rapidly on upland slopes during Year 6.

3.2.3 Invasive Species

The MMP calls for the control of invasive wetland species if they colonize the site. In Year 6, no pepperweed was found on the marsh plain; however, pepperweed remains present on the levee slopes and has the potential to compete with native plants on the marsh plain. Therefore, control of pepperweed should remain a priority on the Tasman site.

Two other invasive species remained present at the margin of the marsh plain in Year 6: Bermuda grass and creeping bent grass. Both are likely to remain restricted to the upper margins of the site and are unlikely to substantially invade the marsh plain. Bermuda grass is rated by the California Invasive Plant Council as having a "moderate" impact on native ecosystems. Creeping bent grass is rated by the council as having a "limited"

impact on native ecosystems. Both species died back in 2015, likely as the result of increased salinity on the Tasman site marsh plain.

3.2.4 California Bulrush Planting and Installation of an Herbivore Deterrent

By the time of vegetation monitoring in Year 6 (2014), few of the 1000 bulrush plugs planted in 2014 had begun to grow. This was likely the result of high salinity observed on the Tasman site in spring 2014 (see Section 3.1.5). However, site observations in spring 2015 by H. T. Harvey & Associates indicate that some of the 1000 plugs planted in 2014 have begun to establish, 1 year after planting (Figure 7).

Figure 7. New California Bulrush Growth Observed in Spring 2015

Monitoring in Year 6 (2014) found that average percent vegetation cover was higher on the marsh plain where plantings were installed and protected from herbivores (19.6% cover) than in sections that received no plantings or protection (15.3% cover). This difference was not statistically significant ($P = 0.20$; student's t-test) at alpha = 0.05. This result suggests that in 2014, plantings and herbivore protection did not lead to increased vegetation cover on the marsh plain. This may be partially attributable to the low vegetation recruitment on the marsh plain in 2014 resulting from the elevated salinity. By contrast, in Year 5 (2013), we did detect a significant effect of the deterrents on the vegetation cover. This is likely because more annual species recruited on the marsh plain in Year 5 when salinity was lower than in Year- 6 and, therefore, more seedlings were present to receive protection from herbivores by the deterrents. However, regardless of whether or not salinity remains relatively high in future years, we expect herbivore deterrents (if properly maintained) to have a positive effect on vegetation spread in future years. This is because herbivore deterrents protect both recently recruited seedlings (with greatest recruitment during years with low winter/spring salinity) and plants that spread through vegetative growth. Vegetative growth will occur during years with low, moderate or high salinity because freshwater, brackish, and salt marsh species are all present in substantial patches on the Tasman site.

3.2.5 Site Maintenance

The general condition of the site continued to be good in Year 6. A shopping cart was observed on the Tasman site in February 2015 on the riprap above the southern culverts. We recommend removing this trash.

3.3 Photodocumentation

Photographs taken from fixed photodocumentation locations are presented in Appendix C.

Section 4.0 Management Recommendations

- The Tasman site MMP calls for habitat monitoring for 6 years or until the site meets its final success criteria. The Tasman site has met the hydrology success criterion but not the final sedimentation or vegetation cover success criteria. However, the success of experimental wetland plantings and natural wetland plant colonization has shown that marsh plain elevations on the site are largely suitable for establishing a diverse brackish tidal marsh plant community. Therefore, we recommend that VTA cease hydrology and sedimentation monitoring but continue to monitor vegetation cover to meet the ultimate goal of restoring a fully tidal brackish marsh similar to the wetland habitat along the Guadalupe River. The timing of the wetland delineation and timing/need for wildlife monitoring should be determined in conversation with the regulatory agencies.

We recommend the following site maintenance actions:

- **Control perennial pepperweed.** We recommend that VTA treat perennial pepperweed on the slopes of the Tasman site with an herbicide in March and May annually until the weed has been eradicated. The herbicide type and application rate should be based on a recommendation from a certified pest control advisor. The herbicide should be approved by the U.S. Environmental Protection Agency for use in and adjacent to aquatic environments. Mature pepperweed seed heads, if present, should be clipped, bagged, and removed from the site before the herbicide is applied.

- **Maintain herbivore deterrents.** We recommend that VTA maintain herbivore deterrents in the configuration installed on the marsh plain in Year 5 to facilitate natural recruitment of vegetation.

- **Monitor Bermuda grass and creeping bent grass.** We recommend that the VTA monitor the spread of Bermuda grass and creeping bent grass during annual vegetation surveys. If either species begins to substantially invade the marsh plain (qualitative observation), the VTA should seek a recommendation to control these species from a certified pest control advisor.

Section 5.0 Agency Requests

We request that the regulatory agencies meet with the VTA to discuss future monitoring and the vegetation cover success criterion at the Tasman site.

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Appendix A. Letter from VTA Adjusting Required Mitigation Acreage for Temporal Loss

SANTA CLARA
Valley Transportation Authority

October 16, 2008

Mr. Brian Wines
San Francisco Bay Regional Water Quality Control Board
151 Clay Street, Suite 1400
Oakland, CA 94612

Subject: **Tasman Corridor Light Rail Transit Project (File No. 2188.07 (KM); Tasman Wetland Site**

Dear Mr. Wines:

The Santa Clara Valley Transportation Authority (VTA) received a Waiver of Water Quality Certification for the Tasman Corridor Light Rail Transit Project (File No. 2188.07 (KM) on June 12, 1997 (attached). On March 27, 1998, VTA received an Approval of Changes to the June 12, 1997 Waiver of Water Quality Certification for the Tasman Corridor Light Rail Transit Project (attached). Due to the delay in implementing the *Tasman Corridor Mitigation and Monitoring Plan* (January 1997), as amended by VTA in letter dated May 1997 that addressed sediment sampling and site preparation criteria, VTA will provide additional mitigation at 10% per year of delay (10 years). The original mitigation consisted of the creation of a minimum of 1.46 acres of new jurisdictional wetlands to compensate for 0.74 acres of impacts to U.S. Army Corps of Engineers jurisdictional area. An additional 10% for 10 years is an additional 100% of mitigation based on 0.74 acres of impacts. Therefore, VTA will add 0.74 acres of mitigation to the 1.46 acres of mitigation for a new total of 2.22 acres. Essentially, this changes the mitigation ratio from 2:1 to 3:1. VTA's property at the Tasman Wetland Project site will accommodate the additional mitigation acreage.

VTA has authorized HT Harvey and Associates to start work on the Tasman Wetland Project immediately. The scope of work is attached, which includes the levee certification that is required before the 6-year monitoring can begin. Ground construction was completed in 1998 with grading/construction of the entire site. This includes the original 1.46 acres of mitigation and the area to be used for the additional 0.74 acres. If the levee is certifiable, it is anticipated that the tide gates will be opened in May 2009. If the levee is not certifiable, it is anticipated that the tide gates will be opened in July 2010 (see attached e-mail from HT Harvey and Associates).

If you have any questions or concerns, please contact Ann Calnan at (408) 321-5976.

Sincerely,

Thomas W. Fitzwater, AICP
Manager, Environmental Programs and Resource Management

Attachments:
VTA February 19, 1998 letter to RWQCB
SFBRWQCB March 27, 1998 letter to VTA
H.T. Harvey & Associates July 7, 2008 letter Scope of Work to VTA
H.T. Harvey & Associates October 15, 2008 Schedule Email

SANTA CLARA
Valley Transportation Authority

February 19, 1998

Via FAX (510)286-1380 w/o attachments
Hardcopy to follow U.S. Mail

Mr. John West
California Regional Water Quality Control Board
2101 Webster Street
Oakland, California 94612

Dear Mr. West,

Summary of Meeting, Jan. 30, 1998
Proposed Approach for
Guadalupe River Wetland Mitigation Project
San Jose, California
Tasman West Light Rail Project
For Santa Clara Valley Transportation Authority (VTA)

Thank you for taking the time to meet with us on Friday, January 30, 1998 to discuss our proposed approach for finalizing the grading plan at the Guadalupe River Wetland Mitigation Project. This letter presents a summary of our discussions at the meeting including the project background and current status and presents our recommended approach to be implement in moving forward with the project.

In summary, we understand that you generally agree with our proposed approach for a modified grading plan. We also understand that you are interested in formulating a Long-Term Management Plan for addressing any residual constituents of concern that may remain below the wetland ecosystem. To address this concern, we have included our recommendation for a Long-Term Management Plan in this letter.

BACKGROUND

VTA purchased the 3-acre property to create a wetland as offset for wetland areas that would be disturbed elsewhere during the construction of the Tasman West Light Rail project. The mitigation area has historically been filled with up to 10 feet of construction rubble and soil that was imported from unknown sources and placed on top of historical wetlands, upland vegetation and portions of the Guadalupe River channel. In January 1997, H.T. Harvey Associates (H.T. Harvey) developed a Wetland Mitigation Plan for the site. The Regional Water Quality Control Board (RWQCB) and the Army Corps of Engineers (ACOE) approved the plan and implementation of the plan began in the spring of 1997.

In summary, the mitigation plan called for the excavation of the fill material to an elevation of 3 feet NGVD, breaching the existing levee that borders the active channel of the Guadalupe River, allowing for natural sedimentation of approximately 18 inches of river-deposited sediment, and allowing the natural wetland vegetation to become established. The plan specified soil-screening criteria that established the maximum concentrations of various organic and inorganic constituents in the soil at the design elevation. The mitigation plan specified that if the concentration of constituents of concern (COCs) exceeded the screening criteria at the design elevation, soil would be excavated an additional three feet and re-sampled.

Prior to excavation, Rust Environment & Infrastructure (Rust) conducted a subsurface investigation to characterize the chemical nature of the fill and underlying native soil for purposes of handling and disposal (Rust, August 1997). Rust excavated three exploratory trenches and collected 15 soil samples from the base of each trench and submitted them for chemical testing of petroleum hydrocarbons, metals, aromatic volatile organic compounds, and asbestos. Results of the testing indicated elevated concentrations of total lead and total mercury. Based on the elevated concentrations of mercury, Rust performed testing for soluble mercury. Rust reported the soluble concentrations as below laboratory detection limits for all samples with the exception of one sample, which had a soluble concentration of 0.0056 milligrams per liter (mg/l). Based on the results, Rust concluded that construction debris mixed with soil constituted approximately 99 percent of the fill material; and the construction debris and associated soil appeared suitable for excavation, hauling, recycling, and reuse as non-hazardous

CURRENT SITUATION

In the late summer of 1997, excavation of the fill material to the design elevation had been completed. On August 23, 1997, GRC implemented a soil sampling and chemical testing program for the soil in the upper 6 inches of the newly exposed surface (GRC, September 1997). The objective of the sampling was to verify and document that soil at the design grade in the mitigation area was at or below the RWQCB SSC, as specified in the mitigation plan.

Results of the soil screening were presented in a report dated September 11, 1997 (GRC, 1997). In summary, the site was divided into 13 sub-areas of approximately equal size. Soil samples were collected at four locations within each sub-area and composited into one sample (Attachment A). The resulting 13 soil samples were chemically tested for total concentrations of 17 metals (California Code of Regulations, Title 22, Metals), organochlorine pesticides, and polynuclear aromatic hydrocarbons (PAH). Results of the chemical testing indicated that the pesticide DDT (DDD+DDE), chlordane, nickel, and mercury exceeded the RWQCB SSC in at least one sub-area sampled (Attachment A). Specifically, concentration ranges for each of these COCs can be summarized as follows:

- DDE+DDD concentrations ranged from 0.004 parts per million (ppm) to 0.082 for 12 sub-areas which exceeded the SSC of 0.003 ppm;
- Chlordane concentrations ranged from 0.170 ppm to 0.260 ppm for 4 sub-areas which exceeded the SSC of the laboratory detection limit;
- Mercury concentrations ranged from 0.36 ppm to 2.6 ppm for 14 sub-areas which exceeded the SSC of 0.35 ppm; and,
- Nickel concentrations ranged from 140 ppm to 170 ppm for 2 sub-areas, which exceeded the SSC of 140 ppm.

The VTA requested that H.T.Harvey and Dames & Moore conduct a mitigation analysis to identify cost effective and environmentally sound options to managing the soil affected with the COCs. To achieve this objective, Dames & Moore/H.T. Harvey:

- Reviewed information provided by VTA concerning the wetland mitigation;
- Conducted a site visit with representatives of the VTA;
- Conducted a literature search to identify other screening criteria that could be applied to the site soils, identify background concentrations that have been reported in previous studies, and identify mitigation alternatives that have been implemented at similar sites in the Bay area; and
- Conducted a review and analysis of possible mitigation approaches.

PROPOSED GRADING PLAN

Through the comparison of the COC concentrations in the mitigation site soils with historical background concentrations and other appropriate sediment screening criteria, it is the opinion of our consultants that constructing a low permeability cap across the site will isolate the existing COCs from the future wetland ecosystem. A brief discussion of the scope of this approach is presented below.

Under this approach, the existing soil surface would be excavated to a depth of 18 inches across the site and clean, import wetland soil will be backfilled to the design elevation of 3 feet NGVD. The import fill would contain a high percentage of clay mixed with some organic material. Under this alternative, no additional soil sampling or chemical testing would be conducted.

Between the time that the levee is breached and the natural sedimentation period is complete, the fill material would act as a cap or buffer to isolate the soil impacted with the COCs from the re-deposited natural sedimentation. Based on the material proposed for import fill, the resulting hydraulic conductivity of the placed material should be in the range of 1×10^{-4} to 1×10^{-6} centimeters per second (cm/s). Once placed, the low-

permeability material will act as a localized "aquitard", across which migration of the COCs will be eliminated or significantly reduced for several reasons as follows:

- The ability of water, carrying dissolved COCs to migrate across the low-permeability cap material will be minimized;
- COCs will adsorb to the clay particles and organic matter in the cap and become immobile; and,
- The soil/water system below the cap will likely revert to an anaerobic environment which will allow the metals to form insoluble sulfide compounds.

Once the natural sedimentation is completed, the re-deposited sediment and cap material will effectively create a three-foot separation between the overlying wetland ecosystem and the underlying COC-affected soil. Because the effective depth of the biologically active zone is typically no more than 18 inches for wetland ecosystems, the initial cap and ultimate three-feet thick soil layer will be adequate to protect potential ecological receptors. A list of references documenting the success of such an approach in other wetland environments and related supporting scientific documentation is presented in Attachment B.

The proposed excavation and backfilling, to a depth of 18 inches, will serve both to isolate the underlying COCs and as an interim surface for re-vegetation. The soils currently identified for backfilling have been recently excavated from San Tomas Aquino Creek by the Santa Clara Valley Water District and are thus wetland soils that contain large quantities of wetland plant seeds and roots. These seeds and roots will accelerate the re-vegetation of the mitigation site marsh surface. In addition, during the first year, an estimated 0.45 feet of sedimentation is expected to occur on the site thus further isolating the COCs from the biologically active zone, introducing a rich soil for plants to root into, and bringing in wetland seeds and benthic invertebrates from the adjacent marsh. With each additional year, the depth of sediment will further deepen and the biologically active zone of the soil will be further distanced from the COCs. The rates of sedimentation/scour on the mitigation marsh plain are predicted to reach equilibrium in years 5 and 6 at 4.5 feet NGVD, 3 vertical feet above the COC-contaminated soil.

PROPOSED LONG-TERM MANAGEMENT PLAN

Because residual COCs may be left in place beneath the low-permeability soil layer, the RWQCB was interested in developing a Long-Term Management Plan to address the residual constituents. During our meeting, we discussed several options, which included the following:

- Complying with the Current Mitigation Plan: The wetland mitigation activities will be monitored according to the current plan. As part of the monitoring, the rate of sedimentation and/or erosion of the wetland soils will be documented. If erosion of

the wetland sediments encroached into the COC-affected soil, the scoured areas would be backfilled. Once the wetlands are established and completion of the mitigation activities approved by the RWQCB and ACOE, monitoring will be discontinued. Long-term management of the residual COCs will then be accomplished by the long term containment of the low-permeability cap and wetland vegetation. Erosion of the wetland vegetation and low-permeability soil is not expected.

- Periodic monitoring: Periodic monitoring will be conducted after the wetlands become established to evaluate the degree of sedimentation or erosion of wetland sediments. If erosion of the wetland sediments encroached into the COC-affected soil, the scoured areas would be backfilled. The frequency of monitoring after the wetlands are established will be for identified high risk conditions. Recommended frequency would be after every major storm event that caused the river to top the inboard flood control levee. The normal flood rate in the wetland is limited by the two culverts that are a part of the project.
- Deed Restriction: Place a covenant in any Deed conveying the property stating that residual COCs remain in the soil and requiring backfill if the area is significantly eroded or scoured.

A 30-year Post-Mitigation Monitoring Period will be implemented. This is consistent with post-closure monitoring scenarios for landfills with low-permeability caps.

CONCLUSION

It is VTA's opinion that, all elements considered, as presented herein, the approach presented is appropriate for the following reasons:

- Provides for an environmentally sound solution for protecting water quality and the riverine ecosystem;
- Is relatively cost effective with respect to other alternatives considered; and,
- Provides for a complete and final solution.

We recommend that the waiver of water quality certification (Corps file No. 1881 S) be amended to reflect this agreement for the approach and Long Term Management Plan. If you have any questions regarding this document, please call me at (408) 321-5835.

Sincerely,

Wesley M. Toy, P.E.
Project Manager

Attachments:
A: Summary of GRC Findings
B: Related Technical References

3/11/98
draft - Don

Date:
File No. 2188.07 (JRW)
Site No. 02-43-C0116

Mr. Wesley Toy
Santa Clara Valley Transportation Authority
3331 North First Street
San Jose, CA 95134-1906

Subject: **Approval of Changes to the June 12, 1997 Waiver of Water Quality Certification for the Tasman Corridor Light Rail Transit Mitigation Project, Alviso, Santa Clara County, CA, Corps File No. 18881S92**

Dear Mr. Toy:

We have reviewed your February 19, 1998, letter in which you summarize our recent meeting, propose a modified grading plan, and, request changes to the subject Waiver of Water Quality Certification. The proposed mitigation site is located immediately north of Highway 237 on the west bank of the Guadalupe River, outside the existing flood control levees. The subject mitigation area was planned to create a minimum of 1.46 acres of new jurisdictional wetlands to compensate for 0.74 acres of surface area impacts to wetlands and other Waters of the United States.

Recent verification samples at the subject mitigation site indicated that pesticide DDT(DDD+DDE), chlordane, nickel, and mercury exceeded the Boards soil screening criteria. In light of verification sampling results, modifications to site grading plan have been proposed. Upon review of your February 19, 1998 proposal, we hereby approve the proposed changes with the following conditions:

1. Except for the proposed February 19, 1998 changes, all conditions of the June 12, 1997 Waiver of Water Quality Certification are still required;
2. The Santa Clara Valley Transportation Authority, present owner/sponsor and expected long-term owner/sponsor of the mitigation area, shall be responsible for the implementation and success of the mitigation. It is expected that the mitigation areas will meet both the technical criteria of USACE-jurisdictional wetlands and the success criteria outlined in the monitoring plan within 3-5 years after site construction;
3. Within eight weeks of the completion of the mitigation site construction, the monitoring biologist will prepare as-built plans based upon post-grading topographic mapping.

These plans will show all significant deviations from the mitigation plans including size, topography or configuration of the site, and any substantive features added to the site that were not included in the original plans. Future analysis of the site will be based upon these plans;

4. The project sponsor shall implement and maintain adequate erosion control measures during and after construction to control the release of sediment to waters of the State
5. Monitoring of the mitigation to ensure its success shall occur for a minimum of five years after the development of the wetland and open water habitats is complete, and shall continue until continual success of the mitigation site has been shown for three consecutive years, and this finding has been accepted by the Regional Board. Monitoring, reporting requirements, and success criteria are described in the February 1998 mitigation plan. As part of the monitoring, the rate of sedimentation and/or erosion of the wetland soils will be documented and results will be submitted along with the annual monitoring report. Annual monitoring reports will be sent to USACE and the RWQCB by 31 December of each monitoring year.
6. A 30-year post Mitigation Monitoring Period will be implemented. Periodic monitoring will be conducted after the wetlands become established to evaluate the degree of sedimentation or erosion of wetland sediments. If erosion of the wetland sediments encroached into the COC-affected soil, the scoured areas will be backfilled with clean fill. The frequency of monitoring after the wetlands are established will be for the identified high risk areas. Recommended frequency would be after every major storm event that caused the river to top the inboard flood control levee. When the final monitoring goals have been met, a final monitoring report and effectiveness evaluation will be submitted to the permitting agencies and will document that all monitoring responsibilities have been met and that the COC protective cap is stabilized and functioning properly;
7. Analysis of the cause of site failures will be made and remedial actions will be recommended to correct the problem if a performance criterion or a final success criterion is not met. Alternative mitigation site planning will begin if it becomes apparent that long-term success criteria for the sites will not be achieved in a timely fashion;
8. Signs will be posted in appropriate areas to educate persons of the importance and sensitivity of the wetlands areas and to help minimize illegal dumping, disturbances and damage to the wetland flora and fauna by humans and other animals (i.e. cats and dogs);
9. A trash removal program in the wetland area will be performed on an as needed basis;
10. Import soils to be used as fill for the project will be appropriately sampled and found to be acceptable by Board staff; and,
11. Deed Restriction: A covenant will be placed in any Deed conveying the property. This covenant will state that residual chemicals of concern (COCs) remain in the soil beneath a protective cap and backfill/re-capping will be required if the area is significantly eroded or scoured to expose the COCs.

We anticipate no further action on this application. However, should new information come to our attention that indicates a water quality problem with this project, the Regional Board may issue Waste Discharge Requirements.

If you have any questions regarding these modifications to the original waiver, please contact John West of my staff at (510) 286-1262.

Sincerely,

Loretta K. Barsamian
Executive Officer

cc: Mark D' Avignon, Regulatory Branch, USACE
Janice Gan, USFWS
Paul Amato and Feride Serefiddin, RWQCB
Brian Hunter, CDFG
Nadell Gayou, DWR
Marla Lafer, SWRCB-DWR

SANTA CLARA
Valley Transportation Authority

March 13, 1998

Via e-MAIL
Hardcopy to follow U.S. Mail

Mr. John West
California Regional Water Quality Control Board
2101 Webster Street
Oakland, California 94612

Dear Mr. West,

Confirmation of Approval of Use of Soils from SCVWD River Sediment Removal for Wetlands Cover Material
Guadalupe River Wetland Mitigation Project
San Jose, California
Tasman West Light Rail Project
For Santa Clara Valley Transportation Authority (VTA)

This letter will confirm our conversation of March 12, 1998 where you provided approval for the Santa Clara Valley Transportation Authority to use approximately 7000 cubic yards of soils as appropriate cover material at our Wetlands Mitigation Site. These soils were initially removed from the San Tomas Aquino Creek by the Santa Clara Valley Water District (SCVWD) as part of their Sediment Removal Project during the summer of 1997. Soil analyses developed by SCVWD was reviewed by our consultant H.T. Harvey & Associates and approved as an acceptable material for this site. The placement of this soil occur within the next 4 weeks.

This approval is adjunct to the approval for changes to the June 12, 1997 Waiver of Water Quality Certification which is to be issued by your office shortly.

Sincerely,

Wesley M. Toy, P.E.
Project Manager

cc: K. Brencic R. Hybarger L. Miller L. Eaton
R. Molseed J. Spalding R. Dona M. Robinson
D. Stephens (H.T. Harvey) fax(408)263-3823 R. Brandt (Dames & Moore) fax (408)451-1137

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APR-09 98 08:16 FROM:RWQCB R2 DOD 5102[illegible] TO:914083215805 PAGE:01

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CalEPA — State of California - Pete Wilson, Governor

San Francisco Bay Regional Water Quality Control Board
2101 Webster Street, Suite 500, Oakland, CA 94612 (510) 286-1255 Fax: 286-1380

Post-it® Fax Note 7671	Date 4/9/98	# of pages 3
To WESLEY TOY	From TOM BERKINS	
Co./Dept. SCVTA	Co. RWQCB	
Phone #	Phone # 510 286-0750	
Fax # 408 321-5805	Fax # 510 286-1380	

REC'D APR 10 1998

MAR 27 1998

Date:
File No. 2188.07 (JRW)
Site No. 02-43-C0116

WETLANDS SITE MITIGATIONS
C885

Mr. Wesley Toy
Santa Clara Valley Transportation Authority
3331 North First Street
San Jose, CA 95134-1906

Subject: **Approval of Changes to the June 12, 1997, Waiver of Water Quality Certification for the Tasman Corridor Light Rail Transit Mitigation Project, Alviso, Santa Clara County, CA, Corps File No. 18881S92**

Dear Mr. Toy:

We have reviewed your February 19, 1998, letter in which you summarize our recent meeting, propose a modified grading plan, and request changes to the subject Waiver of Water Quality Certification. The proposed mitigation site is located immediately north of Highway 237 on the west bank of the Guadalupe River, outside the existing flood control levees. The subject mitigation area was planned to create a minimum of 1.46 acres of new jurisdictional wetlands to compensate for 0.74 acres of surface area impacts to wetlands and other Waters of the United States.

Recent verification samples at the subject mitigation site indicated that pesticide DDT (DDD+DDE), chlordane, nickel, and mercury exceeded the Board's soil screening criteria. In light of verification sampling results, modifications to site grading plan have been proposed. Upon review of your February 19, 1998, proposal, we hereby approve the proposed changes with the following conditions:

1. Except for the proposed February 19, 1998, changes, all conditions of the June 12, 1997, Waiver of Water Quality Certification are still required;
2. The Santa Clara Valley Transportation Authority, present owner/sponsor and expected long-term owner/sponsor of the mitigation area, shall be responsible for the implementation and success of the mitigation. It is expected that the mitigation areas will meet both the technical criteria of jurisdictional wetlands and the success criteria outlined in the monitoring plan within three to five years after site construction;
3. Within eight weeks of the completion of the mitigation site construction, the monitoring biologist will prepare as-built plans based upon post-grading topographic mapping. These plans will show all significant deviations from the mitigation plans including size,

W98040268

topography or configuration of the site, and any substantive features added to the site that were not included in the original plans. Future analysis of the site will be based upon these plans;

4. The project sponsor shall implement and maintain adequate erosion control measures during and after construction to control the release of sediment to waters of the State.

5. Monitoring of the mitigation to ensure its success shall occur for a minimum of five years after the development of the wetland and open water habitats is complete, and shall continue until continual success of the mitigation site has been shown for three consecutive years, and this finding has been accepted by the Regional Board. Monitoring, reporting requirements, and success criteria are described in the February 1998 mitigation plan. As part of the monitoring, the rate of sedimentation and/or erosion of the wetland soils will be documented and results will be submitted along with the annual monitoring report. Annual monitoring reports will be sent to the Corps and the Regional Board by December 31 of each monitoring year.

6. A 30-year post Mitigation Monitoring Period will be implemented. Periodic monitoring will be conducted after the wetlands become established to evaluate the degree of sedimentation or erosion of wetland sediments. If erosion of the wetland sediments encroached into the chemical of concern (COC)-affected soil, the scoured areas will be backfilled with clean fill. The frequency of monitoring after the wetlands are established will be for the identified high risk areas. Recommended frequency would be after every major storm event that caused the river to top the inboard flood control levee. When the final monitoring goals have been met, a final monitoring report and effectiveness evaluation will be submitted to the permitting agencies and will document that all monitoring responsibilities have been met and that the COC protective cap is stabilized and functioning properly.

7. Analysis of the cause of site failures will be made and remedial actions will be recommended to correct the problem if a performance criterion or a final success criterion is not met. Alternative mitigation site planning will begin if it becomes apparent that long-term success criteria for the sites will not be achieved in a timely fashion;

8. Signs will be posted in appropriate areas to educate persons of the importance and sensitivity of the wetlands areas and to help minimize illegal dumping, disturbances and damage to the wetland flora and fauna by humans and other animals (e.g., cats and dogs);

9. A trash removal program in the wetland area will be performed on an as needed basis;

10. Import soils removed from San Tomas Aquino Creek by the Santa Clara Valley Water District as part of its urgent sediment removal project in 1997 were found to be acceptable by Board staff and will be used as fill for the project; and,

11. Deed Restriction: A covenant will be placed in any Deed conveying the property. This covenant will state that residual COCs remain in the soil beneath a protective cap and backfill/re-capping will be required if the area is significantly eroded or scoured to expose the COCs.

We anticipate no further action on this application. However, should new information come to our attention that indicates a water quality problem with this project, the Regional Board may issue Waste Discharge Requirements.

If you have any questions regarding these modifications to the original waiver, please contact John West of my staff at (510) 286-1262.

Sincerely,

Lawrence P. Kolb
for
Loretta K. Barsamian
Executive Officer

cc: Mark D' Avignon, Regulatory Branch, USACE
Janice Gan, USFWS
Paul Amato and Feride Serefiddin, RWQCB
Brian Hunter, CDFG
Nadell Gayou, DWR
Maria Lafer, SWRCB-DWR

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

7 July 2008

Roy Molseed
Santa Clara Valley Transportation Authority
Environmental Analysis Division
3331 North First Street, Building B
San Jose, California 95134

Subject: Proposal for the Tasman Corridor Wetland Mitigation FEMA Certification and Long-term Monitoring (HTH Proposal # 5398)

Dear Roy,

Thank you for requesting a proposal from H. T. Harvey & Associates to assist with obtaining FEMA Certification and providing the long-term ecological monitoring for the Tasman Corridor Wetland Mitigation site. Our revised scope and fee estimate is attached. We have teamed with Schaaf & Wheeler (Hydrology), TRC (Geotechnical Engineering), and RJA (Surveyors) to assist the VTA with the FEMA Certification process.

As requested, we have revised our proposal to include optional tasks if it is necessary to gather additional subsurface geotechnical information and/or design improvements to the levee to meet FEMA requirements.

This proposal includes 6 years of long-term ecological monitoring in accordance with the monitoring scope specified in the projects' Wetland Mitigation and Monitoring Plan (MMP) (H. T. Harvey & Associates 1997). The content of the monitoring plan section of the MMP was the outcome of regulatory agency communications and requirements during preparation of the plan. This monitoring plan specifies a relatively high level of effort which is reflected in our scope and budget. The MMP requires annual topography, water level, vegetation, and wildlife (bird use) monitoring. We have scaled-back the wildlife monitoring from that proposed in the MMP, per my discussion with Ann Calnan.

We look forward to assisting you with this project.

Sincerely,

Max Busnardo

Max Busnardo, M.S.,
Associate Restoration Ecologist

CC: Dan Stephens, H. T. Harvey & Associates

983 University Avenue, Building D • Los Gatos, CA 95032 • Ph: 408.458.3200 • F: 408.458.3210

H. T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

PROPOSED SCOPE OF SERVICES

Tasman Corridor Wetland Mitigation Site
FEMA Certification of Levee and Long-Term Monitoring

Proposal #5398

7 July 2008

The H. T. Harvey & Associates Team (H. T. Harvey & Associates and Schaaf & Wheeler) proposes to provide consulting services to the Santa Clara Valley Transportation Authority (VTA) to assist with obtaining Federal Emergency Management Agency (FEMA) levee certification and to conduct long-term ecological monitoring at the Tasman Corridor Mitigation Site. The goal of the wetland mitigation, per the resource agency permits and Tasman Corridor Mitigation and Monitoring Plan (MMP) is to restore a fully-tidal, brackish marsh similar in structure and function to the adjacent marsh along the Guadalupe River (H. T. Harvey & Associates 1997). Our long-term monitoring scope is based on the MMP, because implementation of this plan was a condition of the resource agency permits. The MMP calls for 6 years of annual monitoring to characterize topography, water surface elevations, and vegetation and to compare these parameters to compliance criteria set forth in the MMP.

A fee estimate is attached. H. T. Harvey & Associates would invoice monthly on a time-and-charges basis, not to exceed the total fee estimate. This proposal is valid for a period of 60 days from the time of submittal.

The tasks covered in this scope are as follows:

Task 1. Determine the Path to FEMA Certification of the Levee

This task will determine the appropriate path to FEMA certification of the levee. There are two possible paths:

1. The existing levee condition meets FEMA criteria and can be certified as is. This assumes that the crown elevation has sufficient freeboard and that the available geotechnical data meets existing FEMA and U. S. Army Corps of Engineers levee criteria.
2. the existing levee condition does not meet FEMA criteria. In the case, a preliminary design will be prepared to develop an improvement plan so that the levee can be certified.

Subtask 1.1 Project Administration, Meetings, Background Information Review. The H. T. Harvey & Associates Team will assess the options for FEMA Levee Certification and achievement of the wetland mitigation objectives. This task includes gathering and reviewing relevant background information for this project and time for HTH's project manager (Max Busnardo, M.S.) to coordinate with VTA and Schaaf & Wheeler.

983 University Avenue, Building D • Los Gatos, CA 95032 • Ph: 408.458.3200 • F: 408.458.3210

Schaaf & Wheeler will review existing information to determine the FEMA-approved, 100-year flood elevation for the Guadalupe River (with installation of the recent Lower Guadalupe River Flood Control Project) relative to the site's levee crest elevation (see Attachment A). TRC's Geotechnical Engineers will review the existing geotechnical data gathered previously by GeoResources to determine if sufficient geotechnical information is available to request a Letter of Map Revision. RJA will survey the levee to determine the exact dimensions and elevations. The outcome of this assessment will be conveyed in a memorandum to the VTA. This task includes up to 2 meetings with VTA and 1 meeting with the resource agencies (e.g. representative(s) of the Regional Water Quality Control Board) and VTA to discuss the next steps.

This task does not include the development of off-site wetland mitigation options. In addition, this task assumes that CEQA and regulatory agency permitting are not required and are not included in this scope.

Optional Subtask Task 1.2. Additional Geotechnical Subsurface Investigation. This Optional Task will be conducted, if TRC determines that additional subsurface investigation is required to supplement existing information (previously collected by GeoResources in the late 1990's). This task includes up to 4 borings and the preparation of a report summarizing the investigations' findings (see Attachment A).

Task 2. FEMA Certification of the Levee

Subtask 2.1 Complete FEMA Letter of Map Revision Forms. If we determine in Task 1 above that the levees' height and geotechnical characteristics meet FEMA requirements, we will proceed with the levee certification process. This task entails preparation of an application for certification to FEMA (Letter of Map Revisions forms and fee).

Optional Subtask 2.2. Preliminary Design of Levee Improvements. Additional levee improvements would be necessary if the existing levee height is less than the FEMA freeboard requirement or does not meet FEMA's geotechnical stability requirements. This optional task covers the preparation of a preliminary design report and cost estimate to modify the levee to meet FEMA requirements (See Attachment A). This task will evaluate various levee improvement options which may include: raising the levee, raising only the roadbed, or adding a floodwall. This task also includes up to 2 meetings with VTA and 1 meeting with VTA and the resource agencies to discuss the levee improvement options, cost and timeline.

This task does not include preparation of Plans and Specifications (i.e., construction bid documents).

Task 3. Year-1 (2009) Monitoring

Vegetation Data Collection, Photo-documentation, and Maintenance Monitoring. H. T. Harvey & Associates will conduct monitoring as outlined in the project's MMP (H. T. Harvey & Associates 1987). Data collection will take place in August-October of each monitoring year.

Vegetation Data Collection. Vegetation sampling will occur between in the fall of each monitoring year, at the end of the growing season. Four permanent transects will be randomly established parallel to the Guadalupe River site. Vegetation development will be monitored by sampling with a 1.0 meter square quadrat frame at numerous random locations along each of the four transects. A minimum of 0.05% of the marsh plain surface will be sampled (~30 quadrats). Total vegetative percent cover, percent cover of each species, and percent cover of bare ground and litter will be visually estimated within each quadrat sample. Slough channels will not be included in the percent cover sampling area, since these areas were designed to support little or no vegetation.

Photo-documentation. Permanent photo-documentation point locations will be selected, mapped via GPS, and photographs will be taken from recorded compass directions. Photographs will also be taken to record any events that may have a significant effect on the success of restoration such as flood, fire, or vandalism.

Maintenance Monitoring. This task includes 2 annual inspections of the wetland mitigation site (1 site visit in May- June and 1 site visit in Sept-Oct), in accordance with Sections 4.1.1, 4.1.2, and 4.1.3 of the Operations and Maintenance Agreement between the VTA and the Santa Clara Valley Water District. We will GPS the locations of invasive plant species that we recommend for removal. This task also includes 1 site visit to inspect invasive species eradication work to be performed by others. HTH will inspect the pilot channels, culverts, rock slope protection, and wetland soil cap to evaluate whether any maintenance is required for these elements of the site. We will also inspect the sliding gates and grease them.

Water Level Monitoring/Topographic Surveys. Water level monitoring will be conducted utilizing 2 continuous water level recording devices (YSI water level recorders). The purpose of water level monitoring is to determine the differences in hydrologic function between the project area and the Guadalupe River marsh. One of the water level recorders will be positioned within the interior of the project area and one water level recorder will be placed near the adjacent Guadalupe River marsh. The recorders will be deployed for a 1-week period during a spring tide series.

Topographic surveys will be conducted at 2 fixed cross-sections, to be located longitudinally (approximately north-south) across the site. In addition, 3 additional cross-sections of the excavated, pilot slough channels will be surveyed. The cross-sections will be tied into local benchmarks and translated into NGVD29. The inlets and outlets of the culverts will also be surveyed to determine if there is any settling. The results of each survey will be compared to previous year's surveys to identify locations and rates of sedimentation, scour, and slough development.

Two topographic surveys will be conducted for this task; a survey prior to opening the tide gates, and a survey conducted approximately 1 year following the opening of the tide gates. This will allow us to determine the effect of tide gate opening on site elevations.

Wildlife Surveys. The MMP includes avian monitoring to assess bird use at the mitigation site. As requested by the VTA, we have modified the avian survey scope presented in the MMP to

produce results that qualitatively demonstrate the wildlife values provided by the mitigation, thus meeting the MMP's intent, while utilizing a level of effort appropriate for a mitigation site of this small size. H. T. Harvey & Associates staff ornithologists will monitor bird use at the mitigation site and in the tidal wetlands along the Guadalupe River immediately adjacent to the site. The existing tidal wetlands in the Guadalupe River adjacent to the site will serve as a reference site, since the target habitat within the mitigation site is similar to the existing habitat in the River.

Baseline avian surveys will be conducted during the year prior to opening the tide gates (if feasible -- tidal restoration should not have to wait on these surveys to be conducted) to document the pre-restoration condition. Four surveys will be conducted during the breeding season (May-June) and 4 surveys will be conducted during the winter (December-January). During each season, 2 of the surveys will be conducted during low tides and 2 surveys will be conducted during high tides. The observer will walk around the entire mitigation site recording all individuals of all avian species using the site. The observer will also record numbers of birds using a portion of the adjacent Guadalupe River tidal wetlands that has roughly the same acreage as the mitigation site. Avian surveys, using the same protocol as conducted for the baseline surveys, will then be conducted in Year-3 and Year-6 following the opening of the tide gates.

Raw count data will be entered into a spreadsheet. Species richness and abundance, both overall and by species, will be compared between seasons, years, and sites (mitigation site and the existing wetlands along the Guadalupe River). The results of the annual wildlife monitoring, along with a brief discussion of any differences or trends noted, will be incorporated into each year's monitoring report.

Data Analysis and Report Preparation. Using the data collected and analyzed above, HTH will generate an annual monitoring report evaluating the site's overall performance, and providing maintenance and management recommendations. The report will include introduction, methods, results, discussion, and recommendations sections. Graphics showing monitoring locations will be included.

A draft report will be submitted to the VTA by November 15th. After the incorporation of one (1) round of written comments, the final monitoring report will be submitted to the VTA and the permitting agencies. We will submit the final report electronically as a PDF document to the VTA and regulatory agencies by 31 December of each monitoring year. Hard copies will be provided, if requested.

Task 4. Year-2 (2010) Monitoring

The scope of work for Year-2 Monitoring is identical to Year-1, except only a single topographic survey will be necessary and no wildlife monitoring will be conducted.

Task 5. Year-3 (2011) Monitoring

The scope of work for Year-3 Monitoring is identical to Year-1, except only a single topographic survey will be necessary and a wetland delineation will be conducted. Year-3 monitoring includes wildlife monitoring per the scope in Task 1.

Wetland Delineation. The Tasman Corridor Wetland Mitigation project is required to create a minimum of 1.46 acres of new USACE jurisdictional area. A formal wetland delineation will be performed at the wetland mitigation site in the third year of monitoring and repeated annually thereafter until the target acreage qualifies as a wetland.

Task 6. Year-4 (2012) Monitoring

The scope of work for Year-3 Monitoring is identical to Year-1, except only a single topographic survey will be necessary and no wildlife monitoring will be conducted. It is assumed that the year-3 wetland delineation will determine that the surface area of USACE jurisdictional habitat has been restored and additional delineations will not be required.

Task 7. Year-5 (2013) Monitoring

The scope of work for Year-3 Monitoring is identical to Year-1, except only a single topographic survey will be necessary and no wildlife monitoring will be conducted. It is assumed that the year-3 wetland delineation will determine that the surface area of USACE jurisdictional habitat has been restored and additional delineations will not be required.

Task 8. Year-6 (2014) Monitoring

The scope of work for Year-3 Monitoring is identical to Year-1, except only a single topographic survey will be necessary. This task includes wildlife monitoring per the scope summarized in Task 1. It is assumed that the year-3 wetland delineation will determine that the surface area of USACE jurisdictional habitat has been restored and additional delineations will not be required.

This task also includes additional project management time to facilitate sign-off from the permitting agencies. It is anticipated that the project will be considered a success by the resource agencies and "signed off" when the performance criteria are met following the end of the 6-year monitoring period. At the final year of the monitoring period, a report will be prepared to establish whether the mitigation sites have achieved the success criteria. HTH will then formalize the mitigation site's completion in a written letter to the resource agencies, on behalf of VTA, requesting written sign-off from the agencies. This task includes 1 site meeting with the permitting agencies, and telephone and email communications with agency personnel.

REFERENCES

H. T. Harvey & Associates. 1997. Tasman Corridor Mitigation and Monitoring Plan. Prepared for the Santa Clara Valley Transportation Authority. Project No. 725-03

From: Max Busnardo [mailto:mbusnardo@harveyecology.com]
Sent: Wed 10/15/2008 2:21 PM
To: Calnan, Ann
Cc: Fitzwater, Tom; Jim Schaaf; Dan Stephens; Donna Ball
Subject: RE: Tasman Wetlands Mitigation Site

Ann,

The answer to the first part of Brian Wine's question ("date by which on the ground construction will be complete for the additional 0.74 acres") is that construction of the additional wetland mitigation was completed in 1998 along with grading/construction of the site as a whole.

Here is our rough schedule for opening the tide gates at the site if:

1. the existing levee is certifiable by FEMA – 1 May 2009 (2 months for our study + FEMA application submittal; 4 months for FEMA response)

2. the existing levee does not meet FEMA standards- 1 July 2010 (1 year for initial study + construction design + FEMA response; assume flood wall cannot be built in rainy season and is constructed in spring/early summer 2010)

Please let me know if you would like to discuss the schedule.

Max

Appendix B. Habitat Elevation Measurement Results

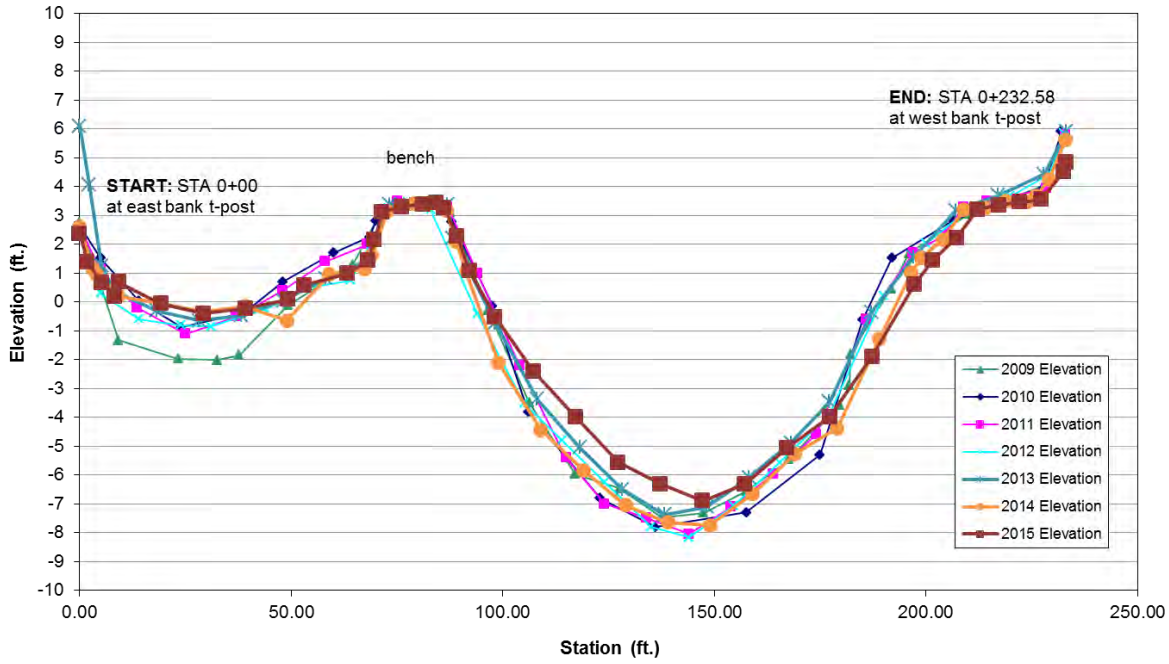

Figure B-1. Tasman Corridor Wetland Mitigation Site; Cross-Section 1

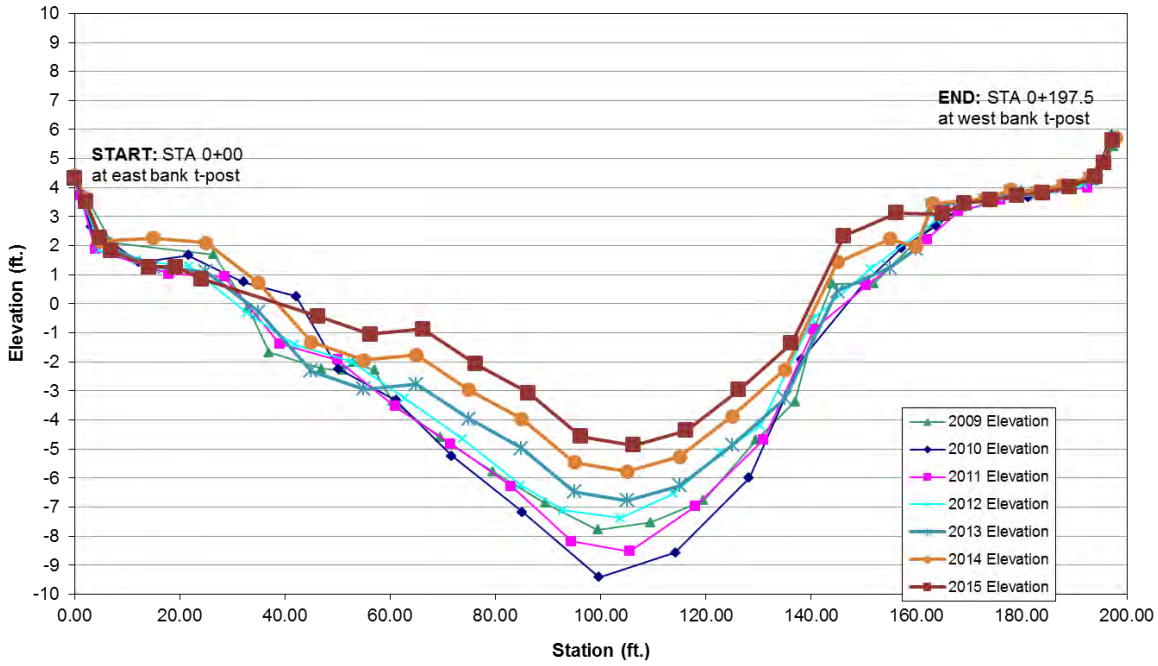

Figure B-2. Tasman Corridor Wetland Mitigation Site; Cross-Section 2

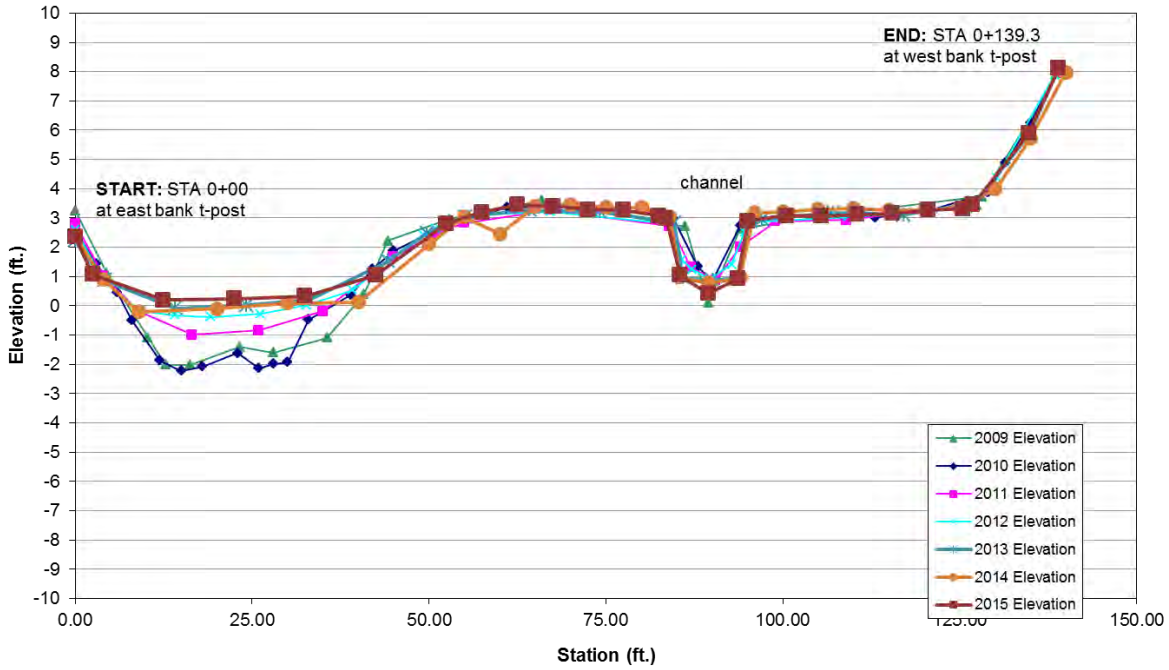

Figure B-3. Tasman Corridor Wetland Mitigation Site; Cross-Section 3

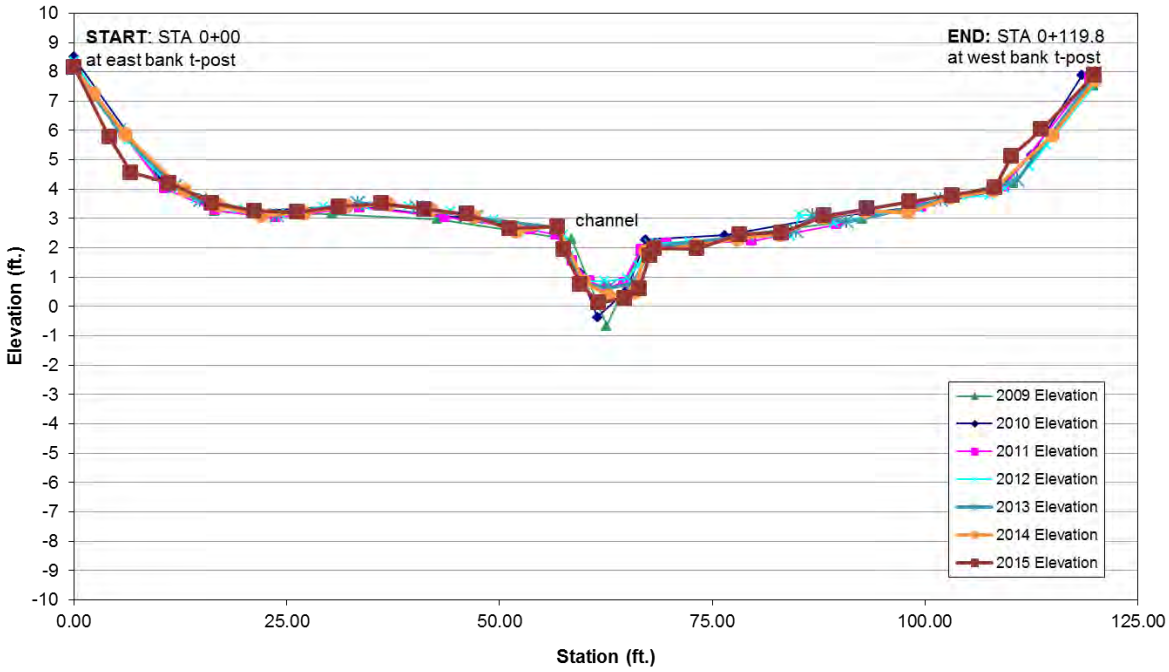

Figure B-4. Tasman Corridor Wetland Mitigation Site; Cross-Section 4

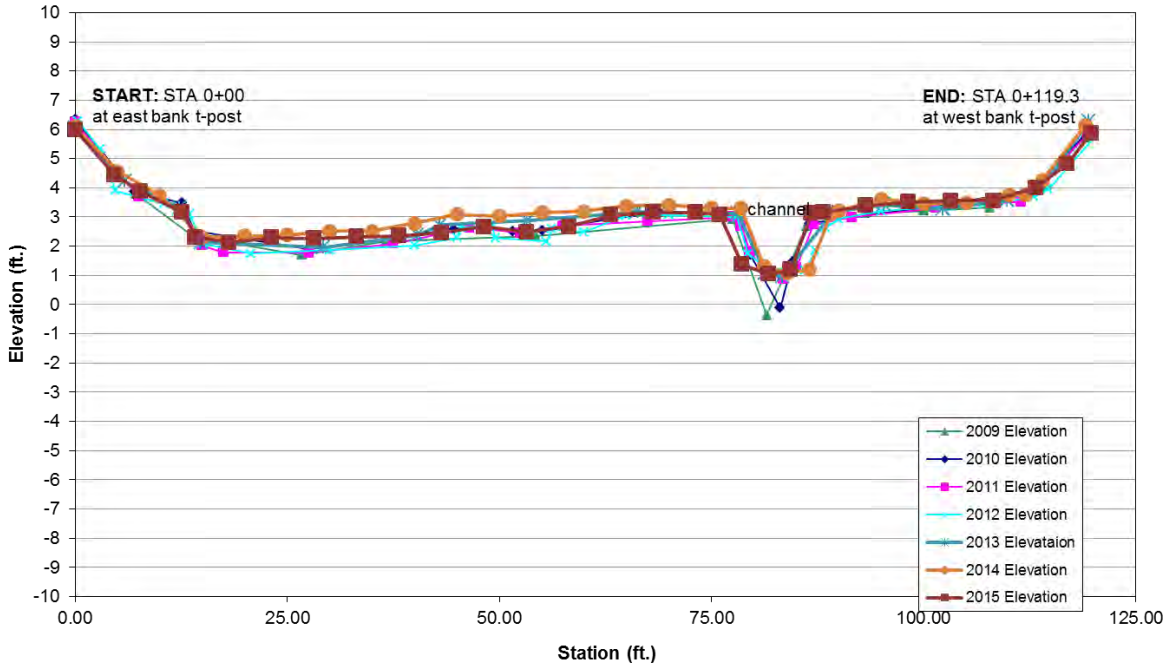

Figure B-5. Tasman Corridor Wetland Mitigation Site; Cross-Section 5

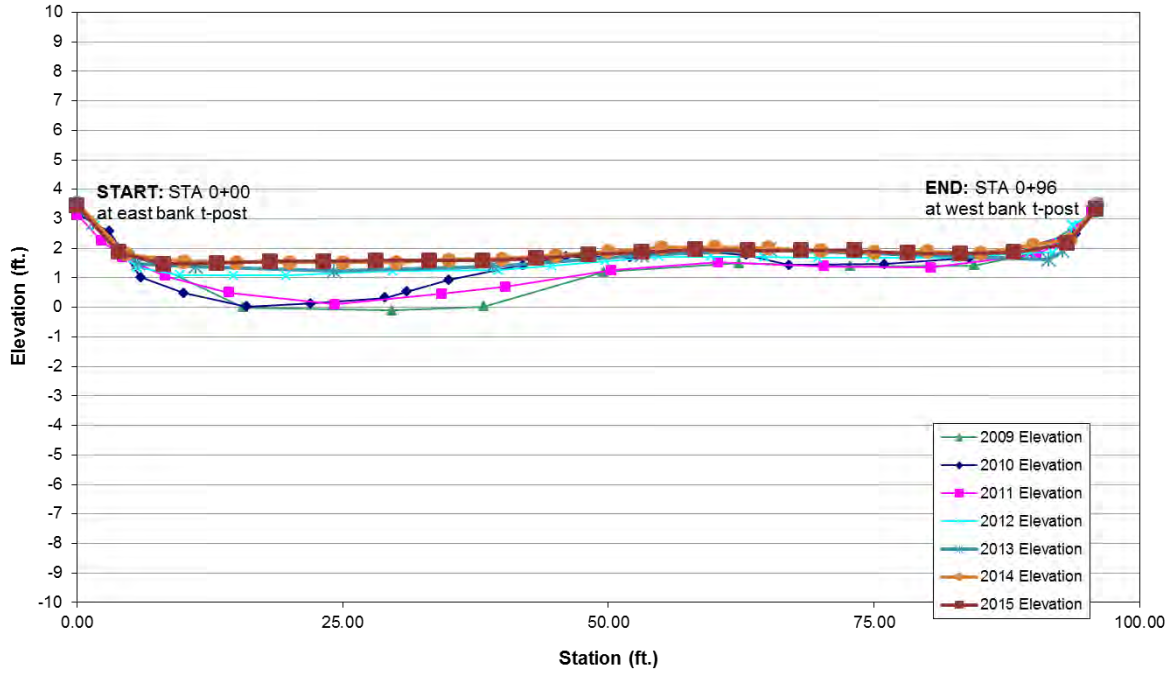

Figure B-6. Tasman Corridor Wetland Mitigation Site; Cross-Section 6

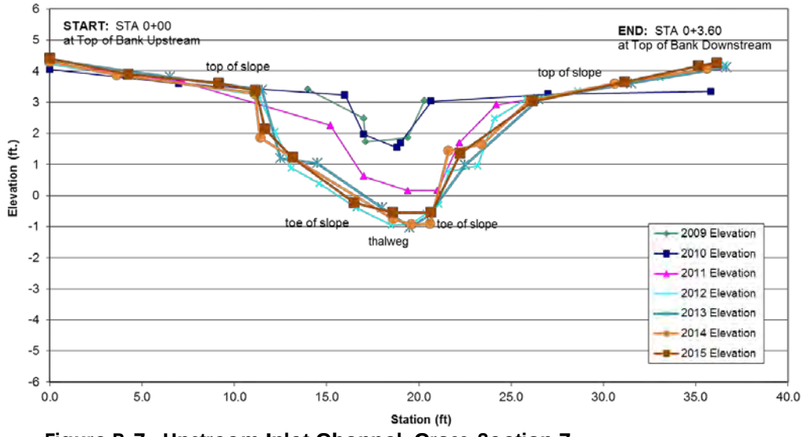

Figure B-7. Upstream Inlet Channel; Cross-Section 7

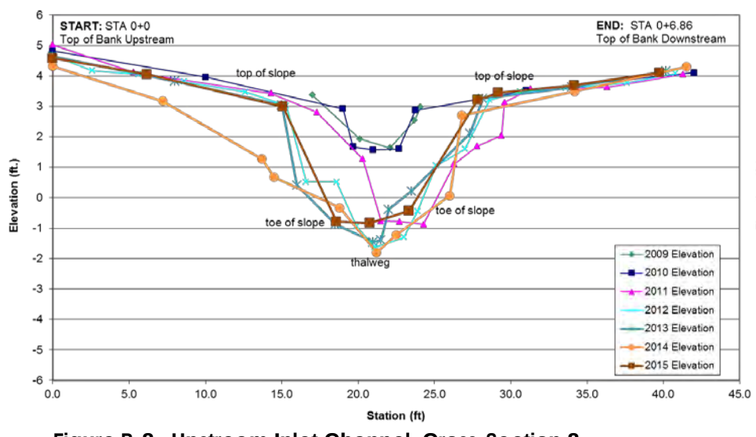

Figure B-8. Upstream Inlet Channel; Cross-Section 8

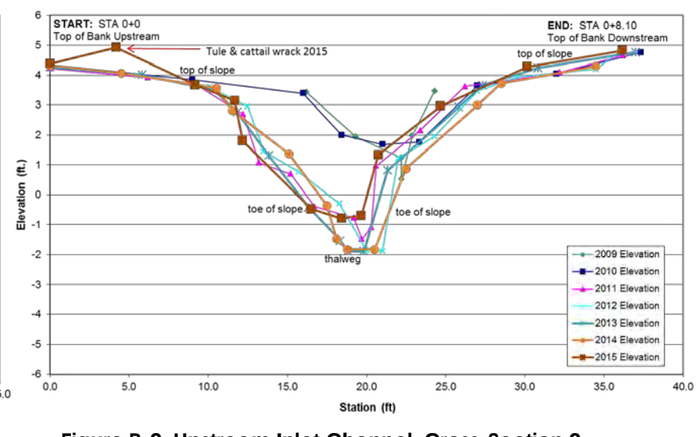

Figure B-9. Upstream Inlet Channel; Cross-Section 9

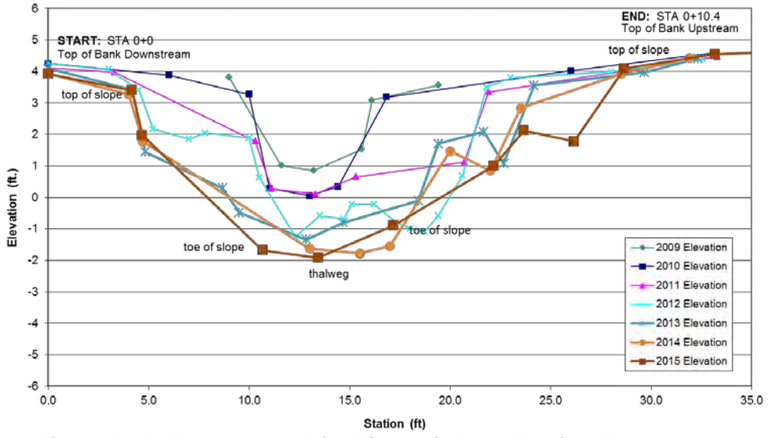

Figure B-10. Downstream Inlet Channel; Cross-Section 10

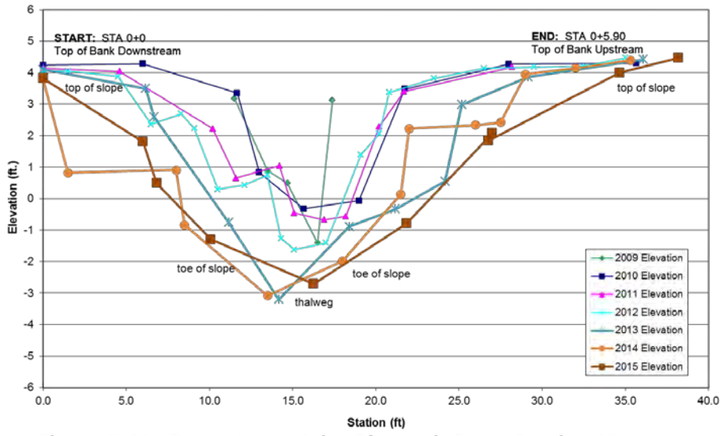

Figure B-11. Downstream Inlet Channel; Cross-Section 11

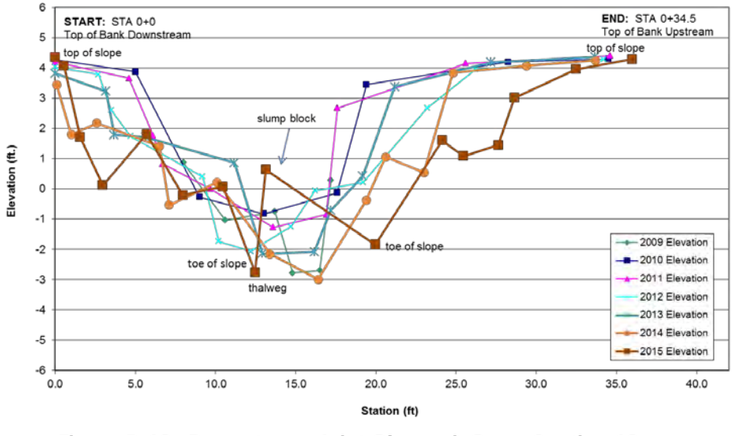

Figure B-12. Downstream Inlet Channel; Cross-Section 12

Appendix C. Photodocumentation from September 2010 and February 2015

September 2009

February 2015

A-1. Photo Point 1

September 2009

February 2015

A-2. Photo Point 2

September 2009

February 2015

A-3. Photo Point 3

September 2009

February 2015

A-4. Photo Point 4

September 2009

February 2015

A-5. Photo Point 5

September 2009

February 2015

A-6. Photo Point 6

September 2009

February 2015

A-7. Photo Point 7

September 2009

February 2015

A-8. Photo Point 8

September 2009

February 2015

A-9. Photo Point 9

September 2009

February 2015

A-10. Photo Point 10

September 2009

February 2015

A-11. Photo Point 11

September 2009

February 2015

A-12. Photo Point 12

March 2014

February 2015

A-13. **Photo Point 13** (added in 2014, therefore, no 2009 photo is available)

March 2014

February 2015

A-14. **Photo Point 14** (added in 2014, therefore, no 2009 photo is available)

March 2014

February 2015

A-15. **Photo Point 15** (added in 2014, therefore, no 2009 photo is available)