



H. T. HARVEY & ASSOCIATES

Ecological Consultants

Upper Penitencia Creek Improvement Project
Year -2 (2014) Monitoring Report

Project # 3518-03

Prepared for:

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Executive Summary

Permit Numbers

This report fulfills the requirement for annual mitigation monitoring reports in accordance with the following permits:

- U.S. Army Corps of Engineers File No. 28924S
- Regional Water Quality Control Board Site No. 02-43-C0654 (bkw)
- California Department of Fish and Wildlife Notification No. 1600-2011-0303-R3

Background

The Upper Penitencia Creek Improvement Project (project) is located at the downstream end of Upper Penitencia Creek (Creek) in San Jose, Santa Clara County, California (Figure 1). The 2.06-acre site is situated approximately 1400 feet (ft) upstream from the Coyote Creek confluence. The project included floodplain wetland habitat creation, riparian habitat restoration, and instream habitat creation as mitigation for permanent impacts to Federal and State jurisdictional wetlands and waters due to construction of the Santa Clara Valley Transportation Authority's (VTA) BART Silicon Valley Berryessa Extension (SVBX) Project.

The project's Mitigation and Monitoring Plan (MMP) requires fisheries monitoring, in addition to vegetation and stream geomorphology/hydrology monitoring (ICF International 2012). The project's Fisheries Monitoring Plan (H. T. Harvey & Associates [HTH] 2013a) includes quantitative assessment of the post-project fish community, particularly site use by the federal and state-listed California coast steelhead (*Oncorhynchus mykiss*).

The MMP and Fisheries Monitoring Plan included the following project goals:

- restore hydrologic and geomorphic functions including sediment transport/deposition,
- restore floodplain connectivity and flood storage,
- restore fish and wildlife habitats, including the provision of on-site habitat and passage for the central California coast steelhead, and
- improve water quality.

Mitigation site construction was completed in October 2012, and native riparian and wetland plants were installed in January 2013 by Marina/East Bay Construction. A total of 3413 native trees and shrubs and 1434 native herbaceous plantings throughout the mitigation site (Anil Verma Associates, Inc. 2013). Year 1 vegetation monitoring was conducted in accordance with the project's MMP in the summer of 2013 (HTH 2013a) and recorded a survival of woody plants in "good" or "fair" health of 83%.

A revised project Vegetation Monitoring Plan (VMP) (HTH 2014b) was prepared that shifted from survival monitoring to a habitat function-based monitoring program as the result of an interagency meeting held on 29 April 2014 with the California Department of Fish and Wildlife (CDFW), Regional Water Quality Control Board (RWQCB), and VTA (HTH 2014c).

In conformance with the project's MMP, Fisheries Monitoring Plan, and VMP, this report presents the Year 2 vegetation, fisheries, and stream geomorphology monitoring results, comparisons to VMP success criteria, and maintenance recommendations.

Results

Vegetation

Vegetation percent cover and survival data was collected individually for both the Streamside Area (comprised of Streamside, Bar, and Boulder Bank Planting Zones) and the Floodplain Area (comprised of the Floodplain and Upper Slope Planting Zones).

Average percent cover of native woody species was 47.6% in the Streamside Area and 8.3% in the Floodplain Area. Both of these measures exceed the VMP Year 2 performance criteria of 20% and 5%, respectively. The average percent cover of native woody species overhanging the bank-full channel was 23.8% and average tree height was 8.1 ft. These measurements serve as baselines against which future measurements will be compared. No cover of invasive species was recorded along any vegetation monitoring transect, meeting the Year 2 performance criterion of less than 5% cover by invasive species.

In February 2014, VTA replanted 236 plants in accordance with MMP survival success criterion. During Year-2 vegetation monitoring, Floodplain Area woody plant survival was 81%. Replanting of 168 plants to bring survival up to 100% is recommended in accordance with the VMP. Streamside Area canopy gaps totaled 631 feet across the site and the installation of 105 cuttings is recommended to fill those gaps. All species of surviving woody plantings had an average health and vigor rating of 2.5 or above (good condition). Ninety seven percent of surviving woody plantings monitored were in good condition, 2% were in fair condition, and 1% were in poor condition. Of the 141 woody recruits tallied within 14000 ft^2 associated with 14 band transects (Figure 2, TF 1-8 and TS 1-6), 140 were native species and 1 was a non-native species (shamel ash [*Fraxinus uhdei*]). A total of 19 native woody species were observed within the project site.

Stream Geomorphology

Precipitation in the 2014 water year was 6.03 inches, approximately 40% of average, resulting in few measureable runoff events. Intermittent and dry conditions were observed throughout much of the year both within the project reach and upstream at two additional streamflow gages. Manual measurements recorded flows of 1-2 cubic feet per second (cfs) entering the project reach at the beginning of the water year. However, this flow went subsurface within 200 feet of entering the project reach during most rainfall and runoff events. No measurable channel changes, sedimentation, scour, or bank instabilities were identified as no substantial flood flows were recorded.

Fisheries

During Year 2, standard electrofishing surveys (spring and fall) were not conducted. Except for habitat units downstream of the new roadway bridge crossing, habitat units in the project site were dry or contained shallow, stagnant water not conducive to electrofishing. All habitat units in the project site were disconnected from reaches upstream of the project site and none were receiving surface flow. In habitat units downstream of the new roadway bridge crossing there was no discernable flow, and the water quality in these units was determined to be too poor to electrofish safely. Continuous flow was observed in the Project reach once in November and twice in February during the 2014 water year. During the spring, investigatory seining was conducted in persistent pools during which one native species, California roach (*Lavinia symetricus*), was captured. During the fall, water levels were substantially lower than in spring. Therefore, in order to prevent injury to fish, seining was not conducted in fall. During visual inspections of the habitat units downstream of the roadway bridge crossing in fall, HTH fish ecologists observed California roach in persistent pools. No steelhead were observed during the limited seining and visual observations conducted during Year 2. Upstream passage may have been possible for adult steelhead during three brief continuous flow events. However, these continuous flow events did not coincide with periods when juvenile steelhead typically outmigrate.

Project goals were not met in Year 2 due to lack of flow associated with regional drought conditions, upstream water diversions, and historically intermittent flow conditions in the Upper Penitencia Creek ecosystem. Native and introduced fishes are expected to continue to redistribute into and through the restored channel as the region emerges from drought and as the restored reaches mature.

Management Recommendations

The following management recommendations should be implemented to keep the site on a trajectory towards successful long-term establishment and attainment of the project's final success criteria:

- Replant missing/dead woody plantings during the 2014/2015 rainy season. Floodplain Area replanting quantities will bring the total number of living woody plantings up to 100% of the originally installed number, in accordance with the VMP Year 2 percent survival success criterion. Species and quantities of Floodplain Area replantings are presented in Table 6. The species recommended for replanting were selected to maintain plant species diversity on the site while selecting for species well adapted to site conditions as observed from survival, natural recruitment, and health and vigor observations. Streamside Area cuttings will be installed in the locations indicated in Figure 7 at 6 foot on-center spacing, not the original planting density (i.e., 1-foot centers). Table 7 shows the species and quantities of cuttings to be installed.
- Hand-pull all native and non-native weeds growing within the planting basins.

- Maintain (via weed whacking or mowing) all herbaceous vegetation outside basins to a maximum height of 1 ft. Recruiting native woody species should be avoided during mowing.
- Several invasive plant species were observed growing in the mitigation site, including Washington fan palm (*Washingtonia robusta*), stinkwort (*Dittrichia graveolens*), castor bean (*Ricinus communis*), she-oak (*Casuarina* sp.), and shamel ash. All individuals of these species should be hand-pulled and removed from the site. This work should be completed by the end of April 2015 before the populations of these species expands significantly.
- A segment of chain link fence has been erected across the restored floodplain within the south-east section of the project (Figure 7). The HTH Team (with Balance Hydrologics, Inc.) recommends the removal of this fence segment as it has the potential to threaten project success by impeding the flow of coarse debris through the creek channel and possibly increasing flood water surface elevations.

Agency Actions

No agency actions are requested at this time.

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Figures

Tables

Photos

Appendices

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Section 1.0 Introduction

1.1 Permit Numbers

This report fulfills the requirement for annual mitigation monitoring reports in accordance with the following permits:

- U.S. Army Corps of Engineers File No. 28924S
- Regional Water Quality Control Board Site No. 02-43-C0654 (bkw)
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1.2 Overview

1.2.1 Jurisdictional Habitat Impacts and Mitigation Construction

The Upper Penitencia Creek Improvement Project (project) is at the downstream end of Upper Penitencia Creek (Creek) in San Jose, Santa Clara County, California (Figure 1). The 2.06-acre habitat mitigation site is situated approximately 1400 feet (ft) upstream from the Coyote Creek confluence. The project included the restoration of floodplain wetland, riparian, and instream habitats as mitigation for permanent impacts to Federal and State jurisdictional wetlands and waters due to construction of the Santa Clara Valley Transportation Authority's (VTA) BART Silicon Valley Berryessa Extension (SVBX) Project.

The SVBX Project consists of the first approximately 10 miles of the larger 16-mile BART Silicon Valley Extension. Construction of the SVBX Project included replacement of an existing Union Pacific Railroad bridge with a BART aerial guideway and replacement of an existing under-sized roadway bridge over a double box culvert with a new free span bridge; both were constructed over Upper Penitencia Creek. The new crossings shaded 0.11 acres of the Creek. Approximately 0.02 acres of the Creek was daylighted as a result of box culvert removal. Removal of the under-sized bridge increased flood conveyance capacity and reduced instream velocities of the Creek, thus benefiting native fish populations. Throughout the rest of the SVBX Project alignment, construction included railroad realignment and re-grading of 1940 linear feet (ln ft) of earthen channels, which eliminated 0.5 acres of wetland habitat.

To mitigate for impacts to jurisdictional habitats, the project's Mitigation and Monitoring Plan (MMP) required creation of 1.06 acres of floodplain wetland habitat and restoration of 1 acre of riparian habitat at the Upper Penitencia Creek Improvement Project site (ICF International [ICF] 2012) (Figure 1). The MMP included the following mitigation project goals:

- restore hydrologic and geomorphic functions including sediment transport/deposition,
- restore floodplain connectivity and flood storage,

- restore fish and wildlife habitats, including the provision of on-site habitat and passage for the federally and state-listed central California coast steelhead (*Oncorhynchus mykiss*), and
- improve water quality.

The project included realignment/regrading of the existing channel to restore more natural geomorphic and ecological function. This included the construction of secondary channels and floodplain wetlands to accommodate high flows, as well as a widened floodplain with restored riparian habitat. Bio-engineered bank treatment structures such as root wads and boulders were installed to protect the new creek configuration and improve aquatic habitat functions. Mitigation site construction was completed in October 2012. Native riparian and wetland plants were installed in January 2013 by Marina/East Bay Construction. Plants were installed throughout six planting zones including the Bar, Boulder Bank/Wrapped Soil Lift, Streamside, Floodplain, Wetland, and Upper Slope; and around bank treatment structures, including large woody debris root wads (Figure 2). The site was also hydroseeded with native grasses and forbs. A total of 3413 native woody trees and shrubs (10 of which were installed as acorns or large seeds) and 1434 native herbaceous plantings were counted throughout the mitigation site during as-built documentation (Anil Verma Associates, Inc. 2013).

1.2.2 Revised Vegetation Monitoring Plan

Vegetation was monitored by H. T. Harvey & Associates (HTH) in 2013 (HTH 2013a) per the project's Mitigation and Monitoring Plan (MMP) (ICF 2012). Willow (*Salix* sp.) and Fremont cottonwood (*Populus fremontii*) cuttings were installed on 1-ft centers in the Boulder Bank Planting Zone (Figure 2) to rapidly stabilize the banks; this is a very high planting density for these species. The site failed to meet its Year 1 woody plant survival performance criterion of 90% due in large part to high mortality rates of those cuttings. We speculate that the low cutting survival was due to high planting density exacerbating competition for water (HTH 2013a). In response to the low survival and as prescribed by the MMP, VTA replanted 236 plants in February 2014 to bring percent survival up to 90% (HTH 2014a).

In an interagency meeting held on 29 April 2014 with the California Department of Fish and Wildlife (CDFW), Regional Water Quality Control Board (RWQCB), and VTA, HTH expressed concern that low survival of cuttings will continue in future years, that the final percent survival success criterion of 70% (ICF International 2012) may not be attainable, and that habitat based metrics would better assess target vegetation establishment. The CDFW, RWQCB, VTA, and HTH agreed that VTA would propose a revised Vegetation Monitoring Plan (VMP) and apply for associated CDFW and RWQCB permit amendments (HTH 2014b). The group also agreed that a habitat-based VMP would better assess the trajectory of habitat establishment and that the revised plan would shift from survival monitoring to a habitat function-based monitoring program (HTH 2014b). Therefore, a revised VMP (HTH 2014b) was submitted to the resource agencies on 4 September 2014 which emphasized the use of metrics that assess habitat functionality. It also established vegetation performance and success criteria that, when compared to monitoring data, will indicate whether the mitigation site is developing towards the project's long-term habitat goals. The VMP called for vegetation monitoring of both the Streamside Area (consisting of Streamside, Bar, and Boulder Bank Planting Zones) and the Floodplain Area (consisting of Floodplain and Upper Slope Planting Zones). The VMP established that all future monitoring, including Year 2 monitoring, will be conducted in accordance with the VMP and its performance/success criteria, and that the VMP will supersede Sections 5.1, 5.3, and 5.4 of the project's MMP (ICF International 2012). Table 1 summarizes the VMP's revised vegetation performance and success criteria that differ from those in the MMP.

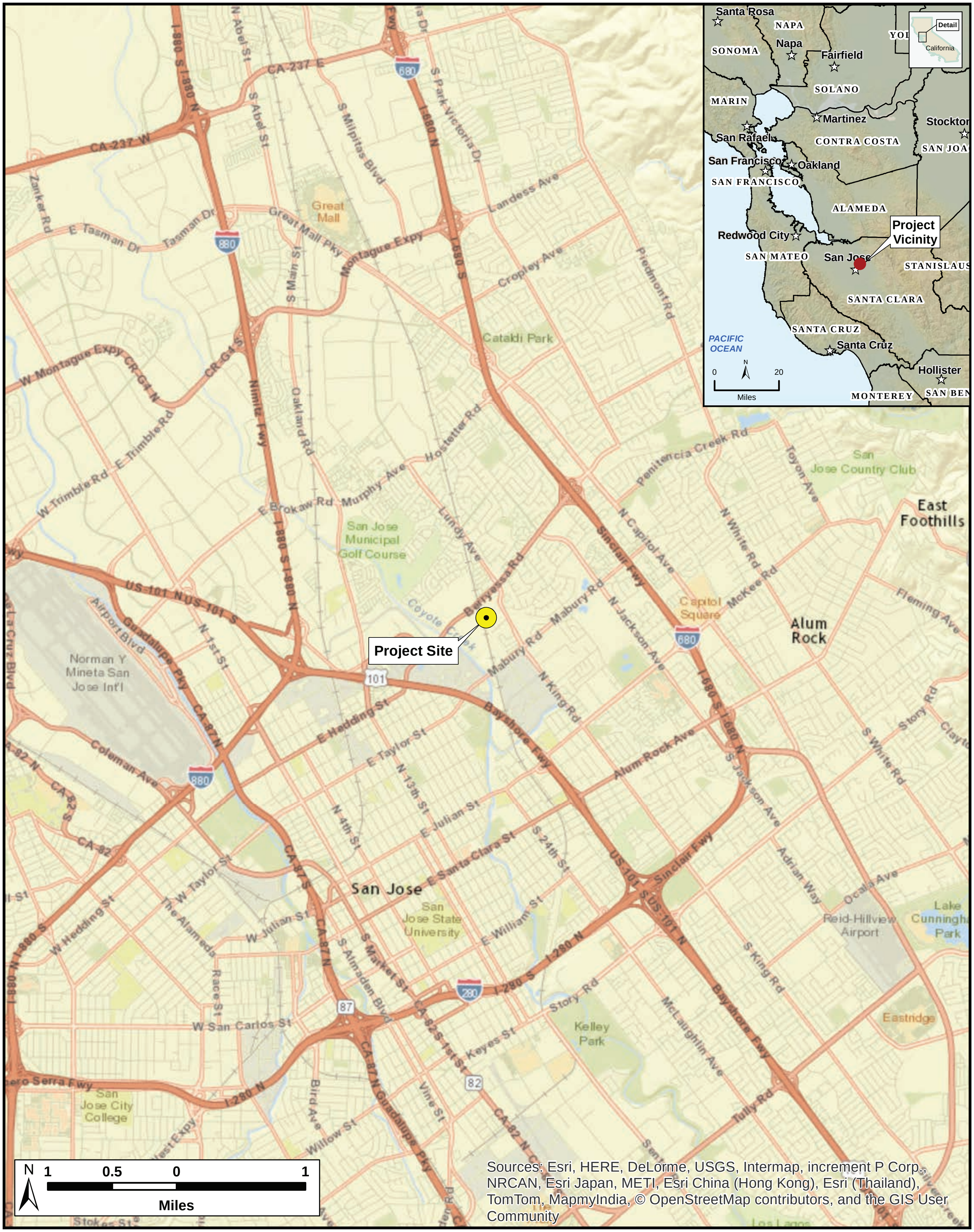
Table 1. Quantitative Vegetation Performance and Final Success Criteria

Monitoring Task	Year 2	Year 3	Year 4	Year 6	Year 8	Year 10
Woody Plant Percent Cover (average cover of native trees and shrubs combined)						
Streamside Area (Streamside/Bar/Boulder Bank Planting Zones)	20%	25%	30%	40%	55%	65%*
Floodplain Area (Floodplain/Upper Slope Planting Zones)	5%	7%	10%	15%	20%	30%*
Vegetation Overhanging Bank-full Channel	baseline	>Year 2	>Year 3	>Year 4	>Year 6	>Year 8*
Invasive Species Percent Cover	<5%	<5%	<5%	<5%	<5%	<5%*

* Final success criterion

The MMP's long-term monitoring requirements also include fisheries monitoring, in addition to vegetation and stream geomorphology/hydrology monitoring. Term and Condition 3b of the National Marine Fisheries Service (NMFS) Biological Opinion (BO) (NMFS 2012) for the project required VTA to develop a Post-construction Fisheries Monitoring Plan (Fisheries Monitoring Plan) to evaluate post-project use of the site by fish. The final Fisheries Monitoring Plan (HTH 2013b) was approved by NMFS on 13 June 2013.

In conformance with project's VMP and Fisheries Monitoring Plan, this report presents the Year 2 vegetation, fisheries, and stream geomorphology monitoring results, comparisons to VMP performance criteria, and maintenance recommendations.



N:\Projects3500\3518-01\03\Reports\Vegetation Monitoring Report\Fig 1 Vicinity Map.mxd

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Figure 1: Vicinity Map
Upper Penitencia Creek Improvement Project
Year-2 (2014) Monitoring Report (3518-03)
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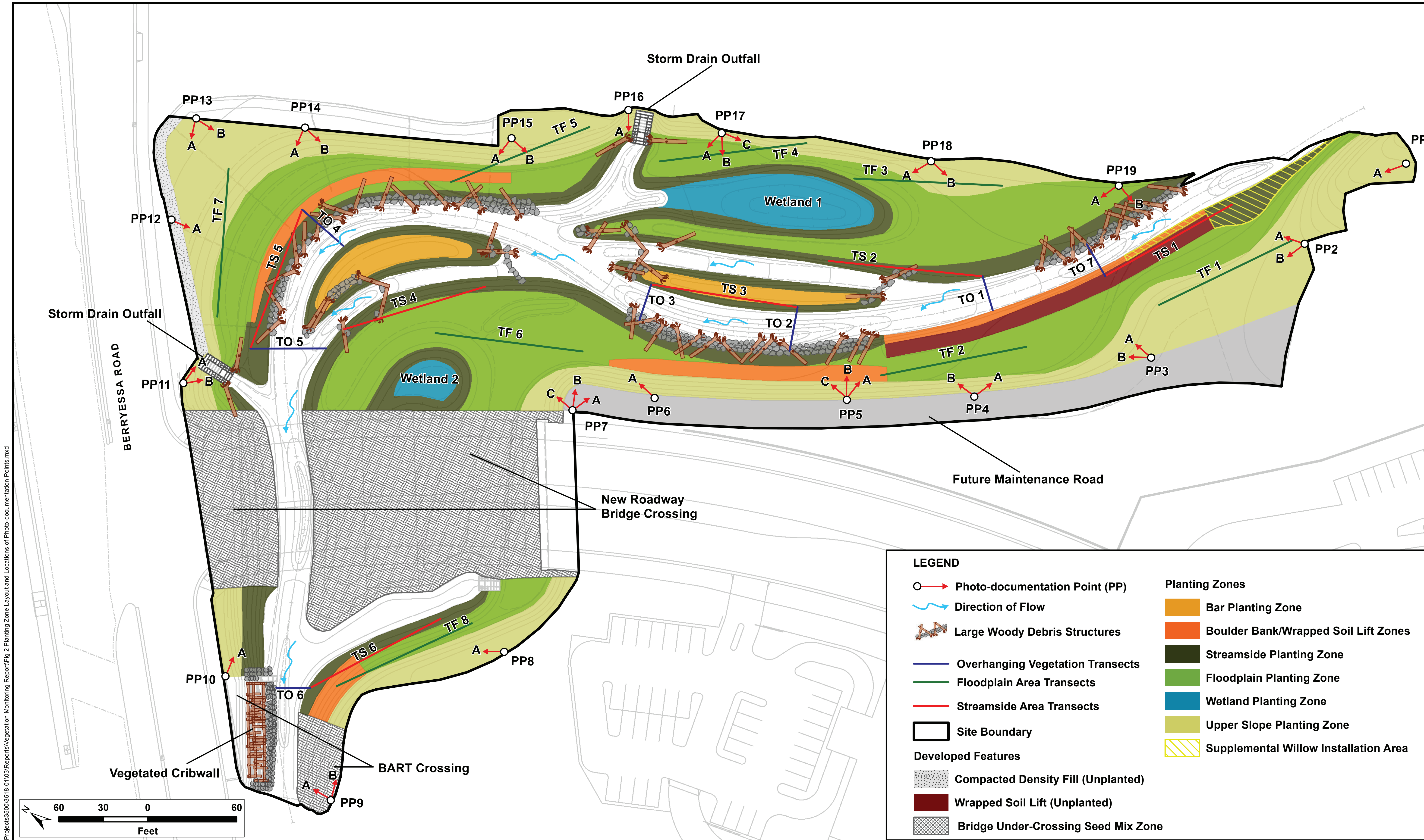

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Figure 2: Planting Zone Layout and Locations of Vegetation Sampling Transects and Photo-documentation Points

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April 2015

Section 2.0 Methods

2.1 Vegetation

H. T. Harvey & Associates' (HTH) restoration ecologists K. Schott, M.S., W. Spangler, B.S., and M. Busnardo, M.S. completed vegetation monitoring surveys on 22-23 and 29 October 2014. All plant species nomenclature follows that set forth by the Jepson Manual 2nd edition (Baldwin et al. 2012). Vegetation monitoring was conducted in accordance with the VMP methods as summarized below.

2.1.1 Woody Plant Percent Cover

Woody plant percent cover was determined using the line intercept method (Bonham 1989). Woody plant cover criteria vary between the combined Streamside, Bar, and Boulder Bank Planting Zones (Streamside Area) and the combined Floodplain and Upper Slope Planting Zones (Floodplain Area) (Table 1). Therefore, fixed-length, 100-ft long permanent transects were installed to discretely sample the combined Streamside and Boulder Bank Planting Zones and the combined Floodplain and Upper Slope Planting Zones. Transect locations were established using a stratified, random method to ensure the locations are both representative of the sample frame and unbiased. Eight transects were installed (transect end points marked with metal U-posts) and measured in the Floodplain Area (Figure 2; TF 1-8) and six transects were installed and measured in the Streamside Area (Figure 2; TS 1-6).

The Kershaw Method was used to verify that the sample size was adequate (Kershaw 1973). Along each transect, data was collected by recording species and length of transect intercept in inches. The average percent cover of native woody vegetation (lumped across species) was calculated for comparison with site performance criteria (Table 1).

2.1.2 Vegetation Percent Cover Overhanging the Bank-full Channel

The percent cover of riparian vegetation canopy overhanging the bank-full channel was measured using the line intercept method (Bonham 1989). A total of seven transects were established perpendicular to the streambank towards the center of the creek's bank-full channel, extending the full width of the bank-full channel (Figure 2; TO 1-7). Transect endpoints were permanently marked with metal U-posts. The Kershaw Method was used to verify that the sample size was adequate (Kershaw 1973). Overhanging vegetation percent cover was assessed by measuring the length of each segment of canopy that overhangs the bank-full channel and intersects the transect line. To calculate the weighted average percent cover, the cumulative length of overhanging vegetation was divided by the total length of the active channel for each species. For this assessment, the bank-full channel was defined as the area between the field indicators of ordinary high water (e.g., shelving, wrack, upper extent of visible scour, lower extent of obligate riparian tree recruitment) on each bank slope.

2.1.3 Tree Height

Tree height was measured on at least three randomly selected native trees per transect in the combined Streamside and Boulder Bank Planting Zones. Enough trees were measured for height measurements to conform to the Kershaw Method as described above (Kershaw 1973). Tree heights were measured using a stadia rod.

The species of each tree measured for height was recorded and the average tree height (lumped across species) was calculated for comparison between monitoring years.

2.1.4 Invasive Plant Species Percent Cover

Percent cover of invasive plant species was quantified along all of the monitoring transects and compared to the performance and success criteria in Table 1. Invasive species were characterized as those species with moderate to high invasiveness as rated by California Invasive Plant Council (Cal-IPC). Moreover, the entire site was visually assessed for invasive plants, and any substantial patches were mapped to inform control efforts.

2.1.5 Dead Plant Assessment

HTH's restoration ecologists determined the number of surviving plantings by species throughout the Floodplain Area (consisting of Floodplain and Upper Slope Planting Zones) by counting all live plants by species in these planting zones. Percent survival was calculated by species by dividing the number of surviving plantings by the number of plantings installed based on the project's Revegetation As-built Plan.

The Streamside Area (comprising Streamside, Bar, and Boulder Bank Planting Zones) was visually assessed for canopy gaps requiring replanting in accordance with the VMP. These gaps were mapped by HTH's restoration ecologists and their lengths recorded (Figure 7).

2.1.6 Wetland Habitat Characterization

Floodplain wetlands that have developed throughout the mitigation site were qualitatively characterized through reconnaissance surveys. This assessment included the general locations of the wetlands, the approximate surface area of each floodplain wetland feature, representative photographs, hydrological observations, and wetland plant community composition and structure.

2.1.7 Woody Plant Health and Vigor

HTH's restoration ecologists conducted a qualitative assessment of overall health and vigor for all woody plantings that intersect the woody plant percent cover transects by considering such factors as internode length, leaf color, and leaf size, as well as presence of browse damage, disease symptoms, and insect infestation. The health and vigor assessment was measured using the numeric and qualitative scale shown in

Table 2. The percentage of individuals by species that fall into the three general health and vigor categories was calculated.

Table 2. Woody Plant Health and Vigor Scale (ICF International 2012)

Health and Vigor Class	Numeric Rating	Observations
Good Condition	3	Plant has relatively long internode lengths and most or all leaves show healthy color and size, and/or <25% of plant's aboveground growth is affected by browse damage, disease, or insect infestation
Fair Condition	2	Plant has medium to long internode lengths and most leaves show healthy color and size, and/or 25-75% of plant's aboveground growth is affected by browse damage, disease, or insect infestation
Poor Condition	1	Plant has relatively short internode lengths and few or some leaves show healthy color and size, and/or >75% of plant's aboveground growth is affected by browse damage, disease, or insect infestation

2.1.8 Woody Plant Natural Recruitment

Natural recruitment was measured by counting all stems of naturally recruiting native woody species that occurred within 5 ft of both sides of each of the 100 ft long woody plant percent cover monitoring transects; this equated to 1000 ft^2 rectangular plots. Data was collected by species and transect, and the average number of recruiting individuals was calculated across transects by species.

2.1.9 Native Woody Plant Species Richness

Native woody plant species richness was determined by habitat type (i.e., streamside willow/cottonwood, floodplain herbaceous/scrub, floodplain wetlands). The ecologists walked the entire site and compiled a list of native woody species for each of these three habitat types.

2.2 Stream Geomorphology

The project's MMP requires geomorphic and hydrologic monitoring over two phases: 1-5 years post-construction (Phase 1) and 6-10 years post-construction (Phase 2). The project's geomorphologist (Balance Hydrologics, Inc.) conducted monitoring 12 times during the 2014 water year. Monitoring components included streamflow and bedload transport measurements, habitat velocity measurements, channel dynamics observations, channel bed samples, and photo-documentation. Details of the methods utilized for geomorphic and hydrologic monitoring are presented in Balance's Year 2 geomorphic and hydrologic monitoring report (Appendix A).

2.3 Fisheries

The purpose of fish monitoring at the project site is "to identify the use of the restored site by fish, and to identify if the site is being used by steelhead, *Oncorhynchus mykiss*" (NMFS 2012). To this end, monitoring is focused on documenting the relative abundance of different fish species and their habitat associations in the project site. The project's Fisheries Monitoring Plan calls for fish monitoring, via electrofishing, two times per year; once in the late spring/early summer and once in late summer/early fall for five years. HTH's fish ecologists conducted the initial Year-1 fish monitoring surveys in fall 2013 in accordance with the Fisheries Monitoring Plan. During Year-2, standard fish surveys were not conducted because the majority of the project site was dry in spring and fall. Typically, electrofishing surveys are timed to coincide with the reported and observed outmigration of juvenile steelhead. During past surveys (fall 2012) HTH fish ecologists mapped 12 habitat units in the project site (Figure 8). Although most of the units were dry, each of the habitat units mapped in Year-1 surveys were assessed during Year-2 surveys.

2.3.1 Electrofishing

In spring and fall 2014, HTH's fish ecologists Neil Kalson, B.S., and Ken Lindke, M.S., measured ambient water temperature and depths and determined that water quality conditions were so poor that electrofishing would pose an unacceptable risk of injuring or killing aquatic species. Hence, electrofishing was not conducted in spring or fall.

2.3.2 Seining

Investigatory seines were conducted during the spring to identify fish observed in habitat units containing water. Pole seines (15 ft. x 4 ft.) with ¼ inch mesh were used to capture fish in habitat units containing sufficient water. In total, six seines were conducted in wetted habitat units (Figure 8). Investigatory seines were not conducted in the fall due to poor water quality.

2.3.3 Fish Handling

During investigatory seining, all fish captured were identified and released to the habitat unit from which they were captured.

2.4 Photo-documentation

Photographs of the project site were taken at 19 fixed photo-documentation points on 22-23 and 29 October 2014. The photo-documentation point locations are shown on Figure 2. Representative photographs are presented on Appendix B.

Section 3.0 Results and Discussion

3.1 Vegetation

3.1.1 Woody Plant Percent Cover

Streamside Area

The average percent cover of native woody vegetation in the Streamside Area was 47.6% (Table 3). Six vegetation percent cover transects were established during Year 2 vegetation monitoring (Figure 2, TS 1-6). The Kershaw Method was used to verify that the number of transects was adequate to accurately estimate percent cover of woody streamside vegetation. The number of transects (six) satisfied the Kershaw Method because there was minimal variation in the cumulative average percent cover across the last three transects (Figure 3). This graph shows that the average percent woody plant cover in the Streamside area was relatively high among the six transects (~50%). The first Streamside Area Transect sampled (which happened to be TS 3) exhibited low woody plant cover because it was located on the shoulder of the southern bar planting zone in an area that receives considerable scour.

Figure 3. Cumulative Average Percent Woody Plant Cover in the Streamside Area as a Function of the Number of Transects Sampled

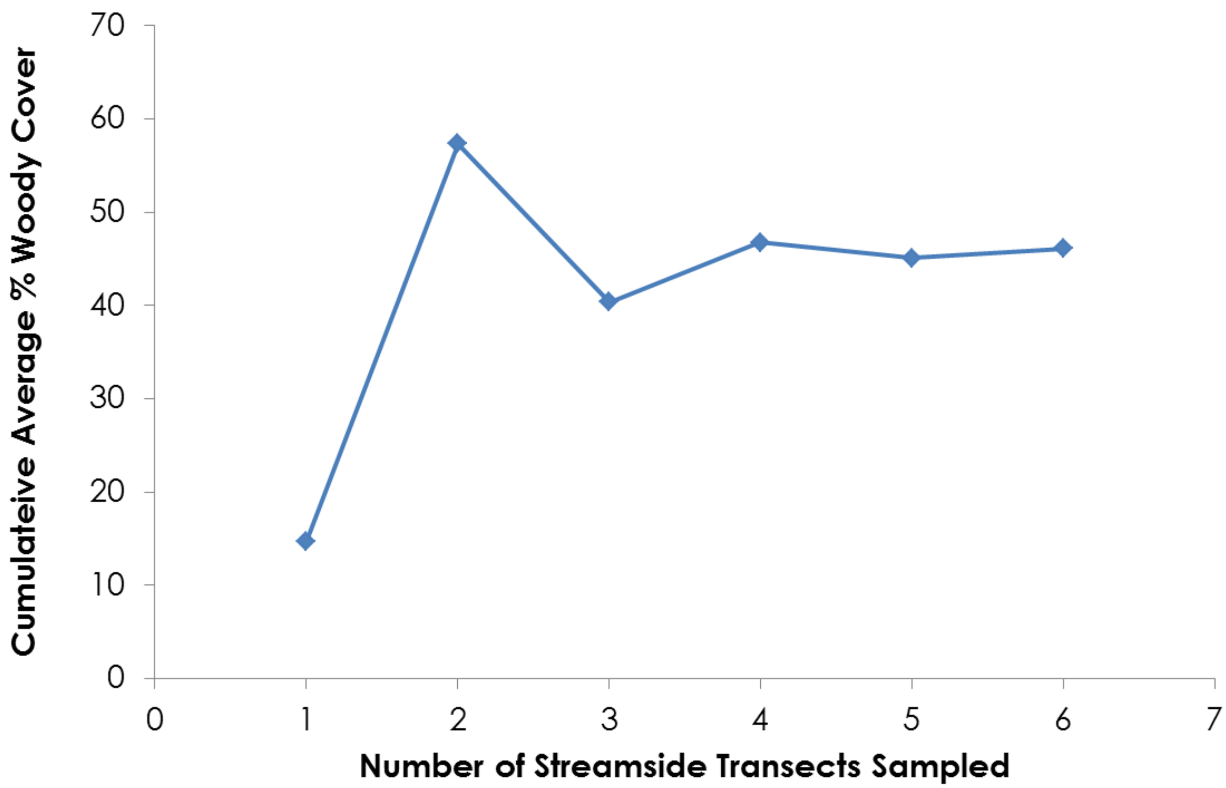


Table 3. Average Percent Cover of Native Woody Plants

		Native Woody Vegetation Cover (%)[a]	
Scientific Name	**Common Name**	**Streamside**	**Floodplain**
Alnus rhombifolia	white alder	3.9	0.0
Artemisia californica	California sagebrush	0.0	2.4
Baccharis glutinosa	marsh baccharis	0.6	0.7
Baccharis pilularis	coyote brush	0.0	3.2
Baccharis salicifolia	mulefat	5.8	0.0
Heteromeles arbutifolia	toyon	0.0	0.5
Populus fremontii	Fremont cottonwood	2.1	0.0
Rosa californica	California rose	1.1	0.8
Rubus ursinus	California blackberry	0.0	0.1
Salix exigua	sandbar willow	15.2	0.0
Salix laevigata	red willow	6.0	0.0
Salix lasiolepis	arroyo willow	12.9	0.0
Sambucus nigra ssp. *caerulea*	blue elderberry	0.0	0.6
	Total	**47.6**	**8.3**

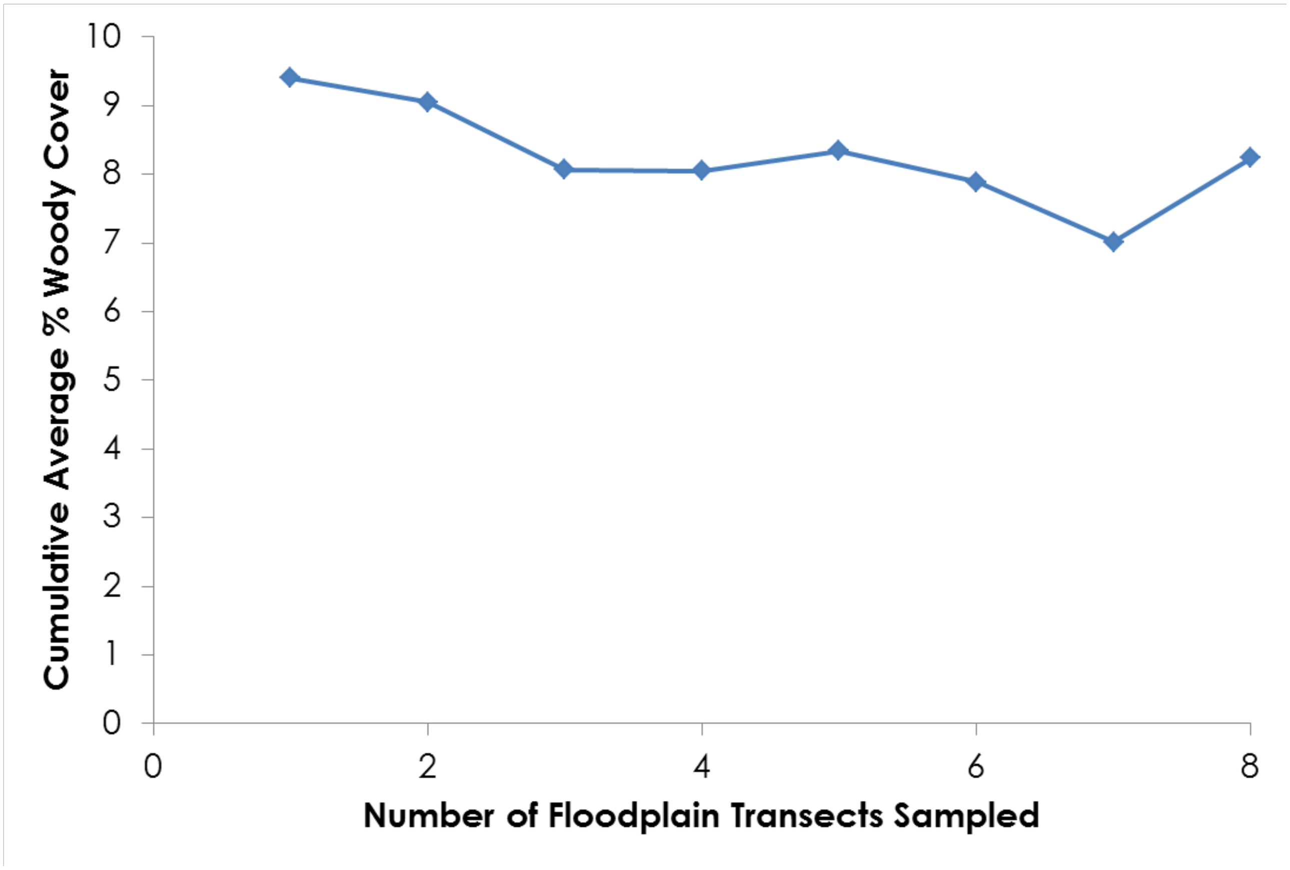
a Only species with at least 0.1% average percent cover along either Streamside or Floodplain Area transects are reported. The single California sycamore (*Platanus racemosa*) individual planted in the Streamside Zone was observed to be alive, however it did not intersect the transects, so does not appear in these data.

Willows represented the greatest percent cover in the Streamside Area with sandbar willow (*Salix exigua*), arroyo willow (*Salix lasiolepis*), and red willow (*Salix laevigata*) representing more than 70% of woody vegetation cover measured (Table 3). The average 47.6% cover measured for Streamside Area transects exceeds the Year 2 performance criterion of 20% cover established in the VMP (Table 1). Native, willow-dominated riparian tree cover has increased rapidly during the first two growing seasons in the Streamside Area. The site currently supports cover that exceeds even the Year 6 performance criterion of 40%. In order to meet the Year 10 final success criterion, the site would need to support an additional 17.4% cover.

Floodplain Area

The average percent cover of native woody vegetation in the Floodplain Area was 8.3% (Table 3). Eight vegetation percent cover transects were established during Year 2 vegetation monitoring (Figure 2, TF 1-8). The Kershaw Method detected minimal variation in the cumulative average woody plant cover as a function of the number of transects; this demonstrates that the number of transects sampled (eight) was more than adequate to accurately estimate the average percent cover of woody vegetation in the floodplain area (Figure 4). Floodplain native woody cover was dominated by coyote brush (*Baccharis pilularis*) and California sagebrush (*Artemisia californica*) (i.e., the relative cover for these species combined exceeded 50% of the overall cover) (Table 3).

Figure 4. Cumulative Average Percent Woody Plan Cover in the Floodplain Area as a Function of the Number of Transects Sampled



The average percent cover of native trees and shrubs combined for Floodplain Area transects (8.3%) exceeds the Year 2 performance criterion of 5% cover established in the VMP (Table 1). This indicates that native woody cover is establishing well on the Floodplain Area of the site.

3.1.2 Vegetation Percent Cover Overhanging the Bankfull Channel

Mature riparian vegetation (e.g. willows and cottonwoods) occurring along the edge of the bank-full channel provides functions that benefit aquatic biota in the channel; these functions include shade over the stream moderating stream temperatures, leaf/detritus inputs to the aquatic food chain, and instream cover via rootwads and logs. Therefore, the VMP included quantification of the percent cover of riparian vegetation canopy overhanging the bank-full channel. Seven vegetation percent cover transects were established during Year 2 vegetation monitoring, exceeding the minimum requirement of five transects (Figure 2, TO 1-7). The Kershaw Method detected minimal variation in the cumulative average woody plant cover across transect numbers 4 through 7; this demonstrates that the number of transects sampled (seven) was more than adequate to accurately estimate the average percent cover of woody vegetation overhanging the bankfull channel (Figure 5). The weighted average percent cover of riparian vegetation overhanging the bank-full channel was 23.8% and included cover by sandbar willow (*Salix exigua*), arroyo willow (*Salix lasiolepis*), and white alder (*Alnus rhombifolia*), in decreasing order (Table 4). The average cover of white alder overhanging the bank-full channel was slightly higher than in the streamside area. Additionally, red willow was not observed along the overhanging cover transects.

Figure 5. Cumulative Average Percent Overhanging Cover as a Function of the Number of Transects Sampled

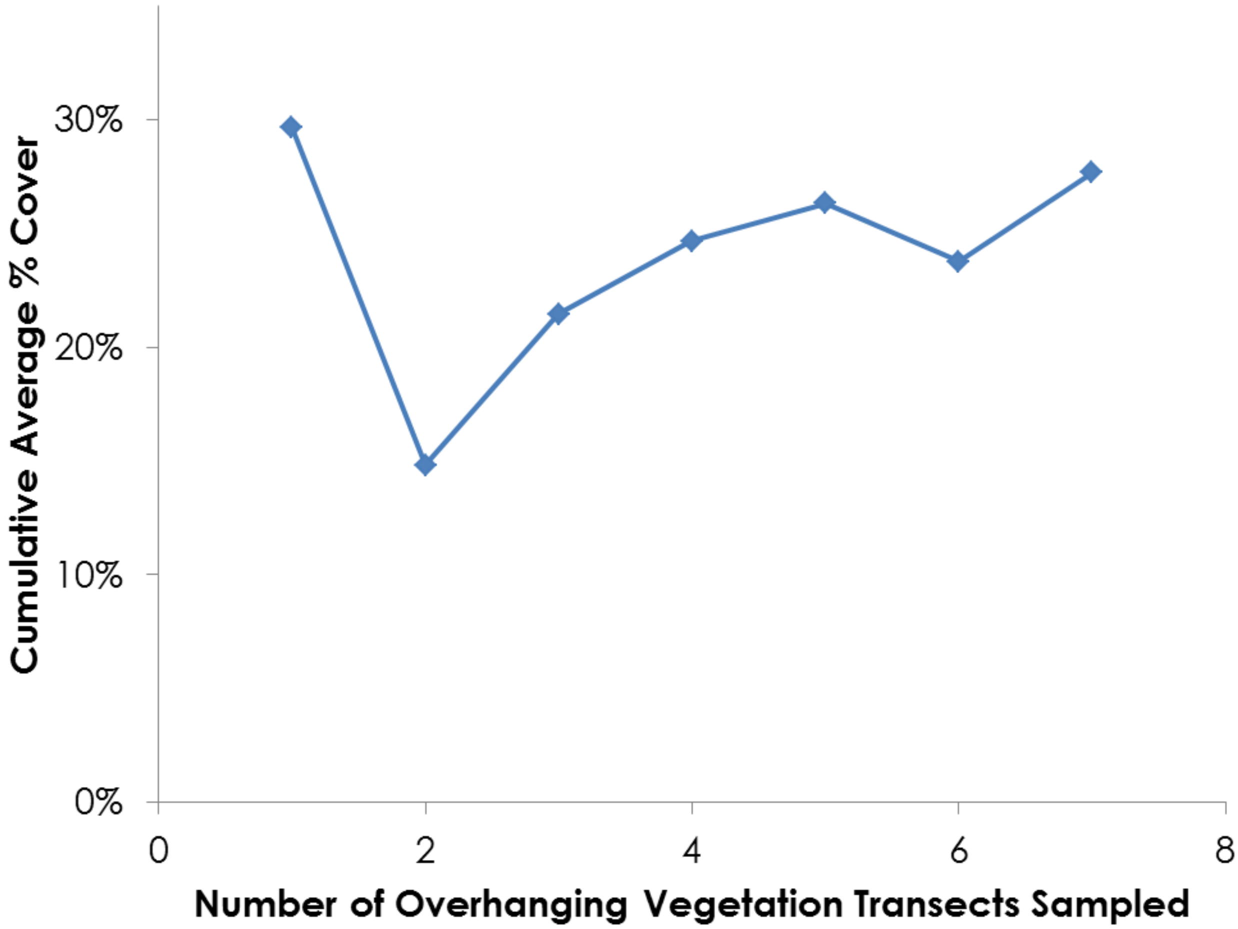


Table 4. Average Percent Cover by Species of Native Woody Vegetation Overhanging the Bank-full Channel

Scientific Name	Common Name	Weighted Average Percent Cover
Alnus rhombifolia	white alder	4.8%
Salix exigua	sandbar willow	13.7%
Salix lasiolepis	arroyo willow	5.3%
	Total	**23.8%**

There are no quantitative performance criteria targets for overhanging vegetation percent cover established in the VMP. The weighted average percent cover of overhanging vegetation in Year 2 monitoring, 23.8%, serves as a baseline for the final success criterion of an overall increasing trend in overhanging vegetation percent cover across monitoring years.

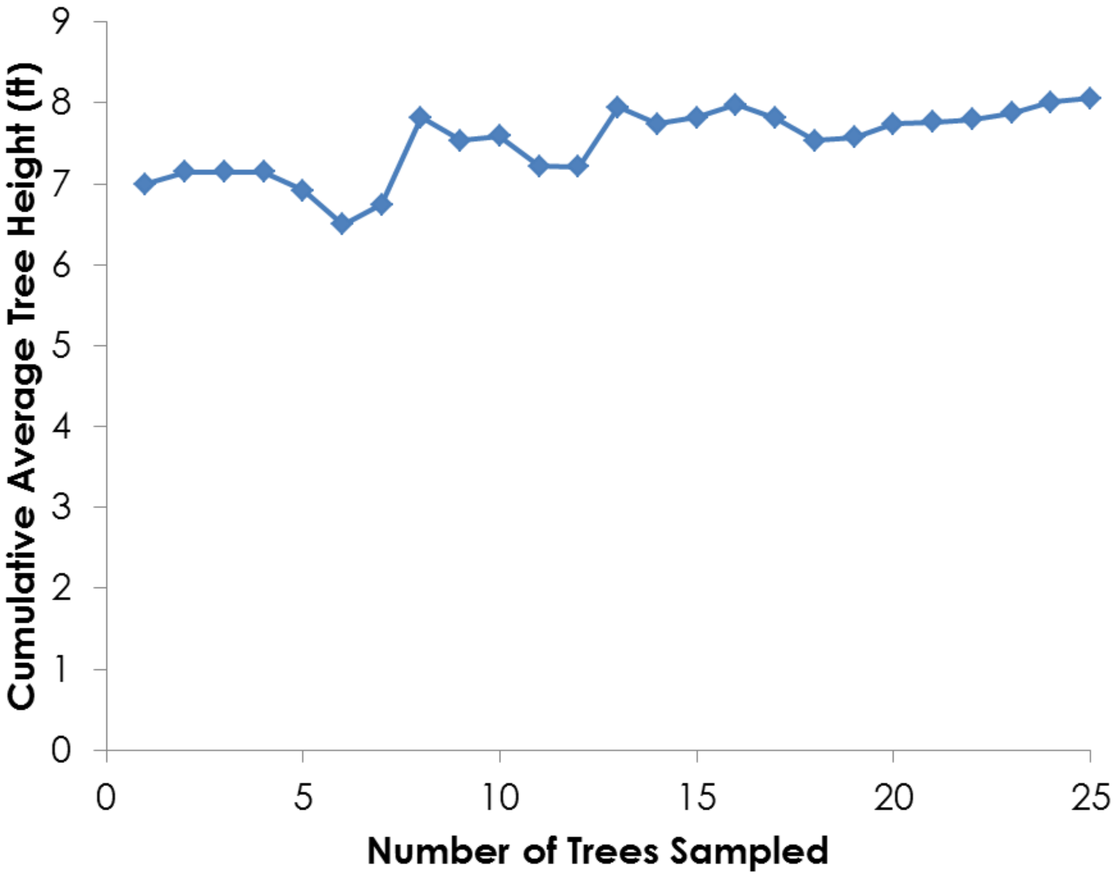
3.1.3 Tree Height

The height of 25 trees that intersected Streamside Area percent cover transects was measured during Year 2 vegetation monitoring exceeding the minimum requirement of 18 trees (3 trees for each of the 6 combined Streamside Area transects) (Table 5). The Kershaw Method indicated that the sample size of 25 trees was adequate to estimate the average tree height because only minimal variation in the cumulative average tree height was detected once the sample number exceeded 17 trees (Figure 6). Average heights for tree species ranged from 14.4 ft (for white alder) to 5.6 ft (for red willow) (Table 5.) The average height of all trees measured across species is 8.1 ft (Table 5).

Table 5. Average Tree Height and Sample Size by Species

Scientific Name	Common Name	Sample size	Average height (ft)
Alnus rhombifolia	white alder	3	14.4
Populus fremontii	Fremont cottonwood	4	6.5
Salix exigua	sandbar willow	8	7.0
Salix laevigata	red willow	2	5.6
Salix lasiolepis	arroyo willow	8	8.0
	Total	**25**	**8.1**

Figure 6. Cumulative Average Tree Height as a Function of the Number of Trees Sampled



There are no quantitative performance criteria targets for tree heights established in the VMP. The Year 2 average tree height measurement serves as a baseline for the final success criterion of an overall increasing trend in average tree height (among species) across monitoring years.

3.1.4 Invasive Plant Species Percent Cover

No invasive plant species was recorded along any percent cover monitoring transect. Accordingly, the site has met the performance criterion of less than 5% invasive species cover. The lack of invasive species intersecting percent cover transects indicates that the current maintenance regime is successful in suppressing invasive species cover.

However, several invasive plant species were observed within and adjacent to the bank-full channel toward the upstream end of the site. These included Washington fan palm (*Washingtonia robusta*), stinkwort (*Dittrichia graveolens*), castor bean (*Ricinus communis*), and several saplings of she-oak (*Casuarina* sp.) and shamel ash (*Fraxinus uhdei*).

3.1.5 Dead Plant Assessment

Floodplain Area

Floodplain Area woody planting survival was 81% (Table 6). 100% of the dead woody plants in the Floodplain Area are recommended for replacement in accordance with the project's VMP. This results in 168 replacement plantings (Table 6). Recommended replanting levels would return plant quantities to at least those originally installed for all species except sticky monkeyflower (*Mimulus aurantiacus*), which was initially installed at high numbers and showed a survival of only 34%. The replacement quantities of marsh baccharis (*Baccharis glutinosa*), toyon (*Heteromeles arbutifolia*), and blue elderberry (*Sambucus nigra* ssp. *caerulea*) were increased to substitute for sticky monkeyflower because these species exhibited high survival and were under-represented relative to other species in the initial planting effort.

Table 6. Year 2 Floodplain Area Survival and Replanting Recommendations

Scientific Name	Common Name	Plantings Installed (#)	Surviving Plantings (#)	Survival (%)	Recommended Replanting Quantity
Aesculus californica	California buckeye	4	2	50%	2
Artemisia californica	California sagebrush	75	75	100%	0
Baccharis glutinosa	marsh baccharis	53	53	100%	40
Baccharis pilularis	coyote brush	137	130	95%	7
Baccharis salicifolia	mulefat	100	84	84%	16
Heteromeles arbutifolia	toyon	28	21	75%	27
Mimulus aurantiacus	sticky monkeyflower	121	41	34%	0
Quercus agrifolia	coast live oak	6	2	33%	4
Rhamnus ilicifolia	hollyleaf redberry	2	0	0%	2
Rosa californica	California rose	265	236	89%	29
Rubus ursinus	California blackberry	31	21	68%	10
Sambucus nigra ssp. *caerulea*	blue elderberry	43	32	74%	31
	Total	**865**	**697**	**81%**	**168**

Streamside Area

Cuttings were successful in forming canopy throughout the majority of the Streamside Area. However, several canopy gaps of substantial length were present in the Streamside Area. The total length of Streamside Area canopy gaps totaled 631 feet, resulting in a recommended total of 105 cuttings to be installed at 6-foot centers. Figure 7 shows the locations of the Streamside Replanting Gaps and Table 7 presents recommended replanting quantities for these Streamside Replanting Gaps.

Table 7. Year 2 Streamside Area Replanting Recommendations

Scientific Name	Common Name	Recommended Replanting Quantity
Populus fremontii	Fremont cottonwood	20
Salix laevigata	red willow	60
Salix lasiolepis	arroyo willow	25
	Total	**105**

*Note- VTA's Contractor will install cuttings by mid-April (installation was delayed due to the time necessary for access permissions to collect cuttings and harvest sites). The relative quantities of red and arroyo willow will depend upon availability at the harvest sites.

N:\Projects3500\3518-01\03\Reports\Vegetation Monitoring Report\Fig 7 Streamside Replanting Gap Location.mxd

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Figure 7: Steamside Replanting Gap Locations

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3.1.6 Wetland Habitat Characterization

The results of qualitative reconnaissance surveys of wetland planting zones are presented below. Wetland 1 is located to the east of the main stream channel while Wetland 2 is smaller and located directly to the east of the new roadway bridge crossing (Figure 2).

Wetland 1 is approximately 104 ft by 32 ft with an approximate surface area of 3300 ft^2. Photos A and B are representative photographs of the state of Wetland 1 in October 2014. The wetland supported standing water with low turbidity in October 2014. The plant community of Wetland 1 was stratified into distinct concentric rings of vegetation spanning a gradient from perennial, emergent wetlands at the lower elevations, to seasonal wetland vegetation along the upper slope. The lowest elevations of Wetland 1 were bare of emergent vegetation. The lowest vegetation consisted of emergent cattails (*Typha* sp.) that are increasing in cover through lateral expansion. Non-emergent vegetation located upslope from the cattails included non-native rabbitsfoot grass (*Polypogon monspeliensis*), planted irisleaf rush (*Juncus xiphioides*), naturally recruited and planted marsh baccharis, and planted willows (*Salix* spp.). The vigorous growth of willows indicated that they were likely rooted into groundwater. In the upper banks of the wetland, mulefat (*Baccharis salicifolia*) and Fremont cottonwood (*Populus fremontii*) plantings showed new growth and good health.

Photo A. Side view of Wetland 1 from the middle of southwest bank

Photo B. View looking southeast down length of Wetland 1 from northwest corner

Wetland 2 measured approximately 35 ft by 20 ft with an approximate surface area of 700 ft^2 . Photos C and D are representative photographs of the state of Wetland 2 in October 2014. There was no standing water observed in Wetland 2 in October 2014. Since Wetland 2 was drier than Wetland 1, the Wetland 2 plant community was composed of seasonal wetland vegetation, with little to no perennial, emergent species. Relatively dense, native-dominated seasonal wetland vegetative cover was observed in the bottom of Wetland 2; the plant community was composed primarily of tall flatsedge (*Cyperus eragrostis*), irisleaf rush (*Juncus xiphioides*), meadow barley (*Hordeum brachyanterum*), and marsh baccharis. Non-native bristly ox-tongue (*Helminthotheca echioides*) and burclover (*Medicago* sp.) were also observed at lower abundances in the bottom of the wetland. Vegetation on the wetland banks included plants from the Streamside Area palette such as sandbar willow.

Photo C. View looking south at Wetland 2

Photo D. View looking west at Wetland 2

3.1.7 Woody Plant Health and Vigor

All species of woody plantings that intercepted percent cover transects had an average health and vigor rating of 2.5 or above (Table 8) indicating that they were in good condition (Table 2). Of the 151 plantings characterized for health and vigor, 97% of surviving plantings were in good condition, 2% were in fair condition, and a single planting, representing 1% of the plantings, was in poor condition (Table 8). No success criterion for this metric was established in the VMP; however, these results indicate that plantings are generally healthy and growing vigorously, despite the drought conditions over the past two growing seasons.

Table 8. Woody Plant Average Health and Vigor and Percentage in Good, Fair, or Poor Health

Scientific Name	Common Name	Sample Size	Year 2 Avg. Health and Vigor Rating	Health Condition		
				Good	Fair	Poor
Alnus rhombifolia	white alder	8	3.0	100%	0%	0%
Artemisia californica	California sagebrush	8	3.0	100%	0%	0%
Baccharis glutinosa	marsh baccharis	6	3.0	100%	0%	0%
Baccharis pilularis	coyote brush	13	3.0	100%	0%	0%
Baccharis salicifolia	mulefat	14	2.9	93%	7%	0%
Heteromeles arbutifolia	toyon	2	3.0	100%	0%	0%
Populus fremontii	Fremont cottonwood	9	3.0	100%	0%	0%
Rosa californica	California rose	13	3.0	100%	0%	0%
Rubus ursinus	California blackberry	1	3.0	100%	0%	0%
Salix exigua	sandbar willow	30	3.0	97%	3%	0%
Salix laevigata	red willow	14	3.0	100%	0%	0%
Salix lasiolepis	arroyo willow	31	2.9	97%	0%	3%
Sambucus nigra ssp. *caerulea*	blue elderberry	2	2.5	50%	50%	0%
	Total/Weighted Average	**151**	**3.0**	**97%**	**2%**	**1%**

3.1.8 Woody Plant Natural Recruitment

All recruiting woody species were tallied within each of the 14, 1000 ft^2 transect bands (Figure 2, TF 1-8 and TS 1-6); therefore, data in Table 9 is presented in terms of stems per 14,000 ft^2. Of the 141 woody stems tallied throughout the 14 transect bands, 140 were native species and 1 was a non-native species (shamel ash). Marsh baccharis, coyote brush, and California rose exhibited the highest stem densities of naturally recruited individuals. For example, marsh baccharis was planted only in the backwater wetland areas, and has naturally recruited into both the Streamside and Floodplain areas (Table 3). California rose was planted only in the Floodplain Area and has naturally recruited into the Streamside Area (Table 3). Year 1 surveys covered half the area of Year 2 surveys but observed only 30 woody stems (29 native and 1 non-native). Reproduction by seed was the predominant mode of recruitment for most species, except marsh baccharis, which recruited vegetatively. Although no success criterion was established in the VMP for this metric, successful recruitment of several native, woody riparian species in Year 2 indicates that the restored abiotic conditions (e.g., increased floodplain connectivity to the low-flow channel, likely shallow depth to groundwater) are suitable for natural recruitment of the target woody riparian plant species.

Table 9. Woody Plant Natural Recruitment Density

Scientific Name	Common Name	Native/ Non-native	Year 1 Density (stems per 7000 ft^2)	Year 2 Density (stems per 14000 ft^2)
Acer negundo	boxelder	Native	1	1
Alnus rhombifolia	white alder	Native	2	0
Artemisia californica	California sagebrush	Native	0	2
Baccharis glutinosa	marsh baccharis	Native	18	43
Baccharis pilularis	coyote brush	Native	0	50
Fraxinus uhdei	shamel ash	Non-native	0	1
Populus fremontii	Fremont cottonwood	Native	3	1
Robinia pseudoacacia	black locust	Non-native	1	0
Rosa californica	California rose	Native	0	31
Rubus ursinus	California blackberry	Native	0	1
Salix exigua	sandbar willow	Native	0	9
Salix laevigata	red willow	Native	3	0
Salix lasiolepis	arroyo willow	Native	1	2
Sambucus nigra ssp. *caerulea*	blue elderberry	Native	1	0
		Total Native	**29**	**140**
		Total Non-native	**1**	**1**
		Total Native + Non-native	**30**	**141**

3.1.9 Native Woody Plant Species Richness

Native woody plant species richness (i.e., number of species) was relatively high at the site. A total of 19 native woody plants were observed within the project site (Table 10). At total of 13 native woody species were observed in the streamside willow/cottonwood habitat type, 12 in the floodplain herbaceous/scrub habitat type, and 7 in the floodplain wetland habitat type (Table 10).

Table 10. Native Woody Species Richness by Habitat Type

Scientific Name	Common Name	Habitat Type Streamside Willow/ Cottonwood	 Floodplain Herbaceous/ Scrub	 Floodplain Wetland
Acer negundo	boxelder	X		
Aesculus californica	California buckeye		X	
Artemisia californica	California sagebrush	X	X	
Alnus rhombifolia	white alder	X		X
Artemisia californica	California sagebrush	X	X	
Baccharis glutinosa	marsh baccharis	X	X	X
Baccharis pilularis	coyote brush	X	X	
Baccharis salicifolia	mulefat	X		X
Heteromeles arbutifolia	toyon		X	
Mimulus aurantiacus	sticky monkeyflower		X	
Platanus racemosa	California sycamore	X		
Populus fremontii	Fremont cottonwood	X	X	X
Quercus agrifolia	coast live oak		X	
Rosa californica	California rose	X	X	X
Rubus ursinus	California blackberry		X	
Salix exigua	sandbar willow	X		
Salix laevigata	red willow	X		X
Salix lasiolepis	arroyo willow	X		X
Sambucus nigra ssp. *caerulea*	blue elderberry		X	
Number of Species	**19**	**13**	**12**	**7**

3.2 Stream Geomorphology

Detailed stream geomorphology monitoring results are discussed in Balance Hydrologics Year 2 geomorphic and hydrologic monitoring report (Appendix A); the following is a summary. Drought conditions continued in the project area during the 2014 water year; 6.03 inches of precipitation fell, equaling to only about 40% of average yearly precipitation for the area.

Project reach conditions in the 2014 water year may represent a benchmark dry year. Streamflow through the project reach was intermittent and inadequate to evaluate project success criteria related to hydrology and geomorphology. Manual measurements recorded flows of 1-2 cubic feet per second (cfs) entering the project reach at the beginning of the water year. However, this flow went subsurface within 200 feet of entering the project reach during most rainfall and runoff events.

No measurable channel changes, sedimentation, scour, or bank instabilities were identified as substantial flood flows were not recorded. Limited flow conditions are regional and reflect the current drought in California. While creek flow continues to be monitored, we do not anticipate substantial improvement until a return to average or higher precipitation and runoff. No adaptive management is deemed necessary at this time.

3.3 Fisheries

3.3.1 Results

The fish community documented during spring investigatory seining consisted of one native species; California roach (*Lavinia symetricus*). Deceased roach were also observed in a habitat unit containing stagnant water. Fish surveys were not conducted in the fall due to poor water quality conditions.

During spring and fall habitat surveys, HTH fish ecologists used habitat names and locations identified in Year 1 for reference when describing the condition of the stream channel in Year 2. Figure 8 shows the plan view locations and habitat units identified in Year 1 and the condition of the habitat units in Year 2. In Year 2, all habitat units in the project site either: 1) contained shallow water with no flow (Photo E), 2) were densely vegetated and filled with stagnant waters (backwaters) (Photo F), 3) contained stagnant pools of water (Photos G & H), or 4) were completely dry (Photo I), (Table 11).

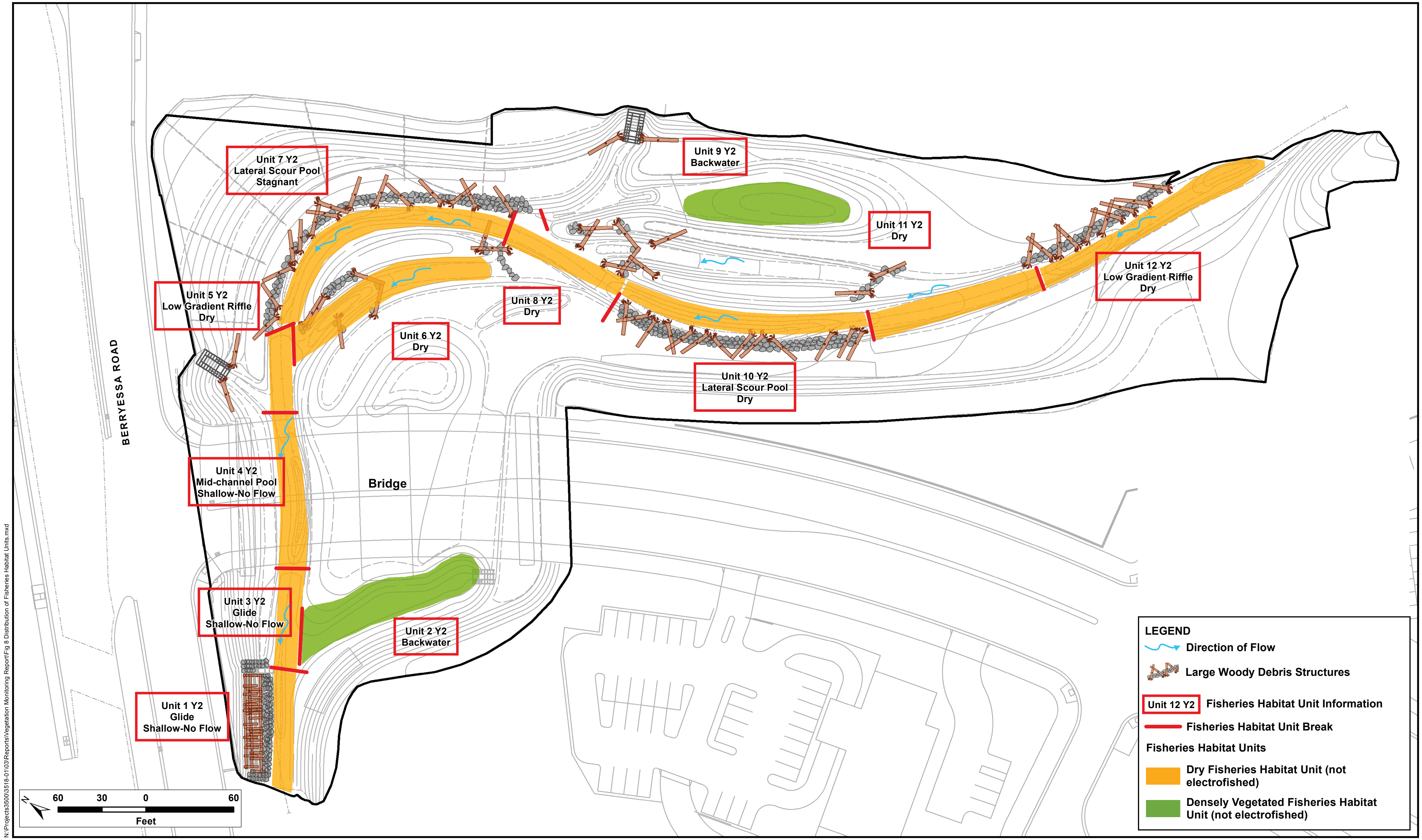

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Figure 8: Distribution of Fisheries Habitat Units

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Table 11. Habitat Unit Type/Condition Observed during Fish Surveys

Habitat Unit Name	Habitat Unit Type/Condition		
	Year 1 Fall	Year 2 Spring	Year 2 Fall
Unit1	Glide	Shallow, No Flow	Shallow, no Flow
Unit2	Backwater	Backwater	Backwater
Unit3	Glide	Shallow, No flow	Shallow, no flow
Unit4	Mid-channel pool	Shallow, no Flow	Shallow, no Flow
Unit5	Low gradient riffle	Dry	Dry
Unit6	Backwater	Dry	Dry
Unit7	Lateral scour pool - rootwad formed	Stagnant pools	Stagnant pools
Unit8	Dry	Dry	Dry
Unit9	Dry	Dry	Backwater
Unit10	Lateral scour pool -rootwad formed	Dry	Dry
Unit11	Dry	Dry	Dry
Unit12	Low gradient riffle	Dry	Dry

Photo E. Shallow habitat unit with no surface flow (Habitat Unit 4)-fall 2014

Photo F. Backwater habitat unit with dense emergent vegetation (Habitat Unit 2)-fall 2014

Photo G. Stagnant pools near rootwad restoration features (Habitat Unit 7)-spring 2014

Photo H. Stagnant pools near rootwad restoration features (Habitat Unit 7) – fall 2014

Photo I. Dry habitat unit (Habitat Unit 8)-fall 2014

3.3.2 Discussion

In Upper Penitencia Creek, the lack of water and connectivity in drought years (e.g., this year) may severely limit access to spawning habitat and may result in poor recruitment in subsequent years. The absence of water in the project reach was not a condition unique to the project reach in Year 2; dry reaches were observed upstream near the entrance to Alum Rock Park and probably occurred at other locations between the Park and the project reach. In the 2014 water year, with the exception of three events during which there was continuous flow through the project reach, there was a persistent absence of connectivity to upstream reaches. Adult steelhead access to upstream spawning habitat may have been possible during brief, continuous flow events, but was otherwise prevented by dry reaches at least until after the survey was conducted in November 2014. Flow events occurred earlier in the year than typical juvenile steelhead outmigration (Moyle 2002). The presence of persistent pools charged by subsurface flow may provide critical over-summering habitat in the project site if features are accessible and if water quality is suitable; during HTH's previous Year-1 surveys it was apparent that steelhead were utilizing restoration features (i.e., root wad scour pools) as habitat during low summer flows. However, during Year-2 the water quality in remaining pools was extremely poor; pools were stagnant and choked with algae and emergent vegetation. During spring visits to the project site, dead California roach carcasses were observed on the margins of some pools (Photo J).

Photo J. California roach (dead) in stagnant pool (Habitat Unit 7), spring 2014

Intermittent Flow. Intermittent, non-continuous flow is a condition of the Upper Penitencia Creek ecosystem and existed prior to construction of the Upper Penitencia Creek Improvement Project. Leicester and Smith (2012) report that in all but the wettest years Upper Penitencia Creek is subject to subsurface flow at some point from Dorel Drive downstream to the percolation ponds located between Noble Avenue and Piedmont Road; an approximately 2200 ft long reach located approximately three miles upstream of the project site. While intermittent flow is probably a historical condition that occurs regularly during drought conditions and seasonally dry periods (Stillwater 2006), contributing factors may also include water impoundment (Cherry Lake Reservoir), diversion to percolation ponds, and unconsolidated sediment within the project reach after construction.

Due to drought conditions in the 2014 water year, most habitat units in the project site were dry or contained stagnant water. Continuous flow through the project site occurred on only three occasions (Appendix A). In persistent downstream habitat units there was no discernible flow. Low flows may influence growth and survival of fish and, in some cases, may result in mortality. Reduced area and volume of habitat units due to low flow conditions may result in changes to water quality (e. g., dissolved oxygen, temperature), increased predation, and reduced foraging opportunities (May and Lee 2004, Hakala and Hartman 2004, Heggenes and Borgstrom 1988). Dry reaches (such as those that occur both upstream of the project site and within the site) prohibit access by adults to upstream spawning habitat and access to the San Francisco Bay by outmigrating juveniles. As a result, adult steelhead spawning success and juvenile growth, fitness, and survival is currently limited in the Upper Penitencia Creek system. Although the project site is located low in the watershed, steelhead redds have been observed near the confluence with Coyote Creek and the potential exists for spawning to occur in the project site as long as there is connectivity up to and through the project reach (HGR 1992 as cited in Leidy et al 2005).

Introduced species. No live introduced species were documented during Year 2. However, in the spring, an unidentified fish carcass that was likely an introduced minnow or carp (Family Cyprinidae) was observed in a dry channel within the restoration site (Photo K). The concentration of fish into pools during low flows may result in high levels of predation on relatively small fish, including juvenile steelhead, by introduced predators. During Year 1 fall 2013 surveys, fish, including introduced species, were concentrated into Habitat Unit 4 (Figure 8) and may have been using this unit as a refuge due to its sheltered location under the newly constructed bridge and its large size; however, in Year 2 surveys, no fish were captured in this unit during investigatory seining or bank (visual) surveys.

Photo K. Unidentified fish carcass in dry reach (likely an introduced minnow or carp (Family Cyprinidae)) – spring 2014

3.4 Photo-documentation

Nineteen (19) permanent photo-documentation points were established during Year 1 vegetation monitoring in 2013 and photos were retaken from these points in October 2014 during Year 2 vegetation monitoring. Representative photos are included in Appendix B. The locations of the photo-points are shown on Figure 2. Additional photos were taken to illustrate maintenance issues.

3.5 Management Recommendations

Management Recommendations

The following management recommendations should be implemented to keep the site on a trajectory towards successful long-term establishment and attainment of the project's final success criteria:

- Replant missing/dead woody plantings during the 2014/2015 rainy season. Floodplain Area replanting quantities will bring the total number of living woody plantings up to 100% of the originally installed number, in accordance with the VMP Year 2 percent survival success criterion.

Species and quantities of Floodplain Area replantings are presented in Table 6. The species recommended for replanting were selected to maintain plant species diversity on the site while selecting for species well adapted to site conditions as observed from survival, natural recruitment, and health and vigor observations. Streamside Area cuttings will be installed in the locations indicated in Figure 7 at 6 foot on-center spacing, not the original planting density (i.e., 1-foot centers). Table 7 shows the species and quantities of cuttings to be installed.

- Hand-pull all native and non-native weeds growing within the planting basins.
- Maintain (via weed whacking or mowing) all herbaceous vegetation outside basins to at maximum height of 1 ft. Recruiting native woody species should be avoided during mowing.
- Several invasive plant species were observed growing in the mitigation site, including Washington fan palm, stinkwort, castor bean, she-oak, and shamel ash. All individuals of these species should be hand-pulled and removed from the site. This work should be completed by the end of April 2015 before the populations of these species expands significantly.
- A segment of chain link fence has been erected across the restored floodplain within the south-east section of the project (Figure 7). The HTH Team (with Balance Hydrologics, Inc.) recommends the removal of this fence segment as it has the potential to threaten project success by impeding the flow of coarse debris through the creek channel and possibly increasing flood water surface elevations.

Agency Actions

No agency actions are requested at this time.

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Appendix A. Stream Geomorphology Monitoring Memo Prepared by Balance Hydrologics

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December 4, 2014

Mr. Max Busnardo
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Submitted Via Email

Dear Mr. Busnardo:

Balance Hydrologics Inc. (Balance) is pleased to provide you with the Year 2 annual report for water year[1] 2014 (WY2014) geomorphic and hydrologic monitoring of the Upper Penitencia Creek Improvement Project, mitigation for the BART Silicon Valley Berryessa Extension Project. As stated in the Mitigation and Monitoring Plan (MMP, Jones, 2012), frequency of monitoring elements depends on the monitoring phase (Phase 1 or 2) and post-construction year. In Year 2, our physical monitoring elements required: 1) streamflow and bedload transport measurements, 2) habitat velocity measurements, 3) channel dynamics observations, 4) channel bed samples, and 5) repeat photo points. While every effort was made to measure these elements, WY2014 was a significantly below-average precipitation year. Runoff and data collection opportunities were limited.

Executive Summary

Balance completed the second year of a 10-year geomorphic and hydrologic monitoring plan in accordance with the project's MMP (Jones, 2012). Precipitation in the second year (WY2014) was roughly 60 percent below average, measured at San Jose International Airport. In fact, the highest flow estimated at the project site was less than 10 cfs, which is significantly less than the estimated bankfull streamflow of 270 cfs for this point in the watershed. Observations indicated intermittent or dry conditions through the project reach throughout much of the year; however, two additional streamflow gages upstream, operated by the Santa Clara Valley Water District (SCVWD), also indicated intermittent or dry conditions throughout much of the year. These limited flow conditions appear to be regional and may reflect the current drought in California. While the monitoring program is designed to address specific questions on channel evolution and habitat complexity the absence of measurable flows in Year 2 precludes us from any conclusions at this time. While creek flow continues to be monitored, we do not

[1] A "water year" (WY) is defined as that period from October 1st of a preceding year through September 30th of the following year, and is named according to the following year. For example, water year 2014 started October 1, 2013 and ended September 30, 2014.

anticipate substantial changes or improvement until a return to average or higher precipitation and runoff. No adaptive management is deemed necessary at this time. Additional monitoring and sampling over a wider range of streamflows will be necessary in future monitoring years to detect and evaluate trends. Balance hydrologists and H. T. Harvey & Associates ecologists continue to work with the Santa Clara Valley Transportation Authority (VTA) and National Marine Fisheries Service (NMFS) to evaluate conditions on a seasonal basis and determine if actions to improve salmonid passage are warranted.

Introduction and Background

The geomorphic and hydrologic monitoring program is designed to assess evolved channel conditions over time. Monitoring elements have been specifically chosen to facilitate evaluation of geomorphic process and general aquatic habitat conditions as the channel evolves from initial construction and develops geomorphic and ecological character and function.

In accordance with the project Mitigation and Monitoring Plan (Jones, 2012), the Upper Penitencia Creek Improvement Project evaluates performance or success of the project elements relative to design goals and based on qualitative characterization and professional judgment. Together data and observations were collected in WY2014 and evaluated to address questions outlined in the MMP for monitoring components specific to Year 2 requirements. These questions include:

- Will the sizes and shapes of the pools, riffles, and floodplain benches evolve as sediment-transporting flows occur?
- Will the connections of the main channel to the high-flow, secondary channels and backwater wetlands change significantly over the short term?
- Will the backwater wetlands develop as intended and increase the complexity of the stream habitat?
- Will general channel bed composition change?
- Will downstream riffles keep upstream pools sufficiently backwatered to maximize usable pool habitat and cover area?
- Will the flooplain flood every 1 to 2 years? Will the primary and secondary channels convey the estimated bankfull flow?
- Will the creek corridor thalweg, pools and riffles, floodplain benches, banks, secondary channels, and backwater wetlands be stable?
- Will the stream corridor increase in habitat complexity?

Figure 1 illustrates the general design features of the site and the location of monitoring and photo-documentation points which serve as the basis for our monitoring work. A sequence of historical aerial photographs is provided in **Figure 2** and show the project site before, during and after construction.

Year 2 Hydrologic and Geomorphic Monitoring Methods

To assess the performance of the restoration and functions of the design elements, Balance visited the site twelve times during WY2014 including: a) a pre-water year visit to install a streamflow gaging station, b) three storm events, c) two visits after other storm events, d) several site visits during drier winter periods for instrument maintenance, datalogger downloads, and general observations, and e) most recently on June 15, 2014 to perform post wet-season geomorphic assessment. A summary of elements monitored in WY2014, including dates and responsible parties, is presented in **Table 1** and described in more detail below:

- We reviewed local rainfall conditions from the National Data Climate Center (NCDC) for San Jose International Airport located approximately 3.0 miles west of the project site;
- We obtained and reviewed preliminary 15-minute streamflow data from the Santa Clara Valley Water District (SCVWD) who operate and maintain two streamflow gages located approximately 0.5 miles upstream (Upper Penitencia Creek below Mabury Avenue, Station 1450) and 2.6 miles upstream (Upper Penitencia Creek at Piedmont Road, Station 1489);
- We completed five streamflow measurements, but did not capture bedload sediment transport during the limited and minor runoff events. Streamflow and bedload sediment transport through the constructed reach are measured to assess the fundamental assumptions of the channel design and sediment model. Limited rainfall and runoff limited opportunities to measure streamflow and bedload sediment transport in WY2014;
- One compound cross-section was established across a range of different habitat features such as deep-pool, shelter, and low-velocity habitat. Velocities were measured at this cross-section on one occasion or event. Measured velocities are compared to habitat criteria presented by Stillwater Sciences (2006). The limited number of storms in WY2014 limited an evaluation to a single, low-flow event;
- Finally, we repeated 10 photographic documentation points (photo points). We note visual changes using a comparison between post construction and the second year of monitoring.

Year 2 Hydrologic and Geomorphic Monitoring Results and Discussion, WY2014

<u>*WY2014 Rainfall summary*</u>

Cumulative daily rainfall for WY2014 is illustrated in **Figure 3** with an annual total precipitation of 6.03 inches as recorded at the San Jose Airport, significantly less than the long-term average (14.7 inches) for the same station. The largest daily rainfall totals were recorded on November 19-20, 2013 (0.76 inches), February 26, 2014 (0.68 inches), February 28, 2014 (0.97 inches), and March 31, 2014 (0.42 inches).

<u>*Hydrology*</u>

An observer log describing our observations and data collected is shown in **Table 2**. In WY2014, we installed a streamflow or discharge gaging station immediately upstream of the project site and made several attempts to manually measure flow over a range of stream depths or stage to develop a stage-discharge rating curve. A stage-discharge rating curve is a graph of discharge versus stage for a given point on a stream, usually at gaging stations, where the stream discharge is measured across the stream channel with a flow meter. Numerous measurements of stream discharge are made over a range of stream stages to create a relationship that converts the continuous record of stream stage to a continuous record of streamflow. However, limited streamflow in WY2014 precluded us from developing a stage-discharge rating curve and record of streamflow in WY2014. As such, we present a preliminary record of stage this year (**Figure 4**) and plot our manual measurements of streamflow at the project reach with preliminary near-continuous streamflow data for upstream gaging stations (Mabury Avenue and Piedmont Road) 0.5 miles and 2.6 miles upstream, respectively, and both operated and maintained by SCVWD (**Figure 5**).

The SCVWD indicates that the Mabury Avenue gaging station is only appropriate for low-flows (less than 20 cfs) and the Piedmont Road gaging station is infrequently maintained (K. Stumpf, SCVWD, pers. comm. 2014). We also note that there are multiple urban storm-drain outfalls in the reach between these stations and the project reach. Therefore, we might assume higher peak streamflows through the project reach than those measured at Mabury Avenue and Piedmont Road, although there may also be infiltration over that reach of creek, which would reduce the amount of flow, particularly at lower streamflows. Future manual measurements across a range of streamflow at the project gaging station will allow us to provide a record of near-continuous flow in subsequent monitoring years.

From Figure 5, we can confirm flow was entering the project reach from the beginning of the water year through January 2014. Balance manually measured flows between 1 and 2 cubic feet per second (cfs) entering the project reach during this period. Flow became discontinuous through the project reach and went subsurface within the first 200 feet after most rainfall and runoff events. During the same period, streamflow ranged between 2.5 and 5 cfs, 0.5 miles upstream at Mabury Avenue. These values suggest flows rapidly decreased within the 0.5 mile reach upstream of the project and further suggest streamflow is infiltrating the streambed over a longer reach than previously observed. Furthermore, these conditions may reflect the natural processes of tributaries in the South Bay during a drought.

Rainfall on November 20, 2013 generated the annual peak flow of 8.2 cfs at Mabury Road and also the annual peak flow at the project reach based on the record of stage, and estimated to be less than 10 cfs, well below the morphologic bankfull flow of 270 cfs estimated by Jordan and others (2009). Based again on the record of stage at the project reach, the channel remained dry from April 3, 2014 through the rest of the water year with the exception of isolated pools. As such, WY2014 may be reflective of a benchmark dry year with streamflow conditions inadequate to evaluate project success criteria or questions related to hydrologic and geomorphologic changes.

Bedload Sediment Transport

In the absence of high streamflows in WY2014, we did not observe or measure bedload sediment transport through the project reach and there was no evidence of new sediment deposition along the channel margins or floodplain after each event. Site conditions and bedload rates from previous years are provided in **Table 3**. The preliminary relationship between instantaneous streamflow and bedload sediment discharge is illustrated in **Figure 6.** Data in Figure 6 include historical data collected by Balance between WY2005 and WY2007 as part of a SCVWD project. These data are used as a reference for comparison to current conditions. Based on a limited number of samples (n = 3) in WY2013 (Year 1) and WY2014 (Year 2) the data appear to fit the general trend observed in previous years; however, additional monitoring is recommended before a bedload sediment rating curve can be developed and used to compute a record of bedload sediment transport.

Channel and bank stability and general geomorphic observations

In the absence of channel-maintenance flows (i.e., flows capable of transporting bedload sediment) in WY2014, we did not identify any measurable channel changes, sedimentation, scour or bank instabilities. As such, samples from the channel bed were not collected for detailed assessment in WY2014. On the other hand, the absence of large flows has provided an opportunity for new vegetation to establish.

Between events and during the dry season, segments of the channel within the project reach failed to convey surface flows and temporarily limited salmonid passage. While we suspect that Upper Penitencia Creek has historically exhibited intermittent or dry conditions, we are evaluating whether these conditions reveal design or construction flaws or reflect conditions under the current drought. We anticipate that these conditions may improve with time but may depend on annual rainfall and runoff conditions. We will continue to work with H.T. Harvey & Associates, NMFS, and VTA to evaluate conditions and make suggested changes if they are deemed to be necessary.

Flow Velocity Measurements for Steelhead Passage Conditions Assessment

This section provides information about the periods of observed continuous flow, flow velocity and depth measurements to assist H. T. Harvey & Associates fisheries ecologists with assessment of steelhead passage and habitat conditions. As noted above, our ability to evaluate hydrologic conditions relevant to steelhead habitat conditions was limited by below average precipitation and runoff in WY2014. Based on our direct observations of flow or high-water marks after an event occurred in WY2014, continuous flow through the project reach did occur as the result of several storm events (November 20, 2013, February 8, 2014, and February 28, 2014) and may have provided opportunities for fish passage. Only the event on February 28, 2014 allowed for measurement of compound cross-section velocity (**Figure 7**), and was characterized as a low-flow event (3 cfs) at the location shown in **Figure 1**. SCVWD gages upstream suggest peak flows during this event may have exceeded 8 cfs, and high-water marks at the project site suggested similar flows occurred before our measurement was conducted. Additional measurements at higher flows will be necessary to understand the extent that the design provides for passage and refuge habitat.

From Figure 7, we observed water depths between 0.2 feet and 2.5 feet in the active or low-flow channel and roughly 1.0 feet in the high-flow channel. A low-flow of 3 cfs resulted in very low velocities across the compound cross-section with a maximum velocity less than 0.5 feet per second (ft/sec) during the February 28th event. The reduced velocities may reflect an increase in hydraulic roughness offered by well-established, in-channel vegetation. We will continue to target higher streamflows in subsequent years to better evaluate high-flow conditions for H. T. Harvey & Associates' assessment of steelhead habitat conditions.

Photographic documentation points

Ten repeat photographs established on December 10, 2012 and repeated on June 4, 2014 are provided in **Appendix A**. We should note that the December photographs were taken after the December 2, 2012 storm, when a flow of roughly 100 cfs was estimated through the project reach. As a result, some minor channel adjustments were observed. Photographs taken on June 2014 are characteristic of a restored channel during a revegetation phase and in the absence of channel-maintaining flows. We anticipate that once the project reach experiences multiple bankfull or greater floods, the channel will be more defined using this type of documentation.

Recommendations for adaptive management

As discussed above, WY2014 was drier than average and absent of any major storm events and resulting streamflow. As a result, many of the questions for evaluation posed in the introduction of this report cannot be answered in Year 2. Furthermore, we do not see a need for any adaptive management actions at this time. It is important that monitoring continue and document performance after future large runoff events during the 10-year monitoring period.

Monitoring frequency in Year 3 will focus on data collection and observations if average or above average precipitation is recorded and streamflow through the project reach is sustained. Monitoring elements that are required in Year 3, per the MMP, will be executed if conditions warrant.

Closing

We greatly appreciate the opportunity to assist you with this monitoring effort and look forward to reporting on the Year-3 geomorphic and hydrologic monitoring efforts.

Respectfully submitted,

BALANCE HYDROLOGICS, Inc.

Brian Hastings, PG
Geomorphologist

Reviewed by:

Jonathan Owens
Senior Hydrologist

Encl. Tables 1 through 3
Figures 1 through 7
Appendix A

References Cited:

Chartrand, S., 2011, Feasibility study and design basis memorandum for mitigation project—Upper Penitencia Creek at Berryessa Campus, Balance Hydrologics consulting report prepared for Valley Transit Authority (VTA), contract No. S09148-Task order 3, 39 p. + appendices.

Jones, M., 2012, BART Silicon Valley, Berryessa extension project—Mitigation and monitoring plan, ICF International consulting report prepared for Valley Transit Authority (VTA), contract No. S09148, 19 p.

Jordan, B.A., Annable, W.K., and Watson, C.C., 2009, An urban geomorphic assessment of the Berryessa and Upper Penitencia Creek watersheds in San Jose, California: A report prepared for the Santa Clara Valley Water District (WLA project #1667), 206 p. + appendices.

Stillwater Sciences, 2006, Upper Penitencia Creek limiting factors analysis: Final technical report. Consulting report prepared for Santa Clara Valley Urban Runoff Pollution Prevention Program, 72 p. + figures + appendices.

Thompson, K., 1972, Determining streamflows for fish life *in* Proceedings, instream flow requirements workshop, Pacific Northwest River Basins Commission, Vancouver, Washington, pp. 31-50.

Table 1. Stream geomorphology, monitoring summary, Years 1-2 (Water Years 2013-2014)
Upper Penitencia Creek at Berryessa Avenue, San Jose, California

Monitoring Components	Baseline (Post-Construction)	Baseline (Post-Construction)	Year 1 (WY2013)	Year 2 (WY2014)	Monitoring
	Date	*Responsible Party*	*Date*	*Date*	*Responsible Party*
Longitudinal profile	1-Dec-2012	Allied Engineering	4-Jun-2013	not applicable	Balance Hydrologics
Cross-sections	1-Dec-2012	Allied Engineering	4-Jun-2013	not applicable	Balance Hydrologics
Flow and bedload transport	--	--	Nov 2012 thru March 2013	Nov 2013 thru March 2014	Balance Hydrologics
Point velocity	--	--	Nov 2012 thru March 2013	Nov 2013 thru March 2014	Balance Hydrologics
Channel dynamics observations	--	--	4-Jun-2013	15-Jun-2014	Balance Hydrologics
Channel bed samples	--	--	4-Jun-2013	*see note	Balance Hydrologics
Photopoints	10-Dec-2012	Balance Hydrologics	4-Jun-2013	15-Jun-2014	Balance Hydrologics

Notes
Channel construction and rewatering was completed in November 2012
Baseline surveys completed by Allied Engineering were provided to Balance Hydrologics in March 2013
* In the absence of bedload transport flows in WY2014, channel bed samples were not collected.

Table 2. Station observer log:
Upper Penitencia Creek above Berryessa Road (UPBR), water year 2014

Site Conditions						*Streamflow*				*Water Quality Observations*				*Remarks*
Date/Time (observer time)	Observer	Stage	High water marks	HWM Date:Time	Hydrograph	Measured Streamflow	Instrument Used	Estimated Accuracy	SCVWD gage streamflow bl Mabury	Water Temperature	Field Specific Conductance	Adjusted Specific Conductance	Additional sampling?	
		(feet)	*(feet)*		*(R/F/S/B)*	*(cfs)*	*(AA/PY)*	*(e/g/f/p)*	*(cfs)*	*(oC)*	*(μmhos/cm)*	*(at 25 oC)*	*(Qss, Qbed)*	
9/26/2013 17:40	aes, jo	0.57	--	--	--	--	--	--	--	--	--	--	--	Install staff plate, level logger and barometric logger upstream of project reach, in pool approximately 5 feet upstream of WY2013 staff plate location.
11/5/2013 13:20	ed	0.60	--	--	B	1.9	AA	f	2.4	--	--	--	--	Site visit to measure flow at start of WY14
11/22/2013 12:00	aes	0.615	--	--	B	--	--	--	1.7	--	--	--	--	Site visit post first flush, photos taken of high water marks in-channel, leaf organic matter (OM) lining channel about 4-6 inches above surface water elevation. Upstream inset channel flowing. Log cribwall solid, no erosion. At upstream BESO, eroded pit about 2-3 feet deep on downstream side of structure.
1/21/2014 11:45	df	0.600	--	--	B	1.69	PY	e	0.8	10.1	405	560	--	Water is turbid, visability approximately 0.75 feet. Some plants growing in water on right bank; some leaves in riffle next to gage.
2/8/2014 10:00	ed, dd	0.30	0.90	2/6/14 6:00	B	--	--	--	0.30	--	--	--		Pool @ gage was cut off from flow. At stages lower than current stage staff will be disconnected from flow. Soils were dry under trees in riparian corridor. Flow estimate at gage 0.1-0.15 cfs. At downstream end of site flow estimate @ downstream fence 1.5-1.75. High flow at Piedmont Ave gage during preceeding few days was 5.45 cfs on 2/6/2014 at 6:00
2/28/2014 8:22	aes, an	0.67	--	--	F	--	--	--	4.5	--	--	--	--	Hydrograph falling but also spiky during site visit, with rainfall occurrence during site visit and gage readings at Piedmont Ave. Flow connectivity throughout project reach; spent ~2 hours in the reach and performing habitat velocity measurements. When returning upstream to staff plate for flow measurement at about 10:30 am, flow had returned to subsurface at upper portion of project reach
2/28/2014 11:25	aes, an	0.46	1.50	2/28/14 4:00	F	1.61	PY	f	2.2	--	--	--	--	Hydrograph falling but also spiky during site visit, with rainfall occurrence during site visit . New growth seen on very recent installation of willow stakes along left bank at upstream end of project reach. New streamwood on left bank and in channel at upstream end of project reach. Accumulation of OM in pool upstream of confluence of creek and first BESO outfall.
3/31/2014 16:56	ed,an	0.49	0.85	3/31/2014 14:30	F	1.83	AA	p	4.2	--	--	--	--	Discontinuous Flow through site upon arrival and through all measurments. Hydrograph falling fast, took and out-odd back-even measurement, they have to be seperated because stage was dropping so fast. Second Q-meas started at 5:12 and measured 1.17 cfs. Stage did not drop much during second measurement
3/31/2014 17:12	ed,an	0.43	0.85	3/31/2014 14:30	F	1.17	AA	f	3.6	--	--	--	--	See above
4/17/2014 11:45	df	dry	dry	--	b	--	--	--	dry	18.5	887	1017	--	Gage is dry, flow measured at fence at downstream end of site was roughly 0.1 cfs, lots of algae in channel and on rocks, water clear other than algae.
6/15/2014 11:30	bkh	dry	dry	--	--	--	--	--	dry	--	--	--	--	Annual site visit to inspect channel, repeat photo points and assess condition of stream gaging station. Met with Rachel Martinez (VTA) to observe willow mortality along sections of channel.
10/10/2014 11:11	df, ks	dry	dry	--	--	--	--	--	dry	--	--	--	--	Channel dry, human feces in channel, levelogger downloaded. Staff plate has graphiti on it, replace next download.

Observer Key: (bkh) Brian Hastings, (jo) Jonathan Owens, (ed) Eric Donaldson, df (Dan Frietas), aes (Anne Senter), an (Anna Nazarov), ks (Krysia Skorko).
Streamflow gaging station operated by SCVWD (ALERT gage 1450, Upper Penitencia Creek below Mabury Road) located roughly 0.5 miles upstream; flow values are provisional and subject to revision
Stage: Water level observed at outside staff plate; arbitrary datum
Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)
SCVWD gage: ALERT gage, Penitencia Creek at Dorel Avenue SF 83, streamflow approximate to nearest reported flow
Specific conductance: Measured in micromhos/cm in field; then adjusted to 25degC by equation (1.8813774452 - [0.050433063928 * field temp] + [0.00058561144042 * field temp^2]) * Field specific conductance
Additional Sampling: Qbed = Bedload sediment

Table 3. Bedload sediment and calculated loading rates:
Upper Penitencia Creek above Berryessa Road (UPBR), water years 2005, 2006, 2007, 2013, and 2014

	Site Conditions					***Bedload Sampling Details and Transport***							
Sample Date and Time	**Observer(s)**	**Bedload Measurement Gage Height**	**Streamflow Discharge**	**Stream Value Source**	**Stream Condition**	**Active Bed Width**	**Sampler Width**	**No. of Verts.**	**Time/Vert.**	**Total Time**	**Sample Dry Weight**	**Bedload-Sediment Discharge Rate**	**Bedload-Sediment Discharge Rate**
(M,D,Y 00:00)		*(feet)*	*(cfs)*	*M,R,E*	*R,F,S, B,U*	*(feet)*	*(feet)*		*(sec)*	*(sec)*	*(gm)*	*(lb/sec)*	*(tons/day)*
WY 2005													
2/15/05 14:30	he, gg	12.70	240.6	R	R	13	0.25	1	45	45	403.0	1.0	44
2/21/05 15:55	jo, eb	12.60	218.6	R	R	9	0.25	7	30	210	1293	0.5	21
2/21/05 16:55	jo, eb	12.05	87.8	M	R	9	0.25	7	30	210	779	0.3	13
3/2/05 8:45	he, gg	11.17	30.7	M	U	4	0.25	5	40	200	92	0.02	0.7
WY 2006													
12/31/05 9:50	gg, ds	10.92	15.8	R	U	8	0.25	2	60	120	12	0.01	0.3
4/6/06 15:15	he, bj	12.15	120.3	M	S	11	0.25	4	30	120	5114	4.1	179
4/6/06 16:15	he, bj	12.15	120.3	M	S	11	0.25	5	30	150	6428	4.2	180
WY 2007													
2/9/07 13:50	he, ds	10.64	5.3	R	F	4.8	0.25	6	60	360	42	0.005	0.2
2/22/07 9:55	ds, an	10.84	10.1	R	F	3	0.25	1	120	120	44	0.01	0.4
WY 2013													
11/30/12 12:15	ed, aes	0.69	19.4	M	R	11.3	0.25	6.0	45	270	21	0.008	0.3
12/22/12 7:30	aes, er	0.78	31.8	M	F	8.0	0.25	8.0	45	360	75	0.015	0.6
12/24/12 8:42	aes, er	0.50	53.3	M	F	10.0	0.25	11.0	45.0	495	777	0.138	6.0
WY 2014													

Notes
Data in water years 2005, 2006, and 2007 were collected by Balance Hydrologics as part of a separate study; bedload sediment was measured within the project reach.
Data in water year 2013 were collected at a different location than in WY2014
Data in water year 2014 were collected at a different location than in WY2013
Observer Key: ds = Dave Shaw, bkh = Brian Hastings, cs = Collin Strasenburgh, ed = Eric Donaldson, aes = Anne Senter, er = Eric Riedner
Streamflow Value Source: M = measured; R = rating curve; E = estimated
Stream Condition: R = rising, F = falling, B = baseflow, U = uncertain, S = steady
Streamflow discharge is the measured or estimated instantaneous flow when sediment was sampled, and usually differs from the mean flow for the day.
Streamflow at Upper Penitencia Creek at Dorel Drive is a real-time station operated by SCVWD and updated every 4-hours or during an event.
Active Bed Width: The width thought by the field observer to be transporting significant amounts of bedload
Sampler Width and Type: 0.25 = 3-inch Helley Smith; 0.50 = 6-inch Helley Smith
Bedload Discharge (lbs/sec) = [active bed width (ft) * sample dry weight (gm) * 0.002205 (lbs)]/ [sampler width (ft) * sampling time (sec)]
Bedload Discharge (tons/day) = [active bed width (ft) * sample dry weight (gm) * 86,400 (sec)]/ [sampler width (ft) * sampling time (sec) * 907,200 (gm)]
Sample Dry Weights in parentheses are temporary Wet Weights w/plastic bags
Observations of no bedload in motion are given a value of 0.01 tons per day so they can be plotted as threshold data.

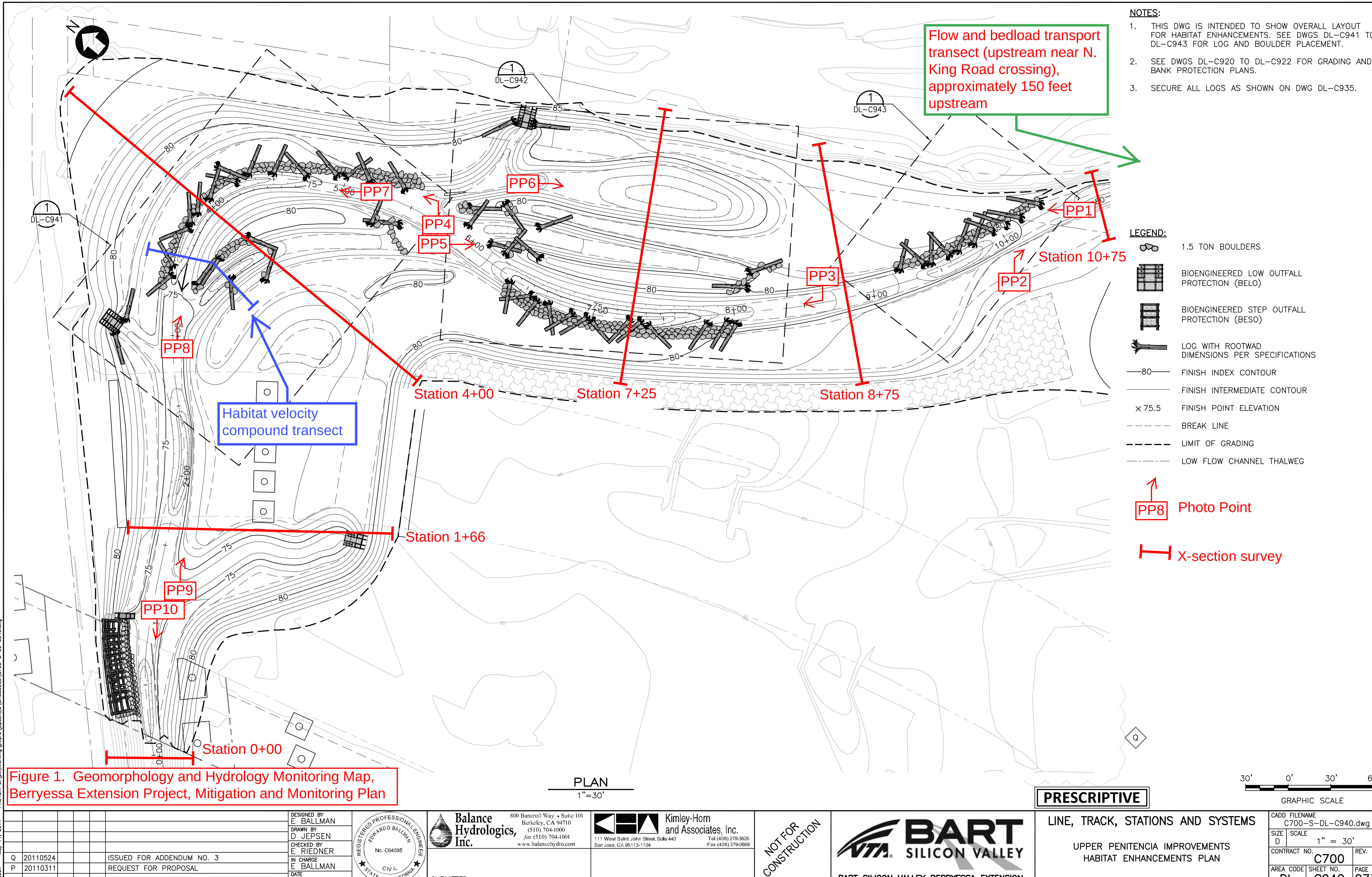
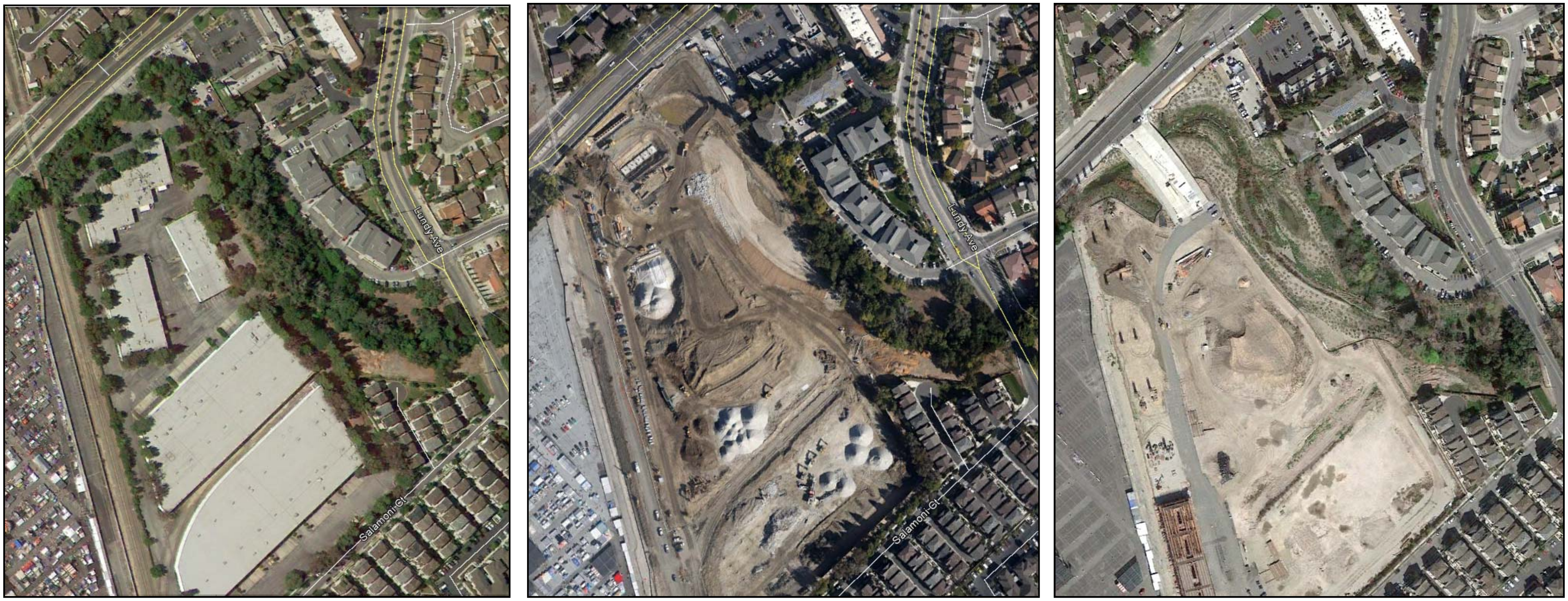


Figure 1. Geomorphology and Hydrology Monitoring Map, Berryessa Extension Project, Mitigation and Monitoring Plan



A. May 19, 2012 , Before construction

B. September 11, 2012,
Channel construction period

C. Summer 2014, 2 years after
completion of construction.

N
W E
S

Imagery: Google Earth

Balance Hydrologics, Inc.

Figure 2. **Sequence of project completion, Upper Penitencia Creek, San Jose, California**

Aerial photographs taken between May 2012 and summer 2014 show the project before, during and after construction.

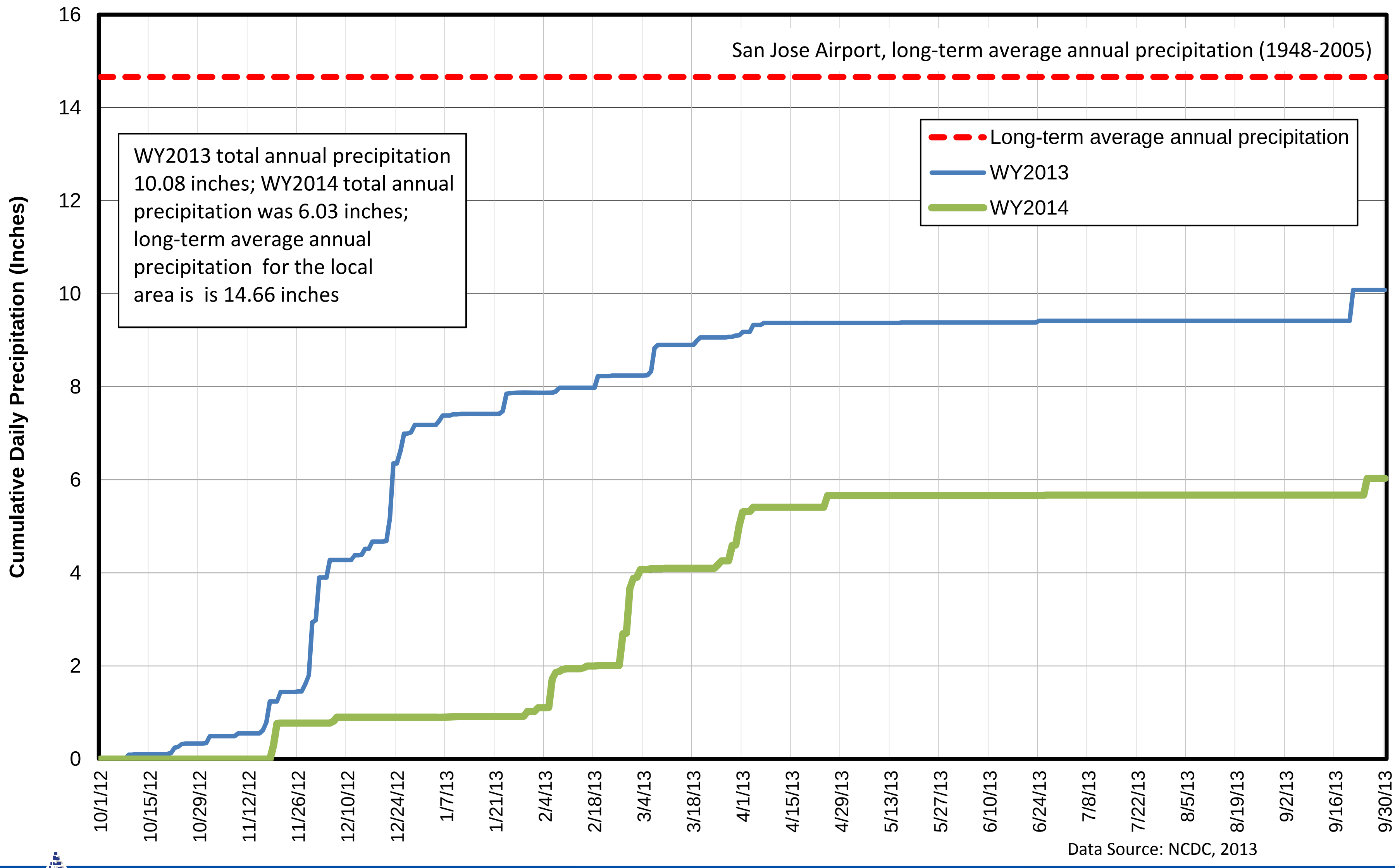


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Figure 3. **Cumulative daily precipitation, San Jose Airport, San Jose, California, water years 2013 and 2014.** Total annual rainfall in both years (post-construction) was well below average.

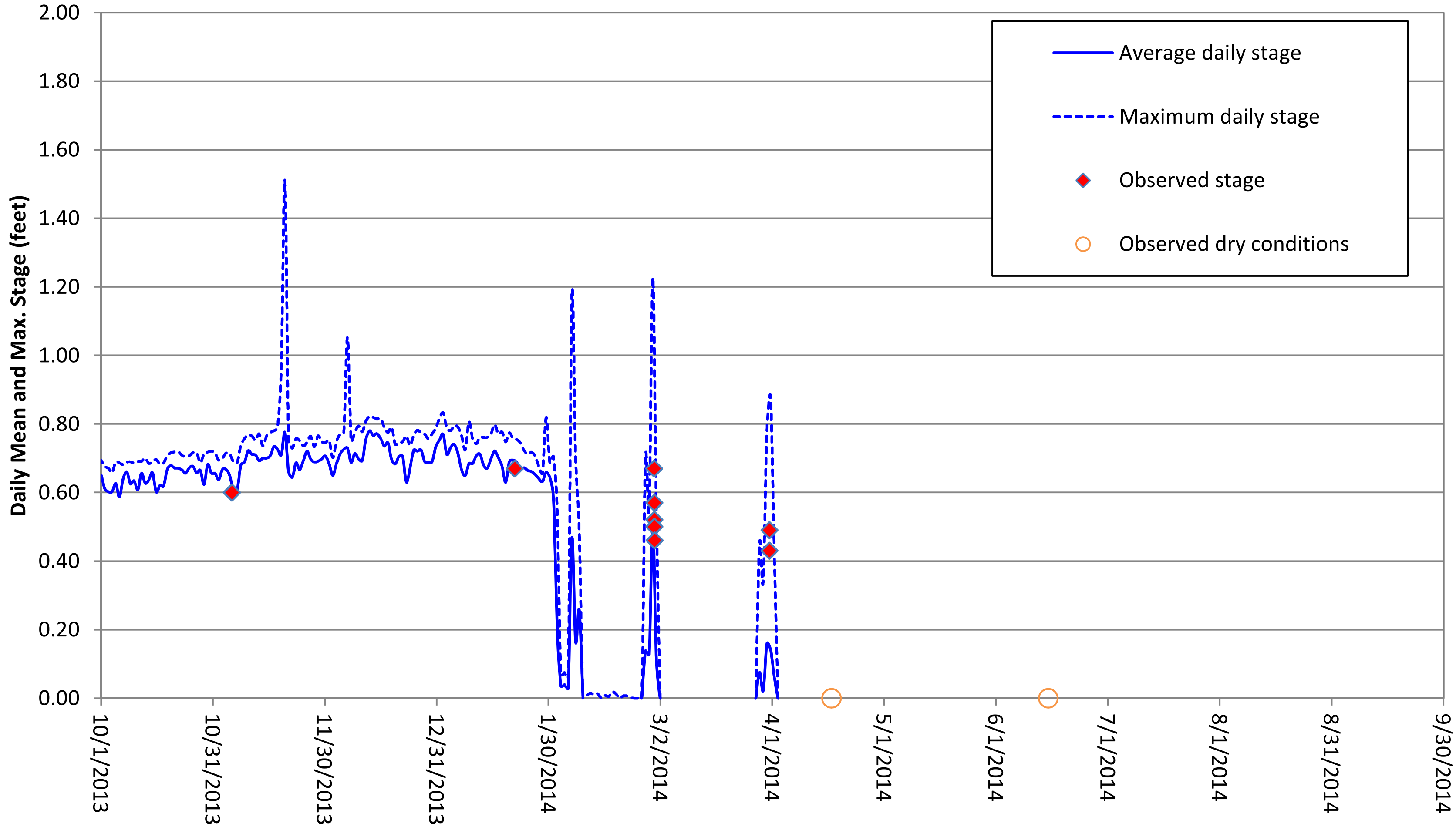

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Figure 4.

Daily stage hydrograph: Upper Penitencia Creek at Berryessa Road, San Jose, California, water year 2014. In general, streamflow entering the project reach ceased after January with intermittent streamflow during a few storms in March and April. Dry channel conditions persisted for the rest of the water year with some isolated pools.

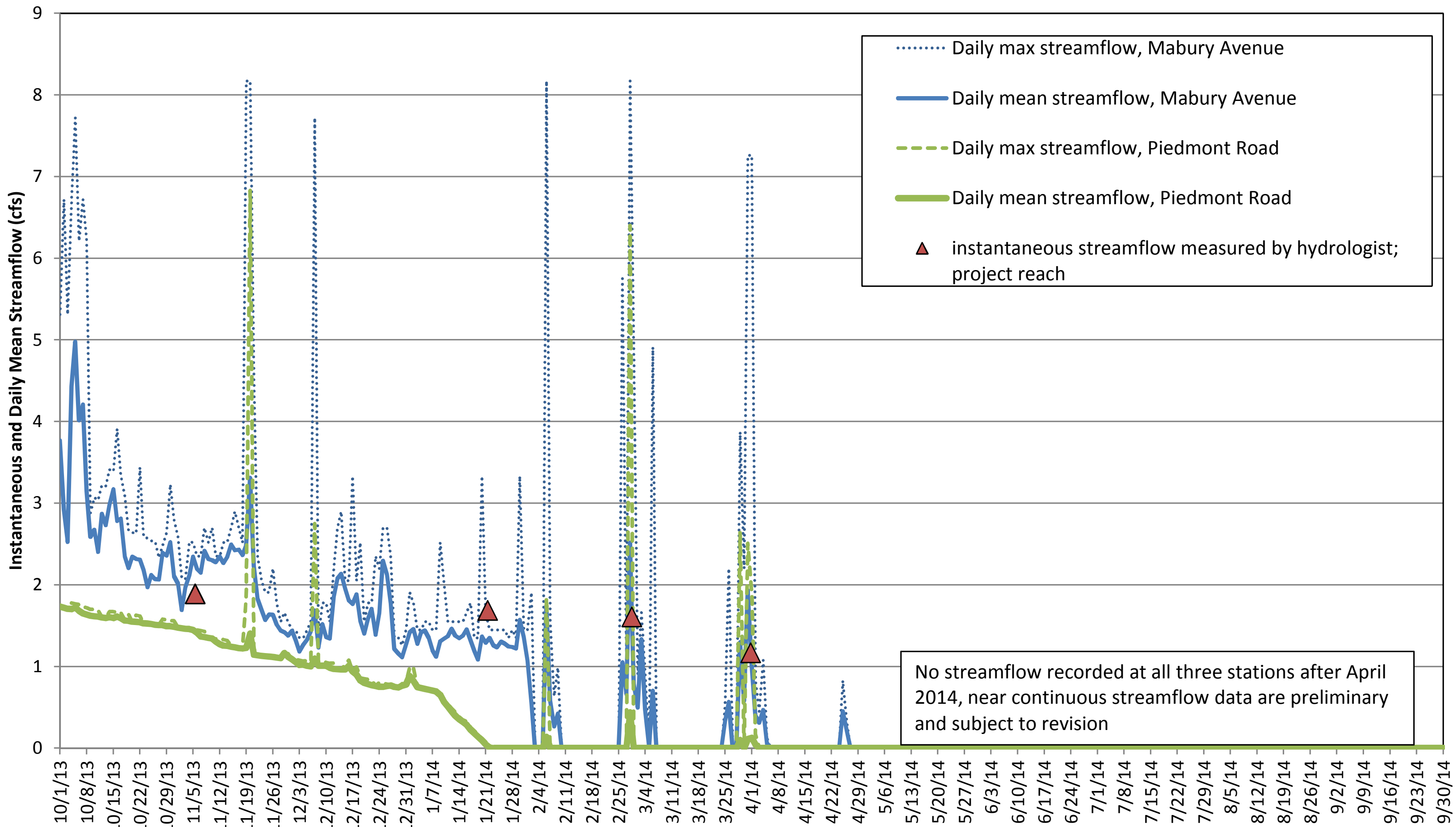

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Figure 5. Daily Mean and Maximum Streamflow, Upper Penitencia Creek at Mabury Avenue and Piedmont Road, San Jose, California, Water Year 2014. Gaging stations are operated by the SCVWD and located 0.5 miles and 2.6 miles upstream of the project reach, respectively. Instantaneous streamflow measured at the project reach is also displayed.

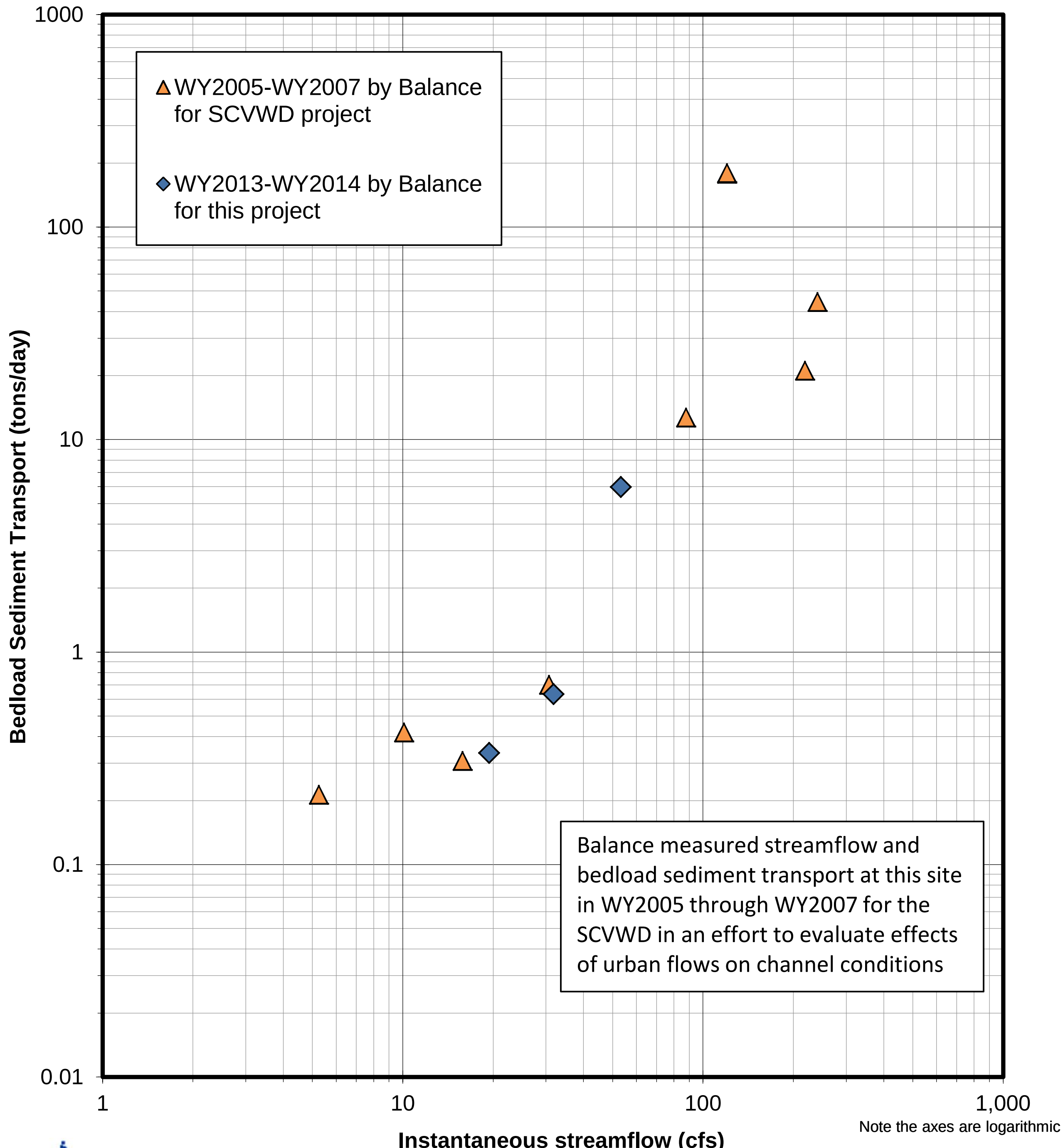

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Figure 6. **Relationship between streamflow and bedload sediment transport, Penitencia Creek at Berryessa Road, San Jose, California, water years 2005, 2006, 2007 and preliminary data for 2013 and 2014.**

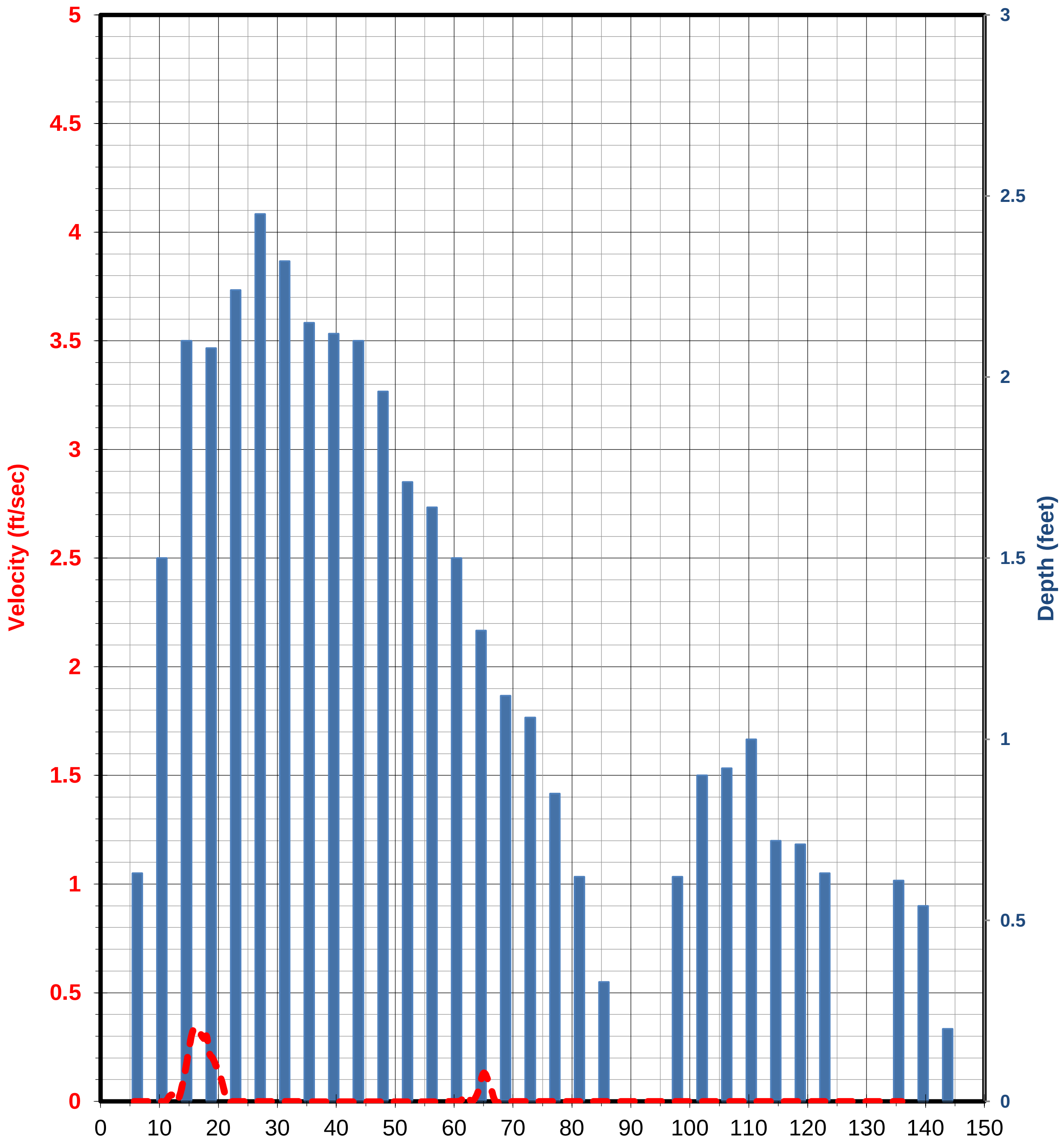

Figure 7. **Habitat velocities and depths for 3 cfs, Upper Penitencia Creek above Berryessa Road, San Jose, California.** Measurement recorded on February 28, 2014.

Appendix B. Photo-documentation

Photo-documentation Point #1 (16 October 2014).

Photo-documentation Point #5a (16 October 2014).

Photo-documentation Point #6 (16 October 2014).

Photo-documentation Point #7c (16 October 2014)

Photo 5. Photo-documentation Point #13a (22 October 2014).

Photo-documentation Point #18b (22 October 2014).

Photo looking upstream from downstream end of site (16 October 2014).