



H. T. HARVEY & ASSOCIATES
Ecological Consultants

Upper Penitencia Creek Improvement Project
Year 3 (2015) Monitoring Report

Project #3518-03

Prepared for:

Ann Calnan
Santa Clara Valley Transportation Authority
3331 N. First Street, Building B
San Jose, CA 95134

Prepared by:

H. T. Harvey & Associates

In Collaboration with:

Balance Hydrologics

May 2016

Executive Summary

Permit Numbers

- 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) was designed to mitigate construction-related impacts on riparian habitat and federal and state jurisdictional wetlands and waters arising from implementing the Santa Clara Valley Transportation Authority's Bay Area Rapid Transit Silicon Valley Berryessa Extension (SVBX) Project. The mitigation design consisted of the creation of 1.0 acre of riparian habitat, 1.06 acres of floodplain wetland habitat, and approximately 982 linear feet of stream channel. The Project site is located at the downstream end of Upper Penitencia Creek, southwest of the intersection of Berryessa Road and North King Road, in San Jose, Santa Clara County, California (Figure 1).

The Project's mitigation and monitoring plan and fish monitoring plan require monitoring vegetation, stream geomorphology and hydrology, and fish ecology. The site failed to meet its Year 1 woody plant survival performance criterion because of the high mortality rate of Fremont cottonwood (*Populus fremontii*) and willow (*Salix* spp.) cuttings, which were installed at a very high density (1-foot on-center spacing). H. T. Harvey & Associates prepared a revised vegetation monitoring plan that shifted from a survival-based monitoring program to a habitat function–based monitoring program that assesses woody plant cover, tree height, invasive species cover, wetland habitat characteristics, woody plant health and vigor, natural recruitment, and woody plant species richness. The new monitoring methodology was developed in coordination with the California Department of Fish and Wildlife (CDFW) and approved by both the CDFW and the Regional Water Quality Control Board. It was based on an overall reassessment of the initial monitoring plan not only due to the die off of certain plants but also because CDFW felt the new methodology was a better approach to assess the development of the mitigation site over time. The Project's fish monitoring plan includes a quantitative assessment of the post-Project fish community, particularly site use by the Central California Coast steelhead (*Oncorhynchus mykiss*) distinct population segment, which is federally listed as endangered.

The MMP identified the following mitigation goals for the Project:

- Restore hydrologic and geomorphic functions, including sediment transport and deposition.
- Restore floodplain connectivity and flood storage.

- Restore fish and wildlife habitats, including the provision of on-site habitat and passage for the federally listed Central California Coast steelhead distinct population segment.

- Improve water quality.

This report depicts the overall conditions of the site in Year 3 and fulfills the requirement for Year 3 monitoring.

Results

Vegetation

Riparian woodland and wetland habitat is developing rapidly at the mitigation site. The Streamside, Bar, and Boulder Bank Planting Zones (Streamside Area) achieved 51.9% cover, which exceeds the 25% cover criterion required for Year 3. The Floodplain and Upper Slope Planting Zones (Floodplain Area) achieved 15.3% cover, which exceeds the 7% cover criterion required for Year 3. The average percent cover of native woody species overhanging the bankfull channel increased from 23.8% in Year 2 to 24.7% in Year 3, and average tree height in the Streamside Area increased from 8.1 feet in Year 2 to 11.9 feet in Year 3, which meets the performance criteria of increasing percent cover of overhanging vegetation and increased tree height between monitoring years. Invasive species were not observed along any of the vegetation monitoring transects or throughout the site as a whole, meeting the Year 3 performance criterion of less than 5% cover by invasive species. Nonnative Italian alder (*Alnus cordata*) was observed in the Streamside Area. This species may have been unintentionally planted in place of white alder (*Alnus rhombifolia*). Italian alder is not considered to be invasive. Thus, its removal is not warranted at this time.

The survival rate of woody plants in the Floodplain Area in Year 3 was 77%. Replanting of 198 plants is recommended to return the number of installed plantings to 100% of the number originally installed, as required by the vegetation monitoring plan for Year 3. Streamside Area canopy gaps in Year 3 totaled 692 linear feet. Installation of a total of 87 Fremont cottonwood, red willow (*Salix laevigata*) and arroyo willow (*Salix lasiolepis*) cuttings on 8-foot centers is recommended to fill those gaps.

Two floodplain wetlands, totaling approximately 0.02 acre, have developed at the mitigation site. They are dominated by hydrophytes ("water-loving" vegetation). The deeper and larger of the two wetlands (approximately 3,060 square feet) had shallow surface soil cracks, an indicator of wetland hydrology.

On average, the mitigation plantings were in good condition and exhibited high health and vigor. Ninety percent of surviving woody plantings were in good condition, and 10% were in fair condition. Seventy-two stems of naturally recruiting native woody species were counted in fourteen 1,000-square-foot transect bands. The average number of recruiting individuals was 0.2 per 1,000 square feet in the Streamside Area and 0.6 per 1,000 square feet in the Floodplain Area. California rose (*Rosa californica*) and coyote brush (*Baccharis pilularis*) had the highest stem densities of naturally recruited individuals. Seventeen native woody species were observed on the Project site.

Stream Geomorphology

Few measureable streamflow events occurred in water year 2015 (October 1, 2014, through September 30, 2015). The low frequency and duration of surface flow through the Project reach is likely due to below-average precipitation and regional declines in groundwater levels over the past four years. Total annual precipitation in water year 2015 was 13.41 inches, approximately 90% of average (14.7 inches). Most of the annual precipitation occurred between November 28 and December 25 during three events. Intermittent and dry conditions were observed throughout much of the year on the Project site and in reaches upstream of the site. A peak streamflow of 350 cubic feet per second was recorded immediately upstream of the Project site at the streamflow gage near Berryessa Road on December 12, 2014. The longest continuous streamflow event (7 days) was measured at the Berryessa Road gaging station from December 15–22, 2014. Flow volume and duration measured at the Berryessa Road gaging station were lower compared to those measured 2.6 miles upstream, at the Piedmont Road gaging station, suggesting that surface flows function to recharge groundwater and that both streamflow volume and duration decrease with distance downstream. Although the peak streamflow event was large enough to mobilize bedload sediments on the Project site, it did not appear to change channel conditions.

Fish

During Year 3, standard biannual (spring and fall) electrofishing surveys were not conducted. Because of the regional drought conditions in 2015, all habitat units on the Project site were dry or contained shallow, stagnant water not conducive to electrofishing. The Project site was hydrologically isolated from reaches downstream and upstream, and was not receiving surface flow at the time of our surveys. In habitat units containing standing water, there was no discernable flow, and the water quality in these units was determined to be too poor to allow safe electrofishing. Performing electrofishing surveys under these circumstances would cause additional, possibly lethal, stress to fish already subject to poor water quality conditions. Although unconfirmed, streamflow through the Project site may have occurred coincident with streamflow events measured upstream of the Project site at the Berryessa Road gaging station. The major streamflow events that were measured occurred during the typical (December through March) adult steelhead spawning migration period, and upstream passage through the Project site may have been possible for adult steelhead during the brief flow events. The major streamflow events did not coincide with periods when juvenile steelhead typically outmigrate.

Project goals for the provision of native fish habitat were not met in Year 3 because of lack of flow most likely associated with regional drought conditions and also potentially due to upstream water diversions and historically intermittent flow conditions in the Upper Penitencia Creek ecosystem. Native and nonnative fishes are expected to redistribute into and through the restored channel when it becomes watered as the region emerges from drought.

Management Recommendations

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

- Install Streamside Area cuttings during the 2015–2016 rainy season (approximately November through February) in canopy gaps at 8-foot on-center spacing. The following table lists the recommended species and quantities of cuttings to be installed.

Streamside Area Replanting Recommendations

Scientific Name	Common Name	Recommended Replanting Quantity
Populus fremontii	Fremont cottonwood	12
Salix laevigata	Red willow	50
Salix lasiolepis	Arroyo willow	25
	Total	**87**

Note: The relative quantities of red and arroyo willows will depend on availability at the harvest sites.

- Replant missing and dead woody plantings in the Floodplain Area during the 2015–2016 rainy season (approximately November through February). 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 vegetation monitoring plan Year 3 percent survival success criterion. The following table lists the recommended species and quantities.

Floodplain Area Replanting Recommendations

Scientific Name	Common Name	Number of Plantings Installed	Number of Surviving Plantings	Survival Rate	Recommended Replanting Quantity
Aesculus californica	California buckeye	4	3	75%	7
Artemisia californica	California sagebrush	75	71	95%	4
Baccharis pilularis	Coyote brush	137	137	100%	0
Baccharis salicifolia	Mulefat	100	82	82%	18
Heteromeles arbutifolia	Toyon	28	21	75%	42
Mimulus aurantiacus	Sticky monkeyflower	121	18	15%	0
Quercus agrifolia	Coast live oak	6	4	67%	9

Scientific Name	Common Name	Number of Plantings Installed	Number of Surviving Plantings	Survival Rate	Recommended Replanting Quantity
Rhamnus ilicifolia	Hollyleaf redberry	2	0	0%	4
Rosa californica	California rose	265	230	87%	35
Rubus ursinus	California blackberry	31	16	52%	15
Sambucus nigra ssp. caerulea	Blue elderberry	43	32	74%	64
	Total	**812**	**614**	**76%**	**198**

Note: Marsh baccharis, which was included in the dead plant assessment in Year 2, was not included in the Year 3 analysis and planting recommendations because marsh baccharis is a nonwoody herbaceous plant species. The vegetation monitoring plan requires 100% of the dead woody plants to be replaced in Year 3.

- Hand-pull all native and nonnative weeds growing in the planting basins.
- Maintain (through weed whacking) all herbaceous vegetation outside basins to a maximum height of 1 foot. Recruiting native woody species should be avoided during weed whacking.
- Remove the segment of chain-link fence that spans the restored floodplain and creek channel in the southeastern section of the Project site. The fence segment has the potential to threaten Project success by impeding the flow of coarse debris through the creek channel and possibly increasing floodwater surface elevations. The chain link fence is in place to maintain a construction site boundary for safety and is expected to be removed in Year 4.
- Install a water depth recorder on the Project site to measure continuous-streamflow depth and duration to describe streamflow events that are most likely to allow for fish passage.

Agency Actions

No agency action is requested at this time.

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Preparers

H. T. Harvey & Associates

Daniel Stephens, B.S., Principal Restoration Ecologist
Sharon Kramer, Ph.D., Principal Fish Ecologist
Max Busnardo, M.S., Senior Restoration Ecologist, Project Manager
Peter Nelson, Ph.D., Senior Fish Ecologist
Neil Kalson, B.S., Fish Ecologist
Ken Lindke, M.S., Quantatative Ecologist
Charles McClain, M.S., Restoration Ecologist
James Merk, M.A., Technical Editor

Balance Hydrologics

Jonathan Owens, M.S., Principal
Brian Hastings, M.S., P.G., Geomorphologist/Hydrologist

Section 1.0 Introduction

1.1 Permit Numbers

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

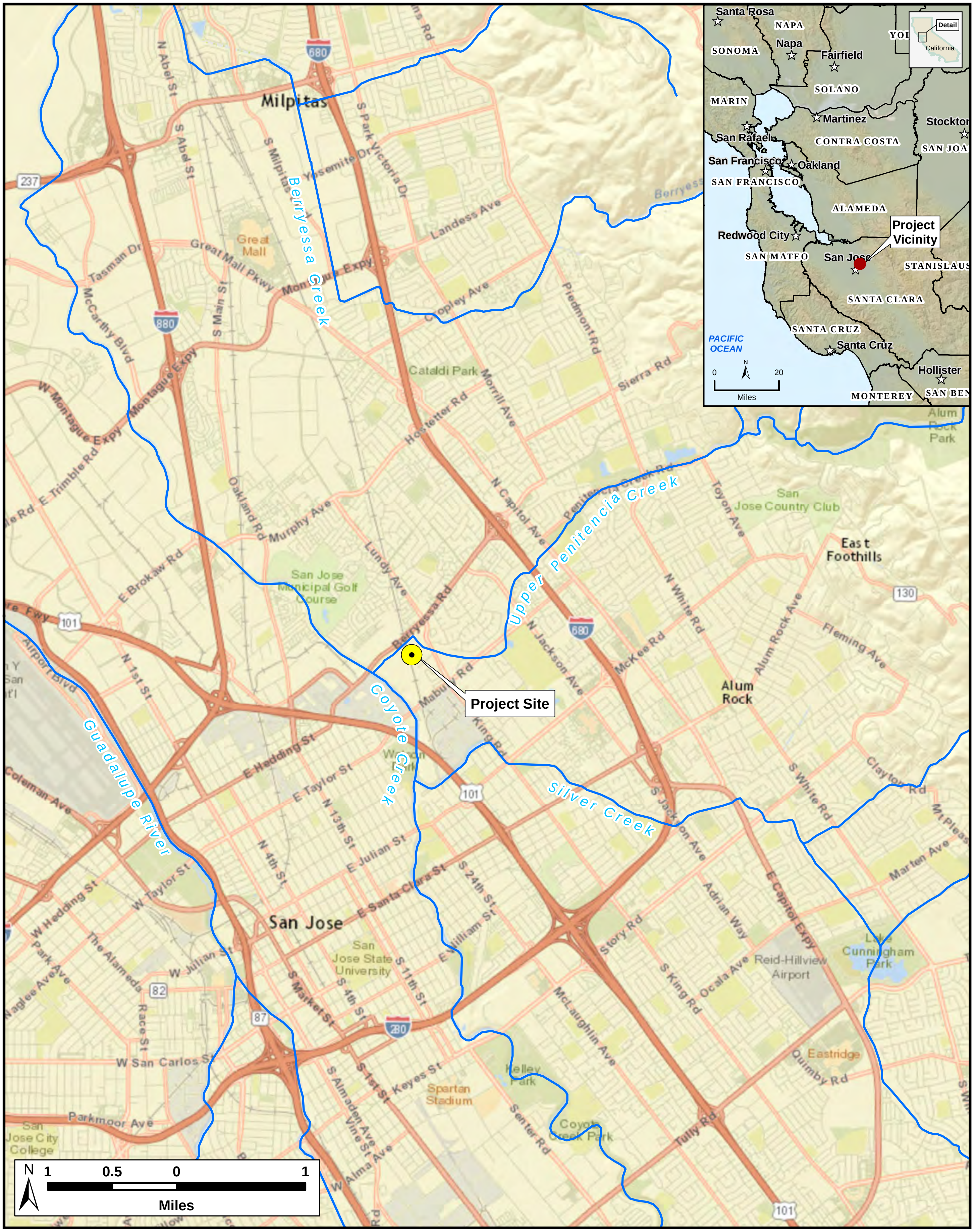
- U.S. Army Corps of Engineers File No. 28924S
- Regional Water Quality Control Board Site No. 02-43-C0654 (bkw)
- California Department of Fish and Wildlife Notification No. 1600-2011-0303-R3

1.2 Background

1.2.1 Jurisdictional Habitat Impacts and Mitigation Construction

The Upper Penitencia Creek Improvement Project (Project) was designed to mitigate construction-related impacts on riparian habitat and federal and state jurisdictional wetlands and waters arising from implementing the Santa Clara Valley Transportation Authority's (VTA's) Bay Area Rapid Transit (BART) Silicon Valley Berryessa Extension Project (SVBX Project). The mitigation design consisted of the creation of 1.0 acre of riparian habitat, 1.06 acres of floodplain wetland habitat, and approximately 982 linear feet of stream channel. The Project site is located at the downstream end of Upper Penitencia Creek, southwest of the intersection of Berryessa Road and North King Road, in San Jose, Santa Clara County, California (Figure 1). The 2.06-acre habitat mitigation site is situated approximately 1,400 feet upstream from the Coyote Creek confluence.

The SVBX Project site consists of the first approximately 10 miles of the larger 16-mile BART Silicon Valley Extension. Construction of the SVBX Project involved replacing a Union Pacific Railroad bridge with a BART aerial guideway and replacing an undersized roadway bridge over a double box culvert with a free-span bridge; both were constructed over Upper Penitencia Creek. The new crossings shaded 0.11 acre of the creek. Approximately 0.02 acre of the creek was daylighted by removing the double box culvert. Removal of this culvert and the undersized bridge increased flood conveyance capacity and reduced instream velocities of the creek, benefiting native fish populations. Throughout the rest of the SVBX Project alignment, construction included railroad realignment and regrading of 1,940 linear feet of earthen channels, which eliminated 0.5 acre of wetland habitat.



N:\Projects3500\3518-01\03\Reports\Year3 Vegetation Monitoring Figure\Fig 1 Vicinity Mapv1.mxd

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Figure 1: Vicinity Map
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To mitigate impacts on jurisdictional habitats, the Project's mitigation and monitoring plan (MMP) required creation of 1.06 acres of floodplain wetland habitat and restoration of 1.0 acre of riparian habitat on the Project site (ICF International 2012). The MMP identified the following mitigation goals for the Project:

- Restore hydrologic and geomorphic functions, including sediment transport and deposition.
- Restore floodplain connectivity and flood storage.
- Restore fish and wildlife habitats, including the provision of on-site habitat and passage for the federally listed Central California Coast steelhead (*Oncorhynchus mykiss*) distinct population segment.
- Improve water quality.

The Project involved realigning and regrading the creek channel to restore natural geomorphic and ecological functions, including constructing secondary channels and floodplain wetlands to accommodate high flows, as well as a widened floodplain with restored riparian habitat. Bioengineered bank treatment structures (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 (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 hydroseeded with native grasses and forbs. A total of 3,413 native woody trees and shrubs and 1,434 native herbaceous plantings were planted throughout the mitigation site (Anil Verma Associates 2013).

1.2.2 Revised Vegetation Monitoring Plan

H. T. Harvey & Associates (HTH) restoration ecologists monitored the vegetation in 2013 (HTH 2013a) in accordance with the MMP. Willow (*Salix* spp.) and Fremont cottonwood (*Populus fremontii*) cuttings were installed on 1-foot centers in the Boulder Bank Planting Zone (Figure 2)—a high planting density for these species—to rapidly stabilize the banks. The site failed to meet its Year 1 woody plant survival performance criterion of 90% in large part because of the high mortality rate of those cuttings. We speculate that the low cutting survival rate was attributable to the high planting density, which exacerbated the competition for water (HTH 2013a). In response to the low survival rate and as prescribed by the MMP, VTA replanted 236 plants in February 2014 to bring the survival rate up to 90% (HTH 2014a).

In an interagency meeting held on April 29, 2014, with the California Department of Fish and Wildlife (CDFW), the Regional Water Quality Control Board (RWQCB), and VTA, HTH expressed concern that the low survival rate of cuttings would 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. 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 be more useful in assessing the trajectory of habitat

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Figure 2: Planting Zone Layout and Locations of Vegetation Sampling Transect and Photodocumentation Points
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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 2014c) was submitted to the resource agencies on September 4, 2014.

The revised VMP 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 toward the Project's long-term habitat goals. The VMP called for vegetation monitoring of both the Streamside Area (consisting of the Streamside, Bar, and Boulder Bank Planting Zones) and the Floodplain Area (consisting of the Floodplain and Upper Slope Planting Zones). The VMP established that all future monitoring will be conducted in accordance with the VMP and its performance and success criteria and that the VMP will supersede Sections 5.1, 5.3, and 5.4 of the MMP (ICF International 2012). Table 1 summarizes the VMP's vegetation performance and success criteria where they differ from those in the MMP.

Table 1. Vegetation Performance and Final Success Criteria

Monitoring Task	Year 2	Year 3	Year 4	Year 6	Year 8	Year 10
Woody Plant Percent Cover						
Streamside Area[2]	20%	25%	30%	40%	55%	65%
Floodplain Area[3]	5%	7%	10%	15%	20%	30%
Vegetation Overhanging Bank-full Channel[4]	Baseline	>Year 2	>Year 3	>Year 4	>Year 6	>Year 8
Invasive Species Percent Cover	<5%	<5%	<5%	<5%	<5%	<5%

[1] Final success criteria.

[2] Streamside, Bar, and Boulder Bank Planting Zones.

[3] Floodplain and Upper Slope Planting Zones.

[4] The average percent cover of vegetation overhanging the bankfull channel in Year 2 was 23.8%, which will serve as the baseline cover value for subsequent monitoring years.

The MMP's long-term monitoring requirements include fish monitoring, as well as vegetation and stream geomorphology/hydrology monitoring. Term and Condition 3b of the National Marine Fish Service (NMFS) Biological Opinion (NMFS 2012) for the Project required VTA to develop a post-construction fish monitoring plan (FMP) to evaluate post-Project use of the site by fish. The final FMP (HTH 2013b) was approved by NMFS on June 13, 2013.

In conformance with Project's MMP, VMP, and FMP, this report presents the Year 3 vegetation, stream geomorphology, and fish monitoring results; comparisons of current vegetation performance to VMP performance criteria; and management recommendations.

Section 2.0 Methods

2.1 Vegetation

Vegetation performance and final success criteria relate to percent native woody tree and shrub cover and percent invasive species cover. In addition, tree height, plant survival, wetland habitat characteristics, plant health and vigor, natural recruitment, and native tree and shrub species richness are being recorded, and photo-documentation is being conducted.

H. T. Harvey & Associates' restoration ecologists Charles McClain, M.S. and Kaitlin Schott, M.S. collected the Year 3 vegetation monitoring data on September 22 and 23, 2015. Plant nomenclature follows Baldwin et al. (2012). Vegetation monitoring was conducted in accordance with the VMP methods as summarized below.

2.1.1 Woody Plant Percent Cover

In Year 2, 14 permanent 100-foot vegetation monitoring transects were established (transect end points were marked with metal U-posts) in a stratified random design: six in the Streamside Area and eight in the Floodplain Area. The transect locations are shown in Figure 2. Percent cover of native woody species (trees and shrubs) was estimated along each transect using the line intercept method (Bonham 1989). Along each transect, data were collected by recording length of native woody vegetation transect intercept in inches. The Kershaw Method was used to verify that an adequate number of transects were sampled to estimate average percent cover (Kershaw 1973). Average percent cover was determined for native woody vegetation in each planting area to allow comparison with site performance criteria in Table 1. Percent cover was estimated for each species. In Year 2, the average percent cover of woody plants was calculated by summing the average absolute percent cover of each tree and shrub species (HTH 2015).

In Year 3, HTH's restoration ecologist improved the method for calculating average cover by averaging the total percent cover of woody plants (summed among species for each transect) across transects. This method would allow the calculation of statistical variance, if necessary, in future years. This method improvement was also applied to the Year 2 data and resulted in minor changes in the average percent woody plant cover for Year 2 compared to last year's report.

2.1.2 Overhanging Vegetation Percent Cover

In accordance with the VMP, overhanging vegetation cover refers to the amount of vegetative canopy that hangs over the water surface of the bankfull channel. The bankfull channel is 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.

In Year 2 (2014), seven vegetation monitoring transects were established in a stratified random design perpendicular to the streambank, extending the entire width of the bankfull channel. The transect locations are shown in Figure 2. In Year 3 (2015), percent cover of native woody species (trees and shrubs) overhanging the bankfull channel was estimated along each transect, using the line intercept method (Bonham 1989). The Kershaw Method was used to verify that an adequate number of transects were sampled to estimate average percent cover (Kershaw 1973). Average percent cover was determined for all native woody vegetation overhanging the bankfull channel to allow comparison with site performance criteria in Table 1. Percent cover was estimated for each species.

2.1.3 Tree Height

Tree height was measured in the Streamside Area on three or more randomly selected native trees along each transect that had at least three trees. A stadia rod was used to estimate the height of each tree to the nearest 0.1 foot. The Kershaw Method was used to verify that an adequate number of transects were sampled to estimate average tree height (Kershaw 1973). Average tree height of all trees and for each species was calculated for comparison between monitoring years. The VMP does not include quantitative performance criteria for tree height.

In Year 3, HTH's restoration ecologist improved the method for calculating average tree height by averaging the total tree height across transects. This method would allow the calculation of statistical variance, if necessary, in future years. This method improvement was also applied to the Year 2 data and resulted in minor changes in the average tree height for Year 2 compared to last year's report.

2.1.4 Invasive Plant Species Percent Cover

Percent cover of invasive plant species was measured along all the monitoring transects and compared to the performance and success criteria presented in Table 1. Invasive species were characterized as those species with moderate to high invasiveness as rated by California Invasive Plant Council. 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

The survivorship of the riparian tree and shrub plantings was determined by field counts of all plants installed in the Floodplain Area. The survival rate for each species was calculated as follows:

Percent Survival of Species A = (Number of Individuals of Species A Alive during the Year 3 [2015] Monitoring Period/Total Number of Species A Installed) * 100.

The Streamside Area was visually assessed for canopy gaps requiring replanting in accordance with the VMP. These gaps were mapped, and their lengths were recorded. Marsh baccharis, which was included in the dead plant assessment in Year 2, was not included in the Year 3 analysis and replanting recommendations because marsh baccharis is a nonwoody herbaceous plant species. The VMP requires 100% of the dead woody plants to be replaced in Year 3 (HTH 2014c).

2.1.6 Wetland Habitat Characterization

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

2.1.7 Woody Plant Health and Vigor

Health and vigor were qualitatively assessed for all planted trees and shrub plantings that intercepted the Streamside Area and Floodplain Area vegetation monitoring transects, using the numerical scale shown in Table 2. Factors such as internode length, leaf color, leaf size, browse damage, disease symptoms, and insect infestation were considered. The percentage of individuals by species that fall into the three general health and vigor classes was calculated.

Table 2. Woody Plant Health and Vigor Scale

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.

Source: ICF International 2012

2.1.8 Woody Plant Natural Recruitment

Natural recruitment was measured by counting the number of stems of naturally recruiting native woody species encountered within 5 feet of the 14 permanent, 100-foot vegetation monitoring transects. Data were collected by species and transect, and the average number of recruiting individuals was calculated across transects by species.

2.1.9 Woody Plant Species Richness

Woody plant species richness was determined by compiling a list of all native tree and shrub species throughout the Project site by habitat type.

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) conducted monitoring five times during water year 2015 (October 1, 2014, through September 30, 2015). Additional measurements (e.g., streamflow velocity measurements, channel dynamics observations, channel bed samples) and photo-documentation of the creek were not completed in Year 3 because of lack of streamflow and insufficient change to the Project site. Details of the methods used for geomorphic and hydrologic monitoring are presented in Balance Hydrologics' Year 3 geomorphic and hydrologic monitoring report (Appendix A).

2.3 Fish

The purpose of fish monitoring at the Project site is, as stated in the FMP, "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 fish species and their habitat associations in the Project site. To meet that goal, the Project's FMP calls for fish monitoring, timed to coincide with the reported and observed outmigration of juvenile steelhead, by means of electrofishing. Electrofishing surveys will be conducted two times per year—once in the late spring/early summer and once in late summer/early fall—for 5 years.

HTH's fish ecologists conducted the initial Year 1 fish monitoring surveys in fall 2013 in accordance with the FMP. During the Year 1 surveys, HTH fish ecologists identified and mapped 12 habitat units at the Project site (Figure 3). Each unit was defined by distinct features (e.g. depth, habitat structures) and described based on habitat types in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 2010). During Years 2 and 3, standard electrofishing surveys were not conducted because most of the Project site was dry or contained standing water. Performing electrofishing surveys under these circumstances would cause additional, possibly lethal, stress to fish already subject to poor water quality conditions. In spring 2015, HTH's fish ecologists Neil Kalson and Ken Lindke visited the Project site to confirm that habitat units were dry and that the Project site was disconnected from downstream and upstream reaches. In fall 2015, HTH's restoration ecologist Kaitlin Schott confirmed that Project units were still dry and disconnected. Hence, Year 3 electrofishing surveys were not conducted during spring or fall.

2.4 Photodocumentation

Photographs to track habitat establishment were taken from 19 photo-documentation points on September 22, 2015, as shown in Figure 2. Photodocumentation was conducted to track habitat development and record any event that may significantly affect the success of the mitigation, such as flood, fire, or vandalism. The Year 3 photographs were compared with photographs taken in Year 1 (2013). Additional photographs were taken during fish monitoring in spring 2015.

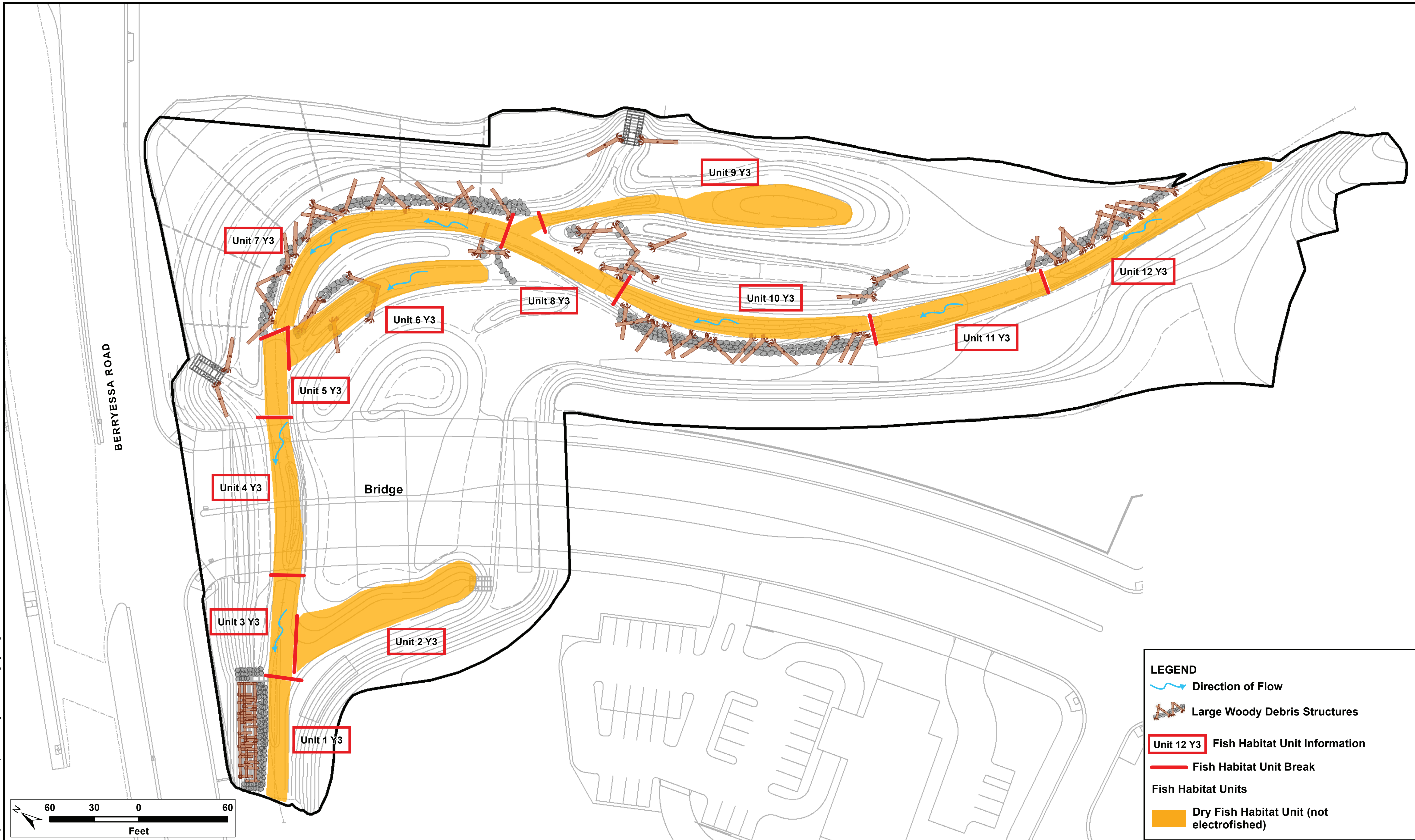

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Figure 3: Distribution of Fish Habitat Units
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Section 3.0 Results and Discussion

3.1 Vegetation

3.1.1 Woody Plant Percent Cover

Streamside Area. A relatively stable estimate of the average percent cover of woody plants in the Streamside Area was obtained after six transects were surveyed (Figure 4). Therefore, we concluded that six transects composed an adequate sample size to accurately estimate average woody plant cover.

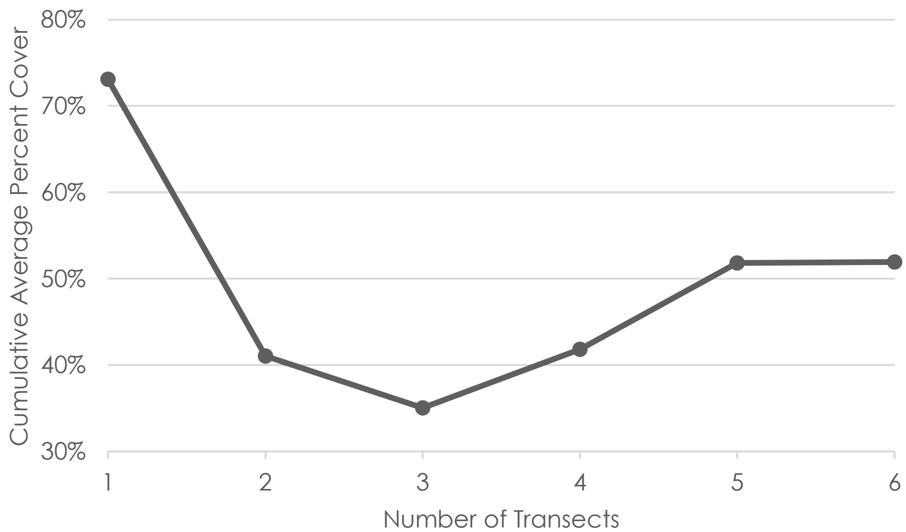

Figure 4. Cumulative Average Percent Cover of Woody Plants in the Streamside Area as a Function of the Number of Transects Sampled

The VMP performance criterion for native woody plant cover in the Streamside Area in Year 3 is 25% (HTH 2014c). Average percent cover of woody plants in Year 3 was 51.9%, exceeding the performance criterion and indicating that high-quality streamside riparian habitat is developing rapidly at the mitigation site (Figure 5). A substantial increase in average woody plant cover was observed between Year 2 (38.8%) and Year 3 (51.9%), due to the rapid growth of native riparian plant species. Species with the greatest cover in the Streamside Area were sandbar willow (*Salix exigua*) and arroyo willow (*Salix lasiolepis*).

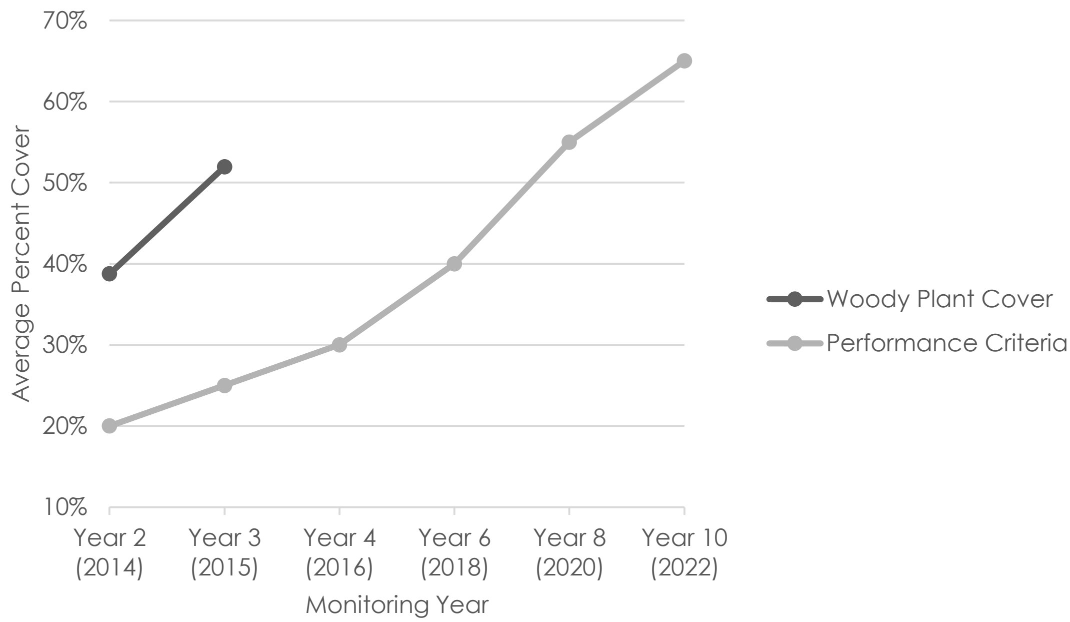

Figure 5. Streamside Area Woody Plant Cover Comparison to Performance Criteria

Table 3. Percent Cover of Planted Tree and Shrub Species in the Streamside Area

		Average Percent Cover by Monitoring Year[1]	
Scientific Name	**Common Name**	**Year 2**	**Year 3**
Alnus rhombifolia	White alder	3.9	6.5
Baccharis pilularis	Coyote brush	0.2	0.5
Baccharis salicifolia	Mulefat	5.8	7.7
Populus fremontii	Fremont cottonwood	2.1	6.5
Rosa californica	Rosa californica	1.1	0.5
Salix exigua	Sandbar willow	15.2	20.3
Salix laevigata	Red willow	6.0	4.7
Salix lasiolepis	Arroyo willow	12.9	16.6
	Average Percent Cover of Woody Plants[2]	**38.8**	**51.9**

[1] Marsh baccharis (*Baccharis glutinosa*), which was included in the woody plant percent cover analysis in Year 2, was not included in the Year 3 analysis because marsh baccharis is a nonwoody perennial herb (Baldwin et al. 2012).

[2] The average percent cover of woody plants is less than the sum of the percent cover of woody plant species because of canopy overlap.

Floodplain Area. A relatively stable estimate of the average percent cover of woody plants in the Floodplain Area was obtained after eight transects were surveyed (Figure 6). Therefore, we concluded that eight transects composed an adequate sample size to accurately estimate average woody plant cover.

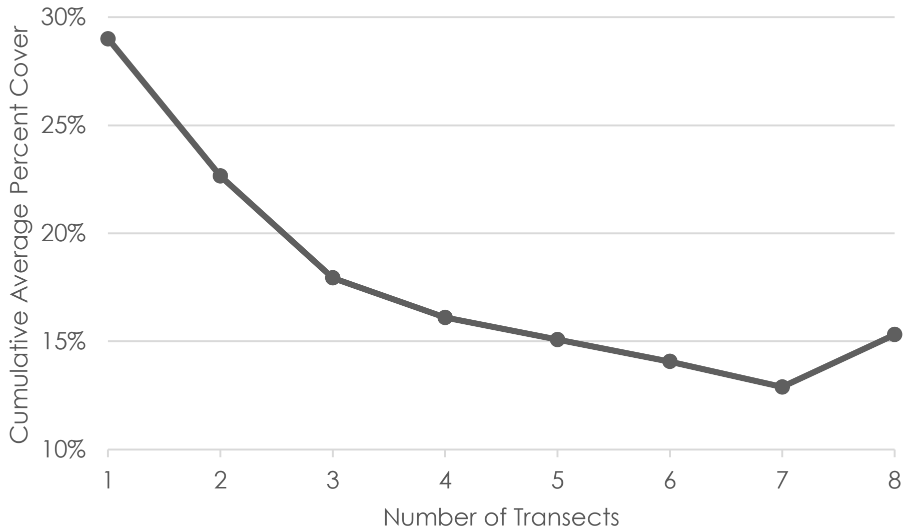

Figure 6. Cumulative Average Percent Cover of Woody Plants in the Floodplain Area as a Function of the Number of Transects Sampled

The VMP performance criterion for woody plant percent cover in the Floodplain Area in Year 3 is 7% (HTH 2014c). Average percent cover of woody plants in Year 3 was 15.3%, exceeding the performance criterion and indicating that the establishment rate of floodplain riparian habitat exceeds the VMP criterion (Figure 7). Species with the greatest cover in the Floodplain Area were coyote brush (*Baccharis pilularis*) and California sagebrush (*Artemisia californica*) (Table 4).

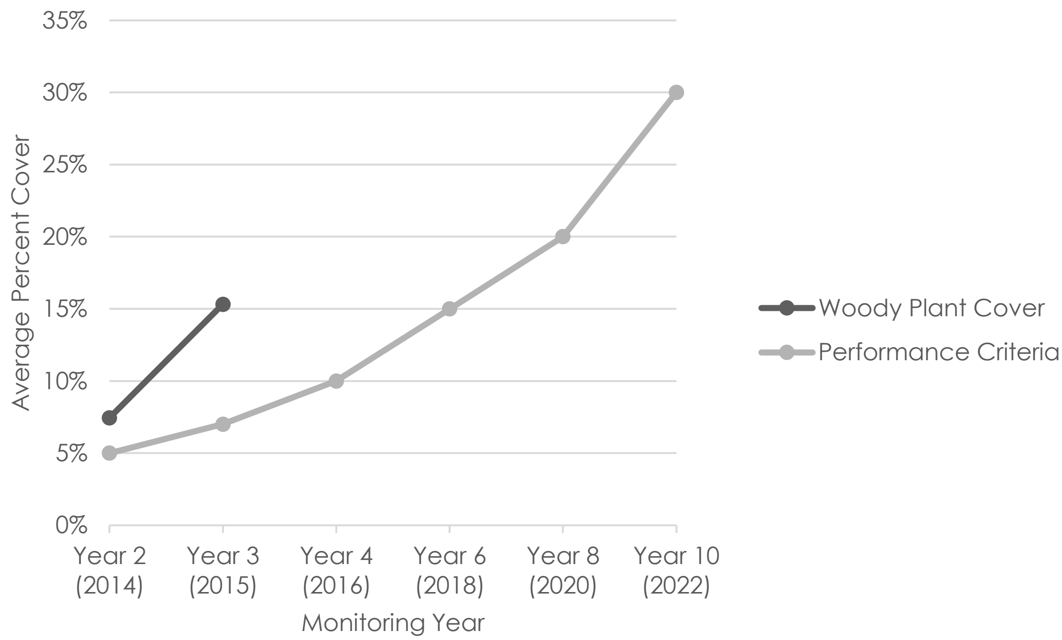

Figure 7. Comparison of Woody Plant Cover in Floodplain Area to Performance Criteria

Table 4. Percent Cover of Planted Tree and Shrub Species in the Floodplain Area

		Average Percent Cover by Monitoring Year[1]	
Scientific Name	**Common Name**	**Year 2**	**Year 3**
Artemisia californica	California sagebrush	2.4	3.4
Baccharis pilularis	Coyote brush	3.2	6.2
Baccharis salicifolia	Mulefat	0.0	1.1
Heteromeles arbutifolia	Toyon	0.5	1.2
Populus fremontii	Fremont cottonwood	0.0	0.7
Rosa californica	Rosa californica	0.8	1.0
Rubus ursinus	California blackberry	0.1	0.1
Salix lasiolepis	Arroyo willow	0.0	0.3
Sambucus nigra ssp. caerulea	Blue elderberry	0.6	1.3
	Total[2]	**7.5**	**15.3**

1 Marsh baccharis, which was included in the woody plant percent cover analysis in Year 2, was not included in the Year 3 analysis because marsh baccharis is a nonwoody perennial herb (Baldwin et al. 2012).

2 The total average cover value for Year 2 varies slightly from the sum of average cover values across species because of rounding assumptions.

3.1.2 Overhanging Vegetation Percent Cover

A relatively stable estimate of the average percent cover of overhanging vegetation was obtained after seven transects were surveyed (Figure 8). Therefore, we concluded that seven transects constituted an adequate sample size.

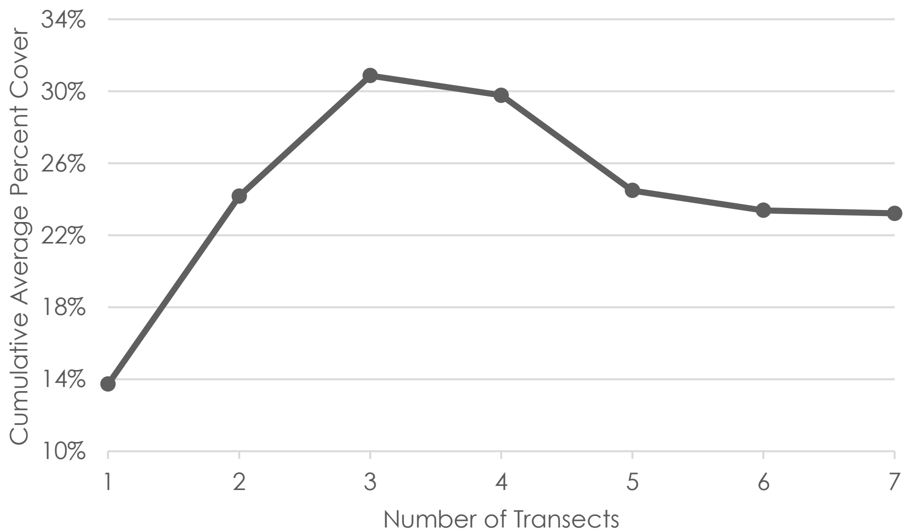

Figure 8. Cumulative Average Percent Cover of Overhanging Vegetation as a Function of the Number of Transects Sampled

No quantitative, annual performance criteria for overhanging vegetation percent cover are identified in the VMP. The final success criterion is an overall increasing trend in the average percent cover of overhanging vegetation among the monitoring years (HTH 2014c). For this reason, the 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. Average percent cover in Year 3 was 24.7%, which indicates that the overhanging vegetation may be on a trajectory toward achieving the final success criterion.

The species with the greatest overhanging cover was sandbar willow (Table 5). White alder was 4.8% of the overhanging cover in Year 2, but it did not intercept a monitoring transect in Year 3.

Table 5. Percent Cover of Planted Tree and Shrubs Species Overhanging the Bankfull Channel

		Average Percent Cover by Monitoring Year	
Scientific Name	**Common Name**	**Year 2**	**Year 3**
Alnus rhombifolia	White alder	4.8	0.0
Salix exigua	Sandbar willow	13.7	16.8
Salix lasiolepis	Arroyo willow	5.3	7.9
	Total	**23.8**	**24.7**

3.1.3 Tree Height

The height of 34 trees was measured, exceeding the VMP's minimum requirement of 18 trees (three trees for each of the six combined Streamside Area transects). A relatively stable estimate of the average tree height was obtained after five transects were surveyed indicating that the sample size was adequate. (Figure 9).

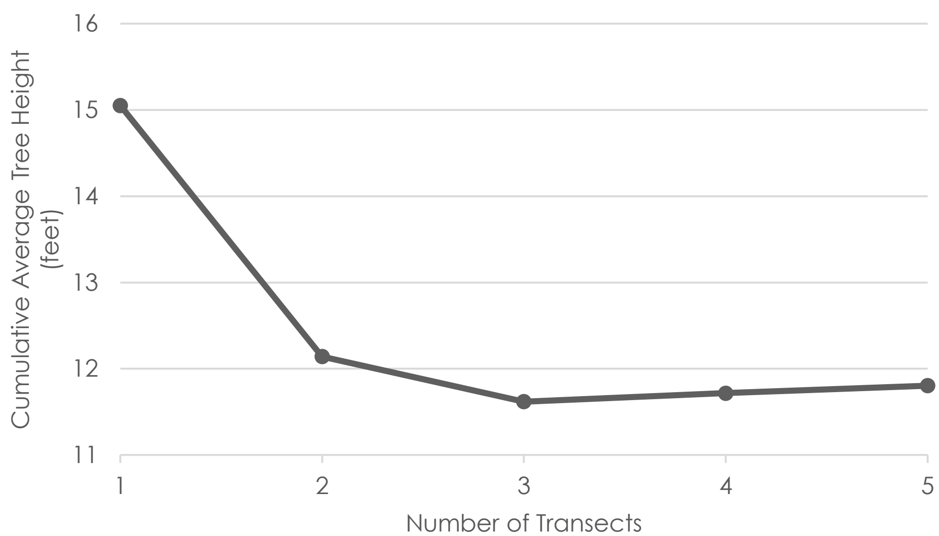

Figure 9. Cumulative Average Tree Height as a Function of the Number of Trees Sampled

No quantitative, annual performance criteria for tree heights are identified in the VMP. The final success criterion is an overall increasing trend in the average tree height among the monitoring years as a whole (HTH 2014c). For this reason, the average tree height in Year 2 monitoring, 7.8 feet, serves as a baseline for the final success criterion of an overall increasing trend in average tree height across monitoring years. Average tree height in Year 3 was 11.8 feet, which indicates that tree height is on a trajectory toward achieving the final success criterion (Table 6).

Average tree heights ranged from 7.9 feet for arroyo willow to 17.6 feet for white alder (Table 6). The average height of Fremont cottonwood, red willow, sandbar willow, and white alder increased since Year 2. The average height of arrow willow decreased 0.1 feet.

Table 6. Average Tree Height and Sample Size by Species

Scientific Name	Common Name	Year 2 Sample Size	Year 2 Average Height (feet)	Year 3 Sample Size	Year 3 Average Height (feet)
Alnus rhombifolia	White alder	3	14.4	5	17.6
Populus fremontii	Fremont cottonwood	4	6.9	7	9.4
Salix exigua	Sandbar willow	8	7.0	7	12.7
Salix laevigata	Red willow	2	5.6	1	13.8
Salix lasiolepis	Arroyo willow	8	8.0	14	7.9
	Sum total	**25**	**—**	**34**	**—**
	Average total (all trees)	**—**	**7.8**	**—**	**11.8**

3.1.4 Invasive Plant Species Percent Cover

No invasive plant species were recorded along any percent cover monitoring transect or throughout the site as a whole. Therefore, the site has met the performance criterion of less than 5% invasive species cover. The lack of invasive species intercepting percent cover transects indicates that the current maintenance regime is successful in suppressing invasive species cover. Nonnative Italian alder (*Alnus cordata*) was observed in the Streamside Area at the east end of TF 8 (Figure 2). This species may have been unintentionally planted in place of white alder. Italian alder is not considered to be invasive. Thus, its removal is not warranted.

3.1.5 Dead Plant Assessment and Plant Replacement Recommendations

Streamside Area. In March 2015, VTA installed 110 willow cuttings on 6-foot centers in the Streamside Area (Ecological Concerns 2015), which is five more plants than the 105 cuttings recommended in the Year 2 monitoring report (HTH 2015). Cuttings installed in Year 2 were successful in forming a canopy throughout most of the Streamside Area; however, several canopy gaps of substantial length were still present in this area in Year 3. The total length of Streamside Area canopy gaps totaled 692 feet, resulting in a recommended total of 87 cuttings to be installed on 8-foot centers in winter 2015–2016. Figure 10 shows the locations of the canopy gaps in the Streamside Area, and Table 7 presents recommended replanting quantities for these gaps.

N:\Projects3500\3518-01\03\Reports\Year3 Vegetation Monitoring Figure\Fig 10 Streamside Replanting Gap Location.mxd

H. T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 10: Locations of Canopy Gaps in Streamside Area

Upper Penitencia Creek Improvement Project
Year 3 (2015) Monitoring Report (3518-03)
May 2016

Table 7. Streamside Area Canopy Gaps -Replanting Recommendations

Scientific Name	Common Name		Recommended Replanting Quantity
Populus fremontii	Fremont cottonwood		12
Salix laevigata	Red willow		50
Salix lasiolepis	Arroyo willow		25
		Total	**87**

Note: The relative quantities of red and arroyo willows will depend on availability at the harvest sites.

Floodplain Area. The Floodplain Area woody planting survival rate was 76% (Table 8). One hundred percent of the dead woody plants in the Floodplain Area are recommended for replacement in accordance with the Project's VMP. This approach would require 198 replacement plantings (Table 8). 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 in high numbers and had a survival rate of only 15%, and marsh baccharis, which is a nonwoody herbaceous species. The replacement quantities of California buckeye (*Aesculus californica*), toyon (*Heteromeles arbutifolia*), coast live oak (*Quercus agrifolia*), hollyleaf redberry (*Rhamnus ilicifolia*), and blue elderberry (*Sambucus nigra* ssp. *caerulea*) were increased to substitute for sticky monkeyflower because these species exhibited a high survival rate and were underrepresented relative to other species in the initial planting effort.

Table 8. Floodplain Area Survival Rate and Replanting Recommendations

Scientific Name	Common Name	Number of Plantings Installed	Number of Surviving Plantings	Survival Rate	Recommended Replanting Quantity
Aesculus californica	California buckeye	4	3	75%	7
Artemisia californica	California sagebrush	75	71	95%	4
Baccharis pilularis	Coyote brush	137	137	100%	0
Baccharis salicifolia	Mulefat	100	82	82%	18
Heteromeles arbutifolia	Toyon	28	21	75%	42
Mimulus aurantiacus	Sticky monkeyflower	121	18	15%	0
Quercus agrifolia	Coast live oak	6	4	67%	9
Rhamnus ilicifolia	Hollyleaf redberry	2	0	0%	4
Rosa californica	California rose	265	230	87%	35
Rubus ursinus	California blackberry	31	16	52%	15
Sambucus nigra ssp. Caerulea	Blue elderberry	43	32	74%	64
	Total	**812**	**614**	**76%**	**198**

3.1.6 Wetland Habitat Characterization

Two wetlands have developed on the restored floodplain, in accordance with the design intent. Wetland 1 is located east of the main stream channel, and Wetland 2 is located east of the new roadway bridge crossing (Figure 2).

Wetland 1. Wetland 1 was approximately 102 feet long and 30 feet wide with a surface area of approximately 3,060 square feet. Photo 1 shows a representative depiction of the state of the wetland in September 2015. The wetland was dry but showed evidence of recent inundation in the form of shallow surface soil cracks. The plant community was stratified into distinct concentric rings of vegetation spanning a gradient from perennial, emergent wetlands at the lower elevations to seasonal wetland vegetation and riparian trees and shrubs along the upper slope. The lowest vegetation consisted of emergent cattails (*Typha* sp.) that are increasing in cover through lateral expansion. Wetland vegetation located upslope from the cattails included rabbitsfoot grass (*Polypogon monspeliensis*), tall flatsedge (*Cyperus eragrostis*), planted irisleaf rush (*Juncus xiphioides*), naturally recruited and planted marsh baccharis, and planted willow. The vigorous growth of willow and cottonwood indicated that they were likely rooted into groundwater. In the upper banks of the wetland, mulefat (*Baccharis salicifolia*) and Fremont cottonwood plantings showed new growth and good health.

Photo 1. View of Wetland 1, looking north from the south bank

Wetland 2. Wetland 2 was approximately 30 feet long and 21 feet wide with a surface area of approximately 630 square feet. Photo 2 shows a representative depiction of the state of the wetland in September 2015. The wetland was dry and composed of marsh baccharis and rush (*Juncus* sp.). Sandbar willow was growing along the wetland banks. The absence of emergent cattails at Wetland 2 indicates that the depth and duration of ponding at Wetland 2 is likely less that in Wetland 1.

Photo 2. View of Wetland 2, looking northeast

3.1.7 Woody Plant Health and Vigor

Average woody plant health and vigor was high (average = 3.0), demonstrating that the planted trees and shrubs displayed healthy foliage and little physical damage or disease (Table 9). Of the 40 plantings characterized for health and vigor, 90% were in good condition and 10% were in fair condition (Table 9). 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 three growing seasons.

Table 9. Woody Plant Health and Vigor

Species	Sample Size	Year 3 Average Health and Vigor Rating	Year 3 Heath Condition		
			Good	Fair	Poor
Arroyo willow	15	3.0	100%	0%	0%
Blue elderberry	4	2.8	75%	25%	0%
Fremont cottonwood	8	3.0	100%	0%	0%
Red willow	1	3.0	100%	0%	0%
Sandbar willow	7	3.0	100%	0%	0%
White alder	5	3.0	100%	0%	0%
Sum total	**40**	—	—	—	—
Average total (all woody plants)	—	**3.0**	**90%**	**10%**	**0%**

3.1.8 Woody Plant Natural Recruitment

Streamside Area. Twelve stems of naturally recruiting native species were counted in six 1,000-square-foot transect bands in the Streamside Area. No nonnative plant species were observed. The average number of recruiting individuals was 0.2 per 1,000 square feet (Table 10). California rose had the highest stem densities of naturally recruited individuals.

Table 10. Woody Plant Natural Recruitment in the Streamside Area

Scientific Name	Common Name	Average Number of Recruiting Individuals per 1,000 Square Feet by Monitoring Year	
		Year 2	Year 3
Acer negundo	Boxelder	0.2	0.0
Alnus rhombifolia	White alder	0.0	0.0
Artemisia californica	California sagebrush	0.3	0.0
Baccharis pilularis	Coyote brush	1.5	0.5
Baccharis salicifolia	Mulefat	0.0	0.0
Populus fremontii	Fremont cottonwood	0.0	0.2
Rosa californica	California rose	1.7	1.0
Rubus ursinus	California blackberry	0.0	0.0
Salix exigua	Sandbar willow	1.5	0.3
Salix lasiolepis	Arroyo willow	0.3	0.0
	Average (all woody plants)	**0.6**	**0.2**

Floodplain Area. Sixty stems of naturally recruiting native species were counted in the eight 1,000-square-foot transect bands in the Floodplain Area. No nonnative plant species were observed. The average number of recruiting individuals was 0.6 per 1,000 square feet (Table 11). Coyote brush had the highest stem densities of naturally recruited individuals.

Table 11. Woody Plant Natural Recruitment in the Floodplain Area

Scientific Name	Common Name	Average Number of Recruiting Individuals per 1,000 Square Feet by Monitoring Year	
		Year 2	Year 3
Acer negundo	Boxelder	0.0	0.1
Aesculus californica	California buckeye	0.0	0.0
Artemisia californica	California sagebrush	0.0	0.0
Baccharis pilularis	Coyote brush	5.5	5.8
Heteromeles arbutifolia	Toyon	0.0	0.0
Populus fremontii	Fremont cottonwood	0.1	0.0
Quercus agrifolia	Coast live oak	0.0	0.0
Rhamnus ilicifolia	Hollyeaf redberry	0.0	0.0
Rosa californica	California rose	2.6	1.5
Rubus ursinus	California blackberry	0.2	0.0
Salix laevigata	Red willow	0.0	0.1
Sambucus nigra ssp. caerulea	Blue elderberry	0.0	0.0
	Average (all woody plants)	**0.7**	**0.6**

3.1.9 Native Woody Plant Species Richness

Native woody plant species richness (i.e., number of species) was relatively high on the Project site. A total of 17 native woody plant species were observed on the site: 10 in the Streamside Area, 13 in the Floodplain Area, and six in the floodplain wetlands (Table 12).

Table 12. Native Woody Species Richness by Habitat Type

Scientific Name	Common Name	Habitat Type		
		Streamside Area	**Floodplain Area**	**Floodplain Wetlands**
Acer negundo	Boxelder	X	X	
Aesculus californica	California buckeye		X	
Alnus rhombifolia	White alder	X		X
Artemisia californica	California sagebrush		X	
Baccharis pilularis	Coyote brush	X	X	
Baccharis salicifolia	Mulefat	X	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	X
Sambucus nigra ssp. caerulea	Blue elderberry		X	
	Number of Species	**10**	**13**	**6**

Note: Marsh baccharis, which was included in the native woody species richness analysis in Year 2, was not included in the Year 3 analysis because marsh baccharis is a nonwoody perennial herb (Baldwin et al. 2012).

3.2 Stream Geomorphology and Hydrology

Detailed stream geomorphology and hydrology monitoring results are presented in Balance Hydrologics' Year 3 monitoring report (Appendix A). This section presents a summary of that discussion. Drought conditions in the Project area continued for a fourth consecutive year during water year 2015. Precipitation totaled 13.4 inches, approximately 90% of the average yearly precipitation (14.7 inches) for the area. More than 67% of this rain (9.0 inches) fell in three events between November 28 and December 25, 2014. The annual peak streamflow occurred on December 12, 2014 and was estimated to be 350 cubic feet per second.

Flow volume and duration measured at the Berryessa Road gaging station were lower compared to those measured 2.6 miles upstream at the Piedmont Road gaging station, suggesting that surface flows function to recharge groundwater and that both streamflow volume and duration decrease with distance downstream. The peak streamflow event was large enough to mobilize bedload sediments in the Project site, however it did not appear to change channel conditions.

Streamflow through the Project site was intermittent and inadequate to allow evaluation of whether Project success criteria related to geomorphology and hydrology were met. Streamflows were measured on approximately 10 days on the Project site and on approximately 29 days 2.6 miles upstream. Streamflow went subsurface before entering the Project site during most rainfall and runoff events.

No sedimentation, scour, or bank instabilities resulting in changes to the channel were identified; however, flood flows were not of sufficient size or duration to potentially cause such effects. Intermittent streamflows and declines in groundwater levels are driven in part by the current regional drought conditions. Substantial increases to streamflows and groundwater levels are unlikely until normal precipitation patterns return. No adaptive management is deemed necessary at this time.

3.3 Fish

3.3.1 Results

During spring and fall habitat surveys, HTH fish ecologists used habitat units and locations established during the fall of Year 1 (Figure 3) when describing the condition of the stream channel in Year 3. In Year 3, all habitat units on the Project site were dry or contained water that was too poor in quality (i.e., stagnant) to allow safe electrofishing. During our surveys, the upper reaches of the main channel (Units 8, 9, 10, 11, and 12) had wet substrate or were completely dry (Table 13). The lower reaches of the main channel and the remaining units (Units 1, 3, 4, 5, and 7) contained wet substrate and there was standing water in one unit (Table 13). In all habitat units, there was not enough water, or the water quality was too poor, to support fish. Representative photographs taken during the fish habitat surveys are presented in Appendix B.

Table 13. Habitat Unit Type/Condition Observed during Fish Surveys

Habitat Unit Name	Habitat Unit Type/Condition		
	Year 1 Fall	Year 3 Spring	Year 3 Fall
Unit 1	Glide	Stagnant pool	Stagnant pool and dry
Unit 2	Backwater	Damp	Damp
Unit 3	Glide	Damp	Damp
Unit 4	Midchannel pool	Damp	Damp
Unit 5	Low-gradient riffle	Damp	Damp
Unit 6	Backwater	Dry	Dry
Unit 7	Lateral scour pool, rootwad formed	Stagnant pool	Damp
Unit 8	Dry	Dry	Dry
Unit 9	Dry	Damp	Damp
Unit 10	Lateral scour pool, rootwad formed	Damp	Damp
Unit 11	Dry	Dry	Dry
Unit 12	Low-gradient riffle	Dry	Dry

3.3.2 Discussion

In Upper Penitencia Creek, the lack of water and connectivity in drought years (e.g., Year 3) may have limited adult steelhead access to spawning habitat, but more likely limited juvenile steelhead access to rearing habitat and may have prevented juvenile steelhead from outmigrating. The lack of water in Years 2 and 3 was not a condition unique to the Project site; dry reaches were observed upstream near the entrance to Alum Rock Park and probably occurred at other locations between the park and the Project site. In water year 2014, there were three events during which Balance Hydrologics measured continuous flow immediately upstream of the Project site at the Berryessa Road streamflow gage. Although unconfirmed, streamflow through the Project site may have occurred coincident with streamflow events measured at the Berryessa Road gaging station. The major streamflow events that were measured occurred during the typical (December through March) adult steelhead spawning migration period, and upstream passage through the Project site may have been possible for adult steelhead during the brief flow events. The major streamflow events did not coincide with periods when juvenile steelhead typically outmigrate. Similar conditions persisted through water year 2015; there were five flow events during which continuous flow was measured upstream of the Project site at the Berryessa Road streamflow gage (Appendix A).

The presence of persistent pools charged by subsurface flow could provide critical oversummering habitat for juvenile steelhead on the Project site if pools are accessible and water quality is suitable. During HTH's previous Year 1 surveys, it was apparent that steelhead were using restoration features (i.e., root wad scour pools) as habitat during low summer flows. However, during Years 2 and 3, the water quality in persistent pools was poor; pools were absent or were stagnant and choked with algae and emergent vegetation.

Intermittent Flow. Intermittent, non-continuous flow is a condition of the Upper Penitencia Creek ecosystem and existed before construction of the Project (Beller et. al. 2012). Leicester and Smith (2012) reported that in all but the wettest years, Upper Penitencia Creek is subject to subsurface flow at some point between Dorel Drive and the percolation ponds located between Noble Avenue and Piedmont Road—an approximately 2,200-foot-long reach located approximately 3 miles upstream of the Project site. Although intermittent flow is probably a historical condition that occurs regularly during drought conditions and seasonally dry periods (Stillwater Sciences 2006), contributing factors also may include water impoundment (Cherry Lake Reservoir); diversion to percolation ponds; and the presence of porous, unconsolidated sediment on the Project site after construction.

Continuous flow was measured upstream of the Project site on only five occasions (Appendix A). Reduced area and volume of habitat units attributable to low-flow conditions may result in changes to water quality (e.g., dissolved oxygen, temperature), increased predation, and reduced foraging opportunities (Heggenes and Borgstrom 1988, Hakala and Hartman 2004, May and Lee 2004) that may influence the growth and survival rates of fish and, in some cases, may result in mortality. Dry reaches (such as those present both downstream and upstream of the Project site and on the site) prohibit access by adult steelhead 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 are limited in part by insufficient flows 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 on the Project site as long as connectivity exists up to and through the Project site (Habitat Restoration Group 1992, as cited in Leidy et al. 2005).

Project goals for the provision of native fish habitat were not met in Year 3 because of lack of flow most likely associated with regional drought conditions and also potentially due to upstream water diversions and historically intermittent flow conditions in the Upper Penitencia Creek ecosystem. Native and nonnative fishes are expected to redistribute into and through the restored channel when it becomes watered as the region emerges from drought.

3.4 Photodocumentation

Photographs taken from 19 permanent photo-documentation points during Year 1 and 3 vegetation monitoring are presented in Appendix C to allow comparison of vegetation growth on the site between the two years. No event was recorded that may significantly affect the success of the mitigation. Representative photographs of fish unit conditions are presented in Appendix B.

3.5 Management Recommendations

3.5.1 Management Recommendations

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

- Replant all dead woody plantings during the 2015–2016 rainy season (approximately November through February). Replanting the recommended quantities will bring the total number of living woody plantings up to 100% of the originally installed number, in accordance with the VMP Year 3 percent survival success criterion. Streamside Area cuttings are recommended to be installed in the locations indicated in Figure 10 on 8-foot centers. Table 7 identifies the species and quantities of cuttings to be installed. Species and quantities of Floodplain Area replantings are identified in Table 8. The species recommended for replanting were selected to maintain plant species diversity on the site and include species well adapted to site conditions based on observations of survival, natural recruitment, and health and vigor.
- Hand-pull all native and nonnative weeds growing in the planting basins.
- Maintain (through weed whacking) all herbaceous vegetation outside basins to a maximum height of 1 foot. Recruiting native woody species should be avoided during weed whacking.
- Remove the segment of chain-link fence that currently spans the restored floodplain and creek channel in the southeastern section of the Project site (Figure 10). This fence segment has the potential to threaten Project success by impeding the flow of coarse debris through the creek channel and possibly increasing floodwater surface elevations. The chain link fence is in place to maintain a construction site boundary for safety and is expected to be removed in Year 4.
- Install a water depth recorder on the Project site to measure continuous-streamflow depth and duration to describe streamflow events that are most likely to allow for fish passage (Appendix A).

3.5.2 Agency Actions

No agency actions are requested at this time.

Section 4.0 References

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Appendix A. Stream Geomorphology and Hydrology Monitoring Memorandum Prepared by Balance Hydrologics

Balance Hydrologics, Inc.®

800 Bancroft Way • Suite 101 • Berkeley, CA 94710 • (510) 704-1000
224 Walnut Avenue • Suite E • Santa Cruz, CA 95060 • (831) 457-9900
PO Box 1077 • Truckee, CA 96160 • (530) 550-9776
www.balancehydro.com • email: office@balancehydro.com

December 1, 2015
(***Revised March 15, 2016***)

Mr. Max Busnardo
Senior Associate Restoration Ecologist
H. T. Harvey and Associates
983 University Avenue, Building D
Los Gatos, California 95032

Submitted Via Email

Dear Mr. Busnardo:

Balance Hydrologics Inc. (Balance) is pleased to provide you with the Year 3 annual report for water year[1] 2015 (WY2015) geomorphic and hydrologic monitoring of the Upper Penitencia Creek Improvement Project (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), post-construction year, and conditions observed during the monitoring year. In Year 3, physical monitoring elements required by the MMP included: 1) streamflow and bedload transport measurements, 2) habitat velocity measurements, 3) channel dynamics observations, 4) channel bed samples, 5) repeat photo point documentation, and 6) repeat longitudinal profile and cross-section surveys. While every effort was made to measure these elements, WY2015 was characterized by below-average precipitation. Runoff and data collection opportunities were limited. In the absence of major channel maintaining events, we selected to postpone some monitoring elements/activities to Year 4 (WY2016). Finally, after 4 years of severe drought in California, including the San Jose area, we briefly discuss its impact on surface-groundwater conditions within the region and its potential effect on local hydrology in Upper Penitencia Creek.

Executive Summary

Balance completed the third year of a 10-year geomorphic and hydrologic monitoring plan in accordance with the Project's MMP (Jones, 2012). Precipitation in the third year continued to be less than average but was roughly 90 percent of the long-term average, as measured at San Jose International Airport. Most of the annual rainfall in WY2015 fell between late November and late December in 2 or 3 events. Resulting streamflow was still intermittent with streamflow recorded for only about 10 days in the year.

[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 2015 started October 1, 2014 and ended September 30, 2015.

Peak streamflow was estimated to be 350 cfs with continuous flow measured for about 7 days during an event in December, as measured at the gage in Upper Penitencia Creek above Berryessa Road. A Santa Clara Valley Water District (SCVWD)-operated streamflow gage, located 2.6 miles upstream, also indicated intermittent or dry conditions throughout much of the year. Groundwater levels in the region also show continuing declines over the last 3 to 4 years, which also may be influencing surface water conditions. These limited flow conditions appear to be regional and likely 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 3 precludes us from any conclusions at this time. While creek flow continues to be monitored, we do not anticipate substantial changes or improvement until a return to average or higher precipitation and runoff. In regards to physical conditions and processes, no adaptive management is deemed necessary at this time. However, we provide an additional monitoring option that may help evaluate absence or presence of continuous streamflow and trends through the project reach.

Introduction and Background

The geomorphic and hydrologic monitoring program is designed to assess physical 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 MMP (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. As stated in prior monitoring reports, below we revisit questions outlined in the MMP for monitoring components specific to Year 3 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 floodplain 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 elements which serve as the basis for our monitoring work. **Figure 2** shows a sequence of aerial photographs of the project site before, during, and 3 years after construction.

Year 3 Hydrologic and Geomorphic Monitoring: Work Completed

Monitoring elements were limited in Year 3 due to the intermittent nature of streamflow and limited sediment transporting events. Streamflow and bedload sediment transport through the constructed reach are measured to assess the fundamental assumptions of the channel design and sediment model. Balance conducted multiple project-site visits during both dry and wet periods to assess conditions. A summary of elements monitored in WY2015, 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 completed five streamflow measurements during the limited and short-duration runoff events and developed a preliminary record of streamflow at a station;
- For comparison, we obtained and reviewed preliminary 15-minute streamflow data from the SCVWD who operate and maintain an automated streamflow gage located approximately 2.6 miles upstream (Upper Penitencia Creek at Piedmont Road, Station 1489);
- We reviewed groundwater levels and recent trends from multiple California Department of Water Resources (DWR) monitoring wells within the vicinity of the project site for context of the drought; and
- Finally, we corresponded with SCVWD to understand upstream channel conditions and operations of the Penitencia groundwater recharge ponds (a.k.a., Robert Gross Recharge Ponds).

We find it useful to also identify elements of the monitoring plan that were not completed in Year 3 due to the absence of physical changes within the project reach:

- Longitudinal profiles
- Cross-sections
- Bedload transport measurements
- Point velocity
- Channel bed samples
- Repeat photopoints

These components will be completed in WY2016 (Year 4) if conditions warrant.

Year 3 Hydrologic and Geomorphic Monitoring: Results and Discussion, WY2015

WY2015 Rainfall Summary

Cumulative daily rainfall for WY2015 is illustrated in **Figure 3** with an annual total precipitation of 13.41 inches as recorded at the San Jose International Airport, slightly less than the long-term average (14.7 inches) for the same station. While rainfall in WY2015 was near normal, more than 67 percent (9.04 inches) of the annual precipitation fell in only three events between November 28 and December 25, 2014. The largest daily rainfall totals were recorded on December 11, 2014 (3.23 inches), December 3, 2014 (1.28 inches), February 3, 2015 (1.26 inches), December 2, 2014 (1.20 inches), and November 29, 2014 (0.71 inches).

Hydrology

An observer log describing our observations and data collected in WY2015 is shown in **Table 2**. In WY2015, we continued to operate a streamflow gaging station immediately upstream of the project site (Upper Penitencia Creek above Berryessa Road, see Figure 1) and manually measured streamflow over a range of stream depths. A preliminary record of daily streamflow in WY2015 for Upper Penitencia Creek above Berryessa Road is presented in **Figure 4**. We note that the stage-discharge rating curve is extrapolated for flows greater than 50 cfs. In an effort to verify peak flows and flow duration, preliminary instantaneous (15-minute) streamflow for an upstream gaging station (Upper Penitencia at Piedmont Road), operated and maintained by SCVWD, was reviewed and compared (**Figure 5**). These data suggest the following:

1. Streamflow measured at two locations in Upper Penitencia Creek, after 3 consecutive years of below average precipitation, was intermittent in WY2015—whereas streamflow is present at times and absent during other times. For example, streamflow was recorded in Upper Penitencia Creek at Piedmont Road (2.5 miles upstream of the project reach) for approximately 29 days (non-continuous) in WY2015; whereas streamflow at the entrance to the project reach was recorded for only 10 days (non-continuous) with a maximum of 7 continuous days of streamflow. This comparison initially suggests that Upper Penitencia Creek is a losing stream in dry years—whereas surface waters function to recharge local groundwater;
2. For each recorded runoff event, flow duration was shorter-lived at the station above Berryessa Road when compared to the station upstream at Piedmont Road. Preliminary peak streamflows were also equal or slightly higher at the upstream station as compared with the downstream station. These results are characteristic of streams crossing an alluvial fan, where surface flows function to recharge groundwater and both streamflow volume and duration decrease with distance downstream; and
3. The annual peak streamflow for Upper Penitencia Creek above Berryessa Road was estimated to be roughly 350 cfs on December 12, 2014. While this peak flow is significant (likely transported bedload sediment), it was short-lived and did not appear to modify channel conditions.

A streamflow gaging station can only inform us about streamflow “at a station” or streamflow past a single point in the creek. Streamflow can change with distance downstream: a decrease as the result of infiltration (as shown in Figure 5) or an increase as a result of contributions from tributaries or stormwater outfalls. Currently, there are no additional gaging stations within or downstream of the project reach. Both infiltration and contributions from stormwater outfalls have been observed and can affect streamflow continuity through the project reach. Balance observed continuity of flow through the project reach on at least two different days and identified high-water marks (i.e., lines of debris, wood, sediment) along the length of the project reach after other separate events. Unfortunately, duration of these continuous flows could not be quantified.

In a third consecutive year, Upper Penitencia Creek continues to be an intermittent stream—a stream that does not flow continuously throughout the year, as when water losses from infiltration/seepage exceed the available streamflow. Increases in bed infiltration can occur as the result of channel disturbance and construction; however, intermittent flows have been recorded upstream of the project reach as well (SCVWD, 2015) and along other streams draining the Diablo Range (Sparkman, J., pers. comm., 2015) in the last couple years. For additional context, we evaluated other factors that were potentially affecting streamflow conditions in and near the project reach, including changes in the groundwater table.

Local and Regional Groundwater Conditions

Groundwater provides a hydraulic floor that sustains perennial flow in most alluvial channels. Changes in depth to groundwater can have measurable effects on streamflow magnitude, duration, and spatial variability. A rapidly falling groundwater table can result in discontinuous streamflow patterns or cease streamflow altogether. A falling groundwater table can be the result of drought (absence of groundwater recharge) and groundwater pumping. Both of these conditions currently exist in the San Jose area. In the past, the SCVWD operated several groundwater recharge ponds around the San Jose area to minimize rapid declines in groundwater and associated subsidence. Two such recharge ponds are located adjacent to Upper Penitencia Creek (Bob Gross Recharge Ponds). These ponds have been off-line for more than 2 years due to the absence of adequate streamflow for diversion to the ponds (Sparkman, J., pers. comm., 2015), possibly exacerbating the rate of groundwater decline.

The California Department of Water Resources (DWR) maintains numerous wells in the San Jose area and monitors static depth to groundwater at least twice a year. While there are no wells within the immediate project reach, DWR provides groundwater data for at least 3 wells upgradient and within 1.5 miles of the project reach. Depths to groundwater between 2011 and 2015 are illustrated for these wells in **Figure 6**. These data suggest groundwater levels have fallen between 9 and 13 feet in the last 3 to 4 years. Well ID 373556 in particular, is located adjacent to Silver Creek, the adjacent watershed to the south with similar watershed land-uses, climate, and geology. In 2012, depth to groundwater in this well was less than 2 feet below ground surface. In 2014 and 2015, groundwater levels have been measured between 13 and 15 feet below ground surface. Silver Creek, in these lower reaches, has been observed to be dry or intermittent during most of these years.

Channel and Bank Stability and General Geomorphic Observations

In the absence of observed channel changes, samples from the channel bed were not collected for detailed assessment nor were channel cross-sections and profile surveyed in WY2015. We have postponed these monitoring activities until years when near normal rainfall and runoff patterns are observed.

Photographic Documentation Points

Repeat photographs are documented annually for qualitative evaluation of channel changes and post-construction conditions. In WY2015, the absence of channel changing events and abundance of native vegetation preclude the practicality of repeat photographs. We anticipate these photographs can be repeated in future years after channel maintaining flows are measured and native vegetation is maintained by natural flows. In the absence of repeat photographs at designated locations, we provide two photographs showing the general conditions of the channel in Year 3 (**Figure 7**). These photographs show the dry channel bed conditions and presence of both native and non-native vegetation in the active channel.

Recommendations for Adaptive Management

As discussed above, WY2015 precipitation was below average and follows 2 other below average years. Streamflow has been intermittent and short-lived. As a result, many of the questions for evaluation posed in the introduction of this report cannot be answered in Year 3. As such, we do not see a need for any adaptive management actions at this time, with one exception.

An understanding of streamflow continuity and duration through the project reach is becoming more critical in these dry years. Currently, under the existing monitoring plan, streamflow is measured entering the project reach. In the last two years, streamflow has been detected at the upstream monitoring station, but qualitatively observed infiltrating the channel bed a short distance into the project reach, leaving the project reach dry. Therefore, the current monitoring effort is insufficient to determine the continuity and duration of flows through the project reach. In an effort to confirm the absence or presence of fish passage flows we recommend adapting the existing monitoring plan to include some instrumentation at or near the downstream end of the project reach. Below we identify a method that we recommend to address this concern and outline its advantages and disadvantages:

Method	Advantages	Disadvantages
Water Depth Recorder	Measures continuous streamflow depths and duration of streamflow	Streamflow is not computed but may not be necessary to address project success criteria

Using the above method and data collected downstream, we can quantify not only the presence of continuous streamflow through the project reach, but indicate the duration of time continuous streamflow persisted. These data also provide context for electrofishing survey results; for example, if fish were not found within or upstream of the project reach, was it because continuous streamflow was absent during critical periods for fish passage? Balance can implement this method immediately and maintain data collection at no additional costs above the existing budget.

Year 3 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. Monitoring frequency in Year 4 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 were suggested, but not completed in Year 3 per the MMP, will be executed in Year 4 if conditions warrant. If additional measures are needed to better evaluate streamflow continuity, thus fish passage, then the above recommendation could be implemented immediately.

Closing

We greatly appreciate the opportunity to assist you with this monitoring effort and look forward to reporting on the Year-4 geomorphic and hydrologic monitoring efforts.

Respectfully Submitted,

BALANCE HYDROLOGICS, Inc.

Brian Hastings, PG
Geomorphologist

Reviewed by:

Jonathan Owens
Senior Hydrologist

Encl. Tables 1, 2
Figures 1-7

References Cited:

DWR, 2015, preliminary data for groundwater levels in San Jose, California

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.

NCDC, 2015, preliminary data for daily rainfall, San Jose International Airport, San Jose, California.

SCVWD, 2015, preliminary data for Upper Penitencia Creek at Piedmont.

Sparkman, J., 2015, pers. comm., Santa Clara Valley Water District, San Jose, California; (408) 630-3254.

Table 1. Stream geomorphology, monitoring summary, Years 1, 2, and 3 (Water Years 2013-2015)
Upper Penitencia Creek at Berryessa Road, San Jose, California

Monitoring Components	Baseline (Post-Construction)	Baseline (Post-Construction)	Year 1 (WY2013)	Year 2 (WY2014)*	Year 3 (WY2015)*	Monitoring
	Date	*Responsible Party*	*Date*	*Date*	*Date*	*Responsible Party*
Longitudinal profile	1-Dec-2012	Allied Engineering	4-Jun-2013	not applicable	post-poned	Balance Hydrologics
Cross-sections	1-Dec-2012	Allied Engineering	4-Jun-2013	not applicable	post-poned	Balance Hydrologics
Flow and bedload transport	--	--	Nov 2012 thru March 2013	Nov 2013 thru March 2014	Nov 2014 thru March 2015	Balance Hydrologics
Point velocity	--	--	Nov 2012 thru March 2013	Nov 2013 thru March 2014	n/a	Balance Hydrologics
Channel dynamics observations	--	--	4-Jun-2013	15-Jun-2014	post-poned	Balance Hydrologics
Channel bed samples	--	--	4-Jun-2013	post-poned	post-poned	Balance Hydrologics
Photopoints	10-Dec-2012	Balance Hydrologics	4-Jun-2013	15-Jun-2014	post-poned	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 sampling opportunities in WY2014 and WY2015, channel bed samples were not collected and surveys were post-poned.

Table 2. Station observer log:
Upper Penitencia Creek above Berryessa Road (UPBR), water year 2015

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	Water Temperature	Field Specific Conductance	Adjusted Specific Conductance	Additional sampling?	
		(feet)	*(feet)*		*(R/F/S/B)*	*(cfs)*	*(AA/PY)*	*(e/g/f/p)*	*(oC)*	*(µmhos/cm)*	*(at 25 oC)*	*(Qss, Qbed)*	
10/10/2014 11:11	df, ks	dry	dry	--	--	--	--	--	--	--	--	--	Channel dry, good amount of human feces in channel, levelogger downloaded. Staff plate has graphiti on it, replace next download.
12/2/2014 9:40	bkh, ks	0.55	0.80	this event	F	--	--	--	--	--	--	--	Initial stage observation upon site visit
12/2/2014 9:50	bkh, ks	0.49	--	--	F	1.30	PY	f	8.90	52	74	--	Heavy rain between 4-7am; 0.8 inches at Penitencia WTP; abundant trash in channel; gage slightly vandalized; no evidence of continuous flow through project channel reach, but HWM at staff plate; abundant debris caught up on rocks holding gage pool, shifts very likely.
12/11/2014 10:23	ks, gp	dry	1.0	Dec. 1-5	--	--	--	--	--	--	--	--	Moderate, steady rain. Gage, velocity, profile sites are dry.
12/11/2014 12:12	ks, gp	0.91	--	--	R	--	--	--	--	--	--	--	Steady, moderate rain. No HWMs. Slight drop in GH, then rise. Lots of debris coming down interferring with reading. Shortened intervals due to debris clogging meter. No bedload moving.
12/11/2014 12:21	ks, gp	0.89	--	--	R	--	--	--	--	--	--	--	no bedload moving
12/11/2014 12:34	ks, gp	1.10	--	--	R	--	--	--	--	--	--	--	no bedload moving
12/11/2014 12:55	ks, gp	1.29	--	--	R	16.50	AA	g	15.40	43	53	no	no bedload moving
12/11/2014 13:00	ks, gp	1.26	--	--	R	--	--	--	--	--	--		no bedload moving
12/11/2014 13:06	ks, gp	1.26	--	--	R	21.05	AA	p	--	--	--	no	Poor quality measurement. 4 verticals.
12/12/2014 11:10	ks, gp	1.38	3.20	12/11/2014	F	--	--	--	--	--	--		no bedload moving
12/12/2014 11:49	ks, gp	1.30	--	--	F	--	--	--	--	--	--		no bedload moving
12/12/2014 12:31	ks, gp	1.25	--	--	F	47.23	AA	g	12.20	241	320	no	Turbulent flow; staff reading bouncing when first arived to creek; water is brown, opaque; standing waves d/s of XS. Staff reading similar to yesterday, but flow is higher-> stage shift? Little debris today.
12/12/2014 14:39	ks, gp	1.10	--	--	B	--	--	--					
12/12/2014 15:18	ks, gp	1.10	--	--	B	33.69	AA	g	12.40	269	353	no	Stage has fallen ~2" since last measurement. Water is brown, opaque. Little debris. No bedload moving. Gravel and cobbles through section.
2/8/2015 11:00	an	dry	see remarks	--	R	--	--	--	--	--	--	--	Arrived at field site around 09:45. No flow in observed reach (u/s of ped bridge to restoration area). Rain intensity increased by 10:30, but still no flow. Left field site at 11:15. Small debris piles observed resting on the larger channel bed boulders, indicating a possible 6" deep flow on 2/7/15. Large debris observed just d/s of staff plate. See photos in project file.
4/3/2015 11:00	df, ks	dry	--	--	--	--	--	--	--	--	--	--	Channel dry, some incision under stilling well; found an old logger with a broken string at the bottom of the stilling well; levelogger Junior was set to recored only until memory full, restarted levelogger.
7/30/2015 15:00	ed, df	dry	--	--	--	--	--	--	--	--	--	--	Observed dry season conditions; re-installed new levelogger
10/19/2015 13:00	ks, gp	dry	--	--	--	--	--	--	--	--	--	--	Downloaded leveloggers; relaunched to correct time to 13:45 PDT; large tree down across channel downstream of gage; abundant weeds growing in channel, no ponded areas; abundant trash in channe

The above entries are observations made by Balance hydrologists/geomorphologists and may not represent all conditions presented by automated data (i.e., streamflow gage)
Observer Key: (bkh) Brian Hastings, (ed) Eric Donaldson, (df) Dan Frietas, (an) Anna Nazarov, (ks) Krysia Skorko, (gp) Gustavo Porras
Stage: Water level observed at outside staff plate
Hydrograph: Describes stream stage as rising (R), falling (F), steady (S), or baseflow (B)
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

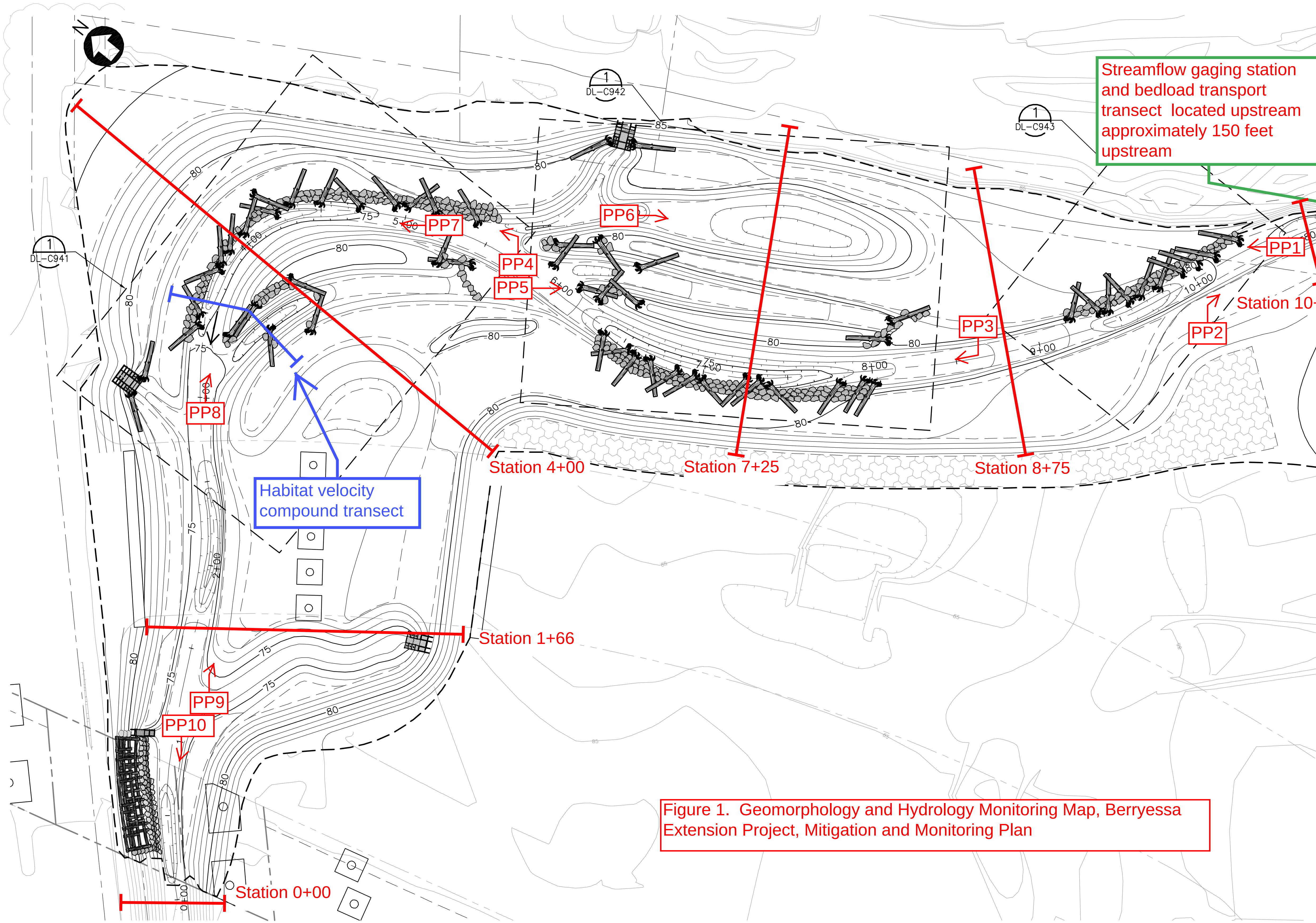

Figure 1. Geomorphology and Hydrology Monitoring Map, Berryessa Extension Project, Mitigation and Monitoring Plan

PLAN
1"=30'

NOTES:

1. THIS DWG IS INTENDED TO SHOW OVERALL LAYOUT FOR HABITAT ENHANCEMENTS. SEE DWGS DL-C941 TO DL-C943 FOR LOG AND BOULDER PLACEMENT.
2. SEE DWGS DL-C920 TO DL-C922 FOR GRADING AND BANK PROTECTION PLANS.
3. SECURE ALL LOGS AS SHOWN ON DWG DL-C935.

LEGEND:

- 1.5 TON BOULDERS
- BIOENGINEERED LOW OUTFALL PROTECTION (BELO)
- BIOENGINEERED STEP OUTFALL PROTECTION (BESO)
- LOG WITH ROOTWAD DIMENSIONS PER SPECIFICATIONS
- 80 FINISH INDEX CONTOUR
- FINISH INTERMEDIATE CONTOUR
- × 75.5 FINISH POINT ELEVATION
- BREAK LINE
- LIMIT OF GRADING
- LOW FLOW CHANNEL THALWEG
- PP8 Photo Point
- X-section survey

30' 0' 30' 60'
GRAPHIC SCALE

PRESCRIPTIVE

REV	DATE	BY	SUB	APP	DESCRIPTION
Q	20110524				ISSUED FOR ADDENDUM NO. 3
P	20110311				REQUEST FOR PROPOSAL

DESIGNED BY E BALLMAN
DRAWN BY D JEPSEN
CHECKED BY E RIEDNER
IN CHARGE E BALLMAN
DATE

REGISTERED PROFESSIONAL ENGINEER EDWARD D. BALLMAN No. C64095 CIVIL STATE OF CALIFORNIA

Balance Hydrologics, Inc. 800 Bancroft Way • Suite 101 Berkeley, CA 94710 (510) 704-1000 fax (510) 704-1001 www.balancehydro.com

SUBMITTED

Kimley-Horn and Associates, Inc. 111 West Saint John Street, Suite 440 San Jose, CA 95113-1104 Tel (408) 279-3826 Fax (408) 279-0869

APPROVED

NOT FOR CONSTRUCTION

VTA BART SILICON VALLEY
BART SILICON VALLEY BERRYESSA EXTENSION

LINE, TRACK, STATIONS AND SYSTEMS

UPPER PENITENCIA IMPROVEMENTS
HABITAT ENHANCEMENTS PLAN

CADD FILENAME C700-S-DL-C940.dwg
SIZE D
SCALE 1" = 30'
CONTRACT NO. C700
REV. Q
AREA CODE DL
SHEET NO. C940
PAGE NO. 0731

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A. May 19, 2012 , Before construction

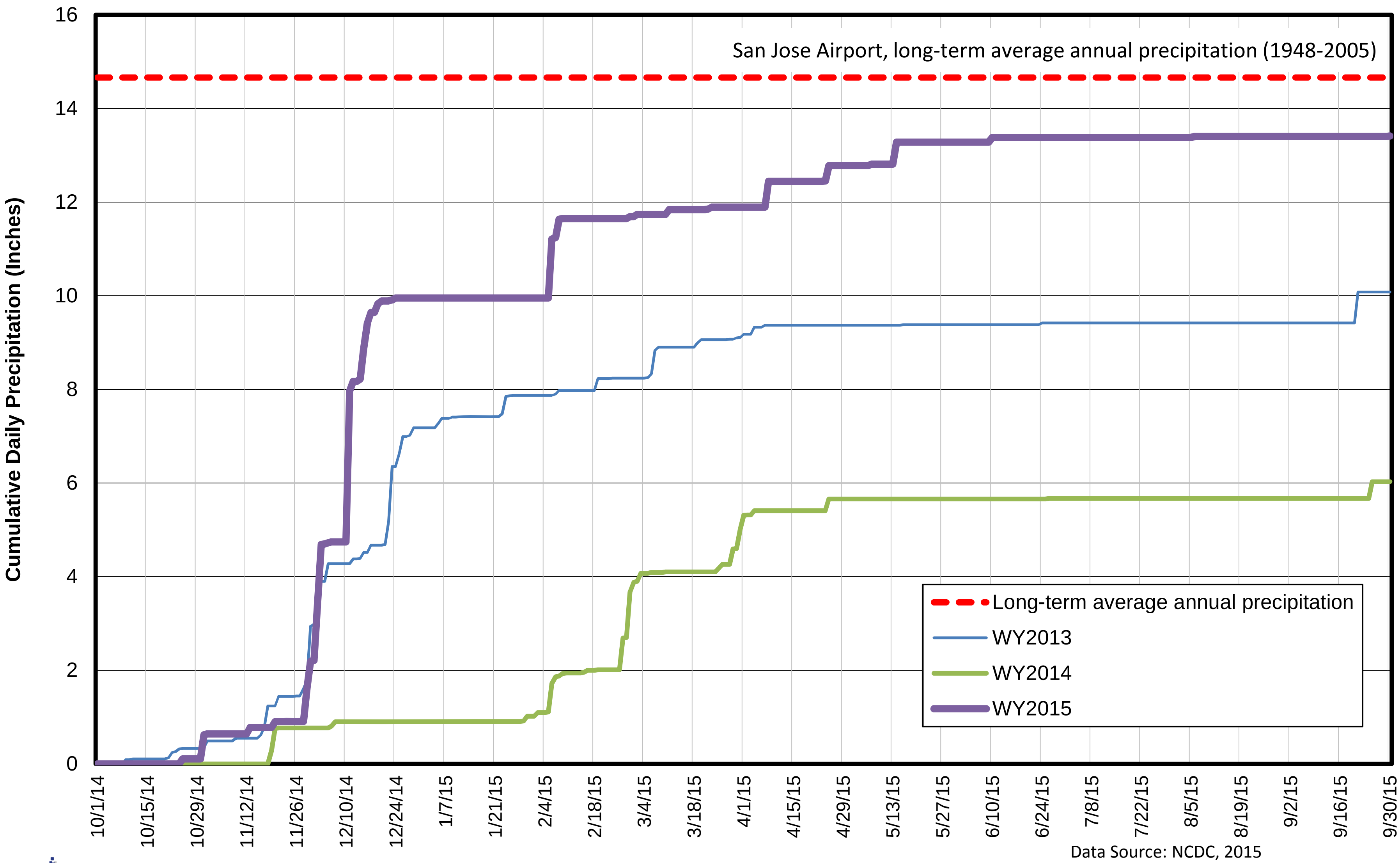
B. September 11, 2012,
Channel construction period

C. March 2015, 3 years after
channel construction.

Imagery: Google Earth

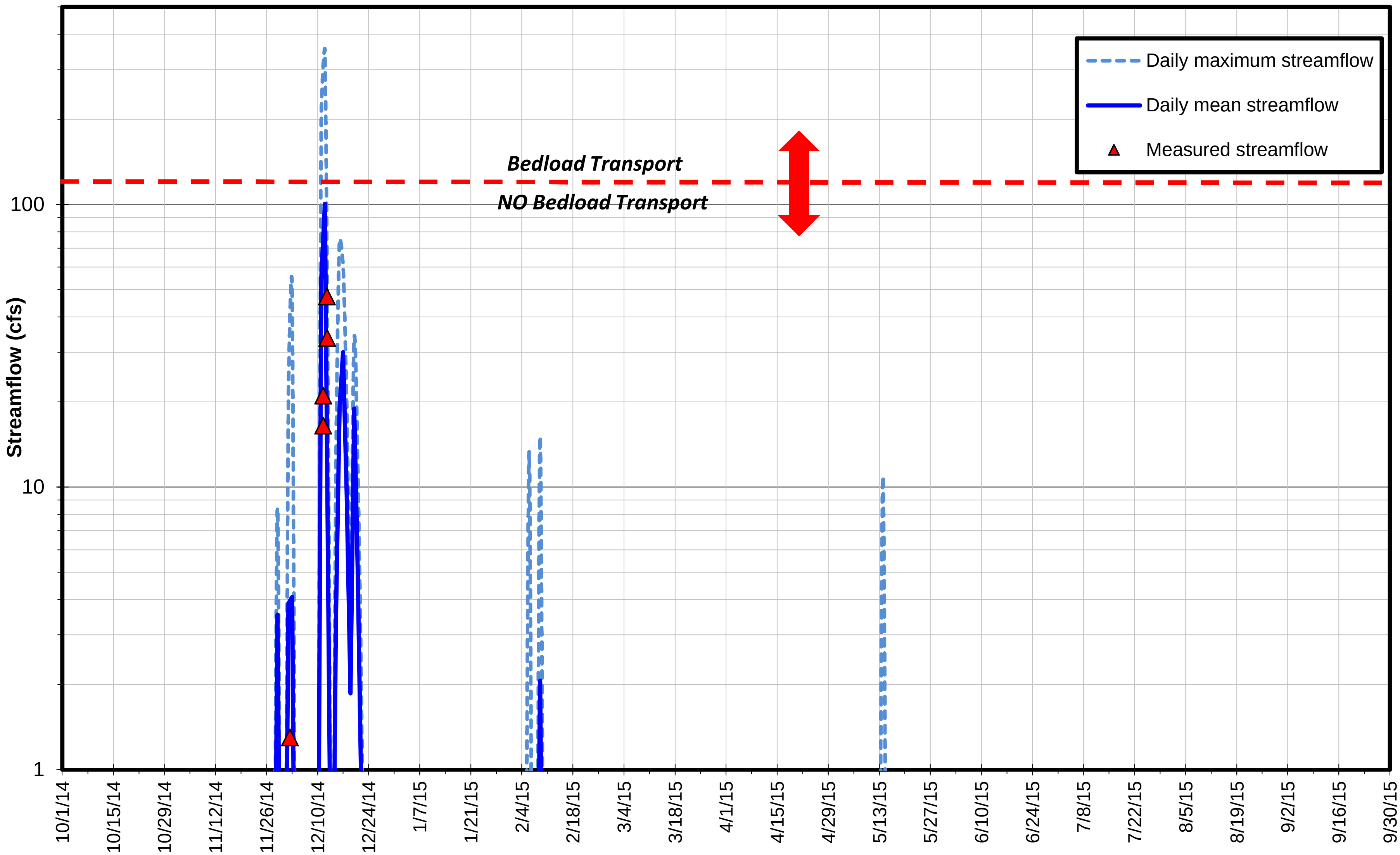
Balance Hydrologics, Inc.

Figure 2. **Sequence of project completion, Upper Penitencia Creek, San Jose, California**
Aerial photographs taken between May 2012 and March 2015 show the project before, during and after construction.



Balance Hydrologics, Inc.

Figure 3. **Cumulative daily precipitation, San Jose Airport, San Jose, California, water years 2013, 2014, and 2015.** Total annual rainfall in all 3 years (post-construction) was below average.



Note that the flow axis is logarithm

Balance Hydrologics, Inc.

Figure 4. **Daily mean and maximum streamflow, Upper Penitencia Creek above Berryessa Road, San Jose, California, water year 2015.** Flow was ephemeral in WY2015 but reflected continued drought conditions. Flows that generate bedload transport are typically greater than 125 cfs at this station (as shown by the dashed red line).

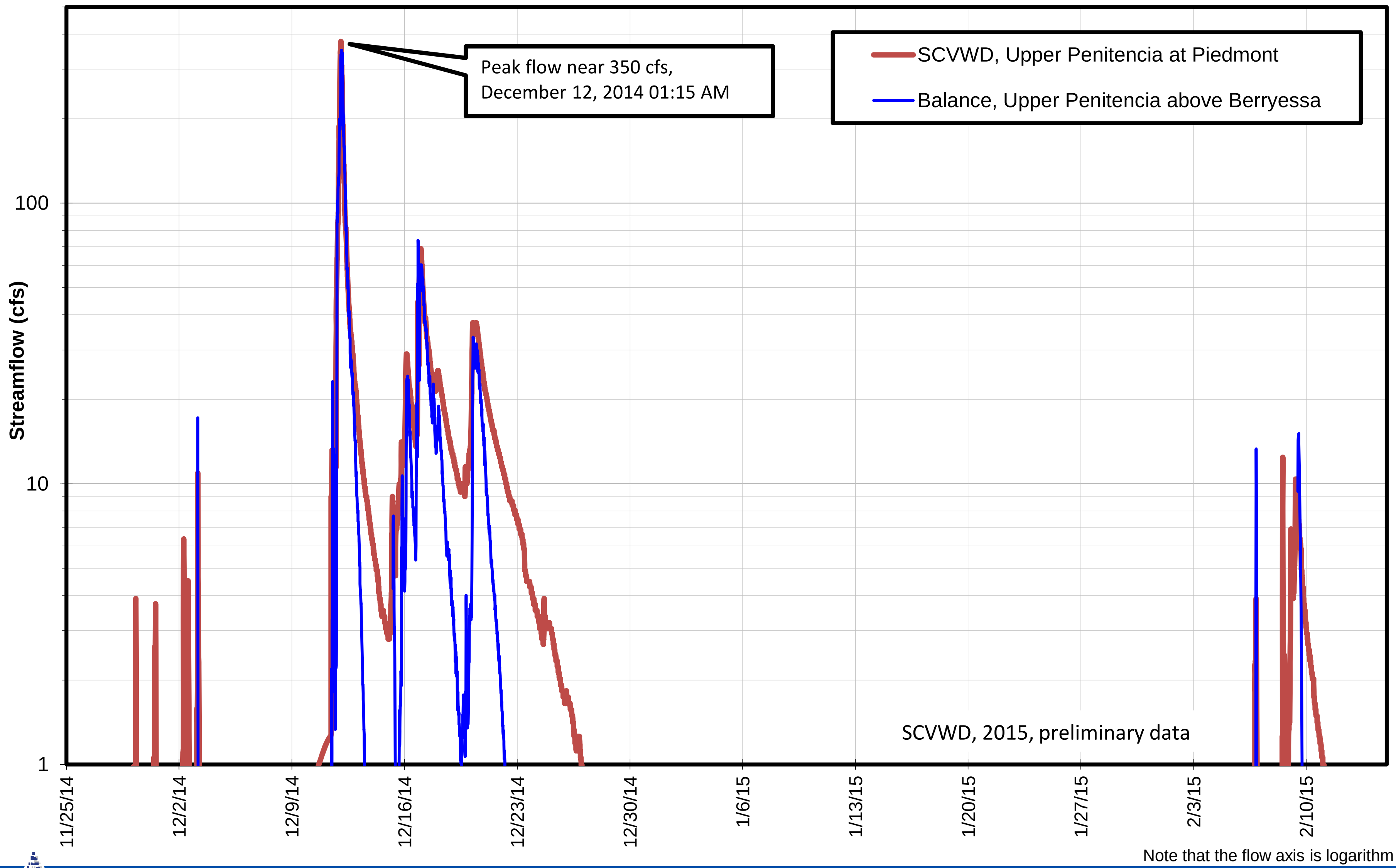


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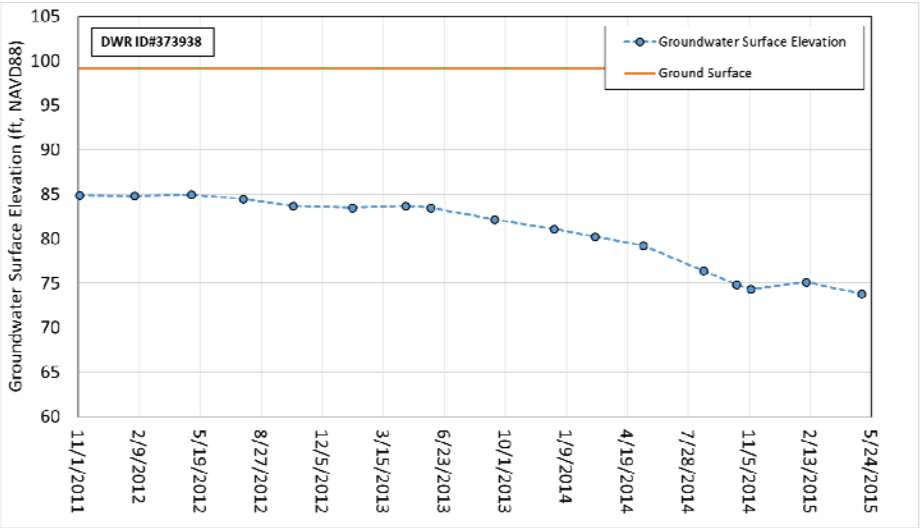
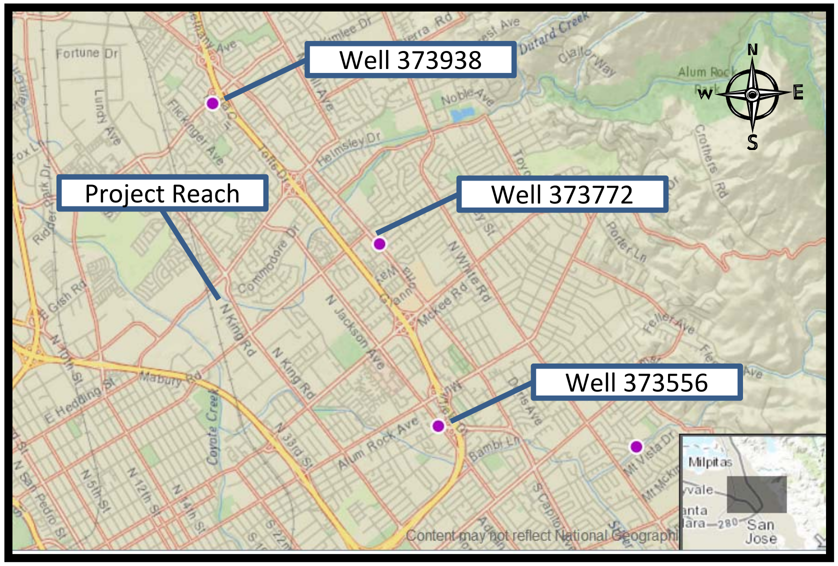
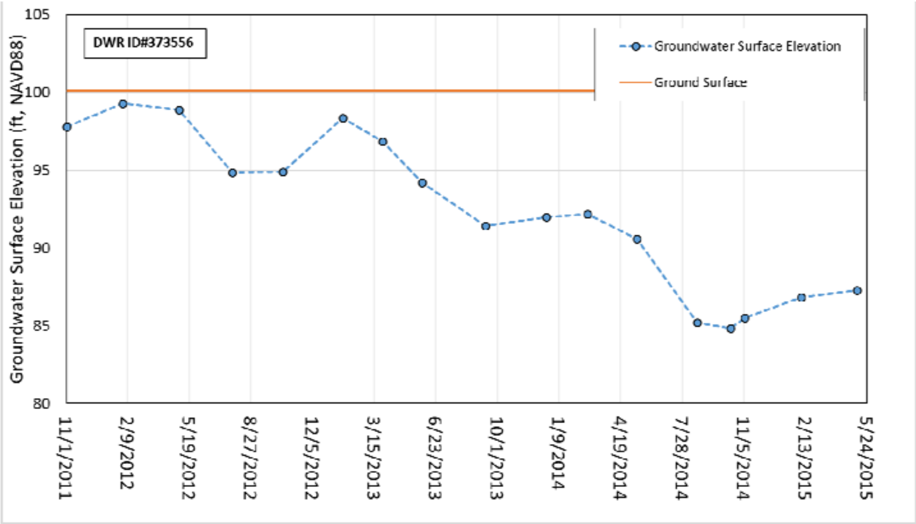
Figure 5. **Instantaneous (15-minute) Streamflow, Upper Penitencia Creek at two locations, San Jose, California, November 25, 2014 - February 15, 2015.** The Balance gaging station is roughly 2.6 miles downstream from the SCVWD gaging station. Period shown is limited to the period of recorded flow at both gaging stations.

214135 Upper Pen Daily Sums_WY15







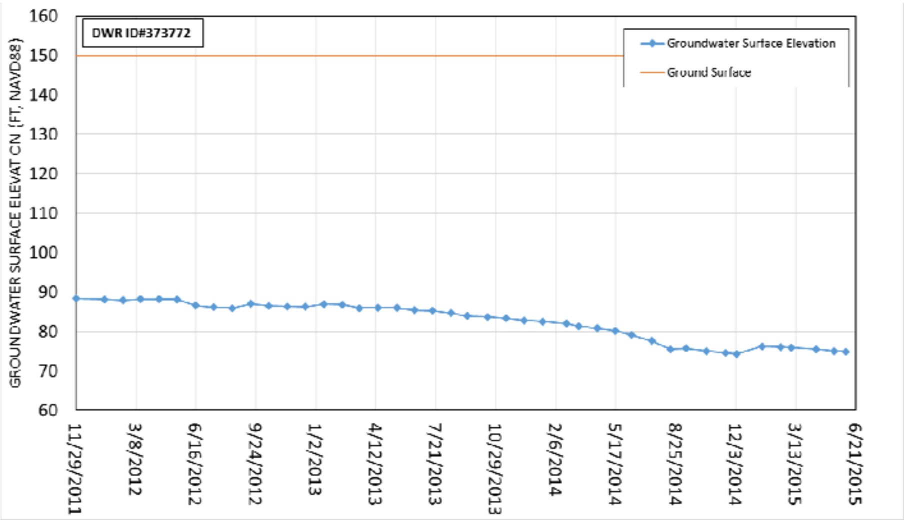


Figure 6. **Local depth to groundwater, near Penitencia Creek, 2011-2015**
San Jose, California
Data suggests local groundwater has declined between 9 and 13 feet as the result of drought conditions and groundwater pumping. As a result, this may affect the ability for the project reach to maintain continuous streamflow.

214135 Aerial photos.ppt

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Figure 7. Photographs showing general conditions and absence of flow in Year 3

Appendix B. Photodocumentation of Fish Habitat Units

Photo 1. **Shallow habitat unit with no surface flow in Habitat Unit 1, looking upstream (spring 2015)**

Photo 2. **Dry habitat in Habitat Unit 1 (fall 2015)**

Photo 3. **Damp channel and standing water in Habitat Unit 4, looking upstream (fall 2015)**

Photo 4. **Stagnant pools near rootwad restoration features in Habitat Unit 7 (spring 2015)**

Photo 5. Damp channel in Habitat Unit 4 (fall 2015)

Appendix C. Vegetation Photodocumentation

Photo 1. Photodocumentation Point 1A looking northwest at the Upper Slope Planting Zone at the eastern end of the mitigation site (August 28, 2013)

Photo 2. Photodocumentation Point 1A looking northwest at the Upper Slope Planting Zone at the eastern end of the mitigation site (September 22, 2015)

Photo 3. Photodocumentation Point 5A, looking east at the Upper Floodplain Planting Zone along the western boundary of the mitigation site (August 28, 2013)

Photo 4. Photodocumentation Point 5A, looking east at the Upper Floodplain Planting Zone along the western boundary of the mitigation site (September 22, 2015)

Photo 5. Photodocumentation Point 6A looking north at the Upper Streamside Planting Zone along the western boundary of the mitigation site (August 28, 2013)

Photo 6. Photodocumentation Point 6A looking north at the Upper Streamside Planting Zone along the western boundary of the mitigation site (September 22, 2015)

Photo 7. **Photodocumentation Point 7C, looking north at the Floodplain Planting Zone in the northwestern portion of the mitigation site (August 28, 2013)**

Photo 8. **Photodocumentation Point 7C, looking north at the Floodplain Planting Zone in the northwestern portion of the mitigation site (September 22, 2015)**

Photo 9. Photodocumentation Point 13B looking south across the Upper Slope Planting Zone to the Floodplain Planting Zone (August 28, 2013)

Photo 10. Photodocumentation Point 13B looking south across the Upper Slope Planting Zone to the Floodplain Planting Zone (September 22, 2015)

Photo 11. Photodocumentation Point 18B, looking south at the Floodplain Planting Zone (August 28, 2013)

Photo 12. Photodocumentation Point 18B, looking south at the Floodplain Planting Zone (September 22, 2015)