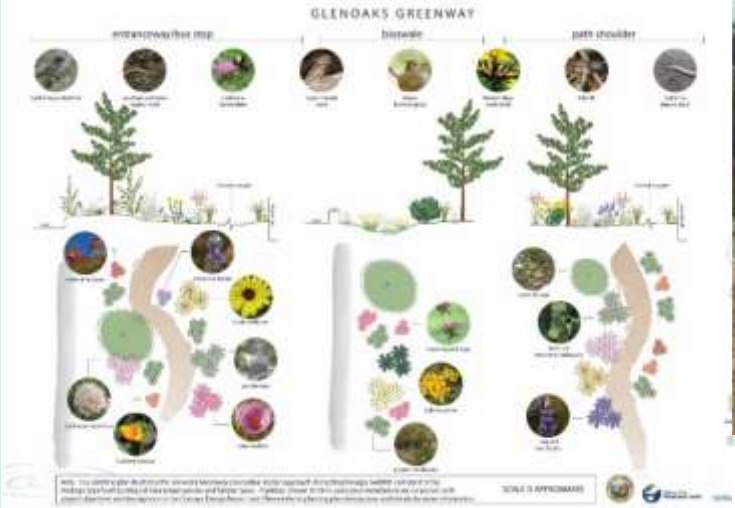
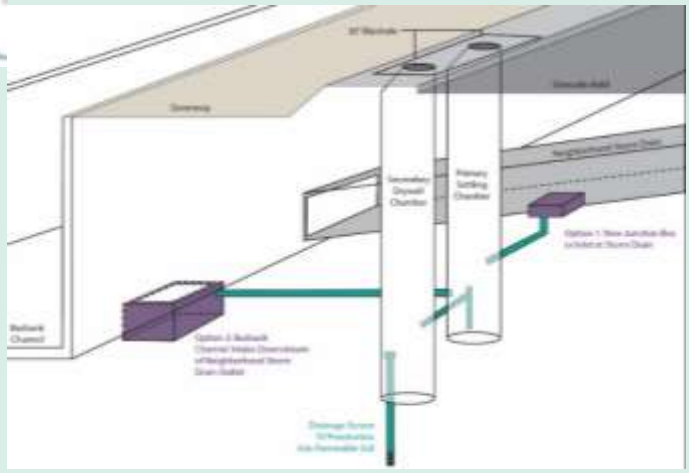
CONCEPTUAL DESIGN PLAN ◦ OCTOBER 2017

Glenoaks Greenway Project





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Cover photos: Top left –Glenoaks Greenway Planting Plan (Stillwater Sciences); top right – Path and planting concept along Burbank Western Channel (Stillwater Sciences); bottom left – Concept for entryway at Roscoe Boulevard (Stillwater Sciences); bottom right – Concept for dry well capture of stormwater flows (Stillwater Sciences).

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1 INTRODUCTION

Future uncertainty in the global climate demands a more resilient approach to urban landscapes in Southern California. Native plant landscapes within the urban matrix are an important component of climate change adaptation and mitigation in greater Los Angeles. Native plants provide important habitat, reduce the heat island effects of unplanted soils or paving, well suited to our climate and precipitation pattern, require less maintenance, and when irrigated with stormwater they reduce water use. The Los Angeles County Board of Supervisors adopted the Los Angeles River Master Plan in June 1996. The implementation of the Master Plan will maintain the river as a recreational resource that provides flood protection and opportunities for recreational and environmental enhancement, improves the aesthetics of the region, enriches the quality of life for residents, and helps sustain the economy of the region. The Council for Watershed Health (CWH) developed a partnership to design and construct Glenoaks Greenway, a 26-foot-wide, mile-long linear park on the Los Angeles County Flood Control District's right of way for the Burbank Western Channel System along Glenoaks Boulevard from Roscoe Boulevard to Cohasset Street in Sun Valley, in the City of Los Angeles. The Glenoaks Greenway Project is an opportunity to a demonstrate a climate appropriate and resilient urban landscape that achieves multiple stakeholder goals and provides multiple benefits for the surrounding community.

In the following sections, the existing project site characteristics, project opportunities, and planning context are described to provide background for the conceptual design plan. The conceptual design plan has been structured by path component and tier (i.e., low, medium, and high) to provide flexibility and opportunities in presentation and budget. Information regarding regulatory requirements to complete the Glenoaks Greenway, recommendations for efficiency, and preliminary costs are provided as a basis for conceptual design.

2 EXISTING PROJECT SITE CHARACTERISTICS AND OPPORTUNITIES

The Existing Project Site Characteristics and Opportunities Section provides a review of all readily available information for the environmental setting of the Glenoaks Greenway project site and highlights design opportunities developed in coordination with the Council for Watershed Health, Santa Monica Mountains Conservancy, City of Los Angeles, County of Los Angeles, and Council District 2. The environmental setting includes a description of the project location, existing infrastructure, soils and grading, hydrology, and vegetation. The project opportunities include improvements to wildlife habitat, groundwater recharge, regional open space and greenspace connections, water quality, recreation, and educational/interpretive and public art opportunities for the local community.

2.1 Environmental Setting

Common Ground from Mountains to the Sea (*Common Ground*, The California Resources Agency et al. 2001) document, which serves as a guiding document to watershed restoration and open space planning for the San Gabriel and Los Angeles rivers, includes the area in which Glenoaks Greenway is situated and provides the context for planning and design. The Glenoaks Greenway runs along the Burbank Western Flood Control Channel (Burbank Western Channel), a tributary to the Los Angeles River, and is therefore influenced by the *Common Ground* guiding

principles. The design of Glenoaks Greenway strives to integrate many of these guiding principles, and each applicable principle is discussed in Project Opportunities (Section 2.2).

2.1.1 Site location

The Glenoaks Greenway is in the San Fernando Valley, within the Sun Valley community, between the Burbank Bob Hope Airport and the Verdugo Mountains (Figure 1). The project area is a narrow strip of land within the right-of-way for the concrete Burbank Western Channel running northwest to southeast adjacent to Glenoaks Boulevard (Figures 1–4). The Glenoaks Greenway, Burbank Western Channel, and the adjacent Interstate 5, divide the low-income residential area to the south—with few opportunities for recreation – from the northern, more affluent hillside residential community. The project is confined to the narrow ribbon of land between the Burbank Western Channel and Glenoaks Boulevard from Roscoe Boulevard on the northern end to Cohasset Street on the southern end, a total distance of roughly 1.37 miles. The area is divided into three sections: 1. Upstream Section - Roscoe Boulevard to Lanark Street, 2. Central Section - Lanark Street to Hollywood Way, and 3. Downstream Section - Hollywood Way to Cohasset Street, as depicted in Figures 1–4. Though the project is completely within the City of Los Angles the southern extent of the site interfaces with the City of Burbank and the bike path at Cohassset street.

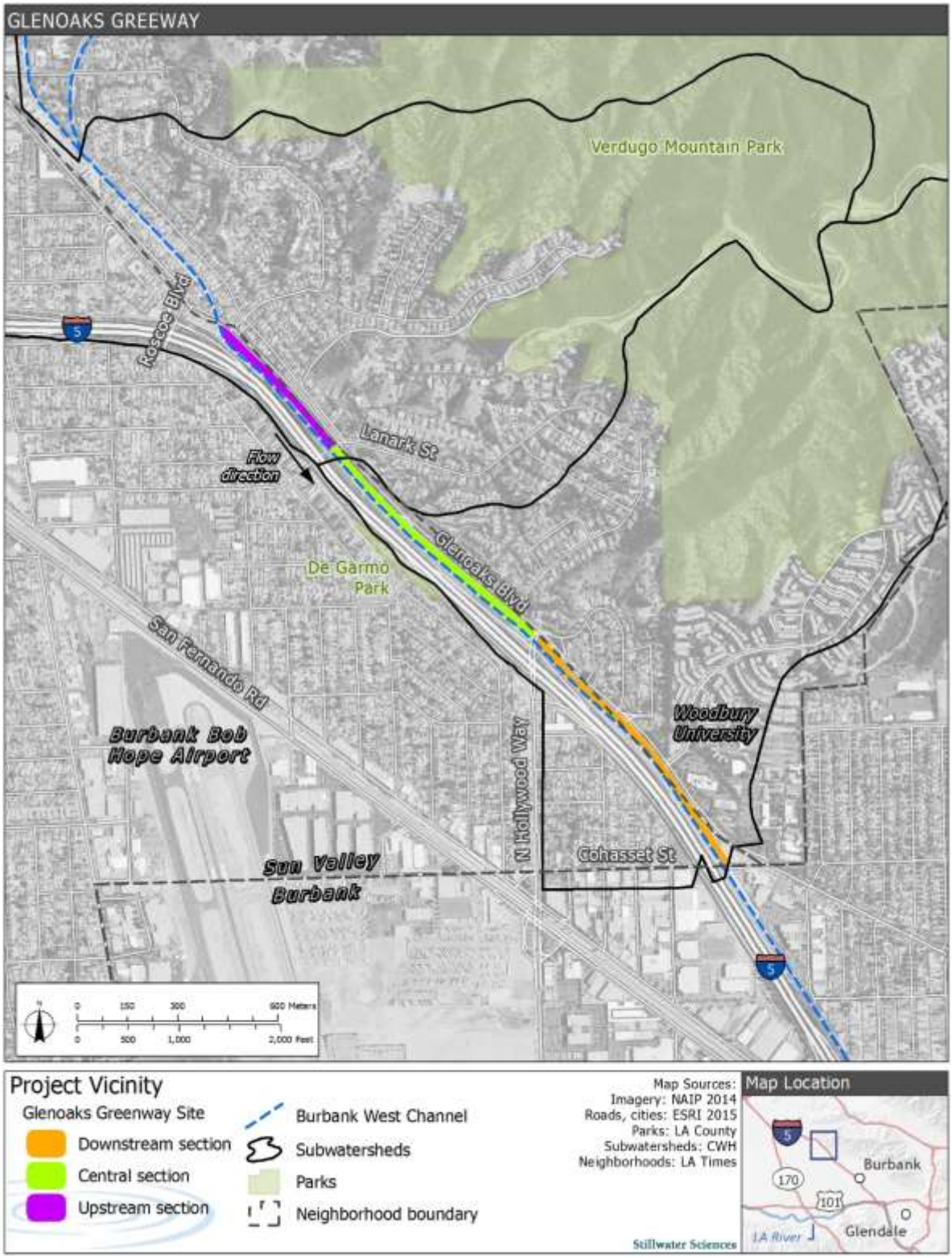

Figure 1. Glenoaks Greenway Project location.

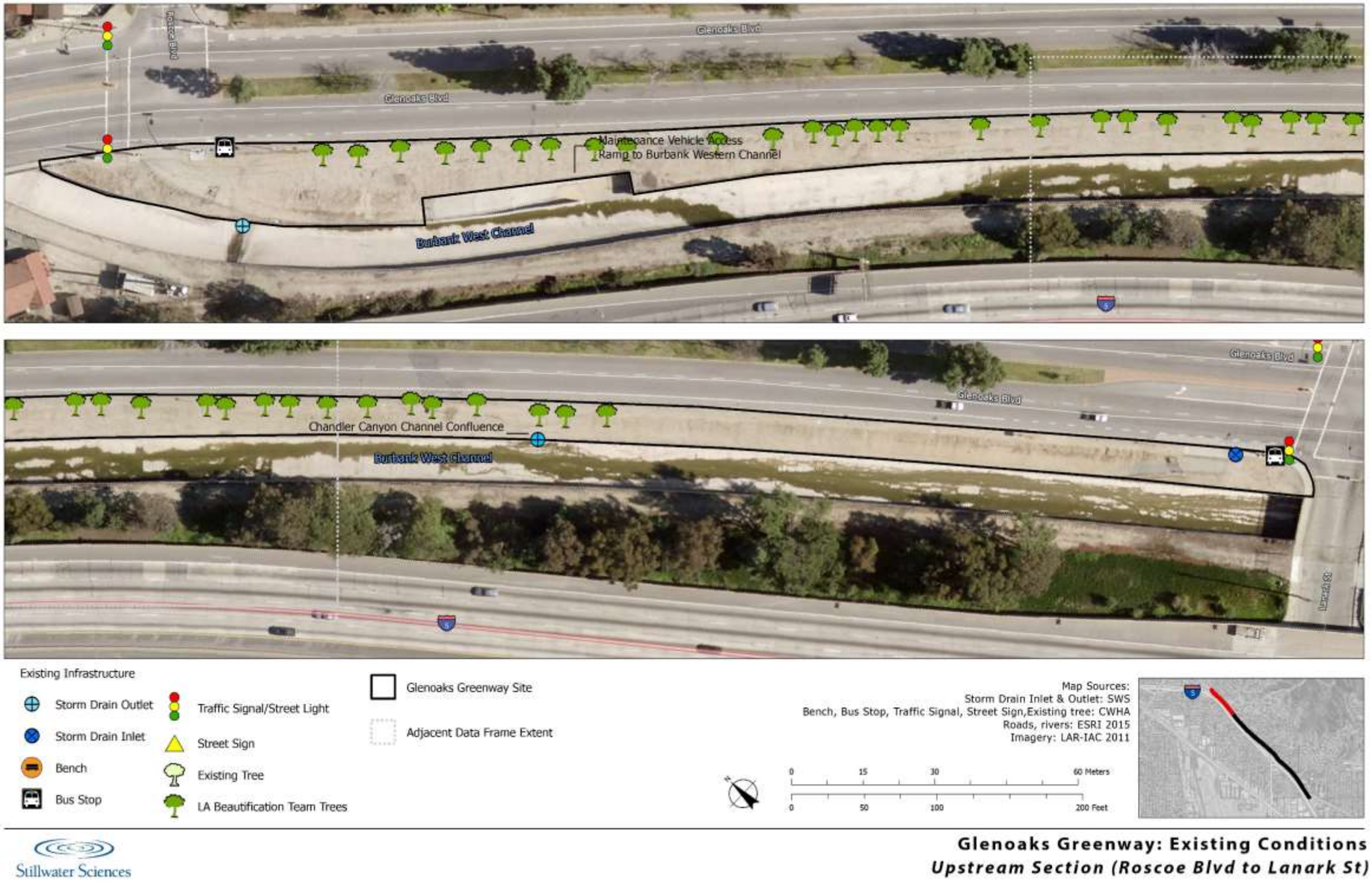

Figure 2. Upstream section of Glenoaks Greenway existing conditions overview.

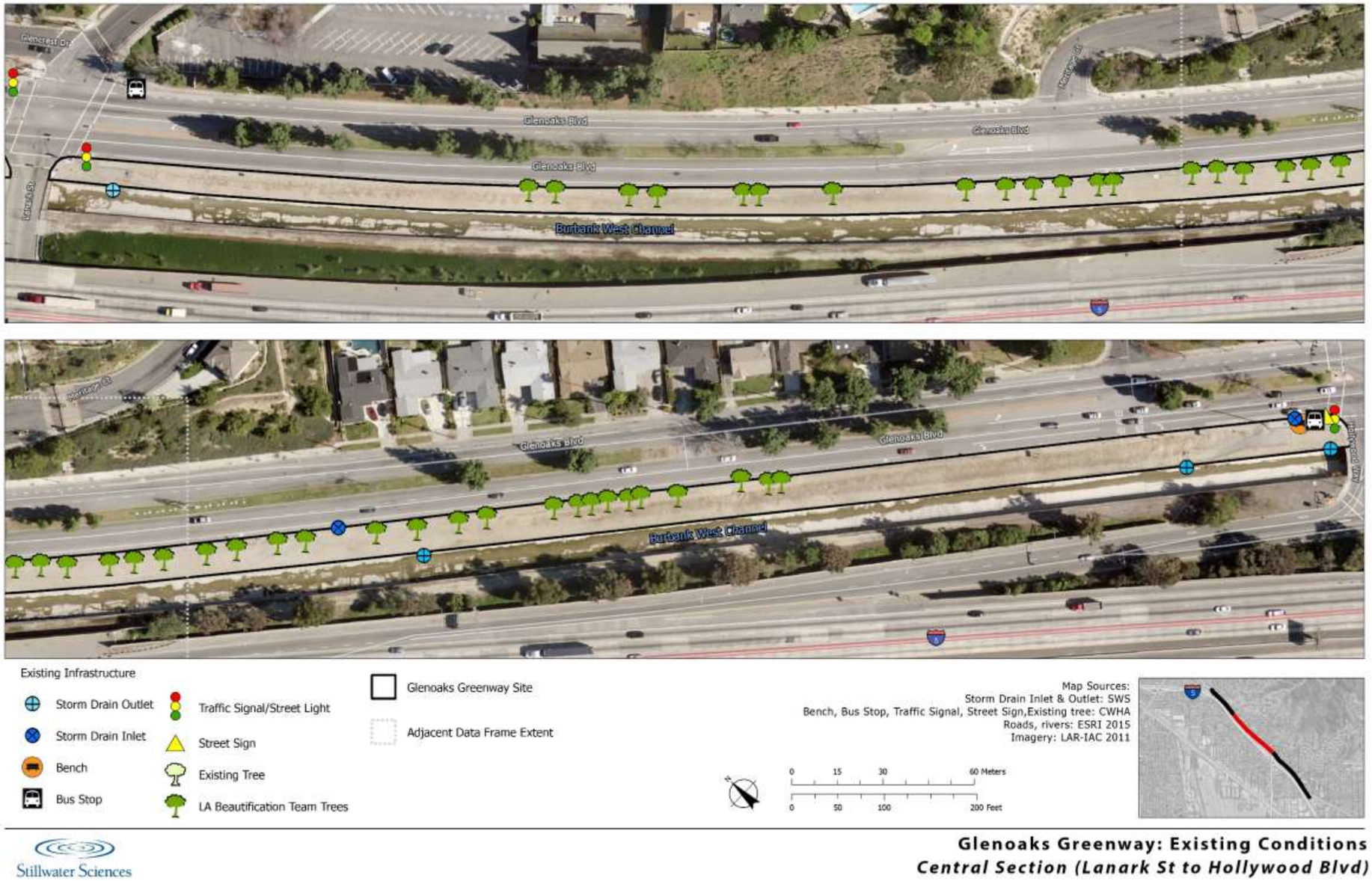

Figure 3. Central section of Glenoaks Greenway existing conditions overview.

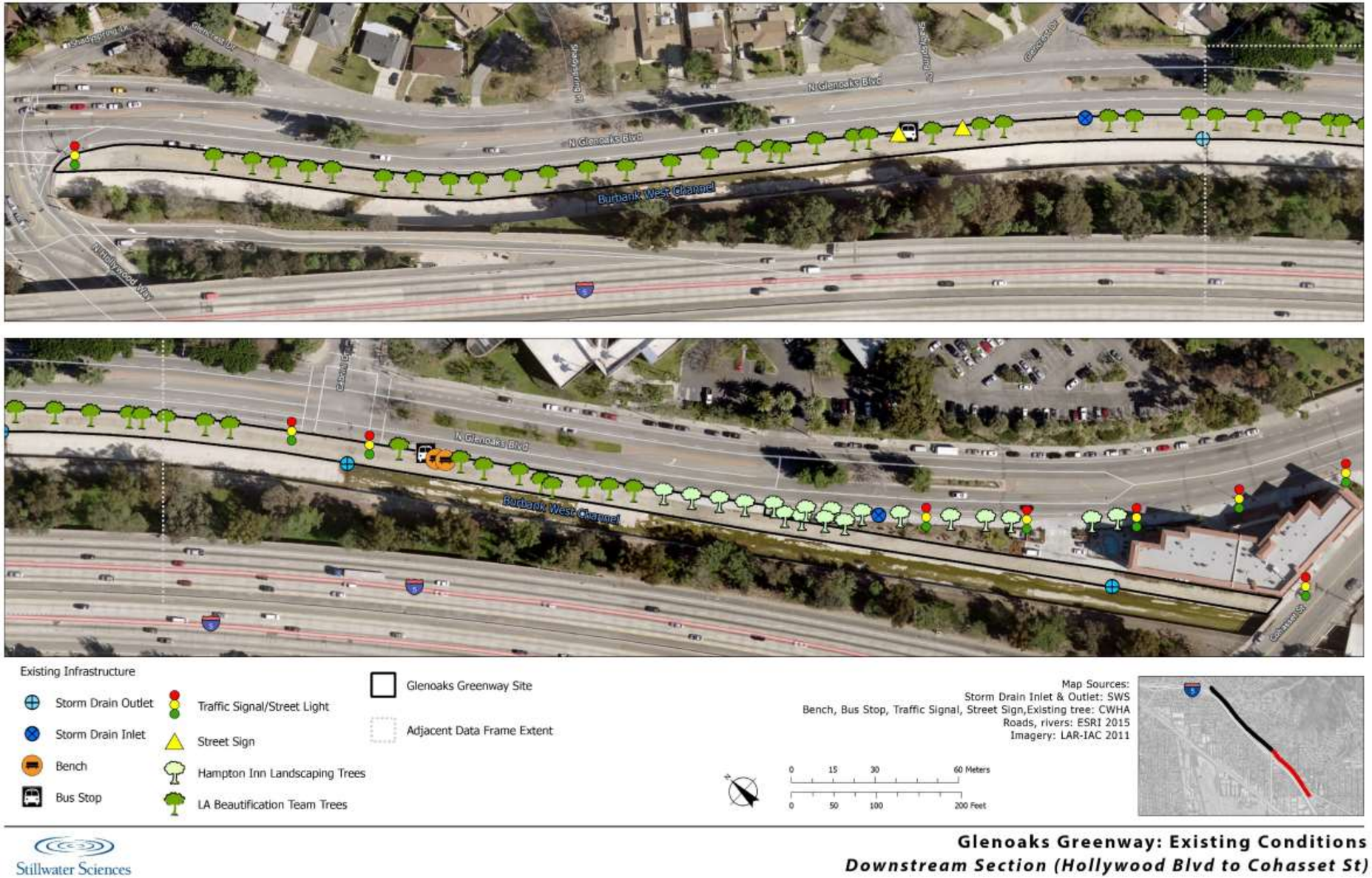

Figure 4. Downstream section of Glenoaks Greenway existing conditions overview.

2.1.2 Ownership

Based on information obtained from the City of Los Angeles and County of Los Angeles, the Glenoaks Greenway is located within the Burbank Western Channel and the Glenoaks Boulevard right-of-ways, jurisdiction of the County of Los Angeles and City of Los Angeles, respectively. See Figure 5 below for a delineation of City and County ownership boundaries.

Figure 5. Ownership boundaries at the Glenoaks Greenway

2.1.3 Infrastructure

The 5.2-acre site is currently undeveloped, except for five bus stops (two of which have benches), a few traffic signals and street lights along Glenoaks Boulevard, and the maintenance access ramp for the Burbank Western Channel (Figures 2–4). There is no shade nor established vegetation, except for recent plantings of roadside tree saplings installed by the Los Angeles (LA) Beautification team that have yet to establish. There is a bike lane on Glenoaks Boulevard and a dedicated bike path along the Burbank Western Channel south of the project area across Cohasset Street. Two roads, Lanark Street and Hollywood Way, cross the Glenoaks Greenway at their intersections with Glenoaks Boulevard (Figure 6). There is a Hampton Inn at the southern end of the project extent at the corner of Glenoaks Boulevard and Cohasset Street.

The Burbank Western Channel forms the western border of the Glenoaks Greenway and nine storm drains discharge into the channel at that border. Some of the storm drains carry water from catch basins on Glenoaks Boulevard and others carry flows collected in the storm drain systems

of neighborhoods to the east of the Greenway. These storm drains pass under the Glenoaks Greenway with inverts roughly ten feet below the existing grade, although catch basin connections adjacent to Glenoaks Blvd are shallower.

Figure 6. Looking south from the Hollywood Way crossing. From L to R: Glenoaks Boulevard, Glenoaks Greenway, and Burbank Western Channel.

2.1.4 Grading and soils

The width of the Glenoaks Greenway is generally between 26 and 35 feet wide, except at the northern end near Roscoe Boulevard (where it stretches to 53 feet wide) and at the southern end behind the Hampton Inn property (where it narrows to 20 feet wide). The site topography slopes downward from the elevation of Glenoaks Boulevard towards the Burbank Western Channel with two tiers of grades; one narrow strip at the grade of Glenoaks Boulevard, where the recent tree plantings and bus stops are situated, and a wider flat area at the channel wall grade used for maintenance vehicle access along the Burbank Western Channel (Figure 6). The difference in elevation between the two grades varies throughout the project area. In some places, such as the intersections with Lanark St. and Hollywood Way, there is no change in elevation; however, for most of the length of the Greenway, the maintenance vehicle access along the channel is approximately three feet lower than the street grade.

The soils within the project area are likely compacted fill from the construction of Glenoaks Boulevard and the Burbank Western Channel. Infiltration tests have not been performed at the site. Pre-development, the area was likely covered with alluvial soils deposited from the creeks and washes of the Verdugo Mountains. With the channelization of local waterways, soil moisture is no longer naturally maintained.

2.1.5 Hydrology

The Burbank Western Channel is a 30-foot-wide rectangular concrete flood control channel administered by the Los Angeles County Flood Control District. It ranges from 9.5 to 11.5 feet deep from the top of the east wall to the bottom of the channel. The slope varies from 0.68 % to

4.35 %. The Burbank Western Channel joins the Los Angeles River approximately 4.5 miles downstream from the Glenoaks Greenway.

The surrounding storm drain system directs much of the storm water from the neighborhoods to the north and northeast into catch basins that pass under Glenoaks Boulevard and into the Burbank Western Channel. As the curbs along Glenoaks Boulevard prevent surface flows from reaching the project area, any water present at the site is a result of rain water falling directly within the project area. Eight storm drains convey flows from the neighborhoods north of the Greenway to the Burbank Western Channel; with outfalls approximately 10 feet below the grade of the Glenoaks Greenway. An open concrete flood control channel, Chandler Canyon Channel, comes down from the Verdugo Mountains, flows under Glenoaks Boulevard, and joins the larger Burbank Western Channel towards the northern end of the project area between Roscoe Boulevard and Lanark Street. Based on analysis of the watershed, the total drainage area of these storm drain systems is estimated to be 736 acres. The 85th percentile 24-hour storm, recommended by the Los Angeles Regional Water Quality Control Board (RWQCB) for sizing volume-based BMPs, would contribute roughly 35.8 acre-ft of stormwater to the Burbank Western Channel.

A map received from the County of Los Angeles Department of Public Works (LACDPW) shows Flood Control District design flows between 10,685 and 11,060 cfs for the Burbank Western Channel within the project area (LACDPW 1949). Another document received from the LACDPW shows design flows between 8,500 and 9,100 cfs with 2 ft of freeboard to the top of the channel wall within the project area (USACE 1960). Construction documents available online from the LACDPW show design flows of 670 cfs for the Chandler Canyon Channel at the confluence with the Burbank Western Channel (LACDPW 1993). These design flows can be used to inform concrete removal and naturalization options of the channel.

2.1.6 Vegetation

Aside from very low cover of nonnative herbaceous vegetation, there are currently no established trees, shrubs, or herbaceous plants within the project area. Years of drought, potentially poor soils, and the neighborhood storm drain system bypassing the area have left the land barren. Trees planted by the LA Beautification team in the summer of 2016 have not yet established and do not have supplemental irrigation system to aid in their establishment (Figure 7). The median of Glenoaks Boulevard and the west bank of the Burbank Western Channel, both of which are outside of the project area, contain established trees including sycamore, eucalyptus, and pine trees. It is not known if these trees currently have irrigation or were established with irrigation systems.

Figure 7. 2016 plantings along Glenoaks Boulevard near the north end of the site.

2.1.7 Pollutants

The Upper Los Angeles River Enhanced Watershed Management Plan (EWMP) (Upper Los Angeles River Watershed Management Group 2016) identifies water body-pollutant combinations (WBPCs) for the reaches and tributaries of the Upper Los Angeles River, including the Burbank Western Channel. The WBPCs listed in the EWMP include three categories of pollutants:

- Category 1 includes pollutants for which Total Maximum Daily Load (TMDL) Water Quality Based Effluent Limits and Receiving Water Limitations are established.
- Category 2 includes pollutants listed on or where data indicates water quality impairment per the State Water Resources Control Board 2010 Clean Water Act Section 303 (d) List of Impaired Water Bodies.
- Category 3 includes pollutants where there is insufficient data to indicate impairment per the State's Listing Policy, but which exceed applicable limitations in the MS4 Permit, or parameters not considered typical pollutants.

The WBPCs included in the Upper Los Angeles River EWMP for the Burbank Western Channel are listed in Table 1 below.

Table 1. WBPCs for the Burbank Western Channel.

Category 1	Category 2	Category 3
E. Coli	2,3,7,8-TCDD (Dioxin)	Benzo(a)Pyrene
Copper Dissolved	Bis(2-ethylhexyl)Phthalate	Benzo(b)Fluoranthene
Copper Total	Chlorine (Total)	beta-BHC
Trash	Chlorodibromomethane	Cadmium Total
	Cyanide	Chloride
	Selenium Total	Chlorine (Total)
		Heptachlor
		Mercury Total
		pH
		TDS
		Thallium Total
		Zinc Total

2.1.7.1 Pollution generation and reduction modeling

Pollution generation and reduction have been evaluated for the Los Angeles area using two different computer-based modeling tools; the Watershed Management Modeling System (WMMS) and the Groundwater Augmentation Model (GWAM). The WMMS was developed for all major watersheds in Los Angeles County by the LACFCD to assist with urban stormwater and runoff management. The GWAM was developed by the Council for Watershed Health and the US Bureau of Reclamation to estimate aquifer recharge in the Los Angeles area.

The WMMS and GWAM can be used together to estimate pollutant load reduction from capture of initial stormwater runoff. The GWAM can estimate the reduction in runoff attributed to capture of the first flush of a storm event. The reduction in runoff can then be applied to WMMS estimates for pollutant loads to determine the reduction in pollutant loads from capture of the first flush of a storm event.

The GWAM was used to estimate runoff reduction from capture of the first ¾” of rain per storm event. The WMMS and GWAM models were compared for two WMMS catchments, shown in Figure 1, that contribute runoff to the area surrounding the Glenoaks Greenway. EWMP implementation results for annual pollutant loading (WMMS) and surface runoff reduction from the capture of the first ¾” of rain per storm event (GWAM) are shown on Table 2.

Table 2. WMMS and GWAM modeling results.

WMMS Model Data		
WMMS Watershed Catchment	Downstream	Upstream
Catchment ID	6617	6619
Surface Runoff (acft)	173.0	356.0
Fecal (Count)	1.1E+13	3.0E+13
Total Copper (lbs.)	9.6	20.9
Total Phosphorus (lbs.)	636.2	1463.5
Total Lead (lbs.)	8.6	18.6
Total Zinc (lbs)	83.7	191.5
Total Sediment (tons)	27.3	38.8
GWAM Model Data		
Annual Surface Runoff (acft)	246.9	415.6
Annual Surface Runoff Capture (First 3/4" of storm) (acft)	79.4	136.1
Annual Pollution Reduction w/ Capture of First 3/4" of Storm	32%	33%

The GWAM showed a reduction of 32% and 33% for the downstream and upstream catchments, respectively, with the capture of the first ¾" of rain in a storm event. The WMMS annual pollutant load estimates are assumed to be reduced by the same percentage for each catchment. The annual pollution loads reported by the WMMS would be reduced by 32% and 33% for the downstream and upstream catchments, respectively, with the capture of the first ¾" of rain in a storm event.

2.2 Project Opportunities

Establishing vegetation throughout the Glenoaks Greenway will provide opportunities to align with the Guiding Principles of *Common Ground* including a focus on public open space, habitat connectivity and quality, trail connection, surface and ground water improvement, and the potential for education and outreach in the local community. As seen in the site photos and exhibited in Existing Project Site Characteristics and Opportunities (Section 2.1), the barren landscape currently provides little to no benefits for wildlife, recreation, or water quality enhancement and ground water recharge. By creating a greenway using native plants, incorporating a multi-use path, and enhancing infrastructure such as bus stops, this project will provide benefits to the local community, wildlife, and water quality. Additionally, the Glenoaks Greenway is in a prime location to form connections linking the Verdugo Mountains to Griffith Park along the Burbank Western Channel. This connection has been identified as an important focus in *Common Ground* and previously as well (Noss 2001, CWC and TNC 2001). The Glenoaks Greenway would also create continuity with an existing bike path, which currently ends at Cohasset Street, creating a clean transition to the Glenoaks Greenway multi-use path. The sections below examine these project opportunities and intersections with *Common Ground*.

2.2.1 Regional open space and greenspace connections

2.2.1.1 Protected areas

Protected areas in the local vicinity of Glenoaks Greenway include:

- Verdugo Mountains State Park, California Department of Parks and Recreation
- Verdugo Mountains Open Space Preserve, jointly operated by the Santa Monica Mountains Conservancy and the City of Glendale
- Brand Park, Glendale
- Stough Canyon Nature Center, Burbank
- Wildwood Canyon Park, Burbank
- La Tuna Canyon Park, Los Angeles
- Tujunga Ponds, Los Angeles

The Verdugo Mountains are being considered as part of the proposed Rim of the Valley Corridor National Park (National Park Service 2015).

2.2.1.2 Access and recreational use

Other than the Foothill Freeway (I-210) and the nearly parallel La Tuna Canyon Road, both of which traverse only the northwestern tip of the range, the Verdugo Mountains are crossed by no paved roads. By contrast, the range contains more than 25 miles of graded and well-maintained fire roads that are used extensively by hikers and mountain bike riders. Several abandoned and overgrown fire roads and ridge-top fire breaks are used recreationally as well. Trails, in the sense of engineered and maintained foot paths, are few, the most notable being the 2.2-mile-long La Tuna Canyon Trail, which was constructed in 1989 by the Los Angeles Conservation Corps with funds provided by the Santa Monica Mountains Conservancy (McKinney 1994).

A central pillar of the *Common Ground* and the first guiding principle is to "Create, Expand, and Improve Public Open Space." Creating the Glenoaks Greenway will increase public open space and the site is in a prime location to increase the connectivity of open space in the region. De Garmo Park (LA City) is the closest park to the Glenoaks Greenway (Figure 1). It runs along the west side of Interstate 5 between Lanark Street and Hollywood Way in a ribbon-like pathway similar to the Glenoaks Greenway site and includes a playground, pathway, and picnic tables. The park does not extend all the way to Lanark Street and Hollywood Way, but there is potential to connect this park to the Glenoaks Greenway at Lanark Street by using space between Interstate 5 and an alley that currently provides access to the park.

The Glenoaks Greenway would also provide an initial connection from the Verdugo Mountains to Griffith Park, which has been identified as an important and missing potential wildlife corridor (The California Resource Agency 2001). As pointed out in *Common Ground*, it is not likely development would be removed; thus, existing possible corridors, especially along waterways such as the Burbank Western Channel, are the most feasible and critical opportunities for expanding connectivity. To the northeast of the project area, Verdugo Mountain Park (LA City) has extensive hiking trails in the Verdugo Mountains. The closest hiking trail is the Chandler Fire Road which begins just off Lanark Street 0.6 miles from the Lanark Street and Glenoaks Boulevard intersection along the Greenway. The Verdugo Mountain Park shares open space with La Tuna Canyon Park (Santa Monica Mountains Conservancy), which also features hiking trails through the mountains. Stough Canyon Park and Wildwood Canyon Park (City of Burbank) are also in the Verdugo Mountains near the site and offer more hiking and continuous open habitat through the mountains. Villa Cabrini Park (LA City) is a small open park and picnic area in the neighborhood below Verdugo Mountain Park. Brace Canyon Park (City of Burbank) is 0.6 miles east of the Cohasset and Glenoaks intersection and offers sports facilities, a playground, and pathways with native plants.

In addition to hiking trails and greenspace connections, the Glenoaks Greenway will enhance bike access in the local vicinity. There are existing Class 1, 2, and 3 bike ways in the area and planned Class 1, 2, and 3 bike ways that will improve bike connections to surrounding neighborhoods (Figure 8). There is an existing Class 2 bike lane along Glenoaks Boulevard. However, the Glenoaks Greenway would provide a safety buffer away from the busy, high speed street for pedestrians and bicyclists who prefer to be away from high traffic conditions.

Figure 8. Existing and planned bike ways in the Glenoaks Greenway vicinity.

2.2.2 Wildlife habitat and species

Before the urban development of the San Fernando Valley, the Burbank Western Channel, or Burbank Wash, was a broad, gravelly streambed that was dry most of the year. Material carried down from the Verdugo Mountains was deposited in alluvial fans across the valley floor. The historical natural plant communities surrounding the creek likely included alluvial flood plain, alluvial scrub, chaparral, and riparian woodland. Dominant and characteristic plant species likely included coast live oak, San Gabriel Mountains leather oak, black cottonwood, birch-leaf mountain-mahogany, toyon, western sycamore, California bay, and various willow species. These vegetation communities provided extensive wildlife habitat. Protected areas within the Verdugo Mountains Park, just north of the Glenoaks Greenway, still sustain many of these native plant and wildlife species.

A Significant Ecological Area (SEA) has been proposed for the Verdugo Mountains by Los Angeles County to protect the area and manage the unique biological value (Figure 9). Glenoaks Greenway will enhance connections to the SEA and other natural resources in the region by providing a wildlife corridor and habitat enhancements. Evidence of mule deer was observed during a site visit. In addition, mountain lions, rattlesnakes, various rodents, and many bird species can be found in the nearby Verdugo Mountains. Similarly, the Glenoaks Greenway would provide habitat for local chaparral associated bird species including wrentit, western scrub jay, California towhee, spotted towhee, California thrasher, and Anna's hummingbird (Table 3). Two special status bird species that occur in the area are the federally threatened California gnatcatcher, which is associated with coastal sage scrub habitat, and the federally and state endangered Least Bell's vireo, which is associated with riparian willow habitat (Table 3).

By identifying target wildlife species and allowing the associated habitat requirements to guide the project design process, the Glenaoks Greenway will provide high quality habitat for the target species. The planting palette focuses on species that will support pollinators such as bees and butterflies, and provide bird habitat (Appendix A). The palette includes drought tolerant native oak woodland, native chaparral, and sagebrush species to ensure sustainability and recruitment in the dry climate. The planting design focuses habitat requirements for target species. For example, California gnatcatcher habitat requirements include coastal sage scrub habitat with low shrubby vegetation dominated by coastal sagebrush, black sage, and lemonade berry. Least Bell's vireo prefer structurally diverse riparian and willow habitat (Table 3).

Table 3. Glenoaks Greenway wildlife associations.

Species (*scientific name*)	**Status**	**Habitat associations**	**Relative abundance in Los Angeles County**
Birds			
Wrentit *Chamaea fasciata*	None	Chaparral, coastal shrub	Common, breeder
Western Scrub Jay *Aphelocoma californica*	None	Chaparral and woodland; prefers trees and shrubs; frequents residential areas	Common, breeder
California Towhee *Melozone crissalis*	None	Chaparral; nests in low, dense foliage of a shrub or tree, or occasionally on ground	Common, breeder
Spotted Towhee *Pipilo maculatus*	None	Chaparral and other shrub habitats; uses shrubs and thickets with abundant leaf litter	Common, breeder
California Thrasher *Toxostoma redivivum*	None	Chaparral or young riparian; requires dense cover	Common, breeder
Anna's Hummingbird *Calypte anna*	None	Chaparral; uses trees, shrubs, and brush for cover	Common, breeder
Coastal California gnatcatcher *Polioptila californica californica*	Federally Threatened, CA Species of Special Concern	Coastal sage scrub; shrubby, low vegetation	Scarce, breeder
Least Bell's vireo *Vireo bellii pusillus*	Federally and State Endangered	Riparian and willow habitats; dense, shrubby, low vegetation with high structural diversity	Scarce, breeder
Reptiles			
Southern California legless lizard *Anniella stebbinsi*	CA Species of Special Concern	Often associated with chaparral and coastal scrub with moist, sandy soils	Uncommon but locally present
Coast horned lizard *Phrynosoma blainvillii*	CA Species of Special Concern	Deserts, chaparral, and grassland; open areas with sandy soil and/or patches of loose soil and low/scattered vegetation	Uncommon
Mammals			
Los Angeles pocket mouse *Perognathus longimembris brevinasus*	CA Species of Special Concern	Low elevation grassland, alluvial sage scrub, and coastal sage scrub	Uncommon
Coyote *Canis latrans*	None	Frequents open brush, scrub, shrub, and herbaceous habitats	Common
Mule deer *Odocoileus hemionus*	None	Early to intermediate successional stages of most forest, woodland, and brush habitat	Common

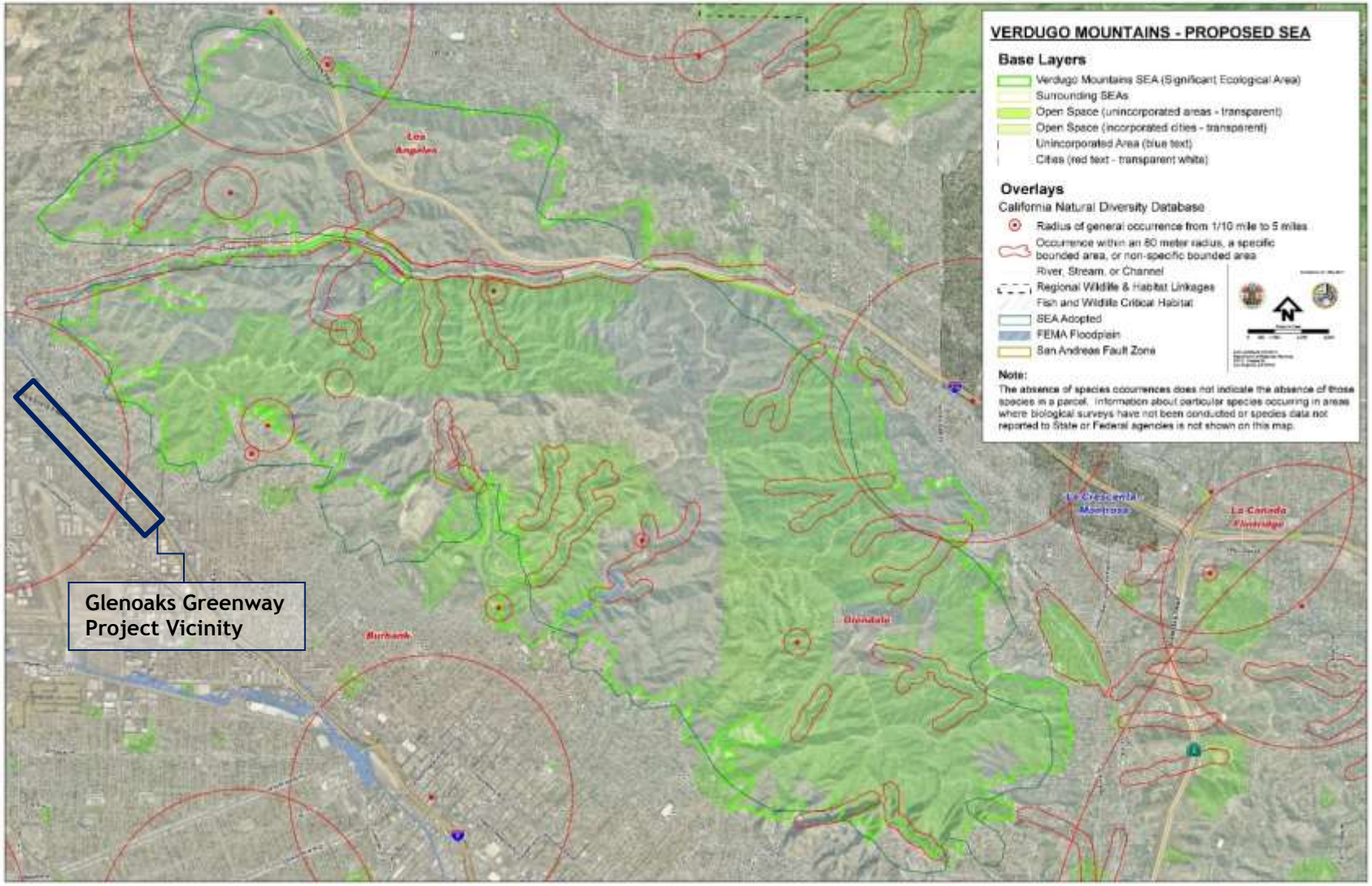

Figure 9. Verdugo Mountains Proposed SEA (LACDRP 2011). Greenway vicinity was added to the Figure to provide project context.

2.2.3 Groundwater recharge and water quality

The Glenoaks Greenway project is consistent with the Greater LA Integrated Regional Water Management Plan (IRWMP), One Water Plan, and Mayor's Sustainable City pLAn. The project is located in the San Fernando Valley, an important planning area for groundwater recharge and storm water treatment projects. *Common Ground* includes a guiding principle to improve quality of surface water and groundwater and encourages local planning as well as regional planning to focus on these issues. The Glenoaks Greenway provides the opportunity to capture and treat storm water from the surrounding urban landscape before it enters the Burbank Western Channel and ultimately the Los Angeles River. Intercepting the neighborhood storm drains that pass under the Glenoaks Greenway with green infrastructure features such as dry wells, infiltration trenches, and planters would provide vegetation with much-needed water, treat runoff before entering the Burbank Western Channel, and infiltrate the neighborhood flows into the San Fernando Basin. These features would improve water quality, as well as support restoration of native habitat and extended ranges of native plant and animal species.

Removing the concrete lining of the Burbank Western Channel to resurrect the historical Burbank Wash would provide the greatest benefits for groundwater recharge and water quality improvements. However, the characteristics of the Burbank Western Channel drainage area have changed significantly since the channel's construction. Potential flood capacity issues would be a primary concern when considering a restoration of the Burbank Wash.

2.2.4 Community access

The Glenoaks Greenway would enhance natural spaces in the Sun Valley community and Verdugo Mountains, by expanding the opportunities for community members to recreate in their backyard. Woodbury University sits at the southern end of the project area across from Glenoaks Boulevard at Cohasset Street. Glenwood Elementary is two blocks west of the project area along Lanark Street. Village Christian School and Vinedale Elementary School are 0.6 miles north of the project site along the Burbank Western Channel. There are multiple places of worship within a few blocks of the project area. Most of the surrounding neighborhoods are residential. The Glenoaks Greenway would provide multiple benefits to neighboring communities including increased safe pedestrian and bike pathways, relief from Urban Heat Island effects, enhanced biodiversity and habitat corridors, improved water quality, education, public art, and interpretive signage, demonstrated water conservation techniques, and potential groundwater replenishment. The project would also be consistent with the Mayor's "Sustainable City pLAn" to invest in infrastructure such as the Great Streets initiative. The project would also provide a missing link to connect to nearby Burbank Channel Bike Path and Los Angeles River Greenwayas well as other linkages in the surrounding Sun Valley community.

3 CONCEPTUAL DESIGN

The Council for Watershed Health convened an agency partners design scoping meeting for the Glenoaks Greenway project facilitated by Stillwater Sciences. The input received during that scoping meeting provided a basis for the conceptual design.

The Glenoaks Greenway project site, currently an unimproved path adjacent to the Burbank Western Channel, is a strategic site for water augmentation, enhanced recreation, and habitat. As described in this Conceptual Design section, the Glenoaks Greenway will provide a safe

recreational pathway surrounded by native plantings and educational and artistic features that connect the community with the urban and natural environment. Table 4 presents features of each major design component in three tiers that increase in complexity and cost from a low tier option to a medium tier option to a high tier option. The subsequent sections of this report describe each design component in more detail. The low tier option includes basic design components that comply with City and County regulations/safety standards. The medium and high tier options build upon low tier design components by adding/modifying related features to enhance design elements. When complete, the design for Glenoaks Greenway will likely reflect a hybrid of the three tier options. Design components from the low, medium, and high tiers can be evaluated independently depending on cost and priorities to achieve the best value in the final design.

Table 4. Glenoaks Greenway design components by tier.

Design components	Low tier	Medium tier	High tier
Trail components			
Spacing and Alignment	12-ft multi-use path along channel wall with no striping. (Minimum maintenance vehicle access requirements: 12 ft wide with 5 ft limited plantings shoulder)	12-ft bike/pedestrian path with striping (4-ft lanes each way with 2-ft shoulders)	12-ft striped bike path with 5-ft pedestrian path in limited plantings shoulder.
Crossings and Entryways	ADA compliant curb cuts at all intersections. Locking removable bollards to block vehicle access but allow maintenance vehicle access.	Low Tier components with the addition of shaded bus stops. Create access from the bus stops to path. Depending on grading a ramp or steps with railings down to the path would be necessary	Include Low and Medium Tier components with additional raised cross walk at Cohasset Street to connect existing bike path, artistic framed gateways, educational signage, and seating, for inviting entrance.
Grading	Maintain current grading for maintenance path.	Smooth existing steep sloped areas at street crossings to achieve 2–5% grade.	No additions to the Medium tier components
Pavement	Unpaved: decomposed granite or quarry fines	Asphalt concrete.	Permeable pavement, glow-in-the-dark striping, colored paving with patterns or native wildlife related theme (paw prints), counters for bikes and pedestrians
Site components			
Lighting and Amenities	City approved basic shoebox luminaires, emergency call boxes along path	Decorative light fixtures geared towards bike path illumination, emergency call boxes, bike rack at the Roscoe Blvd entrance.	Lighting incorporated into decorative fencing, solar lighting options, bike rack at Roscoe Blvd entrance, wifi stations at bus stops near Greenway entrances.

Design components	Low tier	Medium tier	High tier
Fencing	Protective wrought iron non-decorative fencing.	Artistic fencing- local artist employed to incorporate local flora and fauna into the fence design	Collaborative artistic fence to include multiple artists and/or the local community with incorporated lighting in the fence design. Optional musical components (percussive/xylophone) or other moving parts that would not interfere with path.
Green Infrastructure	Curb cuts upstream of existing catch basins to divert water into bioswales for plantings and tree wells. Bioswale overflow would discharge into catch basin.	Same as Low Tier plus sloping pathway away from channel to divert runoff into a small swale adjacent to and alongside the bikeway	Same as Low and Medium Tier with the addition of dry wells at large neighborhood storm drain discharge points for groundwater infiltration and storm flow dissipation.
Planting Palettes and Planting Plans	Baseline planting plan of native species primarily focused on drought resistant chaparral species, for the Roscoe Blvd entrance, bioswale, and path shoulder areas	Increase diversity still focusing on chaparral species	Increase diversity with additional short botanical walk to highlight native species near Roscoe Blvd entrance.
Interpretive & Educational Signage	General signs near crossings with information on the native flora fauna and history	Educational signs in Low Tier with local art incorporated positioned at the crossings and near bus stops	Educational signs in Medium Tier with additional collaborations with the schools and university, connect signs and artistic fencing, additional signs for the botanical walk at Roscoe Blvd entrance
Public Art & Murals	None	None in addition to fencing and educational signs.	Murals and/or tile project in the underpass at Hollywood Way and artistic framed gateways at the entrances.

An overview of the site design is provided in Figures 10–12. The overview highlights design components from all three tiers such as path bollards, limited planting requirements, bioswale areas, dry wells, and bus stops. The three planting areas, Roscoe Boulevard entrance, bioswales, and path shoulder, are displayed as well in this representative cross section; the precise dimensions of the planting areas may change based on layout. A conceptual design view of the low tier path shoulder looking downstream is shown in Figure 13—displaying path shoulder plantings, a quarry fines path, wrought iron fencing, and standard lighting. Each of these components are described further in the sections below.

Figure 10. Upstream section of Glenoaks Greenway conceptual design overview.

Figure 11. Central section of Glenoaks Greenway conceptual design overview.

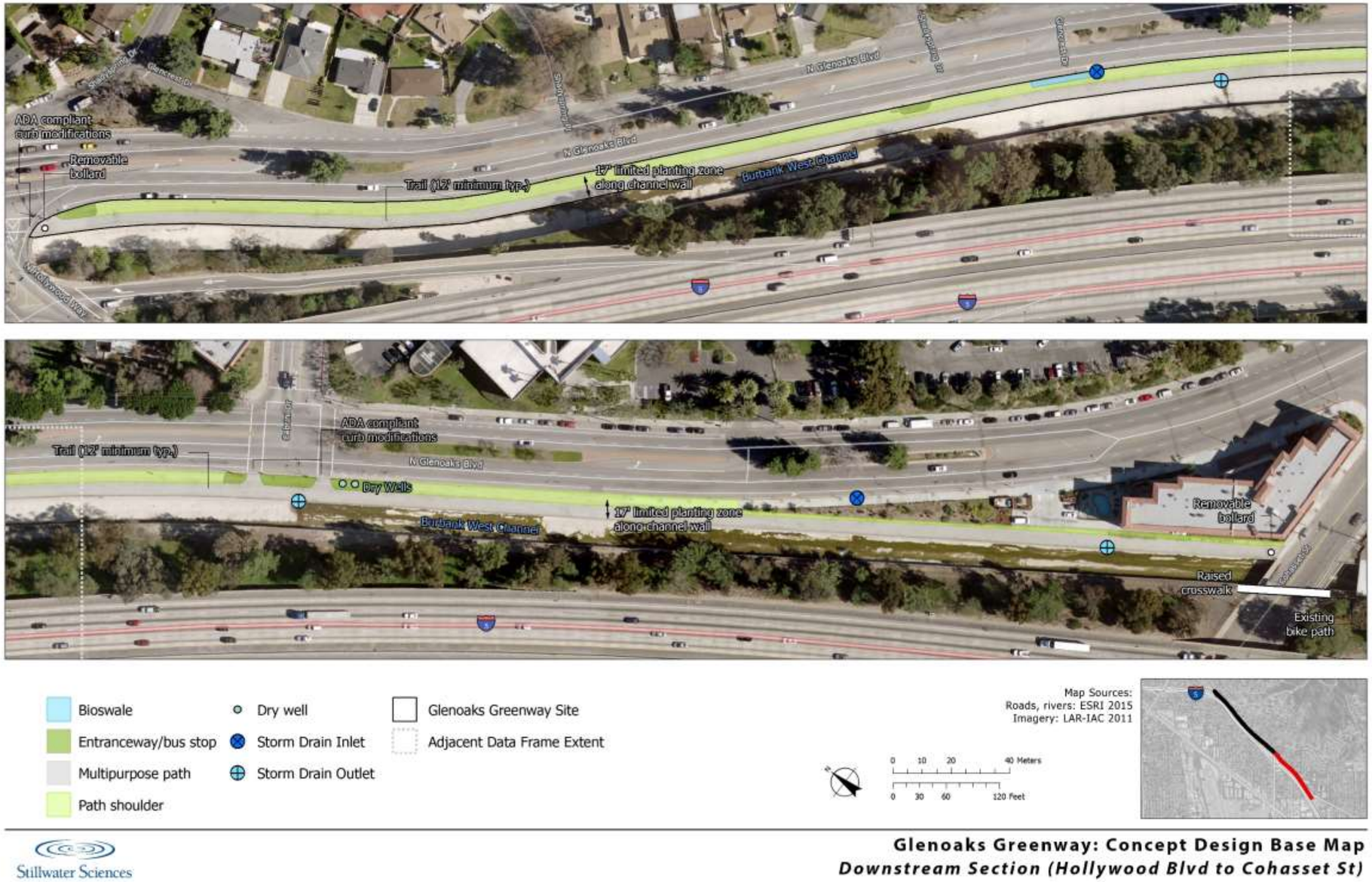

Figure 12. Downstream section of Glenoaks Greenway conceptual design overview.

Figure 13. Low tier Greenway view with quarry fine paved path, drought tolerant plants, and standard lighting and fencing.

3.1 Trail Components

3.1.1 Spacing and alignment

The alignment and features of a new trail on the Glenoaks Greenway are primarily dependent on the available space between Glenoaks Boulevard and the Burbank Western Channel as well as LA County Flood Control District (LACFCD) maintenance requirements. The current maintenance vehicle access capabilities must be maintained and any modifications must meet requirements outlined in the LA River Management Plan Landscaping Guidelines (LACDPW. 2004). Some of these requirements will not be possible, such as a 40-foot centerline turning radius for truck ingress and egress from arterial streets, because the existing site conditions do not accommodate these maintenance requirements.

LA River Master Plan Landscaping Guidelines require 12 feet of clearing for maintenance vehicles plus an additional 5 feet of limited plantings (maximum shrub height 3 to 5 feet) (LACDPW, 2004). A pedestrian or bike path would fit within these requirements, but constrain the path to the channel wall. Trail design descriptions for the Low, Medium, and High Tier Trail Designs are provided below. Refer to Figure 14.

Low tier trail design

The low tier design concept for a path to fit within the constraints of the site would be an unpaved multi-use path within the 12 feet of clearing for maintenance vehicles. Minimal site grading and ground treatment would be required to upgrade the existing site. A multi-use path without any striping would be well-suited to pedestrian use, but not ideal for bikers. An unpaved path without striping is less confining and more comfortable to walk on than a striped and paved path, but may be hazardous for bike traffic navigating pedestrians that could be anywhere along the path rather than within clearly delineated lanes.

Medium tier trail design

The medium tier design concept for a path on the greenway would be a paved and striped bike and pedestrian path. Bike alignment and grading will adhere to Caltrans Class I Bike Path standards (Caltrans, 2006). A Class I Bike Path is defined as a facility providing a separated right of way for the exclusive use of bicycles and pedestrians with cross-flow minimized. This would not include any bikeway in the street such as what exists currently on Glenoaks Boulevard. The minimum paved width for a two-way bike path shall be 7.8 feet, preferably 11.8 feet where heavy bike and pedestrian traffic is anticipated (Caltrans, 2006). This aligns with the 12 feet clearance required for maintenance vehicles and the wider Caltrans standard is recommended. Additionally, paved paths less than 11.8 feet can break up along the edges as a result of maintenance vehicle loads. LA River Master Plan Landscaping Guidelines recommend 2 feet of clearance from all stationary objects, such as the fence along the channel wall (LACDPW, 2004).

High tier trail design

The high tier design concept for a path on the greenway would be a separate, unpaved pedestrian path next to the paved and striped bike path. The proposed unpaved pedestrian path would occupy the 5-foot zone of limited plantings adjacent to the 12 feet of clearing for maintenance vehicles. This arrangement would reduce interference between pedestrians and bikers and provide pedestrians with a more comfortable walking surface. This alignment would limit planting opportunities at the site since no shrubs or plantings could be placed within 5 feet of the bike path for the entire trail alignment.

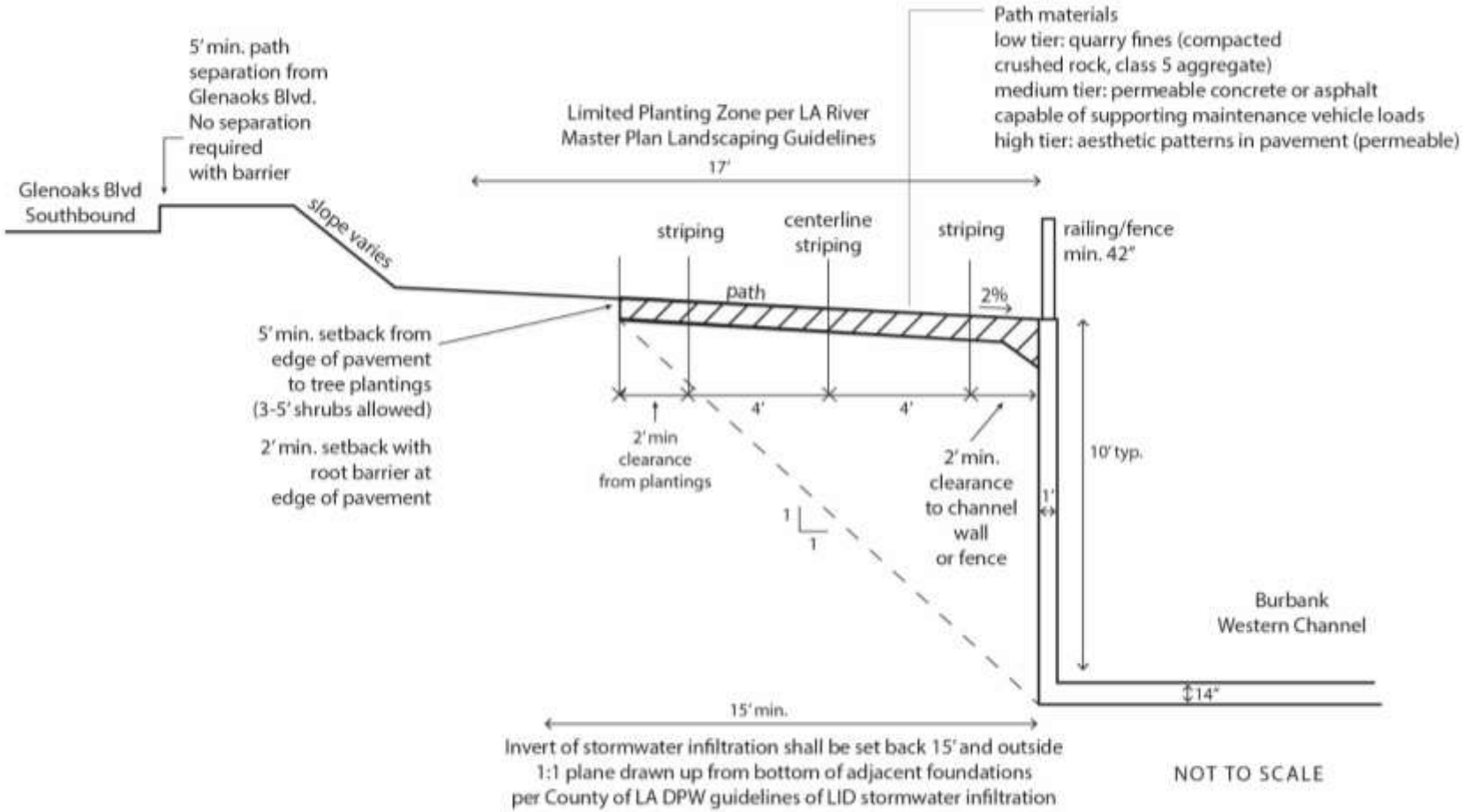

Figure 14. Cross section showing bike path alignment within limited planting zone.

3.1.2 Crossings and entryways

There are several points along the greenway alignment where the proposed path would require a street crossing. Each crossing provides an opportunity to highlight the Glenoaks Greenway access. Roscoe Boulevard and Cohassett Street are the two such crossings that would be improved with markings and signage. Crossings at Hollywood Way and Lanark Street must be improved to accommodate bikers and achieve ADA compliance. Bike crossings would occur at the existing pedestrian crossings.

The low tier design concept at these locations would upgrade all curbs at each crosswalk with ramps to achieve ADA compliance and install locking, removable bollards that would prevent vehicle access to the pathway. Locking, removable bollards would allow LACFCD maintenance vehicles access similar to the current access configuration at the site. Bollards present an obstacle for bikers. The path should be widened at those locations to prevent collisions. Ramps to the roadways should be the same width as the path.

The medium tier design concept would include the features of the low tier design concept but also upgrade the bus stops at Roscoe Boulevard, Lanark Street, Hollywood Way, and Cabrini Drive. These bus stops are located adjacent to the Glenoaks Greenway road crossings providing opportunities to integrate an improved entryway with typical bus stop shade structures. Direct access from the Glenoaks Greenway to each bus stop would improve the commuter experience.

The high tier design concept would build on the medium tier concept with additional entryway features such as ornate gates and fencing as well as public art. Figure 15 below shows an example of the entryway at Roscoe Boulevard, the northern entrance to the Glenoaks Greenway. Additionally, a raised crosswalk could be added at the Cohasset Street crossing to enhance the visibility of bikers travelling between the Glenoaks Greenway path and the existing bike path along the Burbank Western Channel south of Cohasset Street.

Figure 15. High tier Greenway Entrance view with, ADA approved entrance, removable bollard for maintenance access, educational signs and small native species botany walk, and drought tolerant plantings.

3.1.3 Grading

As described in Caltrans standards, bike paths should be designed with the novice rider in mind. This means avoiding sustained steep grades for riders not physically conditioned for steep inclines as well as those with poorly maintained bicycles not able to handle steep downgrades. The maximum grade rate recommended for bike paths is 5%, but 2% is desirable (Caltrans 2006). LA River Landscaping Guidelines recommend 5% at crossings with an 8% maximum grade. Steeper grades should only sustain for a maximum of 500 feet (LACDPW, 2004).

The existing grade of the Glenoaks Greenway is less than 2%, although that varies along the length of the greenway. The steepest grades occur at the Hollywood Way and Lanark Street crossings as the existing grade along the channel wall rises to meet the grade of the streets crossing the channel and then drop down again on the other side to rejoin the grade at the top of the channel wall. These grades are roughly 5%, although more detailed topographic information is required to determine the exact grade. Based on the available information the existing site conditions would not require significant modifications to meet Caltrans and LA River Landscaping Guidelines recommendations (Caltrans, 2006 and LACDPW, 2004).

The low tier design concept would not require any site grading. Medium and high tier design concepts would require fill material at the Hollywood Way and Lanark Street crossings to achieve an approximate 2% grade.

3.1.4 Pavement

The pavement material of the proposed pathway will be one of the most visible and functional elements of the project. Consideration must be given to both form and function of the path when selecting materials. At a minimum, all surface treatments must support maintenance vehicle loads.

The low tier design concept includes a decomposed granite surface treatment. This material is inexpensive, stable, has a natural look, provides a softer walking surface compared to asphalt, and does not absorb heat from the sun like asphalt or dark surface treatments. The material is not ideal for bikers due to skidding and slipping. Vehicle loads can be supported with 3 inches of decomposed granite over 3 inches of compacted aggregate sub-base.

The medium tier design concept includes typical asphalt concrete pavement. Asphalt concrete will be affordable, easily acquired for construction, and preferable for bikers. Per Caltrans bike standards, a minimum pavement thickness of 50 mm (2 inches) of asphalt concrete is recommended. Type "A" or "B" asphalt concrete (as described in Department of Transportation Standard Specifications), with 12.5 mm (0.5 inches) maximum aggregate and medium grading is recommended. Consideration should be given to increasing the asphalt content to provide increased pavement life. Consideration should also be given to sterilization of basement soil to preclude possible weed growth through the pavement. Permeable asphalt and concrete are options. If the path were graded to direct wet weather flow toward planting areas, permeable pavement would not be essential.

The high tier design concept would use premium permeable pavement materials that provide color pattern options and softer walking surfaces for pedestrians. Color options can greatly enhance the aesthetic of the path as well as provide educational opportunities such as native species illustrations and prints in the pavement. These premium materials use a resin that, when mixed with a concrete aggregate, produces a permeable pavement able to withstand the stress of

heavy equipment. It is possible to color the resin and then pour the concrete in separate colored sections to create patterns and themes along the pathway. An example of the artistic design is shown in Figure 16. Additional features for the path include glow-in-the dark striping to enhance late-night and early-morning path visibility as well as mileage counters for pedestrian and bike path users to inform future path designs.

Figure 16. Example of colored permeable pavement installation from University of California Cooperative Extension.

Experimental paving materials such as solar and glowing asphalt have been implemented in small-scale pilot programs. There are not many examples of these materials being used and results are mixed.

A Dutch installation of solar pavers was able to power three Dutch households (9,800 kWh) for a year from a 230 foot by 6-foot strip of solar pavers. A small pilot-installation in Idaho that includes LED light displays has had issues with failures during the initial few months and has not generated enough power to meet its goals of supplying a fountain and small restroom with energy. A 0.62-mile solar path, almost half the length of the Glenoaks Greenway, in France cost roughly 5 Million Euro (~$5.5 Million). All of these pilot programs have cost millions in research and development in addition to the installation costs. Pilot testing is ongoing as of early 2017.

With significant up-front costs for materials testing and research it is difficult to say the true cost of solar paving. The developers claim, based on materials testing, that they can withstand loads from heavy vehicle traffic but have not been tested extensively in the field and primarily support bicycle and pedestrian loads at the pilot test sites. Additionally, the pavers are not ideally positioned to collect sunlight and debris or scratching on the path surface further reduces the efficiency of the solar cells. A stand-alone solar panel on a roof or street light would be significantly cheaper and more effective at harvesting the sun's energy than these experimental pavers.

Another experimental, but less expensive, option is glowing asphalt. A synthetic glowing material and dye is mixed with the asphalt composite before paving, similar to the colored asphalt mentioned above, or can be rolled on top of existing pavements. The glowing material in the asphalt absorbs light during the day and can glow for 10 hours at night. Installations in Europe use the material for artistic designs and rider safety. One installation in Poland cost $31,000 for 300 ft by 6 ft stretch of pavement, or $17 per square foot. Selective use of this material for creating small patterns, designs, or striping could create a unique pathway aesthetic, but it is likely too expensive to use for the entire pathway.

3.2 Lighting and Amenities

The most important feature of the lighting is that it provides a safe space for those traveling along the Glenoaks Greenway at night. Lighting is particularly important along the Hollywood Way underpass. The lighting can also be used to highlight areas of interest such as bus stops, educational signs, and public art. The lighting design should match other features along the path such as bus stops and bollards to create a general theme. Lighting should be 16 feet minimum height and set back 2 feet from the path according to the Los Angeles River Master Plan landscaping guidelines (LACDPW 2004). Low tier lighting should be basic shoebox luminaire. Medium tier lighting could include any kind of decorative light fixtures or lighting geared towards bike path illumination. High tier lighting can incorporate solar lights along the entire path or alternatively at specific locations such as the bus stops, educational signs, and public art. Lighting could also be installed as part of the fencing option as long as it aligns with landscaping guidelines. The lighting design should minimize graffiti and vandalism.

Additional amenities that would enhance the Glenoaks Greenway, include emergency call boxes, bike racks, and wifi stations. At a minimum, Los Angeles River Master Plan Landscaping Guidelines recommend an emergency call box be placed at every mile of a multipurpose path (LACDPW 2004). Three emergency call boxes should be installed for all three tier designs at select locations, likely near bus stops and the entrances to the Glenoaks Greenway; at Roscoe Blvd, Hollywood Way, and Lanark Street. The entrance way at Roscoe Blvd is the widest section of the Glenoaks Greenway providing an opportunity to include an educational interpretive path, additional public art pieces, and amenities to enjoy the area. For the medium and high tier designs two Bollard Cycloops are suggested at the Roscoe Blvd entrance which would accommodate four locked bikes allowing bikers to stop at this location and enjoy the art and educational opportunities. The high tier design includes wifi stations at the Hollywood Way entrance and bus stop, as well as the Roscoe Blvd entrance and bus stop. These locations would access the widest audience, providing visitors with an inviting welcome and engaging them with the Glenoaks Greenway through educational signs and public art.

3.3 Fencing

Currently, there is a chain link fence that runs the length of the Glenoaks Greenway between the Burbank Western Channel and the Glenoaks Greenway itself (Figure 6). The fence is degraded in some areas and will need to be replaced. The fencing for each tier must be protective and practical. The low tier design concept incorporates a wrought iron fence option, which is simple, practical, and more durable than the current chain link fence. The maintenance access ramp to the Burbank Western Channel near Roscoe Blvd will be maintained with a lock and gate. The medium and high tier design concepts include incorporating art into the fence, particularly focused on themes of native flora and fauna (Figure 17). Commissioning local artists to create a story or themed art installation along the fence beginning at the entrance at Roscoe Blvd would

increase visibility and improve aesthetics. Lighting could be incorporated into the fence to increase safety along the path while illuminating the art work in the fence. Artistic gateways at each entrance to the Glenoaks Greenway could be used to welcome visitors and introduce the Glenoaks Greenway to pedestrians passing by (Figure 18). Additionally, the fence could be designed with musical components such as percussive or xylophone aspects. These musical and artistic additions would depend on the artists involved in the project and their expertise and must not interfere with the multipurpose path.

Figure 17. Los Angeles River Nature-link Fencing is an example of an artistic, yet practical fencing that incorporates local flora and fauna (Source: Friends of the Los Angeles River).

Figure 18. Water and Rock Gate created by Brett Goldstone located near the Department of Water and Power building at Fletcher Drive in Atwater (Source: Friends of the Los Angeles River).

3.4 Green Infrastructure

The project area, as well as surrounding streets and neighborhoods, do not have a history of flooding issues in normal years. Discussions with County, City, and community officials did not reveal any significant flooding in recent memory and during a site visit under rainy conditions no flooding was observed. Green infrastructure benefits focus on targeted habitat enhancements, water quality improvements, groundwater infiltration, and improving aesthetics through increased native planting, educational/interpretive, and public art opportunities.

The primary source of stormwater at the project site is runoff captured on Glenoaks Boulevard and rainwater that falls within the boundaries of the project area, between Glenoaks Boulevard and the Burbank Western Channel wall. These two sources would not generate water during the months outside of the rain season. Native plant species, endemic to the Verdugo Significant Ecological Area, selected for the Glenoaks Greenway are accustomed to dry periods (9 months out of the year).

The third source of stormwater at the project site is the neighborhood storm drain systems which collects water from the hilly residential neighborhood to the east of the and conveys the water in large storm drains underneath Glenoaks Boulevard and into the Burbank Western Channel. These

neighborhood storm drain systems do not have any treatment or control structures on them and directly contribute to the storm flows and water quality of the Burbank Western Channel. Additionally, the piped system prohibits natural groundwater infiltration. Water falling in the neighborhoods above the site is conveyed all the way to the Pacific Ocean via the storm drains, Burbank Western Channel, and Los Angeles River. There is a tremendous opportunity to tap into these existing collection systems and achieve water quality and groundwater infiltration benefits.

LACDPW Guidelines for Low Impact Development Stormwater Infiltration require that infiltration not occur within "15 feet, and outside a 1:1 plane drawn up from the bottom of adjacent foundations" (LACDPW 2014). Additionally, maintenance vehicle access requirements require a zone of limited plantings within 17 feet of flood control channel walls. Placing green infrastructure features outside of the 17 feet limited plantings zone would also meet the infiltration requirements for the channel foundation.

3.4.1 Curb cuts and bioswales—low tier

Bioswales are long, shallow depressions in the landscape. They can be vegetated or composed of boulders and rock or a combination of these elements. These open channel systems slow stormwater runoff, capture pollutants, and promote infiltration. Swales tend to be most effective when slopes are between two and six percent to increase the time for treatment, and when water depths do not exceed the vegetation height. These systems can be alternatives to impervious curb and gutter stormwater conveyance systems. Bioswales can either be dry, collecting runoff as it occurs, or wet, where the swale holds standing water, also sometimes referred to as a rain garden.

Glenoaks Boulevard currently has four catch basins along the project area that capture runoff from the curb and gutter system on the southbound lane and convey that water directly to the Burbank Western Channel. Assuming the existing catch basins are sited for optimal stormwater collection, they would be an ideal location for bioswales to capture and treat the stormwater from the gutter system before it is discharged to the Burbank Western Channel. Placing curb cuts inlets and outlets upstream of the existing catch basins (Figure 19) would allow stormwater to pass through the bioswale and then overflow back into the catch basin without modifying the existing catch basins. An alternate design could connect an overflow pipe at the downstream end of the bioswale directly to the catch basin to increase detention time in the bioswale, but would require some modifications to the existing catch basins.

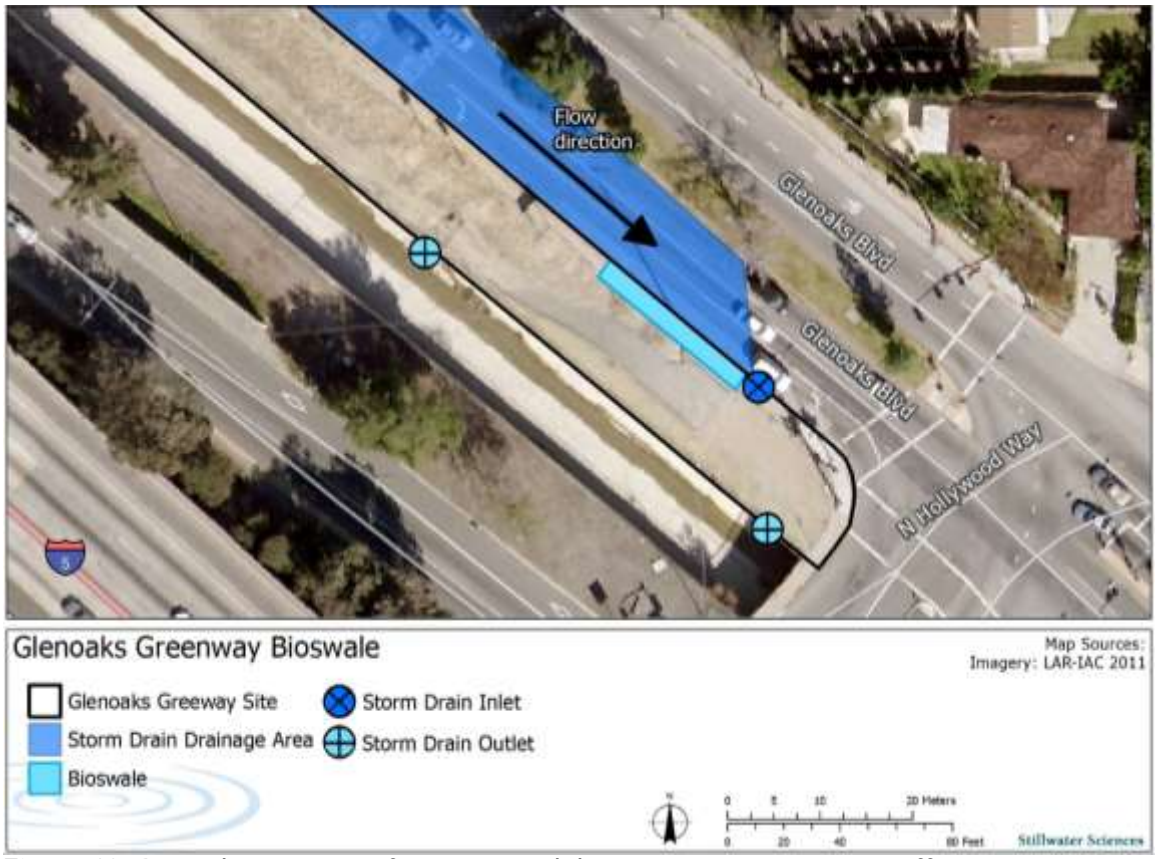

Figure 19. Bioswale upstream of existing catch basin to capture street runoff

These options are a great low-cost design that would achieve several stormwater benefits with minimally disruptive modifications to the existing site. The use of bioswales near the storm drains will aid in filtering out sediment and reducing pollutant loadings (except during major storms) before the water enters the channel where it will receive no additional treatment on its way to the Pacific Ocean. Additionally, the bioswales will be a source of irrigation at the site and increase the diversity of the native plantings along the Glenoaks Greenway.

The following pollutants are expected to be removed by this feature (USEPA 1999):

- Suspended Solids: 30–80 percent removal
- Nitrogen: 15–80 percent removal
- Phosphorous: 15–80 percent removal
- Metals: 15–80 percent removal

3.4.2 Vegetated swales and grading—medium tier

The pedestrian or bike pathway through the Glenoaks Greenway will be a visible highlight of the Greenway, but the pathway also can serve a less obvious function. A flat, graded pathway is essentially a collection surface for rainwater covering most of the project area, especially if it is paved. Typical pathway design would slope the pathway to direct stormwater into the flood control channel, as shown in Figure 14, but by sloping the path to retain water on site as shown in Figure 20, stormwater would flow to plantings—promoting water conservation. The curb cuts and

bioswales discussed in Section 3.4.1 may only occur four times over the length of the project, but a continuous swale along the pathway would create even more diverse planting opportunities over a greater area. Plant species in the bioswale planting palette (see Section 3.5 and Appendix A) were selected based upon their ability to withstand some inundation and prefer slightly longer hydroperiods, but remain drought-tolerant during the dry season (i.e., it is not expected that the bioswales will be ponded of sufficient duration to support wetland plant species such as rushes or sedges).

Attention to the existing grading at the site will guide design and sizing of the vegetated swales. Steeper sections of the swale may require control structures, such as dividers or check dams. Shallow sloped areas where ponding may occur provide opportunities for a larger planting area. This approach will require careful grading to direct runoff to the site and meet slope requirements of vegetated swales as outlined in City of Los Angeles Bureau of Engineering green streets standards (LABOE 2010).

In addition to the detailed grading information, a geotechnical site investigation must be conducted in accordance with standards for vegetated swales (LABOE 2010). Soil infiltration rates are needed to properly design a vegetated swale.

A continuous vegetated swale along the pathway would limit plantings adjacent to the pathway due to limited space between the channel wall and Glenoaks Boulevard. The swales would terminate at existing storm drain connections along the Burbank Western Channel.

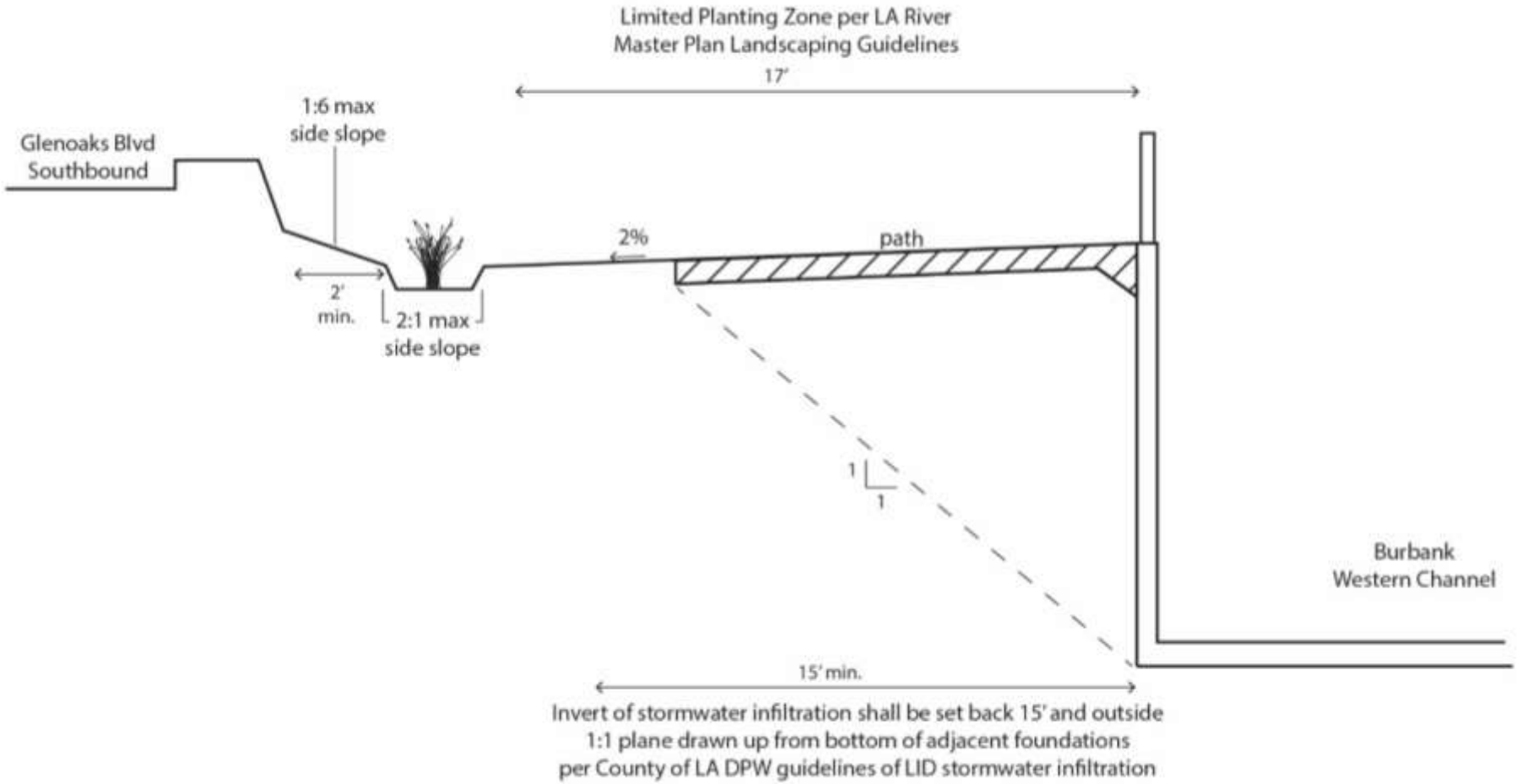

Figure 20. Vegetated swale adjacent to sloped pathway.

3.4.3 Dry wells—high tier

The greatest opportunity for infiltration and treatment of stormwater lies about ten feet below the ground at the project site. The storm drain collection systems that drain the neighborhoods above the Glenoaks Greenway pass underneath Glenoaks Boulevard on the way to the Burbank Western Channel. Intercepting the neighborhood storm drains at the Burbank Western Channel would improve groundwater replenishment in the San Fernando Valley Groundwater Basin.

Dry wells are an option for infiltrating most project area flows into the groundwater basin as well as capturing and dissipating some storm flows. Figure 21 below shows two options for intercepting the storm drains. Option 1 includes installing a junction box on the existing storm drains to avoid any modifications of the Burbank Western Channel. Trenching and shoring would be required during construction. Design of the junction box would require screening of trash and debris to minimize maintenance of the dry wells but maximize flows diverted to the dry wells to increase the groundwater infiltration potential. Option 2 includes a screened intake in the Burbank Western Channel, which could be constructed with minimal trenching and shoring but require modifications to the flood control channel. Option 2 has the potential to capture flows from both the neighborhood storm drain system and the Burbank Western Channel, increasing the potential for groundwater infiltration at the site. Both options would not decrease the capacity of the storm drain systems and would provide some dissipation of flows during storm events. Both options would also utilize a primary settling tank, which would be cleaned via manhole, to prevent sediment and debris from clogging the infiltration tank.

All dry wells will need to discharge at least 15 feet away from the Burbank Western Channel to meet LACDPW Guidelines for Low Impact Development Stormwater Infiltration require that infiltration not occur within 15 feet of foundations (LACDPW 2014), so all dry wells will need to discharge outside of that zone. Dry wells are typically designed for deep infiltration. Meeting these requirements will not increase the cost of the dry wells significantly. However, LACFCD will need to be consulted early in the design phase to confirm infiltration requirements in the vicinity of the flood control channel and to properly site the dry wells. Dry wells require geotechnical investigations to determine the depth to well-draining soils and are designed to infiltrate at that depth. Due to the alluvial soils of the project site, it is likely the subsurface will be sandy, well-draining soils. Historically, highest groundwater levels, according to a California Department of Conservation's Seismic Hazard Zone Report, show a historically high depth to groundwater of 90 feet (CADOC 1998). LACDPW historic well measurement data for Well ID 4969B, roughly 1,200 feet downstream of Cohasset Street, shows a depth to groundwater closer to 200 feet over the past 40 years, safely above the 10 feet required by the LACDPW infiltration guidelines (LACDPW 2014).

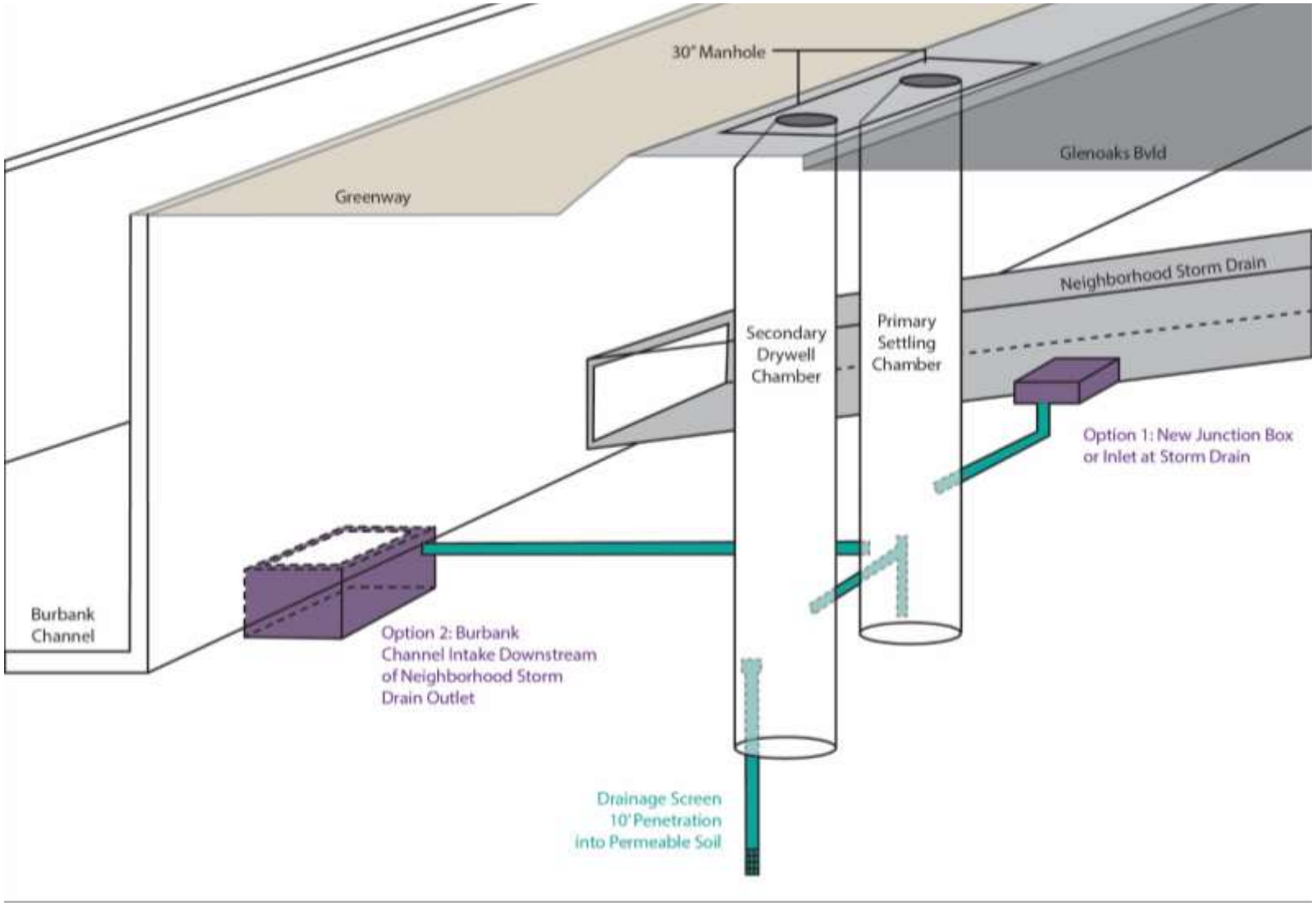

Figure 21. Dry well concept design for intercept of neighborhood storm drain system.

Nearby dry well projects have shown great success at reducing flooding and providing recharge of the groundwater basin. The Glenoaks-Sunland Stormwater Capture project, only 0.75 miles north on Glenoaks Boulevard, was called the most cost-effective Prop O-funded project by Mark Gold, Prop O Citizens Oversight Advisory Committee and can serve as a comparison for dry wells at the Glenoaks Greenway. That project drains a 300-acre area with an estimated annual runoff volume of 275 acre-ft/year into 4 dry wells, although more than 4 drywells would be required to capture all annual runoff. The major neighborhood storm drain systems that pass under the Glenoaks Greenway drain a total of 736 acres with an estimated annual runoff volume of 496 acre-ft/year. The storm drains with the greatest potential for stormwater capture are Chandler Canyon Channel (248 acres and 136 acre-ft/year), Cabrini Drive (138 acres and 96 acre-ft/year), Hollywood Way (131 acres and 80 acre-ft/year), and Lanark Street (86 acres and 68 acre-ft/year). See Figure 22 for a delineation of each storm drains drainage area. Installing a dry well intake in the Burbank Western Channel, as shown in Option 2 on Figure 21, has the potential to capture stormwater from these neighborhood storm drains as well as all of the storm drain systems upstream of the project area that discharge to the channel.

Figure 22. Drainage areas of large neighborhood storm drain systems at Glenoaks Greenway.

3.4.4 Naturalization of the channel

Restoring the Burbank Western Channel to natural conditions would be the most expensive option but also most effective option for infiltration of groundwater, water quality improvements, and creating diverse native planting opportunities.

Information received from LACFCD show two different design flows for the channel. In order to maintain the design flows and flood elevations of the existing rectangular concrete channel in a trapezoidal natural-bottom channel, the channel top width would need to double from approximately 30 feet to 60 feet. Considering the Greenway is less than 30 feet wide in many places, land on the west bank would need to be used to accommodate the expansion. This leaves essentially no room for maintenance vehicle paths, which must be maintained on both sides of the channel. Existing bridges at Hollywood Way and Lanark Streets would need to be modified in order to accommodate the wider flood control channel. Additionally, the transition from a trapezoidal natural-bottom channel back into a rectangular concrete channel at the downstream end of the project area would cause energy losses and increase flood levels. These modifications to bridges, the channel, and overbank would only be sufficient to meet the Burbank Western Channel's original design criteria. The documents outlining the original design criteria are both over 50 years old and the characteristics of the Burbank Western Channel drainage area have changed significantly since then. Based on LACFCD data and personal communication, the existing channel may be undersized--no longer meeting the carrying capacity of its original design storm.

Without additional land on both sides of the channel and modifications to existing roadways and bridges to accommodate the necessary widening of the channel, naturalization of the channel is not feasible at this time.

3.5 Planting Plan

The Glenoaks Greenway is situated along the historical Burbank Wash adjacent to the Verdugo Mountains (Section 2.2.2). In order to support local wildlife and to connect the Greenway to the Verdugo Mountains and the historical habitat, the conceptual planting design includes native southern California species of trees, shrubs, and herbaceous plants. The use of native vegetation in the Glenoaks Greenway is intended to revitalize the native bird and insect population. Species have been selected for the planting palettes to promote pollinators, provide elongated blooming periods, and support local bird populations. This habitat restoration will provide an educational opportunity to promote ecological awareness and preservation. Across the design tiers, the planting palettes incorporate increased species diversity from the low tier design to the high tier design. Figure 23 illustrates the Glenoaks Greenway Planting Plan conceptual design and species diversity.

The Glenoaks Greenway has been divided into three sections to provide variation in the planting palettes and design: 1) the wide area at the Roscoe Blvd Greenway entrance, 2) the bioswales, and 3) the path shoulder (Figures 10–12). Each of these areas have unique attributes as reflected in the planting plans and species selection. The entrance at Roscoe Blvd provides a wider space than the majority of the site, which expands the area outside the Limited Planting Zone allowing for additional trees and large shrubs. The bioswales will provide a slightly longer hydroperiod, increase species diversity, and potentially enhance groundwater replenishment. The path shoulder, which runs the length of the site, will support native drought tolerant species to provide greenery, wildlife habitat, and educational opportunities.

Species in the planting palettes have been chosen based on the following criteria: Drought tolerance, hardiness (e.g., ability to withstand pedestrian traffic), variation in color, texture, and bloom time, maintenance requirements, pollinator and bird habitat, and locally native sources. The planting plans are designed with the explicit intention to thrive without maintenance after the

initial 3-year establishment period; maintenance is expected to be limited to weeding and occasional trimming of overgrowth. To facilitate desired maintenance goals, it is recommended that grass plantings are clustered within each planting zone (and in the path shoulder planting area, planted adjacent to the path). Irrigation during the establishment period is recommended and incorporated into the cost. The low tier planting palette for the path shoulder includes locally native plant species common to chaparral habitat, such as chamise, coastal sagebrush, sugar bush, various sage species, coast live oak, laurel sumac, California buckwheat, bush sunflower, purple needlegrass, and California poppy (Table 5). This tier also incorporates a diversity of bloom times to support pollinators and birds throughout the year. The additional planting palettes build off of this low tier path shoulder palette adding species diversity depending on tier and location (e.g., the bioswales include sticky monkeyflower and hummingbird sage, the entranceway includes ceanothus, lupine, bush mallow, and larkspur; see Table 5). The species will need to be obtained from local (preferably within the watershed), drought tolerant stock and seed sources to ensure survival in the Greenway. Although many of the species selected are naturally resistant to deer herbivory (Table 5), the use of protective measures (e.g., caging) is recommended when plants are young. Once established, the native grasses as well as several other species included in the planting palettes can provide a seed source for other LA River projects in the area. Planting palettes and species densities are provided for each area within each tier in Appendix A.

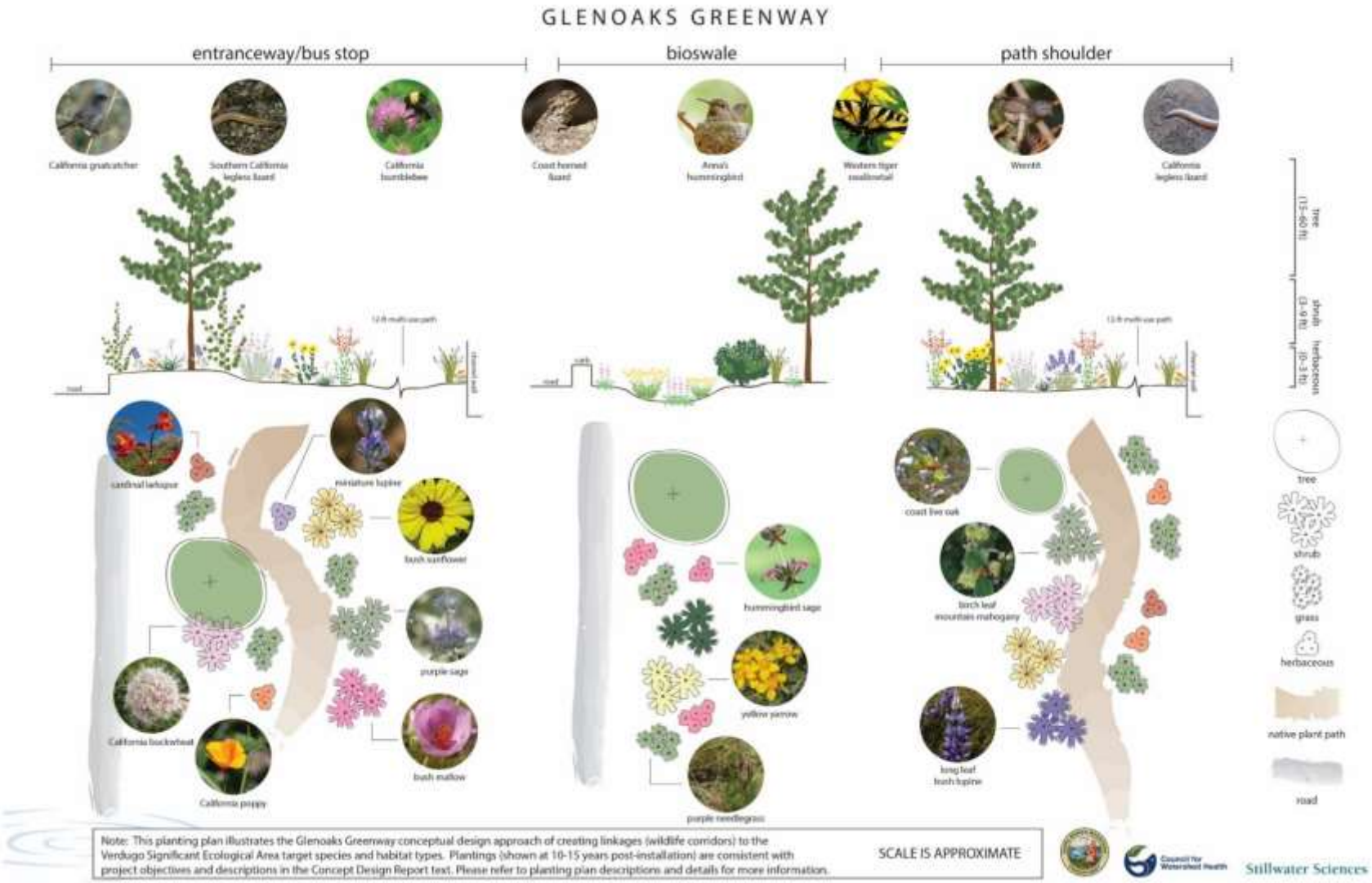

Figure 23. Glenoaks Greenway conceptual planting plan.

Table 5. Proposed plant palettes across planting areas and planting tiers.

Scientific name	Common name	Entrance (low)	Entrance (mid)	Entrance (high)	Bioswale (low)	Bioswale (mid)	Bioswale (high)	Path shoulder (low)	Path shoulder (mid)	Path shoulder (high)	Deer Resistance?
Trees and shrubs											
Adenostoma fasciculatum var. *fasciculatum*	chamise							x	x	x	some
Artemisia californica	coastal sagebrush			x				x	x	x	some
Berberis nevinii	Nevin's barberry			x							yes
Ceanothus crassifolius var. *crassifolius*	hoaryleaf ceanothus									x	yes
Ceanothus leucodermis	chaparral whitethorn			x						x	yes
Ceanothus oliganthus var. *oliganthus*	hairy ceanothus			x						x	no
Cercocarpus betuloides var. *betuloides*	birch-leaf mountain mahogany				x	x	x				some
Dendromecon rigida	bush poppy			x						x	some
Encelia californica	bush sunflower, California brittlebush	x	x	x				x	x	x	yes
Eriodictyon trichocalyx var. *trichocalyx*	Hairy yerba santa			x						x	yes
Eriogonum fasciculatum	California buckwheat	x	x	x				x	x	x	yes
Eriophyllum confertiflorum	yellow yarrow					x	x				some
Heteromeles arbutifolia	toyon					x	x				no
Lupinus longifolius	long leaf bush lupine		x	x						x	some

Scientific name	Common name	Entrance (low)	Entrance (mid)	Entrance (high)	Bioswale (low)	Bioswale (mid)	Bioswale (high)	Path shoulder (low)	Path shoulder (mid)	Path shoulder (high)	Deer Resistance?
Malacothamnus fasciculatus var. *fasciculatus*	bush mallow	x	x	x						x	yes
Malosma laurina	laurel sumac							x	x	x	no
Mimulus aurantiacus var. *pubescens*	sticky monkeyflower						x				yes
Quercus agrifolia var. *agrifolia*	coast live oak	x	x	x	x	x	x	x	x	x	yes
Quercus durata var. *gabrielensis*	San Gabriel oak		x	x					x	x	yes
Rhamnus crocea	spiny redberry						x				yes
Rhus ovata	sugar bush	x	x	x				x	x	x	yes
Salvia apiana	white sage	x	x	x				x	x	x	yes
Salvia leucophylla	purple sage	x	x	x				x	x	x	yes
Salvia mellifera	black sage		x	x					x	x	yes
Subshrubs and Perennials											
Acmispon glaber	deerweed							x	x	x	no
Corethrogyne filaginifolia	common sandaster						x				yes
Delphinium cardinale	cardinal or scarlet larkspur		x	x					x	x	yes
Epilobium canum subsp. *canum*	California fuschia					x	x				yes
Salvia spathacea	California hummingbird sage				x	x	x				yes

Scientific name	Common name	Entrance (low)	Entrance (mid)	Entrance (high)	Bioswale (low)	Bioswale (mid)	Bioswale (high)	Path shoulder (low)	Path shoulder (mid)	Path shoulder (high)	Deer Resistance?
Graminoids											
Bothriochloa barbinodis	cane bluegrass										no
Muhlenbergia rigens	deer grass				x	x	x				yes
Poa secunda ssp. *secunda*	one-sided blue grass	x	x	x	x	x	x	x	x	x	no
Stipa cernua	nodding needle grass			x						x	yes
Stipa coronata	crested needle grass						x				yes
Stipa lepida	foothill needlegrass		x	x					x	x	yes
Stipa pulchra	purple needlegrass	x	x	x	x	x	x	x	x	x	yes
Stipa speciosa	desert needlegrass					x	x				yes
Annuals (or sometimes perennials)											
Camissoniopsis bistorta	California sun cup			x							unknown
Clarkia unguiculata	woodland clarkia		x	x		x	x				unknown
Eschscholzia californica	California poppy	x	x	x				x	x	x	yes
Lupinus bicolor	miniature lupine	x	x	x				x	x	x	unknown
Phacelia minor	wild canterbury bells			x						x	unknown
Phacelia tanacetifolia	lacy phacelia									x	yes
Salvia columbariae	chia			x						x	yes
Total species		**11**	**17**	**27**	**6**	**11**	**15**	**14**	**18**	**29**	

3.6 Interpretive and Educational Signage

The Glenoaks Greenway provides wonderful opportunities for educational and interpretive opportunities. Interpretive and educational signage can be used to share information about history, wildlife and native plants, and greenspace initiatives and infrastructure along the Glenoaks Greenway. Ideas for historical topics, (possibly in the form of a historical timeline), include native peoples and cultures of the Verdugo Mountains area as highlighted in the text box below, Rancho San Rafael land grant and early white settlers, and industrialization of the area.

*The **Verdugo Mountains** were part of the indigenous Tongva people's homelands for over 7,000 years, with villages at some springs in the canyons (Gumprecht, 1999). The Verdugo Mountains were named for Jose Maria Verdugo, holder of the Rancho San Rafael land grant, which covered the mountains during California's Spanish and Mexican periods. On October 20, 1784 Pedro Fages, the military governor of Alta California, granted Jose Maria Verdugo permission to use the rancho, known officially by the name San Rafael but informally called "La Zanja" by Verdugo. The rancho's boundaries were primarily defined by the Verdugo Mountains, the Arroyo Seco and the Los Angeles River, with the boundary following north along the east bank of the river and wrapping westerly around Griffith Park to a point near the Travel Town Museum in the park (Kielbasa, 1998).*

Educational information on the native wildlife and plants could include signs and informative art work along the Greenway. Signs with photos or illustrations of native plants and animals could demonstrate and explain the historical wild landscape. Paw prints of native wildlife could be incorporated into the pavement around the signs to display various native species tracks. Special status species and species that may use the Glenoaks Greenway, as listed in Table 3, could be highlighted. A short meandering path could be installed at the entrance planting zone near Roscoe Blvd with botanical plaques along the path to indicate individual native plant species and their wildlife associations.

To emphasize the context in which the Glenoaks Greenway is being constructed, educational information regarding Santa Monica Mountains Conservancy open space acquisitions, *Common Ground*, LA county greenspace collaborations, and other green spaces in the vicinity is suggested. An educational sign could include a map of the surrounding area with sidewalks and paths heighted that lead to the Verdugo Mountains Open Space Preserve hiking trails off of Lannark Road to the east and to De Garmo Park to the west. Additionally, explanations and diagrams of the bioswales, dry wells, and solar powered lighting could highlight the green infrastructure initiatives along the Greenway itself.

The content, placement, and quantity of signs and interactive education opportunities will depend on the other Glenoaks Greenway components, as well as budget available. Local artist contributions could enhance the displays. The Council for Watershed Health will collaborate with project partners and community resources, such as Woodbury University or Glenwood Elementary, to implement community engagement activities.

3.7 Public Art and Murals

The Glenoaks Greenway provides an excellent opportunity for the community to engage in the creation of public art and murals to improve visual aesthetics and to create a sense of place. The Council for Watershed Health would like to invite local artists from the community to be a part of the planning, design, and implementation of public art and murals for the project. Public art can

be integrated into the entryways, fencing, signage, rock formations, and pathways. Murals can be incorporated into the underpass structures to create visual interest. Using graffiti resistant tiles to create murals will reduce maintenance activities and cost over the long-term. Creative ideas for financing public art and murals include art competitions, grant-funded art and community beautification projects, local school and university projects, and integrated education, art, and greenway multi-benefit grants. Repurposed materials that highlight the history, industry, and culture of the area can be incorporated into these designs. Public art examples of steelhead sculptures and mural art are shown in Figures 24 and 25.

Figure 24. Example of steelhead public art pieces (Source: Public domain).

Figure 25. Sculptures and murals along the Prince Memorial Greenway, Santa Rosa, CA by Mario Uribe and Artstart, Diane Szezepenski and the California Mosaic Mural Project, and Fred Vedder (Creative Sonoma 2017).

4 REGULATORY REQUIREMENTS

This section describes expected regulatory requirements including environmental review, permitting, and other agency consultation required for project implementation.

4.1 Environmental Review

Based on review of the project description and design options in relation to CEQA requirements, a Mitigated Negative Declaration (MND) is the most likely CEQA document required for the project. The typical MND process is estimated to take six to eight months to prepare, incorporate public review comments, and receive approval.

4.2 Permits

Anticipated permits include, but are not limited to the following:

- Construction General Permit issued by the State Water Resources Control Board;
- (SWRCB) which includes a Storm Water Pollution Prevention Plan (SWPPP);
- Traffic Control Plan;
- Encroachment Permit (County of Los Angeles);
- Erosion Control Plan; and
- Access Plan.

4.3 Other Agency Consultation

Consultations will occur with the following agencies to determine jurisdictions over onsite project drainage and other features such as native habitat creation, operations, and maintenance and project-related activities:

- LA County Department of Public Works – Flood Management Division (LACDPW)
- City of Los Angeles – Bureau of Sanitation and Bureau of Engineering (LA BOE)
- California Department of Fish and Wildlife (CDFW)
- United States Army Corps of Engineers (USACE)
- Regional Water Quality Control Board (RWQCB)
- County of Los Angeles
- U.S. Fish and Wildlife Service (USFWS).

5 PRELIMINARY COSTS

5.1 Conceptual Design Cost Estimate

Cost estimates for the conceptual design features discussed in Section 3 are shown in Table 6 below. Cost figures are rough-order-of-magnitude estimates based on sources including City of Los Angeles Prop O project construction cost estimates, prior construction projects, bikeway concept designs and studies, values reported in news articles regarding experimental pavers, and quotes received from vendors. Unit costs are not raw material costs and include mobilization and installation. Design and permitting fees were added to cover engineering fees for design of green infrastructure (the dry well diversion structure requiring the greatest design fee), and CEQA/permitting costs. The green-shaded cells were selected to populate the “Best Value Hybrid” column in Table 6.

Table 6. Glenoaks Greenway design concept cost estimate (rough order of magnitude costs for planning purposes).

Budget category	Unit	Unit price (low)	Unit price (med)	Unit price (high)	Quantity (low)	Quantity (med)	Quantity (high)	Item total (low)	Item total (med)	Item total (high)	Best value hybrid
Path											
Trail Prep	LS	$20,000	$20,000	$28,000	1	1	1	$20,000	$20,000	$28,000	$20,000
Fill/Excavation for Trail	CY	$8	$8	$8	-	6,000	7,800	$-	$48,000	$62,400	$48,000
Paving	SF	$2	$3	$8	86,803	86,803	120,471	$130,205	$260,410	$963,770	$260,410
Artistic Paving	SF	$17	$17	$17	-	-	2,500	$-	$-	$42,500	$42,500
Bollard	EA	$500	$750	$1,000	6	6	6	$3,000	$4,500	$6,000	$3,000
Crosswalk Enhancement	EA	$1,000	$1,000	$1,000	5	5	5	$5,000	$5,000	$5,000	$5,000
Safety Signing/Striping	LS	$13,000	$13,000	$13,000	1	1	1	$13,000	$13,000	$13,000	$13,000
Raised Crosswalk	EA	$7,000	$7,000	$7,000	-	-	1	$-	$-	$7,000	$7,000
Amenities											
Lighting	EA	$3,000	$5,000	$7,500	30	30	30	$90,000	$150,000	$225,000	$90,000
Shaded Bus Stops	EA	$5,000	$7,000	$15,000	-	4	4	$-	$28,000	$60,000	$28,000
Wifi Hot Spot	EA	$1,500	$1,500	$1,500	-	1	2	$-	$1,500	$3,000	$1,500
Fence	LF	$30	$60	$120	7,234	7,234	7,234	$217,008	$434,016	$868,032	$434,016
Artwork/Educational Signs	EA	$7,000	$10,000	$15,000	-	2	5	$-	$20,000	$75,000	$20,000
Green infrastructure											
Soil Testing	EA	$1,500	$1,500	$1,500	4	4	10	$6,000	$6,000	$15,000	$15,000
Curb Bioswale	EA	$20,000	$20,000	$20,000	4	4	4	$80,000	$80,000	$80,000	$80,000
Pathway Vegetated Swale	LF	$35	$35	$35	-	5,534	5,534	$-	$193,676	$193,676	$193,676
Dry Well	EA	$40,000	$40,000	$40,000	-	-	6	$-	$-	$240,000	$240,000
Dry Well Diversion Structure	EA	$60,000	$60,000	$60,000	-	-	6	$-	$-	$360,000	$360,000
Plantings											
Plantings	LS	$20,000	$23,000	$26,000	1	1	1	$20,000	$23,000	$26,000	$26,000
Landscaping	LS	$20,000	$25,000	$30,000	1	1	1	$20,000	$25,000	$30,000	$30,000
Irrigation	LS	$25,000	$25,000	$25,000	1	1	1	$25,000	$25,000	$25,000	$25,000
Subtotal 1								**$629,213**	**$1,337,102**	**$3,328,378**	**$1,942,102**
Design and Permitting Fees		5%	5%	7%				$31,461	$66,855	$232,986	$135,947
Subtotal 2								**$660,673**	**$1,403,957**	**$3,561,364**	**$2,078,049**
Contingency		10%	10%	10%				$66,067	$140,396	$356,136	$207,805
Total								**$726,741**	**$1,544,352**	**$3,917,500**	**$2,285,854**

LS = Lump Sum, CY = Cubic Yard, SF = Square feet, Ea = Each, LF = Linear Feet The green-shaded cells were selected to populate the "Best Value Hybrid" column.

5.2 Operation and Maintenance

Native plantings have been selected based on a thorough review of plant ecology and watershed context as discussed in the habitat and planting palette section of this document. A plant establishment period is planned for the first 3 years. Monitoring plant health and succession would be forecasted in subsequent planning project phases. Plantings are expected to be self-sustaining with little to no maintenance needed past the 3-year plant establishment period.

Bioswale and vegetated swale maintenance would involve annual inspection to evaluate sediment build up and function of the bioswale. Periodic clearing of debris from inlets and swales could be performed as part of overall Greenway maintenance and upkeep.

Maintenance for dry wells involves annual cleanouts with vacuum trucks. Maintenance on all dry wells could be performed in one day by a single truck.

The landscaping irrigation system will require periodic maintenance to see if the sensors and infrastructure are in working condition. It is essential that the vegetation in the vegetated swales be maintained as needed and periodically cleared of trash and plant debris to prevent clogging of the vegetated channels.

Permeable asphalt manufacturers recommend that the surface be vacuumed at least 2 times per year, on six-month intervals, to lift any silt or debris from the surface. This process will prevent clogging of the pervious system. Frequency may be increased due to overhanging vegetation and or excessive dirt & pollutants, which may wash into or over & foul the surface of the pervious system. Power washing is also recommended on an annual basis, but not limited to annually, in order to flush silt or other contaminants, which is essential to maintaining the permeability of the system. It has been determined that these fines cause little to no threat to the system when washed into the lower and larger aggregate.

6 COST BENEFIT EVALUATION

6.1 Cost Benefit Evaluation

In order to provide a Cost Benefit evaluation of the Glenoaks Greenway project, a cost/benefit matrix is provided in Table 7. The cost/benefit matrix summarizes the annual dollar values calculated for each benefit category (refer to Table 6 for more cost details), dividing the benefits into six common categories for use in the analysis: stormwater pollutant removal, water reuse, habitat, and recreation benefits. The approach used to quantify each benefit is describe in greater detail below.

Table 7. Glenoaks Greenway cost/benefit matrix.

Category	Description	Cost*	Benefit
Stormwater Pollutant Removal	Reduces regional treatment costs and improves quality of receiving waters	$523,000**	Refer to Table 8 for pollutant removal benefits
Water Reuse	Replenish groundwater reserves and displace imported water costs	$523,000**	$14,500 annually
Recreation	Reduced health care costs associated with increased physical activity	$2,777,000	$955,500 annually

Category	Description	Cost*	Benefit
Habitat	Wildlife preservation, viewing, and habitat for multiple species	$196,000	$123,400 annually
Property Values	1% increase in property value of homes surrounding the greenway	$3,918,000***	$2,684,000 one-time
Total		$3,918,000	$2,684,000 one-time plus $1,093,400 annually

* Cost values taken from High Tier design of Table 6 and rounded to the nearest $1,000
** Green infrastructure cost split between pollutant removal and reuse categories
*** Total estimated constructed cost of High Tier design including fees and contingency

6.1.1 Stormwater pollutant removal

The storm drain systems that pass under the Glenoaks Greenway contribute runoff from a 786-acre sub basin of the Burbank Western Channel. As stated in Table 8, stormwater pollutant removal benefits are expected as a result of the Glenoaks Greenway. BMPs including native drought tolerant plantings, vegetated swales, porous pavement, smart irrigation (during plant establishment period), and dry wells. These BMPs will reduce total suspended solids, pathogens, phosphorous, nitrogen, heavy metals entering the Burbank Channel. Dry wells will replenish groundwater and combined with other BMPs will serve to reduce sediment loads and absorbed pollutants to the Los Angeles River resulting in water quality benefits.

Table 8. Proposed BMPs and the expected benefits.

BMP activity	Applicability	Expected benefit
Porous Pavement	Reduces TSS by 65–100%; reduces pathogens by 65–100%, reduces total phosphorous by 30–65%, reduces nitrogen by 65-100%; reduces heavy metals 65–100%	Reduce polluted runoff; reduce stormwater runoff
Vegetated Swales*	Reduces TSS by 30–80%; reduces nitrogen by 15–80%; reduces total phosphorous by 15–80%; reduces heavy metals 15–80%	Reduce sediment loads and absorbed pollutants to the Los Angeles River; fix pollutants through root uptake; improve water quality
"Smart" Irrigation System	Reduces water usage; reduces runoff	Lower water demand; reduce polluted runoff
Native plantings/drought tolerant landscaping	Reduces water demand; reduces runoff	Lower water demand, reduce polluted runoff
Trash Screen Inserts in storm drains (possibly Full Capture Device) *or:* Continuous Deflection Separators (CDS) Units	Captures over 90% of trash Reduces floatables by 100%, reduces TSS by 80%, reduces oil and grease by 80-90% reduces phosphorous by 15–80%, reduces heavy metals by 15–80%	Reduce trash to the Los Angeles River as well as other pollutants of concern
Dry Wells		Replenish groundwater; Reduce sediment loads and absorbed pollutants to the Los Angeles River; improve water quality

TSS = total suspended solids.
* Actual pollutant removal percentages vary depending on design of BMP and vegetation planted.
Sources: EPA, 1999; EPA, 1993; CWP, 2000.

6.1.2 Water reuse

The amount of water dry wells can capture from any storm depends on the duration and intensity of the storms. Dry wells infiltrate groundwater at a consistent rate, roughly 0.3 cubic feet per second or 1,080 cubic feet of water per hour per dry well specifications provided by Torrent Resources, with roughly 500 cubic feet of additional volume storage in the column of the dry well. If a storm is of short duration and high intensity, the dry well fills to capacity early in the storm and, as the water in the dry well takes time to infiltrate, most of the storm could bypass the dry well. A storm with the same total rainfall spread out over a longer duration would have a similar rate of infiltration by the dry wells, but over a longer period of time. This makes it difficult to accurately predict the total volume of groundwater dry wells will infiltrate in any year. As storm durations and intensities vary, so does the total volume infiltrated.

Two comparable dry well projects were used to estimate annual groundwater infiltration. Estimates for the Glenoaks-Sunland Stormwater Capture project determined that 5 dry wells would provide 28.6 acre-ft of recharge in a year from a 300-acre watershed, or 5.72 acre-ft per dry well per year. Another project, the Sun Valley Economic Development Administration Public Improvements Project, estimated that 46 drywells would provide 93 acre-ft of recharge in a year from a 146-acre watershed, or 2.02 acre-ft per dry well per year (LADWP 2016). Using an average of these two estimates results in about 4 acre-ft per dry well per year. Based on that estimate, 6 dry wells at the Glenoaks Greenway would recharge roughly 24 acre-ft per year. LADWP values groundwater infiltration at $666 per acre-ft based on the unit cost of untreated, Tier 1 imported water from the Metropolitan Water District (Metropolitan Water District 2016). At that rate, the annual value of groundwater recharge at the Glenoaks Greenway would be $14,500. Untreated Tier 1 imported water rates increase each year and therefore so would the value of dry wells at the Glenoaks Greenway. Upstream storage and additional dry wells in sequence at the larger storm drains could also increase groundwater infiltration. Thus, this estimate is almost certainly conservative over time.

6.1.3 Recreation

Based on site reconnaissance of the existing maintenance road right-of-way usage, a conservative average usership of six users per hour for five hours per day was assumed, or 210 users per week and 10,920 users per year. Some of those users will be repeat users. If a quarter of the annual users are unique users, then a total of 2,730 unique users would be expected annually.

Annual health benefits for people who exercise are estimated to range from $351 annually on average to $702 for seniors when compared to those who do not exercise (Crompton 2011). With 2,730 unique annual users the value of annual health benefits, at $350 per person, would be $955,500.

6.1.4 Habitat

As an extended habitat corridor of the Verdugo Significant Ecological Area, the Glenoaks Greenway will provide wildlife viewing and increased multi-species ecosystem benefits. The habitat corridor will also provide interpretive opportunities to learn about native wildlife and habitat. The Glenoaks Greenway is essentially a 5-acre linear natural park. Based on similar park-related valuation studies, the Glenoaks Greenway is estimated to provide a total annual economic value of $90,441, in 2006 dollars (Loomis and Richardson 2008), or $111,642 in 2017 (bls.gov). Wildlife viewing is estimated to provide an additional $26 per day in 2006 dollars based on

analysis of consumer surplus, also known as net willingness to pay (Loomis and Richardson 2008), or $11,714 annually in 2017 dollars.

6.1.5 Property values

Open space and park land has also been shown to increase property values adjacent to and near parkland (Crompton 2011, Kroeger 2008, Sherer 2006). For purposes of this report, a cursory research query was conducted to document references and metrics used to evaluate increases in property value that could be anticipated from the Glenoaks Greenway project. An analysis of Houston's Bayou Greenway network estimated, conservatively, a 5% increase in residential property values within 600 ft of greenways (Crompton 2011). Another study of a greenbelt in Boulder, Colorado showed that the average value of homes next to the greenbelt were 32 percent higher than properties 3,200 feet away (Sherer 2006). A University of Southern California study determined that an 11-percent increase in the amount of green space within 200 to 500 feet from a house leads to a roughly 1.5-percent increase in the expected sales price (Pincetl et al. 2003).

According to the real estate database company Zillow, the 2017 median value for homes in Sun Valley, CA is $488,000. Using the City of Los Angeles Department of City Planning Zone Information and Map Access System (ZIMAS), there are roughly 550 parcels within 600 feet of the Glenoaks Greenway. Using a conservative 1-percent increase in property value, a house worth $488,000 would increase in value by $4,880 as a result of the Glenoaks Greenway. If 550 properties were affected, the total benefit of the Glenoaks Greenway based on increased property value would be $2,684,000. This number does not include additional property tax revenue from an increase in property values.

6.1.6 Benefits summary

There are a variety of benefits that would likely result from the Glenoaks Greenway project, most notably, health-related benefits to the neighborhood and local community. Other expected benefits of the Glenoaks Greenway project include increased bicycle use and decreased traffic congestion, water quality improvements, increased access within the communities, improved cyclist and pedestrian safety, community education on native species and history, as well as enhanced community pride. Quantifiable benefits include $14,465 for groundwater recharge, $955,500 in health cost savings, and $123,356 for wildlife viewing and habitat, in addition to stormwater pollutant removal benefits, or $1,093,321 in total per year. Conservatively, an additional one time 1-percent increase in property values (an approximately one-time $2,684,000 increase in cumulative property values surrounding the Glenoaks Greenway) can be attributed to the Glenoaks Greenway. As more linkages and connections to future bike networks along the Burbank Western Channel, LA River, and San Fernando Valley are constructed, Glenoaks Greenway usage is expected to increase, providing additional health benefits and reduced traffic congestion, in perpetuity.

6.2 Glenoaks Greenway Funding Opportunities

6.2.1 Other funding sources

The Council for Watershed Health has potential funding for the fence component. Other potential sources of funding include Santa Monica Mountains Conservancy grant funding as well as other state grant funding programs. Local funding may potentially be sought through the City of Los Angeles, County of Los Angeles, and/or other interested parties. Because of the multiple benefits

associated with the Glenoaks Greenway, the project is expected to be highly competitive in multiple grant programs such as groundwater replenishment, water reuse, habitat enhancement, recreation, open space, and water quality improvements regionally and statewide.

6.2.2 Potential sources of revenue

While there is no potential for additional revenues as a result of this project, this project would result in improved facilities for both neighboring communities, schools, and the Woodbury University population. In addition, solar lighting will utilize renewable energy sources. Interpretive signage, native planting, and public art will educate visitors regarding the benefits of green infastructure projects to capture, clean, and infiltratate stormwater, the habitat that native plants provide, the water saved by native and climate appropriate plants, and their connection to the natural, cultural, and historic resources in the watershed.

7 RECOMMENDATIONS

The following recommendations will reduce costs and delays, producing greater project efficiency:

- Coordinate with LACDPW, City of LA, California Department of Fish and Wildlife, US Army Corps of Engineers (USACE), US Fish and Wildlife Service, and the RWQCB at an early stage to determine agency jurisdictions;
- Begin CEQA immediately upon funding approval;
- Order topographic site, soils and geotechnical surveys immediately upon funding approval;
- Utilize Glenoaks Greenway GIS mapping created by the Council for Watershed Health to inform future grant opportunities and strengthen grant application submittals;
- Analyze feasibility in terms of costs and operations and maintenance of solar lighting and other amenities;
- Coordinate with the Los Angeles County Flood Control District to develop inter-agency coordination and pre-permitting reviews for alterations to flood maintenance access and any other related project design features;
- Arrange meetings with stakeholders throughout the pre-design and design phases to ensure public input is integrated with water quality, groundwater replenishment, recreation, public art and education, and habitat goals and site development;
- Begin sizing of BMP’s with the pre-design process;
- Arrange a consultation between LADWP and the Cities of Burbank and Los Angeles regarding underlying groundwater rights and pumping credits if geotechnical results indicate that infiltration is feasible.

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Appendices

Appendix A

Planting Palette and Planting Plans

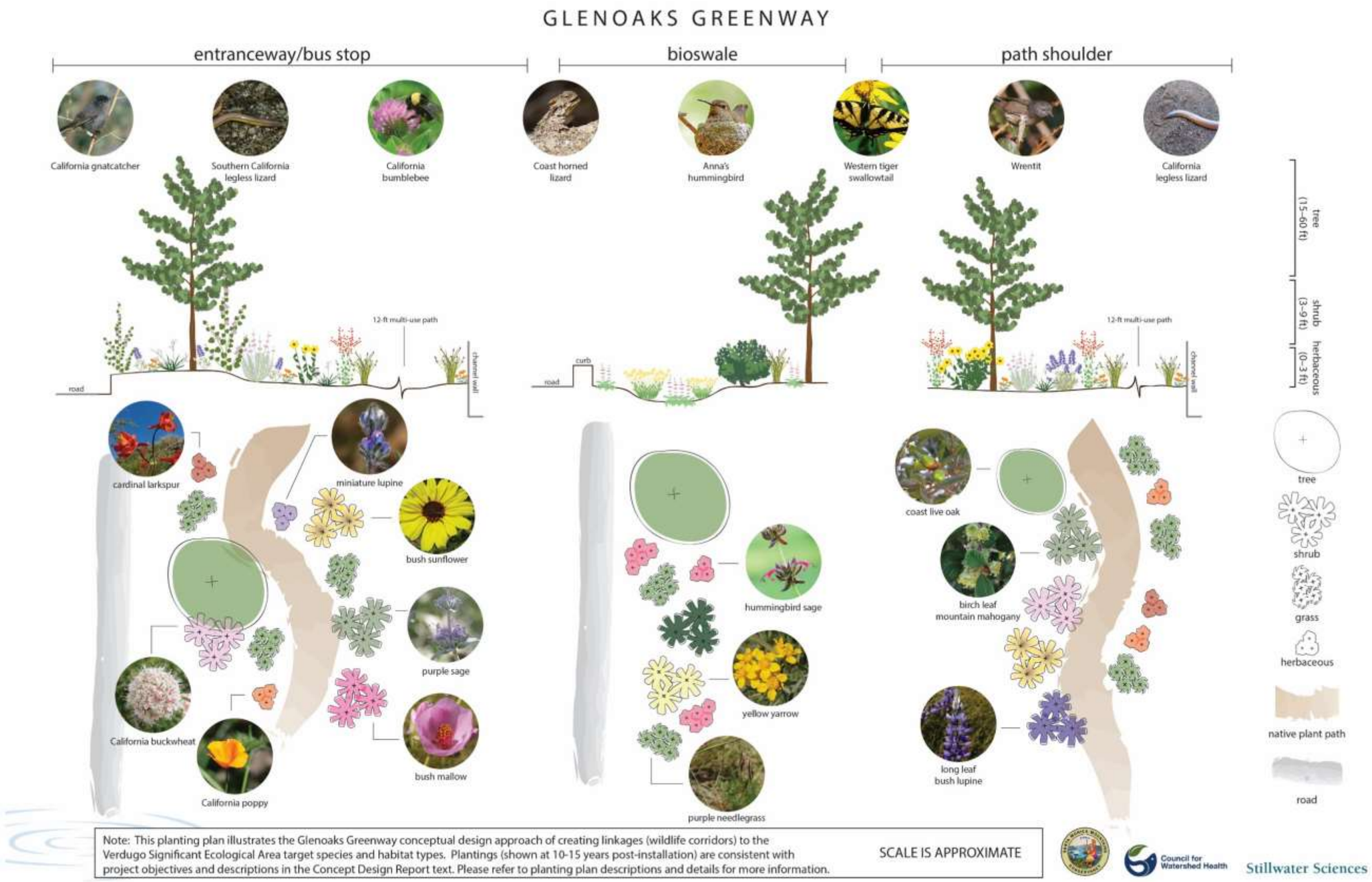

Figure A-1. Planting palette and species diversity.

Table A-1. Planting palette for the low-tier entranceway.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Encelia californica	bush sunflower, California brittlebush	shrub	yes	yes	no	early and mid	yes	yes	yes	Very low, very drought tolerant, no summer water (Very Low)	1–4	3–6	Yes, seeds readily	0.17	3	n/a	2%	17	n/a	n/a
Eriogonum fasciculatum	California buckwheat	shrub	yes	yes	yes	early, mid, and late	yes	yes		Extremely low/very low, very drought tolerant, no summer water (Very Low)	1–3	1–6	Yes, seeds readily	0.17	3	n/a	2%	17	n/a	n/a
Malacothamnus fasciculatus var. *fasciculatus*	bush mallow	shrub	yes	yes	yes	mid-late		yes	yes	Very low, little or no supplemental water, no summer water (Very Low)	3–9	3–9	Yes	0.17	8	n/a	3%	4	n/a	n/a
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30	Yes	0.17	20	n/a	5%	1	n/a	n/a
Rhus ovata	sugar bush	shrub	yes	yes	no	early-mid			yes	Extremely low/very low, drought tolerant, no summer water (Very Low)	4	5	Yes	0.17	8	n/a	1%	1	n/a	n/a
Salvia apiana	white sage	shrub	yes	yes	no	mid-late	yes		yes	Extremely low/very low, no summer water (Very Low)	5	3–8	Yes	0.17	6	n/a	5%	10	n/a	n/a
Salvia leucophylla	purple sage	shrub	yes	yes	yes	mid	yes	yes	yes	Extremely Low/very low, no summer water (Very Low)	3–4.5	3	Yes, seeds readily	0.17	6	n/a	5%	10	n/a	n/a
Graminoids																				
Poa secunda ssp. *secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			0.17	n/a	1	n/a	0.2	0.2	2.8
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	0.17	n/a	6.5	n/a	1.1	1.1	18.0

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Annuals (or sometimes perennials)																				
Eschscholzia californica	California poppy	annual to perennial	yes	yes	yes	early, mid, and late	yes			Very low/low, drought tolerant, no summer water (Very Low)	1.5–3	1.5–3	Yes, seeds readily	0.17	n/a	1.5	n/a	n/a	0.3	4.2
Lupinus bicolor	miniature lupine	annual to perennial	yes	yes	no	mid	yes	yes		Low, no summer water (not listed)	0.6–0.9	0.9–1.5	Yes	0.17	n/a	2.5	n/a	n/a	0.4	6.9
Total trees and shrubs:																		**60**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**1.3**	**20.8**
Total annuals:																		**n/a**	**0.7**	**11.1**
Total container plants:																		**60**	**n/a**	**n/a**

[1] Regional documentation according to The Second Edition of the Jepson Manual (Baldwin et. al. 2012), Calflora Verdugo Mountains and surrounding area plant list (Calflora 2017), and the Shoestring Park Plant List, Durable Plants for Public Landscapes (Mackey 2017).
[2] Flowering seasons are January–March (early), April–June (mid), and July–October (late).
[3] The category of water needs from WUCOLS (Water Use Classification of Landscape Species) is provided in parentheses for each species listed; for detail and definitions, see http://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/.
[4] Potential seed source for other LA River projects.

Table A-2. Planting palette for the mid-tier entranceway.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Encelia californica	bush sunflower, California brittlebush	shrub	yes	yes	no	early and mid	yes	yes	yes	Very low, very drought tolerant, no summer water (Very Low)	1–4	3–6	Yes, seeds readily	0.17	3	n/a	2%	17	n/a	n/a
Eriogonum fasciculatum	California buckwheat	shrub	yes	yes	yes	early, mid, and late	yes	yes		Extremely low/very low, very drought tolerant, no summer water (Very Low)	1–3	1–6	Yes, seeds readily	0.17	3	n/a	2%	17	n/a	n/a
Lupinus longifolius	long leaf bush lupine	shrub	yes	yes	no	mid	yes	yes		Low, drought tolerant, no summer water (not listed)	3–4.5	1.5–4.5	Yes	0.17	3	n/a	2%	17	n/a	n/a
Malacothamnus fasciculatus var. *fasciculatus*	bush mallow	shrub	yes	yes	yes	mid-late		yes	yes	Very low, little or no supplemental water, no summer water (Very Low)	3–9	3–9	Yes	0.17	8	n/a	3%	4	n/a	n/a
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30		0.17	20	n/a	5%	1	n/a	n/a
Quercus durata var. *gabrielensis*	San Gabriel oak	shrub	yes	yes	yes	mid		yes	yes	Drought tolerant, no summer water (Low)	3–9	3–6		0.17	12	n/a	5%	3	n/a	n/a
Rhus ovata	sugar bush	shrub	yes	yes	no	early-mid			yes	Extremely low/very low, drought tolerant, no summer water (Very Low)	4	5	Yes	0.17	8	n/a	1%	1	n/a	n/a
Salvia apiana	white sage	shrub	yes	yes	no	mid-late	yes		yes	Extremely low/very low, no summer water (Very Low)	5	3-8	Yes	0.17	6	n/a	6%	13	n/a	n/a
Salvia leucophylla	purple sage	shrub	yes	yes	yes	mid	yes	yes	yes	Extremely Low/very low, no summer water (Very Low)	3–4.5	3	Yes, seeds readily	0.17	6	n/a	8%	17	n/a	n/a

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Salvia mellifera	black sage	shrub	yes	yes	no	mid	yes		yes	Extremely low/very low, no summer water (Very Low)	3–4.5	3–6	Potential, germination may be low	0.17	6	n/a	6%	13	n/a	n/a
Subshrubs and perennials																				
Delphinium cardinale	cardinal or scarlet larkspur	perennial	yes	yes	no	early-mid			yes	Very low, no summer water (has summer dormancy) (not listed)	1.5–6	0.3–0.6	Yes	0.17	2	n/a	2%	38	n/a	n/a
Graminoids																				
Poa secunda ssp. *Secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			0.17	n/a	1	n/a	0.2	0.2	2.8
Stipa lepida	foothill needlegrass	grass	yes	yes	yes	mid				Very low, no summer water (Very Low)	0.6–1.5	0.3	Yes	0.17	n/a	2	n/a	0.3	0.3	5.5
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	0.17	n/a	5	n/a	0.9	0.9	13.8
Annuals (or sometimes perennials)																				
Eschscholzia californica	California poppy	annual to perennial	yes	yes	yes	early, mid, and late	yes			Very low/low, drought tolerant, no summer water (Very Low)	1.5–3	1.5–3	Yes, seeds readily	0.17	n/a	1.5	n/a	n/a	0.3	4.2
Lupinus bicolor	miniature lupine	annual to perennial	yes	yes	no	mid	yes	yes		Low, no summer water (not listed)	0.6–0.9	0.9–1.5	Yes	0.17	n/a	2.5	n/a	n/a	0.4	6.9
Total trees and shrubs:																		**103**	**n/a**	**n/a**
Total subshrubs and perennials:																		**38**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**1.4**	**22.2**
Total annuals:																		**n/a**	**0.7**	**11.1**
Total container plants:																		**141**	**n/a**	**n/a**

[1] Regional documentation according to The Second Edition of the Jepson Manual (Baldwin et. al. 2012), Calflora Verdugo Mountains and surrounding area plant list (Calflora 2017), and the Shoestring Park Plant List, Durable Plants for Public Landscapes (Mackey 2017).
[2] Flowering seasons are January–March (early), April–June (mid), and July–October (late).
[3] The category of water needs from WUCOLS (Water Use Classification of Landscape Species) is provided in parentheses for each species listed; for detail and definitions, see http://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/.
[4] Potential seed source for other LA River projects.

Table A-3. Planting palette for the high-tier entranceway.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Artemisia californica	coastal sagebrush	shrub	yes	yes	no	late				Extremely low/very low, none, no summer water (Very Low)	3–12	3–6		0.17	12	n/a	3%	2	n/a	n/a
Berberis nevinii	Nevin's barberry	shrub	yes	yes	yes	early-mid			yes	low, drought tolerant, no summer water (Very Low)	3–9	3–8	Yes	0.17	8	n/a	3%	4	n/a	n/a
Ceanothus leucodermis	chaparral whitethorn	shrub	yes	yes	no	mid	yes	yes	yes	Very low, no summer water (Very Low)	6–9	3–6	Yes	0.17	8	n/a	2%	2	n/a	n/a
Ceanothus oliganthus var. *oliganthus*	hairy ceanothus	shrub	yes	yes	no	early and mid	yes	yes	yes	Very low, drought tolerant, no summer water (not listed)	6–12	6–12	Yes	0.17	8	n/a	2%	2	n/a	n/a
Dendromecon rigida	bush poppy	shrub	yes	yes	no	mid				Very low, drought tolerant, no summer water (Very Low)	3–9	3–6	Cuttings better	0.17	6	n/a	2%	4	n/a	n/a
Encelia californica	bush sunflower, California brittlebush	shrub	yes	yes	no	early and mid	yes	yes	yes	Very low, very drought tolerant, no summer water (Very Low)	1–4	3–6	Yes, seeds readily	0.17	3	n/a	1%	8	n/a	n/a
Eriodictyon trichocalyx var. *trichocalyx*	Hairy yerba santa	shrub	yes	yes	yes	mid	yes	yes		Extremely low/very low, drought tolerant, no summer water (Very Low)	1–6	3–6	Yes	0.17	3	n/a	1%	8	n/a	n/a
Eriogonum fasciculatum	California buckwheat	shrub	yes	yes	yes	early, mid, and late	yes	yes		Extremely low/very low, very drought tolerant, no summer water (Very Low)	1–3	1–6	Yes, seeds readily	0.17	3	n/a	1%	8	n/a	n/a
Lupinus longifolius	long leaf bush lupine	shrub	yes	yes	no	mid	yes	yes		Low, drought tolerant, no summer water (not listed)	3–4.5	1.5–4.5	Yes	0.17	3	n/a	1%	8	n/a	n/a
Malacothamnus fasciculatus var. *fasciculatus*	bush mallow	shrub	yes	yes	yes	mid-late		yes	yes	Very low, little or no supplemental water, no summer water (Very Low)	3–9	3–9	Yes	0.17	8	n/a	2%	2	n/a	n/a

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30		0.17	20	n/a	5%	1	n/a	n/a
Quercus durata var. *gabrielensis*	San Gabriel oak	shrub	yes	yes	yes	mid		yes	yes	Drought tolerant, no summer water (Low)	3–9	3–6		0.17	12	n/a	3%	2	n/a	n/a
Rhus ovata	sugar bush	shrub	yes	yes	no	early-mid			yes	Extremely low/very low, drought tolerant, no summer water (Very Low)	4	5	Yes	0.17	8	n/a	1%	1	n/a	n/a
Salvia apiana	white sage	shrub	yes	yes	no	mid-late	yes		yes	Extremely low/very low, no summer water (Very Low)	5	3–8	Yes	0.17	6	n/a	3%	6	n/a	n/a
Salvia leucophylla	purple sage	shrub	yes	yes	yes	mid	yes	yes	yes	Extremely Low/very low, no summer water (Very Low)	3–4.5	3	Yes, seeds readily	0.17	6	n/a	3%	6	n/a	n/a
Salvia mellifera	black sage	shrub	yes	yes	no	mid	yes		yes	Extremely low/very low, no summer water (Very Low)	3–4.5	3–6	Potential, germination may be low	0.17	6	n/a	3%	6	n/a	n/a
Subshrubs and perennials																				
Delphinium cardinale	cardinal or scarlet larkspur	perennial	yes	yes	no	early-mid			yes	Very low, no summer water (has summer dormancy) (not listed)	1.5–6	0.3–0.6	Yes	0.17	2	n/a	2%	38	n/a	n/a
Graminoids																				
Poa secunda ssp. *secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			0.17	n/a	1	n/a	n/a	0.2	2.8
Stipa cernua	nodding needle grass	grass	yes	yes	no	early-mid				Very low, very drought tolerant, no summer water (Very Low)	1.5–3	0.3–1.5	Yes	0.17	n/a	2	n/a	n/a	0.3	5.5
Stipa lepida	foothill needlegrass	grass	yes	yes	yes	mid				Very low, no summer water (Very Low)	0.6–1.5	0.3	Yes	0.17	n/a	2	n/a	n/a	0.3	5.5
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	0.17	n/a	4	n/a	n/a	0.7	11.1

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Annuals (or sometimes perennials)																				
Camissoniopsis bistorta	California sun cup	annual	yes	yes	no	mid				No summer water (not listed)				0.17	n/a	0.5	n/a	n/a	0.1	1.4
Eschscholzia californica	California poppy	annual to perennial	yes	yes	yes	early, mid, and late	yes			Very low/low, drought tolerant, no summer water (Very Low)	1.5–3	1.5–3	Yes, seeds readily	0.17	n/a	1	n/a	n/a	0.2	2.8
Lupinus bicolor	miniature lupine	annual to perennial	yes	yes	no	mid	yes	yes		Low, no summer water (not listed)	0.6–0.9	0.9–1.5	Yes	0.17	n/a	2	n/a	n/a	0.3	5.5
Phacelia minor	wild canterbury bells	annual	yes	yes	no	mid	yes			Very low/low, no summer water (not listed)			Yes	0.17	n/a	0.25	n/a	n/a	0.0	0.7
Salvia columbariae	chia	annual	yes	yes	no	mid	yes			Extremely low/very low, no summer water (not listed)	0.9–2	0.3	Yes	0.17	n/a	0.25	n/a	n/a	0.0	0.7
Total trees and shrubs:																		**70**	**n/a**	**n/a**
Total subshrubs and perennials:																		**38**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**1.6**	**24.9**
Total annuals:																		**n/a**	**0.7**	**11.1**
Total container plants:																		**108**	**n/a**	**n/a**

[1] Regional documentation according to The Second Edition of the Jepson Manual (Baldwin et. al. 2012), Calflora Verdugo Mountains and surrounding area plant list (Calflora 2017), and the Shoestring Park Plant List, Durable Plants for Public Landscapes (Mackey 2017).
[2] Flowering seasons are January–March (early), April–June (mid), and July–October (late).
[3] The category of water needs from WUCOLS (Water Use Classification of Landscape Species) is provided in parentheses for each species listed; for detail and definitions, see http://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/.
[4] Potential seed source for other LA River projects.

Table A-4. Planting palette for the low-tier bioswale.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Cercocarpus betuloides var. *betuloides*	birch-leaf mountain mahogany	shrub	yes	yes	no	early-mid		yes	yes	Very low/low, drought tolerant, no summer water (Very Low)	3–15	3–6	Yes	0.04	8	n/a	20%	5	n/a	n/a
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30		0.04	20	n/a	85%	4	n/a	n/a
Subshrubs and perennials																				
Salvia spathacea	California hummingbird sage	perennial	yes	yes	yes	early-mid	yes		yes	Very low, no summer water (Low)	0.5–1.5	3–6		0.04	3	n/a	20%	37	n/a	n/a
Graminoids																				
Muhlenbergia rigens	deer grass	grass	yes	no	yes	late				Low, no summer water (Low)			Yes	0.04	n/a	0.2	n/a	n/a	0.0	0.1
Poa secunda ssp. *secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			0.04	n/a	1.5	n/a	n/a	0.1	0.9
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	0.04	n/a	8	n/a	n/a	0.3	4.9
Total trees and shrubs:																		**9**	**n/a**	**n/a**
Total subshrubs and perennials:																		**37**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**0.4**	**6.0**
Total container plants:																		**46**	**n/a**	**n/a**

[1] Regional documentation according to The Second Edition of the Jepson Manual (Baldwin et. al. 2012), Calflora Verdugo Mountains and surrounding area plant list (Calflora 2017), and the Shoestring Park Plant List, Durable Plants for Public Landscapes (Mackey 2017).
[2] Flowering seasons are January–March (early), April–June (mid), and July–October (late).
[3] The category of water needs from WUCOLS (Water Use Classification of Landscape Species) is provided in parentheses for each species listed; for detail and definitions, see http://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/.
[4] Potential seed source for other LA River projects.

Table A-5. Planting palette for the mid-tier bioswale.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Cercocarpus betuloides var. *betuloides*	birch-leaf mountain mahogany	shrub	yes	yes	no	early-mid		yes	yes	Very low/low, drought tolerant, no summer water (Very Low)	3–15	3–6	Yes	0.04	8	n/a	20%	5	n/a	n/a
Eriophyllum confertiflorum	yellow yarrow	shrub	yes	yes	no	mid and late	yes	yes		Very low, no summer water (Very Low)	0.5–3	1–1.5	Yes	0.04	3	n/a	10%	19	n/a	n/a
Heteromeles arbutifolia	toyon	shrub	yes	yes	no	mid-late		yes	yes	Low, drought tolerant, no summer water (Very Low)	6–12	6–9	Yes	0.04	12	n/a	32%	4	n/a	n/a
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30		0.04	20	n/a	85%	4	n/a	n/a
Subshrubs and perennials																				
Epilobium canum subsp. *canum*	California fuschia	perennial or subshrub	yes	yes	no	mid-late	yes		yes	Very low/low, drought tolerant, no summer water (Very Low)	1.5–3	1.5–3	Yes	0.04	6	n/a	15%	7	n/a	n/a
Salvia spathacea	California hummingbird sage	perennial	yes	yes	yes	early-mid	yes		yes	Very low, no summer water (Low)	0.5–1.5	3–6		0.04	3	n/a	20%	37	n/a	n/a
Graminoids																				
Muhlenbergia rigens	deer grass	grass	yes	no	yes	late				Low, no summer water (Low)			Yes	0.04	n/a	0.2	n/a	n/a	0.0	0.1
Poa secunda ssp. *secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			0.04	n/a	1.5	n/a	n/a	0.1	0.9
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	0.04	n/a	8	n/a	n/a	0.3	4.9
Stipa speciosa	desert needlegrass	grass	yes	yes	yes	mid				Low, no summer water (not listed)	1.5–3	0.3–0.6	Yes	0.04	n/a	5	n/a	n/a	0.2	3.1
Annuals (or sometimes perennials)																				
Clarkia unguiculata	woodland clarkia	annual	yes	yes	no	mid-late	yes			Low, no summer water (not listed)			Yes	0.04	n/a	2	n/a	n/a	0.1	1.2
Total trees and shrubs:																		**32**	**n/a**	**n/a**
Total subshrubs and perennials:																		**44**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**0.6**	**9.0**
Total annuals:																		**n/a**	**0.1**	**1.2**
Total container plants:																		**76**	**n/a**	**n/a**

[1] Regional documentation according to The Second Edition of the Jepson Manual (Baldwin et. al. 2012), Calflora Verdugo Mountains and surrounding area plant list (Calflora 2017), and the Shoestring Park Plant List, Durable Plants for Public Landscapes (Mackey 2017).
[2] Flowering seasons are January–March (early), April–June (mid), and July–October (late).
[3] The category of water needs from WUCOLS (Water Use Classification of Landscape Species) is provided in parentheses for each species listed; for detail and definitions, see http://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/.
[4] Potential seed source for other LA River projects.

Table A-6. Planting palette for the high-tier bioswale.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Cercocarpus betuloides var. *betuloides*	birch-leaf mountain mahogany	shrub	yes	yes	no	early-mid		yes	yes	Very low/low, drought tolerant, no summer water (Very Low)	3–15	3–6	Yes	0.04	8	n/a	20%	5	n/a	n/a
Eriophyllum confertiflorum	yellow yarrow	shrub	yes	yes	no	mid and late	yes	yes		Very low, no summer water (Very Low)	0.5–3	1–1.5	Yes	0.04	3	n/a	8%	15	n/a	n/a
Heteromeles arbutifolia	toyon	shrub	yes	yes	no	mid-late		yes	yes	Low, drought tolerant, no summer water (Very Low)	6–12	6–9	Yes	0.04	12	n/a	32%	4	n/a	n/a
Mimulus aurantiacus var. *pubescens*	sticky monkeyflower	shrub	yes	yes	no	early-mid		yes	yes	Very low, likes a little bit of water and partial shade, no summer water (may go summer-dormant) (Very Low)	1.5–3	1.5–3	Yes	0.04	6	n/a	12%	6	n/a	n/a
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30		0.04	20	n/a	85%	4	n/a	n/a
Rhamnus crocea	spiny redberry	shrub	yes	yes	yes	early-mid		yes		Extremely low/very low, no summer water (Very Low)	1.5–3	3–6	Yes	0.04	6	n/a	8%	4	n/a	n/a
Subshrubs and perennials																				
Corethrogyne filaginifolia	common sandaster	perennial	yes	yes	no	late		yes		Very low, no summer water (Low)	0.5–1.5	1.5–3		0.04	2	n/a	4%	17	n/a	n/a
Epilobium canum subsp. *canum*	California fuschia	perennial or subshrub	yes	yes	no	mid-late	yes		yes	Very low/low, drought tolerant, no summer water (Very Low)	1.5–3	1.5–3	Yes	0.04	6	n/a	12%	6	n/a	n/a
Salvia spathacea	California hummingbird sage	perennial	yes	yes	yes	early-mid	yes		yes	Very low, no summer water (Low)	0.5–1.5	3–6		0.04	3	n/a	20%	37	n/a	n/a

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Graminoids																				
Muhlenbergia rigens	deer grass	grass	yes	no	yes	late				Low, no summer water (Low)			Yes	0.04	n/a	0.2	n/a	n/a	0.0	0.1
Poa secunda ssp. *secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			0.04	n/a	1.5	n/a	n/a	0.1	0.9
Stipa coronata	crested needle grass	grass	yes	yes	yes	mid				Very low, no summer water (not listed)	3–4	1.5–3	Yes	0.04	n/a	1	n/a	n/a	0.0	0.6
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	0.04	n/a	8	n/a	n/a	0.3	4.9
Stipa speciosa	desert needlegrass	grass	yes	yes	yes	mid				Low, no summer water (not listed)	1.5–3	0.3–0.6	Yes	0.04	n/a	5	n/a	n/a	0.2	3.1
Annuals (or sometimes perennials)																				
Clarkia unguiculata	woodland clarkia	annual	yes	yes	no	mid-late	yes			Low, no summer water (not listed)			Yes	0.04	n/a	2	n/a	n/a	0.1	1.2
Total trees and shrubs:																		**38**	**n/a**	**n/a**
Total subshrubs and perennials:																		**60**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**0.6**	**9.6**
Total annuals:																		**n/a**	**0.1**	**1.2**
Total container plants:																		**98**	**n/a**	**n/a**

[1] Regional documentation according to The Second Edition of the Jepson Manual (Baldwin et. al. 2012), Calflora Verdugo Mountains and surrounding area plant list (Calflora 2017), and the Shoestring Park Plant List, Durable Plants for Public Landscapes (Mackey 2017).
[2] Flowering seasons are January–March (early), April–June (mid), and July–October (late).
[3] The category of water needs from WUCOLS (Water Use Classification of Landscape Species) is provided in parentheses for each species listed; for detail and definitions, see http://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/.
[4] Potential seed source for other LA River projects.

Table A-7. Planting palette for the low-tier path shoulder.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS3)	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Adenostoma fasciculatum var. *fasciculatum*	chamise	shrub	yes	yes	no	mid		yes	yes	Extremely low/very low, may require some watering, no summer water (Very Low)	3–10	3–6	Yes	2.24	8	n/a	8%	122	n/a	n/a
Artemisia californica	coastal sagebrush	shrub	yes	yes	no	late				Extremely low/very low, none, no summer water (Very Low)	3–12	3–6		2.24	12	n/a	8%	54	n/a	n/a
Encelia californica	bush sunflower, California brittlebush	shrub	yes	yes	no	early and mid	yes	yes	yes	Very low, very drought tolerant, no summer water (Very Low)	1–4	3–6	Yes, seeds readily	2.24	3	n/a	2%	217	n/a	n/a
Eriogonum fasciculatum	California buckwheat	shrub	yes	yes	yes	early, mid, and late	yes	yes		Extremely low/very low, very drought tolerant, no summer water (Very Low)	1–3	1–6	Yes, seeds readily	2.24	3	n/a	2%	217	n/a	n/a
Malosma laurina	laurel sumac	shrub	yes	yes	no	mid-late			yes	Extremely low, drought tolerant, no summer water (Very Low)	6–9	6–18	Yes	2.24	12	n/a	4%	27	n/a	n/a
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30		2.24	20	n/a	8%	20	n/a	n/a
Rhus ovata	sugar bush	shrub	yes	yes	no	early-mid			yes	Extremely low/very low, drought tolerant, no summer water (Very Low)	4	5	Yes	2.24	8	n/a	2%	31	n/a	n/a
Salvia apiana	white sage	shrub	yes	yes	no	mid-late	yes		yes	Extremely low/very low, no summer water (Very Low)	5	3–8	Yes	2.24	6	n/a	4%	109	n/a	n/a
Salvia leucophylla	purple sage	shrub	yes	yes	yes	mid	yes	yes	yes	Extremely Low/very low, no summer water (Very Low)	3–4.5	3	Yes, seeds readily	2.24	6	n/a	4%	109	n/a	n/a

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS3)	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Subshrubs and perennials																				
Acmispon glaber	deerweed	subshrub	yes	yes	yes	mid-late	yes	yes		Very low, no summer water (Very Low)	3	3		2.24	2	n/a	2%	488	n/a	n/a
Graminoids																				
Poa secunda ssp. *secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			2.24	n/a	1.5	n/a	n/a	3.4	53.8
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	2.24	n/a	10	n/a	n/a	22.4	358.8
Annuals (or sometimes perennials)																				
Eschscholzia californica	California poppy	annual to perennial	yes	yes	yes	early, mid, and late	yes			Very low/low, drought tolerant, no summer water (Very Low)	1.5–3	1.5–3	Yes, seeds readily	2.24	n/a	1.5	n/a	n/a	3.4	53.8
Lupinus bicolor	miniature lupine	annual to perennial	yes	yes	no	mid	yes	yes		Low, no summer water (not listed)	0.6–0.9	0.9–1.5	Yes	2.24	n/a	2.5	n/a	n/a	5.6	89.7
Total trees and shrubs:																		**906**	**n/a**	**n/a**
Total subshrubs and perennials:																		**488**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**25.8**	**412.6**
Total annuals:																		**n/a**	**9.0**	**143.5**
Total container plants:																		**1394**	**n/a**	**n/a**

[1] Regional documentation according to The Second Edition of the Jepson Manual (Baldwin et. al. 2012), Calflora Verdugo Mountains and surrounding area plant list (Calflora 2017), and the Shoestring Park Plant List, Durable Plants for Public Landscapes (Mackey 2017).
[2] Flowering seasons are January–March (early), April–June (mid), and July–October (late).
[3] The category of water needs from WUCOLS (Water Use Classification of Landscape Species) is provided in parentheses for each species listed; for detail and definitions, see http://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/.
[4] Potential seed source for other LA River projects.

Table A-8. Planting palette for the mid-tier path shoulder.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS3)	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Adenostoma fasciculatum var. *fasciculatum*	chamise	shrub	yes	yes	no	mid		yes	yes	Extremely low/very low, may require some watering, no summer water (Very Low)	3–10	3–6	Yes	2.24	8	n/a	8%	122	n/a	n/a
Artemisia californica	coastal sagebrush	shrub	yes	yes	no	late				Extremely low/very low, none, no summer water (Very Low)	3–12	3–6		2.24	12	n/a	8%	54	n/a	n/a
Encelia californica	bush sunflower, California brittlebush	shrub	yes	yes	no	early and mid	yes	yes	yes	Very low, very drought tolerant, no summer water (Very Low)	1–4	3–6	Yes, seeds readily	2.24	3	n/a	2%	217	n/a	n/a
Eriogonum fasciculatum	California buckwheat	shrub	yes	yes	yes	early, mid, and late	yes	yes		Extremely low/very low, very drought tolerant, no summer water (Very Low)	1–3	1–6	Yes, seeds readily	2.24	3	n/a	2%	217	n/a	n/a
Malosma laurina	laurel sumac	shrub	yes	yes	no	mid-late			yes	Extremely low, drought tolerant, no summer water (Very Low)	6–9	6–18	Yes	2.24	12	n/a	4%	27	n/a	n/a
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30		2.24	20	n/a	8%	20	n/a	n/a
Quercus durata var. *gabrielensis*	San Gabriel oak	shrub	yes	yes	yes	mid		yes	yes	Drought tolerant, no summer water (Low)	3–9	3–6		2.24	12	n/a	1%	7	n/a	n/a
Rhus ovata	sugar bush	shrub	yes	yes	no	early-mid			yes	Extremely low/very low, drought tolerant, no summer water (Very Low)	4	5	Yes	2.24	8	n/a	2%	31	n/a	n/a
Salvia apiana	white sage	shrub	yes	yes	no	mid-late	yes		yes	Extremely low/very low, no summer water (Very Low)	5	3–8	Yes	2.24	6	n/a	4%	109	n/a	n/a
Salvia leucophylla	purple sage	shrub	yes	yes	yes	mid	yes	yes	yes	Extremely Low/very low, no summer water (Very Low)	3–4.5	3	Yes, seeds readily	2.24	6	n/a	4%	109	n/a	n/a

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS3)	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Salvia mellifera	black sage	shrub	yes	yes	no	mid	yes		yes	Extremely low/very low, no summer water (Very Low)	3–4.5	3–6	Potential, germination may be low	2.24	6	n/a	4%	109	n/a	n/a
Subshrubs and perennials																				
Acmispon glaber	deerweed	subshrub	yes	yes	yes	mid-late	yes	yes		Very low, no summer water (Very Low)	3	3		2.24	2	n/a	1%	244	n/a	n/a
Delphinium cardinale	cardinal or scarlet larkspur	perennial	yes	yes	no	early-mid			yes	Very low, no summer water (has summer dormancy) (not listed)	1.5–6	0.3–0.6	Yes	2.24	2	n/a	1%	244	n/a	n/a
Graminoids																				
Poa secunda ssp. *secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			2.24	n/a	1	n/a	n/a	2.2	35.9
Stipa lepida	foothill needlegrass	grass	yes	yes	yes	mid				Very low, no summer water (Very Low)	0.6–1.5	0.3	Yes	2.24	n/a	2	n/a	n/a	4.5	71.8
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	2.24	n/a	8	n/a	n/a	17.9	287.0
Annuals (or sometimes perennials)																				
Eschscholzia californica	California poppy	annual to perennial	yes	yes	yes	early, mid, and late	yes			Very low/low, drought tolerant, no summer water (Very Low)	1.5–3	1.5–3	Yes, seeds readily	2.24	n/a	1.5	n/a	n/a	3.4	53.8
Lupinus bicolor	miniature lupine	annual to perennial	yes	yes	no	mid	yes	yes		Low, no summer water (not listed)	0.6–0.9	0.9–1.5	Yes	2.24	n/a	2.5	n/a	n/a	5.6	89.7
Total trees and shrubs:																		**1022**	**n/a**	**n/a**
Total subshrubs and perennials:																		**488**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**24.7**	**394.7**
Total annuals:																		**n/a**	**9.0**	**143.5**
Total container plants:																		**1510**	**n/a**	**n/a**

[1] Regional documentation according to The Second Edition of the Jepson Manual (Baldwin et. al. 2012), Calflora Verdugo Mountains and surrounding area plant list (Calflora 2017), and the Shoestring Park Plant List, Durable Plants for Public Landscapes (Mackey 2017).
[2] Flowering seasons are January–March (early), April–June (mid), and July–October (late).
[3] The category of water needs from WUCOLS (Water Use Classification of Landscape Species) is provided in parentheses for each species listed; for detail and definitions, see http://ucanr.edu/sites/WUCOLS/WUCOLS_IV_User_Manual/Categories_of_Water_Needs/.
[4] Potential seed source for other LA River projects.

Table A-9. Planting palette for the high-tier path shoulder.

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Trees and shrubs																				
Adenostoma fasciculatum var. *fasciculatum*	chamise	shrub	yes	yes	no	mid		yes	yes	Extremely low/very low, may require some watering, no summer water (Very Low)	3–10	3–6	Yes	2.24	8	n/a	4%	61	n/a	n/a
Artemisia californica	coastal sagebrush	shrub	yes	yes	no	late				Extremely low/very low, none, no summer water (Very Low)	3–12	3–6		2.24	12	n/a	4%	27	n/a	n/a
Ceanothus crassifolius var. *crassifolius*	hoaryleaf ceanothus	shrub	yes	yes	no	early	yes	yes	yes	Extremely low/very low, drought tolerant, no summer water (not listed)	6–12	6–12	Yes	2.24	8	n/a	2%	31	n/a	n/a
Ceanothus leucodermis	chaparral whitethorn	shrub	yes	yes	no	mid	yes	yes	yes	Very low, no summer water (Very Low)	6–9	3–6	Yes	2.24	8	n/a	1%	15	n/a	n/a
Ceanothus oliganthus var. *oliganthus*	hairy ceanothus	shrub	yes	yes	no	early and mid	yes	yes	yes	Very low, drought tolerant, no summer water (not listed)	6–12	6–12	Yes	2.24	8	n/a	2%	31	n/a	n/a
Dendromecon rigida	bush poppy	shrub	yes	yes	no	mid				Very low, drought tolerant, no summer water (Very Low)	3–9	3–6	Cuttings better	2.24	6	n/a	1%	27	n/a	n/a
Encelia californica	bush sunflower, California brittlebush	shrub	yes	yes	no	early and mid	yes	yes	yes	Very low, very drought tolerant, no summer water (Very Low)	1–4	3–6	Yes, seeds readily	2.24	3	n/a	2%	217	n/a	n/a
Eriodictyon trichocalyx var. *trichocalyx*	Hairy yerba santa	shrub	yes	yes	yes	mid	yes	yes		Extremely low/very low, drought tolerant, no summer water (Very Low)	1–6	3–6	Yes	2.24	3	n/a	2%	217	n/a	n/a
Eriogonum fasciculatum	California buckwheat	shrub	yes	yes	yes	early, mid, and late	yes	yes		Extremely low/very low, very drought tolerant, no summer water (Very Low)	1–3	1–6	Yes, seeds readily	2.24	3	n/a	2%	217	n/a	n/a
Lupinus longifolius	long leaf bush lupine	shrub	yes	yes	no	mid	yes	yes		Low, drought tolerant, no summer water (not listed)	3–4.5	1.5–4.5	Yes	2.24	3	n/a	1%	109	n/a	n/a

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Malacothamnus fasciculatus var. *fasciculatus*	bush mallow	shrub	yes	yes	yes	mid-late		yes	yes	Very low, little or no supplemental water, no summer water (Very Low)	3–9	3–9	Yes	2.24	8	n/a	1%	15	n/a	n/a
Malosma laurina	laurel sumac	shrub	yes	yes	no	mid-late			yes	Extremely low, drought tolerant, no summer water (Very Low)	6–9	6–18	Yes	2.24	12	n/a	2%	14	n/a	n/a
Quercus agrifolia var. *agrifolia*	coast live oak	tree	yes	yes	no	early-mid		yes	yes	Low, goes dormant in extreme drought, no summer water (Very Low)	15–60	15–30		2.24	20	n/a	8%	20	n/a	n/a
Quercus durata var. *gabrielensis*	San Gabriel oak	shrub	yes	yes	yes	mid		yes	yes	Drought tolerant, no summer water (Low)	3–9	3–6		2.24	12	n/a	1%	7	n/a	n/a
Rhus ovata	sugar bush	shrub	yes	yes	no	early-mid			yes	Extremely low/very low, drought tolerant, no summer water (Very Low)	4	5	Yes	2.24	8	n/a	1%	15	n/a	n/a
Salvia apiana	white sage	shrub	yes	yes	no	mid-late	yes		yes	Extremely low/very low, no summer water (Very Low)	5	3–8	Yes	2.24	6	n/a	4%	109	n/a	n/a
Salvia leucophylla	purple sage	shrub	yes	yes	yes	mid	yes	yes	yes	Extremely Low/very low, no summer water (Very Low)	3–4.5	3	Yes, seeds readily	2.24	6	n/a	4%	109	n/a	n/a
Salvia mellifera	black sage	shrub	yes	yes	no	mid	yes		yes	Extremely low/very low, no summer water (Very Low)	3–4.5	3–6	Potential, germination may be low	2.24	6	n/a	4%	109	n/a	n/a
Subshrubs and perennials																				
Acmispon glaber	deerweed	subshrub	yes	yes	yes	mid-late	yes	yes		Very low, no summer water (Very Low)	3	3		2.24	2	n/a	1%	244	n/a	n/a
Delphinium cardinale	cardinal or scarlet larkspur	perennial	yes	yes	no	early-mid			yes	Very low, no summer water (has summer dormancy) (not listed)	1.5–6	0.3–0.6	Yes	2.24	2	n/a	1%	244	n/a	n/a

Scientific name	Common name	Life form	Documented regionally[1]			Flowering time[2]	Wildlife			Water needs post-establishment (WUCOLS[3])	Height (ft)	Width (ft)	Seeds[4]	Area of planting zone (acres)	Average spacing (feet on-center)	Seeding rate (lbs/acre)	Percent fill	Number of plants	Seed quantity	
			Jepson manual	Vergudo mountains	Durable plant list		Bees	Butterflies	Birds										lbs	ounces
Graminoids																				
Poa secunda ssp. *secunda*	one-sided blue grass	grass	yes	yes	yes	mid-late				Low, no summer water (not listed)	3			2.24	n/a	1	n/a	n/a	2.2	35.9
Stipa cernua	nodding needle grass	grass	yes	yes	no	early-mid				Very low, very drought tolerant, no summer water (Very Low)	1.5–3	0.3–1.5	Yes	2.24	n/a	2	n/a	n/a	4.5	71.8
Stipa lepida	foothill needlegrass	grass	yes	yes	yes	mid				Very low, no summer water (Very Low)	0.6–1.5	0.3	Yes	2.24	n/a	2	n/a	n/a	4.5	71.8
Stipa pulchra	purple needlegrass	grass	yes	yes	yes	mid	yes			Very low/low, no summer water (Very Low)	2.1–3.6	0.3–1.5	Yes	2.24	n/a	8	n/a	n/a	17.9	287.0
Annuals (or sometimes perennials)																				
Eschscholzia californica	California poppy	annual to perennial	yes	yes	yes	early, mid, and late	yes			Very low/low, drought tolerant, no summer water (Very Low)	1.5–3	1.5–3	Yes, seeds readily	2.24	n/a	1.5	n/a	n/a	3.4	53.8
Lupinus bicolor	miniature lupine	annual to perennial	yes	yes	no	mid	yes	yes		Low, no summer water (not listed)	0.6–0.9	0.9–1.5	Yes	2.24	n/a	2.5	n/a	n/a	5.6	89.7
Phacelia minor	wild canterbury bells	annual	yes	yes	no	mid	yes			Very low/low, no summer water (not listed)			Yes	2.24	n/a	0.5	n/a	n/a	1.1	17.9
Phacelia tanacetifolia	lacy phacelia	annual	yes	yes	no	mid	yes			Very low/low, no summer water (goes summer-dormant) (not listed)	0.6–3	0.6–3	Yes	2.24	n/a	0.5	n/a	n/a	1.1	17.9
Salvia columbariae	chia	annual	yes	yes	no	mid	yes			Extremely low/very low, no summer water (not listed)	0.9–2	0.3	Yes	2.24	n/a	0.5	n/a	n/a	1.1	17.9
Total trees and shrubs:																		**1350**	**n/a**	**n/a**
Total subshrubs and perennials:																		**488**	**n/a**	**n/a**
Total graminoids:																		**n/a**	**29.2**	**466.4**
Total annuals:																		**n/a**	**12.3**	**197.3**
Total container plants:																		**1838**	**n/a**	**n/a**

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[4] Potential seed source for other LA River projects.