ATTACHMENTS FOR SECTION 1.3:

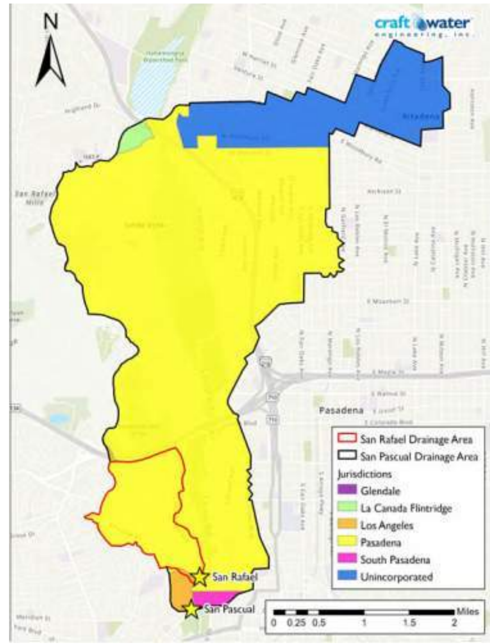
PROJECT SUMMARY

SAN RAFAEL/SAN PASCUAL TREATMENT WETLANDS STORMWATER CAPTURE PROJECT

ULAR WATERSHED MANAGEMENT GROUP, CITY OF PASADENA/CITY OF SOUTH PASADENA

EXISTING SITE CONDITIONS

DRAINAGE AREA



DRAINAGE CHARACTERISTICS

REGIONAL WATER MANAGEMENT PLAN	Upper LA River Watershed
TOTAL DRAINAGE AREA	**5,005 acres** Pasadena (82.4%) Unincorporated LA County (15.2%) City of Los Angeles (1.1%) La Canada Flintridge (0.7%) South Pasadena (0.6%) Glendale (0.1%)
INFILTRATION RATE	0.89 in/hr (San Rafael) 0.3 in/hr (San Pascual)
APPROX. DEPTH TO GROUNDWATER	91 ft BGS
MODELED AVERAGE ANNUAL RUNOFF VOLUME	4,583 ac-ft per year

San Rafael Creek

Arroyo Seco Channel

BMP CHARACTERISTICS

LOCATIONS	San Rafael Creek near San Rafael Avenue Arroyo Seco Channel near San Pascual Avenue	34°07'31.5"N/ 118°09'58.7"W 34°07'14.2"N/ 118°10'02.0"W

Proposed BMP Description: The project includes two sites: San Rafael located in Pasadena and San Pascual in South Pasadena. The San Pascual site was included in the Adaptive Management Section of the Upper Los Angeles River Enhanced Watershed Management Program (EWMP) Group's Annual Report. The project seeks to improve water quality discharged to San Rafael Creek and the Arroyo Seco Channel through capture, infiltration, and restoration of natural streambed processes. The project also proposes to provide water supply benefit by infiltrating to the local groundwater basin. The project includes a stormwater drop-inlet diversion from the LACFCD San Rafael Creek and enhancement of an existing drop inlet structure in the LACFCD Arroyo Seco Channel and a series of 2.6 acre-foot and 6.5 acre-feet infiltration basins and treatment wetlands. During dry-weather events, the water will pass through a natural stream at San Rafael for eventual discharge into the infiltration basin while the San Pascual site will retain the water within the treatment wetland for irrigation at the Arroyo Park and Arroyo Seco Golf Course. During wet-weather events, the water captured will be filtered through a pretreatment unit, flow into the infiltration basin/treatment wetland, and pass through a filtration device. This project has the potential to offer runoff storage and water quality benefits for these jurisdictions that can address the additional needs for stormwater management identified to achieve compliance in the EWMP.

Project Benefits:

- **Water Quality** Improvement in the San Rafael Creek and the Arroyo Seco Channel by removing trash, metals, and nutrients in stormwater and urban runoff
- **Nature-Based** infiltration recharge basins with sustainable native landscaping and storage
- **Park recreational enhancements** with a wetland/habitat area and continuous irrigation water supply
- **Public Access to Waterways** with improved public access to natural treatment wetlands and pedestrian pathways

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SAN RAFAEL/SAN PASCUAL TREATMENT WETLANDS STORMWATER CAPTURE PROJECT

ULAR WATERSHED MANAGEMENT GROUP, CITY OF PASADENA/CITY OF SOUTH PASADENA

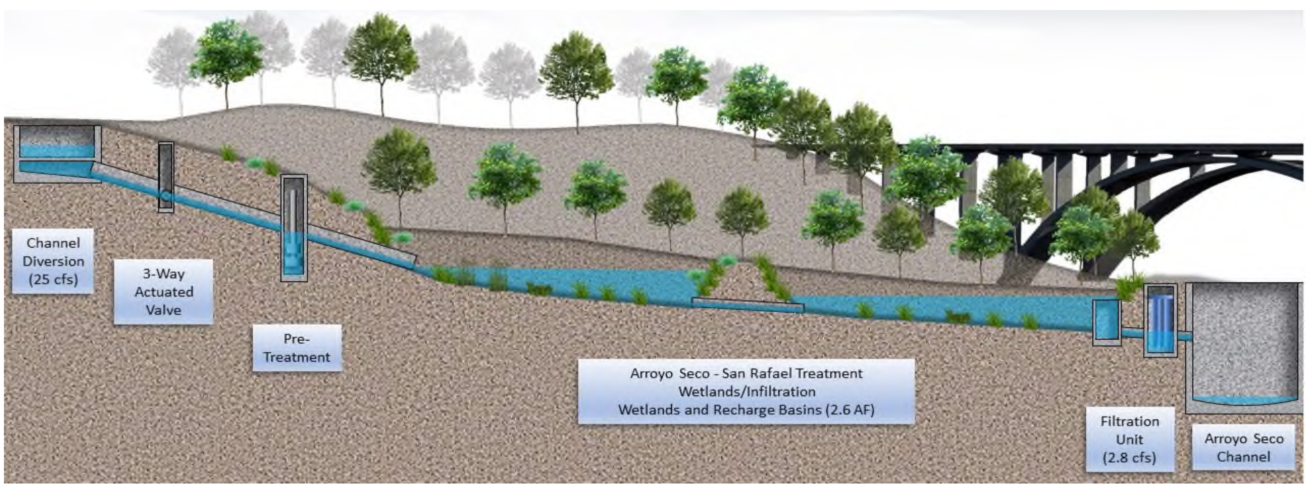
SAN RAFAEL PROPOSED CONCEPTUAL SITE LAYOUT

Natural Infiltration Basin

Public Access

Natural Stream

CROSS SECTION



PRELIMINARY SCW SCORING

SECTION	Score
A.1 Wet Weather Water Quality Benefits • A.1.1 Water Quality Cost Effectiveness > 1.0 AF/$Million • A.1.2 Pollutant Reduction >80%	40
B. Significant Water Supply Benefits • B1. Water Supply Cost Effectiveness • B2. Water Supply Benefit Magnitude	5
C. Community Investment Benefits • Improved flood management • Creation/enhancement/restoration of parks • Improved public access to waterways • Enhanced/new recreational opportunities • Reducing local heat island effect • Increasing number of trees and/or vegetation	10
D. Nature-Based Solutions	10
E. Leveraging Funds and Community Support • Strong local, community-based support	10
TOTAL SCORE	**75**

PROJECT CHARACTERISTICS

Primary Pollutant Zinc Reduction Achieved (% Zn reduction) for both projects	873 lb/yr (67.7%)
Secondary Pollutant Copper (% Cu reduction) for both projects	235 lbs/yr (68.2%)
Design Diversion Rate San Rafael Creek	25 cfs
Storage Capacity for Infiltration Basin with 2.88 filtration unit	2.6 ac-ft (0.88 MG)
24-Hour Capacity for both San Rafael and San Pascual Sites	27.9 ac-ft
Construction Cost Estimate for both San Rafael and San Pascual Sites	$6,333,095

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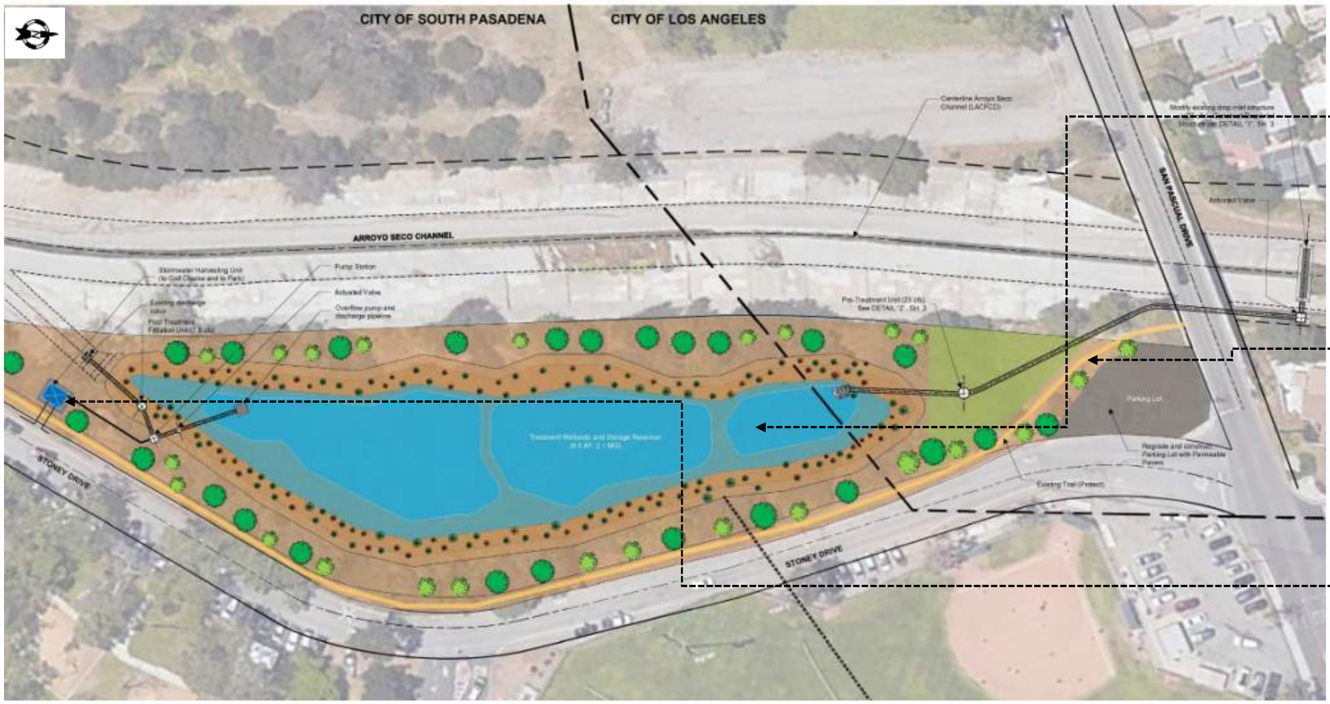
SAN PASCUAL PROPOSED CONCEPTUAL SITE LAYOUT

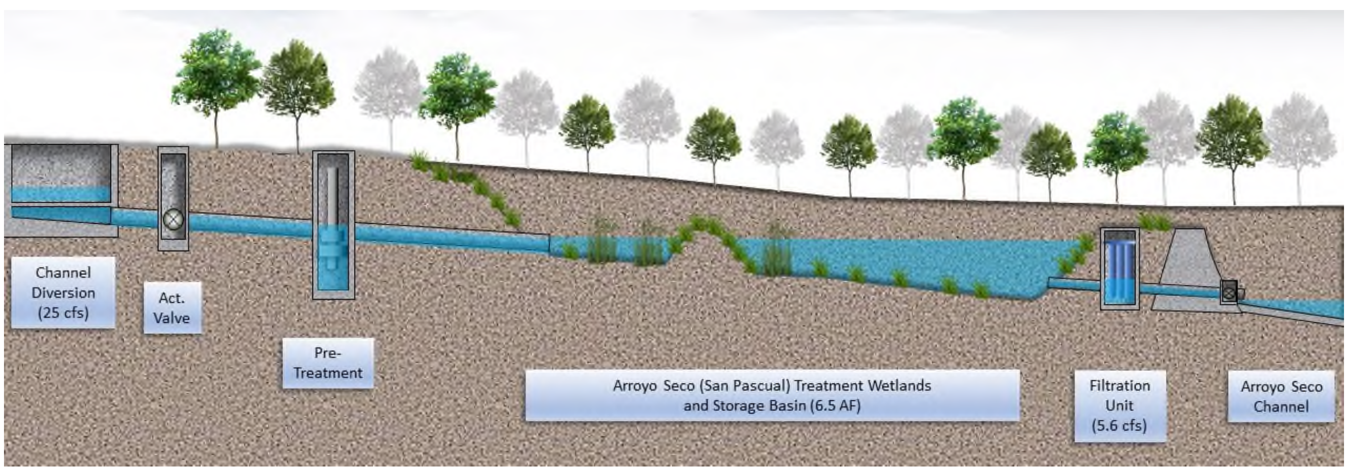


Natural Treatment Wetland

Public Access

Stormwater Harvesting Unit

CROSS SECTION



PROJECT CHARACTERISTICS

Primary Pollutant Zinc Reduction Achieved (% Zn reduction) for both projects	873 lb/yr (67.7%)
Secondary Pollutant Copper (% Cu reduction) for both projects	235 lbs/yr (68.2%)
Design Diversion Rate Arroyo Seco Channel	25 cfs
Storage Capacity for Natural Treatment Wetlands with 5.76 cfs filtration unit	6.5 ac-ft (2.1 MG)
24-Hour Capacity for both San Rafael and San Pascual Sites	27.9 ac-ft
Construction Cost Estimate for both San Rafael and San Pascual Sites	$6,333,095

ULAR WATERSHED MANAGEMENT GROUP, CITY OF PASADENA/CITY OF SOUTH PASADENA

SAN RAFAEL/SAN PASCUAL TREATMENT WETLANDS STORMWATER CAPTURE PROJECT

craftwater engineering, inc.

October 13, 2020

Mr. Brent Maue, Assistant City Engineer
City of Pasadena, Department of Public Works
100 N Garfield Avenue
Pasadena, CA 91101

Safe Clean Water Program

RE: Letter of Support for the City of Pasadena's San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project under the Upper Los Angeles Enhanced Watershed Management Plan

Dear Watershed Area Steering Committee:

The Upper Los Angeles Watershed Management Group (ULAR WMG) would like to express our support of the City of Pasadena's San Rafael/San Pascual Treatment Wetlands Stormwater Capture Project (Project) and their collaborative application with the City of South Pasadena for Measure W grant funding. The proposed Project seeks to improve water quality discharged to the San Rafael Creek through capture, infiltration, groundwater basin recharge and restoration of natural streambed processes, improving the water quality of the Arroyo Seco and the Los Angeles River, and tailored to meet our compliance efforts as detailed in the Upper Los Angeles River (ULAR) Enhanced Watershed Management Program (EWMP). In addition, this multi-benefit Project will incorporate nature-based solutions—such as new recreational walking paths, native landscaping, and natural treatment wetlands—creating vital aquatic habitat, community enhancement, and public outreach and educational opportunities.

The ULAR EWMP was developed with the intention of utilizing a multi-pollutant approach that maximizes the retention and use of urban runoff as a resource for groundwater recharge and irrigation, while also creating additional benefits for the communities in the ULAR watershed through a combination "toolbox" of Distributed and Regional Stormwater Projects to address applicable stormwater quality regulations. One of the original eight Regional Projects identified in the EWMP model, the Lower Arroyo Park, was deemed infeasible and eliminated in 2017. The proposed Project resurrects and re-envisions that concept, targeting pollutants from two LA River tributary watershed areas (641561 and 641580)—that require priority load reductions of 9 and 36%, respectively—to meet the compliance targets through capture and treatment of over ten times the required volume (26 AF), exceeding the final bacteria and metals compliance goals, and eliminating all of the regional and distributed BMP requirements in these collective jurisheds. Further, by mitigating the dry weather flows from the San Rafael Creek, Pasadena is satisfying their commitment to address their high priority non-stormwater outfall through structural controls as outlined in the Segment B Tributary Load Reduction Strategy (LRS) Report submitted and approved by the Regional Board. As such, the San Rafael/San Pascual

Treatment Wetlands Stormwater Capture Park Project is an identified and crucial Regional Project of the ULAR EWMP Implementation Plan, helping us to achieve our Recipe for Final EWMP Compliance as detailed in Appendix 7.A.60 and .75 and the subsequent LRS Report.

By December 2017, the Participating Agencies of the ULAR EWMP, including the County of Los Angeles (County) and the Los Angeles County Flood Control District (LACFCD), were required to satisfy a 31% interim EWMP milestone. This interim milestone specified that each jurisdiction implement Best Management Practices (BMPs) to manage a specific capture volume under the Reasonable Assurance Analysis (RAA) storm condition for each receiving water. The San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project is located adjacent to—and intercepts flows—that would otherwise flow to the Arroyo Seco. To date, the City of Los Angeles (City), the City of Pasadena, and Unincorporated County have achieved 2.59 of the collective 12.08 AF volume required to achieve their interim targets through structural controls and LID efforts. The Project's additional 6.5 AF design volume capture will allow Pasadena to meet and exceed their 2017 6.93 AF target milestone allowing them to come into full compliance, in addition to assisting their partnering Agencies (City and County) in moving forward towards satisfying their required volume managed.

The ULAR EWMP Watershed Management Group (WMG) recognizes the need and value of prioritizing stormwater projects within our ULAR Watershed Management Area (WMA). As such, as the ULAR Watershed Lead—on behalf of the ULAR WMG—we offer our full support to the Cities of Pasadena and South Pasadena in their efforts to obtain Measure W Round 2 grant funding for their San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project. We are confident that this Project will help to restore the water quality and beneficial uses of the Arroyo Seco—and downstream LA River—satisfying interim compliance milestones—and contributing towards the long term compliance efforts of the ULAR EWMP.

Sincerely,

Dawn Petschauer

Dawn Petschauer
Upper LA River Watershed Lead
On behalf of the ULAR EWMP WMG

cc: Kris Markarian, City of Pasadena
Brent Maue, City of Pasadena
Sean Singletary, City of Pasadena
Julian Lee, City of South Pasadena
Alfredo Magallanes, City of Los Angeles, LASAN

4.5.8 Lower Arroyo Park

Lower Arroyo Park is located within the City of South Pasadena in an area that drains to Arroyo Seco. A channelized portion of Arroyo Seco runs through the center of the proposed site parcel. Park facilities include two baseball diamonds, open field space, and playground equipment. The potential BMP type is proposed as a below-ground retention/infiltration basin situated beneath the baseball diamonds and other open field space in the southwest corner and northern portions of the park.

No maximum drainage area was identified for this site since it is located adjacent to a receiving waterbody, Arroyo Seco. After review of available site opportunities and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 145 acres.

After reviewing the hydrologic model results and estimated runoff volume for the various diversion scenarios, it was determined that this project site was suitable for a retention/infiltration BMP sized to accommodate more than the 85th percentile design storm flows contributed from the smaller alternative drainage area. As a result, the recommended active volume of the BMP is 3.7 acre feet.

Table 4-10 below summarizes key conceptual design parameters of the BMP proposed at Lower Arroyo Park. **Figure 4-32** presents summary facts of the Lower Arroyo Park signature project. **Figures 4-33** to **4-35** provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

Table 4-10. Key Design Parameters for Lower Arroyo Park

Summary of Lower Arroyo Park (SP01)		
Project Site Parameters	Total (Maximum) Drainage Area	145 ac
	Alternative (Minimum) Drainage Area	145 ac
	Maximum Recommended BMP Volume	265 ac-ft
	Alternative Recommended BMP Volume	3.7 ac-ft
	Groundwater Depth	25 ft
	Maximum BMP Opportunity Area	10.6 ac
BMP Design Parameters		
	Recommended Maximum BMP Depth (below ground surface)	25 ft
	Available BMP Volume	265 ac-ft
	Recommended Active BMP Volume	**3.7 ac-ft**

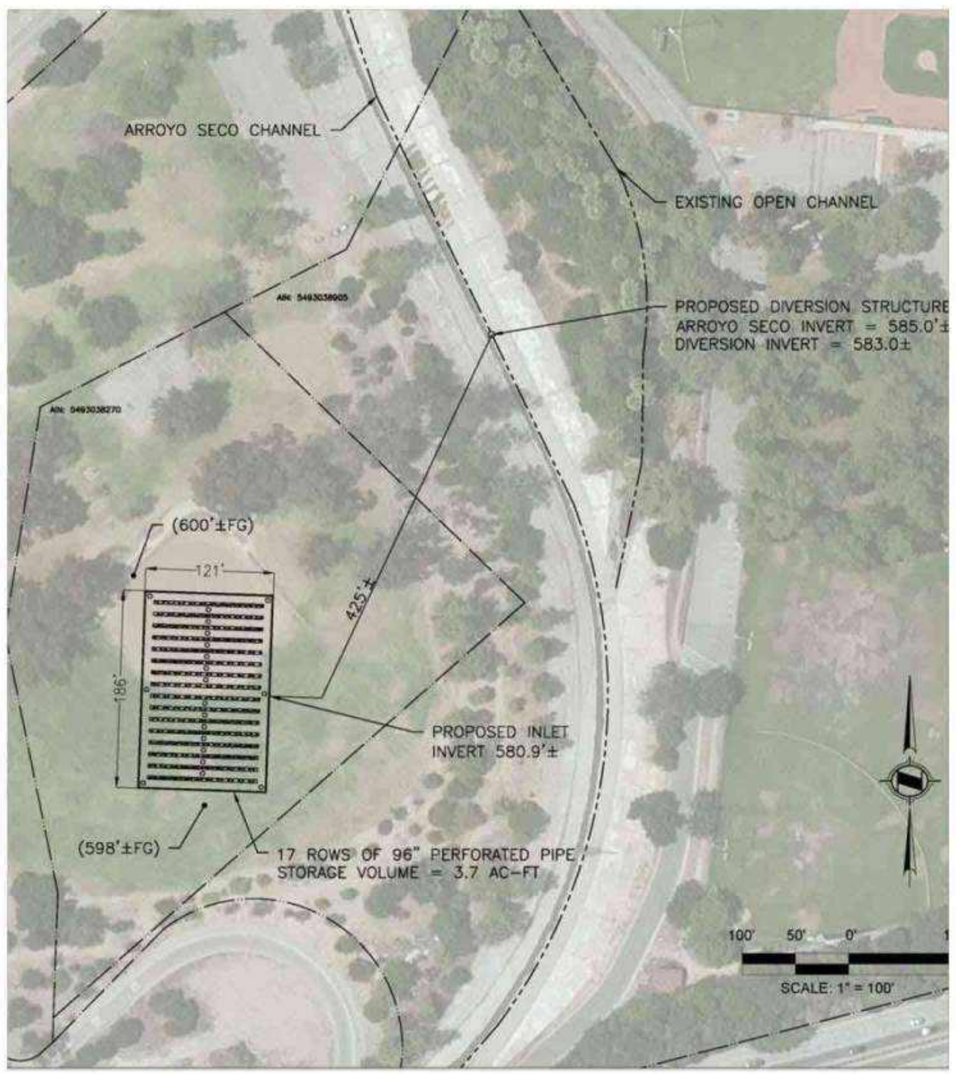
Upper Los Angeles River Enhanced Management Program
Signature Project: Lower Arroyo Park
FACT SHEET PN 182198

Note: Figures are not to scale

Site Location			
Site Location, City	South Pasadena	Site Name	Lower Arroyo Park
Latitude	34° 7' 18.123" N	Longitude	118° 10' 4.0620" W
Landuse	Open Space	Street Address	San Pasqual Avenue & Stoney Drive
Major Watershed	Upper Los Angeles River	Land Owner	City of South Pasadena
Existing Land Use of Site: Park			

Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Min, ac	145/145	Proposed Retrofit	Subsurface Infiltration
Hydrologic Soil Group	Hanford Gravelly Sandy Loam	Recommended BMP Footprint, ft²	22506
Soil Infiltration Rate, in/hr	0.80	Available BMP Volume, ac-ft	265
Manages 85th Percentile, 24 hr Design Storm Event?	Yes	BMP Water Storage Depth, ft	9
Recommended Active BMP Volume, ac-ft	3.7	Gravel Depth, ft	1
Approximate Rainfall Event Depth Captured Based on Recommended Volume, inch = 0.8			

Budget- Level estimates for both soft and hard costs	$5,132,000	**Schedule**	1 year design, 6 months bid, 9 months construction (2 ¼ years total)



Rendered Improvements

Drainage Map

Watershed and Vicinity

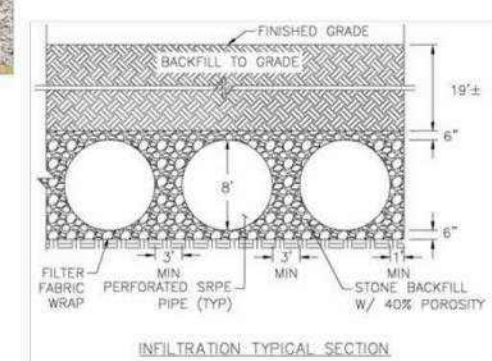


Figure 4-32. Summary Facts: Lower Arroyo Park Signature Project

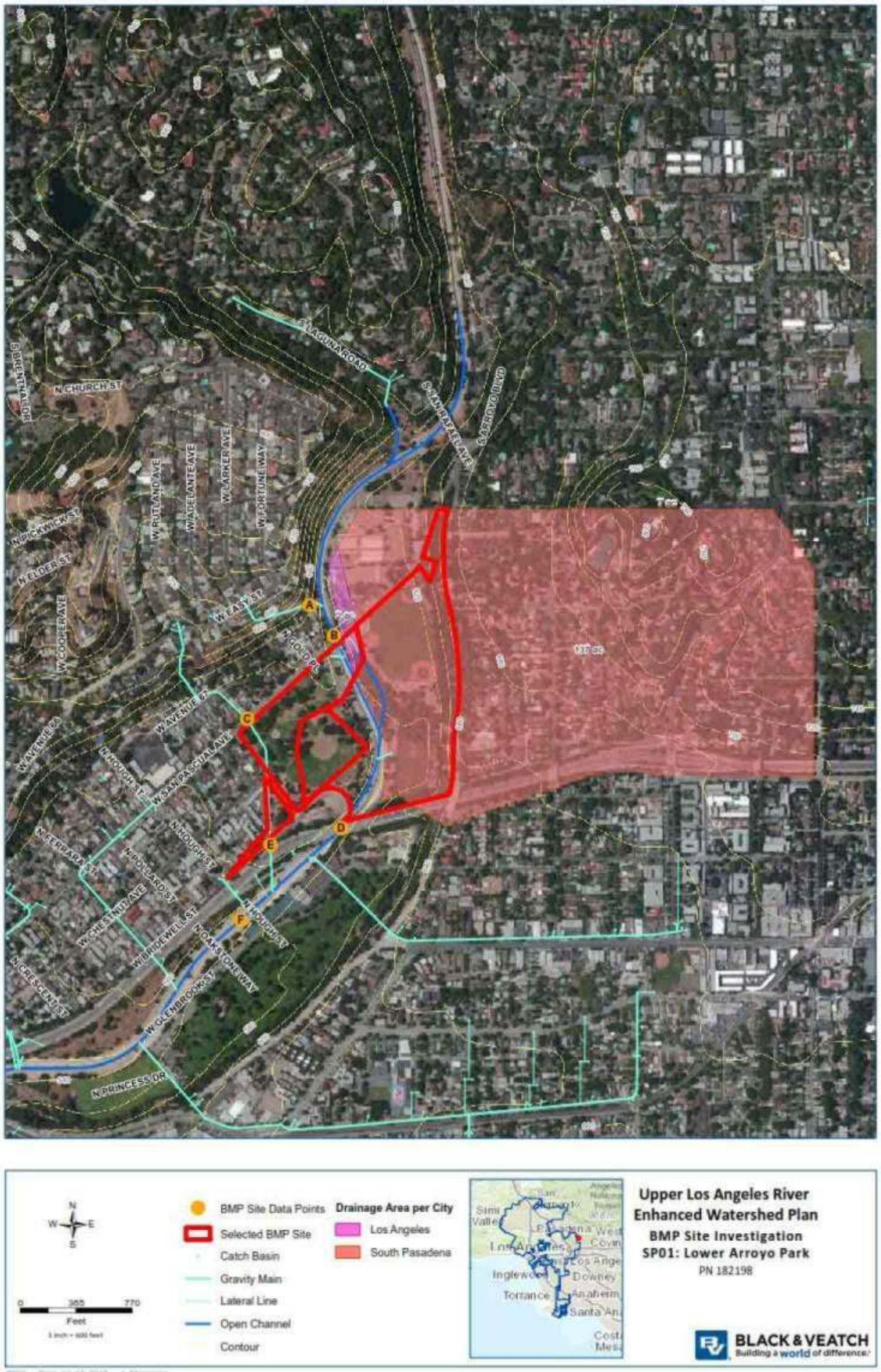


Figure 4-33. Lower Arroyo Park Subsurface Infiltration Drainage Area

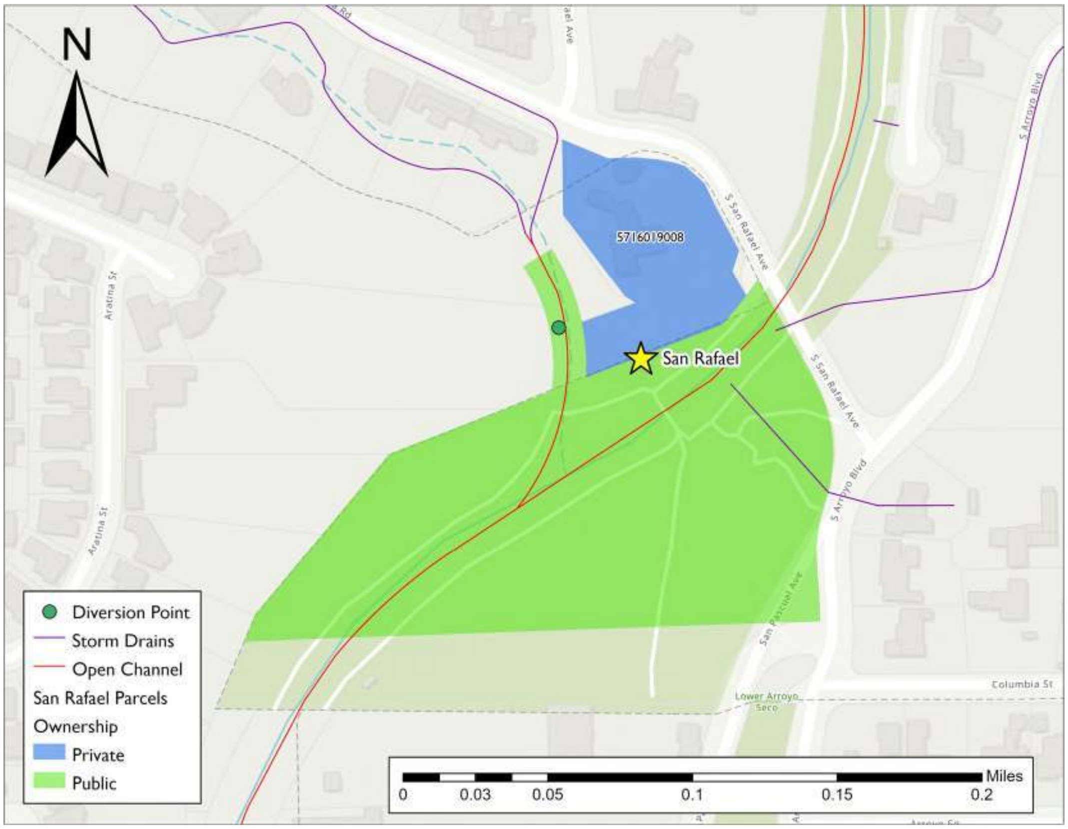
Figure 4-34. Lower Arroyo Park Subsurface Infiltration Site Location

ATTACHMENTS FOR SECTION 1.1:

OVERVIEW

ATTACHMENTS FOR SECTION 1.2:

PROJECT LOCATION



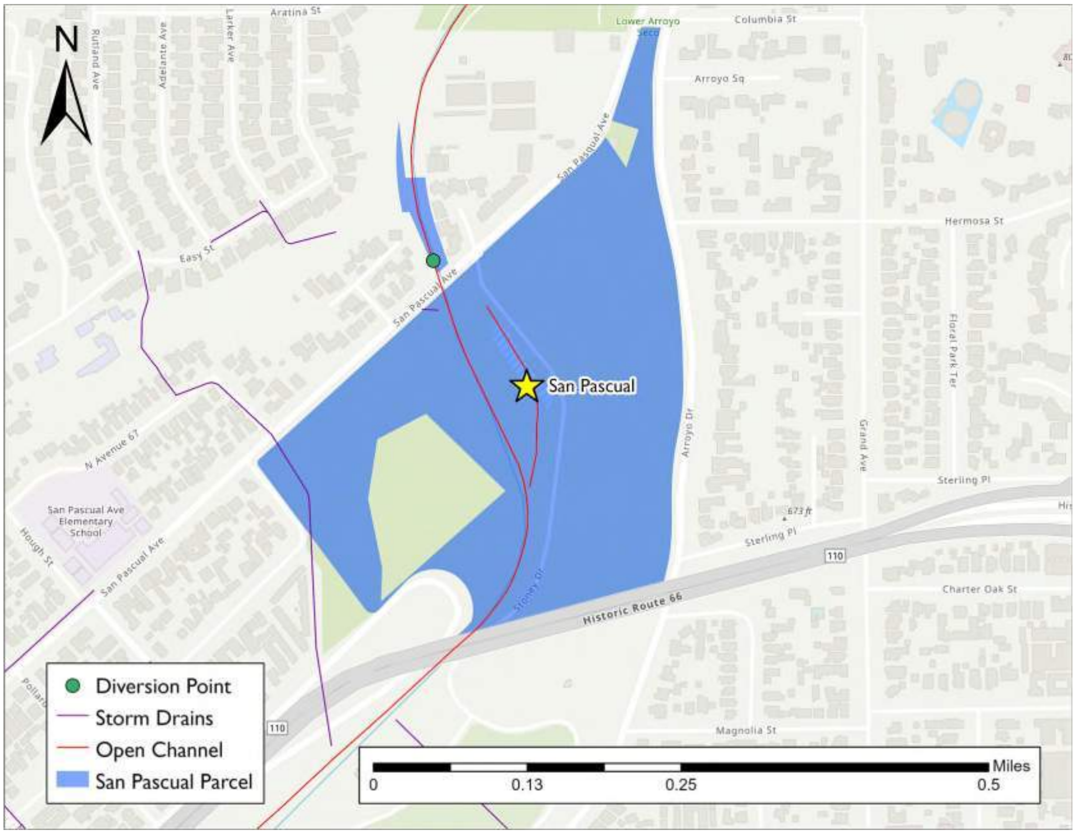


Figure 9. Map of parcel boundary for San Rafael projects.

ATTACHMENTS FOR SECTION 2.1:

CONFIGURATION

ARROYO SECO – SAN RAFAEL TREATMENT WETLANDS

PROJECT DESCRIPTION FOR SCW APPLICATION

October 15, 2020

PRESENTED TO

City of Pasadena
Department of Public Works
100 North Garfield Avenue
Room N306
Pasadena, CA 91101

PRESENTED BY

Craftwater Engineering, Inc.
San Diego | Los Angeles
Tel 805.729.0943
www.craftwaterinc.com

1.0 DESIGN ELEMENTS

This section provides an overview of the project design details.

1.1 CONFIGURATION

Table 1-1 is a summary of the project configuration. Attachment A contains detailed project description while Attachment B contains the plan view and preliminary profile views of the project configuration.

Table 1-1: Project Configuration Summary

BMP Type:		**San Rafael Treatment Facility**	**San Pascual Treatment Facility**	**Treatment Facility Total**
Ponding Depth:	Ft	5	5	5
Footprint Area	Ac	0.52	1.30	1.82

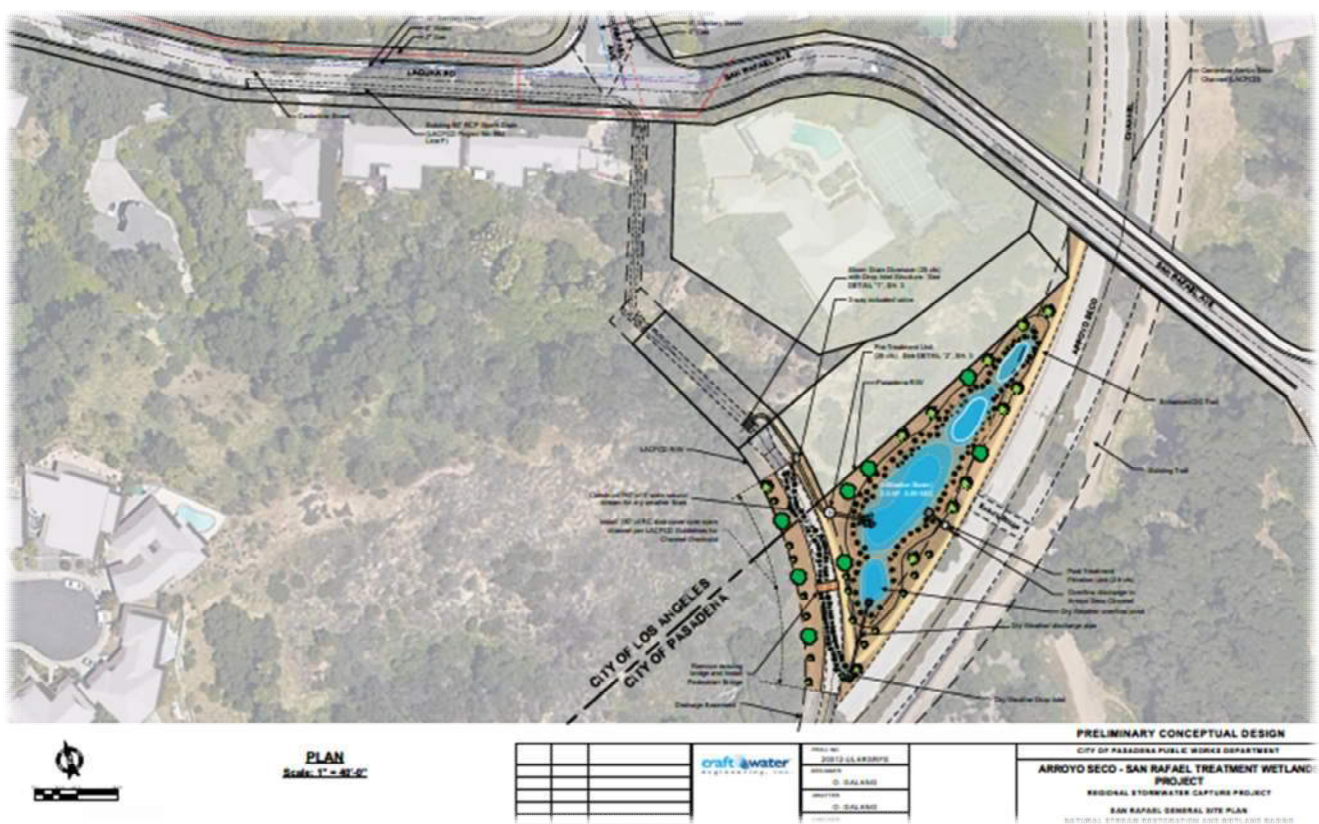


Figure 1. Conceptual layout configuration for San Rafael project site.

Figure 2. Conceptual layout configuration for San Pascual project site.

1.1.1 Diversion and Pretreatment

This section provides details on the project's diversion structure and pretreatment system. Table 1-2 provides a summary of details on the diversion type and maximum diversion rate. Further descriptions of the diversion structures and pretreatment systems are included below.

Table 1-2: Diversion Details

Diverted Pipe ID	Type of Diversion	Typical Max Diversion Rate (cfs)
San Rafael Creek Channel	Gravity	25
Arroyo Seco Channel	Gravity	25
	Total	**50**

The diversion structure is estimated to have an average inflow captured of 0.437 cfs total.

Drop-inlet structures are proposed along the BI0562-Line F concrete channel (San Rafael Creek) and the Arroyo Seco Channel to divert stormwater during low-flow and storm events to the pretreatment device and eventually the stormwater treatment basins.

1.1.1.1 San Rafael Creek Channel Diversion

At the proposed flow rate of 25 cfs, the structure will require a 1.5-foot drop below the existing invert and a 30-inch diameter diversion pipe at a 0.5% slope. The drop inlet structure will have dimensions of approximately 12.0-feet wide and 3-feet long. A schematic of the structure is shown in Attachment B.

1.1.1.2 Arroyo Seco Channel Diversion

At the proposed flow rate of 25 cfs, the structure will require a 1.5-foot drop below the existing invert and a 30-inch diameter diversion pipe at a 0.5% slope. The drop inlet structure will have dimensions of approximately 30.0-feet wide and 3-feet long. A schematic of the structure is shown in Attachment B.

1.1.1.3 Pretreatment System

Stormwater runoff transports sediment, metals, nutrients, trash, and debris that can compromise the performance of the stormwater facility and pollute downstream receiving waters. Pretreatment will be an integral component of the treatment train strategy to extend the life of the system. It is prescribed to reduce the long-term maintenance burden of the facilities, focus maintenance efforts to a concentration and accessible area, and bolster watershed compliance.

For this project, a hydrodynamic separator is proposed to be installed at the diversion points. One hundred percent of floatables and neutrally buoyant debris larger than the screen aperture (2400 microns or 2.4 mm) is collected and settle in the isolated sump of the system, eliminating scour potential. In addition to the screen aperture filtration, at least 80% of particles that are 130 microns or larger in size are removed for the proposed diversion flow. With the chambered system, hydrocarbons float to the top of the water surface and are prevented from being transported downstream. A target flow rate for the device will be based on the final design of the diversion structure. It will be designed to have the capacity to treat the maximum flow diverted to the unit. The size of the unit will also be based on the estimated sediment that will be collected in the sump to maximize sediment removal while balancing the routine maintenance required.

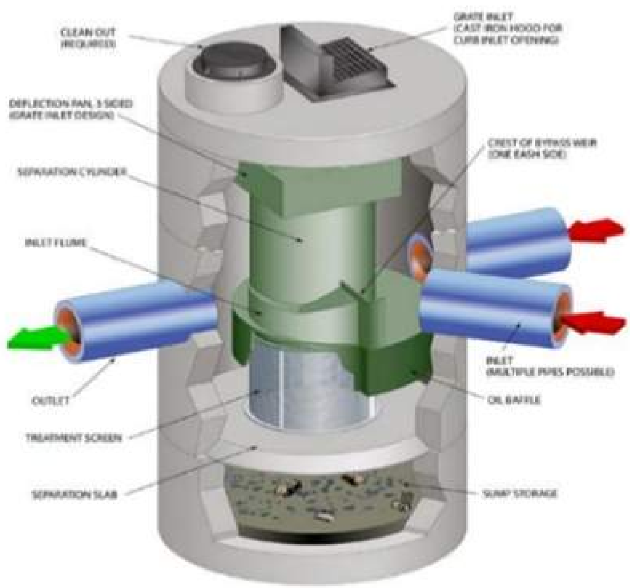


Figure 3. Typical Hydrodynamic Separator (Source: Contech Engineered Solutions)

1.1.2 Storage Component

Onsite stormwater detention is provided by an above ground infiltration basin at the San Rafael site and a treatment wetland and storage reservoir basin at the San Pascual site. The San Rafael infiltration basin will provide 2.6 ac-ft of storage and the San Pascual basin will provide 6.5 ac-ft for a total of 9.1 ac-ft.

1.1.3 Treatment and Discharge

A treatment wetland system is proposed with restored habitat which will provide natural treatment for a portion of the stormwater being diverted.

Additionally, a post-treatment filter system provides final pollutant removal prior to discharge back into the channel. The water flows from the basins to the filter and then back to the channel via gravity. The treatment rates for the San Rafael and the San Pascual sites are 2.88 and 5.76, respectively.

The filter system proposed is a cartridge system. Flow enters the filter where it is then provided sufficient contact time with the filter cartridges. The cartridges contain an opening size of 10 microns and can treat between 0.05 gallons per minute (gpm) to 1 gpm per square foot of cartridge surface area. Multiple cartridges are installed in a large concrete reservoir that can treat up to 5.76 cfs. Pollutants build up on the cartridge preventing migration back to the channel. The cartridges are cleaned and re-used providing an easy maintenance process.

1.1.4 Nature-Based Components

The proposed natural stream, treatment wetland and recharge basin provide an opportunity for the development of diverse and natural flora and fauna habitats. Different plant life emphasizing native vegetation can be planted in the drier infiltration basin sections than the treatment wetlands. These will protect, enhance, and restore habitat, green space, and usable space.

Dry weather flows will be pumped to the surface where the natural stream will be created on top of the San Rafael Channel to demonstrate the natural waterways found within the region.

1.1.5 Above Ground Improvements

The project proposes the above ground improvements discussed above. Additionally, new and restored walking paths and pedestrian bridge will be installed improving public access to the waterway. A rehabilitated parking area off of San Pascual Drive will provide parking access for maintenance vehicles and overflow parking for nearby Arroyo Park.

Native trees, shrubs, and grasses will be installed throughout the spaces to enhance the natural environment of the area.

PRELIMINARY CONCEPTUAL DESIGN

N

0 ft. 24 ft. 40 ft. 80 ft.

PLAN

Scale: 1" = 40'-0"

DATE	MK	DESCRIPTION
REVISIONS		

craftwater engineering, inc.

PROJ. NO. 20012-ULARSRFS

DESIGNER O. GALANG

DRAFTER O. GALANG

CHECKER C. HELMLE

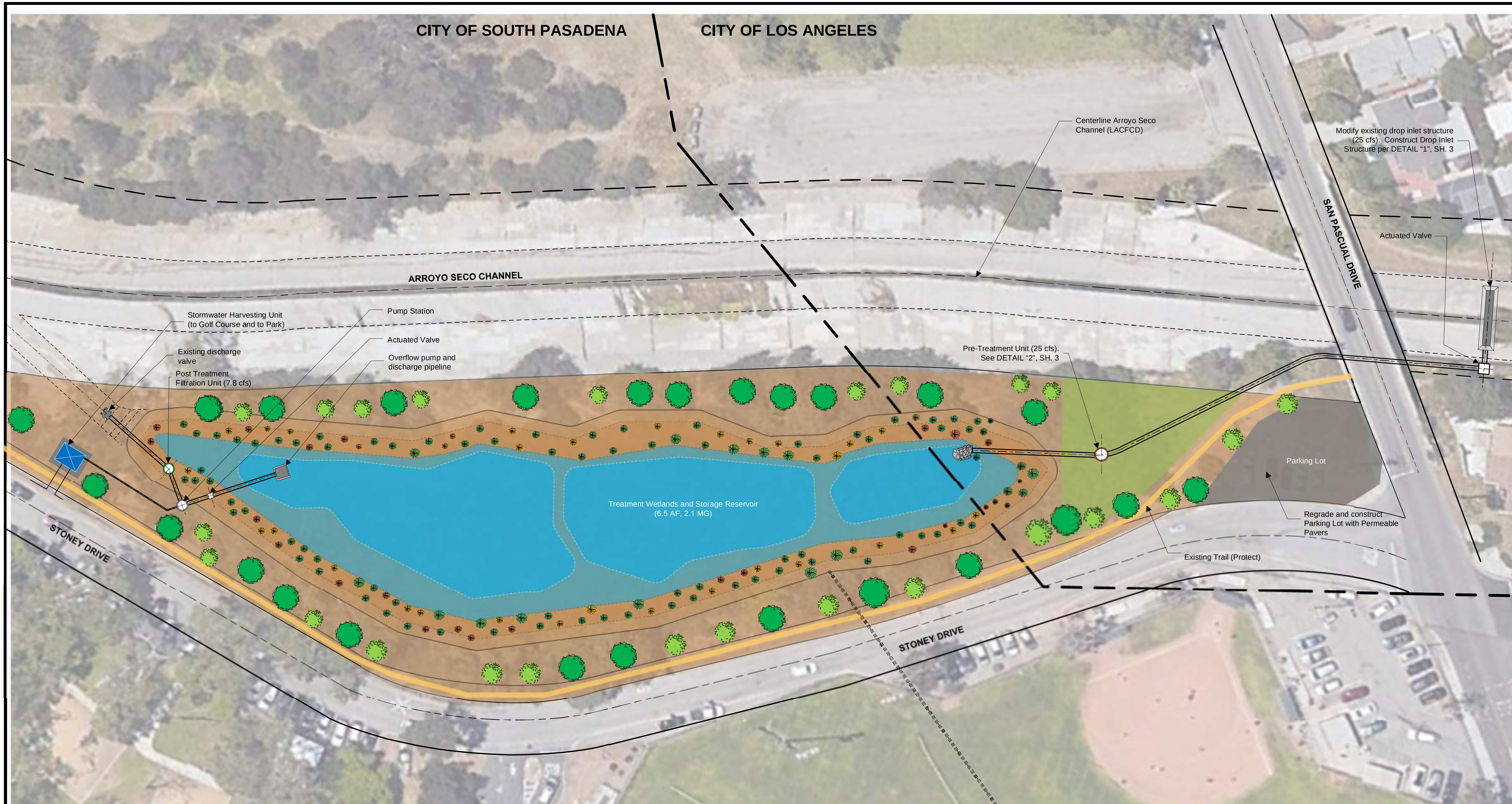
CITY OF PASADENA PUBLIC WORKS DEPARTMENT

ARROYO SECO - SAN RAFAEL TREATMENT WETLANDS PROJECT

REGIONAL STORMWATER CAPTURE PROJECT

SAN RAFAEL GENERAL SITE PLAN
NATURAL STREAM RESTORATION AND WETLAND BASINS

SHEET 1 OF 3



0 ft. 24 ft. 40 ft. 80 ft.

PLAN

Scale: 1" = 40'-0"

DATE	MK	DESCRIPTION
REVISIONS		

craftwater engineering, inc.

PROJ. NO. 20012-ULARSRFS

DESIGNER O. GALANG

DRAFTER O. GALANG

CHECKER C. HELMLE

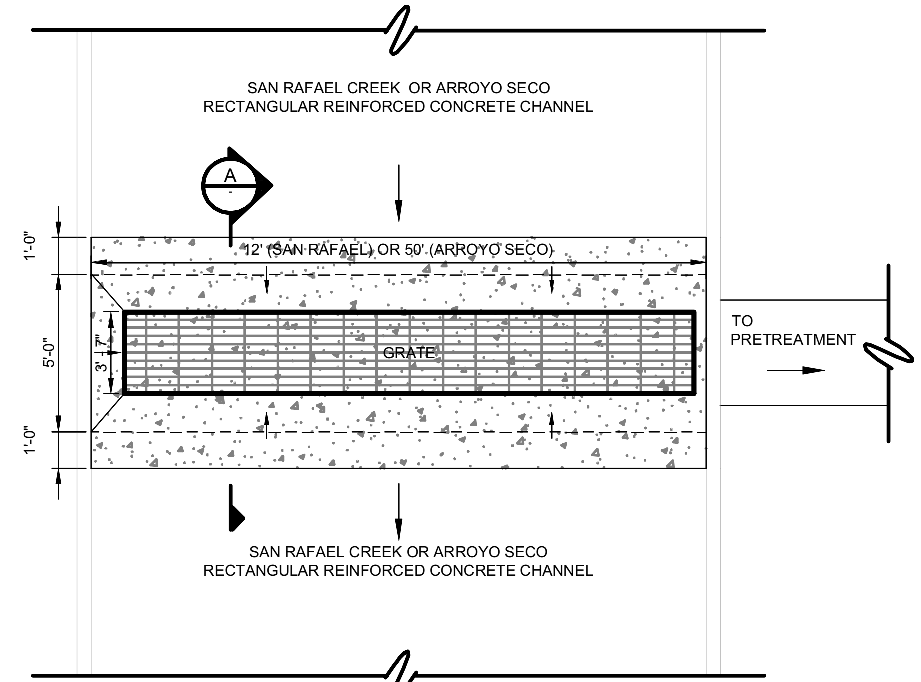
PRELIMINARY CONCEPTUAL DESIGN

CITY OF SOUTH PASADENA PUBLIC WORKS DEPARTMENT

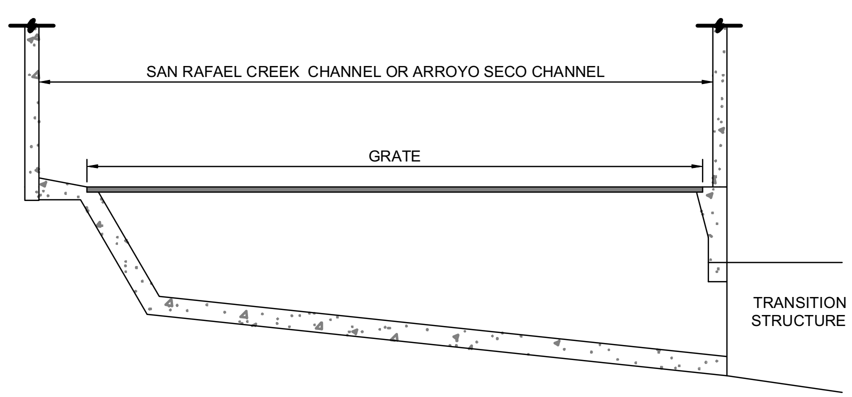
ARROYO SECO – SAN RAFAEL TREATMENT WETLANDS PROJECT

REGIONAL STORMWATER CAPTURE PROJECT

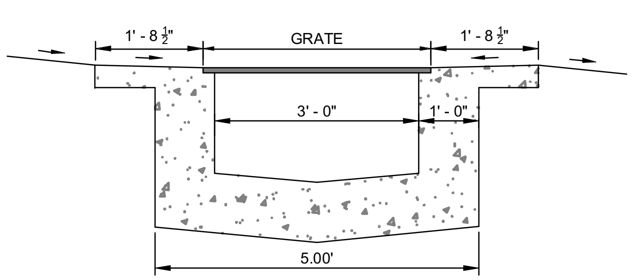
ARROYO SECO (SAN PASCUAL) SITE PLAN
GENERAL SITE PLAN



PLAN VIEW
N.T.S.

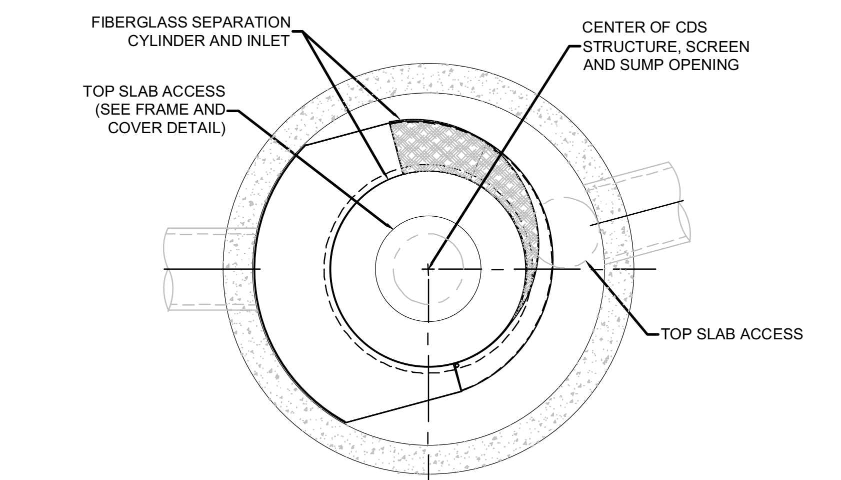


PROFILE VIEW
N.T.S.

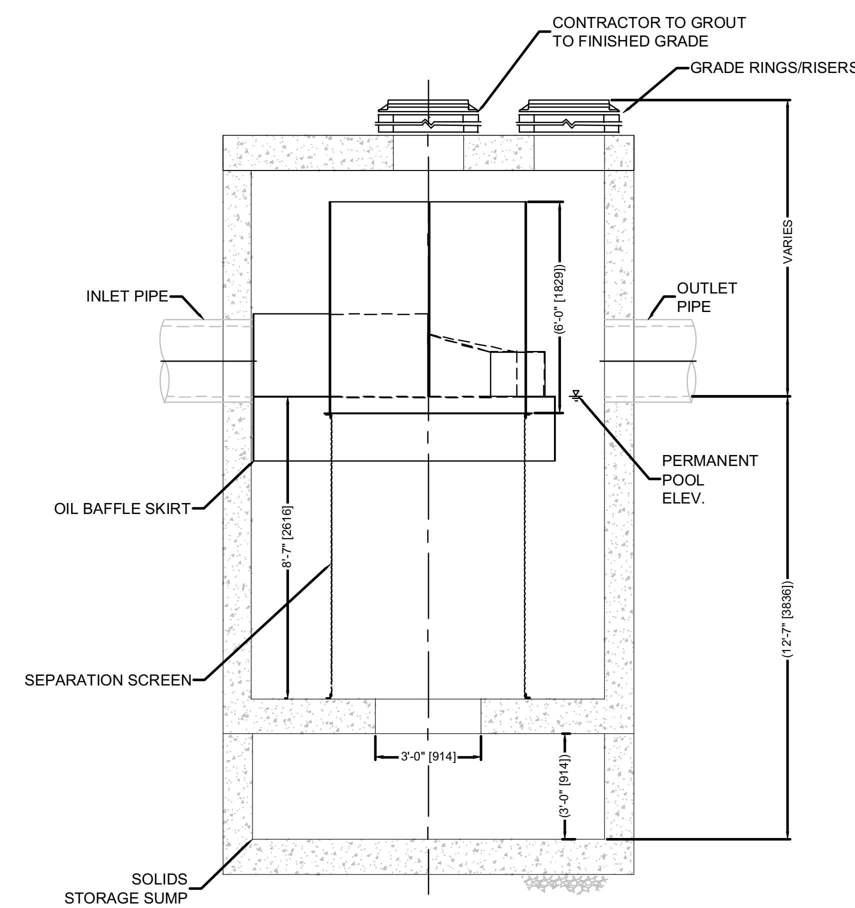


SECTION 'A-A'
N.T.S.

1 – DIVERSION STRUCTURE
NTS



PLAN VIEW B-B
N.T.S.



2 – PRETREATMENT CDS UNIT
NTS

PRELIMINARY 10% DESIGN

NO.	REVISIONS	REVISED BY	APPROVED BY	DATE

DESIGNER:
C. SEMLOW
DRAFTER:
C. SEMLOW
CHECKER:
O. GALANG

CITIES OF PASADENA AND SOUTH PASADENA, CALIFORNIA

ARROYO SECO-SAN RAFAEL TREATMENT WETLANDS PROJECT
REGIONAL STORMWATER CAPTURE PROJECT

DETAILS

DWG.XXXXXXXXXX | SHEET 3 OF XX

ATTACHMENTS FOR SECTION 2.2:

CAPTURE AREA

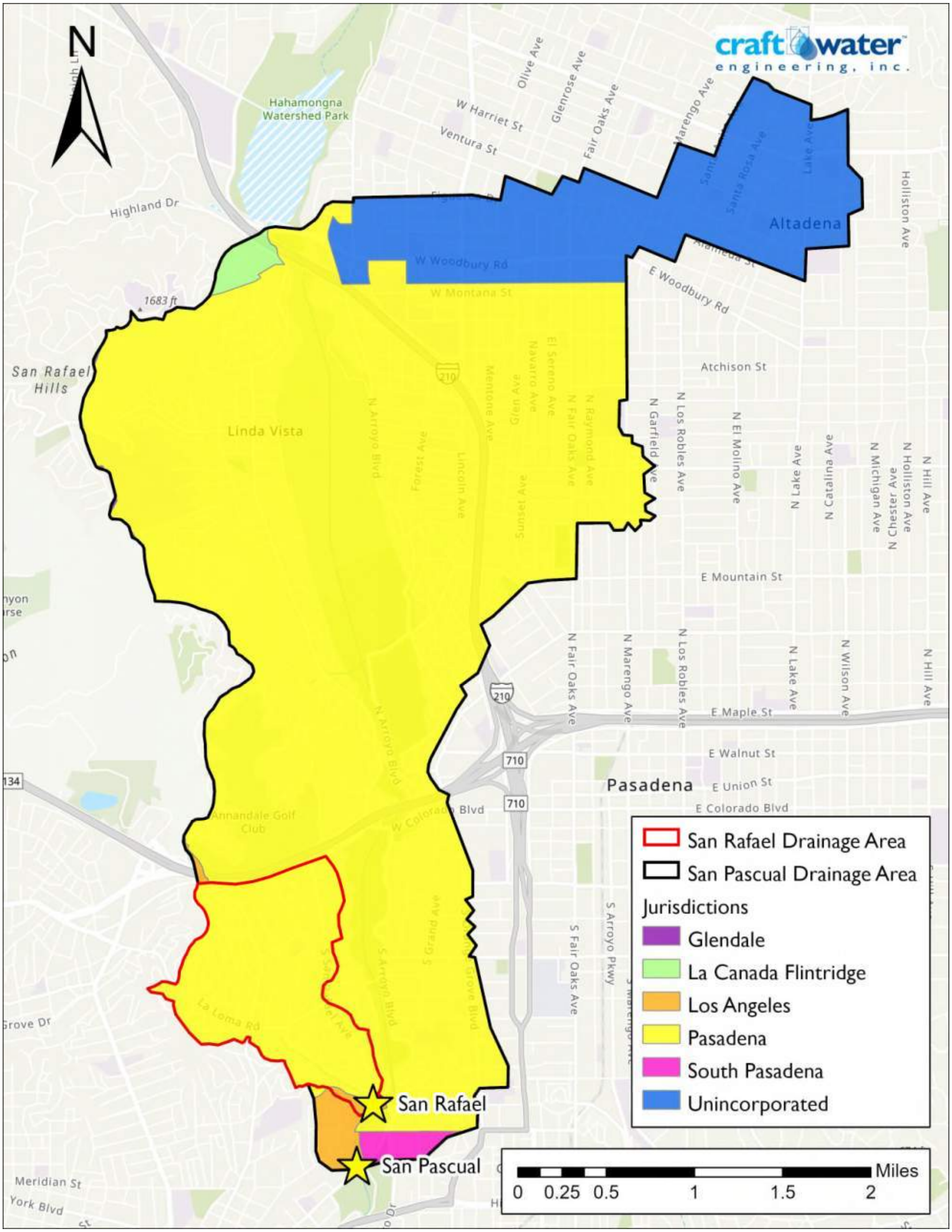


Figure 10. Drainage area jurisdiction boundaries for San Rafael projects

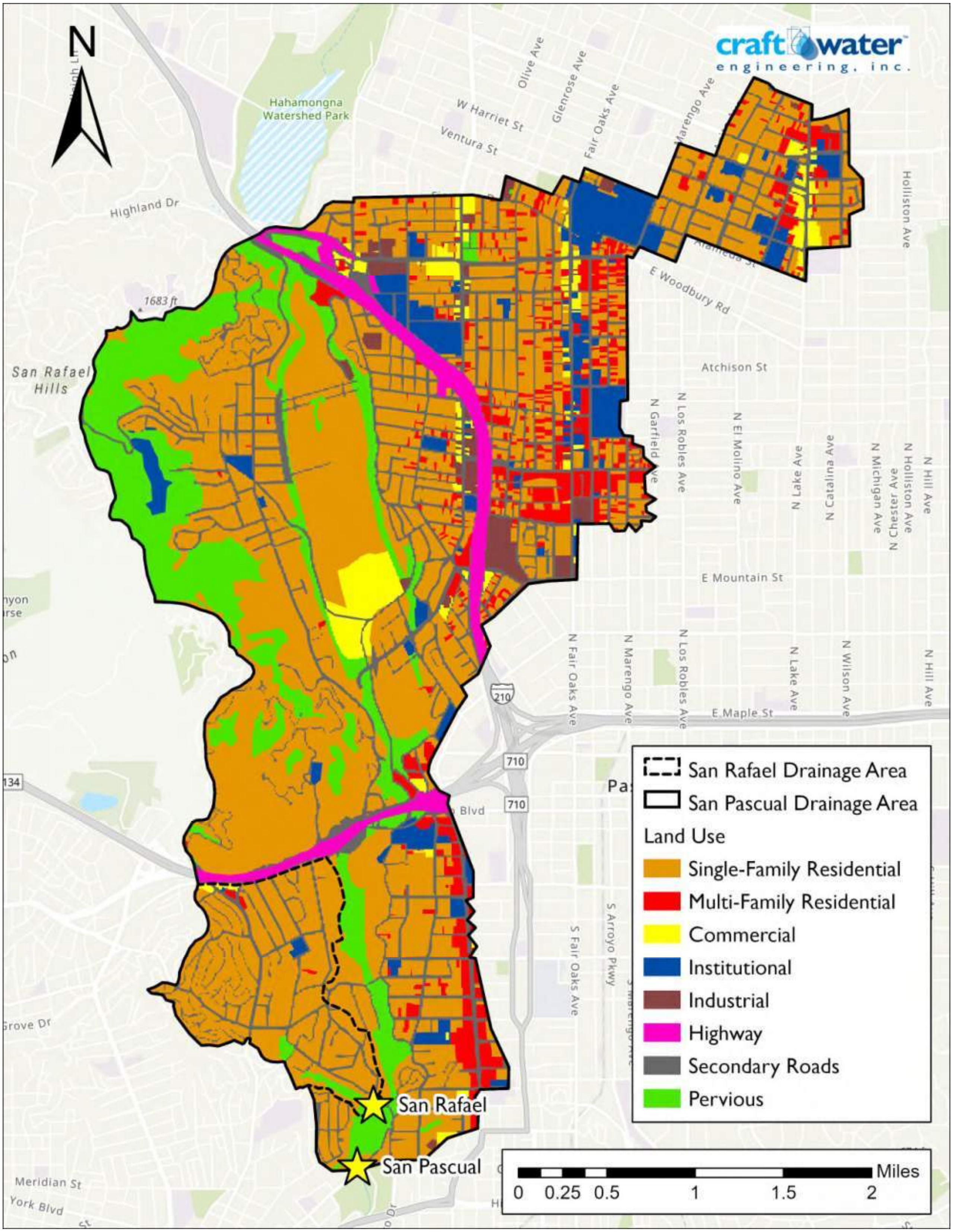


Figure 11. Drainage area land use for the San Rafael projects.

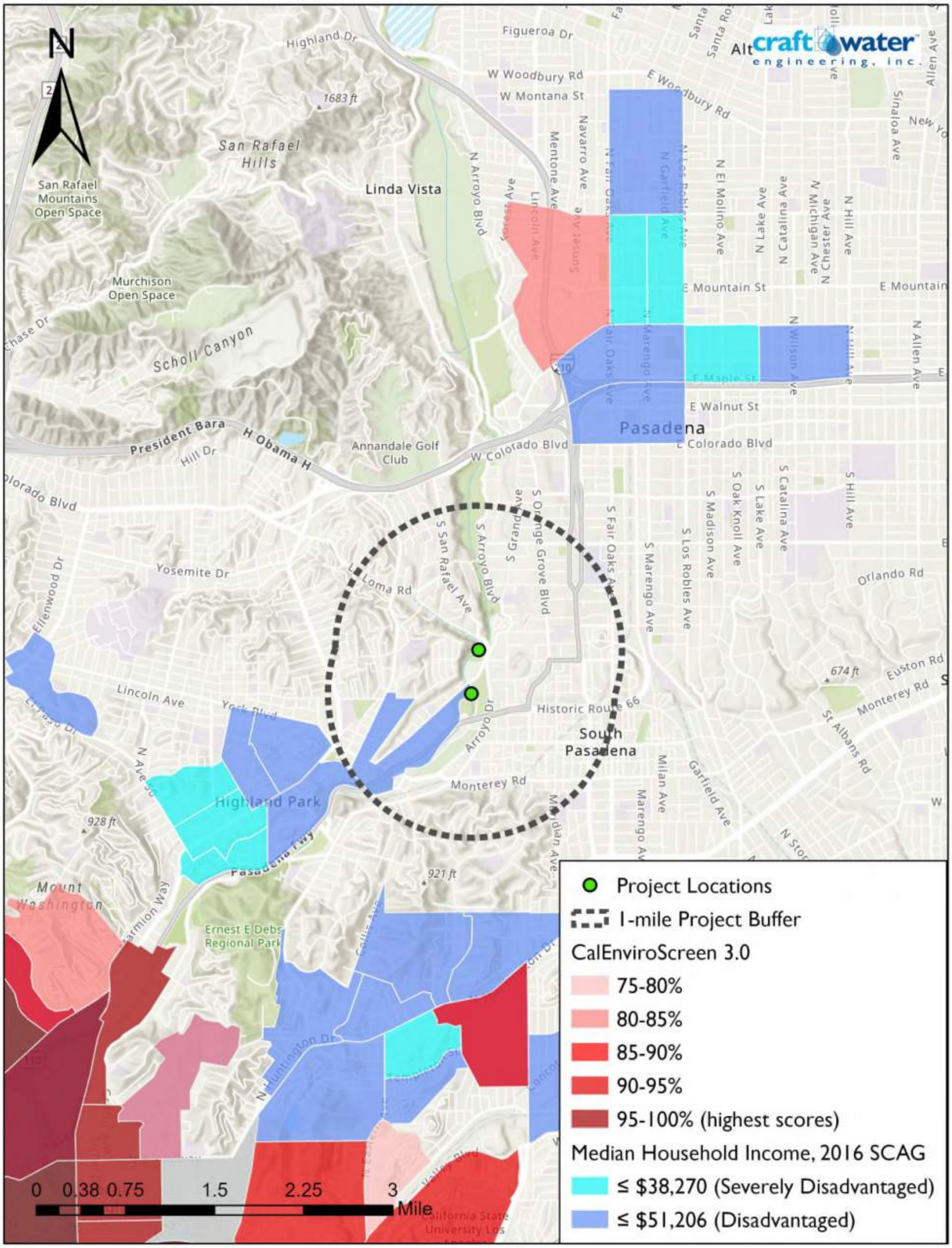


Figure 12. Disadvantaged Communities within the San Rafael Projects Drainage Area

ATTACHMENTS FOR SECTION 2.4:

SITE CONDITIONS & CONSTRAINTS

MEMO

TO: Brent Maue, City of Pasadena
Julian Lee, City of South Pasadena

CC:

FROM: Oliver Galang, PE, Craftwater Engineering

SUBJECT: San Pascual Stormwater Capture Facility
Stormwater Capture Feasibility Study Technical Memorandum

DATE: September 22, 2020

The Upper Los Angeles River Watershed is a largely built-out, urbanized watershed of approximately 485 square miles, or 310,400 acres, in the Upper Los Angeles River Watershed Management Area and over 50 miles of the main line of the LA River. The development of the San Pascual Treatment Wetlands Stormwater Capture Feasibility Study in the City of Pasadena represents another major opportunity to continue the regional scale progress to achieve pollutant load reductions for the Upper Los Angeles River Watershed Management Program. The primary objective of this project is to prepare a Feasibility Study Report for the San Pascual Treatment Wetlands Project, which include the 10% design level documents that could be utilized to support a funding application under Los Angeles County's Safe, Clean Water Program. Towards this goal, this memo presents the analytical results evaluating the potential stormwater capture and water use alternatives and the sizing options for an optimized design. This project is intended to intercept a sizeable portion of the stormwater flows from the Arroyo Seco Channel to the project site (**See Figure 1**). Stormwater will be diverted from the Arroyo Seco reinforced concrete channel (Concrete Conduit Section 2) managed by the Los Angeles County Flood Control District (LACFCD) at an existing diversion point that directs flows to the project location. A surface treatment infiltration basin best management practice (BMP) is proposed at San Pascual Treatment Wetlands to capture and infiltrate stormwater from the diverted drainage channel. Project constraints and potential options will be detailed in this memo to present an array of sizing options that will contribute to both water quality goals as well as other important project considerations and desired outcomes. These options can then be considered and weighed before proceeding with the ultimate design of the project by identifying the project configuration that best meets the desired outcome and contributes to water quality benefits in a cost-effective manner.

Figure 1. San Pascual Site, South Pasadena/Los Angeles

1.0 OBJECTIVES

To identify the most effective stormwater capture configuration at the project site, decision support modeling has been conducted to identify the optimal BMP configuration using a balanced approach that incorporates design storm hydrologic targets as well as long-term water quality considerations. This optimal configuration addresses stormwater runoff that will be diverted to the project site from a potential diversion point near the park. BMP configuration recommendations will be made for the San Pascual site for the following key design criteria.

Diversion Rates

A range of feasible diversion flowrates will be simulated to develop cost-effectiveness curves and to determine the optimal flowrate to be diverted to the capture facility that will provide the greatest water quality benefit without surpassing the point of declining returns. Flowrates will range in values grounded in construction feasibility and subject to other project constraints identified in the initial project concept development.

BMP Storage

The optimal BMP size will be determined subject to the allowable site footprint. Size recommendations will include the following highlighted endpoints:

- The BMP size that is most cost-effective for the project tributary area,
- The BMP size that will capture the 85th percentile, 24-hour storm runoff volume, and
- The BMP size that will achieve multi-benefits, including, but not limited to, addressing stormwater quality and water supply.

Discharge –Water Use and Flowrate

Different routes exist for the outflows from the BMP, and each entail differing requirements, infrastructure, and constraints that impact the overall performance of the stormwater capture system and project cost. Also, these options represent different contributions to other local water supply efforts, of which stormwater is a growing component. If infiltration is feasible at this site due to favorable soil infiltration conditions, it will be utilized to dewater the BMP and contribute to regional groundwater recharge goals. Infiltration feasibility and rates will be determined in a future geotechnical analysis. Additionally, the potential to discharge captured stormwater to nearby sanitary sewers or to filter it and return it to storm drains will be assessed for this site to quantify the potential benefits of different options should infiltration be deemed infeasible. Filtration throughflow rates for commonly available systems and estimates of feasible sanitary sewer capacity will be evaluated to ensure that these discharge options are right sized to the baseline water quality for the drainage area and other system configuration options. Additionally, the potential for on-site irrigation via filtration of captured dry-weather flows will be assessed for viability.

Figure 2 shows the initial evaluated concept of a surface wetland, east of the Arroyo Seco Channel.

Figure 2. Preliminary concept schematic for the San Pascual Treatment Wetlands BMP as a treatment wetland, east of the Arroyo Seco Channel (may not represent final project details).

2.0 BASELINE SITE CONDITIONS AND CONSTRAINTS

The following subsections summarize the baseline watershed, hydrologic, and on-site conditions and constraints that will be accounted for in BMP configuration and optimization analysis for the San Pascual site.

2.1 Watershed Characterization

For this study, the Los Angeles County Watershed Management Modeling System (WMMS) was used within the Loading Simulation Program C++ (LSPC) to simulate the contaminant loading, runoff volume, and flow rate associated with a long-term, 10-year continuous time series (Water Year 2002 to Water Year 2011) as well as the 85th percentile storm. The WMMS is accepted by the Los Angeles Water Quality Control Board for performance of compliance analyses in the context of EWMP/WMP development.

The drainage area delineations for the project site (**Figure 3**) were developed using geospatial data associated with the WMMS modeling subwatersheds and verified/corrected slightly using further GIS analysis where full subwatersheds did not coincide with project locations and where subsurface storm drains overlapped. Digital stormwater pipe inventories and high-resolution Light Detection and Ranging (LiDAR) elevation data were used to accomplish subwatershed splitting. Developed drainage areas were used to model runoff and water quality baseline timeseries'. These were then incorporated into BMP models to optimize the BMP decision variables. The overall area and impervious fraction are summarized in **Table 1** .

Table 1. Summary of watershed and hydrologic conditions for the San Pascual Project drainage area

Total Tributary Area (ac)	Impervious Tributary Area (ac)	Average Annual Runoff (ac-ft)	Average Annual Zn Loading (lbs)	85th Percentile Surface Runoff (ac-ft)	85th Percentile Peak Flow (cfs)
5,005	**1,200 (24%)**	**4,583**	**1,298**	**232**	**305**

2.2 Hydrologic Considerations

Long-term baseline flows and pollutant loads to the site are also summarized in **Table 1**. The total loadings presented in this table represent the maximum possible reductions that could be achieved by control measures at the project site. However, pragmatic diversion limitations, space constraints, and subsequent treatment mechanisms will ultimately limit how much runoff and pollutant mass can potentially be diverted into the BMP. Peak flow rate and total runoff for the 85th percentile design storm (1.05 in., taken from isohyetal data for the centroid of the drainage areas) are found in **Table 1** as well.

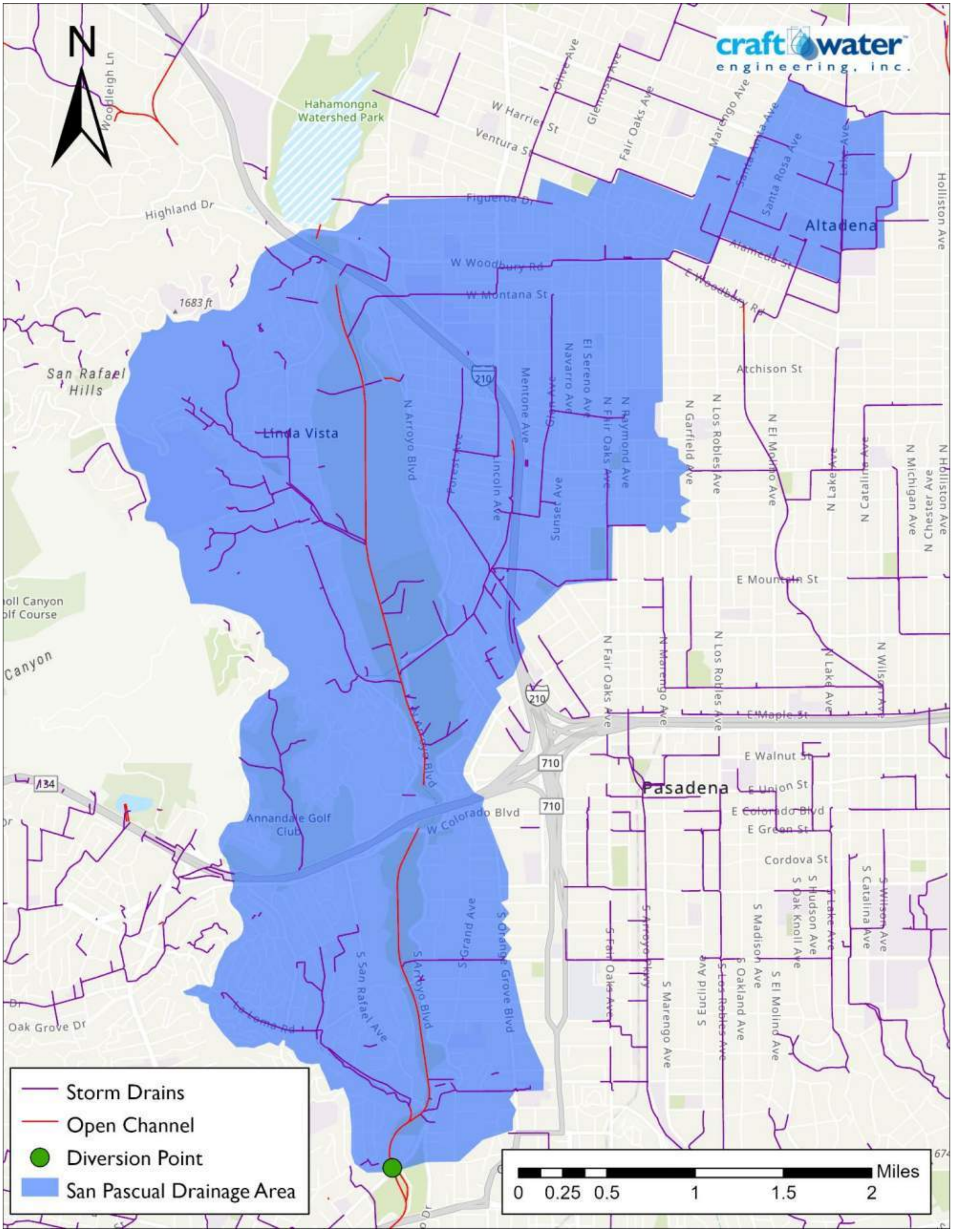


Figure 3. Drainage area for San Pascual Project.

3.0 STORMWATER CAPTURE OPTIMIZATION METHODS

3.1 Water Quality Optimization Strategy

The primary design goal of the San Pascual Treatment Wetlands Project is to reduce long-term annual loading of pollutants to the ULAR watershed using zinc as the limiting pollutant of interest in the analysis as established by the EWMP for this watershed group. To ensure that the system will be sized to maximize load reductions in a cost-effective manner, optimization modeling was performed.

The purpose of optimization modeling is to balance design components (including BMP volume and inflow diversion rates) such that no one component limits the performance of the system subject to potential discharge options (see **Figure 4** at right). Optimization supports decision making throughout the design process by guiding selection of the most cost-effective system design.

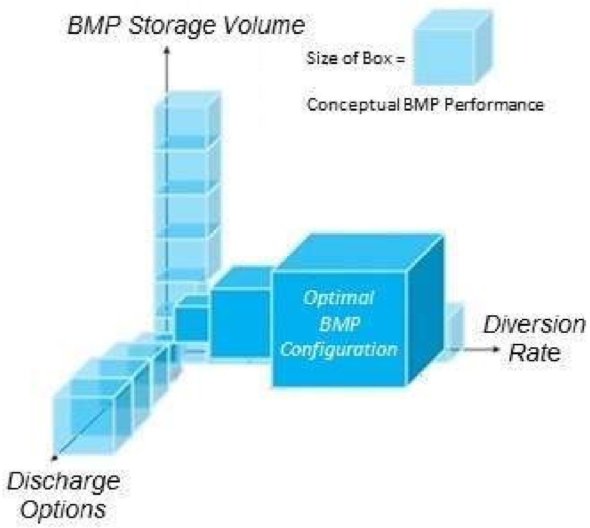


Figure 4. Conceptual illustration of optimization modeling balancing various design components to maximize performance.

The model setup for water quality simulation and optimization is complex, involving several modeling systems and iterative feedback from design engineers. The general methodology is discussed below, and the results are presented thereafter.

3.2 Preliminary Size and Diversion Optimization (SUSTAIN)

The first step of the modeling was to predict BMP performance for a range of potential BMP sizes, diversion points and inflow rates, and discharge alternatives. EPA's System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) model was used for this analysis because its built-in optimization algorithms automate the process of evaluating many different BMP configurations to select a cost-effective solution related to project goals. The model was run using 10 years of runoff and pollutant loading time-series data generated by the WMMS at an hourly time step. During this preliminary decision-support modeling, the discharge alternatives were simulated using certain site constraints to capture approximate BMP throughflow rates at the same time as varying the diversion rate and storage volume. These preliminary optimization model runs produced a point cloud from which the optimal cost-effectiveness curves were extracted. Subsequent targeted modeling then provided a clear decision pathway for the development of optimal project alternatives. Modeling efforts investigated the range of BMP configurations as detailed in the following subsections.

3.2.1 Diversion Rates

Model runs were limited to feasible diversion ranges for the proposed diversion point based on prior project knowledge related to the drainage area and potential project storage size. Diversion rates for the San Pascual BMP were modeled over the range of 10 to 50 cfs, varying in 5 cfs increments, to assess the most cost-effective configuration of diversion inflow rates.

3.2.2 Storage Volume

Site assessments and discussion with project stakeholders indicated an initial surface wetland storage volume of 8.0 ac-ft. These initial estimates for potential storage were developed assuming a maximum ponding depth of 8 feet for surface wetland storage. Modeling was carried out for a BMP storage ranging from 0.1 to 20.0 ac-ft by 0.1 ac-ft increments to assess trends in stormwater treatment efficiencies over a full range of storage sizes to identify points of diminishing return and ensure final recommendations accounted for the full potential treatment for the site.

3.2.3 Discharge Alternatives

The modeling evaluation identified two possible discharge scenarios that are evaluated for their water quality impacts: (1) infiltration into the subsoils, and (2) wetland settling and additional filtration prior to discharge back into the channel. Geotechnical investigations are awaiting completion, so initial assessments of the infiltration option were conducted assuming a conservative infiltration rate of 0.3 in/hr, the minimum acceptable value for an infiltration project in Los Angeles County. A treatment wetland system limits infiltration to maintain a wet pool, so infiltration rates will not impact the performance of this option. Both project options were additionally assessed with the addition of a filtration system at the outlet to increase water quality benefits and ensure adequate treatment. Filtration was modeled at 2.88 cfs and 5.76 cfs discharge rates to represent commonly available filtration devices and corresponding throughput efficiency.

One final option for discharge of captured runoff that was evaluated was discharge to the sanitary sewer. Sewer discharges are typically limited to flowrates that are comparable to filtration devices, but they are further constrained by allowable temporal discharge windows and rates (normally between 10pm to 8am daily) and only during dry weather (defined as 24-hours after any rainfall of greater than or equal to 0.1 in/hr). System capacity and discharge allowances are beyond the scope of this feasibility study, and additional coordination with the sewer purveyor is required during later stages of design to determine the available capacity and discharge rates if this option for the project is desired. A desktop analysis indicates that the closest sewer lines are located approximately 500 feet away at an elevation approximately 80 feet higher than the proposed project site on Arroyo Drive (**Figure 5**). Due to this high topographic relief to the nearest lines, the pursuit of sanitary sewer discharge is not recommended and is not further evaluated in this analysis.

Figure 5. Sanitary sewer in the vicinity of San Pascual Treatment Wetlands.

3.2.4 Inflow Infrastructure

Diverted inflows can be conveyed to the storage BMP via gravity-fed pipes or by way of pumps. The two options have tradeoffs associated with costs that are typically defined by the invert depth of the storm drains at the diversion points and the BMP storage footprint. Gravity-fed inflows require the BMP to be sited deep enough underground for flows to move passively toward the storage. This is associated with excavation and stabilization costs that are determined by the storm drain invert and distance of the diversion. Pumped inflows allow the BMP to be sited vertically with minimal soil cover atop the storage, but these are associated with costs of pumping infrastructure, operation, and maintenance. At different sizes of a given BMP and site, pumping inflows may be more cost-effective than gravity-fed diversions, and vice versa. Because of this, all modeled configurations were assessed for both inflow types to determine the most cost-effective inflow configuration across modeled scenarios.

4.0 OPTIMIZATION MODELING RESULTS

The optimization analysis aimed to maximize the long-term pollutant load reduction and 85th percentile design storm volume capture by simultaneously varying the diversion rate, BMP size, and discharge rates related to options previously discussed. Each of these design features has an associated range of options that were modeled to assess alternatives against long-term water quality benefits and identify the most effective. Additionally, different configurations were paired with estimated planning level cost data to assess alternatives and options against each other to ultimately determine the best configuration for this site. By optimizing based on these variables, multiple pathways to achieve maximum water quality benefit were identified and the most cost-effective alternatives were determined. Different configuration alternatives and modeling parameters are presented below to demonstrate the cost-effectiveness associated with these options and narrow them down to a few key recommended project configurations that will meet different needs for the ULAR watershed and contribute to the goals of the EWMP.

4.1 BMP Type – Infiltration Basin vs Treatment Wetlands

Two BMP types were evaluated for this site; a treatment wetland and an infiltration basin. These BMPs were modeled over the full range of configurations discussed before, and the water quality benefits for the range of projects modeled for the design alternatives are presented in **Figure 6**. These alternatives were evaluated to determine the best options at the San Pascual site given the site-specific constraints. Results display the optimal front of the full range of projects modeled for each of the various BMP types. Based on the modeling results and the desire for groundwater recharge, an infiltration basin has a similar performative advantage on a cost per pound of pollutant removed as a treatment wetland with an estimated ~25lbs difference in reduction of zinc per year. The addition of a filter shows an added benefit and is discussed in the next section.

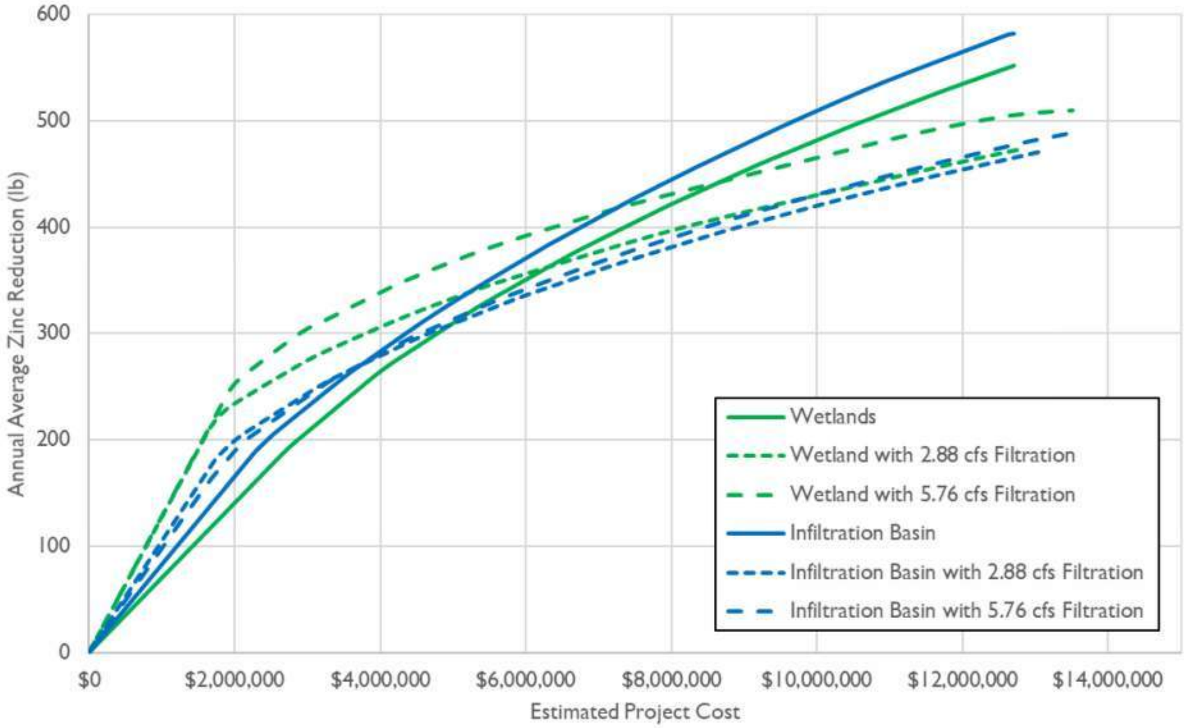


Figure 6. Infiltration BMP versus a Treatment Wetlands BMP

4.2 Filtration Recommendations

Pollutant removal performances can be increased in the vicinity of the maximum project size with the addition of filtration units that clean and discharge the effluent stormwater into the Arroyo Seco. **Figure 7** demonstrates these gains. Based on the results for the project at the maximum site footprint, the inclusion of a single filter increases the average annual zinc load reduction by about 25 lbs./yr. for a minimal cost considering the overall estimated project cost. The addition of a second filter unit that doubles the discharge rate adds even greater water quality benefit at the same overall project storage size and diversion rate. This is not the case for the infiltration basin, as shown in **Figure 8**, wherein slightly less water quality benefit might be realized with the addition of filtration devices. While these devices usually boost the performance for smaller BMPs, they can have this effect on infiltration basins since filtration does not entirely remove pollutant loads from the discharged water. Infiltrated water completely removes all pollutant loading from the drainage system. However, BMP controls can be implemented to ensure that infiltration is prioritized for its pollutant removal and water supply contributions, with filtration only occurring when the BMP is near full storage capacity. Additionally, filtration offers assurances that any water not able to be infiltrated will receive an acceptable level of treatment before discharge back to the storm drain system.

Analysis of the optimal front of the project modeling allowed the selection of the most cost-effective configuration for each project option. These are summarized in **Table 2** and will be discussed further below.

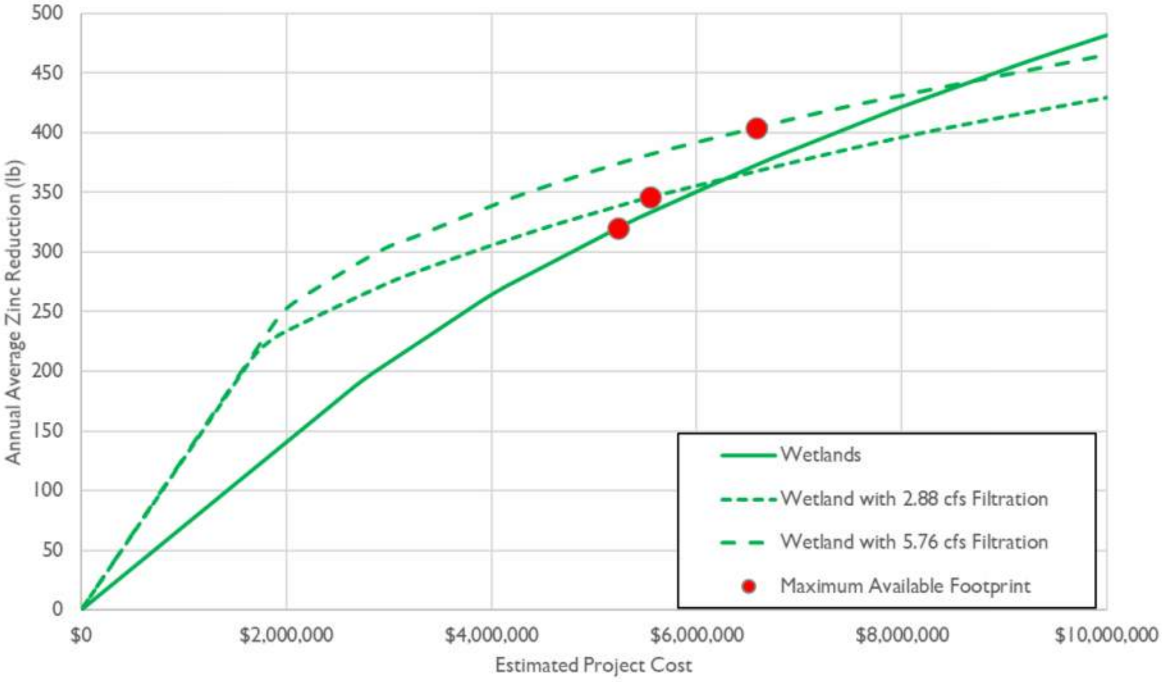


Figure 7. Comparison of treatment wetland results with and without filtration.

Figure 8. Comparison of infiltration basin results with and without filtration.

Table 2. Summary of cost-effective project alternatives.

Project Alternative	Estimated Project Cost	Average Annual Zinc Reduction (lbs)	Unit Cost per Pound of Zinc Removal
Treatment Wetland	$7,884,531	417.6	$18,881 / lb
Treatment Wetland w/ 2.88 cfs Filter	$4,432,849	318.1	$13,935 / lb
Treatment Wetland w/ 5.76 cfs Filter	$4,401,398	351.3	$12,529 / lb
Infiltration Basin	$7,501,516	427.2	$17,560 / lb
Infiltration Basin w/ 2.88 cfs Filter	$4,672,487	300.4	$15,556 / lb
Infiltration Basin w/ 5.76 cfs Filter	$5,561,495	329. 8	$16,864 / lb

5.0 PROJECT ALTERNATIVES AND RECOMMENDATIONS

5.1 BMP Size Alternatives

The following BMP sizes and diversion rates are recommended based on different endpoints of design and with the range of performance that might be realized at the San Pascual site.

5.1.1 Most cost-effective BMP size for the San Pascual site

The most cost-effective BMP at San Pascual Treatment Wetlands, given the footprint constraints of 1.03 acres, is a 6.5 ac-ft storage BMP with a pumped diversion of 25 cfs from the Arroyo Seco (**Figure 9**). This BMP will utilize infiltration and supplemental 5.76 cfs filtration for discharge of captured stormwater to reduce approximately 25% of the average annual zinc load for the drainage area.

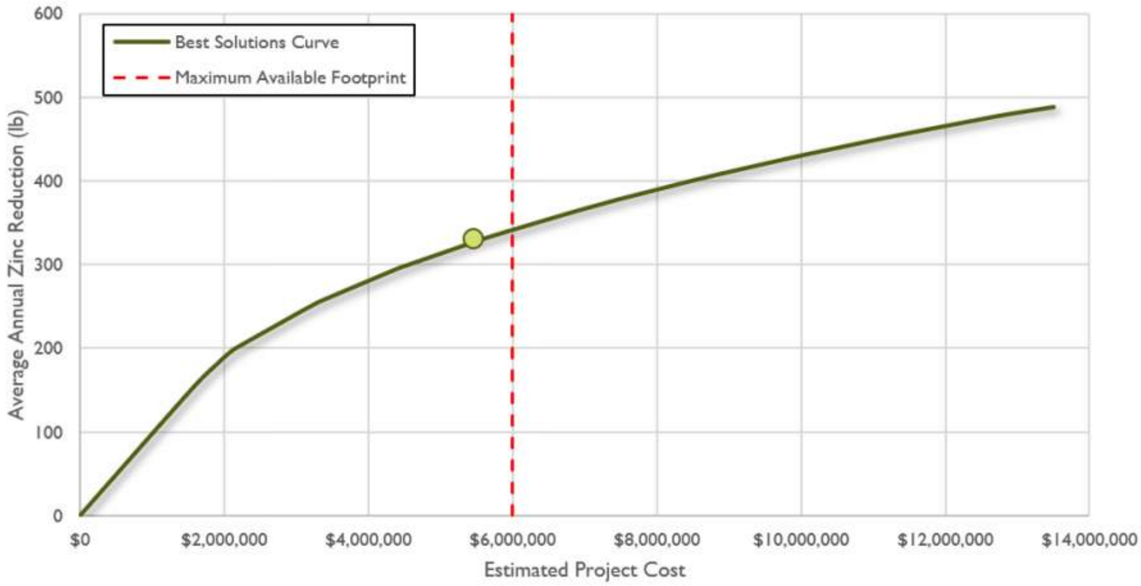


Figure 9. Model-based cost-effective project per footprint constraint recommendation for San Pascual Treatment Wetlands.

5.1.2 Capture of 85th percentile design storm

Based on the infiltration rate of 0.3 in/hr for this project, capture of the 85th percentile storm volume would necessitate a BMP with a diversion of at least 305 cfs and a storage volume of at least 271.7 ac-ft. This BMP is not feasible within the available footprint and is also not practical and would be well beyond the point of diminishing returns for water quality benefit for this site based on long-term average annual load reductions.

5.1.3 Most multi-benefit BMP configuration

Based on the analysis above, the most multi-benefit BMP configuration is the utilization of the full available area on the east side of the river with an infiltration basin that utilizes the existing diversion and dam structures that exist on-site. A supplemental filtration unit can be included to further the removal performance and **Table 3** summarizes the performance of this recommended configuration. The current recommended BMP is right sized for the drainage area and water quality loads while limiting the project to one area thus reducing costs and permitting time. Further study (incorporating forthcoming geotechnical investigation) will determine the optimal element sizing in terms of water supply consideration.

Table 3. Summary of recommended project configuration.

Project Alternative/BMP Type	Diversion Rate (cfs)	Total Storage Volume (ac-ft)	Planning Level Cost	Average Annual Zinc Reduction (lbs)
Infiltration Basin w/ 5.76 cfs filter	25	6.5	$5,561,495	329.8

MEMO

TO: Brent Maue, City of Pasadena
Julian Lee, City of South Pasadena

CC:

FROM: Oliver Galang, PE, Craftwater Engineering

SUBJECT: San Rafael Treatment Wetlands
Stormwater Capture Feasibility Study Technical Memorandum

DATE: September 22, 2020

The Upper Los Angeles River Watershed is a largely built-out, urbanized watershed of approximately 485 square miles, or 310,400 acres, in the Upper Los Angeles River Watershed Management Area and over 50 miles of the main line of the LA River. The development of the San Rafael Treatment Wetlands Stormwater Capture Feasibility Study in the City of Pasadena represents another major opportunity to continue the regional scale progress to achieve pollutant load reductions for the Upper Los Angeles River Watershed Management Program. The primary objective of this project is to prepare a Feasibility Study Report for the San Rafael Treatment Wetlands Project, which include the 10% design level documents that could be utilized to support a funding application under Los Angeles County's Safe, Clean Water Program. Towards this goal, this memo presents the analytical results evaluating the potential stormwater capture and water use alternatives and the sizing options for an optimized design. This project is intended to intercept a sizeable portion of the stormwater flows from the adjacent storm drain to the San Rafael Creek to the proposed project site (**See Figure 1**). Stormwater will be diverted immediately downstream from the outfall of the 72" reinforced concrete pipe (RCP; Project No. BI 0562, Line F) managed by the Los Angeles County Flood Control District (LACFCD) at San Rafael Creek. A surface treatment infiltration basin best management practice (BMP) is proposed at the San Rafael site to capture and infiltrate stormwater from the diverted drainage channel. Project constraints and potential options will be detailed in this memo to present an array of sizing options that will contribute to both water quality goals as well as other important project considerations and desired outcomes. These options can then be considered and weighed before proceeding with the ultimate design of the project by identifying the project configuration that best meets the desired outcome and contributes to water quality benefits in a cost-effective manner.

Figure 1. San Rafael Site, Pasadena

1.0 OBJECTIVES

To identify the most effective stormwater capture configuration at the project site, decision support modeling has been conducted to identify the optimal BMP configuration using a balanced approach that incorporates design storm hydrologic targets as well as long-term water quality considerations. This optimal configuration addresses stormwater runoff that will be diverted to the project site from a potential diversion point near the open space at the confluence. BMP configuration recommendations will be made for the San Rafael site for the following key design criteria.

Diversion Rates

A range of feasible diversion flowrates will be simulated to develop cost-effectiveness curves and to determine the optimal flowrate to be diverted to the capture facility that will provide the greatest water quality benefit without surpassing the point of declining returns. Flowrates will range in values grounded in construction feasibility and subject to other project constraints identified in the initial project concept development.

BMP Storage

The optimal BMP size will be determined subject to the allowable site footprint. Size recommendations will include the following highlighted endpoints:

- The BMP size that is most cost-effective for the project tributary area,
- The BMP size that will capture the 85th percentile, 24-hour storm runoff volume, and
- The BMP size that will achieve multi-benefits, including, but not limited to, addressing stormwater quality and water supply.

Discharge –Water Use and Flowrate

Different routes exist for the outflows from the BMP, and each entail differing requirements, infrastructure, and constraints that impact the overall performance of the stormwater capture system and project cost. Also, these options represent different contributions to other local water supply efforts, of which stormwater is a growing component. If infiltration is feasible at this site due to favorable soil infiltration conditions, it can be utilized to dewater the BMP and contribute to regional groundwater recharge goals. Infiltration feasibility and rates will be determined in a future geotechnical analysis. Additionally, the potential to discharge captured stormwater to nearby sanitary sewers or to filter it and return it to storm drains will be assessed for this site to quantify the potential benefits of different options should infiltration be deemed infeasible. Filtration throughflow rates for commonly available systems and estimates of feasible sanitary sewer capacity will be evaluated to ensure that these discharge options are right sized to the baseline water quality for the drainage area and other system configuration options.

Figure 2 shows the initial evaluated concept of a surface infiltration basin east of San Rafael Creek.

Figure 2. Preliminary concept schematic for the San Rafael Infiltration Basin BMP, east of San Rafael Creek (may not represent final project details).

2.0 BASELINE SITE CONDITIONS AND CONSTRAINTS

The following subsections summarize the baseline watershed, hydrologic, and on-site conditions and constraints that will be accounted for in BMP configuration and optimization analysis for the San Rafael site.

2.1 Watershed Characterization

For this study, the Los Angeles County Watershed Management Modeling System (WMMS) was used within the Loading Simulation Program C++ (LSPC) to simulate the contaminant loading, runoff volume, and flow rate associated with a long-term, 10-year continuous time series (Water Year 2002 to Water Year 2011) as well as the 85^{th} percentile storm. The WMMS is accepted by the Los Angeles Water Quality Control Board for performance of compliance analyses in the context of EWMP/WMP development.

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Table 1. Summary of watershed and hydrologic conditions for the San Rafael Project drainage area

Total Tributary Area (ac)	Impervious Tributary Area (ac)	Average Annual Runoff (ac-ft)	Average Annual Zn Loading (lbs)	85^{th} Percentile Surface Runoff (ac-ft)	85^{th} Percentile Peak Flow (cfs)
441	94 (21%)	288	65	18	22

2.2 Hydrologic Considerations

Long-term baseline flows and pollutant loads to the site are also summarized in **Table 1**. The total loadings presented in this table represent the maximum possible reductions that could be achieved by control measures at the project site. However, pragmatic diversion limitations, space constraints, and subsequent treatment mechanisms will ultimately limit how much runoff and pollutant mass can potentially be diverted into the BMP. Peak flow rate and total runoff for the 85th percentile design storm (1.05 in., taken from isohyetal data for the centroid of the drainage areas) are found in **Table 1** as well.

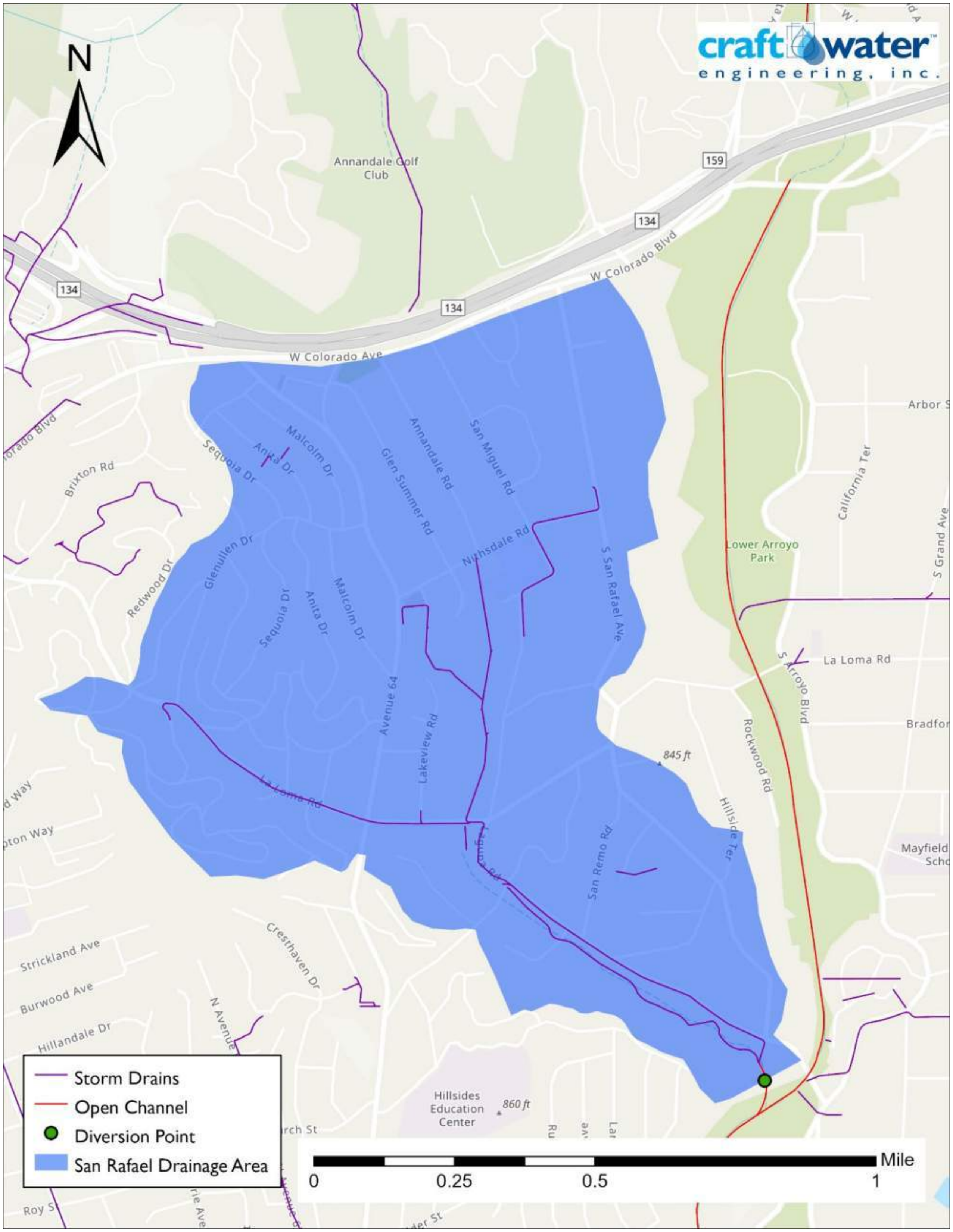

Figure 3. Drainage area for San Rafael Wetlands Project.

3.0 STORMWATER CAPTURE OPTIMIZATION METHODS

3.1 Water Quality Optimization Strategy

The primary design goal of the San Rafael Treatment Wetlands Project is to reduce long-term annual loading of pollutants to the ULAR watershed using zinc as the limiting pollutant of interest in the analysis as established by the EWMP for this watershed group. To ensure that the system will be sized to maximize load reductions in a cost-effective manner, optimization modeling was performed.

The purpose of optimization modeling is to balance design components (including BMP volume and inflow diversion rates) such that no one component limits the performance of the system subject to potential discharge options (see **Figure 4** at right). Optimization supports decision making throughout the design process by guiding selection of the most cost-effective system design.

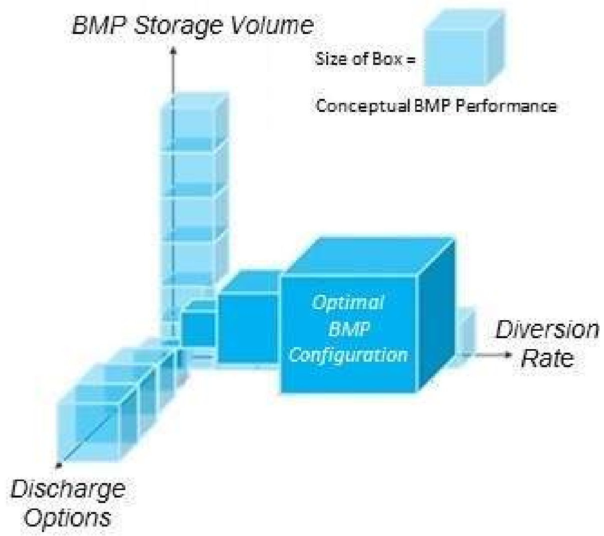

Figure 4. Conceptual illustration of optimization modeling balancing various design components to maximize performance.

The model setup for water quality simulation and optimization is complex, involving several modeling systems and iterative feedback from design engineers. The general methodology is discussed below, and the results are presented thereafter.

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3.2.1 Diversion Rates

Model runs were limited to feasible diversion ranges for the proposed diversion point based on prior project knowledge related to the drainage area and potential project storage size. Diversion rates for the San Rafael BMP were modeled over the range of 10 to 30 cfs, varying in 5 cfs increments, to assess the most cost-effective configuration of diversion inflow rates.

3.2.2 Storage Volume

Site assessments and discussion with project stakeholders indicated an initial surface maximum storage volume of 2.7 ac-ft. These initial estimates for potential storage were developed assuming a ponding depth of 7 feet for surface storage. Modeling was carried out for a BMP storage ranging from 0.1 to 10.0 ac-ft by 0.1 ac-ft increments to assess trends in stormwater treatment efficiencies over a full range of storage sizes to identify points of diminishing return and ensure final recommendations accounted for the full potential treatment for the site.

3.2.3 Discharge Alternatives

The modeling evaluation identified two possible discharge scenarios that are evaluated for their water quality impacts: (1) infiltration into the subsoils, and (2) wetland settling and additional filtration prior to discharge back into the channel. Geotechnical investigations are awaiting completion, but initial assessments of the infiltration option were conducted assuming an infiltration rate of 0.89 in/hr that was found at a potential project site just across the Arroyo Seco from this project location. A treatment wetland system limits infiltration to maintain a wet pool, so infiltration rates will not impact the performance of this option. Both project options were additionally assessed with the addition of a filtration system at the outlet to increase water quality benefits and ensure adequate treatment. Filtration was modeled at 2.88 cfs and 5.76 cfs discharge rates to represent commonly available filtration devices and corresponding throughput efficiency.

One final option for discharge of captured runoff that was evaluated was discharge to the sanitary sewer. Sewer discharges are typically limited to flowrates that are comparable to filtration devices, but they are further constrained by allowable temporal discharge windows and rates (normally between 10pm to 8am daily) and only during dry weather (defined as 24-hours after any rainfall of greater than or equal to 0.1 in/hr). System capacity and discharge allowances are beyond the scope of this feasibility study, and additional coordination with the sewer purveyor is required during later stages of design to determine the available capacity and discharge rates if this option for the project is desired. A desktop analysis indicates that the closest sewer lines are located approximately 500 feet away at an elevation approximately 50 feet higher than the proposed project site on the east side of the Arroyo Seco (**Figure 5**). Due to this high topographic relief and the need to cross over Arroyo Seco to the nearest lines, the pursuit of sanitary sewer discharge is not recommended and is not further evaluated in this analysis.

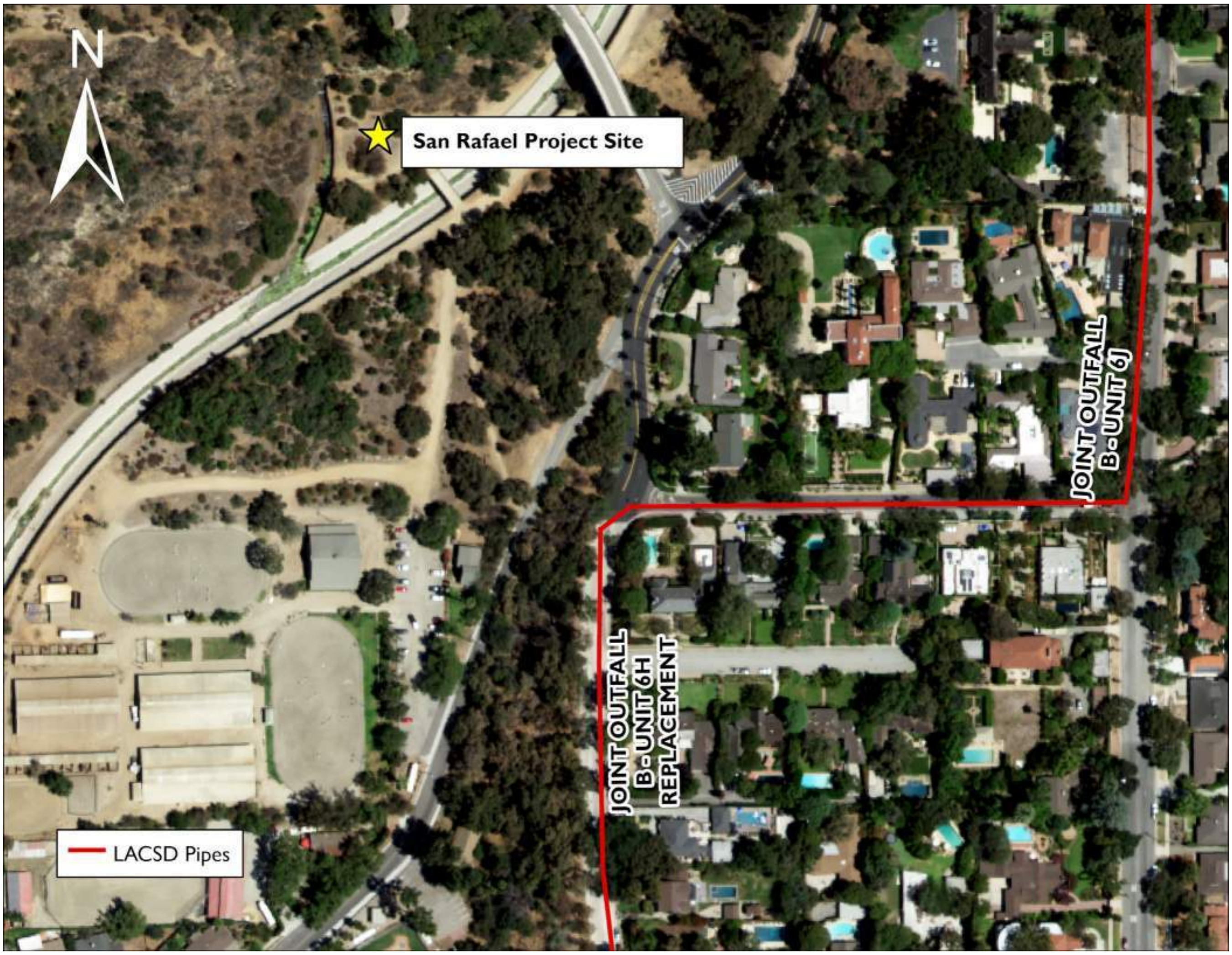

Figure 5. Sanitary sewer in the vicinity of San Rafael Treatment Wetlands.

3.2.4 Inflow Infrastructure

Diverted inflows can be conveyed to the storage BMP via gravity-fed pipes or by way of pumps. The two options have tradeoffs associated with costs that are typically defined by the invert depth of the storm drains at the diversion points and the BMP storage footprint. Gravity-fed inflows require the BMP to be sited deep enough underground for flows to move passively toward the storage. This is associated with excavation and stabilization costs that are determined by the storm drain invert and distance of the diversion. Pumped inflows allow the BMP to be sited vertically with minimal soil cover atop the storage, but these are associated with costs of pumping infrastructure, operation, and maintenance. At different sizes of a given BMP and site, pumping inflows may be more cost-effective than gravity-fed diversions, and vice versa. Because of this, all modeled configurations were assessed for both inflow types to determine the most cost-effective inflow configuration across modeled scenarios.

4.0 OPTIMIZATION MODELING RESULTS

The optimization analysis aimed to maximize the long-term pollutant load reduction and 85th percentile design storm volume capture by simultaneously varying the diversion rate, BMP size, and discharge rates related to options previously discussed. Each of these design features has an associated range of options that were modeled to assess alternatives against long-term water quality benefits and identify the most effective. Additionally, different configurations were paired with estimated planning level cost data to assess alternatives and options against each other to ultimately determine the best configuration for this site. By optimizing based on these variables, multiple pathways to achieve maximum water quality benefit were identified and the most cost-effective alternatives were determined. Different configuration alternatives and modeling parameters are presented below to demonstrate the cost-effectiveness associated with these options and narrow them down to a few key recommended project configurations that will meet different needs for the ULAR watershed and contribute to the goals of the EWMP.

4.1 BMP Type – Infiltration Basin vs Treatment Wetlands

The two possible alternatives evaluated for this site are a treatment wetland or an infiltration basin. Water quality benefits for the range of projects modeled for the design alternatives are presented in **Figure 5**. These alternatives were evaluated to determine the best options at the San Rafael site given the site-specific constraints. Results display the optimal front of the full range of projects modeled for each of the various BMP types. Based on the modeling results and the desire for groundwater recharge, an infiltration basin has an advantage in water quality benefit for all modeled project sizes compared to the treatment wetland. The addition of a filter shows only a slight added benefit for an infiltration basin, but a much greater benefit for the treatment wetland. This is discussed further in the next section.

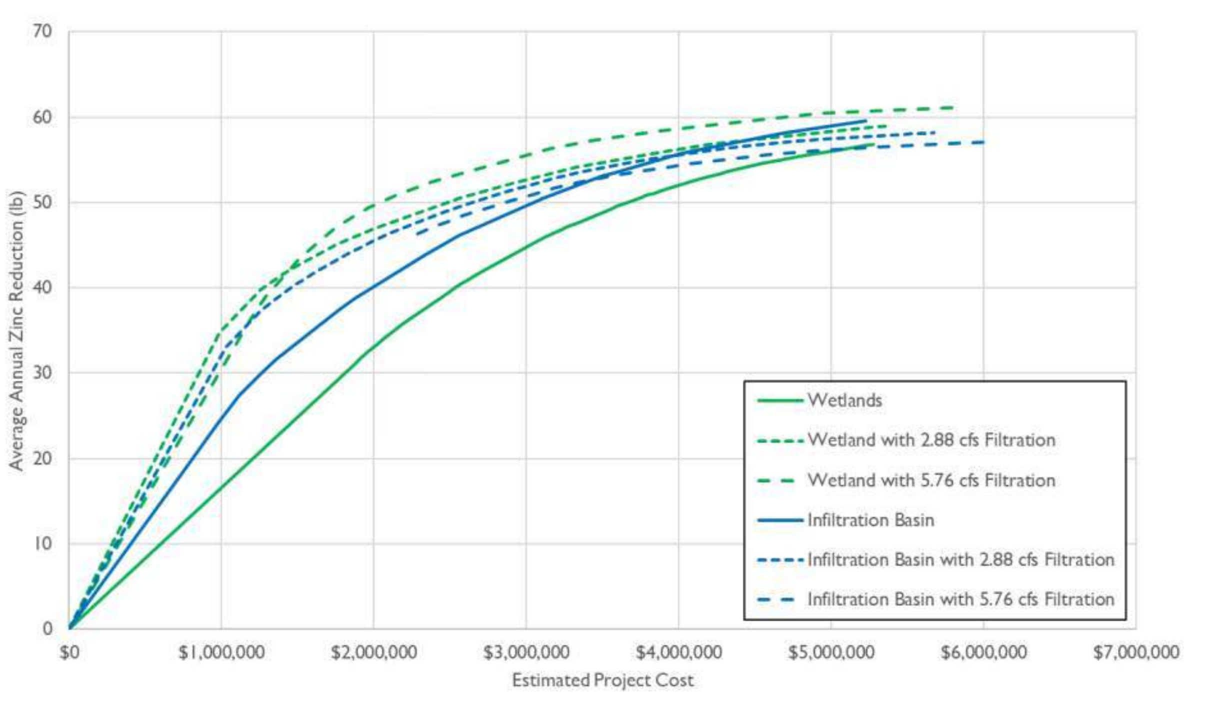

Figure 6. Infiltration BMP versus a Treatment Wetlands BMP

4.2 Filtration Recommendations

Pollutant removal performances can be increased with the addition of filtration units that clean and discharge the effluent stormwater into the Arroyo Seco. **Figure 7** demonstrates a comparison of both the infiltration basin and treatment wetlands with various filtration rates to identify the recommended filter quantities/rates. Based on the results, the inclusion of a single filter increases the overall performance substantially for the treatment wetland, but only slightly for the infiltration basin. This is related to the fact that infiltration of captured runoff provides complete pollutant removal, while filtration is associated with some remaining pollutant in discharged waters (though of acceptable standards). The treatment wetland is appreciably improved with the addition of filtration as a secondary treatment process for the BMP. In terms of level of filtration, the addition of a second filter unit that doubles the discharge rate has only a minimal impact for the added infrastructure cost and is not recommended to be pursued in the full site design.

Analysis of the optimal front of the project modeling allowed the selection of the most cost-effective configuration for each project option. These are summarized in **Table 2** and will be discussed further below.

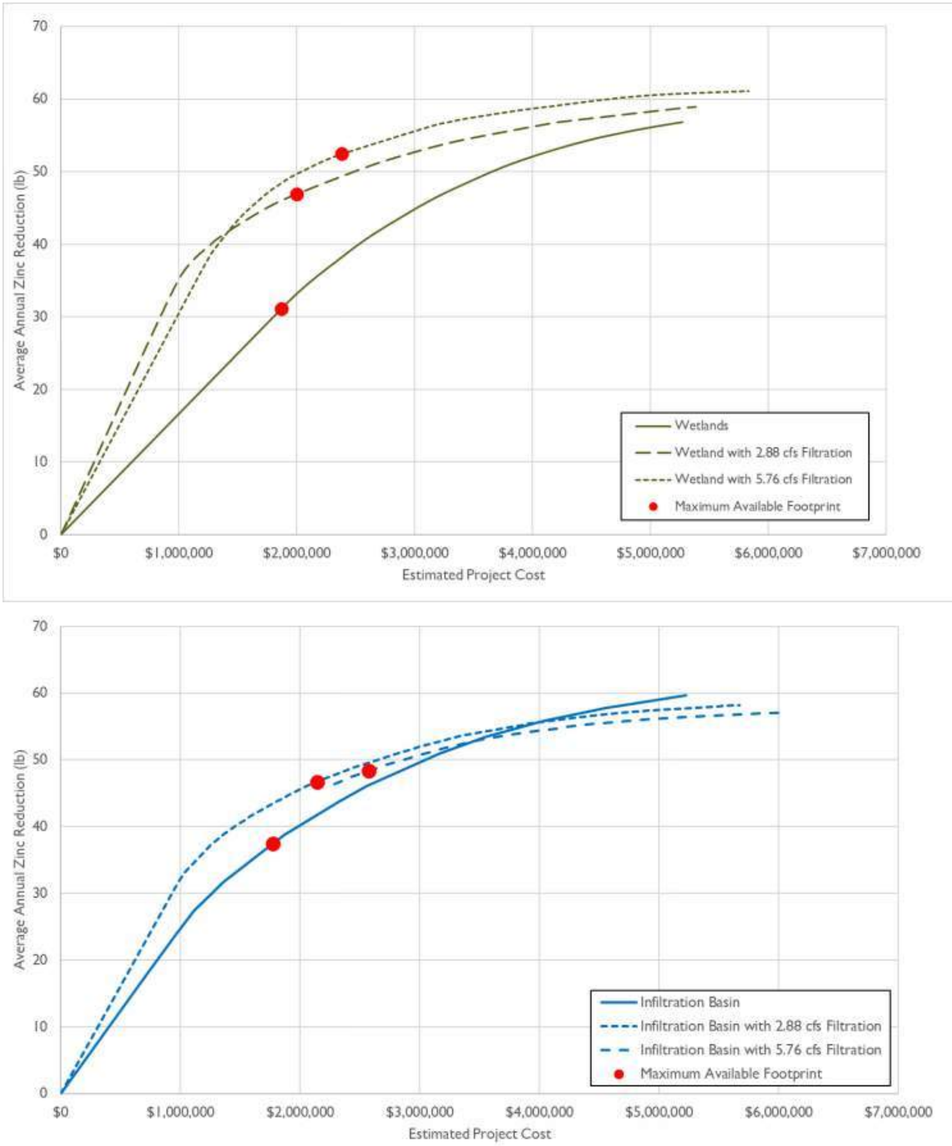

Figure 7. Filter flow rate/quantity comparison

Table 2. Summary of filtration project alternatives (maximum footprint).

Project Alternative	Planning Level Cost	Average Annual Zinc Reduction (lbs)	Unit Cost per Pound of Zinc Removal
Treatment Wetlands	$3,180,611	46.42	$68,518/ lb
Treatment Wetlands w/ 2.88 cfs Filter	$1,757,536	45.15	$38,927 / lb
Treatment Wetlands w/ 5.76 cfs Filter	$2,157,536	50.97	$42,330 / lb
Infiltration Basin	$2,557,379	46.11	$55,463 / lb
Infiltration Basin w/ 2.88 cfs Filter	$2,093,759	46.33	$45,192 / lb
Infiltration Basin w/ 5.76 cfs Filter	$2,382,484	47.10	$50,584 / lb

5.0 PROJECT ALTERNATIVES AND RECOMMENDATIONS

5.1 BMP Size Alternatives

The following BMP sizes and diversion rates are recommended based on different endpoints of design and with the range of performance that might be realized at San Rafael project site.

5.1.1 Most cost-effective BMP size for the San Rafael site

The most cost-effective BMP at San Rafael, given the footprint constraints of 0.3 acres, is a 2.6 ac-ft infiltration basin BMP with a gravity-fed diversion of 25 cfs from Project No. BI 0562, Line F (**Figure 8**). This BMP will utilize infiltration and supplemental 2.88 cfs filtration for discharge of captured stormwater to reduce approximately 71% of the average annual zinc load for the drainage area.

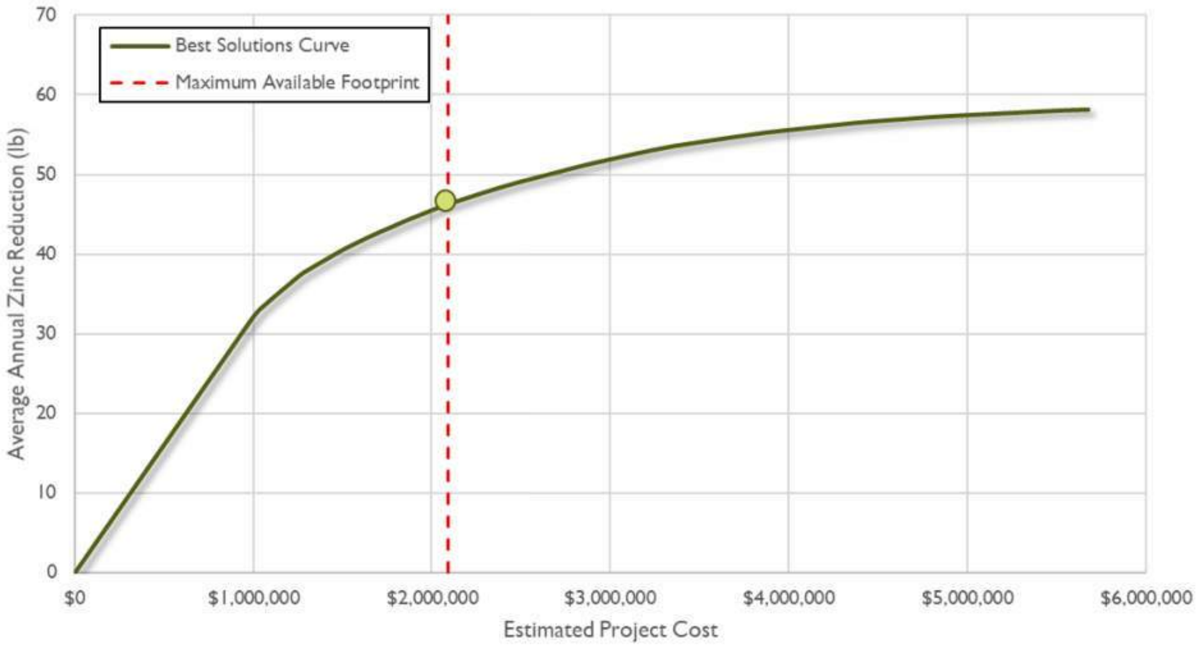

Figure 8. Model-based cost-effective project per footprint constraint recommendation for San Rafael Treatment Wetlands.

5.1.2 Capture of 85th percentile design storm

Based on the infiltration rate of 0.89 in/hr for this project, capture of the 85th percentile storm volume would necessitate a BMP with a diversion of at least 22 cfs and a storage volume of at least 18.3 ac-ft. This BMP is not feasible within the available footprint (2.7 ac-ft) and would be well beyond the point of diminishing returns for water quality benefit for this site based on long-term average annual load reductions.

5.1.3 Most multi-benefit BMP configuration

Based on the analysis above, the most multi-benefit BMP configuration is the utilization of the full available area on the east side of the creek with an infiltration basin that has the option to add to the storage volume through an expansion on the west side of the San Rafael Creek channel. A supplemental filtration unit can be included to

further the removal performance and **Table 3** summarizes the performance of this recommended configuration. The current recommended BMP is right sized for the drainage area and water quality loads while limiting the project to one area thus reducing costs and permitting time. Further study (incorporating forthcoming geotechnical investigation) will determine the optimal element sizing in terms of water supply consideration.

Table 3. Summary of recommended project configuration.

Project Alternative/BMP Type	Diversion Rate (cfs)	Total Storage Volume (ac-ft)	Planning Level Cost	Average Annual Zinc Reduction (lbs)
Infiltration Basin w/ 2.88 cfs filter	25	2.6	$2,093,759	46.33

Courtney Semlow

From: Genevieve Osmena <gosmena@dpw.lacounty.gov>
Sent: Thursday, October 8, 2020 2:40 PM
To: Courtney Semlow
Cc: Oliver Galang; Merrill Taylor; Maue, Brent; Julian Lee; Ernesto Rivera; Nayiri Vartanian
Subject: RE: LACFCD Conceptual Review of Arroyo Seco-San Rafael Treatment Wetlands

Hi Courtney,

Thank you for reaching out to us on your project. Please go ahead and work directly with Ernesto Rivera and Nayiri Vartanian of my team, who I have cc'd above. They will be reviewing the project info and will coordinate with you on the requested concept approval letter. Thank you also for sharing the project fact sheet and the storm drain plans – my team will let you know if they have any questions or need any further info for their review.

Thanks,

Genevieve Osmeña
Senior Civil Engineer
Los Angeles County Public Works
Office: 626-458-4322

From: Courtney Semlow <courtney.semlow@craftwaterinc.com>
Sent: Tuesday, October 6, 2020 5:07 PM
To: Genevieve Osmena <gosmena@dpw.lacounty.gov>
Cc: Oliver Galang <oliver.galang@craftwaterinc.com>; Merrill Taylor <merrill.taylor@craftwaterinc.com>; Maue, Brent <bmaue@cityofpasadena.net>; Julian Lee <jlee@southpasadenaca.gov>
Subject: LACFCD Conceptual Review of Arroyo Seco-San Rafael Treatment Wetlands

CAUTION: External Email. Proceed Responsibly.

Genevieve,

Greetings! On behalf of the Cities of Pasadena and South Pasadena, we are requesting the LACFCD Watershed Manager for the Upper LA River for a Conceptual Level review and approval of the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project.

We are providing the following documents for your reference:

- **Attachment A** Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project Fact Sheet
- **Attachment B** Storm Drain As-Builts

The project is a major opportunity to continue the regional scale progress to achieve pollutant load reductions by the Cities of Pasadena and South Pasadena. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels that are both managed by the LACFCD. A treatment wetland and recharge basin system are proposed adjacent to the Arroyo Seco channel to capture, treat, and infiltrate stormwater from the diverted drainage channel. The proposed diversions will both consist of a drop inlet structure with a rubber dam placed in the Arroyo Seco to ensure that the storm drain will continue to accommodate the existing flood control drainage capacity.

The City of Pasadena will be submitting this project for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22. Once the City initiates the Design Phase of this project, the City will continue to remain closely engaged with the LACFCD to comply with any additional requirements for an LACFCD Permit and a Use and Maintenance Agreement.

Thank you!

Courtney Semlow, PE, CFM, ENV SP | Project Manager
P: 847.445.0886 | courtney.semlow@craftwaterinc.com
Los Angeles | San Diego | craftwaterinc.com

craftwater engineering, inc.

COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

"To Enrich Lives Through Effective and Caring Service"

MARK PESTRELLA, Director

900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331
Telephone: (626) 458-5100
http://dpw.lacounty.gov

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1460
ALHAMBRA, CALIFORNIA 91802-1460

IN REPLY PLEASE REFER TO FILE: SWP-5

October 19, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena
100 North Garfield Avenue, Room N306
Pasadena CA 91101

NOTICE OF CONCEPTUAL APPROVAL FOR SAFE, CLEAN WATER PROGRAM CONSIDERATION OF INFRASTRUCTURE PROJECTS FUNDING

Los Angeles County Flood Control District has been engaged to review the following multi-benefit project concept and is hereby providing this letter of conceptual approval:

Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project
City of Pasadena and City of South Pasadena
Upper Los Angeles Watershed Area

We understand the proposed multi-benefit project will include two regional dry weather and stormwater capture and treatment facilities consisting of surface infiltration facilities, which will help Improve water quality entering the Arroyo Seco Channel. The project will rehabilitate San Rafael Creek and provide treated stormwater and dry weather captures to offset the potable water demand required to irrigate nearby Arroyo Park. In addition, the proposed project will provide habitat, educational opportunities, and diverse vegetation to the existing space, while improving public access and use.

The Project is not currently inconsistent with any District plans, policies, or goals. Conceptual approval does not indicate the District's consent to support or even permit the Project once developed. If funding is ultimately allocated to the Project, it is required that the project proponent remain closely engaged with the District throughout each subsequent project phase and comply with any eventual applicable agreement and/or permit provisions. Please upload a copy of this letter in the Projects Module application when responding to the Regional Program Call for Projects.

Thank you for your interest in the Safe, Clean Water Program. Please be sure to continue to work with your District's Watershed Manager from Los Angeles County Public Works, Genevieve Osmena. Ms. Osmena can be reached at (626) 458-4322 or gosmena@pw.lacountv.gov. Ongoing collaboration is imperative. If the subject project is not funded within 2 years from the date of this letter, a new demonstration of non-objection will be required before the project can again be considered.

MARK PESTRELLA
Chief Engineer
Los Angeles County Flood Control District

KEITH A. LILLEY
Assistant Deputy Director
Stormwater Planning Division

GO:bm
P:\swppub\Secretarial\2020\Letters\Arroyo Seco- San Rafael Conceptual Approval1

ATTACHMENTS FOR SECTION 2.5:

MONITORING

ATTACHMENTS FOR SECTION 2.6:

O & M

2.6 OPERATIONS & MAINTENANCE PLAN

Long-term maintenance of the system is vital to its continued operation. The responsible party for the operation and maintenance of the completed project will be the Cities of Pasadena and South Pasadena.

Table 2-8: Operations & Maintenance Requirements and Costs

Description	No. of Times per Year	No. of Personnel & Hours per Visit	Personnel Expertise Level	Unit Price	Annual Total
Rubber Dam System – Inspection & Cleaning	12	2 @ 4 hrs	Trash & Debris Removal crew	$1,000	$12,000
Diversion Structure – Inspection & Cleaning	12	2 @ 6 hr	Trash & Debris Removal crew	$3,000	$36,000
Pretreatment Device – Vacuum	4	2 @ 8 hrs	Vactor Truck Operator	$5,000	$20,000
Post-Treatment Filter Device – Vacuum	4	2 @ 8 hrs	Vactor Truck Operator	$2,500	$20,000
Wet Well – Dry Season Inspection & Cleaning	3	2 @ 4 hrs	Vactor Truck Operator	$2,000	$6,000
Wet Well – Wet Season Inspection & Cleaning	6	2 @ 2 hrs	Vactor Truck Operator	$2,000	$12,000
Valve Maintenance	2	1 @ 8 hrs	Mechanical Labor	$5,000	$10,000
Control Panel Maintenance	1	1 @ 8 hrs	Electrician	$2,000	$2,000
Storage – Dry Season Inspection & Cleaning	4	4 @ 8 hrs	Vactor Truck Operator	$8,000	$32,000
Storage – Wet Season Inspection & Cleaning	4	4 @ 8 hrs	Vactor Truck Operator	$8,000	$32,000
Filter – Inspection & Cleaning	1	4 @ 32 hrs	Cartridge Cleaning	$24,000	$24,000

A full draft maintenance plan will be developed as a part of the 100% final design. The maintenance plan will include details on equipment needed and standard practices and procedures. The final maintenance plan will be completed at the end of construction when actual brands and part information is made available.

ATTACHMENTS FOR SECTION 3.2:

24-HOUR STORM CAPACITY

ATTACHMENTS FOR SECTION 3.3:

EVENT-BASED DESIGN DETAILS

ATTACHMENTS FOR SECTION 3.4:

LONG-TERM PERFORMANCE

MODELING DETAILS

SCW SUBMISSION – ARROYO SECO/SAN RAFAEL TREATMENT WETLANDS

The following provides a detailed description of modeling developed, assumptions made, and summarized results used for the submission of the Arroyo Seco/San Rafael Treatment Wetlands Project (Project) to the Safe, Clean Water Program (SCWP) module for funding consideration. This document is not meant to be exhaustive of modeling detail but provides relevant parameter assumptions and summarized results in demonstration of how user-submitted values were developed for the SCWP application submission for this Project.

1.0 BASELINE HYDROLOGY & WATER QUALITY MODELING

For purposes of establishing baseline timeseries' for the project location, the Los Angeles County LSPC (Loading Simulation Program C++) model was used for this analysis. Drainage areas to the project site were developed using subwatershed boundaries from the geospatial data supporting the LSPC model and edited where project diversion points did not coincide with subwatershed boundaries. Land cover inputs to the LSPC model were calculated based on the drainage area to the Project from the geospatial data for Hydrologic Response Units (HRUs) supporting the LSPC model. The baseline LSPC model was run for the Water Years of 1992 – 2011 (with a one-year model warmup period over Water Year 1991) to enable 20-year estimates of water supply for the Project as required of the SCWP module. A 10-year estimate of water quality for the Project for Water Years 2002-2011 was used for long-term performance considerations to coincide with established E/WMP evaluation periods in Los Angeles County.

1.1 Summary of Baseline Loading from LSPC Modeling

Modeling Period	Baseline Runoff (ac-ft)	Baseline Zinc Loading (lbs; Primary Pollutant)	Baseline Copper Loading (lbs; Secondary Pollutant)
10-Year Annual Average (WY 2002-2011)	4,583	1,289	345
20-Year Annual Average (WY 1992-2011)	4,008		

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2.0 BMP MODELING

Baseline timeseries' from the LSPC model were used as input to model the Arroyo Seco/San Rafael Project by using the BMP model SUSTAIN (System for Urban Stormwater Treatment and Analysis IntegratioN) that was developed by the United States Environmental Protection Agency (US EPA). SUSTAIN allows the user to route a baseline hydrology and water quality timeseries through a BMP or series of BMPs with real-world natural and engineered parameters (summarized in 2.1) to determine how much stormwater and pollutant may be captured and treated by the BMP. Results for the Project have been presented both separately and in summation for the two BMPs (San Rafael and San Pascual) making up the nested Treatment Wetlands System. BMPs were modeled together but tabulated separately using relevant baseline timeseries' with modeling results aggregated to ensure SCWP submission reflects the sum benefits of the multi-BMP Project. The outputs of SUSTAIN are a full resultant timeseries for hydrology and water quality at each component of the modeled BMP(s). These full results are beyond the scope of reporting but have been summarized using average annual statistics below (2.2 and 0) to demonstrate the water balance over the Project components and the water quality reductions expected for this BMP.

2.1 Arroyo Seco/San Rafael Project BMP Parameters

BMP	Diversion Rate	Wetland Storage Volume	Infiltration Rate	Filtration Rate
San Rafael	25 cfs	2.6 ac-ft	0.89 in/hr	2.88 cfs
San Pascual	25 cfs	6.5 ac-ft	0.30 in/hr	5.76 cfs
Wetland System	***50 cfs***	***9.1 ac-ft***	***Effective Drawdown Rate = 5.18 in/hr***	

2.2 Arroyo Seco/San Rafael Project BMP Water Balance

10-Year Annual Average (ac-ft/yr)

Component	INFLOW	WEIR	ORIFICE	UNDER-DRAIN	BYPASS	OUTFLOW	INFIL	PERCO-LATION	ET	SEEPAGE
San Rafael Diversion	302	11	291	0	0	302	0	0	0	0
San Rafael Wetland	291	95	0	84	0	179	195	195	1	112
San Pascual Diversion	4,583	2,442	2,247	0	0	4,689	0	0	0	0
San Pascual Wetland	2,247	1,035	0	1,036	0	2,071	1,211	1,211	0	175

20-Year Annual Average (ac-ft/yr)

Component	INFLOW	WEIR	ORIFICE	UNDER-DRAIN	BYPASS	OUTFLOW	INFIL	PERCO-LATION	ET	SEEPAGE
San Rafael Diversion	238	58	179	0	0	238	0	0	0	0
San Rafael Wetland	179	56	0	66	0	122	123	123	0	57
San Pascual Diversion	4,008	2,518	1,490	0	0	4,008	0	0	0	0
San Pascual Wetland	1,490	725	0	688	0	1,414	765	765	0	77

2.3 Arroyo Seco/San Rafael Park Project BMP Pollutant Balance

Primary Pollutant – Zinc (lbs/yr)

Component	INFLOW	WEIR	ORIFICE	UNDERDRAIN	BYPASS	OUTFLOW
San Rafael Diversion	67	6	61	0	0	67
San Rafael Wetland	61	13	0	2	0	15
San Pascual Diversion	1,289	841	492	0	0	1,332
San Pascual Wetland	492	126	0	37	0	163

Secondary Pollutant – Copper (lbs/yr)

Component	INFLOW	WEIR	ORIFICE	UNDERDRAIN	BYPASS	OUTFLOW
San Rafael Diversion	20	1	19	0	0	20
San Rafael Wetland	19	3	0	1	0	4
San Pascual Diversion	345	194	151	0	0	345
San Pascual Wetland	151	36	0	14	0	50

3.0 SCW EQUIVALENT STATISTICS

In order to make these results comparable to those generated by the SCW module in lieu of more detailed modeling, the following table has been provided based on BMP modeling results in Section **Error! Reference source not found.**. Note that for these purposes, the 10-year runoff figures have been used to coincide with the equivalent time period of pollutant modeling and estimates. Additionally, runoff reduction in table is not equivalent to contributing water supply volume for this project due to the complexity of discharges. These numbers are presented solely as a comparative to the SCW module values to demonstrate the equivalent methodology used to develop pollutant reduction percentages superseding SCWP module values for the project submission. Note that slight rounding error may be present in table values due to significant digits represented.

Metric	Runoff from Capture Area	Inflow into Project Inlet	Outflow from Project Outlet	Reduction by Project	% Reduction for by Project
Runoff Volume (ac-ft)	4,583	2,538	1,130	1,408	55.5%
Total Zinc (lbs)	1,289	553	178	375	67.7%
Total Copper (lbs)	345	170	54	116	68.2%

ATTACHMENTS FOR SECTION 4.1:

NEXUS

ATTACHMENTS FOR SECTION 4.2:

BENEFIT MAGNITUDE

ATTACHMENTS FOR SECTION 4.3:

COST EFFECTIVENESS

ATTACHMENTS FOR SECTION 5.1:

COMMUNITY INVESTMENT

ATTACHMENTS FOR SECTION 5.2:

LOCAL SUPPORT

ARROYO SECO FOUNDATION

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

I am pleased to submit this letter of support to you on behalf of the Arroyo Seco Foundation (ASF) for the joint project submittal by the Cities of Pasadena and South Pasadena for funding under the Safe Clean Water Program Call for Projects for Fiscal Year 2021-22. T**he Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project** will advance important stormwater and water quality goals in one of the region's primary and most historical natural open spaces, the Arroyo Seco. The project area involves the Arroyo Seco stream, a vital tributary of the Los Angeles River, and San Rafael Creek. This is an important project to restore a key reach of the stream and flood plain in the Arroyo Seco Watershed.

ASF has a thirty-year record of working to restore and enhance stream and habitat conditions in the Arroyo Seco. In the 1990s ASF initiated the low-flow stream restoration project in the Lower Arroyo about half a mile above the sites now being considered in this application. Later in 2008 ASF led the award-winning Central Arroyo Stream Restoration program that brought back native Arroyo chub to the stream near the Rose Bowl. More recently we have worked with the City of Pasadena as the co-sponsor of the widely praised Berkshire Creek Restoration Program in Hahamongna Watershed Park that was completed earlier this year. In each of these major projects, we partnered with the City of Pasadena. Now we look forward to also collaborating with the City of South Pasadena. ASF's goal is to restore as much as possible of the natural hydrology and habitat of the Arroyo Seco, while improving water resources, flood protection and recreation in the watershed.

ASF is pleased that this project will improve water quality and conservation in the Arroyo Seco by capturing and treating stormwater flows in San Rafael Creek and the Arroyo Seco channel on public parcels in the Cities of Pasadena and South Pasadena. It will also contribute to important regional efforts underway by several agencies for the revitalization of the Upper Los Angeles River and Tributaries. We will work with the project partners to ensure that the project will emphasize the nature-based solutions that the Safe Clean Water Program calls for. We also support the educational and community-involvement tasks that that will enhance the benefits to the local communities and ensure project success.

The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project is a major opportunity to continue local progress to achieve pollutant load reductions and stormwater capture by the Cities of Pasadena and South Pasadena. The project will intercept a sizeable portion of the stormwater flows from San Rafael Creek and the Arroyo Seco Channel, which are both managed by the Los Angeles County Flood Control District. A treatment wetland and recharge basin at the confluence of San Rafael Creek and the Arroyo Seco and another in South Pasadena will capture, treat, and infiltrate runoff. The wetland and treatment facilities will be designed to also ensure adequate flood protection. The adjacent areas will be improved with a habitat restoration program.

In the South Pasadena stretch, care will be taken to remove invasive species and improve the wetlands and riparian values of a streamside stretch of land where the historic Garfias stream joined the Arroyo Seco.

There is a long tradition in our region of community involvement and support for protecting and restoring the natural hydrology and habitat of the Arroyo Seco stream and watershed. The Arroyo Seco Watershed Restoration Feasibility Program, prepared by ASF and North East Trees for two state agencies in 2002, specifies the guidelines for nature-based solutions similar to those contained in the Safe Clean Water Program guidelines. The restoration of San Rafael Creek to a healthy condition is a project recommended in the adopted Master Plan for the Arroyo Seco adopted by the Pasadena City Council in 2003, which guides the planning, preservation and enhancement of this environmental treasure in Pasadena.

Safe Clean Water Program funding for this project will promote regional collaboration and be a very important step in the planning and management of the Arroyo Seco flood plain and stream zone. It will implement a long-standing recommended project from Pasadena's Arroyo Seco Master Plan that will have significant water quality benefits. This funding would assist in paying for the planning, design, preparation of construction documents, preparation of the appropriate CEQA document, completion of various important technical studies, and regulatory permits for the rehabilitation of this area. It would result in a "shovel ready project" for which $3.5 million in implementation funding is already in place.

The Arroyo Seco Foundation strongly supports the proposal by the two cities to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and watershed. We urge you to provide the requested funding of $3.5 million for this important project.

Thank you for your consideration of **The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project**. Please let me know if we can provide any further information to assist you in your decision-making process.

Sincerely,

Tim Brick

Tim Brick
Managing Director
(626) 639-4092

October 13, 2020

Mr. Brent Maue, Assistant City Engineer
City of Pasadena, Department of Public Works
100 N Garfield Avenue
Pasadena, CA 91101

Safe Clean Water Program

RE: Letter of Support for the City of Pasadena's San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project under the Upper Los Angeles Enhanced Watershed Management Plan

Dear Watershed Area Steering Committee:

The Upper Los Angeles Watershed Management Group (ULAR WMG) would like to express our support of the City of Pasadena's San Rafael/San Pascual Treatment Wetlands Stormwater Capture Project (Project) and their collaborative application with the City of South Pasadena for Measure W grant funding. The proposed Project seeks to improve water quality discharged to the San Rafael Creek through capture, infiltration, groundwater basin recharge and restoration of natural streambed processes, improving the water quality of the Arroyo Seco and the Los Angeles River, and tailored to meet our compliance efforts as detailed in the Upper Los Angeles River (ULAR) Enhanced Watershed Management Program (EWMP). In addition, this multi-benefit Project will incorporate nature-based solutions—such as new recreational walking paths, native landscaping, and natural treatment wetlands—creating vital aquatic habitat, community enhancement, and public outreach and educational opportunities.

The ULAR EWMP was developed with the intention of utilizing a multi-pollutant approach that maximizes the retention and use of urban runoff as a resource for groundwater recharge and irrigation, while also creating additional benefits for the communities in the ULAR watershed through a combination "toolbox" of Distributed and Regional Stormwater Projects to address applicable stormwater quality regulations. One of the original eight Regional Projects identified in the EWMP model, the Lower Arroyo Park, was deemed infeasible and eliminated in 2017. The proposed Project resurrects and re-envisions that concept, targeting pollutants from two LA River tributary watershed areas (641561 and 641580)—that require priority load reductions of 9 and 36%, respectively—to meet the compliance targets through capture and treatment of over ten times the required volume (26 AF), exceeding the final bacteria and metals compliance goals, and eliminating all of the regional and distributed BMP requirements in these collective jurisheds. Further, by mitigating the dry weather flows from the San Rafael Creek, Pasadena is satisfying their commitment to address their high priority non-stormwater outfall through structural controls as outlined in the Segment B Tributary Load Reduction Strategy (LRS) Report submitted and approved by the Regional Board. As such, the San Rafael/San Pascual

Treatment Wetlands Stormwater Capture Park Project is an identified and crucial Regional Project of the ULAR EWMP Implementation Plan, helping us to achieve our Recipe for Final EWMP Compliance as detailed in Appendix 7.A.60 and .75 and the subsequent LRS Report.

By December 2017, the Participating Agencies of the ULAR EWMP, including the County of Los Angeles (County) and the Los Angeles County Flood Control District (LACFCD), were required to satisfy a 31% interim EWMP milestone. This interim milestone specified that each jurisdiction implement Best Management Practices (BMPs) to manage a specific capture volume under the Reasonable Assurance Analysis (RAA) storm condition for each receiving water. The San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project is located adjacent to—and intercepts flows—that would otherwise flow to the Arroyo Seco. To date, the City of Los Angeles (City), the City of Pasadena, and Unincorporated County have achieved 2.59 of the collective 12.08 AF volume required to achieve their interim targets through structural controls and LID efforts. The Project's additional 6.5 AF design volume capture will allow Pasadena to meet and exceed their 2017 6.93 AF target milestone allowing them to come into full compliance, in addition to assisting their partnering Agencies (City and County) in moving forward towards satisfying their required volume managed.

The ULAR EWMP Watershed Management Group (WMG) recognizes the need and value of prioritizing stormwater projects within our ULAR Watershed Management Area (WMA). As such, as the ULAR Watershed Lead—on behalf of the ULAR WMG—we offer our full support to the Cities of Pasadena and South Pasadena in their efforts to obtain Measure W Round 2 grant funding for their San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project. We are confident that this Project will help to restore the water quality and beneficial uses of the Arroyo Seco—and downstream LA River—satisfying interim compliance milestones—and contributing towards the long term compliance efforts of the ULAR EWMP.

Sincerely,

Dawn Petschauer

Dawn Petschauer
Upper LA River Watershed Lead
On behalf of the ULAR EWMP WMG

cc: Kris Markarian, City of Pasadena
Brent Maue, City of Pasadena
Sean Singletary, City of Pasadena
Julian Lee, City of South Pasadena
Alfredo Magallanes, City of Los Angeles, LASAN

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

The West Pasadena Residents' Association represents over 7,000 households in Southwest Pasadena, almost all of which are within a few blocks of the Arroyo Seco, and many of which are also adjacent to San Rafael Creek. WPRA and its neighborhoods are acutely aware of and interested in the Arroyo Seco's condition and maintenance.

WPRA supports the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project joint project submittal by the cities of Pasadena and South Pasadena under the Los Angeles County Flood Control District (LACFCD) Measure 'W' Program, and by the City of Pasadena for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22 to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and flood plain. **We also urge approval of the additional requested funding of $3.5 million** for this important project.

The project will treat stormwater inflow from the Arroyo Seco channel on public parcels in the City of Pasadena and South Pasadena. It will also contribute to the regional efforts underway by several agencies for the Upper Los Angeles River.

It will include two regional stormwater capture and treatment facilities consisting of surface infiltration facilities, as well as educational and wayfinding signage and viewing areas for recreational purposes. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels.

The community and a long list of stakeholders, both public and private, have worked tirelessly over many years to establish a vision for the future of the Arroyo Seco. The Arroyo Seco Master Plan was adopted by the Pasadena City Council in 2003 and continues to be the roadmap for the planning, preservation and enhancement of this unique gem in our cities. The project to restore San Rafael Creek to a healthy condition is recommended in the adopted Master Plan.

WPRA looks forward to the approval of this submittal and to being involved in the development and public engagement for this important project.

Respectfully,

Dan Beal
President
For the Board of Directors

cc: Steve Madison, Councilmember, District 6
Takako Suzuki, Field Deputy, District 6
Steve Mermell, City Manager
Ara Maloyan, Public Works Director

WEST PASADENA RESIDENTS' ASSOCIATION
POST OFFICE BOX 50252 ▪ PASADENA, CA 91115

SIERRA CLUB
FOUNDED 1892

Pasadena Group

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

We forward this letter of support to you on behalf of Sierra Club for the joint project submittal by the cities of Pasadena and South Pasadena under the Los Angeles County Flood Control District (LACFCD) Measure 'W' Program. We understand the City of Pasadena is submitting this project for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22. The project, identified as **the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project,** will advance important planning efforts within one of the region's primary and most historic natural open spaces, the Arroyo Seco. The project area involves the Arroyo Seco stream, a significant tributary of the Los Angeles River. We find it to be a truly important project to restore this reach of the flood plain within the Arroyo Seco Watershed.

The Sierra Club Pasadena Group, which includes both Pasadena and South Pasadena, has for many years conducted public hikes along the Lower Arroyo Seco at or near the proposed project's site, during which we point out and explain to hikers the many features of the Arroyo Seco and adjacent areas. Both Don Bremner and Virginia Heringer have led these Lower Arroyo hikes, and Virginia Heringer has led hikers there as chair of the Sierra Club's Natural Science Section. Incidentally, our online monthly newsletter is entitled "Arroyo View."

Our organization is not only supportive that the proposed project will treat stormwater inflow from the Arroyo Seco channel on public parcels in Pasadena and South Pasadena but also contribute to the regional positive efforts underway by several agencies for the Upper Los Angeles River. As the project has been explained to us, we understand that it will include two regional stormwater capture and treatment facilities consisting of surface infiltration facilities. Also included will be educational and wayfinding signage and viewing areas for recreational purposes.

We anticipate that the project will be discussed in detail in various forums, from community groups to the City Council and its committees. We will follow those discussions and perhaps participate in them.

The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project is a major opportunity to continue the progress in the region to achieve pollutant load reductions by the cities of Pasadena and South Pasadena. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels that are both managed by the LACFCD. A treatment wetland and recharge basin system are proposed adjacent to the Arroyo Seco channel to capture, treat, and infiltrate stormwater from the diverted drainage channel. The proposed diversions will both consist of a drop inlet structure with a rubber dam placed in the Arroyo Seco to ensure that the storm drain will continue to accommodate the existing flood control drainage capacity.

The community and a long list of stakeholders, both public and private, have worked over many years to establish a vision for the future of the Arroyo Seco and its visitors. The Arroyo Seco Master Plan was adopted by the Pasadena City Council in 2003 and continues to be the roadmap for the planning, preservation and enhancement of this unique gem in our cities. The project to restore San Rafael Creek to a healthy condition is a project recommended in the adopted Master Plan for the Arroyo Seco in Pasadena.

This funding opportunity would allow for a very critical step in the planning and management of the Arroyo Seco flood plain and stream zone as well as implement a long-standing recommended project from Pasadena's Arroyo Seco Master Plan. It is our understanding that if awarded, this grant funding would assist in paying for the planning, design, preparation of construction documents, preparation of the appropriate CEQA document, completion of various important technical studies, and regulatory permits for the rehabilitation of this area, and would result in a "shovel ready project" for which $3.5 million in funding for implementation is already in place.

Our organization supports the proposal by the two cities to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and flood plain. We urge you to provide the additional requested funding of $3.5 million for this important project.

Thank you for your consideration to fund **The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project** in the cities of Pasadena and South Pasadena and for the opportunity to show our complete support for this important project. If our organization can provide any further information, please feel free to contact us.

Best regards,

Virginia Heringer

Virginia Heringer
Sierra Club Pasadena Group Chair

Don Bremner

Don Bremner
Sierra Club Pasadena Group Conservation Chair and Outings Co-Chair
Former member of City of Pasadena Recreation and Parks Commission

October 15, 2020

City of South Pasadena
1414 Mission Street
South Pasadena, CA 91030
Attn: Mr. Julian Lee, Deputy Public Works Director

ARROYO SECO – SAN RAFAEL TREATMENT WETLANDS PROJECT
LETTER OF SUPPORT

Dear Mr. Lee:

We would like to express our support for the Arroyo Seco – San Rafael Treatment Wetlands Project in the Cities of Pasadena and South Pasadena. This Project will improve stormwater quality by intercepting pollutant-laden stormwater and urban runoff pollutants from the San Rafael Creek and from the Arroyo Seco Channel with adjacent treatment basins/wetlands. The enhancement of these areas and the use of native habitat will provide an opportunity to connect the community with the natural environment and the historic Arroyo Seco Channel.

We welcome the opportunity for San Pascual Stables to participate in this Project with the City of Pasadena and South Pasadena and look forward its development.

If you have any questions, please contact David Sterckx , Managing partner, at (310)666-1060 or via email at davidsterckx@sanpascualstables.com.

Sincerely,

D. Sterckx
Managing partner

ATTACHMENTS FOR SECTION 7.1:

COST & SCHEDULE

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client:	**City of Pasadena/City of South Pasadena**	Prepared by:	**MMT**
Project:	**Arroyo Seco-San Rafael Treatment Wetlands**	Checked by:	**OG**
Status:	**10% Cost Estimate**	Date	**10/14/2020**

Description	Qty	Unit	Unit Price	Total
Miscellaneous				**$316,655**
Mobilization / Demobilization (5% of Costs)	1	LS	$316,655.00	$316,655
Channel Diversion and Pretreatment				**$777,976**
Temporary Diversion	2	EA	$20,000.00	$40,000
Drop Inlet w/ Grate	2	EA	$50,000.00	$100,000
Rubber Dam	1	EA	$195,000.00	$195,000
Actuated Valve and Structure	3	EA	$25,000.00	$75,000
Pretreatment Device (25 CFS) (Includes excavation & shoring)	2	EA	$85,000.00	$170,000
Manhole (4' I.D. x 5' Depth) (Includes excavation & shoring)	1	EA	$7,500.00	$7,500
Manhole (4' I.D. x 8' Depth) (Includes excavation & shoring)	1	EA	$10,000.00	$10,000
Piping (30" RCP) to wet well (Includes excavation & shoring)	435	LF	$360.00	$156,600
Backfill and Compaction for Piping Base (crushed aggregate)	226	CY	$46.00	$10,376
Flap Gate	1	EA	$4,000.00	$4,000
Bioswale	950	SF	$10.00	$9,500
Site Preparation and Demolition - Existing Area				**$211,250**
Clear and Grub	92,500	SF	$0.50	$46,250
Tree Removal	110	EA	$1,500.00	$165,000
Treatment Wetland & Recharge Ponds (9.1 AF)				**$536,250**
Grading	7,695	CY	$15.00	$115,425
Backfill and Compaction	45	CY	$25.00	$1,125
Hauling	7,650	CY	$28.00	$214,200
Piping (12" RCP) dry weather connection (Includes excavation & shoring)	50	LF	$200.00	$10,000
Wetland Plastic Liner (30 mil)	8,350	SY	$20.00	$167,000
Outfall Overflow Structure	2	EA	$5,500.00	$11,000
Piping (18" RCP) to Outfall (Includes excavation & shoring)	70	LF	$250.00	$17,500
Wet Well and Conveyance				**$1,168,500**
Wet Well Installation (Includes excavation & shoring)	1	LS	$50,000.00	$50,000
Submersible Pumps and Valves (5.76 cfs)	1	LS	$200,000.00	$200,000
12" DIP to Irrigation Filter (Includes excavation & shoring)	30	LF	$200.00	$6,000
18" RCP to Outfall Filter (Includes excavation & shoring)	50	LF	$250.00	$12,500
Treatment Filter Unit (2.76 cfs)	3	EA	$300,000.00	$900,000
Stormwater Havesting Unit	1	EA	$500,000.00	$500,000

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client:	**City of Pasadena/City of South Pasadena**	Prepared by:	**MMT**
Project:	**Arroyo Seco-San Rafael Treatment Wetlands**	Checked by:	**OG**
Status:	**10% Cost Estimate**	Date	**10/14/2020**

Description	Qty	Unit	Unit Price	Total
Electrical Service, Controls, Instrumentation				**$322,000**
Electrical Service	1	LS	$60,000.00	$60,000
Control Panel and PLC Programming	1	LS	$80,000.00	$80,000
Conduit & Wiring	1	LS	$100,000.00	$100,000
NEMA 4 Junction Box, 6"x6"x6" (1 each for 480V and 120V conduits)	6	EA	$2,000.00	$12,000
Misc. Conduit Fittings, Elbows, Core Drilling and Sealing, etc.	1	LS	$25,000.00	$25,000
Instrumentation	1	LS	$45,000.00	$45,000
Landscape and Irrigation Modifications				**$438,750**
Tree Replacement	75	EA	$2,500.00	$187,500
Shrubs, Perennials, and Grasses	92,500	SF	$2.50	$231,250
90-Day Plant Establishment Period	1	LS	$20,000.00	$20,000
Site Amenities and Improvements				**$825,300**
Decomposed Granite Path	4,800	SF	$10.00	$48,000
Lodgepole Fencing	1,050	LF	$26.00	$27,300
Channel Slab (18'W x 190'L)	1	EA	$750,000.00	$750,000
Start-up, Testing, Prepare Operations & Maintenance Manuals, and Prepare Record Drawings				**$94,500**
SWPPP Implementation	1	LS	$40,000.00	$40,000
Start-up and Testing	1	LS	$46,500.00	$46,500
O&M Manuals	1	LS	$4,000.00	$4,000
Record Drawings	1	LS	$4,000.00	$4,000
SUBTOTAL				**$4,691,181**
			35% Contingency	$1,641,914
			Total Construction Costs	**$6,333,095**
	GRAND TOTAL			**$6,333,095**

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client: **City of Pasadena/City of South Pasadena**
Project: **Arroyo Seco-San Rafael Treatment Wetlands**
Status: **10% Cost Estimate**

Prepared by: **MMT**
Checked by: **OG**
Date **10/14/2020**

Description	Qty	Unit	Unit Price	Total

Assumptions and Exclusions

1 This is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.
2 The unit cost data is derived from inhouse sources, recent bids on similar construction, and RSMeans current construction cost data.
3 This opinion of cost is based on the project program and plans made available at the time of preparation.
4 Material prices are based on current quotations and do not include escalation.
5 This opinion of cost assumes that all improvements will be constructed at one time.
6 Quantity take offs were performed when possible and parametric estimates and allowances are used for items that cannot be quantified at this stage of the design.
7 This opinion has been based on a competitive open bid situation with a recommended 5 - 7 bonafide reputable bids from general contractors and a minimum of 3 bidders for all items of subcontracted work.
8 All unit costs take into account sales tax, general conditions, bonding and insurance, and subcontractor and general contractor overhead and profit.
9 Where applicable, unit costs include the cost of freight.

The following are excluded:

1 Environmental clearances and permits
2 Hazardous spoil disposal, if encountered
3 Property and Right of Way acquisition or easements
4 Legal and accounting fees
5 Plan check, building permit fees
6 Utility Connection Fees
7 Testing and inspection
8 Fire and all risk insurance
9 Removal of unforeseen underground obstructions
10 Relocation of unforeseen subsurface utilities
11 Signage and wayfinding
12 Additional fill or import
13 Loose furniture and equipment
14 Utility connection fees
15 Tel/data system
16 Construction contingency
17 Work done after business hours
18 Design, engineering and consulting fees other than those specifically listed in the above estimate

Items that may affect the cost estimate:

1 Modifications to the scope of work included in this estimate
2 Unforeseen sub-surface conditions
3 Restrictive technical specifications or excessive contract conditions
4 Any other non-competitive bid situations
5 Bids delayed beyond the projected schedule

Client:	**City of Pasadena/City of South Pasadena**	Prepared by:	**MMT**
Project:	**Arroyo Seco-San Rafael Treatment Wetlands**	Checked by:	**OG**
Status:	**10% Cost Estimate**	Date:	**10/14/2020**

Description	Total
Miscellaneous	**$316,655**
Channel Diversion and Pretreatment	**$777,976**
Site Preparation and Demolition - Existing Park Area	**$211,250**
Storage	**$536,250**
Wet Well and Conveyance	**$1,168,500**
Electrical Service, Controls, Instrumentation	**$322,000**
Landscape and Irrigation Modifications	**$438,750**
Site Amenities and Improvements	**$825,300**
Start-up, Testing, Prepare Operations & Maintenance Manuals, and Prepare Record Drawings	**$94,500**
SUBTOTAL	**$4,691,181**
35% Contingency	$1,641,914
Total Construction Costs	**$6,333,095**
Pre-Design, Design, and Construction Support (15%)	$949,964
Community Outreach during Design	$50,000
Environmental Planning and Permitting (2%)	$126,662
Agency Project Management (2.5%)	$158,327
Construction Management (10% of construction)	$633,309
Construction Surveying	$20,000
Total Soft Costs	**$1,938,263**
GRAND TOTAL	**$8,271,357**

Assumptions and Exclusions

1 This is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.
2 The unit cost data is derived from inhouse sources, recent bids on similar construction, and RS Means current construction cost data.
3 This opinion of cost is based on the project program and plans made available at the time of preparation.
4 Material prices are based on current quotations and do not include escalation.
5 This opinion of cost assumes that all improvements will be constructed at one time.
6 Quantity take offs were performed when possible and parametric estimates and allowances are used for items that cannot be quantified at this stage of the design.
7 This opinion has been based on a competitive open bid situation with a recommended 5 - 7 bonafide reputable bids from general contractors and a minimum of 3 bidders for all items of subcontracted work.
8 All unit costs take into account sales tax, general conditions, bonding and insurance, and subcontractor and general contractor overhead and profit.
9 Where applicable, unit costs include the cost of freight.

The following are excluded:

1 Environmental clearances and permits
2 Hazardous spoil disposal, if encountered
3 Property and Right of Way acquisition or easements
4 Legal and accounting fees
5 Plan check, building permit fees
6 Utility Connection Fees
7 Testing and inspection
8 Fire and all risk insurance
9 Removal of unforeseen underground obstructions
10 Relocation of unforseen subsurface utilities
11 Signage and wayfinding
12 Additional fill or import
13 Loose furniture and equipment
14 Utility connection fees
15 Tel/data system
16 Construction contingency
17 Work done after business hours
18 Design, engineering and consulting fees other than those specifically listed in the above estimate

Items that may affect the cost estimate:

1 Modifications to the scope of work included in this estimate
2 Unforeseen sub-surface conditions
3 Restrictive technical specifications or excessive contract conditions
4 Any other non-competitive bid situations
5 Bids delayed beyond the projected schedule

ATTACHMENTS FOR SECTION 7.2:

COST SHARE

State of California • Natural Resources Agency
Gavin Newsom, Governor

DEPARTMENT OF PARKS AND RECREATION
P.O. Box 942896 • Sacramento, CA 94296-0001
(916) 653-7423
Lisa Ann L. Mangat, Director

July 20, 2020

Rosa Laveaga, Landscape Architect
Arroyo Seco Project Supervisor
City of Pasadena, Public Works Engineering Dept.
P.O Box 7115
Pasadena, CA 91109-7115

Sent via Email Only
rlaveaga@cityofpasadena.net

Re: Proposition 68 - Arroyo Seco - San Rafael Treatment Wetlands Project (Project)

Dear Rosa Laveaga:

As you know, the State Budget Act of 2019-20 [Item 3790-101-6088 (2)2(c)] allocated $3,500,000 for Arroyo Seco Water Reuse and Natural Stream Restoration from the Proposition 68 Urban Counties Per Capita Program. On September 20, 2019, Office of Grants and Local Services (OGALS) staff met with you and City of Pasadena (Pasadena) staff, in addition to City of South Pasadena (South Pasadena) staff, to discuss this grant opportunity and review the "Urban Counties Per Capita Program Arroyo Seco Procedural Guide" (Guide). Since the Budget Act did not identify a grant recipient, OGALS encouraged Pasadena and South Pasadena to work together to determine the best approach for fulfilling the budget intent.

Since our September 2019 meeting, OGALS received a draft Memorandum of Understanding (MOU) between Pasadena and South Pasadena that outlines the proposed responsibilities for each agency for the Project. OGALS understands that Pasadena will serve as the grantee. As grantee, Pasadena will agree to all provisions of the grant contract and will submit a complete application, payment requests and the final Project close-out documentation as required in the Guide.

South Pasadena will be responsible for providing necessary reporting documentation to Pasadena. Both agencies will provide match and any additional required funds, as well as access to the Project site during construction. Section 4 of the MOU states the term of the MOU starts from the date each agency signs the MOU and continues until the Project is complete and the final payment is received. Currently, the draft MOU does not address long term maintenance and operation of the improvements at the Arroyo Seco; therefore, the MOU will need to be modified to reflect these long-term requirements.

As a reminder, the grant contract requires that the Project remain open to the public and maintained for a period of thirty years. Further, a deed restriction must be placed on the Project property before OGALS can process reimbursement payments. Therefore, once the grant contract is fully executed, Pasadena will need to file a deed restriction on the portions of the Project property that it owns.

Concurrently, OGALS will provide South Pasadena with a customized contract that contains provisions pertaining to the thirty-year contract performance period and the deed restriction requirement. Once the customized contract is fully executed, South Pasadena will then file a deed restriction on the portions of the Project property that it owns. Both deed restrictions (on Pasadena property and South Pasadena property) will need to be recorded prior to OGALS issuing any grant payments to Pasadena.

As reference, OGALS and Pasadena must execute the grant contract before the June 30, 2022 encumbrance date. The Project must be complete by March 31, 2024 to allow time for a final site inspection and processing of the final payment before the June 30, 2024 liquidation date.

OGALS looks forward to working with Pasadena to ensure a successful Project outcome. If you have questions or need further assistance, please contact Project Officer, Stephanie Schiechl at (916) 651-8580 or Stephanie.Schiechl@parks.ca.gov.

Sincerely,

Jean a. Lacher

Jean Lacher, Chief
Office of Grants and Local Services

cc: Kristine Courdy, Deputy Director, Public Works Department,
City of South Pasadena, kcourdy@southpasadenaca.gov
Lee Butterfield, Manager, Office of Grants and Local Services
Jana Clarke, Supervisor, Office of Grants and Local Services
Stephanie Schiechl, Project Officer, Office of Grants and Local Services

ATTACHMENTS FOR SECTION 8.1:

ENVIRONMENTAL DOCUMENTS AND PERMITS

8.0 ADDITIONAL FEASIBILITY INFORMATION

This section presents additional information regarding project feasibility and technical details gathered during project design and feasibility assessment.

8.1 ENVIRONMENTAL DOCUMENTS AND PERMITS

8.1.1 Environmental Documentation

Evaluation of the environmental impacts of the project is required before construction. The following table summarizes the status of the environmental documentation for this project.

Table 8-1. Environmental Documentation Summary

CEQA Lead Agency:	Cities of Pasadena and South Pasadena
Environmental Documentation (Anticipated):	Mitigated Negative Declaration
Current Status:	The preparation of the Initial Study and the anticipated Mitigated Negative Declaration are proposed as a part of the development of the 30% design. The CEQA documentation will be completed with the full design anticipated to be September 2022.
NEPA Required?:	No

Past project experience has shown that the Initial Study most often identifies a Mitigated Negative Declaration for projects that are constructed in similar locations. The most significant impacts are temporary during the construction period and once construction is complete, will be gone entirely. Upon project completion, the project will ultimately provide a net benefit to the water quality and natural environment.

For cost estimating purposes only, a MND is indicated. Once an Initial Study is completed the appropriate environmental review will be determined.

The CEQA Initial Study and associated Mitigated Negative Declaration are anticipated to take up to one year and will occur simultaneously with the design phase.

8.1.2 Permitting

8.1.2.1 LA County Flood Control District Permits

Consultation with the LACFCD is required before the project components can be constructed. Table 8-2 summarizes the required LACFCD permits anticipated for this project.

The project will impact the San Rafael Creek Channel and the Arroyo Seco Channel through the installation of a drop inlet with a grate cover within the channel bottom. The design will ensure conveyance of the existing design capacity of the infrastructure thus maintaining the flood control capabilities of the system. An example of the proposed drop structure detail can be found in Attachment B. After construction, the facilities are assumed to require access by the City maintenance crews to remove any debris that is impeding the performance.

Table 8-2: Listing of Anticipated Required LACFCD Permits

Agency	Permit/Notification Name	Rationale	Initial Steps & Anticipated Challenges
LA County Flood Control District	Major Modification Permit	A water diversion structure is considered a drainage facility modification.	Complete and submit application for review via EpicLA. Challenges anticipated are the design review periods and the processing of the Use and Maintenance Agreement.
LA County Flood Control District	Discharge Permit	Non-storm water (treated water) will be discharged directly into an existing District facility.	Complete and submit application for review via EpicLA. Challenges anticipated are the design review periods and the processing of the Use and Maintenance Agreement.

The anticipated LACFCD permit schedule is as follows:

Table 8-3: LACFCD Permit Schedule

<table>
<tr><th>Task</th><th>Task Complete</th><th colspan="2">Duration</th></tr>
<tr><td colspan="2">Submit Permit Application w/ 60% Plans</td><td>NTP + 24 weeks</td><td>6 months after Design NTP</td></tr>
<tr><td>60% Plan Review</td><td>NTP + 30 weeks</td><td colspan="2">6 weeks after Application Submittal</td></tr>
<tr><td>90% Plan Review</td><td>NTP + 42 weeks</td><td colspan="2">6 weeks after Plan Submittal</td></tr>
<tr><td>100% Plan Approval</td><td>NTP + 48 weeks</td><td colspan="2">2 weeks after Plan Submittal</td></tr>
<tr><td>Permit Issued</td><td>NTP + 48 weeks</td><td colspan="2">End of 100% Plan Approval</td></tr>
</table>

8.1.2.2 Additional Agency Permits

Consultation with additional regulatory agencies and acquisition of permits is required before the project components can be constructed. The following table summarizes the plan checks, regulatory permits and approvals relevant to the project.

Table 8-4: Listing of Anticipated Required Additional Agency Permits

Agency	Permit/Notification Name	Rationale	Initial Steps
City of Pasadena Department of Public Works	--	City of Pasadena Department of Public Works is the property manager.	Contact Department of Public Works department
City of South Pasadena Public Works Department	--	City of South Pasadena Public Works is the property manager.	Contact Public Works department

Agency	Permit/Notification Name	Rationale	Initial Steps
United States Army Corp of Engineers	Section 404 Permit	Potential discharge of dredged or fill material into waters of the United States	File a permit with the Army Corps of Engineers
California Department of Fish & Wildlife	Streambed Alteration Notification 1601	Diversion of flow and alteration of the bed of any river	Submit Lake and Streambed Alteration (LSA) Notification CA DFW
State Water Resources Control Board	Construction General Permit	One or more acres of soil will be disturbed during construction.	Develop a Storm Water Pollution Prevention Plan (SWPPP).
LA County Department of Public Health	Cross Connection and Water Pollution Control Program	Ensure that there is no hazard to the potable water system.	Undergo review and approval.
Greater LA County Vector Control District	Mosquito Abatement District	Potential mosquito concerns.	Provide Vector Control District conceptual project plans for review.
South Coast Air Quality Management District	Rule 403	Prevent, reduce, or mitigate fugitive dust emissions from construction activities.	Construction in the South Coast Air Basin must incorporate best available control measures included in Table 1 of Rule 403

The acquisition and securing of all the required permits and environmental documentation are anticipated to be around 2.0% of the total project costs for a grand total of $140,454. All permits are anticipated to be filed and acquired by the end of the 100% final design phase.

ATTACHMENTS FOR SECTION 8.2:

VECTOR MINIMIZATION

ATTACHMENTS FOR SECTION 8.6:

TECHNICAL REPORTS

ATTACHMENTS FOR SECTION 8.7:

OTHER

ARROYO SECO-SAN RAFAEL TREATMENT WETLANDS
PRELIMINARY DESIGN AND FEASIBILITY STUDY REPORT

October 15, 2020

PRESENTED TO

City of Pasadena
Department of Public Works
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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ac-ft	acre-feet
BMP	Best Management Practice
CEQA	California Environmental Quality Act
cfs	cubic feet per second
DAC	Disadvantaged community
EPA	Environmental Protection Agency
EWMP	Enhanced Watershed Management Program
ft	feet
FY	Fiscal Year
GIS	Geospatial Information System
gpm	Gallons per minute
hr	hour
in	inch
IRWMP	Integrated Regional Water Management Plan
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LiDAR	Light Detection and Ranging
LSPC	Loading Simulation Program C++
MND	Mitigated Negative Determination
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NTP	Notice to Proceed
O&M	Operations and Maintenance
RAA	Reasonable Assurance Analysis
SCW	Safe, Clean Water
SUSTAIN	System for Urban Stormwater Treatment and Analysis IntegratioN
SWRP	Storm Water Resource Plans
TMDL	Total Maximum Daily Loads
ULAR	Upper Los Angeles River
WMMS	Watershed Management Modeling System
WY	Water Year

1.0 GENERAL INFORMATION

This section provides general information on the project including location and background.

1.1 OVERVIEW

Table 1-1 provides an overview of the project and the Project Developer(s):

Table 1-1: Project Overview

Project Name:	Arroyo Seco-San Rafael Treatment Wetlands
Brief Project Description:	Two regional stormwater capture and treatment facilities located within open space near the Arroyo Seco Channel in Pasadena and South Pasadena.
Call for Projects Year:	FY21-22
SCW Watershed Area:	Upper Los Angeles River
Total SCW Funding Requested:	$4,771,357
Phases	Design, Construction, O&M
Project Weather Type:	Wet
Project Lead(s):	City of Pasadena
Additional Project Collaborators:	City of South Pasadena
Additional Project Collaborators:	City of Los Angeles
Is this a non-municipal project?	No

1.2 PROJECT LOCATION

Table 1-2 summarizes the project location. A site map and project location map can be found in **Attachment A**.

Table 1-2: Project Location

Latitude:	34.125321	34.120605
Longitude:	-118.166416	-118.167336
Street Address:		
City:	Pasadena	South Pasadena
State:	CA	CA
Zip Code:	91105	91030
Municipality:	Pasadena	South Pasadena
Disadvantage Community (DAC)	Yes	Yes
Distance to nearest DAC	0.3 miles	0.1 miles
Compliance with Anti-Displacement Policies of Feasibility Study Requirements:	Yes	Yes

1.2.1 Disadvantaged Community Benefits

1.2.1.1 Benefits to the DAC

The project concept will improve park space immediately adjacent to the Arroyo Seco channel. A walking trail will be incorporated around the BMP facilities. The existing trail along the Arroyo Seco will be rehabilitated in the vicinity of the project limits. Natural vegetation and new trees will provide gathering spaces and areas for rest. As shown in the DAC Map in Attachment A, there is a DAC tract on the west side of the Arroyo Seco within short walking distance to the project area. Existing bridges connect this community to the project.

1.2.1.2 Water Quality Benefits to the DAC

The proposed diversion will help remove floatables, sediment, and nutrient laden water from the San Rafael Creek and Arroyo Seco creating a more pleasing natural look to the built channel infrastructure in the region. The natural treatment provided in the wetland and natural stream along with the series of treatment filters will discharge treated, cleaner water to the Arroyo Seco.

1.2.1.3 Water Supply Benefits to the DAC

Water percolating down into soils within the proposed infiltration basin at the San Rafael site will help recharge groundwater. Additionally, reuse of water stored in the wetland at the San Pascual site for park irrigation helps reduce potable water use.

1.2.1.4 Community Investment Benefits to the DAC

This project will contribute to the enhancement and restoration of the existing unused areas along the channel. Providing points of interest and rest areas along the Arroyo Seco trail will encourage more use. In addition, the project proposes the planting of additional trees which will lead to more carbon sequestration within the area.

1.2.1.5 Project's Engagement with the DAC to date

No outreach has been performed to date.

1.2.2 Consideration of Anti-Displacement Policies

The design will comply with displacement avoidance measures to ensure local community development. This project will promote a healthy neighborhood by providing refreshed green space, recreation, and an improved environment. During this project, there is not any anticipated potential to increase gentrification as the project is contained within the existing public space and does not impact existing affordable housing, real estate, or increase the surrounding property value in any substantial way.

1.3 PROJECT DESCRIPTION

1.3.1 Project Fact Sheet

See **Attachment A** for a Project Fact Sheet for a summary that outlines the primary components of the proposed Project. The summary includes the key design elements of the Project (capacity, drainage area, location, etc.) and the benefits to be realized by the Project, and a detailed summary of the estimated project scoring.

1.3.2 Regional Water Management Plan (SWRP, E/WMP, IRWMP, or other)

The Upper Los Angeles River Watershed is a largely built-out, urbanized watershed of approximately 485 square miles, or 310,400 acres, in the Upper Los Angeles River Watershed Management Area and over 50 miles of the main line of the LA River. The development of the Arroyo Seco/San Pascual Treatment Wetlands and San Rafael Infiltration Basin is another major opportunity to continue the regional scale progress to achieve pollutant load reductions for the Upper Los Angeles River Watershed Management Program.

The Upper LA River EWMP included a project for the City of South Pasadena (Lower Arroyo Park) that is similar in location and purpose as the one proposed herein. Further analysis of that project determined there were significant technical feasibility constraints. The initial EWMP has since been improved upon and has been incorporated into the IRWMP and the SWRP. The San Pascual Treatment Wetland site proposed in this report was included in the Adaptive Management Section of the ULAR EWMP Group's Annual Report. The addition of the San Rafael Infiltration Basin site discussed in this report provides additional treatment in the Arroyo Seco watershed and ultimately supports the goals described in the Upper LA River EWMP and the Load Reduction Strategy (LRS). This combined project system will go even further than the original concepts proposed in the EWMP and may help offset other needed stormwater BMPs elsewhere in the watershed.

1.3.3 Detailed Description and Historical Background

1.3.3.1 Overview

The San Rafael site is located at the confluence of the San Rafael Creek and the Arroyo Seco channel just south of San Rafael Ave in Pasadena, CA. The proposed infiltration basin will intercept some wet weather flows from the San Rafael Creek which conveys runoff primarily from Los Angeles and Pasadena to the Arroyo Seco Channel. All dry weather flows will be directed to a natural stream constructed above the San Rafael Creek concrete channel. The San Pascual site is located further downstream along the Arroyo Seco channel where wet and dry weather runoff will be directed from Pasadena, and South Pasadena areas north of Arroyo Park and San Pascual Stables. The San Pascual site is bounded by the Arroyo Seco channel to the south and San Pascual Ave to the north and the proposed treatment wetlands will reutilize and expand the capacity of an existing dike and existing irrigation system.

The project has the potential to provide significant water quality benefits for multiple jurisdictions due to the significant drainage area size (5,005 acres), location of the adjacent creek and channel, and available development space. The project will capture and treat 100% of the dry-weather flows in accordance with the ULAR LRS.

1.3.3.2 Project Objectives

The San Rafael & San Pascual Project objectives include:

- Primary
  - Improve the water quality within Arroyo Seco Channel as outlined in the EWMP and LRS
  - Enhance the existing sites by installing nature based, natural treatment wetland and groundwater recharge basins
  - Rehabilitate San Rafael Creek by providing a natural creek bed for low flow events.
- Secondary
  - Provide treated stormwater to offset the potable water demand required to irrigate nearby Arroyo Park
  - Provide habitat, educational opportunities, and diverse vegetation to the existing space
  - Educate the public on integrated systems and sustainable resources practices
  - Improve public access and use

The major mechanisms by which the Project will achieve the primary objectives are through diversion, runoff/pollutant capture, filtration, recharge, and release. The treatment wetland systems will provide natural filtration and capture. The San Rafael will infiltration basin will provide groundwater recharge and the San Pascual wetland will reuse the treated water for park irrigation. Native, natural landscaping will improve aesthetics of the spaces and provide habitat for wildlife and recreational use.

2.0 DESIGN ELEMENTS

This section provides an overview of the project design details.

2.1 CONFIGURATION

Table 2-1 is a summary of the project configuration. Attachment A contains detailed project description while Attachment B contains the plan view and preliminary profile views of the project configuration.

Table 2-1: Project Configuration Summary

BMP Type:		**San Rafael Treatment Facility**	**San Pascual Treatment Facility**	**Treatment Facility Total**
Ponding Depth:	Ft	5	5	5
Footprint Area	Ac	0.52	1.30	1.82

Figure 1. Conceptual layout configuration for San Rafael project site.

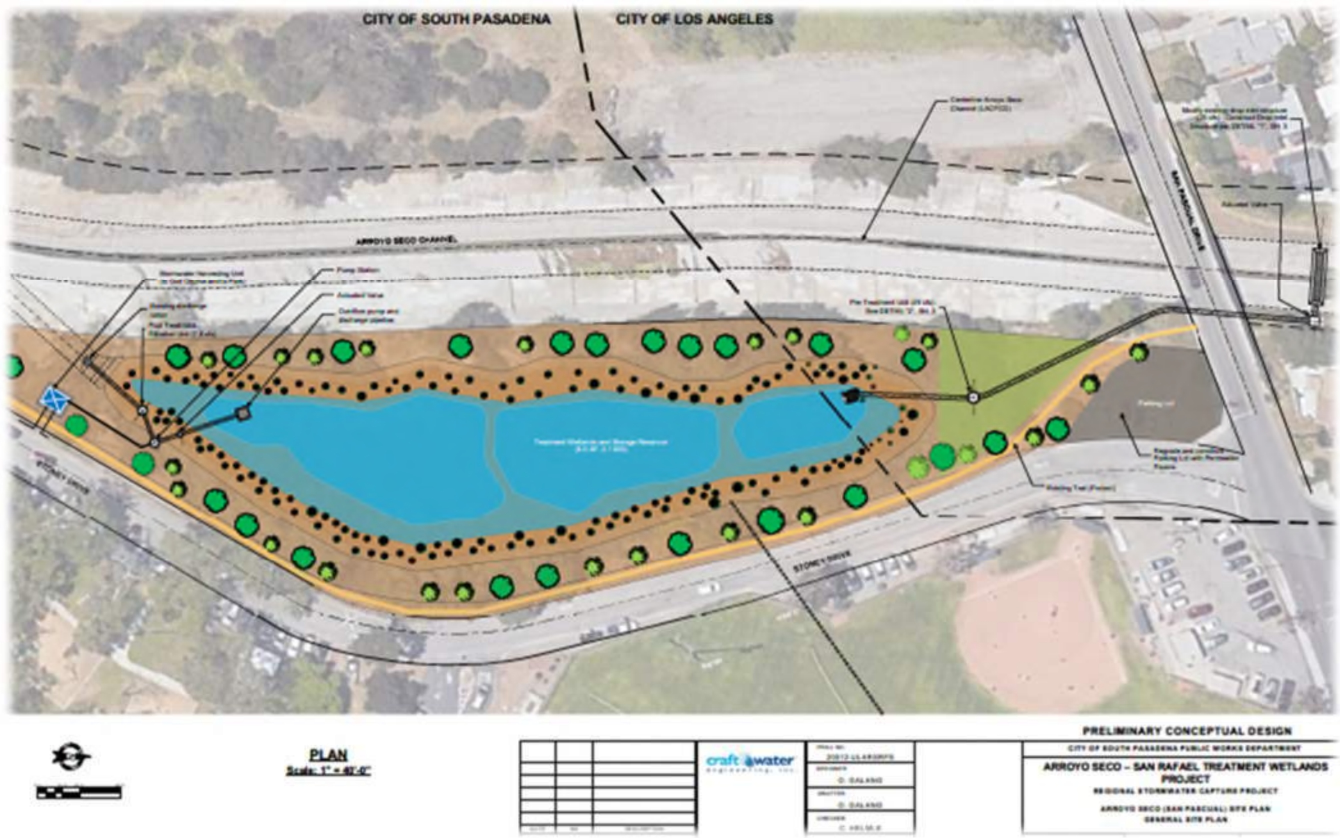


Figure 2. Conceptual layout configuration for San Pascual project site.

2.1.1 Diversion and Pretreatment

Information regarding the diversion and pretreatment system are discussed in Section 2.3 of this report.

2.1.2 Storage Component

Onsite stormwater detention is provided by an above ground infiltration basin at the San Rafael site and a treatment wetland and storage reservoir basin at the San Pascual site. The San Rafael infiltration basin will provide 2.6 ac-ft of storage and the San Pascual basin will provide 6.5 ac-ft for a total of 9.1 ac-ft.

2.1.3 Treatment and Discharge

A treatment wetland system is proposed with restored habitat which will provide natural treatment for a portion of the stormwater being diverted.

Additionally, a post-treatment filter system provides final pollutant removal prior to discharge back into the channel. The water flows from the basins to the filter and then back to the channel via gravity. The treatment rates for the San Rafael and the San Pascual sites are 2.88 and 5.76, respectively.

The filter system proposed is a cartridge system. Flow enters the filter where it is then provided sufficient contact time with the filter cartridges. The cartridges contain an opening size of 10 microns and can treat between 0.05 gallons per minute (gpm) to 1 gpm per square foot of cartridge surface area. Multiple cartridges are installed in a large concrete reservoir that can treat up to 5.76 cfs. Pollutants build up on the cartridge preventing migration back to the channel. The cartridges are cleaned and re-used providing an easy maintenance process.

2.1.4 Nature-Based Components

The proposed natural stream, treatment wetland and recharge basin provide an opportunity for the development of diverse and natural flora and fauna habitats. Different plant life emphasizing native vegetation can be planted in the drier infiltration basin sections than the treatment wetlands. These will protect, enhance, and restore habitat, green space, and usable space.

Dry weather flows will be pumped to the surface where the natural stream will be created on top of the San Rafael Channel to demonstrate the natural waterways found within the region.

2.1.5 Above Ground Improvements

The project proposes the above ground improvements discussed above. Additionally, new and restored walking paths and pedestrian bridge will be installed improving public access to the waterway. A rehabilitated parking area off of San Pascual Drive will provide parking access for maintenance vehicles and overflow parking for nearby Arroyo Park.

Native trees, shrubs, and grasses will be installed throughout the spaces to enhance the natural environment of the area.

2.2 CAPTURE AREA

Table 2-2 is a summary of the area that drains to the project.

Table 2-2: Capture Area Summary

	San Rafael	San Pascual	Total
Total Capture Area	441.1	4,564.4	5,005.5
Impervious Area	94.3	1,106.0	1,200.3
Pervious Area	346.9	3,458.3	3,805.2

2.2.1 Land Use

Table 2-3 is a summary of the land use breakdown for the area that drains to the project. A map showing the distribution of the land uses can be found in Attachment A.

Table 2-3: Land Use Summary

	San Rafael		San Pascual		Total	
Land Use Type	Percent of Impervious	Acres	Percent of Impervious	Acres	Percent of Impervious	Acres
Single Family Residential	76.4%	72.0	41.0%	454.0	43.8%	526.0
Multi-Family Residential	1.1%	1.1	11.6%	128.4	10.8%	129.5
Commercial	1.5%	1.4	7.1%	78.5	6.7%	79.9
Institutional	1.5%	1.4	7.8%	86.2	7.3%	87.7
Industrial	0.0%	0.0	4.6%	51.1	4.3%	51.1
Highways and Interstates	0.0%	0.0	7.1%	78.3	6.5%	78.3
Secondary Roads and Alleys	19.4%	18.3	20.8%	229.6	20.6%	247.8

2.2.2 Municipal Jurisdictional Areas

Table 2-4 is a summary of the municipal jurisdictional area breakdown for the project drainage area. A map showing the municipal contributions is found in Attachment A.

Table 2-4: Jurisdiction Summary

	San Rafael		San Pascual		Total	
Jurisdiction	Area (acres)	% Watershed	Area (acres)	% Watershed	Area (acres)	% Watershed
Pasadena	432.4	98.0%	3690.6	80.9%	4123.0	82.4%
Unincorporated LA County			758.3	16.6%	758.3	15.1%
City of LA	8.7	2.0%	46.6	1.0%	55.3	1.1%
La Canada Flintridge			34.3	0.8%	34.3	0.7%
South Pasadena			32.2	0.7%	32.2	0.6%
Glendale			2.5	0.1%	2.5	0.0%

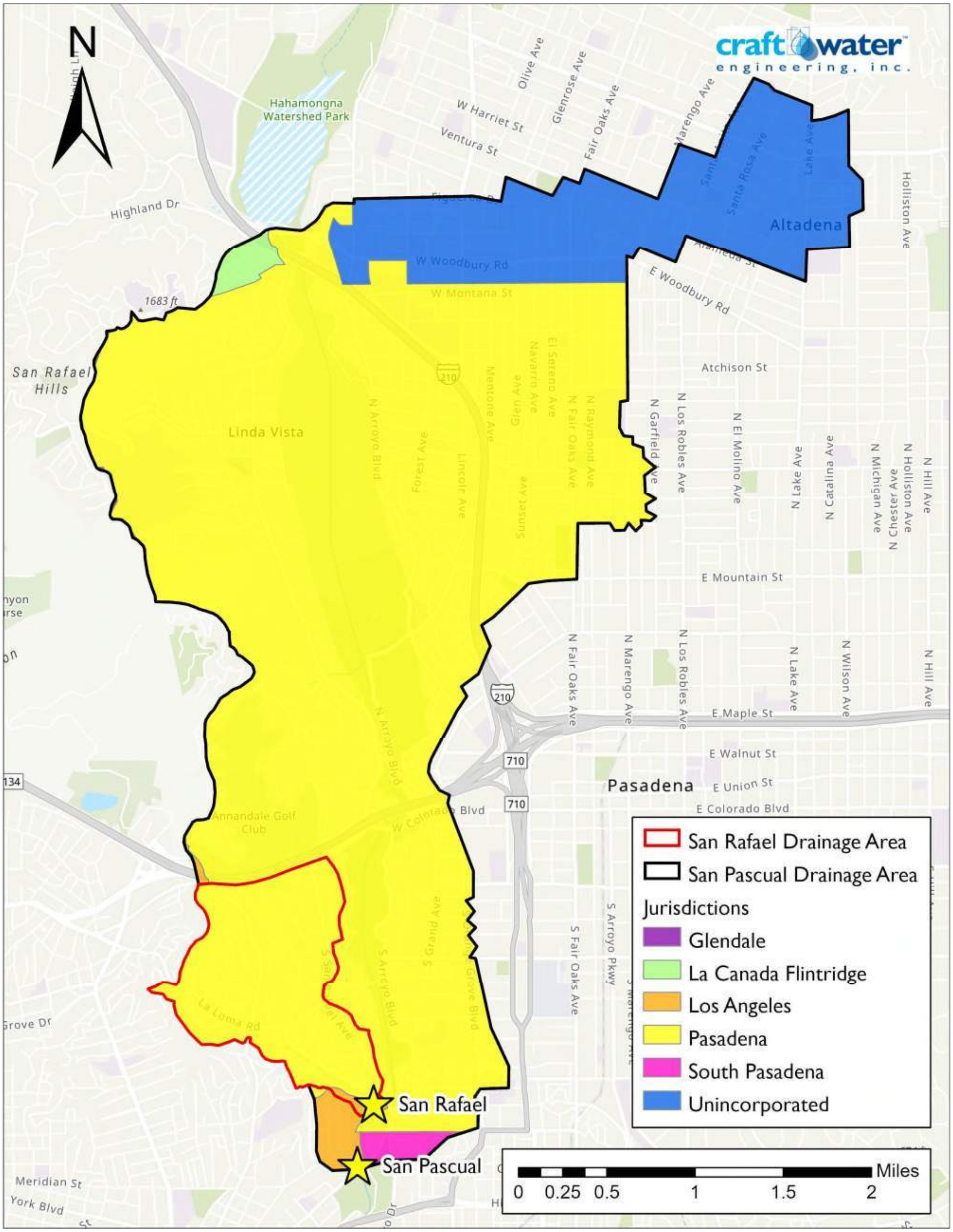


Figure 3. Drainage area jurisdiction boundaries for the San Rafael projects.

2.3 DIVERSION

This section provides details on the project's diversion structure and pretreatment system. Table 2-5 provides a summary of details on the diversion type and maximum diversion rate. Further descriptions of the diversion structures and pretreatment systems are included below.

Table 2-5: Diversion Details

Diverted Pipe ID	Type of Diversion	Typical Max Diversion Rate (cfs)
San Rafael Creek Channel	Gravity	25
Arroyo Seco Channel	Gravity	25
	Total	**50**

The diversion structure is estimated to have an average inflow captured of 0.437 cfs total.

2.3.1 Diversion Structure Description & Conditions

Drop-inlet structures are proposed along the BI0562-Line F concrete channel (San Rafael Creek) and the Arroyo Seco Channel to divert stormwater during low-flow and storm events to the pretreatment device and eventually the stormwater treatment basins.

2.3.1.1 San Rafael Creek Channel Diversion

At the proposed flow rate of 25 cfs, the structure will require a 1.5-foot drop below the existing invert and a 30-inch diameter diversion pipe at a 0.5% slope. The drop inlet structure will have dimensions of approximately 12.0-feet wide and 3-feet long. A schematic of the structure is shown in Attachment B.

2.3.1.2 Arroyo Seco Channel Diversion

At the proposed flow rate of 25 cfs, the structure will require a 1.5-foot drop below the existing invert and a 30-inch diameter diversion pipe at a 0.5% slope. The drop inlet structure will have dimensions of approximately 30.0-feet wide and 3-feet long. A schematic of the structure is shown in Attachment B.

2.3.2 Pretreatment System

Stormwater runoff transports sediment, metals, nutrients, trash, and debris that can compromise the performance of the stormwater facility and pollute downstream receiving waters. Pretreatment will be an integral component of the treatment train strategy to extend the life of the system. It is prescribed to reduce the long-term maintenance burden of the facilities, focus maintenance efforts to a concentration and accessible area, and bolster watershed compliance.

For this project, a hydrodynamic separator is proposed to be installed at the diversion points. One hundred percent of floatables and neutrally buoyant debris larger than the screen aperture (2400 microns or 2.4 mm) is collected and settle in the isolated sump of the system, eliminating scour potential. In addition to the screen aperture filtration, at least 80% of particles that are 130 microns or larger in size are removed for the proposed diversion flow. With the chambered system, hydrocarbons float to the top of the water surface and are prevented from being transported downstream. A target flow rate for the device will be based on the final design of the diversion structure. It will be designed to have the capacity to treat the maximum flow diverted to the unit. The size of the unit will also be based on the estimated sediment that will be collected in the sump to maximize sediment removal while balancing the routine maintenance required.

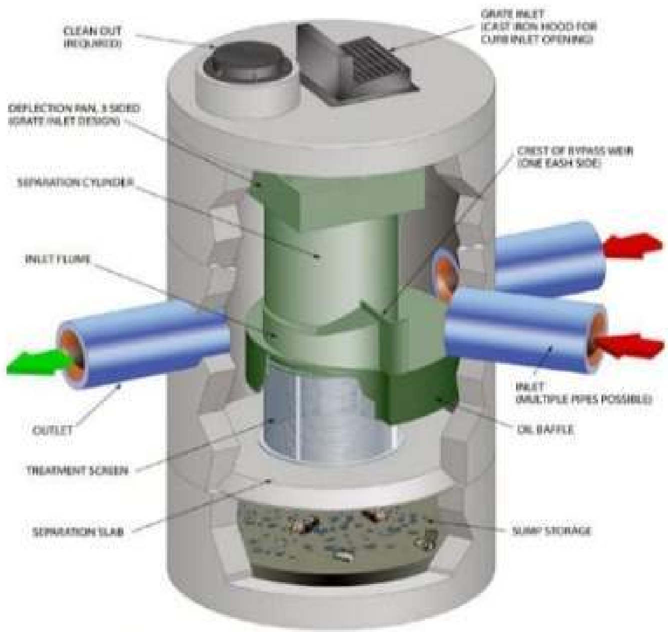


Figure 4. Typical Hydrodynamic Separator (Source: Contech Engineered Solutions)

2.4 SITE CONDITIONS & CONSTRAINTS

The following is a summary of the engineering analysis or estimates of existing site conditions, including existing and/or potential constraints or limitations due to existing conditions.

2.4.1 Site History

The San Rafael and San Pascual sites are undeveloped spaces created during the channelization of the Arroyo Seco in the 1930s. The San Pascual site has an existing dike that currently receives dry weather flows and is closed off with limited access due to dense vegetation. The dike was historically used to provide irrigation water to the nearby park but has since been abandoned due to pollutants fouling the distribution system.

2.4.2 Geotechnical Investigation

Borings and infiltration tests are expected to take place during the Design Phase of the project.

While the full geotechnical investigation has not occurred yet at these sites, infiltration rate estimates are necessary to perform the modeling analysis. For these purposes, an estimate of 0.89 in/hr was used at the San Rafael Project site based on results of prior estimates at a site just adjacent to this one across Arroyo Seco where soils and conditions are very similar. There is no known infiltration testing for the San Pascual Project site, so the most conservative estimate of 0.3 in/hr was used. This is the minimum value accepted in LA County for infiltration practices. Modeling performance results will be refined once geotechnical investigations are complete, but they should not greatly impact the recommended project sizing or configuration substantially as this uncertainty was accounted for in determining the ultimate recommendations.

2.4.3 Hydrology, Hydraulics, and Water Quality

For this project, the Los Angeles County Watershed Management Modeling System (WMMS) was used within the Loading Simulation Program C++ (LSPC) to simulate the contaminant loading, runoff volume, and flow rates associated with a long-term, 10-year continuous time series (Water Year 2002 to Water Year 2011). LSPC was also used to estimate runoff volume and peak flow for the 85th percentile storm to each diversion point. Table 2-6 summarizes the existing baseline hydrology and water quality for the primary pollutant of concern. The full stormwater capture memorandum can be found in Attachment E and F.

Table 2-6: Summary of Hydrologic Conditions

Diverted Pipe ID	Average Annual Runoff (ac-ft)	Average Annual Zinc Loading (lbs)	85th Percentile Surface Runoff (ac-ft)	85th Percentile Peak Flow (cfs)
Arroyo Seco	4,583	1,289	232	305

2.4.4 Utility Data Review

To locate the existing utilities in the area, the existing LACFCD storm drain as-builts were reviewed. The following utilities were identified to be near the project area.

2.4.4.1 Utilities Near San Rafael Creek and Arroyo Seco

Review of the LACFCD storm drain as-builts did not reveal any nearby utilities. The remote location of the projects and their proximity to the Arroyo Seco are unlikely to conflict with existing major utilities. Nonetheless, existing utility as-builts will be requested from utility companies during the Design phase to ensure no conflicts are present. Existing utilities associated with the existing irrigation system located south of the dike will be reviewed and replaced as needed to accommodate the new project design.

2.4.5 Site Access & Right-of-Way

The project requires access to the sites and the channel. An existing traffic-rated bridge crossing south of San Rafael Avenue will provide access to the San Rafael BMP where the proposed parking lot at the north end of the San Pascual site will provide access to that BMP. Existing paths along the edge of the channels will be rehabilitated and expanded as needed to provide access to the diversion structures.

A request for a Conceptual Review was sent to the LACFCD Upper LA River Watershed Manager on 10/6/20. The LACFCD will continue to be consulted following the completion of this feasibility report as part of the design process. This will require a more rigorous hydraulic study and analysis that will be performed to demonstrate that the proposed diversion system will not have any effect to the existing drainage capacity of the existing storm drains. In addition, an LACFCD permit will be obtained and the City will also be required to enter into a Use and Maintenance Agreement with the LACFCD.

2.5 MONITORING

This section provides an overview of monitoring data related to the project.

2.5.1 Historic Monitoring

There are historic monitoring water quality sites extending back into 2015 for Arroyo Seco as part of the Upper LA River Watershed Coordinated Integrated Monitoring Program. These two sites are in the lower reach of the Arroyo Seco and monitor three water quality analytes (Total Suspended Solids, E coli and bis Phthalate) slightly upstream from the San Rafael site. Below are the historical values from composites of grab samples and continuous measurements:

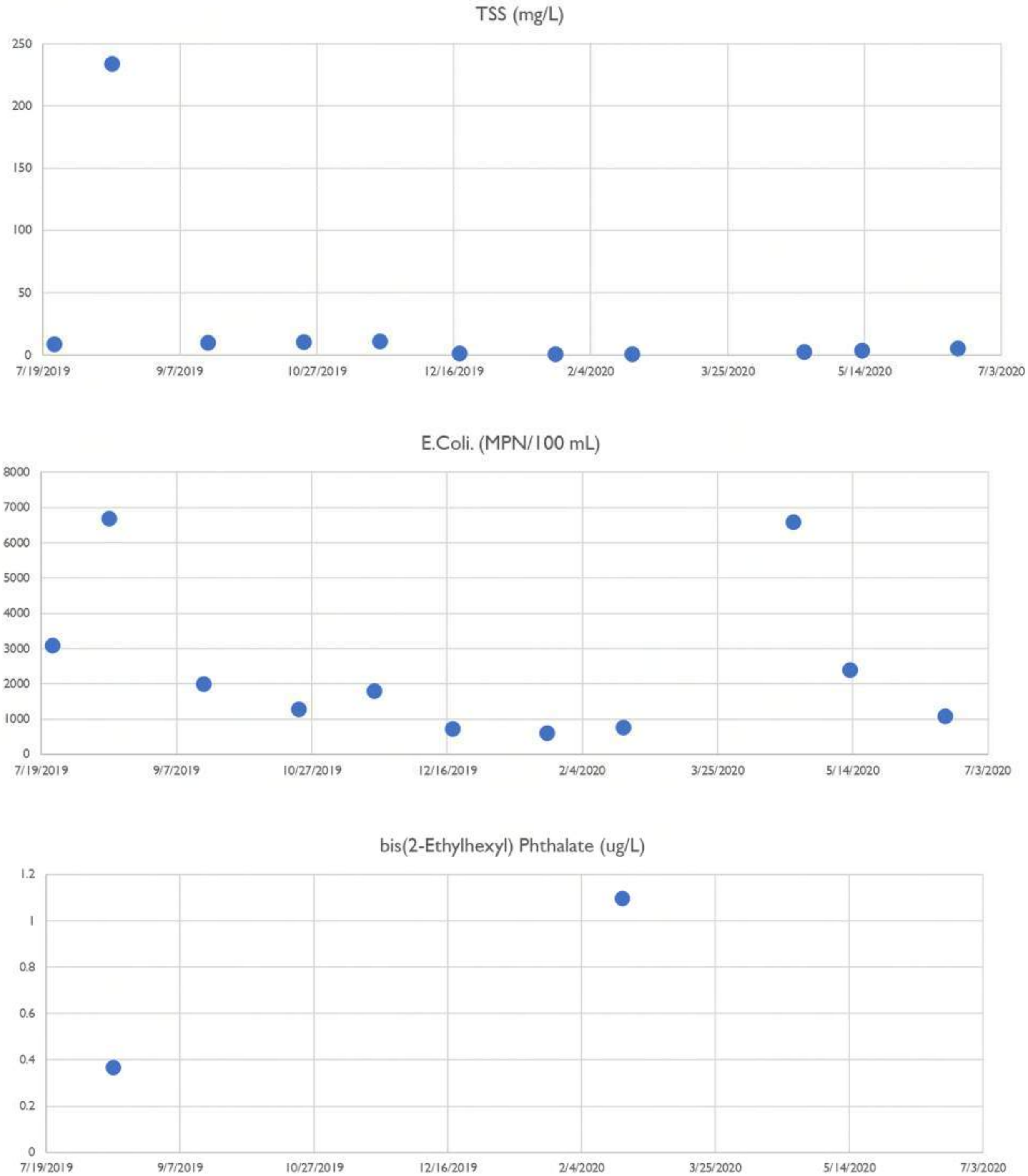


Figure 5. Historic Arroyo Seco Monitoring Data

Over 6 screening events conducted during dry weather in 2015, the ARS-152 outfall was only flowing in one instance, at a very low trickle flow around 0.0001 cfs and sampling for fecal indicator bacteria found no detectable Enterococcus and only 30 cfu/100mL E. Coli.

Additionally, a dry weather water quality measurement was completed at five sites between Johnston Creek and San Rafael Creek with the following results by Kinnetic Laboratories Incorporated for the City of Pasadena.

Table 2-7: Summary of Dry Weather Quality Measurements at five sites between Johnston Creek and San Rafael Creek

Site 4 Location	Date/Time	Temp (C)	pH	Dissolved Oxygen (%)	Specific Conductance (mS/cm)	Salinity (PSS)	Turbidity (NTU)
Beginning of San Rafael Creek	5/14/2019 11:52 am	21.82	8.37	108.2	1.95	0.98	64
Beginning of San Rafael Creek	3/16/2018 11:10 am	17.40	8.53	107.3	1.36	0.67	81.9

2.5.2 Project Monitoring Plan

A full monitoring plan will be developed as a part of the 100% final design documentation. The preliminary identified constituents of concern are metals (copper, lead, and zinc), bacteria, nitrogen compounds, and trash. Flow, pH, and temperature should also be monitored. ***Figure 7*** shows the possible monitoring locations that can establish the system performance. The plan will demonstrate how the estimated benefits outlined in Section 3 and 4 of this report will be evaluated.

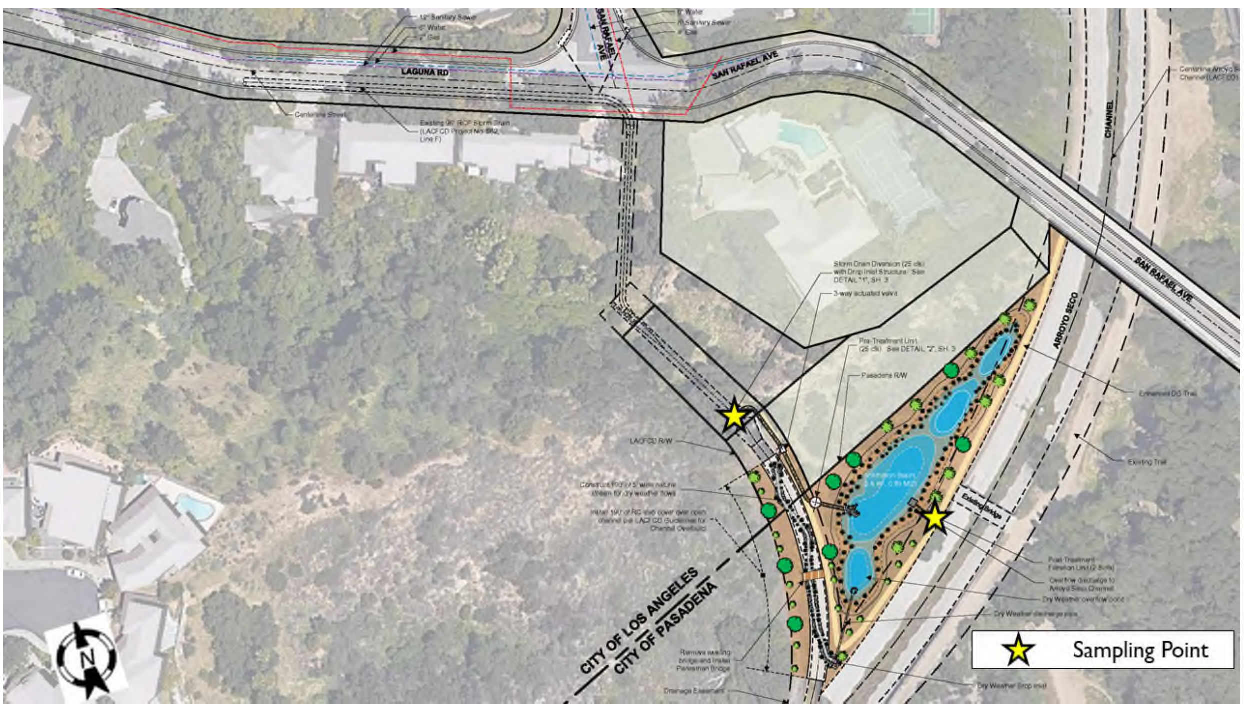


Figure 6. Proposed monitoring locations at San Rafael Site.

Figure 7. Proposed monitoring locations at San Pascual Site.

2.6 OPERATIONS & MAINTENANCE PLAN

Long-term maintenance of the system is vital to its continued operation. The responsible party for the operation and maintenance of the completed project will be the Cities of Pasadena and South Pasadena.

Table 2-8: Operations & Maintenance Requirements and Costs

Description	No. of Times per Year	No. of Personnel & Hours per Visit	Personnel Expertise Level	Unit Price	Annual Total
Rubber Dam System – Inspection & Cleaning	12	2 @ 4 hrs	Trash & Debris Removal crew	$1,000	$12,000
Diversion Structure – Inspection & Cleaning	12	2 @ 6 hr	Trash & Debris Removal crew	$3,000	$36,000
Pretreatment Device – Vacuum	4	2 @ 8 hrs	Vactor Truck Operator	$5,000	$20,000
Post-Treatment Filter Device – Vacuum	4	2 @ 8 hrs	Vactor Truck Operator	$2,500	$20,000
Wet Well – Dry Season Inspection & Cleaning	3	2 @ 4 hrs	Vactor Truck Operator	$2,000	$6,000
Wet Well – Wet Season Inspection & Cleaning	6	2 @ 2 hrs	Vactor Truck Operator	$2,000	$12,000
Valve Maintenance	2	1 @ 8 hrs	Mechanical Labor	$5,000	$10,000
Control Panel Maintenance	1	1 @ 8 hrs	Electrician	$2,000	$2,000
Storage – Dry Season Inspection & Cleaning	4	4 @ 8 hrs	Vactor Truck Operator	$8,000	$32,000
Storage – Wet Season Inspection & Cleaning	4	4 @ 8 hrs	Vactor Truck Operator	$8,000	$32,000
Filter – Inspection & Cleaning	1	4 @ 32 hrs	Cartridge Cleaning	$24,000	$24,000

A full draft maintenance plan will be developed as a part of the 100% final design. The maintenance plan will include details on equipment needed and standard practices and procedures. The final maintenance plan will be completed at the end of construction when actual brands and part information is made available.

3.0 WATER QUALITY BENEFITS

This section provides an overview of project elements related to water quality benefits, including calculations used for Section A (Water Quality Benefits) of the SCW Project Scoring Criteria.

3.1 MS4 COMPLIANCE

The Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175 (Permit) for Los Angeles County allows for permit compliance to be accomplished through development of Enhanced Watershed Management Programs (EWMP). These plans involve an extensive inventory of stormwater management in each watershed, modeling to establish baseline understanding of hydrology and water quality dynamics, and planning around a Reasonable Assurance Analysis (RAA) to demonstrate that planning will result in adequate receiving water protections to meet the requirements of the MS4 permit and all relevant deadlines for compliance. The Upper Los Angeles River (ULAR) EWMP Group was formed by member jurisdictions in the ULAR Watershed Management Area, and the Group is comprised of the cities of Alhambra, Burbank, Calabasas, Glendale, Hidden Hills, La Cañada Flintridge, Los Angeles, Montebello, Monterey Park, Pasadena, Rosemead, San Fernando, San Gabriel, San Marino, South El Monte, South Pasadena, Temple City, the County of Los Angeles (Unincorporated County), and the Los Angeles County Flood Control District (LACFCD). The Group has designed the ULAR EWMP with the intent to facilitate a robust, comprehensive approach to stormwater management for the Los Angeles River watershed to address the priority water quality conditions in the EWMP area. The ULAR EWMP builds upon the planning efforts of the past and provides additional projects to address water quality issues in the Upper LA River. One of the identified opportunities in the ULAR EWMP and the LRS was a project at Lower Arroyo Park. This project has been more fully developed with detailed modeling and engineering design to form the combined project system presented herein as the Arroyo Seco – San Rafael Treatment Wetlands Project.

The combined treatment wetlands of the Arroyo Seco – San Rafael Treatment Wetlands Project are located on the Arroyo Seco at the bottom of a 5,005-acre drainage area consisting of residential, commercial, industrial, and transportation land uses. Stormwater runoff is conveyed through the storm drain network, along San Rafael Creek, and along Arroyo Seco to the project site. The drainage area encompasses various jurisdictions providing benefit to multiple watershed partners.

Previous recommendations for structural BMP volumes and critical year runoff capture were made in the ULAR EWMP at the jurisdictional scale based on modeling and assumptions from the Reasonable Assurance Analysis. Table 3-1 summarizes statistics for the recommended Arroyo Seco – San Rafael Treatment Wetlands Project compared to EWMP compliance recommendations at the jurisdictional scale for greater context of how this project contributes to broader watershed goals. These recommended storage and capture volumes for the City of Pasadena are shown in **Figure 8** and compared to statistics for the full cost-effective size for the Arroyo Seco – San Rafael Treatment Wetlands Project. This plot demonstrates that the storage size for the optimized BMP contributes substantially to the EWMP and LRS recommendations for Pasadena and South Pasadena. Additionally, because this project was optimized and engineered to contribute the most cost-effective water quality benefits possible, the amount of managed volume exceeds the proportion of bulk storage volume alone for these jurisdictions. What this means is that ultimately these jurisdictions may not need the full storage volume recommended by the EWMP due to the outstanding performance of projects like the one detailed herein.

Table 3-1*:* Placing the Arroyo Seco – San Rafael Treatment Wetlands Project in the context of the ULAR EWMP

	Recommended BMP Storage	24-Hr Volume Managed
EWMP Recommendation – Pasadena/South Pasadena	39.8 ac-ft	60.3 ac-ft
Project Contribution – Arroyo Seco/San Rafael Treatment Wetlands	22.9%	46.3%
Remaining Requirement - ULAR EWMP	30.7 ac-ft	32.4 ac-ft

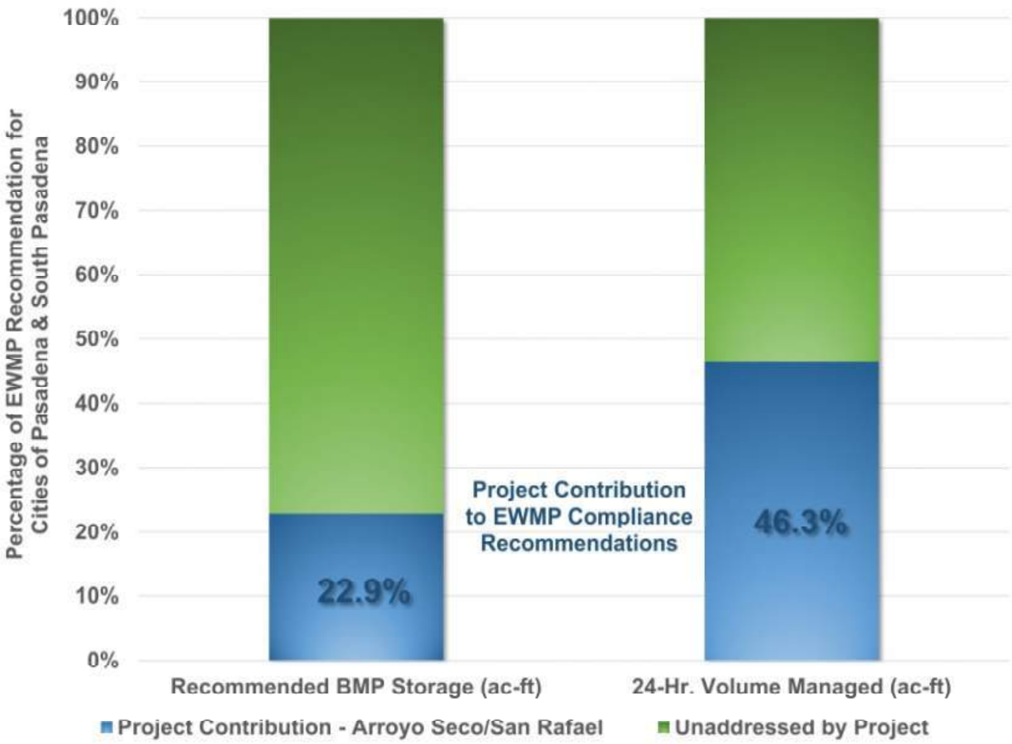


Figure 8 Placing cost-effective sizing of Arroyo Seco/San Rafael Project in the context of the ULAR EWMP.

3.2 24-HOUR CAPACITY

The below table contains information regarding key parameters of the project's capacity. Note that the drawdown rate expressed considers infiltration rates, project infiltrative footprints, as well as filtration rates for the full project system to calculate a single equivalent drawdown rate for the overall project as required for input to the SCW module.

Table 3-2: 24-hour Storm Capacity Breakdown

24-hour Storm Capacity Breakdown	
Effective Draw Down Rate:	5.18 in/hr
Stormwater Use During 24-hr Design Event:	0.0 ac-ft
SCW Module-Generated 24-hr Capacity:	27.94

3.3 EVENT-BASED DESIGN DETAILS

This section details the event-based analysis for the capture system and how it performs:

Estimated Total Inflow Volume during Design Event: ***231.7 ac-ft***

Project design event:

A 1.05 inch 85th percentile LA County hyetograph was modeled to determine flows to the site through the WMMS model. Flows were developed for this rain event to the points of diversion for the project. As currently designed, the gravity-fed diversions would catch as much of the event as possible given the maximum diversion rates and the capacity and throughflow of the regional project. Real-time controls could be added for better peak management given the limited size of the diversions and large drainage area producing an event that is impractical to capture by a single practice. Inflows could be delayed until flows were high enough to target the peak of the storm event to accomplish this.

85th percentile Storm Capture:

A portion of 85th percentile storm is being captured by the unit though the entire event cannot be managed due to storage and throughput limitations. This could be overcome by the addition of real-time controls if desired and/or if other stormwater capture practices are added within the drainage area that would work in conjunction with the one proposed herein to enable its full capture.

Project inlet flows are based on a water budget calculation over 24 hours for the unit taking into account hourly flows to the diversion point on an hourly basis and subject to storage capacity.

Table 3-3: Project Inlets 85th Percentile Flow Rates

Project Inlets		
Diversion Pipe ID	Estimated Max Inflow rate (cfs)	Total Inflow (ac-ft)
Arroyo Seco	50	27.17

Table 3-4: Project Outlets 85th Percentile Outflow Volume

Project Outlets			
Event Outflow Volume	Treated?	Treatment Description	Percent of Volume Treated
17.14	Yes	Proprietary filtration device	100%

Method Used for Estimates:

The WMMS modeled 85th percentile storm was routed through the proposed diversion and subject to proposed storage and outlet filtration capacities.

3.4 LONG TERM PERFORMANCE

This section presents the results of modeling for the proposed facility and configuration as related to the primary and secondary pollutants. These annual average pollutant reduction estimates were developed using WMMS for the ten-year period over waters years 2002-2011 as is consistent with the ULAR EWMP.

Table 3-5: Long Term BMP Performance Summary (10-Year Averages)

Long-Term BMP Performance Summary (10-Year Averages)			
Pollutant	Baseline Load	Load Diverted To BMP	Load Discharged From BMP
Zinc (lbs)	1,289 lbs.	553 lbs.	178 lbs.
Copper (lbs)	345 lbs.	170 lbs.	54 lbs.

Table 3-6: Long Term BMP Performance Reduction Summary (10-Year Averages)

Pollutant	Reduction Method Used	Justification for Use	Reduction (%)
Primary – Zinc	Percent Load Reduction	Limiting pollutant – ULAR EWMP	67.7%
Secondary - Copper	Percent Load Reduction	Category 1A pollutant – ULAR EWMP	68.2%

Custom Value Justification

The system contains different surface elements and different filtration rates. The different filtration rate and BMP types within the treatment chain required custom model representation. Pollutant reduction values were developed using the baseline modeling in LSPC and BMP modeling in SUSTAIN. Further details of the methods, assumptions, and results can be found in the attached modeling details documentation.

4.0 WATER SUPPLY

This section provides an overview of project elements related to water supply benefits, including calculations used for Section B (Significant Water Supply Benefits) of SCW Project Scoring Criteria.

4.1 NEXUS

There is some potential for this project to provide multiple benefits at the nexus of water supply and stormwater. The following describes how this has been considered in development of this project.

Onsite Irrigation Use

This project could utilize captured flows to offset onsite irrigation needs at the nearby Arroyo Park and Arroyo Seco Golf Course. Dry weather flows require additional studies during design development, but dry weather flow on the Arroyo Seco should be non-trivial since the drainage area is large. Modeled dry weather flows are not a reliable substitute for monitoring, which should be first conducted to assess the potential supply at the site. This can then be weighed against irrigation demand to determine if these flows would be a consistent enough source for water that would justify the cost of filtration equipment and accompanying irrigation system components.

Water Recycling

There are sanitary sewer lines in the vicinity of the project, but the distance of these lines from the project site and the difference in elevation would not make this a viable alternative for water supply contribution.

Aquifer Recharge

The project will be infiltrating some of the runoff captured, and it is located right near the boundary for the Raymond Groundwater Basin. Therefore, infiltrated water will contribute to water supply for this regional resource.

4.2 BENEFIT MAGNITUDE

Project Scoring Criteria Section B is based upon estimates of annual average water supply benefit. Water supply benefit can include, but is not limited to, water diverted to a separate groundwater recharge facility, into a water treatment plant, to a sanitary sewer to be converted into recycled water, etc. This section provides documentation of estimates of annual average water supply benefit.

Average dry weather inflow to the project: 0.437 cfs

Methods used to estimate average dry weather inflow to the project:

Flows from the WMMS model were averaged during dry weather. Wet weather was defined as any time period where rainfall was at least 0.1 in/hr and 24-hours after such timesteps.

Annual inflows (total) to the project for potential water supply: 4,246 ac-ft

Methods used to estimate annual inflows for potential water supply:

This is the baseline runoff to the project from WMMS for water years 1992 – 2011.

Annual average capture for water supply: 134 ac-ft

Methods used to calculate water supply benefits:

This is the portion of annual stormwater capture from WMMS that will be infiltrated.

4.3 COST EFFECTIVENESS

Project Scoring Criteria Section B2 incorporates life-cycle costs. The cost-effectiveness for water supply benefit is calculated from other sections in the Module. The calculation for B2 scoring is based on a numerator of life-cycle cost (from Design Elements > Cost) and a denominator of annual average benefit magnitude (from Water Supply > Benefit Magnitude).

***Cost Effectiveness:* $4,498/ac-ft**

5.0 COMMUNITY INVESTMENT

5.1 COMMUNITY INVESTMENT BENEFITS

This section provides an overview of project elements related to community investment benefits, which are used in calculations for the SCW Project Scoring Criteria.

Table 5-1: Community Investment Benefits

Investment Type	Applicable?
Does this project improve flood management, flood conveyance, or flood risk mitigation?	Yes
Does this project create, enhance, or restore park space, habitat, or wetland space?	Yes
Does this project improve public access to waterways?	Yes
Does this project create or enhance new recreational opportunities?	Yes
Does this project create or enhance green spaces at school?	No
Does this project reduce heat local island effect and increase shade?	Yes
Does this project increase shade or the number of trees or other vegetation at the site location?	Yes

Flood Management, Flood Conveyance, and Flood Risk Mitigation

The system has detention capabilities that could contribute towards enhanced flood retention capabilities of the whole storm drain system. To contribute meaningfully to flood protection, stormwater BMPs must utilize a combination of volume capture and peak flow reduction. Analysis indicated that a diversion rate of 50 cfs was ideal for this project, and this diversion rate would not fully capture the 85th percentile storm event peak. The volume detention does contribute to flood management, and because this project site is in the upland areas of the greater watershed, it offers distributed volume control that is needed across the watershed to mitigate flooding from the largest rain events.

Parks, Habitat, or Wetland Creation

The use of two different BMP types allows for a diverse habitat for plants, animals, and insects. The proposed wetland areas will introduce more aquatic plant and animal species to this area of the Arroyo Seco that currently features more species that prefer dry conditions. The infiltration areas placed along side the wetlands will act as a transition between the wet and dry.

Public Access to Waterways

The construction of a new treatment wetland and natural stream will provide the local community with access to these waterways as well as the existing Arroyo Seco channel. The project also creates a watershed education opportunity regarding the contributions of this project towards protecting the water quality in the Arroyo Seco River.

Create or Enhance new Recreational Opportunities

The project proposes a wetland and infiltration basin BMP system that will create passive recreational opportunities for the visitors including aquatic life and butterfly observation. Improved hiking and equestrian trails will enhance access to this area along the Arroyo Seco channel.

Interpretive signage will help educate on the waterways, habitat created, and local fauna and flora.

Reducing Heat Island Effect

The addition of several species of native trees at the San Rafael site will provide shade and cooling effects at a location that is currently mostly barren and empty. The natural stream proposed to cover the existing San Rafael Creek channel will also provide soil cover of a previous impervious surface further reducing heat absorption. Enhanced vegetation and minimal impervious surfaces for this project will contribute to reductions in the heat island effect.

Tree Count/Shade Increase

Native trees that are part of the post-construction landscape plan will contribute to increased tree count and shade for the area. Special consideration will be made for the infiltration basin area to increase the total tree count at the site.

5.2 LOCAL SUPPORT

5.2.1 Prior Outreach Conducted for this Project

Both cities have reached out to several area stakeholders to relay information about this project's intent. After meetings and conversations with these stakeholders, each has provided a letter of support for the project and the funding being requested. One of these stakeholders is the Arroyo Seco Foundation (ASF) a longtime advocate for the Arroyo Seco. The ASF has committed to being a project partner and will lead the outreach efforts for this project if funded.

5.2.2 Outreach Plan for this Project Moving Forward

The Cities of Pasadena and South Pasadena will conduct an active Public Outreach effort. The cities will host and conduct community outreach meetings with the local community concurrent with the implementation of this project.

The following Outreach Plan will be conducted and further details by the ASF:

1. **General Goal:** Create opportunities for local community participation and feedback.

2. **Target Audience:** Area residents, youth, environmental groups, and local businesses.

3. **Initial Design Phase, Site Visit, and Introduction to the Community.** During the initial design phase, a community meeting and site visit will be conducted to discuss the regulatory drivers, share the project objectives, present the major design components, and solicit feedback regarding the proposed improvements. Input will be reviewed and considered into the design process.

4. **Design Plan Development, Community Follow-up.** A subsequent community meeting will be conducted to summarize the progress of the project, list the feedback received from the prior community meeting, and present how the community response was incorporated into the design approach. Additional feedback will also be requested from the community participants.

5. **Design Documents, Community Presentation.** A final design meeting will be conducted to present the final version of the proposed project. Additional comments and feedback will be requested and discussed with the City representatives.

6. **Pre-Construction Community Meeting.** Prior to the start of construction, a Pre-Construction Community Meeting will be conducted to inform the residents of the construction activities including the schedule, haul routes, traffic controls, and other potential community impacts. Construction signage will be on-site with the appropriate City representatives.

5.2.3 Demonstration of Community-Based Support

Please see the attached letters from the following entities as evidence of multi-stakeholder community support:

Table 5-2: Local Support Organization Summary

Supporting Organization	Description
Arroyo Seco Foundation	ASF has a thirty-year record of working to restore and enhance stream and habitat conditions in the Arroyo Seco. They recognize this project as being an important in restoring a key reach of the stream and floodplain in the Arroyo Seco Watershed.
Upper Los Angeles River Watershed Management Group	The Group recognizes the importance of the projects to meet and exceed required capture volumes and pollutant load reductions as well as creating vital aquatic habitat, community enhancement, and public outreach and educational opportunities. The Group recommends the project obtain Measure W Round 2 grant funding.
West Pasadena Residents Association	The Association of over 7,000 households in Southwest Pasadena supports the project plans to restore San Rafael Creek and the Arroyo Seco to a healthy condition.
Sierra Club Pasadena Group	Supports the project for opportunities to lead hikes and educational opportunities. Also, thinks the project will contribute to regional positive efforts underway by several agencies for the ULAR.
San Pascual Stables	As a direct neighbor to the project, the San Pascual Stables in South Pasadena welcomes the opportunity to participate in this project that will connect the community with the natural environment and the historic Arroyo Seco Channel.

6.0 NATURE BASED SOLUTIONS

This section provides an overview of project elements that leverage nature-based solutions, which are used in the SCW Project Scoring Criteria.

Table 6-1: Nature Based Solutions

Nature Based Evaluation	Applicable?	Description
Does this project implement natural processes?	Yes	A naturally vegetated wetland/infiltration BMP will be installed. A naturally lined stream will replace the concrete channel during low flow events.
Does this project utilize natural materials?	Yes	Landscape plans post construction include additional native trees, shrubs, and grasses to be installed throughout the project sites. Also included is native compacted soil and decomposed granite for trail restoration.

6.1 NATURE-BASED LIMITS

The proposed project uses nature-based solutions for several components of the BMP treatment train. Proprietary pretreatment structures were selected in lieu of a sediment forebay due to maintenance and space concerns. However, a natural stream downstream of the pretreatment unit at San Rafael will provide conveyance, energy dissipation, and facilitate infiltration. Two different types of natural BMPs are proposed to help provide stormwater treatment and storage during wet- and dry-weather flows.

6.2 REMOVED IMPERMEABLE AREA

Table 6-2 details the impermeable area removed by the project.

Table 6-2: Removed Impermeable Area by Project

Project Impervious	Units	Value
Prior Impervious Area	Ac	0.04
Post Impervious Area	Ac	0.02

7.0 COST AND SCHEDULE

7.1 PHASE COST

Table 7-1 and Table 7-2 provide details on the Project Cost by Phase and annualized costs. A detailed cost breakdown can be found in **Attachment C**.

Table 7-1. Cost and Schedule by Phase

Phase	Description	Cost	Completion Date
Design	Final Design (30/60/90/100)	$949,964	06/2022
Design	Environmental Planning (CEQA) and Permitting	$126,662	06/2022
Design	Community Outreach during Design	$50,000	06/2022
Design	Agency Management (Design)	$68,327	06/2022
Construction	Construction Cost[1]	$6,333,095	06/2024
Construction	Construction Administration and Design Support	$633,309	06/2024
Construction	Construction Survey	$20,000	06/2024
Construction	Agency Management (Construction)	$90,000	06/2024

Table 7-2. Annualized Costs

Maintenance Cost:	$218,000
Operation Cost:	$25,000
Monitoring Cost:	$15,000
Project Life Span:	50

Table 7-3. Life-Cycle Costs

Life-Cycle Cost for Project:	$14,461,783.38
Annualized Cost for Project:	$602,727.48

[1] The Construction Cost Estimate is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.

This section provides an overview of the project's funding and community support, which are used in calculations for the SCW Project Scoring Criteria.

7.2 COST SHARE

The City of Pasadena acknowledges that eligible expenditures are only those incurred after November 7, 2018 for this project.

The City of Pasadena has evaluated and obtained other sources of funding for this project. The following table describes the cost share summary realized for this project.

Table 7-4. Cost Share Summary

Type of Cost Share	Amount	Status	Description
Grant Awards	$3,500,000	Commitment Received	The City of Pasadena and South Pasadena were awarded funds from Proposition 68 Urban Counties Per Capita Program for the Arroyo Seco Water Reuse and Natural Stream Restoration project. The entirety of this grant is going towards planning, design, and construction of the project described herein. Date Received: 08/2019 Expenditure Deadline: 03/31/2024 Conditions: • 20% match for no DAC • Projects must be at the Arroyo Seco and be for the purposes of water reuse or natural stream restoration • Multiple projects may be completed under one contract; each project requires a separate application packet. • A project can only have one location. One project serving several parks is not permitted.

7.3 FUNDING REQUEST

The following is the schedule of funding (by Year and Phase) summary table.

Table 7-5. Schedule of Funding by Year

Year	SCW Funding Requested	Phase	Description
Year 1 (FY 2021-22)	$126,662	Design	Environmental Planning (CEQA) and Permitting
Year 1	$949,964	Design	Professional Design Services (30/60/90/100)
Year 1	$50,000	Design	Community Outreach during Design
Year 1	$68,327	Design	Agency Project Management (Design Phase)
Total Year 1	**$1,194,953**		
Year 2	$944,365	Construction	Construction Contract, Year 2 Budget
Year 2	$30,000	Construction	Agency Project Management, Year 2
Year 2	$211,103	Construction	Construction Administration, Year 2
Year 2	$20,000	Construction	Construction Survey and Staking, Year 2
Total Year 2	**$1,205,468**		
Year 3	$944,365	Construction	Construction Contract, Year 3 Budget
Year 3	$30,000	Construction	Agency Project Management, Year 3
Year 3	$211,103	Construction	Construction Administration, Year 3
Total Year 3	**$1,185,468**		
Year 4	$944,365	Construction	Construction Contract, Year 4 Budget
Year 4	$30,000	Construction	Agency Project Management, Year 4
Year 4	$211,103	Construction	Construction Administration, Year 4
Total Year 4	**$1,185,468**		
Year 5	$243,000	O & M	O&M Cost for the System, Year 5
Year 5	$15,000	Monitoring	Monitoring Cost, Year 5
Total Year 5	**$258,000**		
Total	**$5,029,357**		

8.0 ADDITIONAL FEASIBILITY INFORMATION

This section presents additional information regarding project feasibility and technical details gathered during project design and feasibility assessment.

8.1 ENVIRONMENTAL DOCUMENTS AND PERMITS

8.1.1 Environmental Documentation

Evaluation of the environmental impacts of the project is required before construction. The following table summarizes the status of the environmental documentation for this project.

Table 8-1. Environmental Documentation Summary

CEQA Lead Agency:	Cities of Pasadena and South Pasadena
Environmental Documentation (Anticipated):	Mitigated Negative Declaration
Current Status:	The preparation of the Initial Study and the anticipated Mitigated Negative Declaration are proposed as a part of the development of the 30% design. The CEQA documentation will be completed with the full design anticipated to be June 2022.
NEPA Required?:	No

Past project experience has shown that the Initial Study most often identifies a Mitigated Negative Declaration for projects that are constructed in similar locations. The most significant impacts are temporary during the construction period and once construction is complete, will be gone entirely. Upon project completion, the project will ultimately provide a net benefit to the water quality and natural environment.

For cost estimating purposes only, a MND is indicated. Once an Initial Study is completed the appropriate environmental review will be determined.

The CEQA Initial Study and associated Mitigated Negative Declaration are anticipated to take up to one year and will occur simultaneously with the design phase.

8.1.2 Permitting

8.1.2.1 LA County Flood Control District Permits

Consultation with the LACFCD is required before the project components can be constructed. Table 8-2 summarizes the required LACFCD permits anticipated for this project.

The project will impact the San Rafael Creek Channel and the Arroyo Seco Channel through the installation of a drop inlet with a grate cover within the channel bottom. The design will ensure conveyance of the existing design capacity of the infrastructure thus maintaining the flood control capabilities of the system. An example of the proposed drop structure detail can be found in Attachment B. After construction, the facilities are assumed to require access by the City maintenance crews to remove any debris that is impeding the performance.

Table 8-2: Listing of Anticipated Required LACFCD Permits

Agency	Permit/Notification Name	Rationale	Initial Steps & Anticipated Challenges
LA County Flood Control District	Major Modification Permit	A water diversion structure is considered a drainage facility modification.	Complete and submit application for review via EpicLA. Challenges anticipated are the design review periods and the processing of the Use and Maintenance Agreement.
LA County Flood Control District	Discharge Permit	Non-storm water (treated water) will be discharged directly into an existing District facility.	Complete and submit application for review via EpicLA. Challenges anticipated are the design review periods and the processing of the Use and Maintenance Agreement.

The anticipated LACFCD permit schedule is as follows:

Table 8-3: LACFCD Permit Schedule

Task	Task Complete	Duration
Submit Permit Application w/ 60% Plans	NTP + 24 weeks	6 months after Design NTP
60% Plan Review	NTP + 30 weeks	6 weeks after Application Submittal
90% Plan Review	NTP + 42 weeks	6 weeks after Plan Submittal
100% Plan Approval	NTP + 48 weeks	2 weeks after Plan Submittal
Permit Issued	NTP + 48 weeks	End of 100% Plan Approval

8.1.2.2 Additional Agency Permits

Consultation with additional regulatory agencies and acquisition of permits is required before the project components can be constructed. The following table summarizes the plan checks, regulatory permits and approvals relevant to the project.

Table 8-4: Listing of Anticipated Required Additional Agency Permits

Agency	Permit/Notification Name	Rationale	Initial Steps
City of Pasadena Department of Public Works	--	City of Pasadena Department of Public Works is the property manager.	Contact Department of Public Works department
City of South Pasadena Public Works Department	--	City of South Pasadena Public Works is the property manager.	Contact Public Works department

Agency	Permit/Notification Name	Rationale	Initial Steps
United States Army Corp of Engineers	Section 404 Permit	Potential discharge of dredged or fill material into waters of the United States	File a permit with the Army Corps of Engineers
California Department of Fish & Wildlife	Streambed Alteration Notification 1601	Diversion of flow and alteration of the bed of any river	Submit Lake and Streambed Alteration (LSA) Notification CA DFW
State Water Resources Control Board	Construction General Permit	One or more acres of soil will be disturbed during construction.	Develop a Storm Water Pollution Prevention Plan (SWPPP).
LA County Department of Public Health	Cross Connection and Water Pollution Control Program	Ensure that there is no hazard to the potable water system.	Undergo review and approval.
Greater LA County Vector Control District	Mosquito Abatement District	Potential mosquito concerns.	Provide Vector Control District conceptual project plans for review.
South Coast Air Quality Management District	Rule 403	Prevent, reduce, or mitigate fugitive dust emissions from construction activities.	Construction in the South Coast Air Basin must incorporate best available control measures included in Table 1 of Rule 403

The acquisition and securing of all the required permits and environmental documentation are anticipated to be around 2.0% of the total project costs for a grand total of $126,662. All permits are anticipated to be filed and acquired by the end of the 100% final design phase.

8.2 VECTOR MINIMIZATION

As a part of final design, the City will review the design documents with the Greater LA County Vector Control District to ensure that the system meets all requirements and minimizes the potential for vector increases. Vector Minimization Strategy and Protocols are summarized below.

Coordination

- Guidelines outlined in the California Department of Public Health's Checklist for Minimizing Vector Production in Stormwater Management Structures
- Coordination with the Greater LA County Vector Control District will be conducted to discuss potential for mosquitos in the system. This will be initiated at the start of the design process.

Design Reviews

The City will review the design documents (30/60/90/100) with the Greater LA Vector Control District to ensure that the system meets their requirements to minimize the potential for vectors.

Project Description and potential mitigation measures

The proposed project consists of storm diversion, pretreatment unit, above ground treatment and storage basins. A filtration unit and discharge pipeline return flows back to the channel.

Vector Minimization Measures

The following are the potential mitigation measures to reduce vectors:

- Incorporating best vector control practices in design documents. For example, maintenance manhole covers be watertight and have sealed pick holes to control odors and vectors. Additionally, a healthy wetland provides habitat for many unique animals including natural enemies of mosquitoes. These natural predators keep the mosquito population low. Certain birds, frogs, fish, and insects can live in the wetland and feed on mosquito larvae and/or adults.
- The infiltration system will be designed to infiltrate/drain the system within 3 days following a storm event to prevent long-term standing water.
- Routine inspection for required vector control, which would be conducted as part of the routine operation and maintenance protocols.

8.3 ALTERNATIVES STUDIED

Alternatives evaluated included combinations of diversion rates, alternative footprints and orientations, and various outflow rates. The full discussion on alternatives studied can be found in **Attachment E**.

8.4 SIMILAR PROJECT EFFECTIVENESS

Projects similar to the Arroyo Seco-San Rafael Treatment Wetlands project are being designed and constructed throughout Los Angeles County. A couple (including the Dominguez Gap Wetlands, South LA Wetlands, Machado Lake Wetlands, and Echo Park Wetlands) have been completed and are in the monitoring phase. Nationally and internationally, thousands of constructed stormwater wetlands have been successfully implemented; the International BMP Database reports with statistical significance that wetland basins and channels are expected to reduce concentrations of heavy metals, bacteria, nutrients, and total suspended solids. In the future, it is anticipated that local project effectiveness will be obtained through monitoring efforts but at this time, there is no comparable completed and monitored project that includes a combination of wetlands and recharge basins.

8.5 LEGAL REQUIREMENTS AND OBLIGATIONS

There are two primary legal issues that require addressing through the course of the project; access and regulatory compliance.

The main project sites are owned and maintained by the City of Pasadena and the City of South Pasadena. However, construction requires accessing the LACFCD channel as a key component of this project. The LACFCD requires that the hydraulics of the existing infrastructure not be negatively impacted, and that access is maintained. The Cities will be required to enter into an operation and maintenance agreement with the LACFCD for continued access for the constructed diversion structures. All required permits and agreements will be in place through the construction of the project.

As stated in the project background, one of the key drivers for this project is the compliance with the water quality targets identified in the ULAR EWMP and the Load Reduction Strategy (LRS). Design and construction of the project brings the ULAR EWMP Group closer to watershed-wide compliance through water quality improvement. The City is required to demonstrate project performance to the Water Resource Control Board for acceptance towards the water quality objectives. The project will be monitored and reported on as required.

8.6 TECHNICAL REPORTS

The stormwater capture strategy including the basis, assumptions, and procedure of identifying the diversion location, rates, storage size, and outflow rates are contained within the attached Stormwater Capture Strategy Memorandum. The memo serves as the supporting modeling analysis for the basis of preliminary design. The memos are found in **Attachment E and F**.

8.7 OTHER

All required project information previously provided.

9.0 SCORING

Section	Score Range	Scoring Standards	Scoring
A.1 Wet Weather Water Quality Benefits -OR-	**50 points max**	**The project provides water quality benefits**	**40 points**
	20 points max	A.1.1: For Wet Weather BMPs Only: Water Quality Cost Effectiveness Cost Effectiveness) = (24-hour BMP Capacity) / (Construction Cost in $Millions) - <0.4 (AF / $-Million) = 0 points - 0.4 - 0.6 (AF / $-Million) = 7 points - 0.6 - 0.8 (AF/ $-Million) = 11 points - 0.8 - 1.0 (AF / $-Million) = 14 points - >1.0 (AF/ $-Million) = 20 points	20
	30 points max	A.1.2: For Wet Weather BMPs Only: Water Quality Benefit Magnitude. Quantify the pollutant reduction (i.e. concentration, load, exceedance day, etc.) for a class of pollutants using the similar analysis as the E/WMP which use the Districts/Watershed Management Modeling System (WMMS). The analysis should be an average percent reduction comparing influent and effluent for the class of pollutant over a ten-year period showing the impact of the Project. Modeling should include the latest performance data to reflect the efficiency of the multi-pollutant BMP Type. **Primary Class of Pollutants** - >50% = 15 points - > 80% = 20 points *(20 points max)* **Second or More Classes of Pollutants** - >50% =5 points - > 80% = 10 points *(10 points max)*	20
A.2 Dry Weather Water Quality Benefits	20 points	A.2.1: For dry weather BMPs only, projects must be designed to capture, infiltrate, or divert 100% of all tributary dry weather flows.	
	20 points max	A.2.2: For Dry Weather BMPs only. Tributary size of the dry weather BMP - < 200 Acres = 10 points - > 200 Acres = 20 points	
B. Significant Water Supply Benefits	**25 points max**	**The project provides water supply benefits**	**5 points**
	13 points max	B1. Water Supply Cost Effectiveness. The total life-cycle cost per unit of acre foot of stormwater and/or urban runoff volume captured for water supply is: - > $2,500 / ac-ft = 0 points - $2,000 - $2,500 / ac-ft = 3 points - $1,500 - $2,000 / ac-ft = 6 points - $1,000 - $1,500 / ac-ft = 10 points - < $1,000 / ac-ft = 13 points	0
	12 points max	B2. Water Supply Benefit Magnitude. The yearly additional water supply volume resulting from the project is: - < 25 ac-ft / year = 0 points - 25 - 100 ac-ft / year = 2 points - 100 - 200 ac-ft / year = 5 points - 200 - 300 ac-ft / year = 9 points - > 300 ac-ft / year = 12 points	5

C. Community Investment Benefits	**10 points max**	**The project provides Community Investment Benefits**	**10 points**
	10 points	C1. Project includes: - One of the Community Investment Benefits defined below = 2 points - Three distinct Community Investment Benefits = 5 points - Six distinct Community Investment Benefit = 10 points Community Investment Benefits include: - Improved flood management, flood conveyance, or flood risk mitigation - Creation, enhancement, or restoration of parks, habitat, or wetlands - Improved public access to waterways - Enhanced or new recreational opportunities - Greening of schools - Reducing local heat island effect and increasing shade - Increasing the number of trees increase and/or other vegetation at the site location that will increase carbon reduction/sequestration and improve air quality	10
D. Nature-Based Solutions	**15 points max**	**The project implements Nature-Based Solutions**	**10 points**
	15 points	D.1. Project: - Implements natural processes or mimics natural processes to slow, detain, capture, and absorb/infiltrate water in a manner that protects, enhances and/or restores habitat, green space, and/or usable open space = 5 points - Utilizes natural materials such as soils and vegetation with a preference for native vegetation = 5 points - Removes Impermeable Area from Project (1 point per 20% paved area removed) = 5 points	10
E. Leveraging Funds and Community Support	**10 points max**	**The project achieves one or more of the following:**	**7 points**
	6 points max	E1. Cost-Share. Additional Funding has been awarded for the project. - > 25% Funding Matched = 3 points - > 50% Funding Matched = 6 points	3
	4 points	E2. The project demonstrates strong local, community-based support and/or has been developed as part of a partnership with local NGOs/CBOs.	4
Total	Total Points All Sections: 110		**72**

10.0 ATTACHMENTS

ATTACHMENT A: LOCATION MAP, LAND USE MAP, DAC MAP, AND PROJECT FACT SHEETS

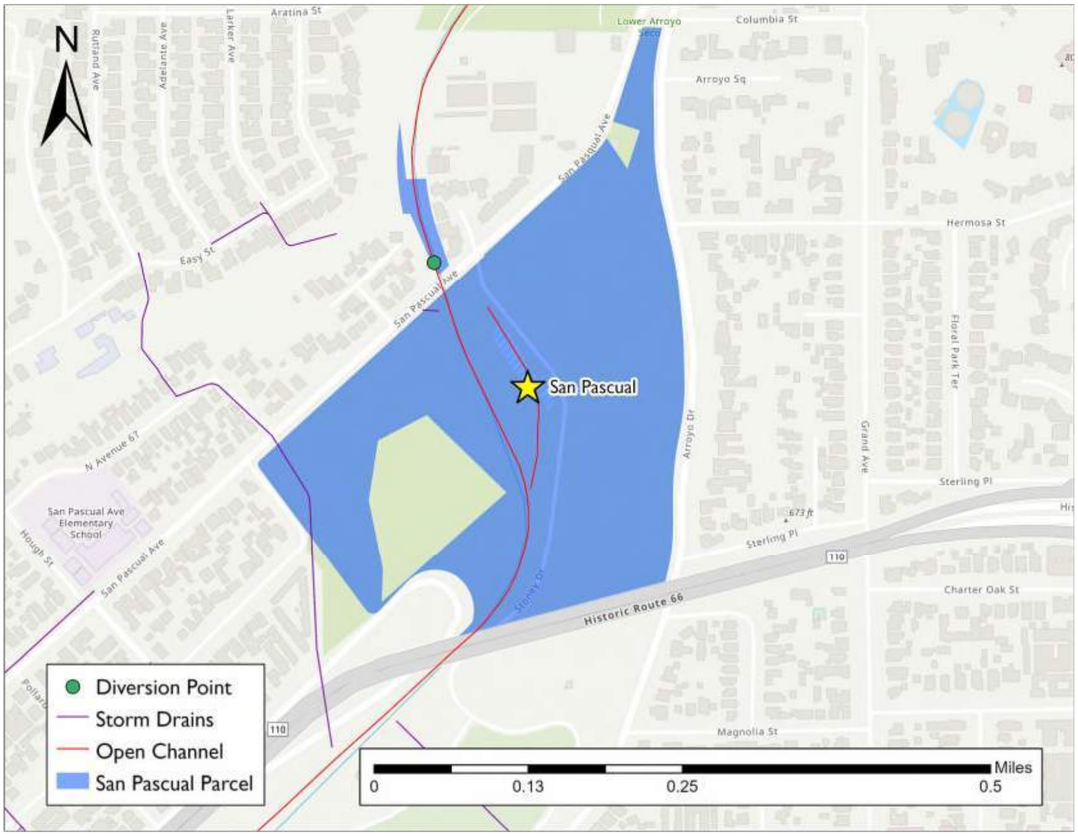


Figure 9. Map of parcel boundary for San Rafael projects.

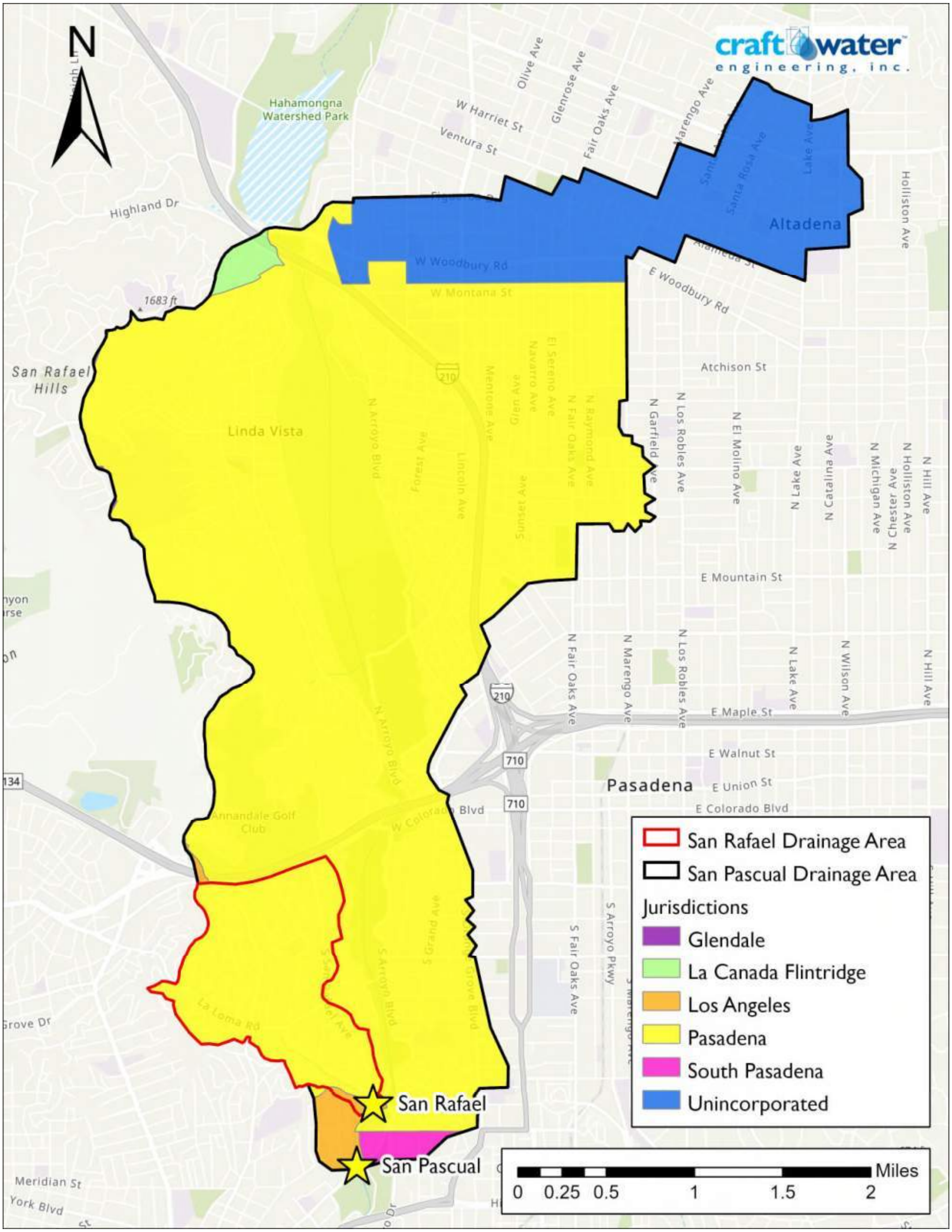


Figure 10. Drainage area jurisdiction boundaries for San Rafael projects

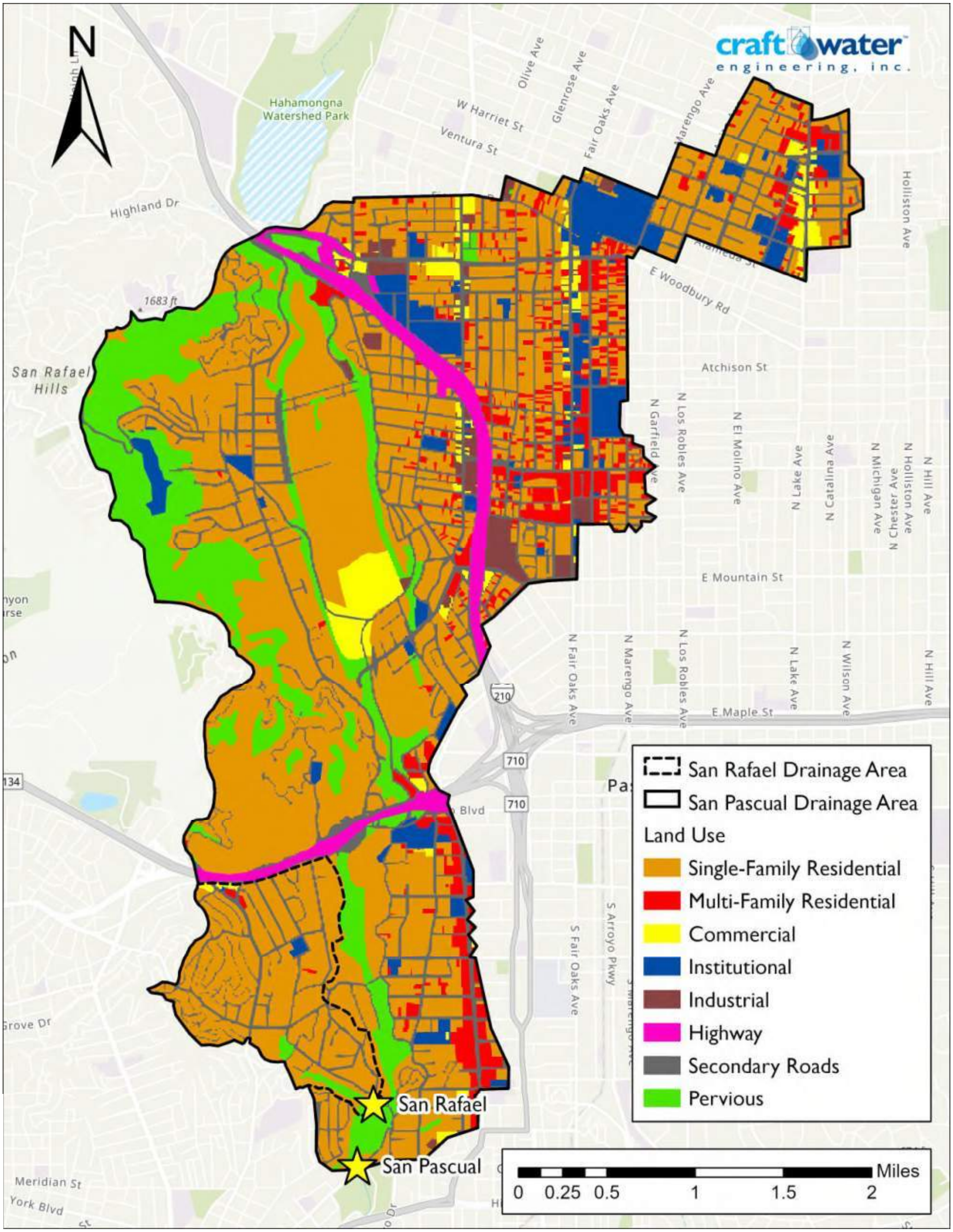


Figure 11. Drainage area land use for the San Rafael projects.

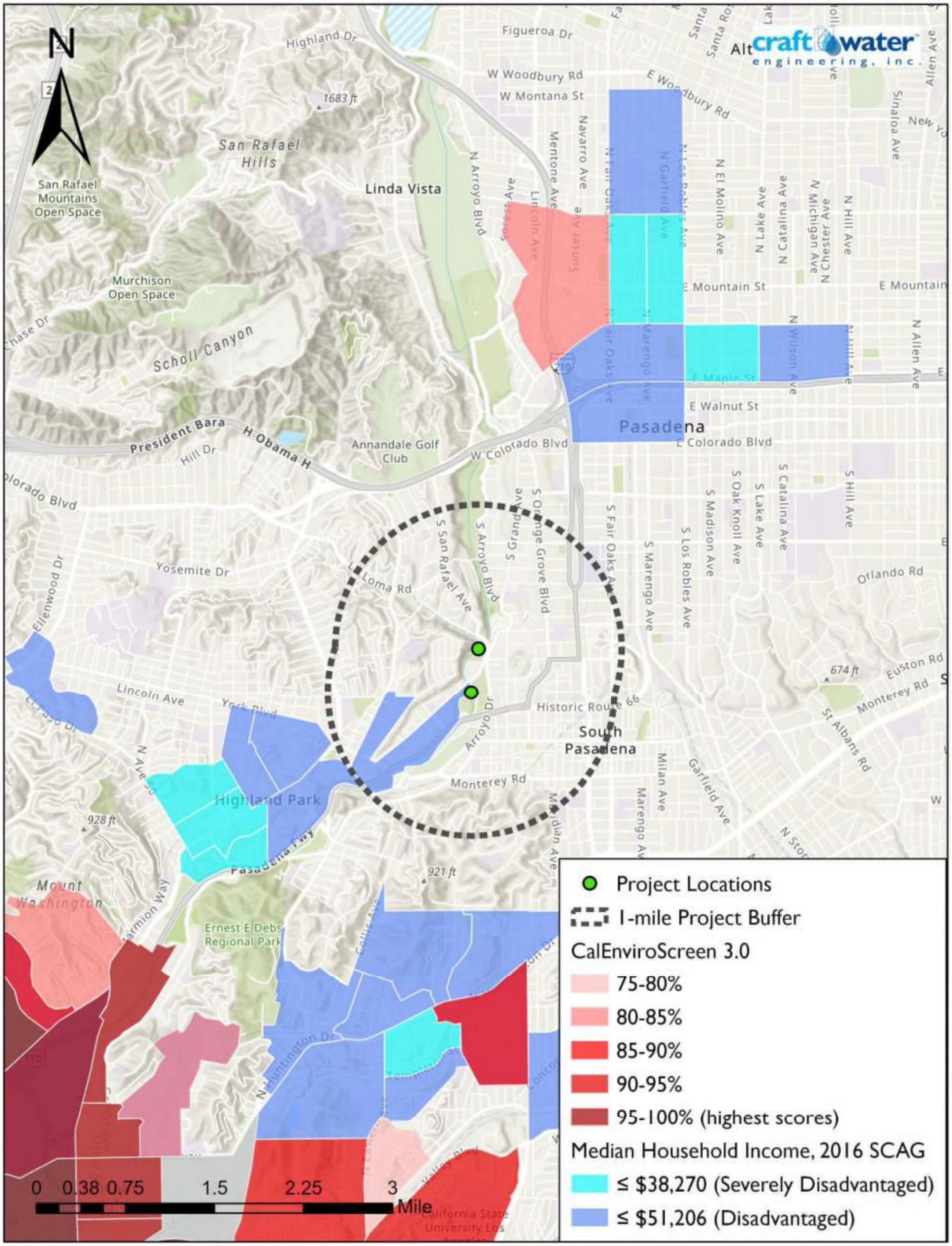


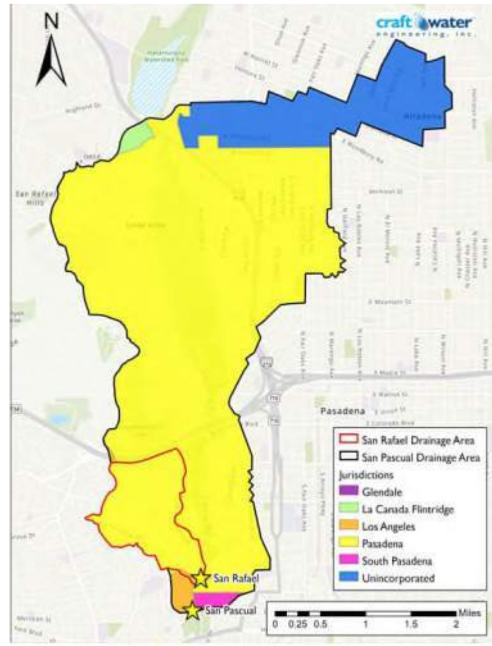
Figure 12. Disadvantaged Communities within the San Rafael Projects Drainage Area

ULAR WATERSHED MANAGEMENT GROUP, CITY OF PASADENA/CITY OF SOUTH PASADENA

SAN RAFAEL/SAN PASCUAL TREATMENT WETLANDS STORMWATER CAPTURE PROJECT

EXISTING SITE CONDITIONS

DRAINAGE AREA



DRAINAGE CHARACTERISTICS

REGIONAL WATER MANAGEMENT PLAN	Upper LA River Watershed
TOTAL DRAINAGE AREA	**5,005 acres** Pasadena (82.4%) Unincorporated LA County (15.2%) City of Los Angeles (1.1%) La Canada Flintridge (0.7%) South Pasadena (0.6%) Glendale (0.1%)
INFILTRATION RATE	0.89 in/hr (San Rafael) 0.3 in/hr (San Pascual)
APPROX. DEPTH TO GROUNDWATER	91 ft BGS
MODELED AVERAGE ANNUAL RUNOFF VOLUME	4,583 ac-ft per year

San Rafael Creek

Arroyo Seco Channel

BMP CHARACTERISTICS

LOCATIONS	San Rafael Creek near San Rafael Avenue Arroyo Seco Channel near San Pascual Avenue	34°07'31.5"N/ 118°09'58.7"W 34°07'14.2"N/ 118°10'02.0"W

Proposed BMP Description: The project includes two sites: San Rafael located in Pasadena and San Pascual in South Pasadena. The San Pascual site was included in the Adaptive Management Section of the Upper Los Angeles River Enhanced Watershed Management Program (EWMP) Group's Annual Report. The project seeks to improve water quality discharged to San Rafael Creek and the Arroyo Seco Channel through capture, infiltration, and restoration of natural streambed processes. The project also proposes to provide water supply benefit by infiltrating to the local groundwater basin. The project includes a stormwater drop-inlet diversion from the LACFCD San Rafael Creek and enhancement of an existing drop inlet structure in the LACFCD Arroyo Seco Channel and a series of 2.6 acre-foot and 6.5 acre-feet infiltration basins and treatment wetlands. During dry-weather events, the water will pass through a natural stream at San Rafael for eventual discharge into the infiltration basin while the San Pascual site will retain the water within the treatment wetland for irrigation at the Arroyo Park and Arroyo Seco Golf Course. During wet-weather events, the water captured will be filtered through a pretreatment unit, flow into the infiltration basin/treatment wetland, and pass through a filtration device. This project has the potential to offer runoff storage and water quality benefits for these jurisdictions that can address the additional needs for stormwater management identified to achieve compliance in the EWMP.

Project Benefits:

- **Water Quality** Improvement in the San Rafael Creek and the Arroyo Seco Channel by removing trash, metals, and nutrients in stormwater and urban runoff
- **Nature-Based** infiltration recharge basins with sustainable native landscaping and storage
- **Park recreational enhancements** with a wetland/habitat area and continuous irrigation water supply
- **Public Access to Waterways** with improved public access to natural treatment wetlands and pedestrian pathways

ULAR WATERSHED MANAGEMENT GROUP, CITY OF PASADENA/CITY OF SOUTH PASADENA

SAN RAFAEL/SAN PASCUAL TREATMENT WETLANDS STORMWATER CAPTURE PROJECT

SAN RAFAEL PROPOSED CONCEPTUAL SITE LAYOUT

Natural Infiltration Basin

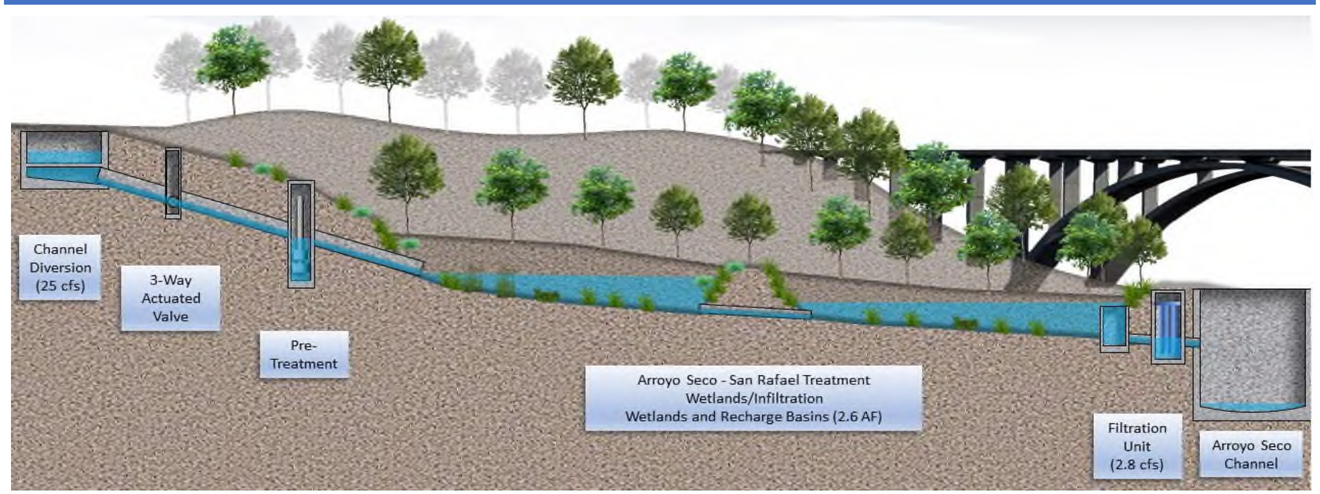
Public Access

Natural Stream

PRELIMINARY SCW SCORING

SECTION	Score
A.1 Wet Weather Water Quality Benefits • A.1.1 Water Quality Cost Effectiveness > 1.0 AF/$Million • A.1.2 Pollutant Reduction >80%	40
B. Significant Water Supply Benefits • B1. Water Supply Cost Effectiveness • B2. Water Supply Benefit Magnitude	5
C. Community Investment Benefits • Improved flood management • Creation/enhancement/restoration of parks • Improved public access to waterways • Enhanced/new recreational opportunities • Reducing local heat island effect • Increasing number of trees and/or vegetation	10
D. Nature-Based Solutions	10
E. Leveraging Funds and Community Support • Strong local, community-based support	10
TOTAL SCORE	**75**

CROSS SECTION



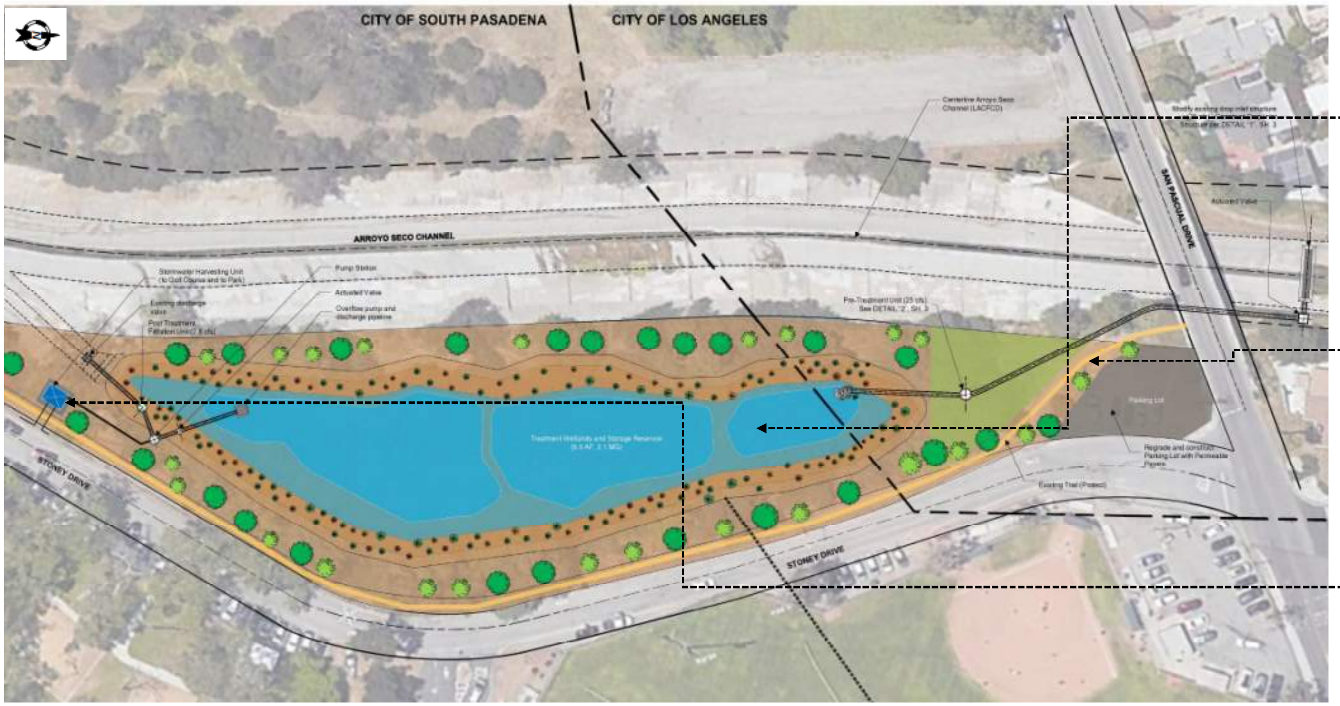
PROJECT CHARACTERISTICS

Primary Pollutant Zinc Reduction Achieved (% Zn reduction) for both projects	873 lb/yr (67.7%)
Secondary Pollutant Copper (% Cu reduction) for both projects	235 lbs/yr (68.2%)
Design Diversion Rate San Rafael Creek	25 cfs
Storage Capacity for Infiltration Basin with 2.88 filtration unit	2.6 ac-ft (0.88 MG)
24-Hour Capacity for both San Rafael and San Pascual Sites	27.9 ac-ft
Construction Cost Estimate for both San Rafael and San Pascual Sites	$6,333,095

ULAR WATERSHED MANAGEMENT GROUP, CITY OF PASADENA/CITY OF SOUTH PASADENA

SAN RAFAEL/SAN PASCUAL TREATMENT WETLANDS STORMWATER CAPTURE PROJECT

SAN PASCUAL PROPOSED CONCEPTUAL SITE LAYOUT

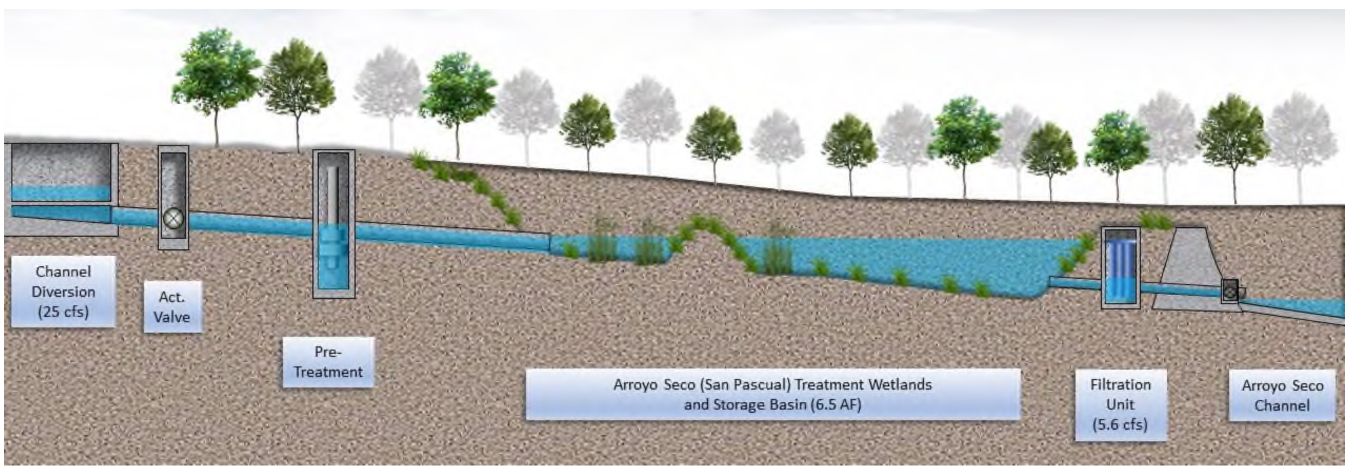


Natural Treatment Wetland

Public Access

Stormwater Harvesting Unit

CROSS SECTION



PROJECT CHARACTERISTICS

Primary Pollutant Zinc Reduction Achieved (% Zn reduction) for both projects	873 lb/yr (67.7%)
Secondary Pollutant Copper (% Cu reduction) for both projects	235 lbs/yr (68.2%)
Design Diversion Rate Arroyo Seco Channel	25 cfs
Storage Capacity for Natural Treatment Wetlands with 5.76 cfs filtration unit	6.5 ac-ft (2.1 MG)
24-Hour Capacity for both San Rafael and San Pascual Sites	27.9 ac-ft
Construction Cost Estimate for both San Rafael and San Pascual Sites	$6,333,095

ATTACHMENT B: 10% DESIGN DRAWINGS

Note: The site configuration may be modified during final design.

PLAN
Scale: 1" = 40'-0"

0 ft. 24 ft. 40 ft. 80 ft.

DATE	MK	DESCRIPTION
		REVISIONS

craft water engineering, inc.

PROJ. NO. 20012-ULARSRFS
DESIGNER O. GALANG
DRAFTER O. GALANG
CHECKER C. HELMLE

PRELIMINARY CONCEPTUAL DESIGN

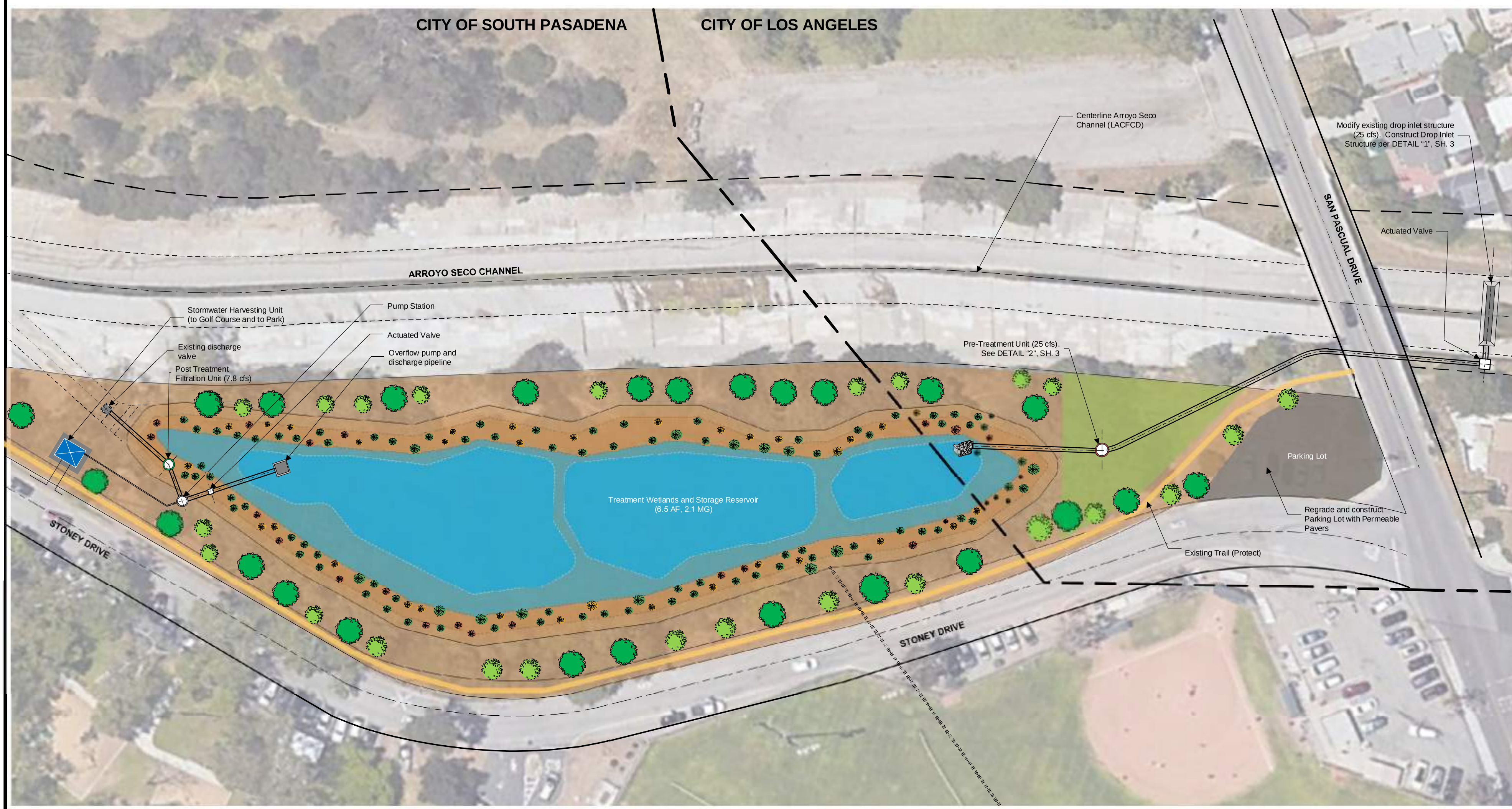
CITY OF PASADENA PUBLIC WORKS DEPARTMENT

ARROYO SECO - SAN RAFAEL TREATMENT WETLANDS PROJECT

REGIONAL STORMWATER CAPTURE PROJECT

SAN RAFAEL GENERAL SITE PLAN
NATURAL STREAM RESTORATION AND WETLAND BASINS

SHEET 1 OF 3



PLAN

Scale: 1" = 40'-0"

0 ft. 24 ft. 40 ft. 80 ft.

DATE	MK	DESCRIPTION

REVISIONS

craftwater engineering, inc.

PROJ. NO. 20012-ULARSRFS

DESIGNER O. GALANG

DRAFTER O. GALANG

CHECKER C. HELMLE

PRELIMINARY CONCEPTUAL DESIGN

CITY OF SOUTH PASADENA PUBLIC WORKS DEPARTMENT

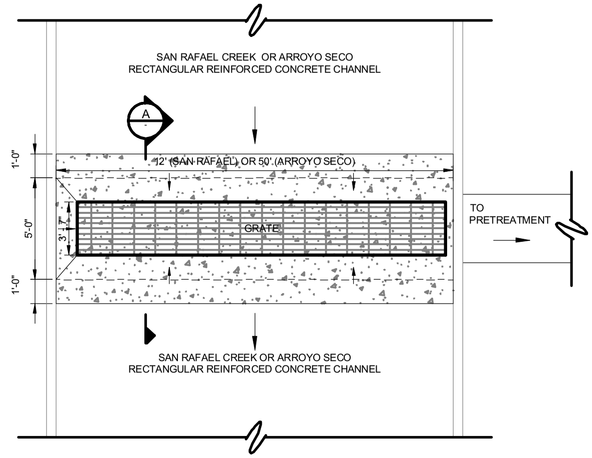
ARROYO SECO – SAN RAFAEL TREATMENT WETLANDS PROJECT

REGIONAL STORMWATER CAPTURE PROJECT

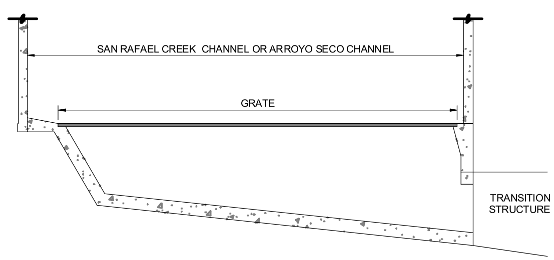
ARROYO SECO (SAN PASCUAL) SITE PLAN

GENERAL SITE PLAN

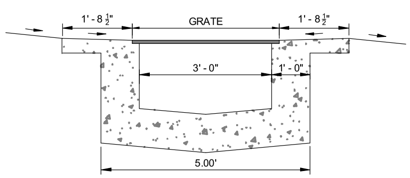
SHEET 2 OF 3



PLAN VIEW
N.T.S.

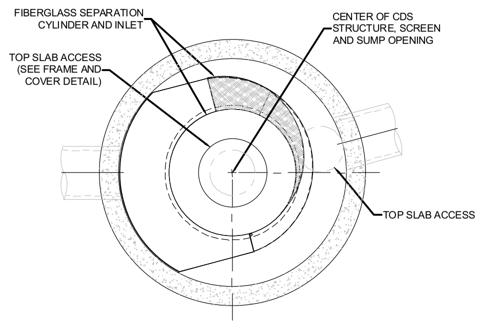


PROFILE VIEW
N.T.S.

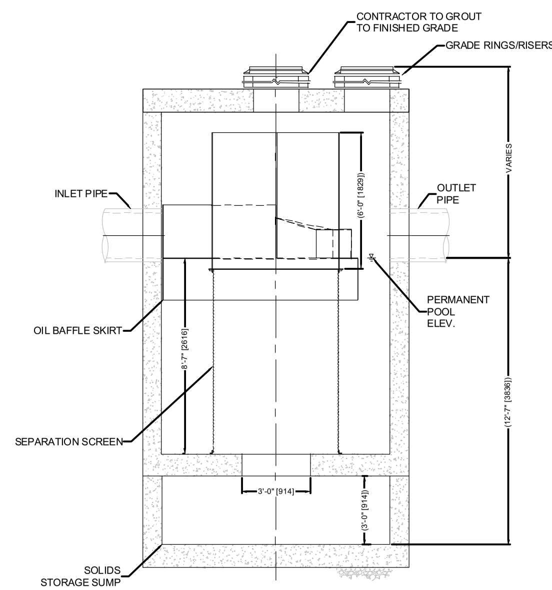


SECTION 'A-A'
N.T.S.

1 DIVERSION STRUCTURE
NTS



PLAN VIEW B-B
N.T.S.



2 PRETREATMENT CDS UNIT
NTS

PRELIMINARY 10% DESIGN

NO.	REVISIONS	REVISED BY	APPROVED BY	DATE

DESIGNER:
C. SEMLOW
DRAFTER:
C. SEMLOW
CHECKER:
O. GALANG

CITIES OF PASADENA AND SOUTH PASADENA, CALIFORNIA

ARROYO SECO-SAN RAFAEL TREATMENT WETLANDS PROJECT
REGIONAL STORMWATER CAPTURE PROJECT

DETAILS

DWG.XXXXXXXXXX

SHEET 3 OF XX

ATTACHMENT C: ENGINEER’S 10% COST ESTIMATE

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client: **City of Pasadena/City of South Pasadena**
Project: **Arroyo Seco-San Rafael Treatment Wetlands**
Status: **10% Cost Estimate**

Prepared by: **MMT**
Checked by: **OG**
Date **10/14/2020**

Description	Qty	Unit	Unit Price	Total
Miscellaneous				**$316,655**
Mobilization / Demobilization (5% of Costs)	1	LS	$316,655.00	$316,655
Channel Diversion and Pretreatment				**$777,976**
Temporary Diversion	2	EA	$20,000.00	$40,000
Drop Inlet w/ Grate	2	EA	$50,000.00	$100,000
Rubber Dam	1	EA	$195,000.00	$195,000
Actuated Valve and Structure	3	EA	$25,000.00	$75,000
Pretreatment Device (25 CFS) (Includes excavation & shoring)	2	EA	$85,000.00	$170,000
Manhole (4' I.D. x 5' Depth) (Includes excavation & shoring)	1	EA	$7,500.00	$7,500
Manhole (4' I.D. x 8' Depth) (Includes excavation & shoring)	1	EA	$10,000.00	$10,000
Piping (30" RCP) to wet well (Includes excavation & shoring)	435	LF	$360.00	$156,600
Backfill and Compaction for Piping Base (crushed aggregate)	226	CY	$46.00	$10,376
Flap Gate	1	EA	$4,000.00	$4,000
Bioswale	950	SF	$10.00	$9,500
Site Preparation and Demolition - Existing Area				**$211,250**
Clear and Grub	92,500	SF	$0.50	$46,250
Tree Removal	110	EA	$1,500.00	$165,000
Treatment Wetland & Recharge Ponds (9.1 AF)				**$536,250**
Grading	7,695	CY	$15.00	$115,425
Backfill and Compaction	45	CY	$25.00	$1,125
Hauling	7,650	CY	$28.00	$214,200
Piping (12" RCP) dry weather connection (Includes excavation & shoring)	50	LF	$200.00	$10,000
Wetland Plastic Liner (30 mil)	8,350	SY	$20.00	$167,000
Outfall Overflow Structure	2	EA	$5,500.00	$11,000
Piping (18" RCP) to Outfall (Includes excavation & shoring)	70	LF	$250.00	$17,500
Wet Well and Conveyance				**$1,168,500**
Wet Well Installation (Includes excavation & shoring)	1	LS	$50,000.00	$50,000
Submersible Pumps and Valves (5.76 cfs)	1	LS	$200,000.00	$200,000
12" DIP to Irrigation Filter (Includes excavation & shoring)	30	LF	$200.00	$6,000
18" RCP to Outfall Filter (Includes excavation & shoring)	50	LF	$250.00	$12,500
Treatment Filter Unit (2.76 cfs)	3	EA	$300,000.00	$900,000
Stormwater Havesting Unit	1	EA	$500,000.00	$500,000

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client: **City of Pasadena/City of South Pasadena**
Project: **Arroyo Seco-San Rafael Treatment Wetlands**
Status: **10% Cost Estimate**

Prepared by: **MMT**
Checked by: **OG**
Date **10/14/2020**

Description	Qty	Unit	Unit Price	Total
Electrical Service, Controls, Instrumentation				**$322,000**
Electrical Service	1	LS	$60,000.00	$60,000
Control Panel and PLC Programming	1	LS	$80,000.00	$80,000
Conduit & Wiring	1	LS	$100,000.00	$100,000
NEMA 4 Junction Box, 6"x6"x6" (1 each for 480V and 120V conduits)	6	EA	$2,000.00	$12,000
Misc. Conduit Fittings, Elbows, Core Drilling and Sealing, etc.	1	LS	$25,000.00	$25,000
Instrumentation	1	LS	$45,000.00	$45,000
Landscape and Irrigation Modifications				**$438,750**
Tree Replacement	75	EA	$2,500.00	$187,500
Shrubs, Perennials, and Grasses	92,500	SF	$2.50	$231,250
90-Day Plant Establishment Period	1	LS	$20,000.00	$20,000
Site Amenities and Improvements				**$825,300**
Decomposed Granite Path	4,800	SF	$10.00	$48,000
Lodgepole Fencing	1,050	LF	$26.00	$27,300
Channel Slab (18'W x 190'L)	1	EA	$750,000.00	$750,000
Start-up, Testing, Prepare Operations & Maintenance Manuals, and Prepare Record Drawings				**$94,500**
SWPPP Implementation	1	LS	$40,000.00	$40,000
Start-up and Testing	1	LS	$46,500.00	$46,500
O&M Manuals	1	LS	$4,000.00	$4,000
Record Drawings	1	LS	$4,000.00	$4,000
SUBTOTAL				**$4,691,181**
			35% Contingency	$1,641,914
			Total Construction Costs	**$6,333,095**
	GRAND TOTAL			**$6,333,095**

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client: **City of Pasadena/City of South Pasadena**
Project: **Arroyo Seco-San Rafael Treatment Wetlands**
Status: **10% Cost Estimate**

Prepared by: **MMT**
Checked by: **OG**
Date **10/14/2020**

Description	Qty	Unit	Unit Price	Total

Assumptions and Exclusions

1 This is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.
2 The unit cost data is derived from inhouse sources, recent bids on similar construction, and RSMeans current construction cost data.
3 This opinion of cost is based on the project program and plans made available at the time of preparation.
4 Material prices are based on current quotations and do not include escalation.
5 This opinion of cost assumes that all improvements will be constructed at one time.
6 Quantity take offs were performed when possible and parametric estimates and allowances are used for items that cannot be quantified at this stage of the design.
7 This opinion has been based on a competitive open bid situation with a recommended 5 - 7 bonafide reputable bids from general contractors and a minimum of 3 bidders for all items of subcontracted work.
8 All unit costs take into account sales tax, general conditions, bonding and insurance, and subcontractor and general contractor overhead and profit.
9 Where applicable, unit costs include the cost of freight.

The following are excluded:

1 Environmental clearances and permits
2 Hazardous spoil disposal, if encountered
3 Property and Right of Way acquisition or easements
4 Legal and accounting fees
5 Plan check, building permit fees
6 Utility Connection Fees
7 Testing and inspection
8 Fire and all risk insurance
9 Removal of unforeseen underground obstructions
10 Relocation of unforeseen subsurface utilities
11 Signage and wayfinding
12 Additional fill or import
13 Loose furniture and equipment
14 Utility connection fees
15 Tel/data system
16 Construction contingency
17 Work done after business hours
18 Design, engineering and consulting fees other than those specifically listed in the above estimate

Items that may affect the cost estimate:

1 Modifications to the scope of work included in this estimate
2 Unforeseen sub-surface conditions
3 Restrictive technical specifications or excessive contract conditions
4 Any other non-competitive bid situations
5 Bids delayed beyond the projected schedule

Client:	**City of Pasadena/City of South Pasadena**	Prepared by:	**MMT**
Project:	**Arroyo Seco-San Rafael Treatment Wetlands**	Checked by:	**OG**
Status:	**10% Cost Estimate**	Date:	**10/14/2020**

Description	Total
Miscellaneous	**$316,655**
Channel Diversion and Pretreatment	**$777,976**
Site Preparation and Demolition - Existing Park Area	**$211,250**
Storage	**$536,250**
Wet Well and Conveyance	**$1,168,500**
Electrical Service, Controls, Instrumentation	**$322,000**
Landscape and Irrigation Modifications	**$438,750**
Site Amenities and Improvements	**$825,300**
Start-up, Testing, Prepare Operations & Maintenance Manuals, and Prepare Record Drawings	**$94,500**
SUBTOTAL	**$4,691,181**
35% Contingency	$1,641,914
Total Construction Costs	**$6,333,095**
Pre-Design, Design, and Construction Support (15%)	$949,964
Community Outreach during Design	$50,000
Environmental Planning and Permitting (2%)	$126,662
Agency Project Management (2.5%)	$158,327
Construction Management (10% of construction)	$633,309
Construction Surveying	$20,000
Total Soft Costs	**$1,938,263**
GRAND TOTAL	**$8,271,357**

Assumptions and Exclusions

1. This is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.
2. The unit cost data is derived from inhouse sources, recent bids on similar construction, and RS Means current construction cost data.
3. This opinion of cost is based on the project program and plans made available at the time of preparation.
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5. This opinion of cost assumes that all improvements will be constructed at one time.
6. Quantity take offs were performed when possible and parametric estimates and allowances are used for items that cannot be quantified at this stage of the design.
7. This opinion has been based on a competitive open bid situation with a recommended 5 - 7 bonafide reputable bids from general contractors and a minimum of 3 bidders for all items of subcontracted work.
8. All unit costs take into account sales tax, general conditions, bonding and insurance, and subcontractor and general contractor overhead and profit.
9. Where applicable, unit costs include the cost of freight.

The following are excluded:

1. Environmental clearances and permits
2. Hazardous spoil disposal, if encountered
3. Property and Right of Way acquisition or easements
4. Legal and accounting fees
5. Plan check, building permit fees
6. Utility Connection Fees
7. Testing and inspection
8. Fire and all risk insurance
9. Removal of unforeseen underground obstructions
10. Relocation of unforseen subsurface utilities
11. Signage and wayfinding
12. Additional fill or import
13. Loose furniture and equipment
14. Utility connection fees
15. Tel/data system
16. Construction contingency
17. Work done after business hours
18. Design, engineering and consulting fees other than those specifically listed in the above estimate

Items that may affect the cost estimate:

1. Modifications to the scope of work included in this estimate
2. Unforeseen sub-surface conditions
3. Restrictive technical specifications or excessive contract conditions
4. Any other non-competitive bid situations
5. Bids delayed beyond the projected schedule

ATTACHMENT D: LACFCD CONCEPTUAL REVIEW CORRESPONDENCE

Courtney Semlow

From: Genevieve Osmena <gosmena@dpw.lacounty.gov>
Sent: Thursday, October 8, 2020 2:40 PM
To: Courtney Semlow
Cc: Oliver Galang; Merrill Taylor; Maue, Brent; Julian Lee; Ernesto Rivera; Nayiri Vartanian
Subject: RE: LACFCD Conceptual Review of Arroyo Seco-San Rafael Treatment Wetlands

Hi Courtney,

Thank you for reaching out to us on your project. Please go ahead and work directly with Ernesto Rivera and Nayiri Vartanian of my team, who I have cc'd above. They will be reviewing the project info and will coordinate with you on the requested concept approval letter. Thank you also for sharing the project fact sheet and the storm drain plans – my team will let you know if they have any questions or need any further info for their review.

Thanks,

Genevieve Osmeña
Senior Civil Engineer
Los Angeles County Public Works
Office: 626-458-4322

From: Courtney Semlow <courtney.semlow@craftwaterinc.com>
Sent: Tuesday, October 6, 2020 5:07 PM
To: Genevieve Osmena <gosmena@dpw.lacounty.gov>
Cc: Oliver Galang <oliver.galang@craftwaterinc.com>; Merrill Taylor <merrill.taylor@craftwaterinc.com>; Maue, Brent <bmaue@cityofpasadena.net>; Julian Lee <jlee@southpasadenaca.gov>
Subject: LACFCD Conceptual Review of Arroyo Seco-San Rafael Treatment Wetlands

CAUTION: External Email. Proceed Responsibly.

Genevieve,

Greetings! On behalf of the Cities of Pasadena and South Pasadena, we are requesting the LACFCD Watershed Manager for the Upper LA River for a Conceptual Level review and approval of the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project.

We are providing the following documents for your reference:

- **Attachment A** Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project Fact Sheet
- **Attachment B** Storm Drain As-Builts

The project is a major opportunity to continue the regional scale progress to achieve pollutant load reductions by the Cities of Pasadena and South Pasadena. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels that are both managed by the LACFCD. A treatment wetland and recharge basin system are proposed adjacent to the Arroyo Seco channel to capture, treat, and infiltrate stormwater from the diverted drainage channel. The proposed diversions will both consist of a drop inlet structure with a rubber dam placed in the Arroyo Seco to ensure that the storm drain will continue to accommodate the existing flood control drainage capacity.

The City of Pasadena will be submitting this project for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22. Once the City initiates the Design Phase of this project, the City will continue to remain closely engaged with the LACFCD to comply with any additional requirements for an LACFCD Permit and a Use and Maintenance Agreement.

Thank you!

Courtney Semlow, PE, CFM, ENV SP | Project Manager
P: 847.445.0886 | courtney.semlow@craftwaterinc.com
Los Angeles | San Diego | craftwaterinc.com

craftwater engineering, inc.

ATTACHMENT E: SAN PASCUAL STORMWATER CAPTURE ANALYSIS

MEMO

TO: Brent Maue, City of Pasadena
Julian Lee, City of South Pasadena

CC:

FROM: Oliver Galang, PE, Craftwater Engineering

SUBJECT: San Pascual Stormwater Capture Facility
Stormwater Capture Feasibility Study Technical Memorandum

DATE: September 22, 2020

The Upper Los Angeles River Watershed is a largely built-out, urbanized watershed of approximately 485 square miles, or 310,400 acres, in the Upper Los Angeles River Watershed Management Area and over 50 miles of the main line of the LA River. The development of the San Pascual Treatment Wetlands Stormwater Capture Feasibility Study in the City of Pasadena represents another major opportunity to continue the regional scale progress to achieve pollutant load reductions for the Upper Los Angeles River Watershed Management Program. The primary objective of this project is to prepare a Feasibility Study Report for the San Pascual Treatment Wetlands Project, which include the 10% design level documents that could be utilized to support a funding application under Los Angeles County's Safe, Clean Water Program. Towards this goal, this memo presents the analytical results evaluating the potential stormwater capture and water use alternatives and the sizing options for an optimized design. This project is intended to intercept a sizeable portion of the stormwater flows from the Arroyo Seco Channel to the project site (**See Figure 1**). Stormwater will be diverted from the Arroyo Seco reinforced concrete channel (Concrete Conduit Section 2) managed by the Los Angeles County Flood Control District (LACFCD) at an existing diversion point that directs flows to the project location. A surface treatment infiltration basin best management practice (BMP) is proposed at San Pascual Treatment Wetlands to capture and infiltrate stormwater from the diverted drainage channel. Project constraints and potential options will be detailed in this memo to present an array of sizing options that will contribute to both water quality goals as well as other important project considerations and desired outcomes. These options can then be considered and weighed before proceeding with the ultimate design of the project by identifying the project configuration that best meets the desired outcome and contributes to water quality benefits in a cost-effective manner.

Figure 1. San Pascual Site, South Pasadena/Los Angeles

1.0 OBJECTIVES

To identify the most effective stormwater capture configuration at the project site, decision support modeling has been conducted to identify the optimal BMP configuration using a balanced approach that incorporates design storm hydrologic targets as well as long-term water quality considerations. This optimal configuration addresses stormwater runoff that will be diverted to the project site from a potential diversion point near the park. BMP configuration recommendations will be made for the San Pascual site for the following key design criteria.

Diversion Rates

A range of feasible diversion flowrates will be simulated to develop cost-effectiveness curves and to determine the optimal flowrate to be diverted to the capture facility that will provide the greatest water quality benefit without surpassing the point of declining returns. Flowrates will range in values grounded in construction feasibility and subject to other project constraints identified in the initial project concept development.

BMP Storage

The optimal BMP size will be determined subject to the allowable site footprint. Size recommendations will include the following highlighted endpoints:

- The BMP size that is most cost-effective for the project tributary area,
- The BMP size that will capture the 85th percentile, 24-hour storm runoff volume, and
- The BMP size that will achieve multi-benefits, including, but not limited to, addressing stormwater quality and water supply.

Discharge –Water Use and Flowrate

Different routes exist for the outflows from the BMP, and each entail differing requirements, infrastructure, and constraints that impact the overall performance of the stormwater capture system and project cost. Also, these options represent different contributions to other local water supply efforts, of which stormwater is a growing component. If infiltration is feasible at this site due to favorable soil infiltration conditions, it will be utilized to dewater the BMP and contribute to regional groundwater recharge goals. Infiltration feasibility and rates will be determined in a future geotechnical analysis. Additionally, the potential to discharge captured stormwater to nearby sanitary sewers or to filter it and return it to storm drains will be assessed for this site to quantify the potential benefits of different options should infiltration be deemed infeasible. Filtration throughflow rates for commonly available systems and estimates of feasible sanitary sewer capacity will be evaluated to ensure that these discharge options are right sized to the baseline water quality for the drainage area and other system configuration options. Additionally, the potential for on-site irrigation via filtration of captured dry-weather flows will be assessed for viability.

Figure 2 shows the initial evaluated concept of a surface wetland, east of the Arroyo Seco Channel.

Figure 2. Preliminary concept schematic for the San Pascual Treatment Wetlands BMP as a treatment wetland, east of the Arroyo Seco Channel (may not represent final project details).

2.0 BASELINE SITE CONDITIONS AND CONSTRAINTS

The following subsections summarize the baseline watershed, hydrologic, and on-site conditions and constraints that will be accounted for in BMP configuration and optimization analysis for the San Pascual site.

2.1 Watershed Characterization

For this study, the Los Angeles County Watershed Management Modeling System (WMMS) was used within the Loading Simulation Program C++ (LSPC) to simulate the contaminant loading, runoff volume, and flow rate associated with a long-term, 10-year continuous time series (Water Year 2002 to Water Year 2011) as well as the 85th percentile storm. The WMMS is accepted by the Los Angeles Water Quality Control Board for performance of compliance analyses in the context of EWMP/WMP development.

The drainage area delineations for the project site (**Figure 3**) were developed using geospatial data associated with the WMMS modeling subwatersheds and verified/corrected slightly using further GIS analysis where full subwatersheds did not coincide with project locations and where subsurface storm drains overlapped. Digital stormwater pipe inventories and high-resolution Light Detection and Ranging (LiDAR) elevation data were used to accomplish subwatershed splitting. Developed drainage areas were used to model runoff and water quality baseline timeseries'. These were then incorporated into BMP models to optimize the BMP decision variables. The overall area and impervious fraction are summarized in **Table 1** .

Table 1. Summary of watershed and hydrologic conditions for the San Pascual Project drainage area

Total Tributary Area (ac)	Impervious Tributary Area (ac)	Average Annual Runoff (ac-ft)	Average Annual Zn Loading (lbs)	85th Percentile Surface Runoff (ac-ft)	85th Percentile Peak Flow (cfs)
5,005	1,200 (24%)	4,583	1,298	232	305

2.2 Hydrologic Considerations

Long-term baseline flows and pollutant loads to the site are also summarized in **Table 1**. The total loadings presented in this table represent the maximum possible reductions that could be achieved by control measures at the project site. However, pragmatic diversion limitations, space constraints, and subsequent treatment mechanisms will ultimately limit how much runoff and pollutant mass can potentially be diverted into the BMP. Peak flow rate and total runoff for the 85th percentile design storm (1.05 in., taken from isohyetal data for the centroid of the drainage areas) are found in **Table 1** as well.

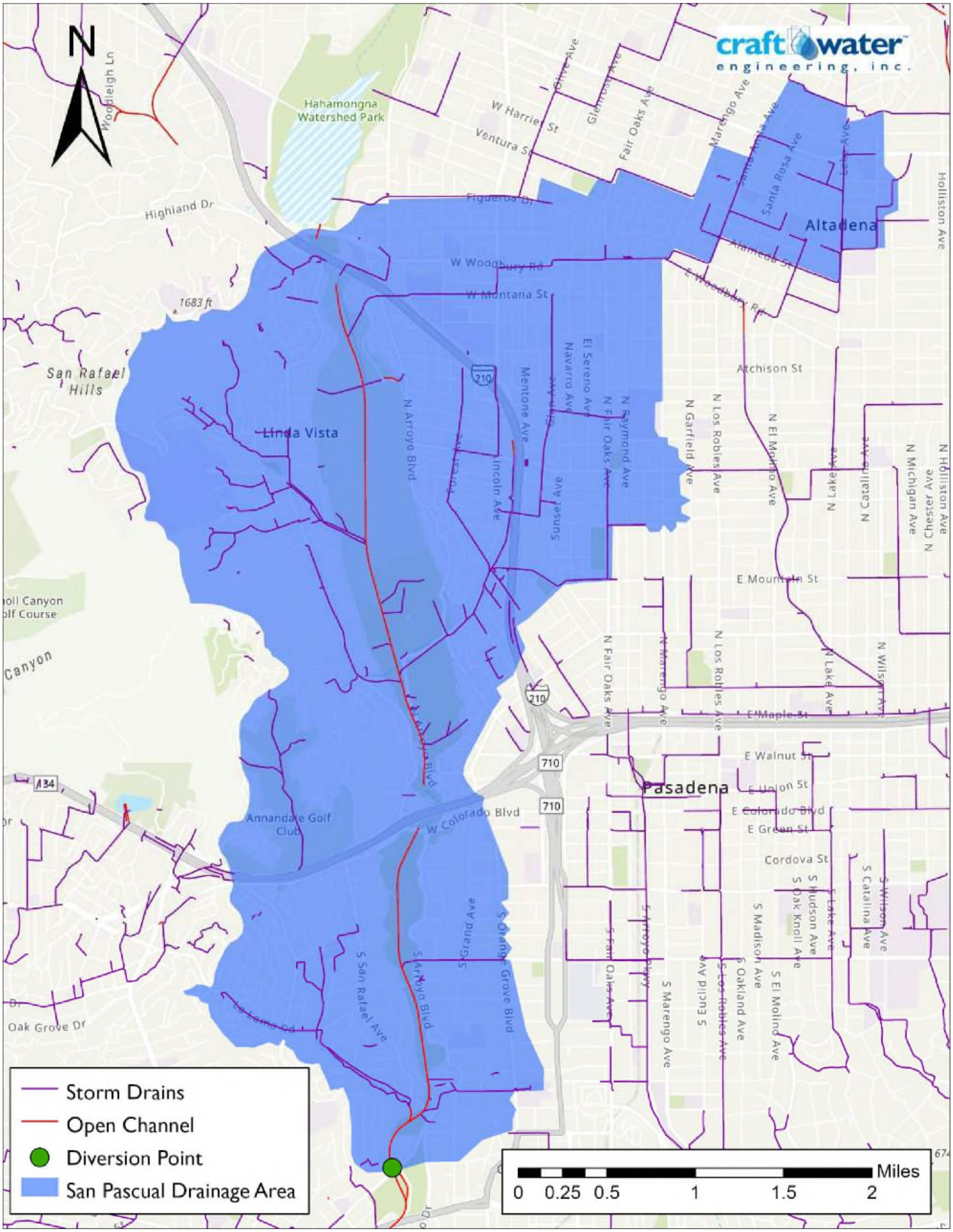


Figure 3. Drainage area for San Pascual Project.

3.0 STORMWATER CAPTURE OPTIMIZATION METHODS

3.1 Water Quality Optimization Strategy

The primary design goal of the San Pascual Treatment Wetlands Project is to reduce long-term annual loading of pollutants to the ULAR watershed using zinc as the limiting pollutant of interest in the analysis as established by the EWMP for this watershed group. To ensure that the system will be sized to maximize load reductions in a cost-effective manner, optimization modeling was performed.

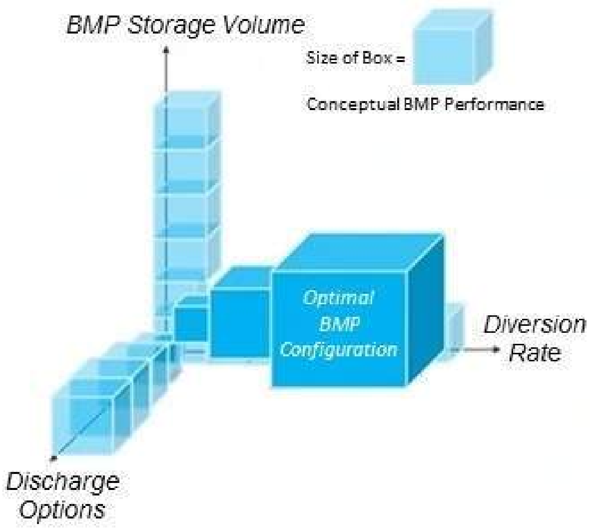


Figure 4. Conceptual illustration of optimization modeling balancing various design components to maximize performance.

The purpose of optimization modeling is to balance design components (including BMP volume and inflow diversion rates) such that no one component limits the performance of the system subject to potential discharge options (see **Figure 4** at right). Optimization supports decision making throughout the design process by guiding selection of the most cost-effective system design.

The model setup for water quality simulation and optimization is complex, involving several modeling systems and iterative feedback from design engineers. The general methodology is discussed below, and the results are presented thereafter.

3.2 Preliminary Size and Diversion Optimization (SUSTAIN)

The first step of the modeling was to predict BMP performance for a range of potential BMP sizes, diversion points and inflow rates, and discharge alternatives. EPA's System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) model was used for this analysis because its built-in optimization algorithms automate the process of evaluating many different BMP configurations to select a cost-effective solution related to project goals. The model was run using 10 years of runoff and pollutant loading time-series data generated by the WMMS at an hourly time step. During this preliminary decision-support modeling, the discharge alternatives were simulated using certain site constraints to capture approximate BMP throughflow rates at the same time as varying the diversion rate and storage volume. These preliminary optimization model runs produced a point cloud from which the optimal cost-effectiveness curves were extracted. Subsequent targeted modeling then provided a clear decision pathway for the development of optimal project alternatives. Modeling efforts investigated the range of BMP configurations as detailed in the following subsections.

3.2.1 Diversion Rates

Model runs were limited to feasible diversion ranges for the proposed diversion point based on prior project knowledge related to the drainage area and potential project storage size. Diversion rates for the San Pascual BMP were modeled over the range of 10 to 50 cfs, varying in 5 cfs increments, to assess the most cost-effective configuration of diversion inflow rates.

3.2.2 Storage Volume

Site assessments and discussion with project stakeholders indicated an initial surface wetland storage volume of 8.0 ac-ft. These initial estimates for potential storage were developed assuming a maximum ponding depth of 8 feet for surface wetland storage. Modeling was carried out for a BMP storage ranging from 0.1 to 20.0 ac-ft by 0.1 ac-ft increments to assess trends in stormwater treatment efficiencies over a full range of storage sizes to identify points of diminishing return and ensure final recommendations accounted for the full potential treatment for the site.

3.2.3 Discharge Alternatives

The modeling evaluation identified two possible discharge scenarios that are evaluated for their water quality impacts: (1) infiltration into the subsoils, and (2) wetland settling and additional filtration prior to discharge back into the channel. Geotechnical investigations are awaiting completion, so initial assessments of the infiltration option were conducted assuming a conservative infiltration rate of 0.3 in/hr, the minimum acceptable value for an infiltration project in Los Angeles County. A treatment wetland system limits infiltration to maintain a wet pool, so infiltration rates will not impact the performance of this option. Both project options were additionally assessed with the addition of a filtration system at the outlet to increase water quality benefits and ensure adequate treatment. Filtration was modeled at 2.88 cfs and 5.76 cfs discharge rates to represent commonly available filtration devices and corresponding throughput efficiency.

One final option for discharge of captured runoff that was evaluated was discharge to the sanitary sewer. Sewer discharges are typically limited to flowrates that are comparable to filtration devices, but they are further constrained by allowable temporal discharge windows and rates (normally between 10pm to 8am daily) and only during dry weather (defined as 24-hours after any rainfall of greater than or equal to 0.1 in/hr). System capacity and discharge allowances are beyond the scope of this feasibility study, and additional coordination with the sewer purveyor is required during later stages of design to determine the available capacity and discharge rates if this option for the project is desired. A desktop analysis indicates that the closest sewer lines are located approximately 500 feet away at an elevation approximately 80 feet higher than the proposed project site on Arroyo Drive (**Figure 5**). Due to this high topographic relief to the nearest lines, the pursuit of sanitary sewer discharge is not recommended and is not further evaluated in this analysis.

Figure 5. Sanitary sewer in the vicinity of San Pascual Treatment Wetlands.

3.2.4 Inflow Infrastructure

Diverted inflows can be conveyed to the storage BMP via gravity-fed pipes or by way of pumps. The two options have tradeoffs associated with costs that are typically defined by the invert depth of the storm drains at the diversion points and the BMP storage footprint. Gravity-fed inflows require the BMP to be sited deep enough underground for flows to move passively toward the storage. This is associated with excavation and stabilization costs that are determined by the storm drain invert and distance of the diversion. Pumped inflows allow the BMP to be sited vertically with minimal soil cover atop the storage, but these are associated with costs of pumping infrastructure, operation, and maintenance. At different sizes of a given BMP and site, pumping inflows may be more cost-effective than gravity-fed diversions, and vice versa. Because of this, all modeled configurations were assessed for both inflow types to determine the most cost-effective inflow configuration across modeled scenarios.

4.0 OPTIMIZATION MODELING RESULTS

The optimization analysis aimed to maximize the long-term pollutant load reduction and 85th percentile design storm volume capture by simultaneously varying the diversion rate, BMP size, and discharge rates related to options previously discussed. Each of these design features has an associated range of options that were modeled to assess alternatives against long-term water quality benefits and identify the most effective. Additionally, different configurations were paired with estimated planning level cost data to assess alternatives and options against each other to ultimately determine the best configuration for this site. By optimizing based on these variables, multiple pathways to achieve maximum water quality benefit were identified and the most cost-effective alternatives were determined. Different configuration alternatives and modeling parameters are presented below to demonstrate the cost-effectiveness associated with these options and narrow them down to a few key recommended project configurations that will meet different needs for the ULAR watershed and contribute to the goals of the EWMP.

4.1 BMP Type – Infiltration Basin vs Treatment Wetlands

Two BMP types were evaluated for this site; a treatment wetland and an infiltration basin. These BMPs were modeled over the full range of configurations discussed before, and the water quality benefits for the range of projects modeled for the design alternatives are presented in **Figure 6.** These alternatives were evaluated to determine the best options at the San Pascual site given the site-specific constraints. Results display the optimal front of the full range of projects modeled for each of the various BMP types. Based on the modeling results and the desire for groundwater recharge, an infiltration basin has a similar performative advantage on a cost per pound of pollutant removed as a treatment wetland with an estimated ~25lbs difference in reduction of zinc per year. The addition of a filter shows an added benefit and is discussed in the next section.

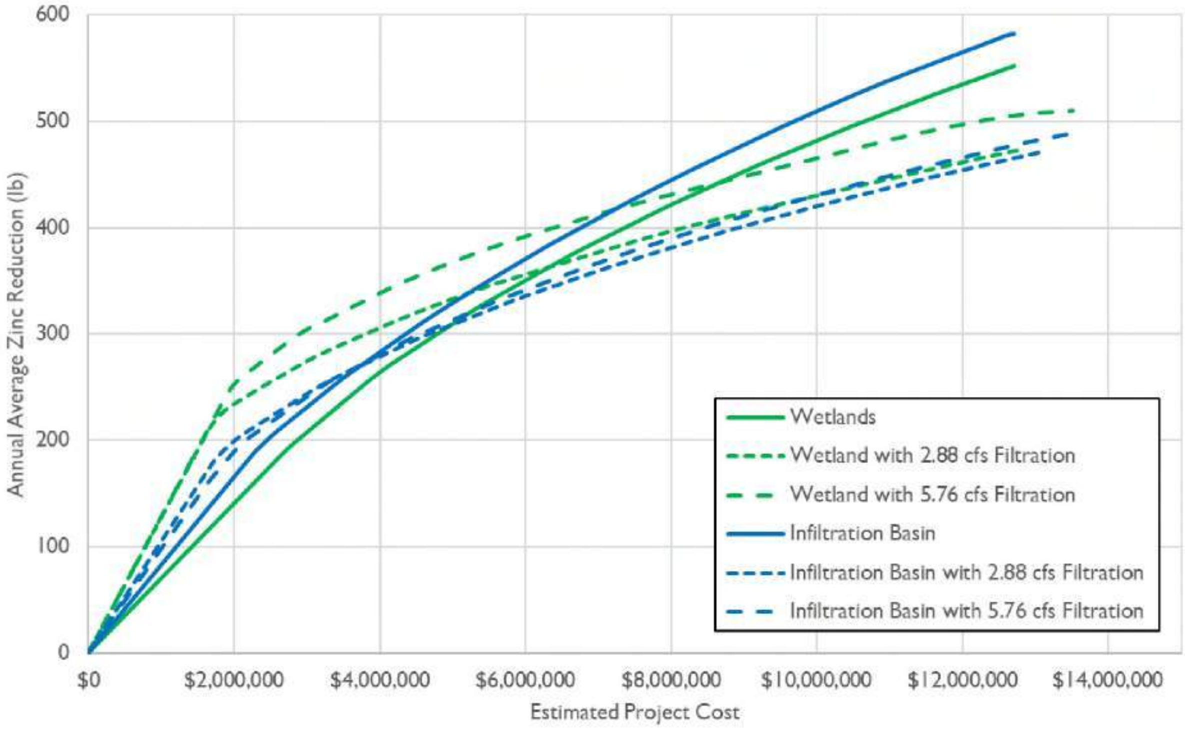


Figure 6. Infiltration BMP versus a Treatment Wetlands BMP

4.2 Filtration Recommendations

Pollutant removal performances can be increased in the vicinity of the maximum project size with the addition of filtration units that clean and discharge the effluent stormwater into the Arroyo Seco. **Figure 7** demonstrates these gains. Based on the results for the project at the maximum site footprint, the inclusion of a single filter increases the average annual zinc load reduction by about 25 lbs./yr. for a minimal cost considering the overall estimated project cost. The addition of a second filter unit that doubles the discharge rate adds even greater water quality benefit at the same overall project storage size and diversion rate. This is not the case for the infiltration basin, as shown in **Figure 8**, wherein slightly less water quality benefit might be realized with the addition of filtration devices. While these devices usually boost the performance for smaller BMPs, they can have this effect on infiltration basins since filtration does not entirely remove pollutant loads from the discharged water. Infiltrated water completely removes all pollutant loading from the drainage system. However, BMP controls can be implemented to ensure that infiltration is prioritized for its pollutant removal and water supply contributions, with filtration only occurring when the BMP is near full storage capacity. Additionally, filtration offers assurances that any water not able to be infiltrated will receive an acceptable level of treatment before discharge back to the storm drain system.

Analysis of the optimal front of the project modeling allowed the selection of the most cost-effective configuration for each project option. These are summarized in **Table 2** and will be discussed further below.

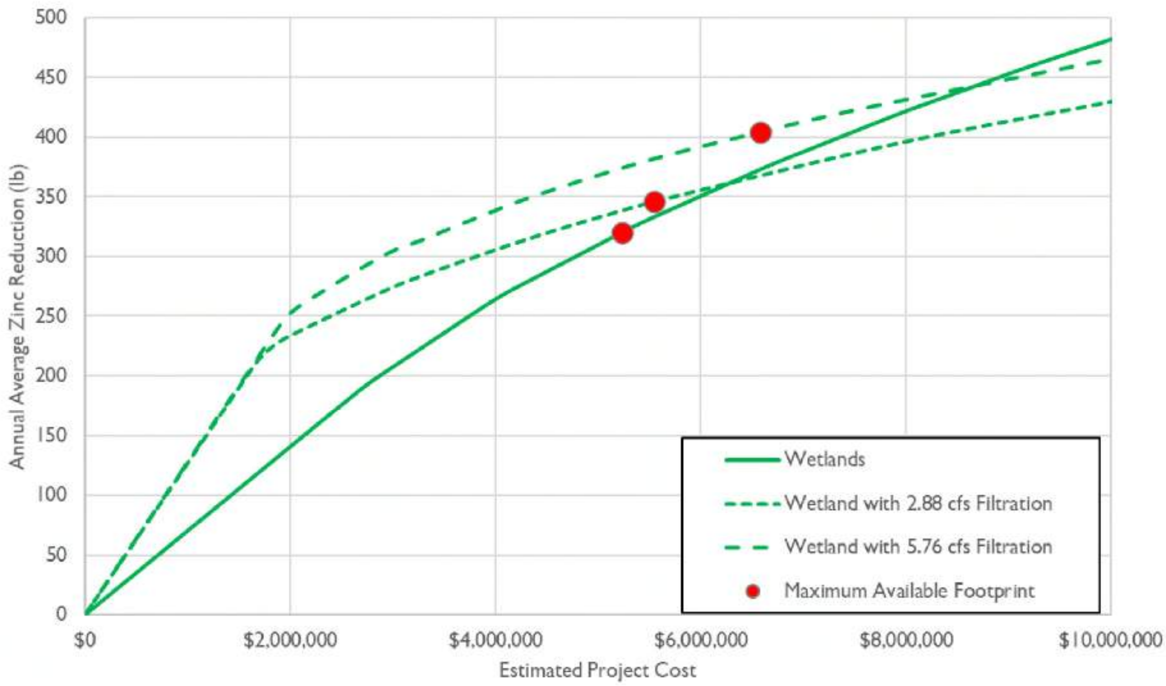


Figure 7. Comparison of treatment wetland results with and without filtration.

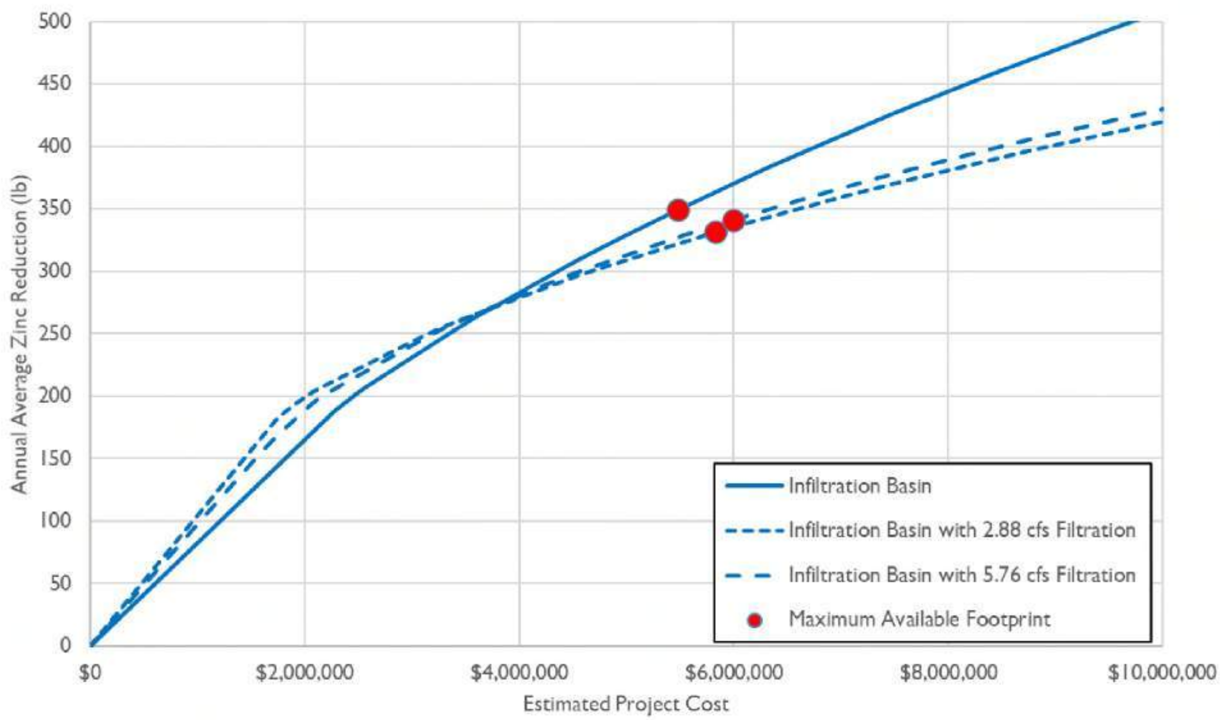


Figure 8. Comparison of infiltration basin results with and without filtration.

Table 2. Summary of cost-effective project alternatives.

Project Alternative	Estimated Project Cost	Average Annual Zinc Reduction (lbs)	Unit Cost per Pound of Zinc Removal
Treatment Wetland	$7,884,531	417.6	$18,881 / lb
Treatment Wetland w/ 2.88 cfs Filter	$4,432,849	318.1	$13,935 / lb
Treatment Wetland w/ 5.76 cfs Filter	$4,401,398	351.3	$12,529 / lb
Infiltration Basin	$7,501,516	427.2	$17,560 / lb
Infiltration Basin w/ 2.88 cfs Filter	$4,672,487	300.4	$15,556 / lb
Infiltration Basin w/ 5.76 cfs Filter	$5,561,495	329. 8	$16,864 / lb

5.0 PROJECT ALTERNATIVES AND RECOMMENDATIONS

5.1 BMP Size Alternatives

The following BMP sizes and diversion rates are recommended based on different endpoints of design and with the range of performance that might be realized at the San Pascual site.

5.1.1 Most cost-effective BMP size for the San Pascual site

The most cost-effective BMP at San Pascual Treatment Wetlands, given the footprint constraints of 1.03 acres, is a 6.5 ac-ft storage BMP with a pumped diversion of 25 cfs from the Arroyo Seco (**Figure 9**). This BMP will utilize infiltration and supplemental 5.76 cfs filtration for discharge of captured stormwater to reduce approximately 25% of the average annual zinc load for the drainage area.

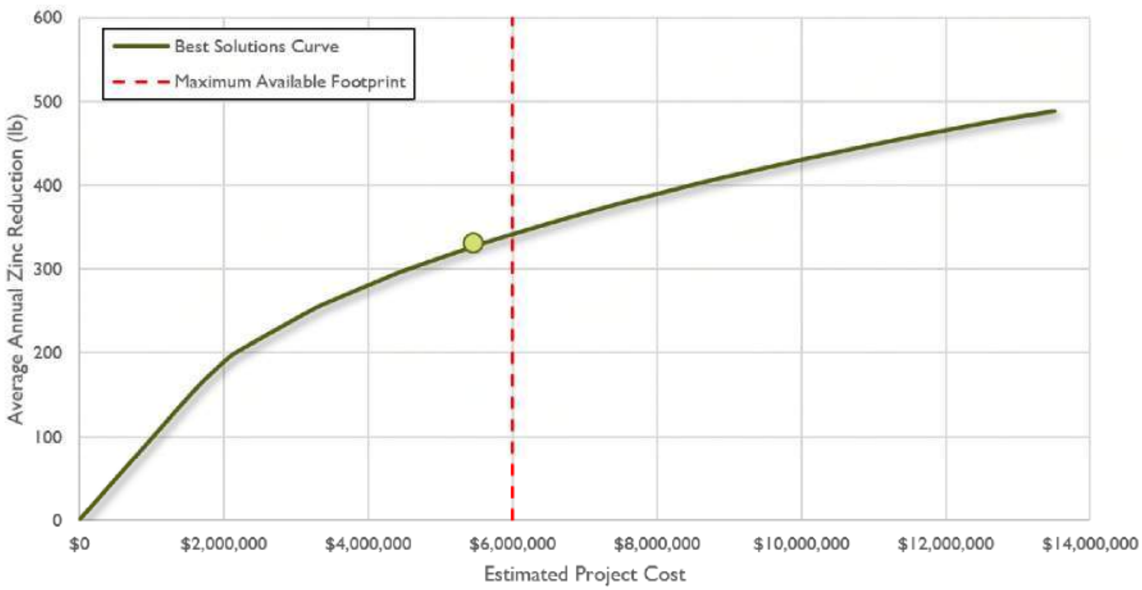


Figure 9. Model-based cost-effective project per footprint constraint recommendation for San Pascual Treatment Wetlands.

5.1.2 Capture of 85th percentile design storm

Based on the infiltration rate of 0.3 in/hr for this project, capture of the 85th percentile storm volume would necessitate a BMP with a diversion of at least 305 cfs and a storage volume of at least 271.7 ac-ft. This BMP is not feasible within the available footprint and is also not practical and would be well beyond the point of diminishing returns for water quality benefit for this site based on long-term average annual load reductions.

5.1.3 Most multi-benefit BMP configuration

Based on the analysis above, the most multi-benefit BMP configuration is the utilization of the full available area on the east side of the river with an infiltration basin that utilizes the existing diversion and dam structures that exist on-site. A supplemental filtration unit can be included to further the removal performance and **Table 3** summarizes the performance of this recommended configuration. The current recommended BMP is right sized for the drainage area and water quality loads while limiting the project to one area thus reducing costs and permitting time. Further study (incorporating forthcoming geotechnical investigation) will determine the optimal element sizing in terms of water supply consideration.

Table 3. Summary of recommended project configuration.

Project Alternative/BMP Type	Diversion Rate (cfs)	Total Storage Volume (ac-ft)	Planning Level Cost	Average Annual Zinc Reduction (lbs)
Infiltration Basin w/ 5.76 cfs filter	25	6.5	$5,561,495	329.8

ATTACHMENT F: SAN RAFAEL STORMWATER CAPTURE ANALYSIS

MEMO

TO: Brent Maue, City of Pasadena
Julian Lee, City of South Pasadena

CC:

FROM: Oliver Galang, PE, Craftwater Engineering

SUBJECT: San Rafael Treatment Wetlands
Stormwater Capture Feasibility Study Technical Memorandum

DATE: September 22, 2020

Figure 1. San Rafael Site, Pasadena

The Upper Los Angeles River Watershed is a largely built-out, urbanized watershed of approximately 485 square miles, or 310,400 acres, in the Upper Los Angeles River Watershed Management Area and over 50 miles of the main line of the LA River. The development of the San Rafael Treatment Wetlands Stormwater Capture Feasibility Study in the City of Pasadena represents another major opportunity to continue the regional scale progress to achieve pollutant load reductions for the Upper Los Angeles River Watershed Management Program. The primary objective of this project is to prepare a Feasibility Study Report for the San Rafael Treatment Wetlands Project, which include the 10% design level documents that could be utilized to support a funding application under Los Angeles County's Safe, Clean Water Program. Towards this goal, this memo presents the analytical results evaluating the potential stormwater capture and water use alternatives and the sizing options for an optimized design. This project is intended to intercept a sizeable portion of the stormwater flows from the adjacent storm drain to the San Rafael Creek to the proposed project site (**See Figure 1**). Stormwater will be diverted immediately downstream from the outfall of the 72" reinforced concrete pipe (RCP; Project No. BI 0562, Line F) managed by the Los Angeles County Flood Control District (LACFCD) at San Rafael Creek. A surface treatment infiltration basin best management practice (BMP) is proposed at the San Rafael site to capture and infiltrate stormwater from the diverted drainage channel. Project constraints and potential options will be detailed in this memo to present an array of sizing options that will contribute to both water quality goals as well as other important project considerations and desired outcomes. These options can then be considered and weighed before proceeding with the ultimate design of the project by identifying the project configuration that best meets the desired outcome and contributes to water quality benefits in a cost-effective manner.

1.0 OBJECTIVES

To identify the most effective stormwater capture configuration at the project site, decision support modeling has been conducted to identify the optimal BMP configuration using a balanced approach that incorporates design storm hydrologic targets as well as long-term water quality considerations. This optimal configuration addresses stormwater runoff that will be diverted to the project site from a potential diversion point near the open space at the confluence. BMP configuration recommendations will be made for the San Rafael site for the following key design criteria.

Diversion Rates

A range of feasible diversion flowrates will be simulated to develop cost-effectiveness curves and to determine the optimal flowrate to be diverted to the capture facility that will provide the greatest water quality benefit without surpassing the point of declining returns. Flowrates will range in values grounded in construction feasibility and subject to other project constraints identified in the initial project concept development.

BMP Storage

The optimal BMP size will be determined subject to the allowable site footprint. Size recommendations will include the following highlighted endpoints:

- The BMP size that is most cost-effective for the project tributary area,
- The BMP size that will capture the 85th percentile, 24-hour storm runoff volume, and
- The BMP size that will achieve multi-benefits, including, but not limited to, addressing stormwater quality and water supply.

Discharge –Water Use and Flowrate

Different routes exist for the outflows from the BMP, and each entail differing requirements, infrastructure, and constraints that impact the overall performance of the stormwater capture system and project cost. Also, these options represent different contributions to other local water supply efforts, of which stormwater is a growing component. If infiltration is feasible at this site due to favorable soil infiltration conditions, it can be utilized to dewater the BMP and contribute to regional groundwater recharge goals. Infiltration feasibility and rates will be determined in a future geotechnical analysis. Additionally, the potential to discharge captured stormwater to nearby sanitary sewers or to filter it and return it to storm drains will be assessed for this site to quantify the potential benefits of different options should infiltration be deemed infeasible. Filtration throughflow rates for commonly available systems and estimates of feasible sanitary sewer capacity will be evaluated to ensure that these discharge options are right sized to the baseline water quality for the drainage area and other system configuration options.

Figure 2 shows the initial evaluated concept of a surface infiltration basin east of San Rafael Creek.

Figure 2. Preliminary concept schematic for the San Rafael Infiltration Basin BMP, east of San Rafael Creek (may not represent final project details).

2.0 BASELINE SITE CONDITIONS AND CONSTRAINTS

The following subsections summarize the baseline watershed, hydrologic, and on-site conditions and constraints that will be accounted for in BMP configuration and optimization analysis for the San Rafael site.

2.1 Watershed Characterization

For this study, the Los Angeles County Watershed Management Modeling System (WMMS) was used within the Loading Simulation Program C++ (LSPC) to simulate the contaminant loading, runoff volume, and flow rate associated with a long-term, 10-year continuous time series (Water Year 2002 to Water Year 2011) as well as the 85th percentile storm. The WMMS is accepted by the Los Angeles Water Quality Control Board for performance of compliance analyses in the context of EWMP/WMP development.

The drainage area delineations for the project site (**Figure 3**) were developed using geospatial data associated with the WMMS modeling subwatersheds and verified/corrected slightly using further GIS analysis where full subwatersheds did not coincide with project locations and where subsurface storm drains overlapped. Digital stormwater pipe inventories and high-resolution Light Detection and Ranging (LiDAR) elevation data were used to accomplish subwatershed splitting. Developed drainage areas were used to model runoff and water quality baseline timeseries. These were then incorporated into BMP models to optimize the BMP decision variables. The overall area and impervious fraction are summarized in **Table 1** .

Table 1. Summary of watershed and hydrologic conditions for the San Rafael Project drainage area

Total Tributary Area (ac)	Impervious Tributary Area (ac)	Average Annual Runoff (ac-ft)	Average Annual Zn Loading (lbs)	85th Percentile Surface Runoff (ac-ft)	85th Percentile Peak Flow (cfs)
441	94 (21%)	288	65	18	22

2.2 Hydrologic Considerations

Long-term baseline flows and pollutant loads to the site are also summarized in **Table 1**. The total loadings presented in this table represent the maximum possible reductions that could be achieved by control measures at the project site. However, pragmatic diversion limitations, space constraints, and subsequent treatment mechanisms will ultimately limit how much runoff and pollutant mass can potentially be diverted into the BMP. Peak flow rate and total runoff for the 85th percentile design storm (1.05 in., taken from isohyetal data for the centroid of the drainage areas) are found in **Table 1** as well.

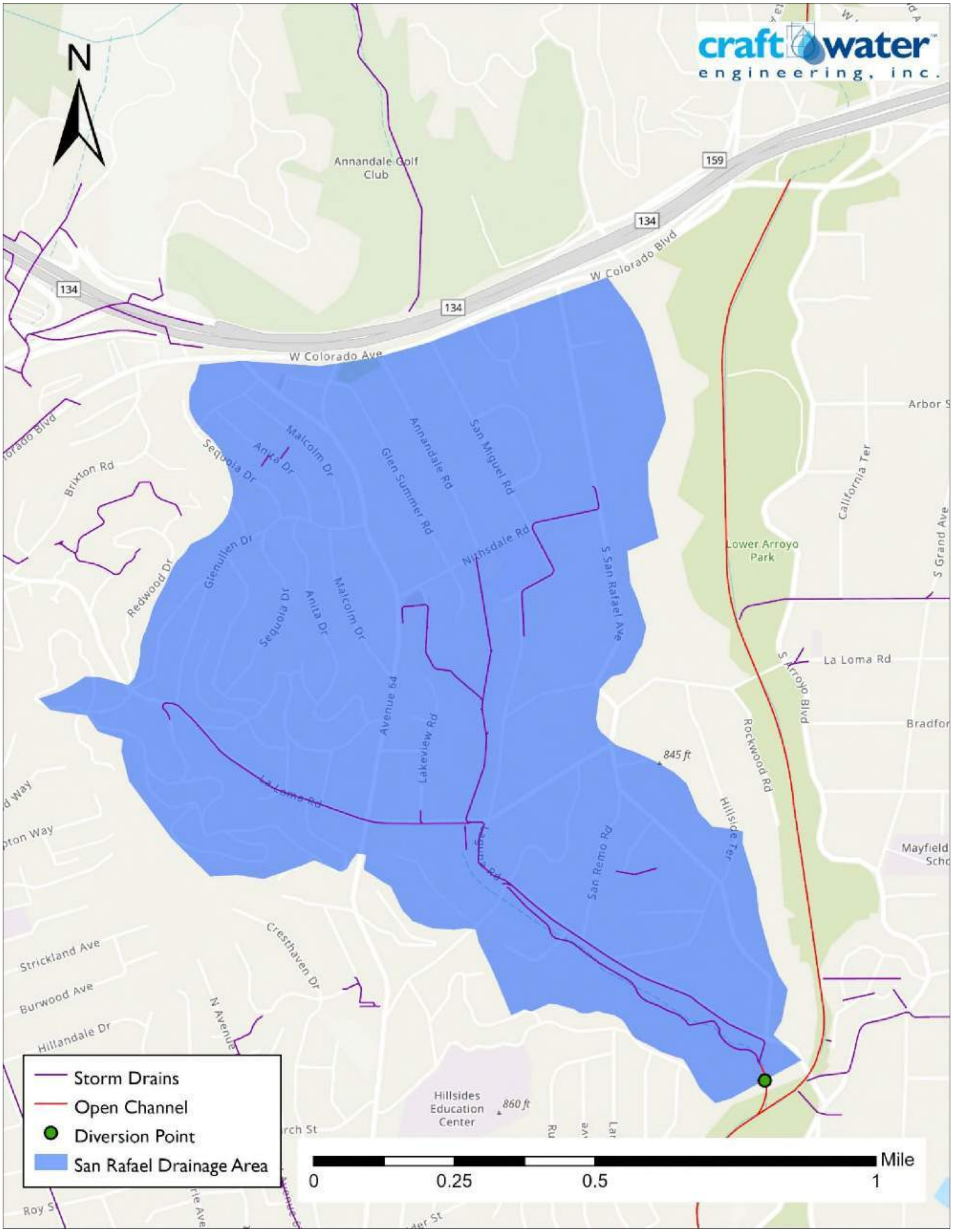


Figure 3. Drainage area for San Rafael Wetlands Project.

3.0 STORMWATER CAPTURE OPTIMIZATION METHODS

3.1 Water Quality Optimization Strategy

The primary design goal of the San Rafael Treatment Wetlands Project is to reduce long-term annual loading of pollutants to the ULAR watershed using zinc as the limiting pollutant of interest in the analysis as established by the EWMP for this watershed group. To ensure that the system will be sized to maximize load reductions in a cost-effective manner, optimization modeling was performed.

The purpose of optimization modeling is to balance design components (including BMP volume and inflow diversion rates) such that no one component limits the performance of the system subject to potential discharge options (see **Figure 4** at right). Optimization supports decision making throughout the design process by guiding selection of the most cost-effective system design.

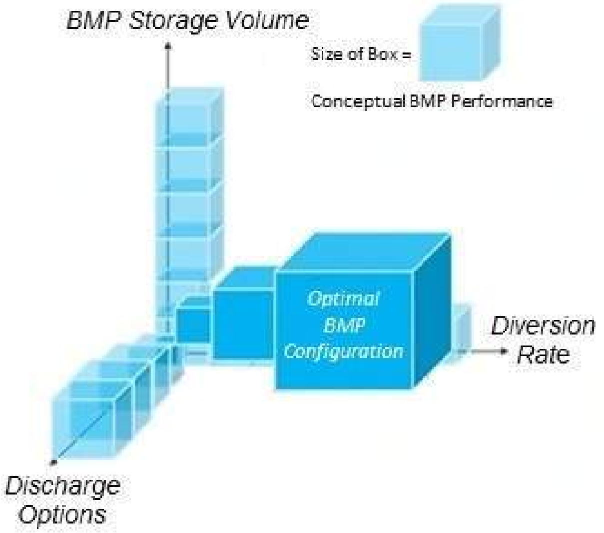


Figure 4. Conceptual illustration of optimization modeling balancing various design components to maximize performance.

The model setup for water quality simulation and optimization is complex, involving several modeling systems and iterative feedback from design engineers. The general methodology is discussed below, and the results are presented thereafter.

3.2 Preliminary Size and Diversion Optimization (SUSTAIN)

The first step of the modeling was to predict BMP performance for a range of potential BMP sizes, diversion points and inflow rates, and discharge alternatives. EPA's System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) model was used for this analysis because its built-in optimization algorithms automate the process of evaluating many different BMP configurations to select a cost-effective solution related to project goals. The model was run using 10 years of runoff and pollutant loading time-series data generated by the WMMS at an hourly time step. During this preliminary decision-support modeling, the discharge alternatives were simulated using certain site constraints to capture approximate BMP throughflow rates at the same time as varying the diversion rate and storage volume. These preliminary optimization model runs produced a point cloud from which the optimal cost-effectiveness curves were extracted. Subsequent targeted modeling then provided a clear decision pathway for the development of optimal project alternatives. Modeling efforts investigated the range of BMP configurations as detailed in the following subsections.

3.2.1 Diversion Rates

Model runs were limited to feasible diversion ranges for the proposed diversion point based on prior project knowledge related to the drainage area and potential project storage size. Diversion rates for the San Rafael BMP were modeled over the range of 10 to 30 cfs, varying in 5 cfs increments, to assess the most cost-effective configuration of diversion inflow rates.

3.2.2 Storage Volume

Site assessments and discussion with project stakeholders indicated an initial surface maximum storage volume of 2.7 ac-ft. These initial estimates for potential storage were developed assuming a ponding depth of 7 feet for surface storage. Modeling was carried out for a BMP storage ranging from 0.1 to 10.0 ac-ft by 0.1 ac-ft increments to assess trends in stormwater treatment efficiencies over a full range of storage sizes to identify points of diminishing return and ensure final recommendations accounted for the full potential treatment for the site.

3.2.3 Discharge Alternatives

The modeling evaluation identified two possible discharge scenarios that are evaluated for their water quality impacts: (1) infiltration into the subsoils, and (2) wetland settling and additional filtration prior to discharge back into the channel. Geotechnical investigations are awaiting completion, but initial assessments of the infiltration option were conducted assuming an infiltration rate of 0.89 in/hr that was found at a potential project site just across the Arroyo Seco from this project location. A treatment wetland system limits infiltration to maintain a wet pool, so infiltration rates will not impact the performance of this option. Both project options were additionally assessed with the addition of a filtration system at the outlet to increase water quality benefits and ensure adequate treatment. Filtration was modeled at 2.88 cfs and 5.76 cfs discharge rates to represent commonly available filtration devices and corresponding throughput efficiency.

One final option for discharge of captured runoff that was evaluated was discharge to the sanitary sewer. Sewer discharges are typically limited to flowrates that are comparable to filtration devices, but they are further constrained by allowable temporal discharge windows and rates (normally between 10pm to 8am daily) and only during dry weather (defined as 24-hours after any rainfall of greater than or equal to 0.1 in/hr). System capacity and discharge allowances are beyond the scope of this feasibility study, and additional coordination with the sewer purveyor is required during later stages of design to determine the available capacity and discharge rates if this option for the project is desired. A desktop analysis indicates that the closest sewer lines are located approximately 500 feet away at an elevation approximately 50 feet higher than the proposed project site on the east side of the Arroyo Seco (**Figure 5**). Due to this high topographic relief and the need to cross over Arroyo Seco to the nearest lines, the pursuit of sanitary sewer discharge is not recommended and is not further evaluated in this analysis.

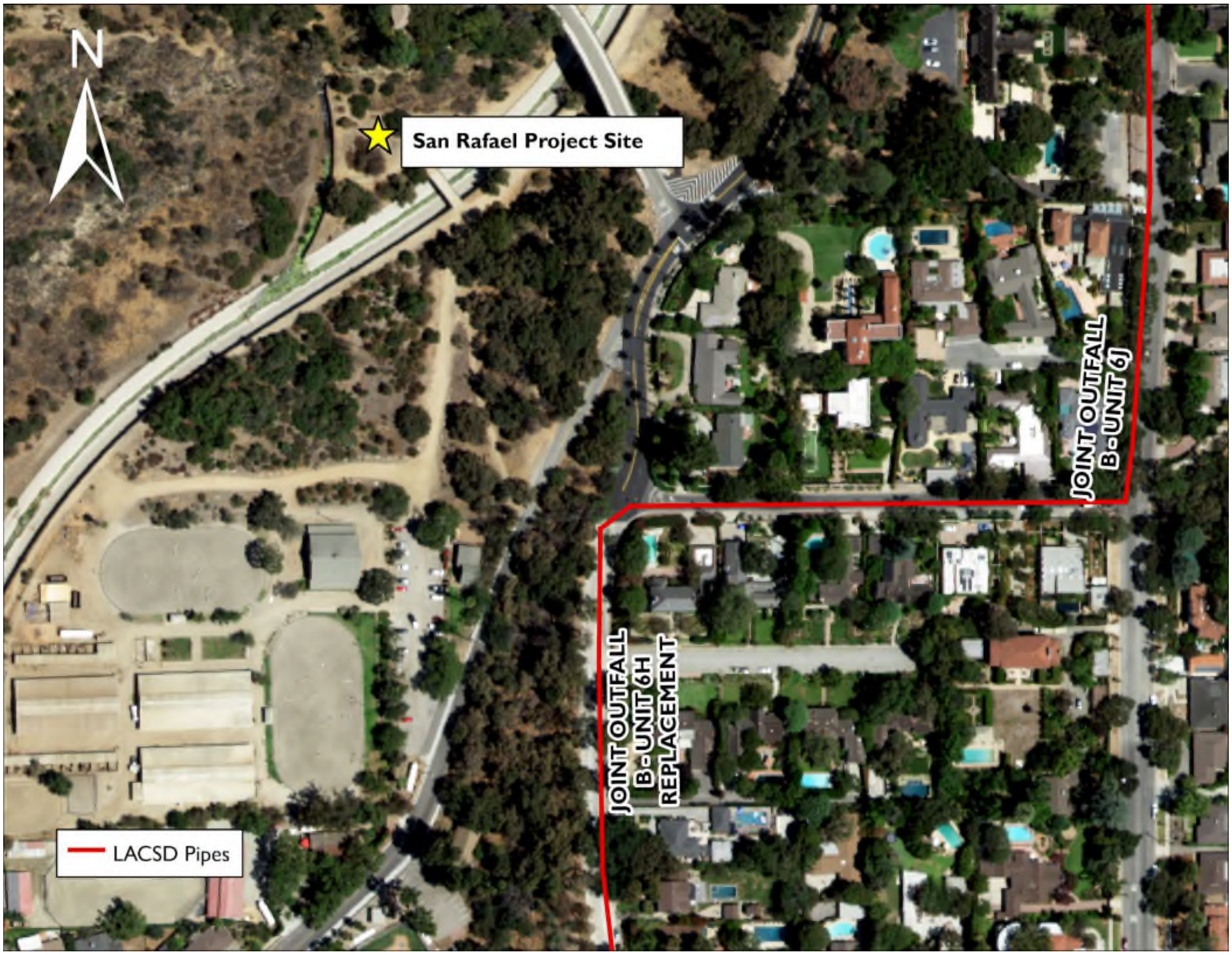


Figure 5. Sanitary sewer in the vicinity of San Rafael Treatment Wetlands.

3.2.4 Inflow Infrastructure

Diverted inflows can be conveyed to the storage BMP via gravity-fed pipes or by way of pumps. The two options have tradeoffs associated with costs that are typically defined by the invert depth of the storm drains at the diversion points and the BMP storage footprint. Gravity-fed inflows require the BMP to be sited deep enough underground for flows to move passively toward the storage. This is associated with excavation and stabilization costs that are determined by the storm drain invert and distance of the diversion. Pumped inflows allow the BMP to be sited vertically with minimal soil cover atop the storage, but these are associated with costs of pumping infrastructure, operation, and maintenance. At different sizes of a given BMP and site, pumping inflows may be more cost-effective than gravity-fed diversions, and vice versa. Because of this, all modeled configurations were assessed for both inflow types to determine the most cost-effective inflow configuration across modeled scenarios.

4.0 OPTIMIZATION MODELING RESULTS

The optimization analysis aimed to maximize the long-term pollutant load reduction and 85th percentile design storm volume capture by simultaneously varying the diversion rate, BMP size, and discharge rates related to options previously discussed. Each of these design features has an associated range of options that were modeled to assess alternatives against long-term water quality benefits and identify the most effective. Additionally, different configurations were paired with estimated planning level cost data to assess alternatives and options against each other to ultimately determine the best configuration for this site. By optimizing based on these variables, multiple pathways to achieve maximum water quality benefit were identified and the most cost-effective alternatives were determined. Different configuration alternatives and modeling parameters are presented below to demonstrate the cost-effectiveness associated with these options and narrow them down to a few key recommended project configurations that will meet different needs for the ULAR watershed and contribute to the goals of the EWMP.

4.1 BMP Type – Infiltration Basin vs Treatment Wetlands

The two possible alternatives evaluated for this site are a treatment wetland or an infiltration basin. Water quality benefits for the range of projects modeled for the design alternatives are presented in **Figure 5**. These alternatives were evaluated to determine the best options at the San Rafael site given the site-specific constraints. Results display the optimal front of the full range of projects modeled for each of the various BMP types. Based on the modeling results and the desire for groundwater recharge, an infiltration basin has an advantage in water quality benefit for all modeled project sizes compared to the treatment wetland. The addition of a filter shows only a slight added benefit for an infiltration basin, but a much greater benefit for the treatment wetland. This is discussed further in the next section.

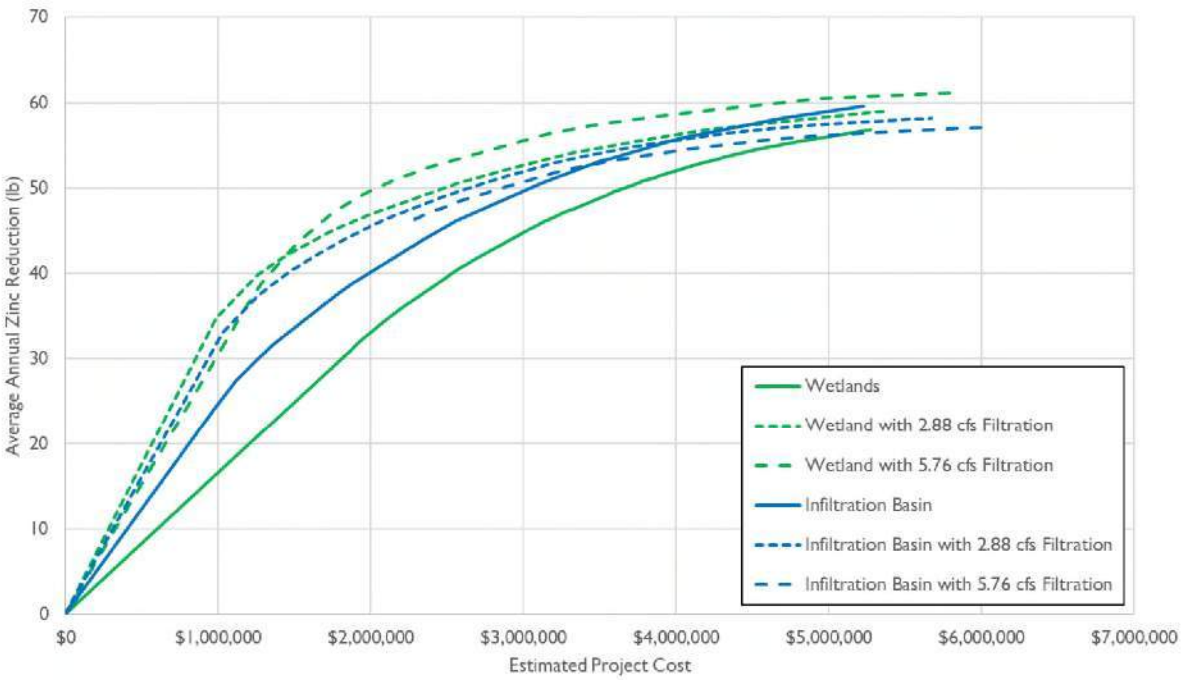


Figure 6. Infiltration BMP versus a Treatment Wetlands BMP

4.2 Filtration Recommendations

Pollutant removal performances can be increased with the addition of filtration units that clean and discharge the effluent stormwater into the Arroyo Seco. **Figure 7** demonstrates a comparison of both the infiltration basin and treatment wetlands with various filtration rates to identify the recommended filter quantities/rates. Based on the results, the inclusion of a single filter increases the overall performance substantially for the treatment wetland, but only slightly for the infiltration basin. This is related to the fact that infiltration of captured runoff provides complete pollutant removal, while filtration is associated with some remaining pollutant in discharged waters (though of acceptable standards). The treatment wetland is appreciably improved with the addition of filtration as a secondary treatment process for the BMP. In terms of level of filtration, the addition of a second filter unit that doubles the discharge rate has only a minimal impact for the added infrastructure cost and is not recommended to be pursued in the full site design.

Analysis of the optimal front of the project modeling allowed the selection of the most cost-effective configuration for each project option. These are summarized in **Table 2** and will be discussed further below.

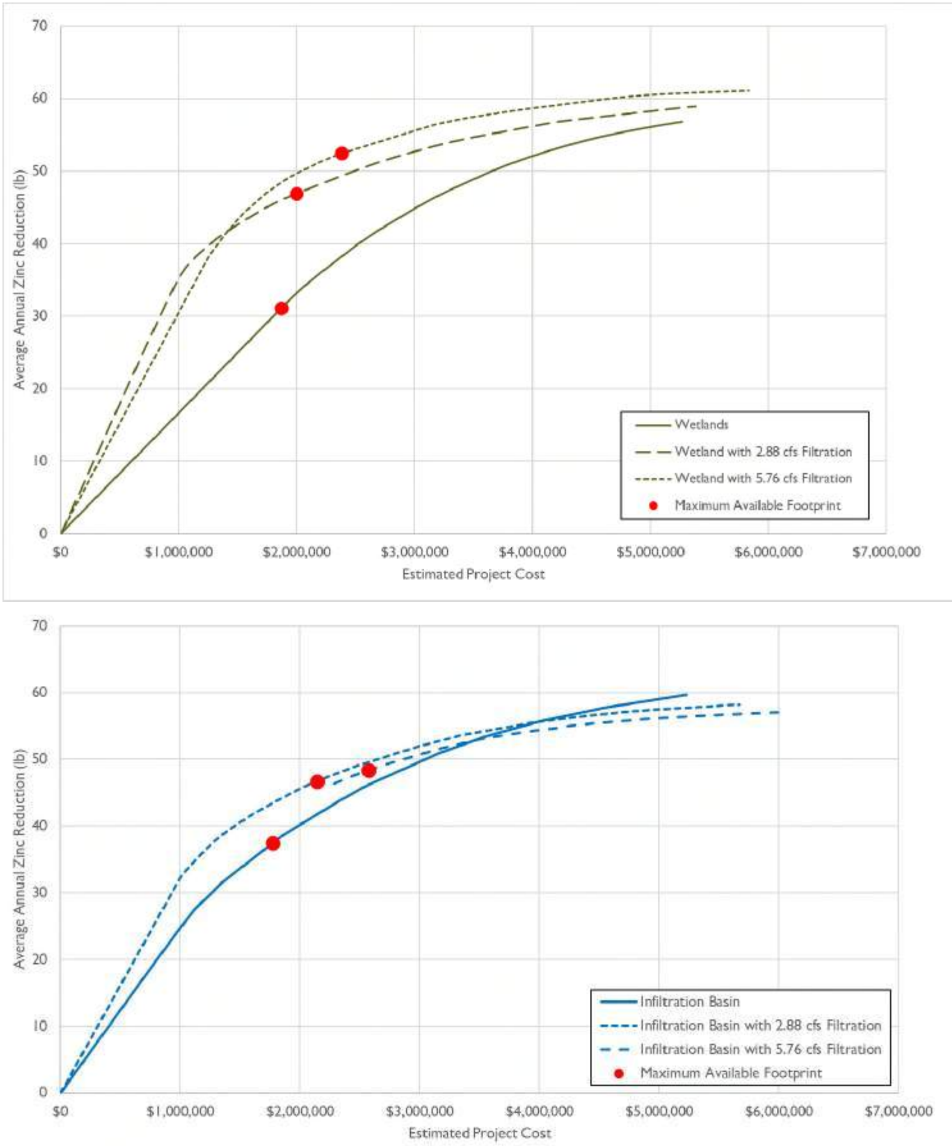


Figure 7. Filter flow rate/quantity comparison

Table 2. Summary of filtration project alternatives (maximum footprint).

Project Alternative	Planning Level Cost	Average Annual Zinc Reduction (lbs)	Unit Cost per Pound of Zinc Removal
Treatment Wetlands	$3,180,611	46.42	$68,518/ lb
Treatment Wetlands w/ 2.88 cfs Filter	$1,757,536	45.15	$38,927 / lb
Treatment Wetlands w/ 5.76 cfs Filter	$2,157,536	50.97	$42,330 / lb
Infiltration Basin	$2,557,379	46.11	$55,463 / lb
Infiltration Basin w/ 2.88 cfs Filter	$2,093,759	46.33	$45,192 / lb
Infiltration Basin w/ 5.76 cfs Filter	$2,382,484	47.10	$50,584 / lb

5.0 PROJECT ALTERNATIVES AND RECOMMENDATIONS

5.1 BMP Size Alternatives

The following BMP sizes and diversion rates are recommended based on different endpoints of design and with the range of performance that might be realized at San Rafael project site.

5.1.1 Most cost-effective BMP size for the San Rafael site

The most cost-effective BMP at San Rafael, given the footprint constraints of 0.3 acres, is a 2.6 ac-ft infiltration basin BMP with a gravity-fed diversion of 25 cfs from Project No. BI 0562, Line F (**Figure 8**). This BMP will utilize infiltration and supplemental 2.88 cfs filtration for discharge of captured stormwater to reduce approximately 71% of the average annual zinc load for the drainage area.

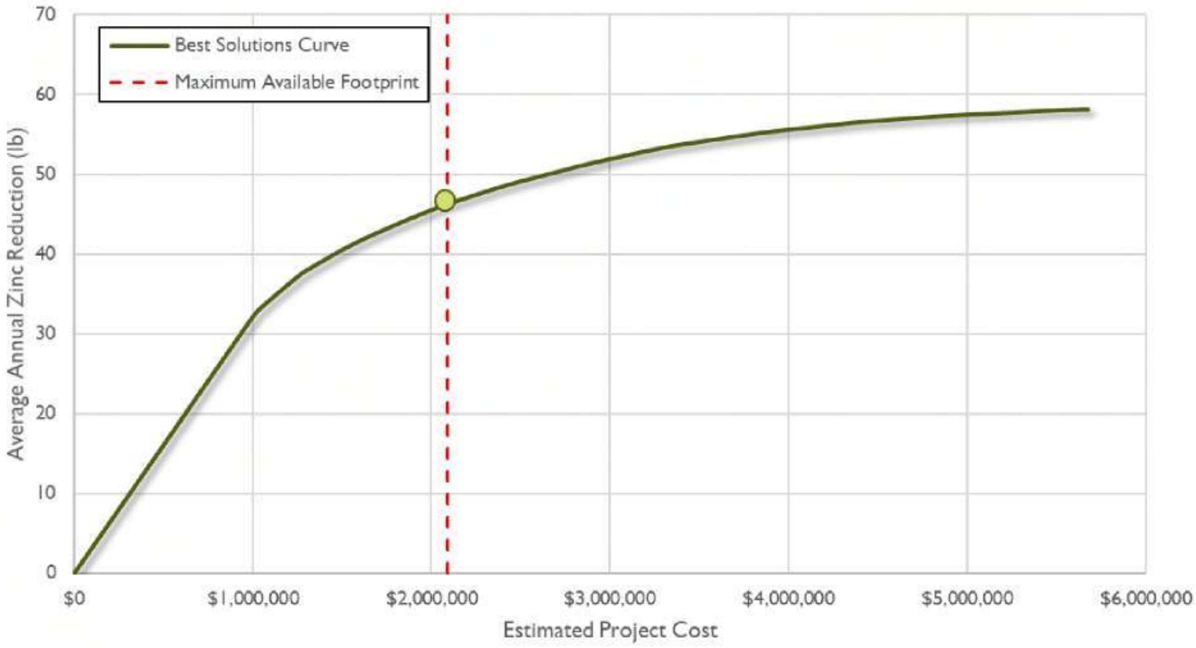


Figure 8. Model-based cost-effective project per footprint constraint recommendation for San Rafael Treatment Wetlands.

5.1.2 Capture of 85th percentile design storm

Based on the infiltration rate of 0.89 in/hr for this project, capture of the 85th percentile storm volume would necessitate a BMP with a diversion of at least 22 cfs and a storage volume of at least 18.3 ac-ft. This BMP is not feasible within the available footprint (2.7 ac-ft) and would be well beyond the point of diminishing returns for water quality benefit for this site based on long-term average annual load reductions.

5.1.3 Most multi-benefit BMP configuration

Based on the analysis above, the most multi-benefit BMP configuration is the utilization of the full available area on the east side of the creek with an infiltration basin that has the option to add to the storage volume through an expansion on the west side of the San Rafael Creek channel. A supplemental filtration unit can be included to

further the removal performance and **Table 3** summarizes the performance of this recommended configuration. The current recommended BMP is right sized for the drainage area and water quality loads while limiting the project to one area thus reducing costs and permitting time. Further study (incorporating forthcoming geotechnical investigation) will determine the optimal element sizing in terms of water supply consideration.

Table 3. Summary of recommended project configuration.

Project Alternative/BMP Type	Diversion Rate (cfs)	Total Storage Volume (ac-ft)	Planning Level Cost	Average Annual Zinc Reduction (lbs)
Infiltration Basin w/ 2.88 cfs filter	25	2.6	$2,093,759	46.33

ATTACHMENT G: OGALS PROPOSITION 68 GRANT CORRESPONDENCE

July 20, 2020

Rosa Laveaga, Landscape Architect
Arroyo Seco Project Supervisor
City of Pasadena, Public Works Engineering Dept.
P.O Box 7115
Pasadena, CA 91109-7115

Sent via Email Only
rlaveaga@cityofpasadena.net

Re: Proposition 68 - Arroyo Seco - San Rafael Treatment Wetlands Project (Project)

Dear Rosa Laveaga:

As you know, the State Budget Act of 2019-20 [Item 3790-101-6088 (2)2(c)] allocated $3,500,000 for Arroyo Seco Water Reuse and Natural Stream Restoration from the Proposition 68 Urban Counties Per Capita Program. On September 20, 2019, Office of Grants and Local Services (OGALS) staff met with you and City of Pasadena (Pasadena) staff, in addition to City of South Pasadena (South Pasadena) staff, to discuss this grant opportunity and review the "Urban Counties Per Capita Program Arroyo Seco Procedural Guide" (Guide). Since the Budget Act did not identify a grant recipient, OGALS encouraged Pasadena and South Pasadena to work together to determine the best approach for fulfilling the budget intent.

Since our September 2019 meeting, OGALS received a draft Memorandum of Understanding (MOU) between Pasadena and South Pasadena that outlines the proposed responsibilities for each agency for the Project. OGALS understands that Pasadena will serve as the grantee. As grantee, Pasadena will agree to all provisions of the grant contract and will submit a complete application, payment requests and the final Project close-out documentation as required in the Guide.

South Pasadena will be responsible for providing necessary reporting documentation to Pasadena. Both agencies will provide match and any additional required funds, as well as access to the Project site during construction. Section 4 of the MOU states the term of the MOU starts from the date each agency signs the MOU and continues until the Project is complete and the final payment is received. Currently, the draft MOU does not address long term maintenance and operation of the improvements at the Arroyo Seco; therefore, the MOU will need to be modified to reflect these long-term requirements.

As a reminder, the grant contract requires that the Project remain open to the public and maintained for a period of thirty years. Further, a deed restriction must be placed on the Project property before OGALS can process reimbursement payments. Therefore, once the grant contract is fully executed, Pasadena will need to file a deed restriction on the portions of the Project property that it owns.

Concurrently, OGALS will provide South Pasadena with a customized contract that contains provisions pertaining to the thirty-year contract performance period and the deed restriction requirement. Once the customized contract is fully executed, South Pasadena will then file a deed restriction on the portions of the Project property that it owns. Both deed restrictions (on Pasadena property and South Pasadena property) will need to be recorded prior to OGALS issuing any grant payments to Pasadena.

As reference, OGALS and Pasadena must execute the grant contract before the June 30, 2022 encumbrance date. The Project must be complete by March 31, 2024 to allow time for a final site inspection and processing of the final payment before the June 30, 2024 liquidation date.

OGALS looks forward to working with Pasadena to ensure a successful Project outcome. If you have questions or need further assistance, please contact Project Officer, Stephanie Schiechl at (916) 651-8580 or Stephanie.Schiechl@parks.ca.gov.

Sincerely,

Jean a. Lacher

Jean Lacher, Chief
Office of Grants and Local Services

cc: Kristine Courdy, Deputy Director, Public Works Department,
City of South Pasadena, kcourdy@southpasadenaca.gov
Lee Butterfield, Manager, Office of Grants and Local Services
Jana Clarke, Supervisor, Office of Grants and Local Services
Stephanie Schiechl, Project Officer, Office of Grants and Local Services

ATTACHMENT H: COMMUNITY SUPPORT LETTERS

ARROYO SECO FOUNDATION

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

I am pleased to submit this letter of support to you on behalf of the Arroyo Seco Foundation (ASF) for the joint project submittal by the Cities of Pasadena and South Pasadena for funding under the Safe Clean Water Program Call for Projects for Fiscal Year 2021-22. T**he Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project** will advance important stormwater and water quality goals in one of the region's primary and most historical natural open spaces, the Arroyo Seco. The project area involves the Arroyo Seco stream, a vital tributary of the Los Angeles River, and San Rafael Creek. This is an important project to restore a key reach of the stream and flood plain in the Arroyo Seco Watershed.

ASF has a thirty-year record of working to restore and enhance stream and habitat conditions in the Arroyo Seco. In the 1990s ASF initiated the low-flow stream restoration project in the Lower Arroyo about half a mile above the sites now being considered in this application. Later in 2008 ASF led the award-winning Central Arroyo Stream Restoration program that brought back native Arroyo chub to the stream near the Rose Bowl. More recently we have worked with the City of Pasadena as the co-sponsor of the widely praised Berkshire Creek Restoration Program in Hahamongna Watershed Park that was completed earlier this year. In each of these major projects, we partnered with the City of Pasadena. Now we look forward to also collaborating with the City of South Pasadena. ASF's goal is to restore as much as possible of the natural hydrology and habitat of the Arroyo Seco, while improving water resources, flood protection and recreation in the watershed.

ASF is pleased that this project will improve water quality and conservation in the Arroyo Seco by capturing and treating stormwater flows in San Rafael Creek and the Arroyo Seco channel on public parcels in the Cities of Pasadena and South Pasadena. It will also contribute to important regional efforts underway by several agencies for the revitalization of the Upper Los Angeles River and Tributaries. We will work with the project partners to ensure that the project will emphasize the nature-based solutions that the Safe Clean Water Program calls for. We also support the educational and community-involvement tasks that that will enhance the benefits to the local communities and ensure project success.

PO Box 91622, Pasadena, CA 91109-1622 (323) 405-7326 www.arroyoseco.org

The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project is a major opportunity to continue local progress to achieve pollutant load reductions and stormwater capture by the Cities of Pasadena and South Pasadena. The project will intercept a sizeable portion of the stormwater flows from San Rafael Creek and the Arroyo Seco Channel, which are both managed by the Los Angeles County Flood Control District. A treatment wetland and recharge basin at the confluence of San Rafael Creek and the Arroyo Seco and another in South Pasadena will capture, treat, and infiltrate runoff. The wetland and treatment facilities will be designed to also ensure adequate flood protection. The adjacent areas will be improved with a habitat restoration program.

In the South Pasadena stretch, care will be taken to remove invasive species and improve the wetlands and riparian values of a streamside stretch of land where the historic Garfias stream joined the Arroyo Seco.

There is a long tradition in our region of community involvement and support for protecting and restoring the natural hydrology and habitat of the Arroyo Seco stream and watershed. The Arroyo Seco Watershed Restoration Feasibility Program, prepared by ASF and North East Trees for two state agencies in 2002, specifies the guidelines for nature-based solutions similar to those contained in the Safe Clean Water Program guidelines. The restoration of San Rafael Creek to a healthy condition is a project recommended in the adopted Master Plan for the Arroyo Seco adopted by the Pasadena City Council in 2003, which guides the planning, preservation and enhancement of this environmental treasure in Pasadena.

Safe Clean Water Program funding for this project will promote regional collaboration and be a very important step in the planning and management of the Arroyo Seco flood plain and stream zone. It will implement a long-standing recommended project from Pasadena's Arroyo Seco Master Plan that will have significant water quality benefits. This funding would assist in paying for the planning, design, preparation of construction documents, preparation of the appropriate CEQA document, completion of various important technical studies, and regulatory permits for the rehabilitation of this area. It would result in a "shovel ready project" for which $3.5 million in implementation funding is already in place.

The Arroyo Seco Foundation strongly supports the proposal by the two cities to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and watershed. We urge you to provide the requested funding of $3.5 million for this important project.

Thank you for your consideration of **The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project**. Please let me know if we can provide any further information to assist you in your decision-making process.

Sincerely,

Tim Brick

Tim Brick
Managing Director
(626) 639-4092

October 13, 2020

Mr. Brent Maue, Assistant City Engineer
City of Pasadena, Department of Public Works
100 N Garfield Avenue
Pasadena, CA 91101

Safe Clean Water Program

RE: Letter of Support for the City of Pasadena's San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project under the Upper Los Angeles Enhanced Watershed Management Plan

Dear Watershed Area Steering Committee:

The Upper Los Angeles Watershed Management Group (ULAR WMG) would like to express our support of the City of Pasadena's San Rafael/San Pascual Treatment Wetlands Stormwater Capture Project (Project) and their collaborative application with the City of South Pasadena for Measure W grant funding. The proposed Project seeks to improve water quality discharged to the San Rafael Creek through capture, infiltration, groundwater basin recharge and restoration of natural streambed processes, improving the water quality of the Arroyo Seco and the Los Angeles River, and tailored to meet our compliance efforts as detailed in the Upper Los Angeles River (ULAR) Enhanced Watershed Management Program (EWMP). In addition, this multi-benefit Project will incorporate nature-based solutions—such as new recreational walking paths, native landscaping, and natural treatment wetlands—creating vital aquatic habitat, community enhancement, and public outreach and educational opportunities.

The ULAR EWMP was developed with the intention of utilizing a multi-pollutant approach that maximizes the retention and use of urban runoff as a resource for groundwater recharge and irrigation, while also creating additional benefits for the communities in the ULAR watershed through a combination "toolbox" of Distributed and Regional Stormwater Projects to address applicable stormwater quality regulations. One of the original eight Regional Projects identified in the EWMP model, the Lower Arroyo Park, was deemed infeasible and eliminated in 2017. The proposed Project resurrects and re-envisions that concept, targeting pollutants from two LA River tributary watershed areas (641561 and 641580)—that require priority load reductions of 9 and 36%, respectively—to meet the compliance targets through capture and treatment of over ten times the required volume (26 AF), exceeding the final bacteria and metals compliance goals, and eliminating all of the regional and distributed BMP requirements in these collective jurisheds. Further, by mitigating the dry weather flows from the San Rafael Creek, Pasadena is satisfying their commitment to address their high priority non-stormwater outfall through structural controls as outlined in the Segment B Tributary Load Reduction Strategy (LRS) Report submitted and approved by the Regional Board. As such, the San Rafael/San Pascual

Treatment Wetlands Stormwater Capture Park Project is an identified and crucial Regional Project of the ULAR EWMP Implementation Plan, helping us to achieve our Recipe for Final EWMP Compliance as detailed in Appendix 7.A.60 and .75 and the subsequent LRS Report.

By December 2017, the Participating Agencies of the ULAR EWMP, including the County of Los Angeles (County) and the Los Angeles County Flood Control District (LACFCD), were required to satisfy a 31% interim EWMP milestone. This interim milestone specified that each jurisdiction implement Best Management Practices (BMPs) to manage a specific capture volume under the Reasonable Assurance Analysis (RAA) storm condition for each receiving water. The San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project is located adjacent to—and intercepts flows—that would otherwise flow to the Arroyo Seco. To date, the City of Los Angeles (City), the City of Pasadena, and Unincorporated County have achieved 2.59 of the collective 12.08 AF volume required to achieve their interim targets through structural controls and LID efforts. The Project's additional 6.5 AF design volume capture will allow Pasadena to meet and exceed their 2017 6.93 AF target milestone allowing them to come into full compliance, in addition to assisting their partnering Agencies (City and County) in moving forward towards satisfying their required volume managed.

The ULAR EWMP Watershed Management Group (WMG) recognizes the need and value of prioritizing stormwater projects within our ULAR Watershed Management Area (WMA). As such, as the ULAR Watershed Lead—on behalf of the ULAR WMG—we offer our full support to the Cities of Pasadena and South Pasadena in their efforts to obtain Measure W Round 2 grant funding for their San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project. We are confident that this Project will help to restore the water quality and beneficial uses of the Arroyo Seco—and downstream LA River—satisfying interim compliance milestones—and contributing towards the long term compliance efforts of the ULAR EWMP.

Sincerely,

Dawn Petschauer

Dawn Petschauer
Upper LA River Watershed Lead
On behalf of the ULAR EWMP WMG

cc: Kris Markarian, City of Pasadena
Brent Maue, City of Pasadena
Sean Singletary, City of Pasadena
Julian Lee, City of South Pasadena
Alfredo Magallanes, City of Los Angeles, LASAN

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

The West Pasadena Residents' Association represents over 7,000 households in Southwest Pasadena, almost all of which are within a few blocks of the Arroyo Seco, and many of which are also adjacent to San Rafael Creek. WPRA and its neighborhoods are acutely aware of and interested in the Arroyo Seco's condition and maintenance.

WPRA supports the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project joint project submittal by the cities of Pasadena and South Pasadena under the Los Angeles County Flood Control District (LACFCD) Measure 'W' Program, and by the City of Pasadena for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22 to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and flood plain. **We also urge approval of the additional requested funding of $3.5 million** for this important project.

The project will treat stormwater inflow from the Arroyo Seco channel on public parcels in the City of Pasadena and South Pasadena. It will also contribute to the regional efforts underway by several agencies for the Upper Los Angeles River.

It will include two regional stormwater capture and treatment facilities consisting of surface infiltration facilities, as well as educational and wayfinding signage and viewing areas for recreational purposes. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels.

The community and a long list of stakeholders, both public and private, have worked tirelessly over many years to establish a vision for the future of the Arroyo Seco. The Arroyo Seco Master Plan was adopted by the Pasadena City Council in 2003 and continues to be the roadmap for the planning, preservation and enhancement of this unique gem in our cities. The project to restore San Rafael Creek to a healthy condition is recommended in the adopted Master Plan.

WPRA looks forward to the approval of this submittal and to being involved in the development and public engagement for this important project.

Respectfully,

Dan Beal
President
For the Board of Directors

cc: Steve Madison, Councilmember, District 6
Takako Suzuki, Field Deputy, District 6
Steve Mermell, City Manager
Ara Maloyan, Public Works Director

WEST PASADENA RESIDENTS' ASSOCIATION
POST OFFICE BOX 50252 ▪ PASADENA, CA 91115

SIERRA CLUB
FOUNDED 1892

Pasadena Group

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

We forward this letter of support to you on behalf of Sierra Club for the joint project submittal by the cities of Pasadena and South Pasadena under the Los Angeles County Flood Control District (LACFCD) Measure 'W' Program. We understand the City of Pasadena is submitting this project for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22. The project, identified as **the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project,** will advance important planning efforts within one of the region's primary and most historic natural open spaces, the Arroyo Seco. The project area involves the Arroyo Seco stream, a significant tributary of the Los Angeles River. We find it to be a truly important project to restore this reach of the flood plain within the Arroyo Seco Watershed.

The Sierra Club Pasadena Group, which includes both Pasadena and South Pasadena, has for many years conducted public hikes along the Lower Arroyo Seco at or near the proposed project's site, during which we point out and explain to hikers the many features of the Arroyo Seco and adjacent areas. Both Don Bremner and Virginia Heringer have led these Lower Arroyo hikes, and Virginia Heringer has led hikers there as chair of the Sierra Club's Natural Science Section. Incidentally, our online monthly newsletter is entitled "Arroyo View."

Our organization is not only supportive that the proposed project will treat stormwater inflow from the Arroyo Seco channel on public parcels in Pasadena and South Pasadena but also contribute to the regional positive efforts underway by several agencies for the Upper Los Angeles River. As the project has been explained to us, we understand that it will include two regional stormwater capture and treatment facilities consisting of surface infiltration facilities. Also included will be educational and wayfinding signage and viewing areas for recreational purposes.

We anticipate that the project will be discussed in detail in various forums, from community groups to the City Council and its committees. We will follow those discussions and perhaps participate in them.

The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project is a major opportunity to continue the progress in the region to achieve pollutant load reductions by the cities of Pasadena and South Pasadena. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels that are both managed by the LACFCD. A treatment wetland and recharge basin system are proposed adjacent to the Arroyo Seco channel to capture, treat, and infiltrate stormwater from the diverted drainage channel. The proposed diversions will both consist of a drop inlet structure with a rubber dam placed in the Arroyo Seco to ensure that the storm drain will continue to accommodate the existing flood control drainage capacity.

The community and a long list of stakeholders, both public and private, have worked over many years to establish a vision for the future of the Arroyo Seco and its visitors. The Arroyo Seco Master Plan was adopted by the Pasadena City Council in 2003 and continues to be the roadmap for the planning, preservation and enhancement of this unique gem in our cities. The project to restore San Rafael Creek to a healthy condition is a project recommended in the adopted Master Plan for the Arroyo Seco in Pasadena.

This funding opportunity would allow for a very critical step in the planning and management of the Arroyo Seco flood plain and stream zone as well as implement a long-standing recommended project from Pasadena's Arroyo Seco Master Plan. It is our understanding that if awarded, this grant funding would assist in paying for the planning, design, preparation of construction documents, preparation of the appropriate CEQA document, completion of various important technical studies, and regulatory permits for the rehabilitation of this area, and would result in a "shovel ready project" for which $3.5 million in funding for implementation is already in place.

Our organization supports the proposal by the two cities to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and flood plain. We urge you to provide the additional requested funding of $3.5 million for this important project.

Thank you for your consideration to fund **The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project** in the cities of Pasadena and South Pasadena and for the opportunity to show our complete support for this important project. If our organization can provide any further information, please feel free to contact us.

Best regards,

Virginia Heringer

Virginia Heringer
Sierra Club Pasadena Group Chair

Don Bremner

Don Bremner
Sierra Club Pasadena Group Conservation Chair and Outings Co-Chair
Former member of City of Pasadena Recreation and Parks Commission

October 15, 2020

City of South Pasadena
1414 Mission Street
South Pasadena, CA 91030
Attn: Mr. Julian Lee, Deputy Public Works Director

ARROYO SECO – SAN RAFAEL TREATMENT WETLANDS PROJECT
LETTER OF SUPPORT

Dear Mr. Lee:

We would like to express our support for the Arroyo Seco – San Rafael Treatment Wetlands Project in the Cities of Pasadena and South Pasadena. This Project will improve stormwater quality by intercepting pollutant-laden stormwater and urban runoff pollutants from the San Rafael Creek and from the Arroyo Seco Channel with adjacent treatment basins/wetlands. The enhancement of these areas and the use of native habitat will provide an opportunity to connect the community with the natural environment and the historic Arroyo Seco Channel.

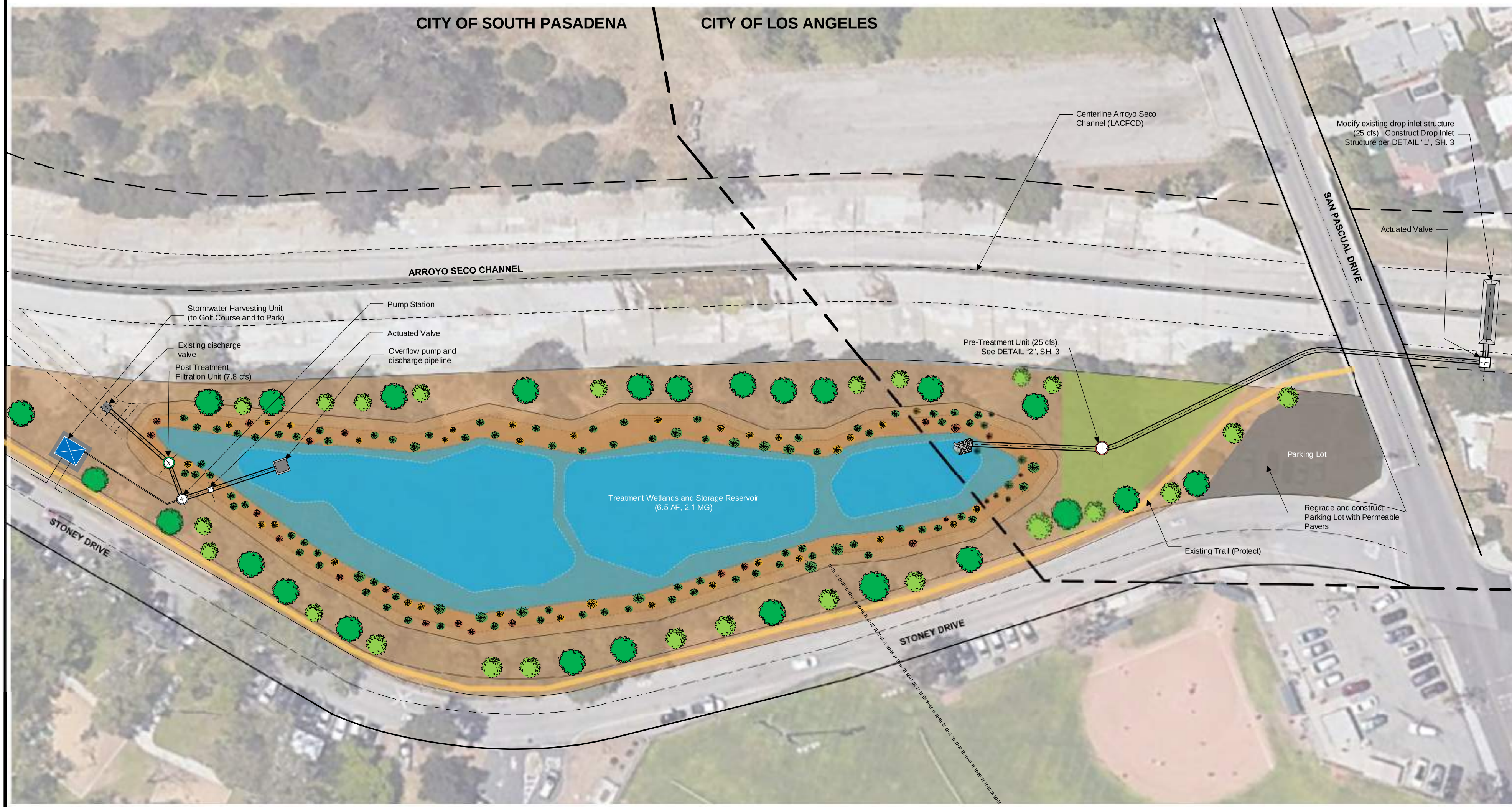
We welcome the opportunity for San Pascual Stables to participate in this Project with the City of Pasadena and South Pasadena and look forward its development.

If you have any questions, please contact David Sterckx , Managing partner, at (310)666-1060 or via email at davidsterckx@sanpascualstables.com.

Sincerely,

D. Sterckx
Managing partner

ATTACHMENT I: MODELING DETAILS



PLAN

Scale: 1" = 40'-0"

0 ft. 24 ft. 40 ft. 80 ft.

DATE	MK	DESCRIPTION
REVISIONS		

craftwater engineering, inc.

PROJ. NO. 20012-ULARSRFS

DESIGNER O. GALANG

DRAFTER O. GALANG

CHECKER C. HELMLE

PRELIMINARY CONCEPTUAL DESIGN

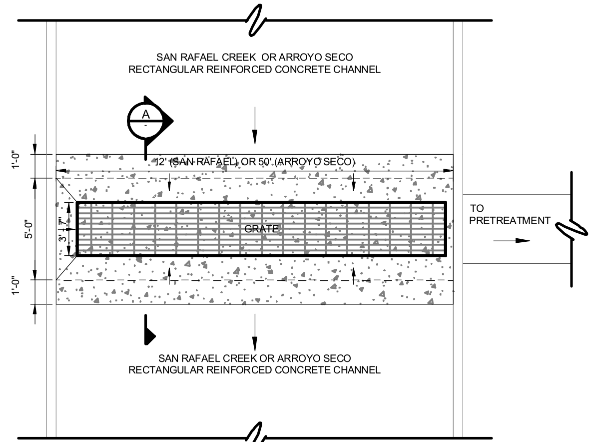
CITY OF SOUTH PASADENA PUBLIC WORKS DEPARTMENT

ARROYO SECO – SAN RAFAEL TREATMENT WETLANDS PROJECT

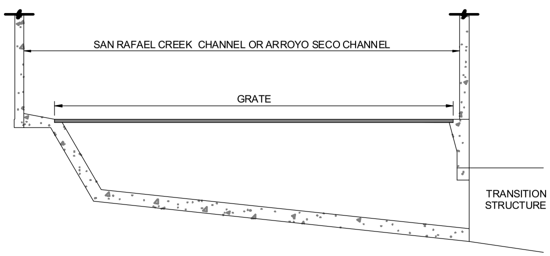
REGIONAL STORMWATER CAPTURE PROJECT

ARROYO SECO (SAN PASCUAL) SITE PLAN
GENERAL SITE PLAN

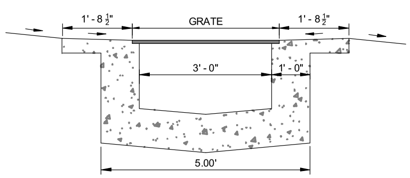
SHEET 2 OF 3



PLAN VIEW
N.T.S.

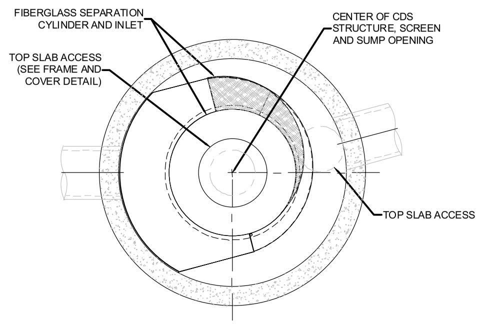


PROFILE VIEW
N.T.S.

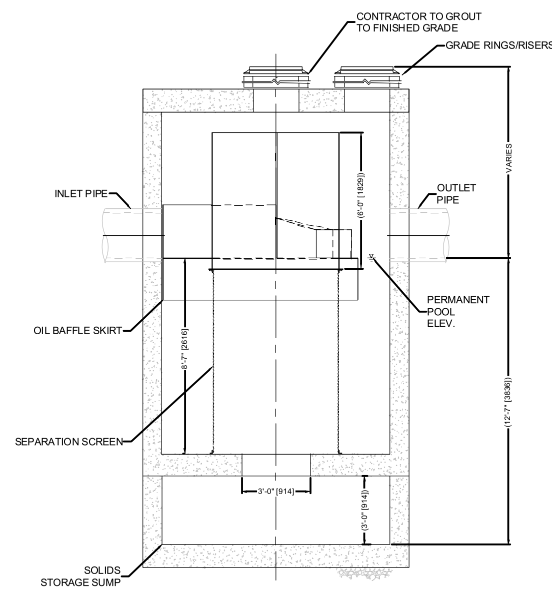


SECTION 'A-A'
N.T.S.

1 DIVERSION STRUCTURE
NTS



PLAN VIEW B-B
N.T.S.



2 PRETREATMENT CDS UNIT
NTS

PRELIMINARY 10% DESIGN

NO.	REVISIONS	REVISED BY	APPROVED BY	DATE

DESIGNER:
C. SEMLOW
DRAFTER:
C. SEMLOW
CHECKER:
O. GALANG

CITIES OF PASADENA AND SOUTH PASADENA, CALIFORNIA

ARROYO SECO-SAN RAFAEL TREATMENT WETLANDS PROJECT
REGIONAL STORMWATER CAPTURE PROJECT

DETAILS

DWG.XXXXXXXXXX

SHEET 3 OF XX

ATTACHMENT C: ENGINEER’S 10% COST ESTIMATE

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client: **City of Pasadena/City of South Pasadena**
Project: **Arroyo Seco-San Rafael Treatment Wetlands**
Status: **10% Cost Estimate**

Prepared by: **MMT**
Checked by: **OG**
Date **10/14/2020**

Description	Qty	Unit	Unit Price	Total
Miscellaneous				**$316,655**
Mobilization / Demobilization (5% of Costs)	1	LS	$316,655.00	$316,655
Channel Diversion and Pretreatment				**$777,976**
Temporary Diversion	2	EA	$20,000.00	$40,000
Drop Inlet w/ Grate	2	EA	$50,000.00	$100,000
Rubber Dam	1	EA	$195,000.00	$195,000
Actuated Valve and Structure	3	EA	$25,000.00	$75,000
Pretreatment Device (25 CFS) (Includes excavation & shoring)	2	EA	$85,000.00	$170,000
Manhole (4' I.D. x 5' Depth) (Includes excavation & shoring)	1	EA	$7,500.00	$7,500
Manhole (4' I.D. x 8' Depth) (Includes excavation & shoring)	1	EA	$10,000.00	$10,000
Piping (30" RCP) to wet well (Includes excavation & shoring)	435	LF	$360.00	$156,600
Backfill and Compaction for Piping Base (crushed aggregate)	226	CY	$46.00	$10,376
Flap Gate	1	EA	$4,000.00	$4,000
Bioswale	950	SF	$10.00	$9,500
Site Preparation and Demolition - Existing Area				**$211,250**
Clear and Grub	92,500	SF	$0.50	$46,250
Tree Removal	110	EA	$1,500.00	$165,000
Treatment Wetland & Recharge Ponds (9.1 AF)				**$536,250**
Grading	7,695	CY	$15.00	$115,425
Backfill and Compaction	45	CY	$25.00	$1,125
Hauling	7,650	CY	$28.00	$214,200
Piping (12" RCP) dry weather connection (Includes excavation & shoring)	50	LF	$200.00	$10,000
Wetland Plastic Liner (30 mil)	8,350	SY	$20.00	$167,000
Outfall Overflow Structure	2	EA	$5,500.00	$11,000
Piping (18" RCP) to Outfall (Includes excavation & shoring)	70	LF	$250.00	$17,500
Wet Well and Conveyance				**$1,168,500**
Wet Well Installation (Includes excavation & shoring)	1	LS	$50,000.00	$50,000
Submersible Pumps and Valves (5.76 cfs)	1	LS	$200,000.00	$200,000
12" DIP to Irrigation Filter (Includes excavation & shoring)	30	LF	$200.00	$6,000
18" RCP to Outfall Filter (Includes excavation & shoring)	50	LF	$250.00	$12,500
Treatment Filter Unit (2.76 cfs)	3	EA	$300,000.00	$900,000
Stormwater Havesting Unit	1	EA	$500,000.00	$500,000

ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COSTS

Client: **City of Pasadena/City of South Pasadena**
Project: **Arroyo Seco-San Rafael Treatment Wetlands**
Status: **10% Cost Estimate**

Prepared by: **MMT**
Checked by: **OG**
Date **10/14/2020**

Description	Qty	Unit	Unit Price	Total
Electrical Service, Controls, Instrumentation				**$322,000**
Electrical Service	1	LS	$60,000.00	$60,000
Control Panel and PLC Programming	1	LS	$80,000.00	$80,000
Conduit & Wiring	1	LS	$100,000.00	$100,000
NEMA 4 Junction Box, 6"x6"x6" (1 each for 480V and 120V conduits)	6	EA	$2,000.00	$12,000
Misc. Conduit Fittings, Elbows, Core Drilling and Sealing, etc.	1	LS	$25,000.00	$25,000
Instrumentation	1	LS	$45,000.00	$45,000
Landscape and Irrigation Modifications				**$438,750**
Tree Replacement	75	EA	$2,500.00	$187,500
Shrubs, Perennials, and Grasses	92,500	SF	$2.50	$231,250
90-Day Plant Establishment Period	1	LS	$20,000.00	$20,000
Site Amenities and Improvements				**$825,300**
Decomposed Granite Path	4,800	SF	$10.00	$48,000
Lodgepole Fencing	1,050	LF	$26.00	$27,300
Channel Slab (18'W x 190'L)	1	EA	$750,000.00	$750,000
Start-up, Testing, Prepare Operations & Maintenance Manuals, and Prepare Record Drawings				**$94,500**
SWPPP Implementation	1	LS	$40,000.00	$40,000
Start-up and Testing	1	LS	$46,500.00	$46,500
O&M Manuals	1	LS	$4,000.00	$4,000
Record Drawings	1	LS	$4,000.00	$4,000
SUBTOTAL				**$4,691,181**
			35% Contingency	$1,641,914
			Total Construction Costs	**$6,333,095**
	GRAND TOTAL			**$6,333,095**

craft water engineering, inc.

Client: **City of Pasadena/City of South Pasadena**
Project: **Arroyo Seco-San Rafael Treatment Wetlands**
Status: **10% Cost Estimate**

Prepared by: **MMT**
Checked by: **OG**
Date **10/14/2020**

Description	Qty	Unit	Unit Price	Total

Assumptions and Exclusions

1 This is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.
2 The unit cost data is derived from inhouse sources, recent bids on similar construction, and RSMeans current construction cost data.
3 This opinion of cost is based on the project program and plans made available at the time of preparation.
4 Material prices are based on current quotations and do not include escalation.
5 This opinion of cost assumes that all improvements will be constructed at one time.
6 Quantity take offs were performed when possible and parametric estimates and allowances are used for items that cannot be quantified at this stage of the design.
7 This opinion has been based on a competitive open bid situation with a recommended 5 - 7 bonafide reputable bids from general contractors and a minimum of 3 bidders for all items of subcontracted work.
8 All unit costs take into account sales tax, general conditions, bonding and insurance, and subcontractor and general contractor overhead and profit.
9 Where applicable, unit costs include the cost of freight.

The following are excluded:

1 Environmental clearances and permits
2 Hazardous spoil disposal, if encountered
3 Property and Right of Way acquisition or easements
4 Legal and accounting fees
5 Plan check, building permit fees
6 Utility Connection Fees
7 Testing and inspection
8 Fire and all risk insurance
9 Removal of unforeseen underground obstructions
10 Relocation of unforeseen subsurface utilities
11 Signage and wayfinding
12 Additional fill or import
13 Loose furniture and equipment
14 Utility connection fees
15 Tel/data system
16 Construction contingency
17 Work done after business hours
18 Design, engineering and consulting fees other than those specifically listed in the above estimate

Items that may affect the cost estimate:

1 Modifications to the scope of work included in this estimate
2 Unforeseen sub-surface conditions
3 Restrictive technical specifications or excessive contract conditions
4 Any other non-competitive bid situations
5 Bids delayed beyond the projected schedule

Client:	**City of Pasadena/City of South Pasadena**	Prepared by:	**MMT**
Project:	**Arroyo Seco-San Rafael Treatment Wetlands**	Checked by:	**OG**
Status:	**10% Cost Estimate**	Date:	**10/14/2020**

Description	Total
Miscellaneous	**$316,655**
Channel Diversion and Pretreatment	**$777,976**
Site Preparation and Demolition - Existing Park Area	**$211,250**
Storage	**$536,250**
Wet Well and Conveyance	**$1,168,500**
Electrical Service, Controls, Instrumentation	**$322,000**
Landscape and Irrigation Modifications	**$438,750**
Site Amenities and Improvements	**$825,300**
Start-up, Testing, Prepare Operations & Maintenance Manuals, and Prepare Record Drawings	**$94,500**
SUBTOTAL	**$4,691,181**
35% Contingency	$1,641,914
Total Construction Costs	**$6,333,095**
Pre-Design, Design, and Construction Support (15%)	$949,964
Community Outreach during Design	$50,000
Environmental Planning and Permitting (2%)	$126,662
Agency Project Management (2.5%)	$158,327
Construction Management (10% of construction)	$633,309
Construction Surveying	$20,000
Total Soft Costs	**$1,938,263**
GRAND TOTAL	**$8,271,357**

Assumptions and Exclusions

1 This is a rough order of magnitude preliminary opinion of probable construction costs only. Actual costs may vary.
2 The unit cost data is derived from inhouse sources, recent bids on similar construction, and RS Means current construction cost data.
3 This opinion of cost is based on the project program and plans made available at the time of preparation.
4 Material prices are based on current quotations and do not include escalation.
5 This opinion of cost assumes that all improvements will be constructed at one time.
6 Quantity take offs were performed when possible and parametric estimates and allowances are used for items that cannot be quantified at this stage of the design.
7 This opinion has been based on a competitive open bid situation with a recommended 5 - 7 bonafide reputable bids from general contractors and a minimum of 3 bidders for all items of subcontracted work.
8 All unit costs take into account sales tax, general conditions, bonding and insurance, and subcontractor and general contractor overhead and profit.
9 Where applicable, unit costs include the cost of freight.

The following are excluded:

1 Environmental clearances and permits
2 Hazardous spoil disposal, if encountered
3 Property and Right of Way acquisition or easements
4 Legal and accounting fees
5 Plan check, building permit fees
6 Utility Connection Fees
7 Testing and inspection
8 Fire and all risk insurance
9 Removal of unforeseen underground obstructions
10 Relocation of unforseen subsurface utilities
11 Signage and wayfinding
12 Additional fill or import
13 Loose furniture and equipment
14 Utility connection fees
15 Tel/data system
16 Construction contingency
17 Work done after business hours
18 Design, engineering and consulting fees other than those specifically listed in the above estimate

Items that may affect the cost estimate:

1 Modifications to the scope of work included in this estimate
2 Unforeseen sub-surface conditions
3 Restrictive technical specifications or excessive contract conditions
4 Any other non-competitive bid situations
5 Bids delayed beyond the projected schedule

ATTACHMENT D: LACFCD CONCEPTUAL REVIEW CORRESPONDENCE

Courtney Semlow

From: Genevieve Osmena <gosmena@dpw.lacounty.gov>
Sent: Thursday, October 8, 2020 2:40 PM
To: Courtney Semlow
Cc: Oliver Galang; Merrill Taylor; Maue, Brent; Julian Lee; Ernesto Rivera; Nayiri Vartanian
Subject: RE: LACFCD Conceptual Review of Arroyo Seco-San Rafael Treatment Wetlands

Hi Courtney,

Thank you for reaching out to us on your project. Please go ahead and work directly with Ernesto Rivera and Nayiri Vartanian of my team, who I have cc'd above. They will be reviewing the project info and will coordinate with you on the requested concept approval letter. Thank you also for sharing the project fact sheet and the storm drain plans – my team will let you know if they have any questions or need any further info for their review.

Thanks,

Genevieve Osmeña
Senior Civil Engineer
Los Angeles County Public Works
Office: 626-458-4322

From: Courtney Semlow <courtney.semlow@craftwaterinc.com>
Sent: Tuesday, October 6, 2020 5:07 PM
To: Genevieve Osmena <gosmena@dpw.lacounty.gov>
Cc: Oliver Galang <oliver.galang@craftwaterinc.com>; Merrill Taylor <merrill.taylor@craftwaterinc.com>; Maue, Brent <bmaue@cityofpasadena.net>; Julian Lee <jlee@southpasadenaca.gov>
Subject: LACFCD Conceptual Review of Arroyo Seco-San Rafael Treatment Wetlands

Genevieve,

Greetings! On behalf of the Cities of Pasadena and South Pasadena, we are requesting the LACFCD Watershed Manager for the Upper LA River for a Conceptual Level review and approval of the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project.

We are providing the following documents for your reference:

- **Attachment A** Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project Fact Sheet
- **Attachment B** Storm Drain As-Builts

The project is a major opportunity to continue the regional scale progress to achieve pollutant load reductions by the Cities of Pasadena and South Pasadena. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels that are both managed by the LACFCD. A treatment wetland and recharge basin system are proposed adjacent to the Arroyo Seco channel to capture, treat, and infiltrate stormwater from the diverted drainage channel. The proposed diversions will both consist of a drop inlet structure with a rubber dam placed in the Arroyo Seco to ensure that the storm drain will continue to accommodate the existing flood control drainage capacity.

The City of Pasadena will be submitting this project for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22. Once the City initiates the Design Phase of this project, the City will continue to remain closely engaged with the LACFCD to comply with any additional requirements for an LACFCD Permit and a Use and Maintenance Agreement.

Thank you!

Courtney Semlow, PE, CFM, ENV SP | Project Manager
P: 847.445.0886 | courtney.semlow@craftwaterinc.com
Los Angeles | San Diego | craftwaterinc.com
craftwater engineering, inc.

ATTACHMENT E: SAN PASCUAL STORMWATER CAPTURE ANALYSIS

MEMO

TO: Brent Maue, City of Pasadena
Julian Lee, City of South Pasadena

CC:

FROM: Oliver Galang, PE, Craftwater Engineering

SUBJECT: San Pascual Stormwater Capture Facility
Stormwater Capture Feasibility Study Technical Memorandum

DATE: September 22, 2020

Figure 1. San Pascual Site, South Pasadena/Los Angeles

The Upper Los Angeles River Watershed is a largely built-out, urbanized watershed of approximately 485 square miles, or 310,400 acres, in the Upper Los Angeles River Watershed Management Area and over 50 miles of the main line of the LA River. The development of the San Pascual Treatment Wetlands Stormwater Capture Feasibility Study in the City of Pasadena represents another major opportunity to continue the regional scale progress to achieve pollutant load reductions for the Upper Los Angeles River Watershed Management Program. The primary objective of this project is to prepare a Feasibility Study Report for the San Pascual Treatment Wetlands Project, which include the 10% design level documents that could be utilized to support a funding application under Los Angeles County's Safe, Clean Water Program. Towards this goal, this memo presents the analytical results evaluating the potential stormwater capture and water use alternatives and the sizing options for an optimized design. This project is intended to intercept a sizeable portion of the stormwater flows from the Arroyo Seco Channel to the project site (**See Figure 1**). Stormwater will be diverted from the Arroyo Seco reinforced concrete channel (Concrete Conduit Section 2) managed by the Los Angeles County Flood Control District (LACFCD) at an existing diversion point that directs flows to the project location. A surface treatment infiltration basin best management practice (BMP) is proposed at San Pascual Treatment Wetlands to capture and infiltrate stormwater from the diverted drainage channel. Project constraints and potential options will be detailed in this memo to present an array of sizing options that will contribute to both water quality goals as well as other important project considerations and desired outcomes. These options can then be considered and weighed before proceeding with the ultimate design of the project by identifying the project configuration that best meets the desired outcome and contributes to water quality benefits in a cost-effective manner.

1.0 OBJECTIVES

To identify the most effective stormwater capture configuration at the project site, decision support modeling has been conducted to identify the optimal BMP configuration using a balanced approach that incorporates design storm hydrologic targets as well as long-term water quality considerations. This optimal configuration addresses stormwater runoff that will be diverted to the project site from a potential diversion point near the park. BMP configuration recommendations will be made for the San Pascual site for the following key design criteria.

Diversion Rates

A range of feasible diversion flowrates will be simulated to develop cost-effectiveness curves and to determine the optimal flowrate to be diverted to the capture facility that will provide the greatest water quality benefit without surpassing the point of declining returns. Flowrates will range in values grounded in construction feasibility and subject to other project constraints identified in the initial project concept development.

BMP Storage

The optimal BMP size will be determined subject to the allowable site footprint. Size recommendations will include the following highlighted endpoints:

- The BMP size that is most cost-effective for the project tributary area,
- The BMP size that will capture the 85th percentile, 24-hour storm runoff volume, and
- The BMP size that will achieve multi-benefits, including, but not limited to, addressing stormwater quality and water supply.

Discharge –Water Use and Flowrate

Different routes exist for the outflows from the BMP, and each entail differing requirements, infrastructure, and constraints that impact the overall performance of the stormwater capture system and project cost. Also, these options represent different contributions to other local water supply efforts, of which stormwater is a growing component. If infiltration is feasible at this site due to favorable soil infiltration conditions, it will be utilized to dewater the BMP and contribute to regional groundwater recharge goals. Infiltration feasibility and rates will be determined in a future geotechnical analysis. Additionally, the potential to discharge captured stormwater to nearby sanitary sewers or to filter it and return it to storm drains will be assessed for this site to quantify the potential benefits of different options should infiltration be deemed infeasible. Filtration throughflow rates for commonly available systems and estimates of feasible sanitary sewer capacity will be evaluated to ensure that these discharge options are right sized to the baseline water quality for the drainage area and other system configuration options. Additionally, the potential for on-site irrigation via filtration of captured dry-weather flows will be assessed for viability.

Figure 2 shows the initial evaluated concept of a surface wetland, east of the Arroyo Seco Channel.

Figure 2. Preliminary concept schematic for the San Pascual Treatment Wetlands BMP as a treatment wetland, east of the Arroyo Seco Channel (may not represent final project details).

2.0 BASELINE SITE CONDITIONS AND CONSTRAINTS

The following subsections summarize the baseline watershed, hydrologic, and on-site conditions and constraints that will be accounted for in BMP configuration and optimization analysis for the San Pascual site.

2.1 Watershed Characterization

For this study, the Los Angeles County Watershed Management Modeling System (WMMS) was used within the Loading Simulation Program C++ (LSPC) to simulate the contaminant loading, runoff volume, and flow rate associated with a long-term, 10-year continuous time series (Water Year 2002 to Water Year 2011) as well as the 85th percentile storm. The WMMS is accepted by the Los Angeles Water Quality Control Board for performance of compliance analyses in the context of EWMP/WMP development.

The drainage area delineations for the project site (**Figure 3**) were developed using geospatial data associated with the WMMS modeling subwatersheds and verified/corrected slightly using further GIS analysis where full subwatersheds did not coincide with project locations and where subsurface storm drains overlapped. Digital stormwater pipe inventories and high-resolution Light Detection and Ranging (LiDAR) elevation data were used to accomplish subwatershed splitting. Developed drainage areas were used to model runoff and water quality baseline timeseries'. These were then incorporated into BMP models to optimize the BMP decision variables. The overall area and impervious fraction are summarized in **Table 1** .

Table 1. Summary of watershed and hydrologic conditions for the San Pascual Project drainage area

Total Tributary Area (ac)	Impervious Tributary Area (ac)	Average Annual Runoff (ac-ft)	Average Annual Zn Loading (lbs)	85th Percentile Surface Runoff (ac-ft)	85th Percentile Peak Flow (cfs)
5,005	1,200 (24%)	4,583	1,298	232	305

2.2 Hydrologic Considerations

Long-term baseline flows and pollutant loads to the site are also summarized in **Table 1**. The total loadings presented in this table represent the maximum possible reductions that could be achieved by control measures at the project site. However, pragmatic diversion limitations, space constraints, and subsequent treatment mechanisms will ultimately limit how much runoff and pollutant mass can potentially be diverted into the BMP. Peak flow rate and total runoff for the 85th percentile design storm (1.05 in., taken from isohyetal data for the centroid of the drainage areas) are found in **Table 1** as well.

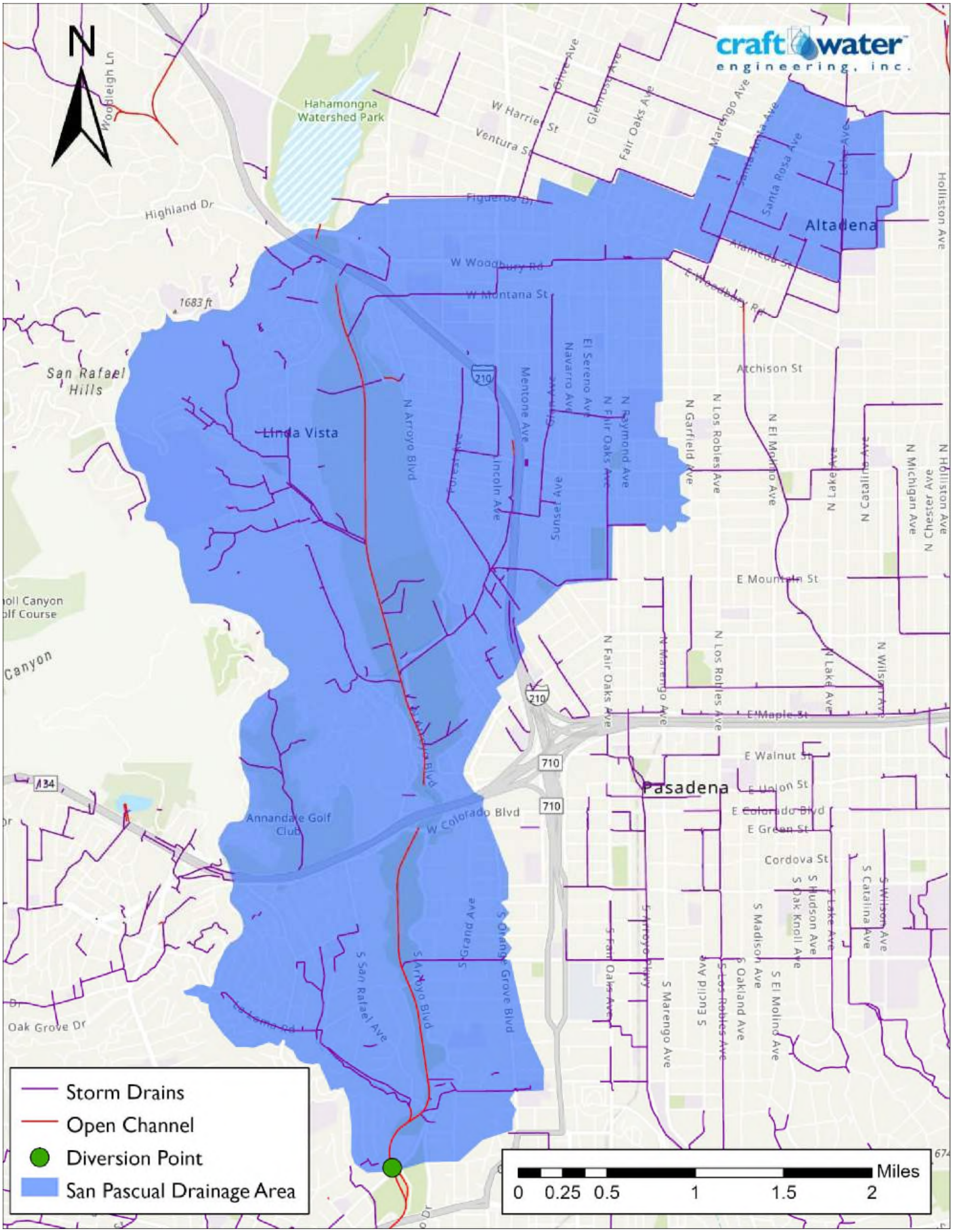


Figure 3. Drainage area for San Pascual Project.

3.0 STORMWATER CAPTURE OPTIMIZATION METHODS

3.1 Water Quality Optimization Strategy

The primary design goal of the San Pascual Treatment Wetlands Project is to reduce long-term annual loading of pollutants to the ULAR watershed using zinc as the limiting pollutant of interest in the analysis as established by the EWMP for this watershed group. To ensure that the system will be sized to maximize load reductions in a cost-effective manner, optimization modeling was performed.

The purpose of optimization modeling is to balance design components (including BMP volume and inflow diversion rates) such that no one component limits the performance of the system subject to potential discharge options (see **Figure 4** at right). Optimization supports decision making throughout the design process by guiding selection of the most cost-effective system design.

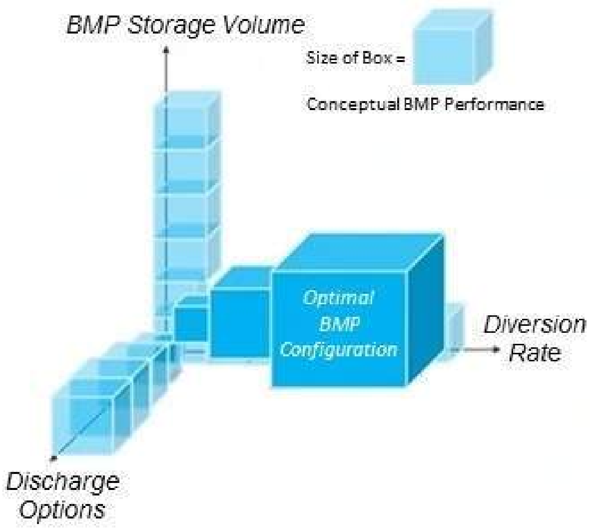


Figure 4. Conceptual illustration of optimization modeling balancing various design components to maximize performance.

The model setup for water quality simulation and optimization is complex, involving several modeling systems and iterative feedback from design engineers. The general methodology is discussed below, and the results are presented thereafter.

3.2 Preliminary Size and Diversion Optimization (SUSTAIN)

The first step of the modeling was to predict BMP performance for a range of potential BMP sizes, diversion points and inflow rates, and discharge alternatives. EPA's System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) model was used for this analysis because its built-in optimization algorithms automate the process of evaluating many different BMP configurations to select a cost-effective solution related to project goals. The model was run using 10 years of runoff and pollutant loading time-series data generated by the WMMS at an hourly time step. During this preliminary decision-support modeling, the discharge alternatives were simulated using certain site constraints to capture approximate BMP throughflow rates at the same time as varying the diversion rate and storage volume. These preliminary optimization model runs produced a point cloud from which the optimal cost-effectiveness curves were extracted. Subsequent targeted modeling then provided a clear decision pathway for the development of optimal project alternatives. Modeling efforts investigated the range of BMP configurations as detailed in the following subsections.

3.2.1 Diversion Rates

Model runs were limited to feasible diversion ranges for the proposed diversion point based on prior project knowledge related to the drainage area and potential project storage size. Diversion rates for the San Pascual BMP were modeled over the range of 10 to 50 cfs, varying in 5 cfs increments, to assess the most cost-effective configuration of diversion inflow rates.

3.2.2 Storage Volume

Site assessments and discussion with project stakeholders indicated an initial surface wetland storage volume of 8.0 ac-ft. These initial estimates for potential storage were developed assuming a maximum ponding depth of 8 feet for surface wetland storage. Modeling was carried out for a BMP storage ranging from 0.1 to 20.0 ac-ft by 0.1 ac-ft increments to assess trends in stormwater treatment efficiencies over a full range of storage sizes to identify points of diminishing return and ensure final recommendations accounted for the full potential treatment for the site.

3.2.3 Discharge Alternatives

The modeling evaluation identified two possible discharge scenarios that are evaluated for their water quality impacts: (1) infiltration into the subsoils, and (2) wetland settling and additional filtration prior to discharge back into the channel. Geotechnical investigations are awaiting completion, so initial assessments of the infiltration option were conducted assuming a conservative infiltration rate of 0.3 in/hr, the minimum acceptable value for an infiltration project in Los Angeles County. A treatment wetland system limits infiltration to maintain a wet pool, so infiltration rates will not impact the performance of this option. Both project options were additionally assessed with the addition of a filtration system at the outlet to increase water quality benefits and ensure adequate treatment. Filtration was modeled at 2.88 cfs and 5.76 cfs discharge rates to represent commonly available filtration devices and corresponding throughput efficiency.

One final option for discharge of captured runoff that was evaluated was discharge to the sanitary sewer. Sewer discharges are typically limited to flowrates that are comparable to filtration devices, but they are further constrained by allowable temporal discharge windows and rates (normally between 10pm to 8am daily) and only during dry weather (defined as 24-hours after any rainfall of greater than or equal to 0.1 in/hr). System capacity and discharge allowances are beyond the scope of this feasibility study, and additional coordination with the sewer purveyor is required during later stages of design to determine the available capacity and discharge rates if this option for the project is desired. A desktop analysis indicates that the closest sewer lines are located approximately 500 feet away at an elevation approximately 80 feet higher than the proposed project site on Arroyo Drive (**Figure 5**). Due to this high topographic relief to the nearest lines, the pursuit of sanitary sewer discharge is not recommended and is not further evaluated in this analysis.

Figure 5. Sanitary sewer in the vicinity of San Pascual Treatment Wetlands.

3.2.4 Inflow Infrastructure

Diverted inflows can be conveyed to the storage BMP via gravity-fed pipes or by way of pumps. The two options have tradeoffs associated with costs that are typically defined by the invert depth of the storm drains at the diversion points and the BMP storage footprint. Gravity-fed inflows require the BMP to be sited deep enough underground for flows to move passively toward the storage. This is associated with excavation and stabilization costs that are determined by the storm drain invert and distance of the diversion. Pumped inflows allow the BMP to be sited vertically with minimal soil cover atop the storage, but these are associated with costs of pumping infrastructure, operation, and maintenance. At different sizes of a given BMP and site, pumping inflows may be more cost-effective than gravity-fed diversions, and vice versa. Because of this, all modeled configurations were assessed for both inflow types to determine the most cost-effective inflow configuration across modeled scenarios.

4.0 OPTIMIZATION MODELING RESULTS

The optimization analysis aimed to maximize the long-term pollutant load reduction and 85th percentile design storm volume capture by simultaneously varying the diversion rate, BMP size, and discharge rates related to options previously discussed. Each of these design features has an associated range of options that were modeled to assess alternatives against long-term water quality benefits and identify the most effective. Additionally, different configurations were paired with estimated planning level cost data to assess alternatives and options against each other to ultimately determine the best configuration for this site. By optimizing based on these variables, multiple pathways to achieve maximum water quality benefit were identified and the most cost-effective alternatives were determined. Different configuration alternatives and modeling parameters are presented below to demonstrate the cost-effectiveness associated with these options and narrow them down to a few key recommended project configurations that will meet different needs for the ULAR watershed and contribute to the goals of the EWMP.

4.1 BMP Type – Infiltration Basin vs Treatment Wetlands

Two BMP types were evaluated for this site; a treatment wetland and an infiltration basin. These BMPs were modeled over the full range of configurations discussed before, and the water quality benefits for the range of projects modeled for the design alternatives are presented in **Figure 6**. These alternatives were evaluated to determine the best options at the San Pascual site given the site-specific constraints. Results display the optimal front of the full range of projects modeled for each of the various BMP types. Based on the modeling results and the desire for groundwater recharge, an infiltration basin has a similar performative advantage on a cost per pound of pollutant removed as a treatment wetland with an estimated ~25lbs difference in reduction of zinc per year. The addition of a filter shows an added benefit and is discussed in the next section.

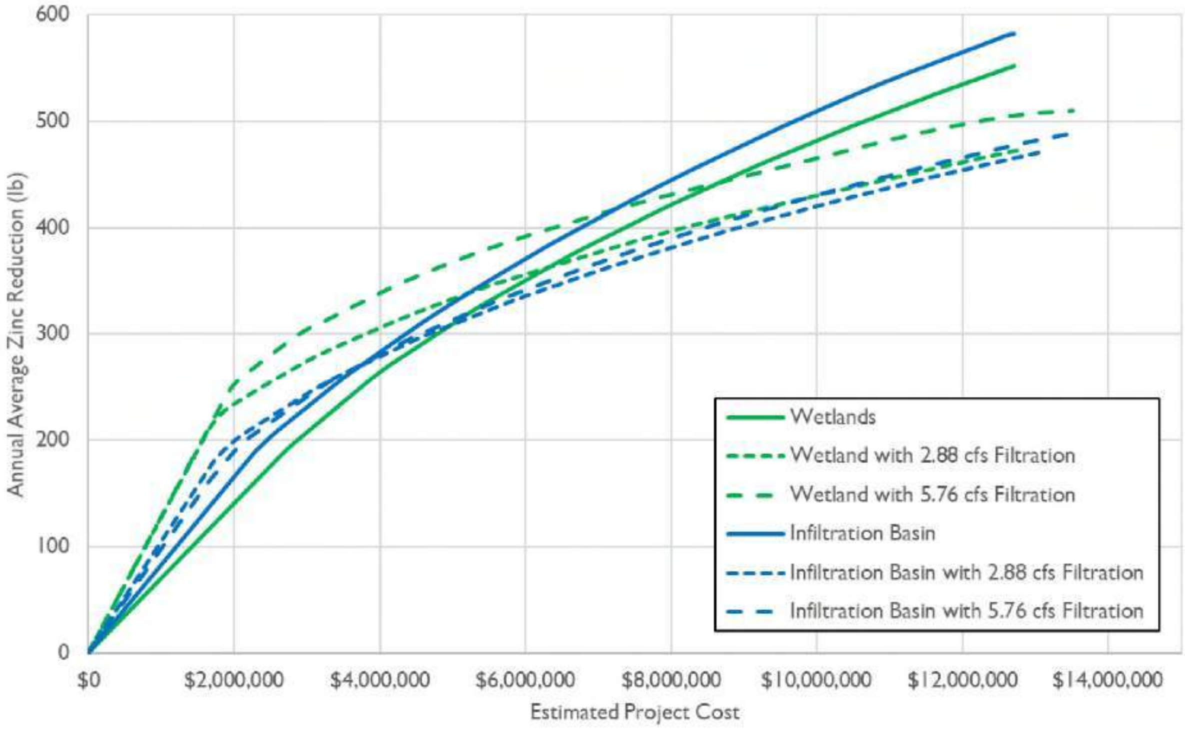


Figure 6. Infiltration BMP versus a Treatment Wetlands BMP

4.2 Filtration Recommendations

Pollutant removal performances can be increased in the vicinity of the maximum project size with the addition of filtration units that clean and discharge the effluent stormwater into the Arroyo Seco. **Figure 7** demonstrates these gains. Based on the results for the project at the maximum site footprint, the inclusion of a single filter increases the average annual zinc load reduction by about 25 lbs./yr. for a minimal cost considering the overall estimated project cost. The addition of a second filter unit that doubles the discharge rate adds even greater water quality benefit at the same overall project storage size and diversion rate. This is not the case for the infiltration basin, as shown in **Figure 8**, wherein slightly less water quality benefit might be realized with the addition of filtration devices. While these devices usually boost the performance for smaller BMPs, they can have this effect on infiltration basins since filtration does not entirely remove pollutant loads from the discharged water. Infiltrated water completely removes all pollutant loading from the drainage system. However, BMP controls can be implemented to ensure that infiltration is prioritized for its pollutant removal and water supply contributions, with filtration only occurring when the BMP is near full storage capacity. Additionally, filtration offers assurances that any water not able to be infiltrated will receive an acceptable level of treatment before discharge back to the storm drain system.

Analysis of the optimal front of the project modeling allowed the selection of the most cost-effective configuration for each project option. These are summarized in **Table 2** and will be discussed further below.

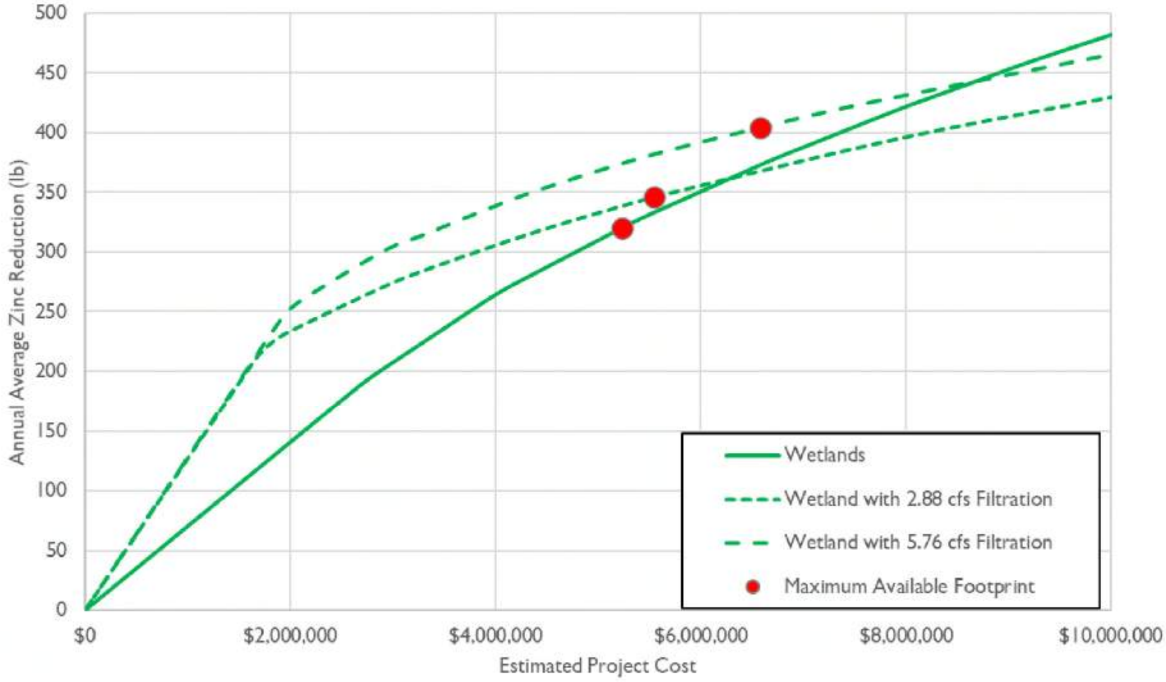


Figure 7. Comparison of treatment wetland results with and without filtration.

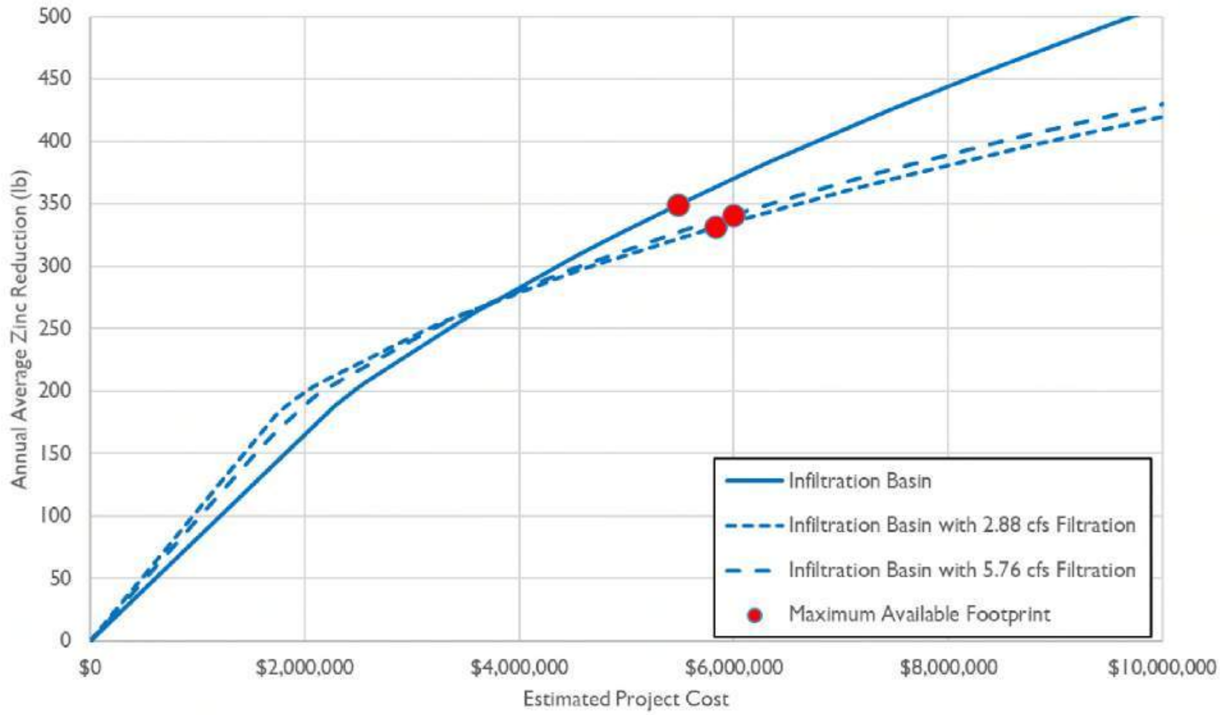


Figure 8. Comparison of infiltration basin results with and without filtration.

Table 2. Summary of cost-effective project alternatives.

Project Alternative	Estimated Project Cost	Average Annual Zinc Reduction (lbs)	Unit Cost per Pound of Zinc Removal
Treatment Wetland	$7,884,531	417.6	$18,881 / lb
Treatment Wetland w/ 2.88 cfs Filter	$4,432,849	318.1	$13,935 / lb
Treatment Wetland w/ 5.76 cfs Filter	$4,401,398	351.3	$12,529 / lb
Infiltration Basin	$7,501,516	427.2	$17,560 / lb
Infiltration Basin w/ 2.88 cfs Filter	$4,672,487	300.4	$15,556 / lb
Infiltration Basin w/ 5.76 cfs Filter	$5,561,495	329. 8	$16,864 / lb

5.0 PROJECT ALTERNATIVES AND RECOMMENDATIONS

5.1 BMP Size Alternatives

The following BMP sizes and diversion rates are recommended based on different endpoints of design and with the range of performance that might be realized at the San Pascual site.

5.1.1 Most cost-effective BMP size for the San Pascual site

The most cost-effective BMP at San Pascual Treatment Wetlands, given the footprint constraints of 1.03 acres, is a 6.5 ac-ft storage BMP with a pumped diversion of 25 cfs from the Arroyo Seco (**Figure 9**). This BMP will utilize infiltration and supplemental 5.76 cfs filtration for discharge of captured stormwater to reduce approximately 25% of the average annual zinc load for the drainage area.

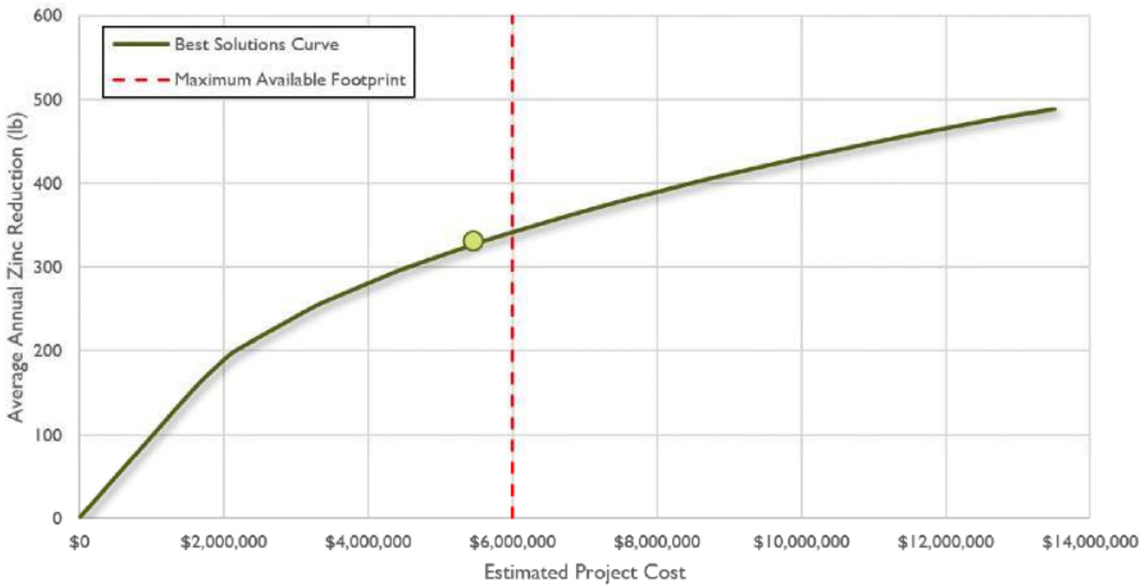


Figure 9. Model-based cost-effective project per footprint constraint recommendation for San Pascual Treatment Wetlands.

5.1.2 Capture of 85th percentile design storm

Based on the infiltration rate of 0.3 in/hr for this project, capture of the 85th percentile storm volume would necessitate a BMP with a diversion of at least 305 cfs and a storage volume of at least 271.7 ac-ft. This BMP is not feasible within the available footprint and is also not practical and would be well beyond the point of diminishing returns for water quality benefit for this site based on long-term average annual load reductions.

5.1.3 Most multi-benefit BMP configuration

Based on the analysis above, the most multi-benefit BMP configuration is the utilization of the full available area on the east side of the river with an infiltration basin that utilizes the existing diversion and dam structures that exist on-site. A supplemental filtration unit can be included to further the removal performance and **Table 3** summarizes the performance of this recommended configuration. The current recommended BMP is right sized for the drainage area and water quality loads while limiting the project to one area thus reducing costs and permitting time. Further study (incorporating forthcoming geotechnical investigation) will determine the optimal element sizing in terms of water supply consideration.

Table 3. Summary of recommended project configuration.

Project Alternative/BMP Type	Diversion Rate (cfs)	Total Storage Volume (ac-ft)	Planning Level Cost	Average Annual Zinc Reduction (lbs)
Infiltration Basin w/ 5.76 cfs filter	25	6.5	$5,561,495	329.8

ATTACHMENT F: SAN RAFAEL STORMWATER CAPTURE ANALYSIS

MEMO

TO: Brent Maue, City of Pasadena
Julian Lee, City of South Pasadena

CC:

FROM: Oliver Galang, PE, Craftwater Engineering

SUBJECT: San Rafael Treatment Wetlands
Stormwater Capture Feasibility Study Technical Memorandum

DATE: September 22, 2020

Figure 1. San Rafael Site, Pasadena

The Upper Los Angeles River Watershed is a largely built-out, urbanized watershed of approximately 485 square miles, or 310,400 acres, in the Upper Los Angeles River Watershed Management Area and over 50 miles of the main line of the LA River. The development of the San Rafael Treatment Wetlands Stormwater Capture Feasibility Study in the City of Pasadena represents another major opportunity to continue the regional scale progress to achieve pollutant load reductions for the Upper Los Angeles River Watershed Management Program. The primary objective of this project is to prepare a Feasibility Study Report for the San Rafael Treatment Wetlands Project, which include the 10% design level documents that could be utilized to support a funding application under Los Angeles County's Safe, Clean Water Program. Towards this goal, this memo presents the analytical results evaluating the potential stormwater capture and water use alternatives and the sizing options for an optimized design. This project is intended to intercept a sizeable portion of the stormwater flows from the adjacent storm drain to the San Rafael Creek to the proposed project site (**See Figure 1**). Stormwater will be diverted immediately downstream from the outfall of the 72" reinforced concrete pipe (RCP; Project No. BI 0562, Line F) managed by the Los Angeles County Flood Control District (LACFCD) at San Rafael Creek. A surface treatment infiltration basin best management practice (BMP) is proposed at the San Rafael site to capture and infiltrate stormwater from the diverted drainage channel. Project constraints and potential options will be detailed in this memo to present an array of sizing options that will contribute to both water quality goals as well as other important project considerations and desired outcomes. These options can then be considered and weighed before proceeding with the ultimate design of the project by identifying the project configuration that best meets the desired outcome and contributes to water quality benefits in a cost-effective manner.

1.0 OBJECTIVES

To identify the most effective stormwater capture configuration at the project site, decision support modeling has been conducted to identify the optimal BMP configuration using a balanced approach that incorporates design storm hydrologic targets as well as long-term water quality considerations. This optimal configuration addresses stormwater runoff that will be diverted to the project site from a potential diversion point near the open space at the confluence. BMP configuration recommendations will be made for the San Rafael site for the following key design criteria.

Diversion Rates

A range of feasible diversion flowrates will be simulated to develop cost-effectiveness curves and to determine the optimal flowrate to be diverted to the capture facility that will provide the greatest water quality benefit without surpassing the point of declining returns. Flowrates will range in values grounded in construction feasibility and subject to other project constraints identified in the initial project concept development.

BMP Storage

The optimal BMP size will be determined subject to the allowable site footprint. Size recommendations will include the following highlighted endpoints:

- The BMP size that is most cost-effective for the project tributary area,
- The BMP size that will capture the 85th percentile, 24-hour storm runoff volume, and
- The BMP size that will achieve multi-benefits, including, but not limited to, addressing stormwater quality and water supply.

Discharge –Water Use and Flowrate

Different routes exist for the outflows from the BMP, and each entail differing requirements, infrastructure, and constraints that impact the overall performance of the stormwater capture system and project cost. Also, these options represent different contributions to other local water supply efforts, of which stormwater is a growing component. If infiltration is feasible at this site due to favorable soil infiltration conditions, it can be utilized to dewater the BMP and contribute to regional groundwater recharge goals. Infiltration feasibility and rates will be determined in a future geotechnical analysis. Additionally, the potential to discharge captured stormwater to nearby sanitary sewers or to filter it and return it to storm drains will be assessed for this site to quantify the potential benefits of different options should infiltration be deemed infeasible. Filtration throughflow rates for commonly available systems and estimates of feasible sanitary sewer capacity will be evaluated to ensure that these discharge options are right sized to the baseline water quality for the drainage area and other system configuration options.

Figure 2 shows the initial evaluated concept of a surface infiltration basin east of San Rafael Creek.

Figure 2. Preliminary concept schematic for the San Rafael Infiltration Basin BMP, east of San Rafael Creek (may not represent final project details).

2.0 BASELINE SITE CONDITIONS AND CONSTRAINTS

The following subsections summarize the baseline watershed, hydrologic, and on-site conditions and constraints that will be accounted for in BMP configuration and optimization analysis for the San Rafael site.

2.1 Watershed Characterization

For this study, the Los Angeles County Watershed Management Modeling System (WMMS) was used within the Loading Simulation Program C++ (LSPC) to simulate the contaminant loading, runoff volume, and flow rate associated with a long-term, 10-year continuous time series (Water Year 2002 to Water Year 2011) as well as the 85^{th} percentile storm. The WMMS is accepted by the Los Angeles Water Quality Control Board for performance of compliance analyses in the context of EWMP/WMP development.

The drainage area delineations for the project site (**Figure 3**) were developed using geospatial data associated with the WMMS modeling subwatersheds and verified/corrected slightly using further GIS analysis where full subwatersheds did not coincide with project locations and where subsurface storm drains overlapped. Digital stormwater pipe inventories and high-resolution Light Detection and Ranging (LiDAR) elevation data were used to accomplish subwatershed splitting. Developed drainage areas were used to model runoff and water quality baseline timeseries. These were then incorporated into BMP models to optimize the BMP decision variables. The overall area and impervious fraction are summarized in **Table 1** .

Table 1. Summary of watershed and hydrologic conditions for the San Rafael Project drainage area

Total Tributary Area (ac)	Impervious Tributary Area (ac)	Average Annual Runoff (ac-ft)	Average Annual Zn Loading (lbs)	85^{th} Percentile Surface Runoff (ac-ft)	85^{th} Percentile Peak Flow (cfs)
441	94 (21%)	288	65	18	22

2.2 Hydrologic Considerations

Long-term baseline flows and pollutant loads to the site are also summarized in **Table 1**. The total loadings presented in this table represent the maximum possible reductions that could be achieved by control measures at the project site. However, pragmatic diversion limitations, space constraints, and subsequent treatment mechanisms will ultimately limit how much runoff and pollutant mass can potentially be diverted into the BMP. Peak flow rate and total runoff for the 85th percentile design storm (1.05 in., taken from isohyetal data for the centroid of the drainage areas) are found in **Table 1** as well.

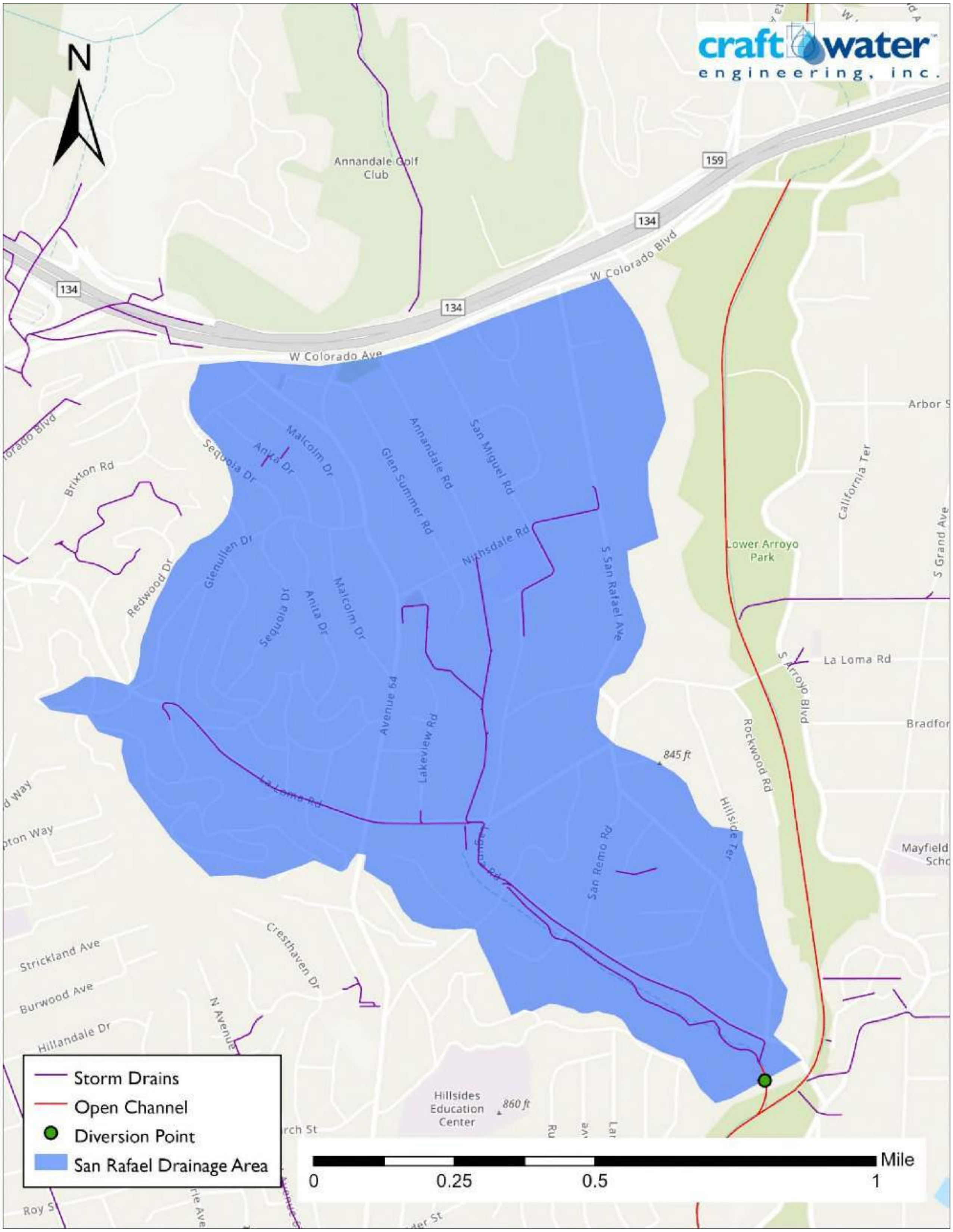


Figure 3. Drainage area for San Rafael Wetlands Project.

3.0 STORMWATER CAPTURE OPTIMIZATION METHODS

3.1 Water Quality Optimization Strategy

The primary design goal of the San Rafael Treatment Wetlands Project is to reduce long-term annual loading of pollutants to the ULAR watershed using zinc as the limiting pollutant of interest in the analysis as established by the EWMP for this watershed group. To ensure that the system will be sized to maximize load reductions in a cost-effective manner, optimization modeling was performed.

The purpose of optimization modeling is to balance design components (including BMP volume and inflow diversion rates) such that no one component limits the performance of the system subject to potential discharge options (see **Figure 4** at right). Optimization supports decision making throughout the design process by guiding selection of the most cost-effective system design.

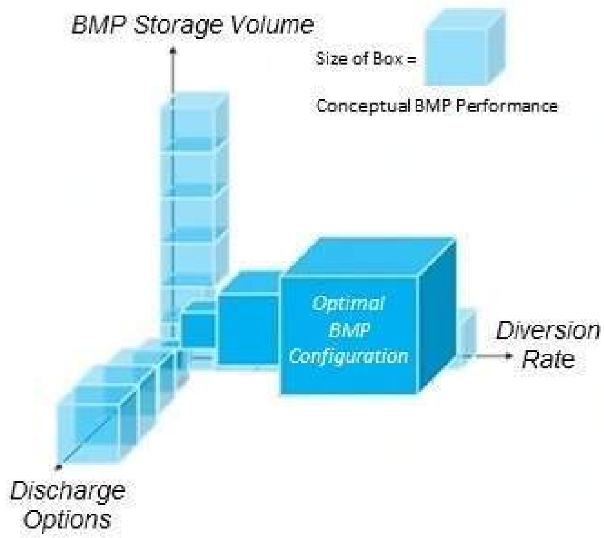


Figure 4. Conceptual illustration of optimization modeling balancing various design components to maximize performance.

The model setup for water quality simulation and optimization is complex, involving several modeling systems and iterative feedback from design engineers. The general methodology is discussed below, and the results are presented thereafter.

3.2 Preliminary Size and Diversion Optimization (SUSTAIN)

The first step of the modeling was to predict BMP performance for a range of potential BMP sizes, diversion points and inflow rates, and discharge alternatives. EPA's System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN) model was used for this analysis because its built-in optimization algorithms automate the process of evaluating many different BMP configurations to select a cost-effective solution related to project goals. The model was run using 10 years of runoff and pollutant loading time-series data generated by the WMMS at an hourly time step. During this preliminary decision-support modeling, the discharge alternatives were simulated using certain site constraints to capture approximate BMP throughflow rates at the same time as varying the diversion rate and storage volume. These preliminary optimization model runs produced a point cloud from which the optimal cost-effectiveness curves were extracted. Subsequent targeted modeling then provided a clear decision pathway for the development of optimal project alternatives. Modeling efforts investigated the range of BMP configurations as detailed in the following subsections.

3.2.1 Diversion Rates

Model runs were limited to feasible diversion ranges for the proposed diversion point based on prior project knowledge related to the drainage area and potential project storage size. Diversion rates for the San Rafael BMP were modeled over the range of 10 to 30 cfs, varying in 5 cfs increments, to assess the most cost-effective configuration of diversion inflow rates.

3.2.2 Storage Volume

Site assessments and discussion with project stakeholders indicated an initial surface maximum storage volume of 2.7 ac-ft. These initial estimates for potential storage were developed assuming a ponding depth of 7 feet for surface storage. Modeling was carried out for a BMP storage ranging from 0.1 to 10.0 ac-ft by 0.1 ac-ft increments to assess trends in stormwater treatment efficiencies over a full range of storage sizes to identify points of diminishing return and ensure final recommendations accounted for the full potential treatment for the site.

3.2.3 Discharge Alternatives

The modeling evaluation identified two possible discharge scenarios that are evaluated for their water quality impacts: (1) infiltration into the subsoils, and (2) wetland settling and additional filtration prior to discharge back into the channel. Geotechnical investigations are awaiting completion, but initial assessments of the infiltration option were conducted assuming an infiltration rate of 0.89 in/hr that was found at a potential project site just across the Arroyo Seco from this project location. A treatment wetland system limits infiltration to maintain a wet pool, so infiltration rates will not impact the performance of this option. Both project options were additionally assessed with the addition of a filtration system at the outlet to increase water quality benefits and ensure adequate treatment. Filtration was modeled at 2.88 cfs and 5.76 cfs discharge rates to represent commonly available filtration devices and corresponding throughput efficiency.

One final option for discharge of captured runoff that was evaluated was discharge to the sanitary sewer. Sewer discharges are typically limited to flowrates that are comparable to filtration devices, but they are further constrained by allowable temporal discharge windows and rates (normally between 10pm to 8am daily) and only during dry weather (defined as 24-hours after any rainfall of greater than or equal to 0.1 in/hr). System capacity and discharge allowances are beyond the scope of this feasibility study, and additional coordination with the sewer purveyor is required during later stages of design to determine the available capacity and discharge rates if this option for the project is desired. A desktop analysis indicates that the closest sewer lines are located approximately 500 feet away at an elevation approximately 50 feet higher than the proposed project site on the east side of the Arroyo Seco (**Figure 5**). Due to this high topographic relief and the need to cross over Arroyo Seco to the nearest lines, the pursuit of sanitary sewer discharge is not recommended and is not further evaluated in this analysis.

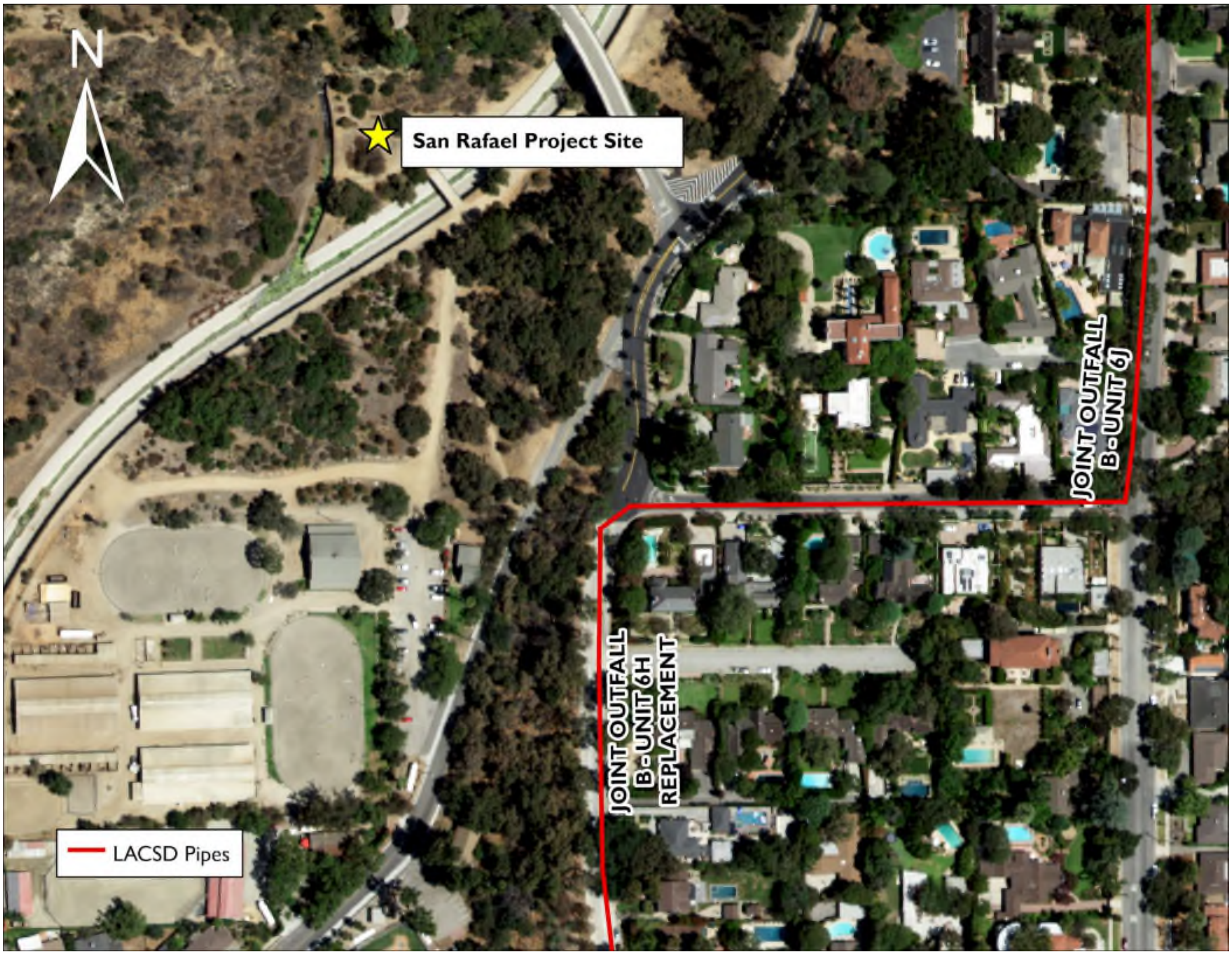


Figure 5. Sanitary sewer in the vicinity of San Rafael Treatment Wetlands.

3.2.4 Inflow Infrastructure

Diverted inflows can be conveyed to the storage BMP via gravity-fed pipes or by way of pumps. The two options have tradeoffs associated with costs that are typically defined by the invert depth of the storm drains at the diversion points and the BMP storage footprint. Gravity-fed inflows require the BMP to be sited deep enough underground for flows to move passively toward the storage. This is associated with excavation and stabilization costs that are determined by the storm drain invert and distance of the diversion. Pumped inflows allow the BMP to be sited vertically with minimal soil cover atop the storage, but these are associated with costs of pumping infrastructure, operation, and maintenance. At different sizes of a given BMP and site, pumping inflows may be more cost-effective than gravity-fed diversions, and vice versa. Because of this, all modeled configurations were assessed for both inflow types to determine the most cost-effective inflow configuration across modeled scenarios.

4.0 OPTIMIZATION MODELING RESULTS

The optimization analysis aimed to maximize the long-term pollutant load reduction and 85th percentile design storm volume capture by simultaneously varying the diversion rate, BMP size, and discharge rates related to options previously discussed. Each of these design features has an associated range of options that were modeled to assess alternatives against long-term water quality benefits and identify the most effective. Additionally, different configurations were paired with estimated planning level cost data to assess alternatives and options against each other to ultimately determine the best configuration for this site. By optimizing based on these variables, multiple pathways to achieve maximum water quality benefit were identified and the most cost-effective alternatives were determined. Different configuration alternatives and modeling parameters are presented below to demonstrate the cost-effectiveness associated with these options and narrow them down to a few key recommended project configurations that will meet different needs for the ULAR watershed and contribute to the goals of the EWMP.

4.1 BMP Type – Infiltration Basin vs Treatment Wetlands

The two possible alternatives evaluated for this site are a treatment wetland or an infiltration basin. Water quality benefits for the range of projects modeled for the design alternatives are presented in **Figure 5**. These alternatives were evaluated to determine the best options at the San Rafael site given the site-specific constraints. Results display the optimal front of the full range of projects modeled for each of the various BMP types. Based on the modeling results and the desire for groundwater recharge, an infiltration basin has an advantage in water quality benefit for all modeled project sizes compared to the treatment wetland. The addition of a filter shows only a slight added benefit for an infiltration basin, but a much greater benefit for the treatment wetland. This is discussed further in the next section.

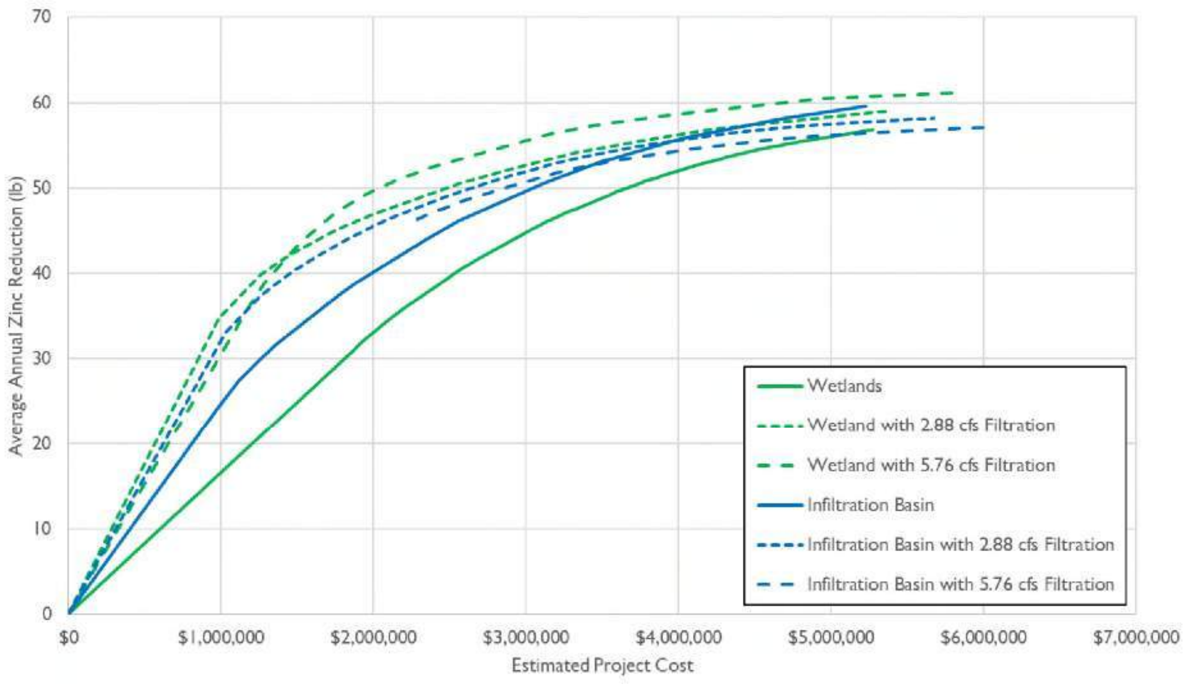


Figure 6. Infiltration BMP versus a Treatment Wetlands BMP

4.2 Filtration Recommendations

Pollutant removal performances can be increased with the addition of filtration units that clean and discharge the effluent stormwater into the Arroyo Seco. **Figure 7** demonstrates a comparison of both the infiltration basin and treatment wetlands with various filtration rates to identify the recommended filter quantities/rates. Based on the results, the inclusion of a single filter increases the overall performance substantially for the treatment wetland, but only slightly for the infiltration basin. This is related to the fact that infiltration of captured runoff provides complete pollutant removal, while filtration is associated with some remaining pollutant in discharged waters (though of acceptable standards). The treatment wetland is appreciably improved with the addition of filtration as a secondary treatment process for the BMP. In terms of level of filtration, the addition of a second filter unit that doubles the discharge rate has only a minimal impact for the added infrastructure cost and is not recommended to be pursued in the full site design.

Analysis of the optimal front of the project modeling allowed the selection of the most cost-effective configuration for each project option. These are summarized in **Table 2** and will be discussed further below.

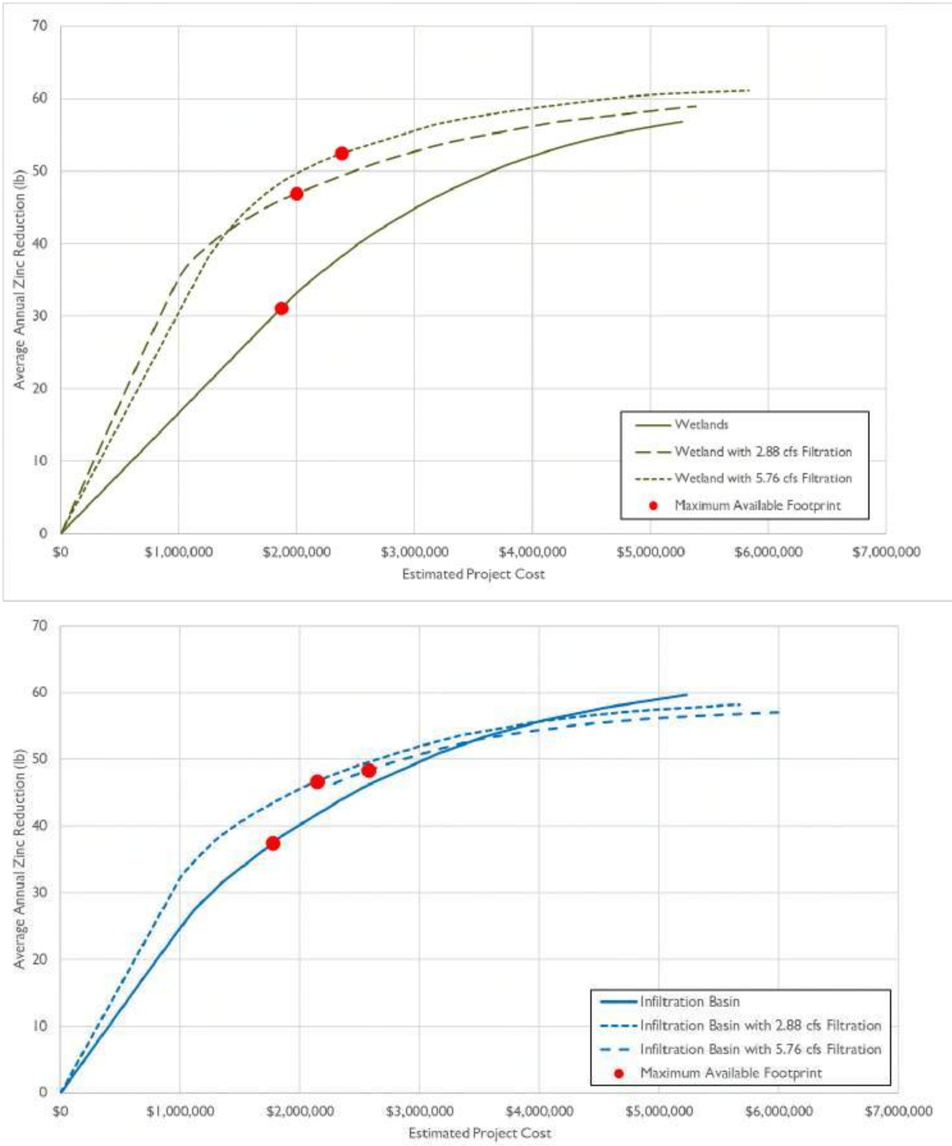


Figure 7. Filter flow rate/quantity comparison

Table 2. Summary of filtration project alternatives (maximum footprint).

Project Alternative	Planning Level Cost	Average Annual Zinc Reduction (lbs)	Unit Cost per Pound of Zinc Removal
Treatment Wetlands	$3,180,611	46.42	$68,518/ lb
Treatment Wetlands w/ 2.88 cfs Filter	$1,757,536	45.15	$38,927 / lb
Treatment Wetlands w/ 5.76 cfs Filter	$2,157,536	50.97	$42,330 / lb
Infiltration Basin	$2,557,379	46.11	$55,463 / lb
Infiltration Basin w/ 2.88 cfs Filter	$2,093,759	46.33	$45,192 / lb
Infiltration Basin w/ 5.76 cfs Filter	$2,382,484	47.10	$50,584 / lb

5.0 PROJECT ALTERNATIVES AND RECOMMENDATIONS

5.1 BMP Size Alternatives

The following BMP sizes and diversion rates are recommended based on different endpoints of design and with the range of performance that might be realized at San Rafael project site.

5.1.1 Most cost-effective BMP size for the San Rafael site

The most cost-effective BMP at San Rafael, given the footprint constraints of 0.3 acres, is a 2.6 ac-ft infiltration basin BMP with a gravity-fed diversion of 25 cfs from Project No. BI 0562, Line F (**Figure 8**). This BMP will utilize infiltration and supplemental 2.88 cfs filtration for discharge of captured stormwater to reduce approximately 71% of the average annual zinc load for the drainage area.

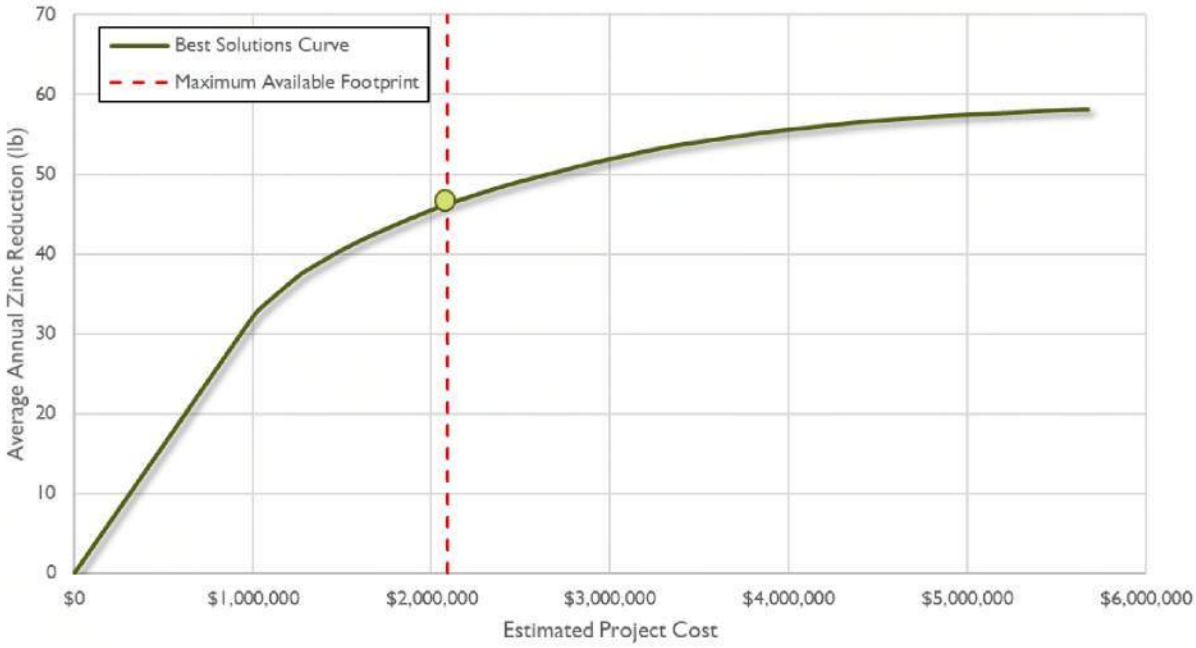


Figure 8. Model-based cost-effective project per footprint constraint recommendation for San Rafael Treatment Wetlands.

5.1.2 Capture of 85th percentile design storm

Based on the infiltration rate of 0.89 in/hr for this project, capture of the 85th percentile storm volume would necessitate a BMP with a diversion of at least 22 cfs and a storage volume of at least 18.3 ac-ft. This BMP is not feasible within the available footprint (2.7 ac-ft) and would be well beyond the point of diminishing returns for water quality benefit for this site based on long-term average annual load reductions.

5.1.3 Most multi-benefit BMP configuration

Based on the analysis above, the most multi-benefit BMP configuration is the utilization of the full available area on the east side of the creek with an infiltration basin that has the option to add to the storage volume through an expansion on the west side of the San Rafael Creek channel. A supplemental filtration unit can be included to

further the removal performance and **Table 3** summarizes the performance of this recommended configuration. The current recommended BMP is right sized for the drainage area and water quality loads while limiting the project to one area thus reducing costs and permitting time. Further study (incorporating forthcoming geotechnical investigation) will determine the optimal element sizing in terms of water supply consideration.

Table 3. Summary of recommended project configuration.

Project Alternative/BMP Type	Diversion Rate (cfs)	Total Storage Volume (ac-ft)	Planning Level Cost	Average Annual Zinc Reduction (lbs)
Infiltration Basin w/ 2.88 cfs filter	25	2.6	$2,093,759	46.33

ATTACHMENT G: OGALS PROPOSITION 68 GRANT CORRESPONDENCE

State of California • Natural Resources Agency
Gavin Newsom, Governor
DEPARTMENT OF PARKS AND RECREATION
Lisa Ann L. Mangat, Director
P.O. Box 942896 • Sacramento, CA 94296-0001
(916) 653-7423

July 20, 2020

Rosa Laveaga, Landscape Architect
Arroyo Seco Project Supervisor
City of Pasadena, Public Works Engineering Dept.
P.O Box 7115
Pasadena, CA 91109-7115

Sent via Email Only
rlaveaga@cityofpasadena.net

Re: Proposition 68 - Arroyo Seco - San Rafael Treatment Wetlands Project (Project)

Dear Rosa Laveaga:

As you know, the State Budget Act of 2019-20 [Item 3790-101-6088 (2)2(c)] allocated $3,500,000 for Arroyo Seco Water Reuse and Natural Stream Restoration from the Proposition 68 Urban Counties Per Capita Program. On September 20, 2019, Office of Grants and Local Services (OGALS) staff met with you and City of Pasadena (Pasadena) staff, in addition to City of South Pasadena (South Pasadena) staff, to discuss this grant opportunity and review the "Urban Counties Per Capita Program Arroyo Seco Procedural Guide" (Guide). Since the Budget Act did not identify a grant recipient, OGALS encouraged Pasadena and South Pasadena to work together to determine the best approach for fulfilling the budget intent.

Since our September 2019 meeting, OGALS received a draft Memorandum of Understanding (MOU) between Pasadena and South Pasadena that outlines the proposed responsibilities for each agency for the Project. OGALS understands that Pasadena will serve as the grantee. As grantee, Pasadena will agree to all provisions of the grant contract and will submit a complete application, payment requests and the final Project close-out documentation as required in the Guide.

South Pasadena will be responsible for providing necessary reporting documentation to Pasadena. Both agencies will provide match and any additional required funds, as well as access to the Project site during construction. Section 4 of the MOU states the term of the MOU starts from the date each agency signs the MOU and continues until the Project is complete and the final payment is received. Currently, the draft MOU does not address long term maintenance and operation of the improvements at the Arroyo Seco; therefore, the MOU will need to be modified to reflect these long-term requirements.

As a reminder, the grant contract requires that the Project remain open to the public and maintained for a period of thirty years. Further, a deed restriction must be placed on the Project property before OGALS can process reimbursement payments. Therefore, once the grant contract is fully executed, Pasadena will need to file a deed restriction on the portions of the Project property that it owns.

Concurrently, OGALS will provide South Pasadena with a customized contract that contains provisions pertaining to the thirty-year contract performance period and the deed restriction requirement. Once the customized contract is fully executed, South Pasadena will then file a deed restriction on the portions of the Project property that it owns. Both deed restrictions (on Pasadena property and South Pasadena property) will need to be recorded prior to OGALS issuing any grant payments to Pasadena.

As reference, OGALS and Pasadena must execute the grant contract before the June 30, 2022 encumbrance date. The Project must be complete by March 31, 2024 to allow time for a final site inspection and processing of the final payment before the June 30, 2024 liquidation date.

OGALS looks forward to working with Pasadena to ensure a successful Project outcome. If you have questions or need further assistance, please contact Project Officer, Stephanie Schiechl at (916) 651-8580 or Stephanie.Schiechl@parks.ca.gov.

Sincerely,

Jean A. Lacher

Jean Lacher, Chief
Office of Grants and Local Services

cc: Kristine Courdy, Deputy Director, Public Works Department,
City of South Pasadena, kcourdy@southpasadenaca.gov
Lee Butterfield, Manager, Office of Grants and Local Services
Jana Clarke, Supervisor, Office of Grants and Local Services
Stephanie Schiechl, Project Officer, Office of Grants and Local Services

ATTACHMENT H: COMMUNITY SUPPORT LETTERS

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

I am pleased to submit this letter of support to you on behalf of the Arroyo Seco Foundation (ASF) for the joint project submittal by the Cities of Pasadena and South Pasadena for funding under the Safe Clean Water Program Call for Projects for Fiscal Year 2021-22. T**he Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project** will advance important stormwater and water quality goals in one of the region's primary and most historical natural open spaces, the Arroyo Seco. The project area involves the Arroyo Seco stream, a vital tributary of the Los Angeles River, and San Rafael Creek. This is an important project to restore a key reach of the stream and flood plain in the Arroyo Seco Watershed.

ASF has a thirty-year record of working to restore and enhance stream and habitat conditions in the Arroyo Seco. In the 1990s ASF initiated the low-flow stream restoration project in the Lower Arroyo about half a mile above the sites now being considered in this application. Later in 2008 ASF led the award-winning Central Arroyo Stream Restoration program that brought back native Arroyo chub to the stream near the Rose Bowl. More recently we have worked with the City of Pasadena as the co-sponsor of the widely praised Berkshire Creek Restoration Program in Hahamongna Watershed Park that was completed earlier this year. In each of these major projects, we partnered with the City of Pasadena. Now we look forward to also collaborating with the City of South Pasadena. ASF's goal is to restore as much as possible of the natural hydrology and habitat of the Arroyo Seco, while improving water resources, flood protection and recreation in the watershed.

ASF is pleased that this project will improve water quality and conservation in the Arroyo Seco by capturing and treating stormwater flows in San Rafael Creek and the Arroyo Seco channel on public parcels in the Cities of Pasadena and South Pasadena. It will also contribute to important regional efforts underway by several agencies for the revitalization of the Upper Los Angeles River and Tributaries. We will work with the project partners to ensure that the project will emphasize the nature-based solutions that the Safe Clean Water Program calls for. We also support the educational and community-involvement tasks that that will enhance the benefits to the local communities and ensure project success.

The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project is a major opportunity to continue local progress to achieve pollutant load reductions and stormwater capture by the Cities of Pasadena and South Pasadena. The project will intercept a sizeable portion of the stormwater flows from San Rafael Creek and the Arroyo Seco Channel, which are both managed by the Los Angeles County Flood Control District. A treatment wetland and recharge basin at the confluence of San Rafael Creek and the Arroyo Seco and another in South Pasadena will capture, treat, and infiltrate runoff. The wetland and treatment facilities will be designed to also ensure adequate flood protection. The adjacent areas will be improved with a habitat restoration program.

In the South Pasadena stretch, care will be taken to remove invasive species and improve the wetlands and riparian values of a streamside stretch of land where the historic Garfias stream joined the Arroyo Seco.

There is a long tradition in our region of community involvement and support for protecting and restoring the natural hydrology and habitat of the Arroyo Seco stream and watershed. The Arroyo Seco Watershed Restoration Feasibility Program, prepared by ASF and North East Trees for two state agencies in 2002, specifies the guidelines for nature-based solutions similar to those contained in the Safe Clean Water Program guidelines. The restoration of San Rafael Creek to a healthy condition is a project recommended in the adopted Master Plan for the Arroyo Seco adopted by the Pasadena City Council in 2003, which guides the planning, preservation and enhancement of this environmental treasure in Pasadena.

Safe Clean Water Program funding for this project will promote regional collaboration and be a very important step in the planning and management of the Arroyo Seco flood plain and stream zone. It will implement a long-standing recommended project from Pasadena’s Arroyo Seco Master Plan that will have significant water quality benefits. This funding would assist in paying for the planning, design, preparation of construction documents, preparation of the appropriate CEQA document, completion of various important technical studies, and regulatory permits for the rehabilitation of this area. It would result in a “shovel ready project” for which $3.5 million in implementation funding is already in place.

The Arroyo Seco Foundation strongly supports the proposal by the two cities to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and watershed. We urge you to provide the requested funding of $3.5 million for this important project.

Thank you for your consideration of **The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project**. Please let me know if we can provide any further information to assist you in your decision-making process.

Sincerely,

Tim Brick

Tim Brick
Managing Director
(626) 639-4092

October 13, 2020

Mr. Brent Maue, Assistant City Engineer
City of Pasadena, Department of Public Works
100 N Garfield Avenue
Pasadena, CA 91101

Safe Clean Water Program

RE: Letter of Support for the City of Pasadena's San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project under the Upper Los Angeles Enhanced Watershed Management Plan

Dear Watershed Area Steering Committee:

The Upper Los Angeles Watershed Management Group (ULAR WMG) would like to express our support of the City of Pasadena's San Rafael/San Pascual Treatment Wetlands Stormwater Capture Project (Project) and their collaborative application with the City of South Pasadena for Measure W grant funding. The proposed Project seeks to improve water quality discharged to the San Rafael Creek through capture, infiltration, groundwater basin recharge and restoration of natural streambed processes, improving the water quality of the Arroyo Seco and the Los Angeles River, and tailored to meet our compliance efforts as detailed in the Upper Los Angeles River (ULAR) Enhanced Watershed Management Program (EWMP). In addition, this multi-benefit Project will incorporate nature-based solutions—such as new recreational walking paths, native landscaping, and natural treatment wetlands—creating vital aquatic habitat, community enhancement, and public outreach and educational opportunities.

The ULAR EWMP was developed with the intention of utilizing a multi-pollutant approach that maximizes the retention and use of urban runoff as a resource for groundwater recharge and irrigation, while also creating additional benefits for the communities in the ULAR watershed through a combination "toolbox" of Distributed and Regional Stormwater Projects to address applicable stormwater quality regulations. One of the original eight Regional Projects identified in the EWMP model, the Lower Arroyo Park, was deemed infeasible and eliminated in 2017. The proposed Project resurrects and re-envisions that concept, targeting pollutants from two LA River tributary watershed areas (641561 and 641580)—that require priority load reductions of 9 and 36%, respectively—to meet the compliance targets through capture and treatment of over ten times the required volume (26 AF), exceeding the final bacteria and metals compliance goals, and eliminating all of the regional and distributed BMP requirements in these collective jurisheds. Further, by mitigating the dry weather flows from the San Rafael Creek, Pasadena is satisfying their commitment to address their high priority non-stormwater outfall through structural controls as outlined in the Segment B Tributary Load Reduction Strategy (LRS) Report submitted and approved by the Regional Board. As such, the San Rafael/San Pascual

Treatment Wetlands Stormwater Capture Park Project is an identified and crucial Regional Project of the ULAR EWMP Implementation Plan, helping us to achieve our Recipe for Final EWMP Compliance as detailed in Appendix 7.A.60 and .75 and the subsequent LRS Report.

By December 2017, the Participating Agencies of the ULAR EWMP, including the County of Los Angeles (County) and the Los Angeles County Flood Control District (LACFCD), were required to satisfy a 31% interim EWMP milestone. This interim milestone specified that each jurisdiction implement Best Management Practices (BMPs) to manage a specific capture volume under the Reasonable Assurance Analysis (RAA) storm condition for each receiving water. The San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project is located adjacent to—and intercepts flows—that would otherwise flow to the Arroyo Seco. To date, the City of Los Angeles (City), the City of Pasadena, and Unincorporated County have achieved 2.59 of the collective 12.08 AF volume required to achieve their interim targets through structural controls and LID efforts. The Project's additional 6.5 AF design volume capture will allow Pasadena to meet and exceed their 2017 6.93 AF target milestone allowing them to come into full compliance, in addition to assisting their partnering Agencies (City and County) in moving forward towards satisfying their required volume managed.

The ULAR EWMP Watershed Management Group (WMG) recognizes the need and value of prioritizing stormwater projects within our ULAR Watershed Management Area (WMA). As such, as the ULAR Watershed Lead—on behalf of the ULAR WMG—we offer our full support to the Cities of Pasadena and South Pasadena in their efforts to obtain Measure W Round 2 grant funding for their San Rafael/San Pascual Treatment Wetlands Stormwater Capture Park Project. We are confident that this Project will help to restore the water quality and beneficial uses of the Arroyo Seco—and downstream LA River—satisfying interim compliance milestones—and contributing towards the long term compliance efforts of the ULAR EWMP.

Sincerely,

Dawn Petschauer

Dawn Petschauer
Upper LA River Watershed Lead
On behalf of the ULAR EWMP WMG

cc: Kris Markarian, City of Pasadena
Brent Maue, City of Pasadena
Sean Singletary, City of Pasadena
Julian Lee, City of South Pasadena
Alfredo Magallanes, City of Los Angeles, LASAN

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

The West Pasadena Residents' Association represents over 7,000 households in Southwest Pasadena, almost all of which are within a few blocks of the Arroyo Seco, and many of which are also adjacent to San Rafael Creek. WPRA and its neighborhoods are acutely aware of and interested in the Arroyo Seco's condition and maintenance.

WPRA supports the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project joint project submittal by the cities of Pasadena and South Pasadena under the Los Angeles County Flood Control District (LACFCD) Measure 'W' Program, and by the City of Pasadena for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22 to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and flood plain. **We also urge approval of the additional requested funding of $3.5 million** for this important project.

The project will treat stormwater inflow from the Arroyo Seco channel on public parcels in the City of Pasadena and South Pasadena. It will also contribute to the regional efforts underway by several agencies for the Upper Los Angeles River.

It will include two regional stormwater capture and treatment facilities consisting of surface infiltration facilities, as well as educational and wayfinding signage and viewing areas for recreational purposes. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels.

The community and a long list of stakeholders, both public and private, have worked tirelessly over many years to establish a vision for the future of the Arroyo Seco. The Arroyo Seco Master Plan was adopted by the Pasadena City Council in 2003 and continues to be the roadmap for the planning, preservation and enhancement of this unique gem in our cities. The project to restore San Rafael Creek to a healthy condition is recommended in the adopted Master Plan.

WPRA looks forward to the approval of this submittal and to being involved in the development and public engagement for this important project.

Respectfully,

Dan Beal
President
For the Board of Directors

cc: Steve Madison, Councilmember, District 6
Takako Suzuki, Field Deputy, District 6
Steve Mermell, City Manager
Ara Maloyan, Public Works Director

SIERRA CLUB FOUNDED 1892

Pasadena Group

October 14, 2020

Mr. Brent Maue
Assistant City Engineer
City of Pasadena Department of Public Works
Engineering Division
100 N. Garfield Avenue, Rm. N306
Pasadena, CA 91109

RE: Support for Arroyo Seco - San Rafael Treatment Wetlands Stormwater Capture Project in the Cities of Pasadena and South Pasadena

Dear Mr. Maue:

We forward this letter of support to you on behalf of Sierra Club for the joint project submittal by the cities of Pasadena and South Pasadena under the Los Angeles County Flood Control District (LACFCD) Measure 'W' Program. We understand the City of Pasadena is submitting this project for funding under the Safe, Clean Water Program Call for Projects for Fiscal Year 2021-22. The project, identified as **the Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project,** will advance important planning efforts within one of the region's primary and most historic natural open spaces, the Arroyo Seco. The project area involves the Arroyo Seco stream, a significant tributary of the Los Angeles River. We find it to be a truly important project to restore this reach of the flood plain within the Arroyo Seco Watershed.

The Sierra Club Pasadena Group, which includes both Pasadena and South Pasadena, has for many years conducted public hikes along the Lower Arroyo Seco at or near the proposed project's site, during which we point out and explain to hikers the many features of the Arroyo Seco and adjacent areas. Both Don Bremner and Virginia Heringer have led these Lower Arroyo hikes, and Virginia Heringer has led hikers there as chair of the Sierra Club's Natural Science Section. Incidentally, our online monthly newsletter is entitled "Arroyo View."

Our organization is not only supportive that the proposed project will treat stormwater inflow from the Arroyo Seco channel on public parcels in Pasadena and South Pasadena but also contribute to the regional positive efforts underway by several agencies for the Upper Los Angeles River. As the project has been explained to us, we understand that it will include two regional stormwater capture and treatment facilities consisting of surface infiltration facilities. Also included will be educational and wayfinding signage and viewing areas for recreational purposes.

We anticipate that the project will be discussed in detail in various forums, from community groups to the City Council and its committees. We will follow those discussions and perhaps participate in them.

The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project is a major opportunity to continue the progress in the region to achieve pollutant load reductions by the cities of Pasadena and South Pasadena. The project is intended to intercept a sizeable portion of the stormwater flows from adjacent San Rafael Creek and Arroyo Seco Channels that are both managed by the LACFCD. A treatment wetland and recharge basin system are proposed adjacent to the Arroyo Seco channel to capture, treat, and infiltrate stormwater from the diverted drainage channel. The proposed diversions will both consist of a drop inlet structure with a rubber dam placed in the Arroyo Seco to ensure that the storm drain will continue to accommodate the existing flood control drainage capacity.

The community and a long list of stakeholders, both public and private, have worked over many years to establish a vision for the future of the Arroyo Seco and its visitors. The Arroyo Seco Master Plan was adopted by the Pasadena City Council in 2003 and continues to be the roadmap for the planning, preservation and enhancement of this unique gem in our cities. The project to restore San Rafael Creek to a healthy condition is a project recommended in the adopted Master Plan for the Arroyo Seco in Pasadena.

This funding opportunity would allow for a very critical step in the planning and management of the Arroyo Seco flood plain and stream zone as well as implement a long-standing recommended project from Pasadena's Arroyo Seco Master Plan. It is our understanding that if awarded, this grant funding would assist in paying for the planning, design, preparation of construction documents, preparation of the appropriate CEQA document, completion of various important technical studies, and regulatory permits for the rehabilitation of this area, and would result in a "shovel ready project" for which $3.5 million in funding for implementation is already in place.

Our organization supports the proposal by the two cities to advance the restoration of San Rafael Creek and this reach of the Arroyo Seco stream and flood plain. We urge you to provide the additional requested funding of $3.5 million for this important project.

Thank you for your consideration to fund **The Arroyo Seco-San Rafael Treatment Wetlands Stormwater Capture Project** in the cities of Pasadena and South Pasadena and for the opportunity to show our complete support for this important project. If our organization can provide any further information, please feel free to contact us.

Best regards,

Virginia Heringer

Virginia Heringer
Sierra Club Pasadena Group Chair

Don Bremner

Don Bremner
Sierra Club Pasadena Group Conservation Chair and Outings Co-Chair
Former member of City of Pasadena Recreation and Parks Commission

October 15, 2020

City of South Pasadena
1414 Mission Street
South Pasadena, CA 91030
Attn: Mr. Julian Lee, Deputy Public Works Director

ARROYO SECO – SAN RAFAEL TREATMENT WETLANDS PROJECT
LETTER OF SUPPORT

Dear Mr. Lee:

We would like to express our support for the Arroyo Seco – San Rafael Treatment Wetlands Project in the Cities of Pasadena and South Pasadena. This Project will improve stormwater quality by intercepting pollutant-laden stormwater and urban runoff pollutants from the San Rafael Creek and from the Arroyo Seco Channel with adjacent treatment basins/wetlands. The enhancement of these areas and the use of native habitat will provide an opportunity to connect the community with the natural environment and the historic Arroyo Seco Channel.

We welcome the opportunity for San Pascual Stables to participate in this Project with the City of Pasadena and South Pasadena and look forward its development.

If you have any questions, please contact David Sterckx , Managing partner, at (310)666-1060 or via email at davidsterckx@sanpascualstables.com.

Sincerely,

D. Sterckx
Managing partner

ATTACHMENT I: MODELING DETAILS

MODELING DETAILS

SCW SUBMISSION – ARROYO SECO/SAN RAFAEL TREATMENT WETLANDS

The following provides a detailed description of modeling developed, assumptions made, and summarized results used for the submission of the Arroyo Seco/San Rafael Treatment Wetlands Project (Project) to the Safe, Clean Water Program (SCWP) module for funding consideration. This document is not meant to be exhaustive of modeling detail but provides relevant parameter assumptions and summarized results in demonstration of how user-submitted values were developed for the SCWP application submission for this Project.

1.0 BASELINE HYDROLOGY & WATER QUALITY MODELING

For purposes of establishing baseline timeseries' for the project location, the Los Angeles County LSPC (Loading Simulation Program C++) model was used for this analysis. Drainage areas to the project site were developed using subwatershed boundaries from the geospatial data supporting the LSPC model and edited where project diversion points did not coincide with subwatershed boundaries. Land cover inputs to the LSPC model were calculated based on the drainage area to the Project from the geospatial data for Hydrologic Response Units (HRUs) supporting the LSPC model. The baseline LSPC model was run for the Water Years of 1992 – 2011 (with a one-year model warmup period over Water Year 1991) to enable 20-year estimates of water supply for the Project as required of the SCWP module. A 10-year estimate of water quality for the Project for Water Years 2002-2011 was used for long-term performance considerations to coincide with established E/WMP evaluation periods in Los Angeles County.

1.1 Summary of Baseline Loading from LSPC Modeling

Modeling Period	Baseline Runoff (ac-ft)	Baseline Zinc Loading (lbs; Primary Pollutant)	Baseline Copper Loading (lbs; Secondary Pollutant)
10-Year Annual Average (WY 2002-2011)	4,583	1,289	345
20-Year Annual Average (WY 1992-2011)	4,008		

craftwater engineering, inc.
San Diego | Los Angeles
805.729.0943
craftwaterinc.com

2.0 BMP MODELING

Baseline timeseries' from the LSPC model were used as input to model the Arroyo Seco/San Rafael Project by using the BMP model SUSTAIN (System for Urban Stormwater Treatment and Analysis IntegratioN) that was developed by the United States Environmental Protection Agency (US EPA). SUSTAIN allows the user to route a baseline hydrology and water quality timeseries through a BMP or series of BMPs with real-world natural and engineered parameters (summarized in 2.1) to determine how much stormwater and pollutant may be captured and treated by the BMP. Results for the Project have been presented both separately and in summation for the two BMPs (San Rafael and San Pascual) making up the nested Treatment Wetlands System. BMPs were modeled together but tabulated separately using relevant baseline timeseries' with modeling results aggregated to ensure SCWP submission reflects the sum benefits of the multi-BMP Project. The outputs of SUSTAIN are a full resultant timeseries for hydrology and water quality at each component of the modeled BMP(s). These full results are beyond the scope of reporting but have been summarized using average annual statistics below (2.2 and 0) to demonstrate the water balance over the Project components and the water quality reductions expected for this BMP.

2.1 Arroyo Seco/San Rafael Project BMP Parameters

BMP	Diversion Rate	Wetland Storage Volume	Infiltration Rate	Filtration Rate
San Rafael	25 cfs	2.6 ac-ft	0.89 in/hr	2.88 cfs
San Pascual	25 cfs	6.5 ac-ft	0.30 in/hr	5.76 cfs
Wetland System	***50 cfs***	***9.1 ac-ft***	***Effective Drawdown Rate = 5.18 in/hr***	

2.2 Arroyo Seco/San Rafael Project BMP Water Balance

10-Year Annual Average (ac-ft/yr)

Component	INFLOW	WEIR	ORIFICE	UNDER-DRAIN	BYPASS	OUTFLOW	INFIL	PERCO-LATION	ET	SEEPAGE
San Rafael Diversion	302	11	291	0	0	302	0	0	0	0
San Rafael Wetland	291	95	0	84	0	179	195	195	1	112
San Pascual Diversion	4,583	2,442	2,247	0	0	4,689	0	0	0	0
San Pascual Wetland	2,247	1,035	0	1,036	0	2,071	1,211	1,211	0	175

20-Year Annual Average (ac-ft/yr)

Component	INFLOW	WEIR	ORIFICE	UNDER-DRAIN	BYPASS	OUTFLOW	INFIL	PERCO-LATION	ET	SEEPAGE
San Rafael Diversion	238	58	179	0	0	238	0	0	0	0
San Rafael Wetland	179	56	0	66	0	122	123	123	0	57
San Pascual Diversion	4,008	2,518	1,490	0	0	4,008	0	0	0	0
San Pascual Wetland	1,490	725	0	688	0	1,414	765	765	0	77

2.3 Arroyo Seco/San Rafael Park Project BMP Pollutant Balance

Primary Pollutant – Zinc (lbs/yr)

Component	INFLOW	WEIR	ORIFICE	UNDERDRAIN	BYPASS	OUTFLOW
San Rafael Diversion	67	6	61	0	0	67
San Rafael Wetland	61	13	0	2	0	15
San Pascual Diversion	1,289	841	492	0	0	1,332
San Pascual Wetland	492	126	0	37	0	163

Secondary Pollutant – Copper (lbs/yr)

Component	INFLOW	WEIR	ORIFICE	UNDERDRAIN	BYPASS	OUTFLOW
San Rafael Diversion	20	1	19	0	0	20
San Rafael Wetland	19	3	0	1	0	4
San Pascual Diversion	345	194	151	0	0	345
San Pascual Wetland	151	36	0	14	0	50

3.0 SCW EQUIVALENT STATISTICS

In order to make these results comparable to those generated by the SCW module in lieu of more detailed modeling, the following table has been provided based on BMP modeling results in Section **Error! Reference source not found.**. Note that for these purposes, the 10-year runoff figures have been used to coincide with the equivalent time period of pollutant modeling and estimates. Additionally, runoff reduction in table is not equivalent to contributing water supply volume for this project due to the complexity of discharges. These numbers are presented solely as a comparative to the SCW module values to demonstrate the equivalent methodology used to develop pollutant reduction percentages superseding SCWP module values for the project submission. Note that slight rounding error may be present in table values due to significant digits represented.

Metric	Runoff from Capture Area	Inflow into Project Inlet	Outflow from Project Outlet	Reduction by Project	% Reduction for by Project
Runoff Volume (ac-ft)	4,583	2,538	1,130	1,408	55.5%
Total Zinc (lbs)	1,289	553	178	375	67.7%
Total Copper (lbs)	345	170	54	116	68.2%

SAFE, CLEAN WATER PROGRAM

TECHNICAL RESOURCES SUMMARY

Regional Program Projects Module

PROJECT CONCEPT NAME	South Pasadena Huntington Drive Regional Green Street
PROJECT CONCEPT LEAD(S)	City of South Pasadena
SCW WATERSHED AREA	Upper Los Angeles River
TOTAL SCW FUNDING REQUESTED FLAT RATE	$ 300k

Submitted On: Thursday, October 15, 2020

Created By: Julian Lee, Deputy Public Works Director, City of South Pasadena (Julian Lee)

OVERVIEW

The Technical Resources Program is a part of the Safe, Clean Water Regional Program providing resources to community groups, municipalities, and individuals who need technical assistance to develop their Project concepts. Each Watershed Area Steering Committee will determine how to appropriate funds for the Technical Resources Program.

The Technical Resources Program funds the development of Project Feasibility Studies. Technical Assistance Teams will work with the necessary parties to add Projects for which there are completed Feasibility Studies to an eligible water quality plan, assist in acquiring a letter of support for non-Municipal Infrastructure Program Project Applicants, and address other prerequisites to apply to the Infrastructure Program. Upon completion, Feasibility Studies shall be submitted to the Watershed Area Steering Committees for consideration.

The Watershed Area Steering Committees will decide which Project concepts will be forwarded to the Technical Assistance Teams for development. The District will provide Technical Assistance Teams comprised of subject matter experts in Stormwater and/or Urban Runoff infrastructure design, hydrology, soils, Nature-Based Solutions, green infrastructure, Stormwater and/or Urban Runoff quality, water supply, recreation, open space, community needs, and other areas. The Technical Assistance Teams will complete Feasibility Studies in partnership with and on behalf of Municipalities, CBOs, NGOs, and others who may not have the technical resources or capabilities to develop Feasibility Studies.

This document summarizes a Project concept that is being proposed for Feasibility Study funding under the Technical Resources Program. This document is based upon inputs to and outputs from the web-based tool called the ‘SCW Regional Program Projects Module’ (https://portal.safecleanwaterla.org/projects-module/).

ORGANIZATIONAL OVERVIEW:

1 GENERAL INFORMATION

1.1 Overview
1.2 Project Location
1.3 Summary
1.4 Additional Information

2 DESIGN ELEMENTS

2.1 Configuration
2.2 Capture Area
2.3 Site Conditions & Constraints
2.4 Cost
2.5 Operations & Maintenance
2.6 Additional Information

3 WATER QUALITY & WATER SUPPLY

4.1 Water Quality
4.2 Water Supply
4.3 Additional Information

4 **COMMUNITY**

5.1 Community Investment
5.2 Community Engagement
5.3 Additional Information

5 NATURE-BASED SOLUTIONS

6 ATTACHMENTS

1 GENERAL INFORMATION

This section provides general information on the Project concept including location and a brief description.

1.1 Overview

The following table provides an overview of the Project concept and the proposed Lead(s):

Project concept Name:	South Pasadena Huntington Drive Regional Green Street
Brief Project concept description:	The City is requesting a feasibility study for the capture and infiltration of stormwater flows to a green street along Huntington Drive.
Call for Projects year:	FY21-22
SCW Watershed Area:	Upper Los Angeles River
Total Funding SCW Requested Flat Rate:	$ 300k
Target Date of Completion:	10/15/2021
Project Concept Lead(s):	City of South Pasadena
Additional Project concept Collaborators:	N/A
Additional Project concept Collaborators:	N/A
Additional Project concept Collaborators:	N/A
LACFCD assistance for maintenance of the Project concept?	No
Is this a non-municipal project?	No
Primary Contact (if differs from submitter):	N/A
Primary Contact Email (if differs from submitter):	jlee@southpasadenaca.gov
Secondary Contact (if differs from submitter):	N/A
Secondary Contact Email (if differs from submitter):	N/A

1.2 Project Location

The following table details the Project location:

Latitude:	34.104172
Longitude:	-118.146687
Street Address:	Huntington Dr & Marengo Ave
City:	South Pasadena
State:	CA
Zip Code:	91030
Municipality:	South Pasadena

Is the project located within or providing a benefit to a Disadvantaged Community (DAC)?

Yes

The following is a summary of how the Project concept will benefit its DAC with a discussion of measures on displacement avoidance:

According to the California Department of Water Resources' DAC Mapping Tool (2016 Census Data, there are two DAC block groups of 1,591 people one mile upstream of the project area. (GEOID 060374806002, 060374806005.)

DAC information source: https://gis.water.ca.gov/app/dacs/

1.3 Summary

Attachments for this Section	
Attachment Name	Description
Huntington Drive Project Illustrative Summary	Compact, illustrative summary that outlines the primary components of the proposed Feasibility Study.

Please describe the historical background of the Project concept, including but not limited to: a background of the level of community engagement conducted so far; a summary of who has been involved in the concept to date, and a summary of the work done by these project partners and collaborators (consultants, municipalities, NGOs, CBOs, etc); as well as other important historical project background that may be important for your WASC to know about the project. Please also state which regional water management plan includes the proposed project (SWRP, E/WMP, IRWMP or other, if applicable):

In terms of projects to be implemented under the Upper LA River EWMP, the City's initial focus was on its "signature" regional stormwater capture project at Lower Arroyo Park, within the Arroyo Seco watershed. With several updates and improvements made to the original concept, this project was submitted for SCW 2020/2021 Technical Resources Program funding in December 2019. The City's Public Works Department then focused on the LA River main stem watershed, as the EWMP also requires the City to implement stormwater capture projects within this drainage area. Specifically, the EWMP's predicted stormwater capture capacity for the subwatershed that the project is within--subwatershed ID# 636480--requires 13.3 acre-feet of stormwater capture capacity by 2028. (See EWMP Appendix 7, Table 7A-40.) Within this subwatershed the EWMP lists the implementation of both "green streets" and regional stormwater infiltration or capture/use projects as an optimal approach to reducing pollutant loading and meet water quality milestones. Huntington Drive is listed as a potential green street location in Appendix 6.E of the EWMP. (See attachment.)

A 2020 review of the drainage area by Public Works Department staff revealed a promising opportunity at the street medians along Huntington Drive, surrounding the intersection of Huntington Drive and Marengo Avenue. The medians could be retrofitted to implement a green street that captures regional stormwater and urban runoff, providing water quality, water supply, nature based solutions, and community benefits. See Section 2 of this application for more information on these benefits. Through the feasibility study process, the City will hold community-based workshops with the general public and other stakeholders, such as local environmental groups.

1.4 Additional Information

Additional general information regarding Project concept is provided as the following attachments:

Attachments for this Section	
Attachment Name	Description
Huntington Drive Project Illustrative Summary	Compact, illustrative summary that outlines the primary components of the proposed Feasibility Study.
ULAR EWMP Appendix 6E	Location of project within the Upper LA River EWMP.

2 DESIGN ELEMENTS

This section provides an overview of the anticipated design elements for the Project concept.

2.1 Configuration

The following is a description of the Project concept layout including its anticipated footprint and key components:

See the maps included as an attachment to this section for visual aids based on the following description.

The City street medians surrounding the intersection of Huntington Drive and Marengo Avenue, from Fair Oaks Avenue to Fletcher Avenue--have approximately 0.77 acres of open space that could be retrofitted to capture stormwater and urban runoff from the upstream drainage area, as well as the roadway and surrounding neighborhood. This retrofit would consist of installing underground storage chambers or dry wells beneath the medians, and connecting them via diversion pipes to an underground storm drain located just east of the intersection. The existing turf would also be replaced with drought tolerant plants. Educational signage could be incorporated in the walkways at pedestrian crossings.

Due to the large capture area, the capacity of the system to capture the 85th percentile, 24 hour storm event could be up to 31 acre-feet. The available footprint for the system is not large enough to capture this volume. In addition, expected limits to available construction funding would likely result in a reduced capture capacity. For the purposes of this application, we are currently estimating a capacity of 5 acre-feet. The actual capacity would be determined through the collaborative SCW Feasibility Study that is being requested through this application. On this assumption, it is also worth noting:

• Over impervious drainage areas, pollutant loading and concentrations are heavier during the beginning of storm events. And so projects that capture less than the 85th percentile, 24 hour storm event remain an efficient approach to improving water quality.
• The high-level cost estimate listed in Section 2.4 of this application is based on a runoff capture capacity of 5 acre-feet. Should the feasibility determine a different optimal capacity, this cost would change significantly.

The project holds promising opportunities to implement water quality, water supply, nature based solutions, and community benefits. This includes the following:

• Three adjacent medians of about 17 ft width on Huntington Drive running from Fair Oaks Avenue to Fletcher Avenue--about 3,000 ft of street length--which could provide room for the installation of a regional stormwater capture project.
• A storm drain pipe passing underneath the western end of one of the medians, just east of the intersection of Huntington Drive and Marengo Avenue. This proximity to the project area cold reduce the cost to divert upstream runoff flows to the medians.
• A large upstream drainage capture area for the storm drain pipe of about 600 acres.
• A sanitary sewer trunk line passing along the same intersection as the storm drain pipe. (Providing a water supply alternative to infiltration.)
• An opportunity to improve the existing turf on the medians by replacing it with drought tolerant, native plant species. This would complement and continue the adjacent project that was recently completed for the triangular median at Fair Oaks Ave and Huntington Dr. The triangular median is just 50 feet from the westerly median within this project scope.
• From the bullet points above, the possibility of implementing a "regional green street": A project that

provides the nature based and community benefits of a green street, with the water quality and supply benefits of a regional stormwater capture project.

The water supply concept will vary based on the results of the Feasibility Study requested through this application:

• If infiltration is feasible, captured runoff would be infiltrated into the soil beneath the system.
• If infiltration is not feasible, captured runoff could be detained, then released to an existing 18-inch sanitary sewer trunk line that, similar to the storm drain pipe, passes the intersection of Huntington Drive and Marengo Ave.
• Captured water could also be used to supplement irrigation of the medians. This would be determined through the feasibility study requested through this application.

Specify whether the project is Wet or Dry:

Wet

Estimated Capacity for the Project concept:

5 ac-ft

2.2 Capture Area

The size and land uses of the capture area upstream of a project plays an important role in its water quality and water supply benefits.

The following table details the capture area and its imperviousness:

Capture Area Summary	
Capture Area:	602.4 ac
Impervious Area:	313.7 ac
Pervious Area:	288.7 ac

The following table is a summary of the land use breakdown for the impervious area that drains to the project:

Breakdown of Impervious Acreage in Capture Area		
Land Use Type	Percent Impervious	Acres
Commercial	17.3 %	54.27
Highways and Interstates	6.58 %	20.64
Industrial	0.42 %	1.32
Institutional	6.8 %	21.33
Multi Family Residential	19.14 %	60.04
Secondary Roads and Alleys	29.11 %	91.32
Single Family Residential	19.81 %	62.14
Urban Open Space	0.84 %	2.64

2.3 Site Conditions & Constraints

The following is a summary of engineering analyses performed to date, and a description of

existing and / or potential constraints or limitations due to existing conditions.

This project concept is planning-level and subject to review and revision during project design. A variety of confounding factors, including geotechnical and environmental considerations, will need to be further investigated to inform project design. Factors to be considered include but are not limited to the following:

• Drainage delineation: the drainage was delineated using best available data in GIS analysis. A site visit and grading analysis should be performed before design to refine the capture areas and ensure maximum capture of runoff.
• Groundwater levels: the distance between the bottom of the infiltrating surface and the seasonal high groundwater level should be at least 5 feet apart to allow for adequate infiltration. This should be confirmed prior to construction.
• Infiltration rates: Infiltration rates can vary from site to site. Ideally, infiltration tests should be performed prior to construction to ensure the structure is sized appropriately.
• Tree removal: Tree removal could disturb active nests or destroy protected trees, which may increase time for site-specific CEQA compliance.
• Utilities: a utilities survey should be performed during design to ensure no utilities will be disrupted during construction.
• Street closures: The temporary closing of lanes on Huntington Drive during the construction phase of the project.
• Environmental factors: additional investigation should be performed at project sites to assess the possibility of interference of existing contamination with stormwater infiltration.

2.4 Cost

The following tables provide details on the anticipated capital and annualized costs for the Project concept:

Capital Cost Breakdown	
Construction Cost:	$ 5,000,000.00
Planning and Design Cost*	$ 500,000.00

*Includes early concept design, pre-project monitoring, feasibility study development, site investigations, formal project design, intermediate and project completion audits, CEQA and other environmental impact studies and permitting.

Annual Cost Breakdown	
Annual Maintenance Cost:	$ 30,000.00
Annual Operation Cost:	$ 5,000.00
Annual Monitoring Cost:	$ 5,000.00
Project Life Span:	50 years

2.5 Operations & Maintenance

The following is a description of the operations and maintenance needs for the Project:

See the Attachment to Section 2 for an EPA fact sheet on underground retention/detention systems for information on operations and maintenance. Typical maintenance activities and frequencies include:

• Periodic inspection and maintenance to verify proper operation of the facility. This includes cleaning to remove accumulated trash, grit, sediments, and other debris.
• Preventing mosquito access to standing water sources in BMPs (particularly below-ground). BMPs that hold water for over 72 hours and/or rely on electrical or mechanical devices to dewater may require routine inspections and treatments by local mosquito and vector control agencies to suppress mosquito production.

Detailed operations and maintenance needs will be determined through the feasibility study process.

The following is the agency and contact person that will be responsible for operations and maintenance of the Project:

City of South Pasadena, Julian Lee, Deputy Public Works Director

The following expertise or technical training is necessary to perform basic operation and maintenance of the Project:

The expertise or technical training necessary to perform basic operation and maintenance of the Project may include vactor truck operators and mechanical laborers. Specific technical training required will be determined through the feasibility study process.

2.6 Additional Information

Additional information regarding design elements for the Project concept is provided as the following attachments:

Attachments for this Section	
Attachment Name	Description
Maps	Maps showing project location within the watershed, drainage, storm drain and sewer piping, and disadvantaged communities.
EPA retention-detention basin fact sheet	See page 5 for O&M information.

3 WATER QUALITY & WATER SUPPLY

This section provides an overview of project elements that will provide water quality and water supply benefits.

3.1 Water Quality

The following describes how the Project concept will address primary pollutants of concern:

This project could capture stormwater and urban runoff from a large regional drainage area, prior to discharge to surface waters. This will also capture pollutants in the stormwater and urban runoff and prevent the pollutants' release to the LA River (and upstream Laguna Channel). The primary pollutants that will be captured and prevented from being released to these downstream waterbodies include bacteria, metals, toxics, and trash. For more information on these primary pollutants, see the following application response.

The following describes the water quality concerns in the vicinity and downstream of the proposed Project concept area:

The LA River is impaired and is under TMDLs for dry and wet weather bacteria, metals including zinc and copper, and trash. The harbor at the LA River estuary is impaired for toxic chemicals. This project will support the Upper LA River EWMP Group's effort to attain its dry weather bacteria targets, as well as its 2024 interim and 2028 final TMDL/EWMP stormwater compliance targets for the LA River. Specifically, the project will help achieve the EWMP's predicted stormwater capture capacity for the subwatershed that it is within: Subwatershed ID# 636480 requires 13.3 acre-feet of stormwater capture capacity by 2028. (See EWMP Appendix 7, Table 7A-40.)

3.2 Water Supply

The following describes and justifies the nexus between water supply and the stormwater and/or urban runoff that will be captured/infiltrated/diverted by the Project:

If feasible, stormwater captured will be infiltrated and used to recharge groundwater supplies. If infiltration is not feasible, captured runoff could be detained, then released to an existing 18-inch sanitary sewer trunk line that, similar to the storm drain pipe, passes the intersection of Huntington Drive and Marengo Ave. Captured water could also be used to supplement irrigation of the median. This would be determined through the feasibility study requested through this application.

Will this Project capture water for onsite irrigation use?

No

The following describes onsite use by the Project:

Captured water could also be used to supplement irrigation of the median. This would be determined through the feasibility study requested through this application.

Will this Project capture water used for water recycling by a wastewater treatment facility?

No

The following describes water recycling by the project:

If infiltration is not feasible, captured flows would be detained, then released to an existing sanitary sewer trunk line located below Marengo Avenue.

Will the Project be connected to a managed water supply aquifer?

Yes

If Yes, managed Aquifer Name:

Main San Gabriel Basin

3.3 Additional Information

Additional information regarding water quality and water supply benefits of the Project concept is provided as the following attachments:

4 COMMUNITY

This section provides an overview of project elements related to community investment benefits and community engagement performed to date.

4.1 Community Investment

The following table details the Project's anticipated community investment benefits:

Community Investment		
Investment Type	Applicable?	Detailed Description
Does this project improve flood management, flood conveyance, or flood risk mitigation?	Yes	The project will increase flood protection through reduced peak flow rates from peak flow attenuation in the existing storm drain system.
Does this project create, enhance, or restore park space, habitat, or wetland space?	Yes	The project will enhance park space by replacing the existing turf with native plants.
Does this project improve public access to waterways?	No	N/A
Does this project create or enhance new recreational opportunities?	No	N/A
Does this project create or enhance green spaces at school?	No	N/A
Does this project reduce heat local island effect and increase shade?	No	N/A
Does this project increase shade or the number of trees or other vegetation at the site location?	Yes	The project will replace the existing turf with native plants. Additional native trees will also be considered through the feasibility study process.

4.2 Community Engagement

The following describes the effort of outreach and engagement that has occurred to date and identify (if any) agencies / municipalities / stakeholders that were involved in the development of the Project concept:

The City is the sole agency involved in the development of the project concept. Through the feasibility study process, the City will hold community-based workshops with the general public and other stakeholders, such as local environmental groups.

The following describes the plan to outreach and engage the community during the early development phase of the Project:

Through the feasibility study process, the City will hold community-based workshops with the general public and other stakeholders, such as local environmental groups. The workshops will inform stakeholders on the City's project approach, and allow them to participate in project development.

4.3 Additional Information

Additional information regarding community benefits and engagement for the Project concept is provided as the following attachments:

5 NATURE-BASED SOLUTIONS

This section provides an overview of Project elements that will leverage nature-based solutions.

Will this Project implement natural processes?

Yes

The following is a description of natural processes that will be implemented:

The underground stormwater capture system will mimic natural processes to slow, detain, capture, and (potentially) infiltrate water, which will help protect and enhance downstream surface waters. The potential addition of trees will also slow, detain, capture, and absorb water in a manner that enhances open space.

Will this project utilize natural materials?

Yes

The following is a description of natural materials that will be utilized:

Surface features will include native plants and potentially trees on the medians.

The following describes how nature-based solutions are utilized to the maximum extent feasible. If nature-based solutions are not used, a description of what options have been considered and why they were not included is provided.

An underground stormwater capture system--versus an aboveground nature-based system--was selected due to the existing use of the project location as street medians. To help maximize nature-based solutions, the project will improve the existing turf on the medians by replacing it with drought tolerant, native plant species. This improvement would also complement and continue the adjacent project that was recently completed for the triangular median at Fair Oaks Ave and Huntington Dr. Ave and Huntington Drive. The triangular median is just 50 feet from the westerly median within this project scope.

6 ATTACHMENTS

Attachments are bundled and organized in the following pages, with cover pages between each subsection.

ATTACHMENTS FOR SECTION 1.3:

Illustrative Overview

Huntington Drive Regional Green Street | City of South Pasadena

Safe, Clean Water Technical Resources Program

Project Overview

Project Type: Regional Green Street

Location:

- Street medians in the City of South Pasadena
- On Huntington Drive from Fair Oaks Ave to Fletcher Ave

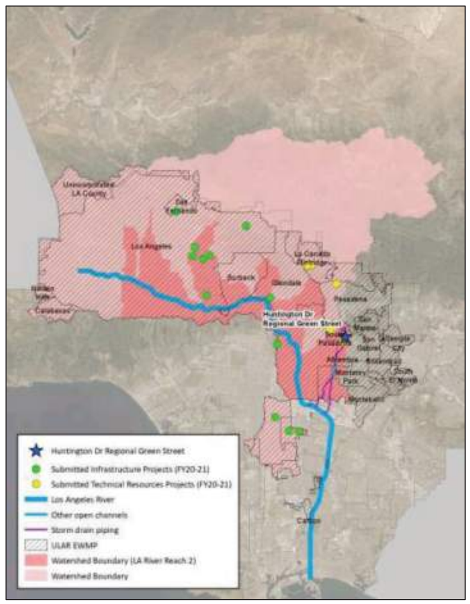
Subwatershed: LA River main stem

Key Benefits:

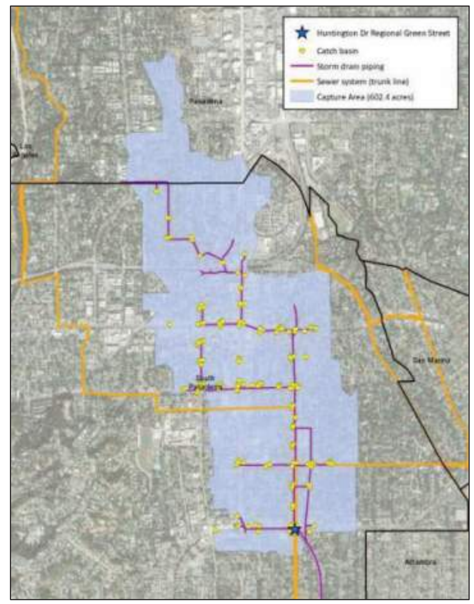
- Water quality (regional stormwater capture)
- Water supply (aquifer recharge or reclamation)
- Nature-based solutions (native planting on medians)
- Community (improvement to medians)
- Identified as a green street location in the EWMP

Funding Request: $300,000 to prepare a Feasibility Study following SCWP guidelines

Water Quality & Supply



The street medians are located within the eastern limit of the Upper LA River watershed management area. The project discharges through underground storm drains, daylights in the Laguna Channel for a stretch, then returns to underground storm drains before reaching the main stem of the LA River.



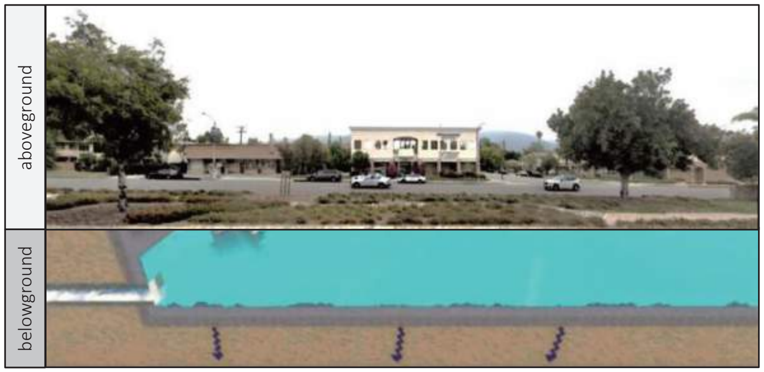
An underground storm drain line with an upstream drainage area of ≈600 acres passes underneath the west end of one of the street medians, just east of the intersection of Huntington Drive and Marengo Avenue.

The medians have ≈0.77 acres of open space. The space below the medians could be used to divert runoff from the adjacent storm drain. For the purposes of this application, the available capture capacity is estimated at 5 acre-feet. The actual capacity would be determined through the Feasibility Study requested through this application.

Huntington Drive Regional Green Street | City of South Pasadena

Safe, Clean Water Technical Resources Program

Water Quality & Supply (continued)



Underground regional infiltration system below a street median

The regional stormwater and urban runoff flows identified on Page 1 could be captured with underground storage chambers or dry wells located beneath the medians. Along with the median improvements identified in the "Nature Based Solutions" section below, the project could be considered a "regional green street": Providing both the nature-based and community benefits of a green street with the water quality and supply benefits of a regional stormwater capture project.

If a feasibility study deems infiltration infeasible, captured runoff could be detained, then released to an existing 18-inch sanitary sewer trunk line that passes the intersection of Huntington Drive and Marengo Ave. Captured water could also be used to supplement irrigation of the median. This would be determined through the Feasibility Study requested through this application.

Community Benefits

- Beautification of street (via replacement of the existing turf with native plants)
- Enhanced habitat (via replacement of the existing turf with native plants including potentially native trees)
- Improved flood protection
- New educational opportunities (via educational signage that may be incorporated in the walkways at pedestrian crossings)

Nature Based Solutions

This project provides an opportunity to improve the existing turf on the medians by replacing it with drought tolerant, native plant species. This would complement and continue the adjacent project that was recently completed for the triangular median at Fair Oaks Ave and Huntington Drive. The triangular median is just 50 feet from the westerly median within this project scope.

Existing medians on Huntington Drive

Potential median improvement
(picture taken from recent landscaping project at adjacent median)

Consideration of native trees

ATTACHMENTS FOR SECTION 1.4:

General Information

Huntington Drive Regional Green Street | City of South Pasadena

Safe, Clean Water Technical Resources Program

Project Overview

Project Type: Regional Green Street

Location:

- Street medians in the City of South Pasadena
- On Huntington Drive from Fair Oaks Ave to Fletcher Ave

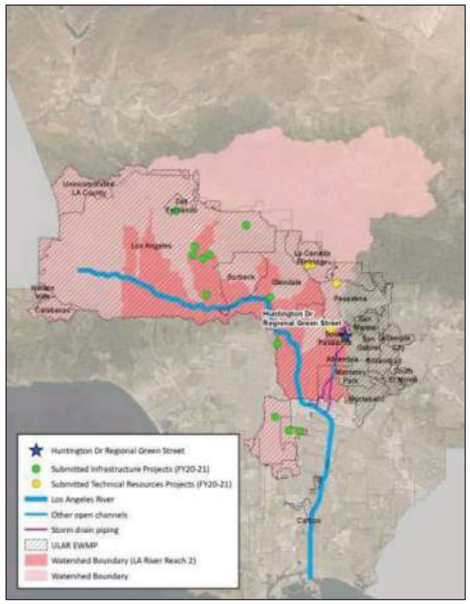
Subwatershed: LA River main stem

Key Benefits:

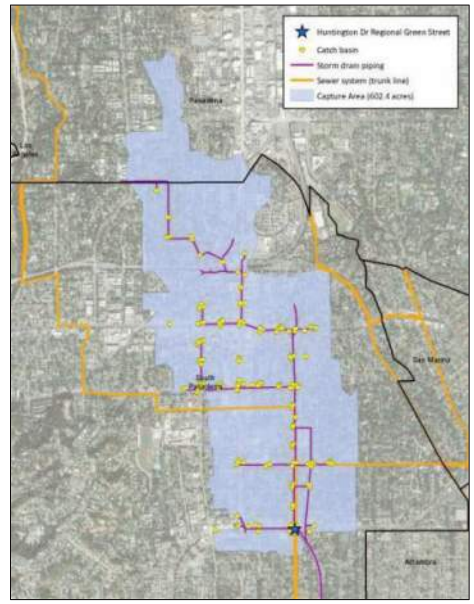
- Water quality (regional stormwater capture)
- Water supply (aquifer recharge or reclamation)
- Nature-based solutions (native planting on medians)
- Community (improvement to medians)
- Identified as a green street location in the EWMP

Funding Request: $300,000 to prepare a Feasibility Study following SCWP guidelines

Water Quality & Supply



The street medians are located within the eastern limit of the Upper LA River watershed management area. The project discharges through underground storm drains, daylights in the Laguna Channel for a stretch, then returns to underground storm drains before reaching the main stem of the LA River.



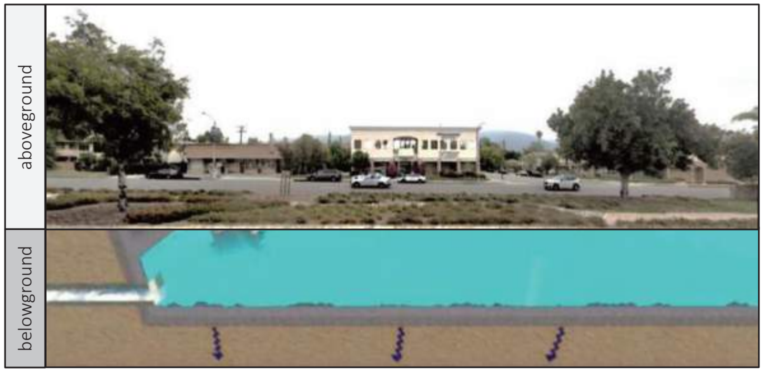
An underground storm drain line with an upstream drainage area of ≈600 acres passes underneath the west end of one of the street medians, just east of the intersection of Huntington Drive and Marengo Avenue.

The medians have ≈0.77 acres of open space. The space below the medians could be used to divert runoff from the adjacent storm drain. For the purposes of this application, the available capture capacity is estimated at 5 acre-feet. The actual capacity would be determined through the Feasibility Study requested through this application.

Huntington Drive Regional Green Street | City of South Pasadena

Safe, Clean Water Technical Resources Program

Water Quality & Supply (continued)



Underground regional infiltration system below a street median

The regional stormwater and urban runoff flows identified on Page 1 could be captured with underground storage chambers or dry wells located beneath the medians. Along with the median improvements identified in the "Nature Based Solutions" section below, the project could be considered a "regional green street": Providing both the nature-based and community benefits of a green street with the water quality and supply benefits of a regional stormwater capture project.

If a feasibility study deems infiltration infeasible, captured runoff could be detained, then released to an existing 18-inch sanitary sewer trunk line that passes the intersection of Huntington Drive and Marengo Ave. Captured water could also be used to supplement irrigation of the median. This would be determined through the Feasibility Study requested through this application.

Community Benefits

- Beautification of street (via replacement of the existing turf with native plants)
- Enhanced habitat (via replacement of the existing turf with native plants including potentially native trees)
- Improved flood protection
- New educational opportunities (via educational signage that may be incorporated in the walkways at pedestrian crossings)

Nature Based Solutions

This project provides an opportunity to improve the existing turf on the medians by replacing it with drought tolerant, native plant species. This would complement and continue the adjacent project that was recently completed for the triangular median at Fair Oaks Ave and Huntington Drive. The triangular median is just 50 feet from the westerly median within this project scope.

Existing medians on Huntington Drive

Potential median improvement
(picture taken from recent landscaping project at adjacent median)

Consideration of native trees

Appendix 6.E
Green Streets Results Synthesis and List of Opportunities

Table 6.E-18. Screened Green Street Opportunities Considered in the EWMP for City of South Pasadena

Subwatershed	Street Name	Drainage Configuration	Centerline Length (ft)
615880	(unknown)	Bioretention (No Underdrains)	892
615880	Ashbourne Dr	Bioretention (No Underdrains)	29
615880	Camden Ave	Bioretention (No Underdrains)	730
615880	Camden Pkwy	Bioretention (No Underdrains)	1,066
615880	Court Ave	Bioretention (No Underdrains)	434
615880	E Huntington Dr	Bioretention (No Underdrains)	1,528
615880	Garfield Ave	Bioretention (No Underdrains)	1,081
615880	Garfield Rd	Bioretention (No Underdrains)	1,081
615880	Huntington Dr	Bioretention (No Underdrains)	165
615880	la Senda Pl	Bioretention (No Underdrains)	927
615880	N Curtis Ave	Bioretention (No Underdrains)	7
615880	N Dos Robles Pl	Bioretention (No Underdrains)	31
615880	N Marguerita Ave	Bioretention (No Underdrains)	20
615880	Oak St	Bioretention (No Underdrains)	25
615880	Olive Ave	Bioretention (No Underdrains)	637
615880	W Huntington Dr	Bioretention (No Underdrains)	165
615880	W Pine St	Bioretention (No Underdrains)	880
615980	(unknown)	Bioretention (No Underdrains)	15
615980	Amberwood Dr	Bioretention (No Underdrains)	632
615980	Brent Ave	Bioretention (No Underdrains)	50
615980	Chelten Way	Bioretention (No Underdrains)	15
615980	Chelton Way	Bioretention (No Underdrains)	15
615980	Clark Pl	Bioretention (No Underdrains)	143
615980	Ellincourt Dr	Bioretention (No Underdrains)	501
615980	Foothill St	Bioretention (No Underdrains)	389
615980	Garfield Ave	Bioretention (No Underdrains)	4,044
615980	Garfield Rd	Bioretention (No Underdrains)	4,044
615980	Grevelia St	Bioretention (No Underdrains)	986
615980	Hardison Ln	Bioretention (No Underdrains)	269
615980	Hardison Pl	Bioretention (No Underdrains)	284
615980	Hope St	Bioretention (No Underdrains)	6
615980	Las Flores Dr	Bioretention (No Underdrains)	51
615980	Le Droit Dr	Bioretention (No Underdrains)	627
615980	Milan Ave	Bioretention (No Underdrains)	1,608
615980	Mill Rd	Bioretention (No Underdrains)	286
615980	Mission Aly	Bioretention (No Underdrains)	73
615980	Mission St	Bioretention (No Underdrains)	1,111
615980	Mockingbird Ln	Bioretention (No Underdrains)	259
615980	Monterey Rd	Bioretention (No Underdrains)	1,194
615980	Montrose Ave	Bioretention (No Underdrains)	1,968
615980	Montrose Ln	Bioretention (No Underdrains)	602
615980	North Aly	Bioretention (No Underdrains)	206
615980	Oxley St	Bioretention (No Underdrains)	967
615980	Palermo Ln	Bioretention (No Underdrains)	105
615980	Park Ave	Bioretention (No Underdrains)	69
615980	Pico Aly	Bioretention (No Underdrains)	66
615980	Raymond Hill Rd	Bioretention (No Underdrains)	268
615980	Raymondale Dr	Bioretention (No Underdrains)	563
615980	South Aly	Bioretention (No Underdrains)	25
615980	Stratford Ln	Bioretention (No Underdrains)	18
615980	W State St	Bioretention (No Underdrains)	129
616080	Garfield Ave	Bioretention (No Underdrains)	128
616080	Garfield Rd	Bioretention (No Underdrains)	128
616080	Hardison Ln	Bioretention (No Underdrains)	21
616080	Hardison Pl	Bioretention (No Underdrains)	3
616080	Raymond Hill Rd	Bioretention (No Underdrains)	73
636280	(unknown)	Biofiltration (Underdrains)	1,355
636280	Alpha St	Biofiltration (Underdrains)	1,039
636280	Alta Vista Ave	Biofiltration (Underdrains)	309
636280	Alta Vista Cir	Biofiltration (Underdrains)	62
636280	Bank St	Biofiltration (Underdrains)	364
636280	Beech St	Biofiltration (Underdrains)	290
636280	Berkshire Ave	Biofiltration (Underdrains)	144
636280	Bonita Dr	Biofiltration (Underdrains)	245
636280	Braewood Ct	Biofiltration (Underdrains)	29
636280	Cam Cerrado	Biofiltration (Underdrains)	356
636280	Cam del Cielo	Biofiltration (Underdrains)	299
636280	Cam del Sol	Biofiltration (Underdrains)	1,239
636280	Cam Lindo	Biofiltration (Underdrains)	2,497

Subwatershed	Street Name	Drainage Configuration	Centerline Length (ft)
636280	Cam Verde	Biofiltration (Underdrains)	944
636280	Cambridge Pl	Biofiltration (Underdrains)	533
636280	Collier Aly	Biofiltration (Underdrains)	868
636280	Diamond Ave	Biofiltration (Underdrains)	2,578
636280	Driveway	Biofiltration (Underdrains)	42
636280	E Moffatt St	Biofiltration (Underdrains)	465
636280	el Centro St	Biofiltration (Underdrains)	434
636280	el Cerrito Cir	Biofiltration (Underdrains)	239
636280	el Coronado St	Biofiltration (Underdrains)	371
636280	el Tesorito St	Biofiltration (Underdrains)	172
636280	Fairview Ave	Biofiltration (Underdrains)	500
636280	Flores de Oro	Biofiltration (Underdrains)	653
636280	Gillette Crescent St	Biofiltration (Underdrains)	790
636280	Glendon Ct	Biofiltration (Underdrains)	473
636280	Glendon Ln	Biofiltration (Underdrains)	244
636280	Glendon Way	Biofiltration (Underdrains)	1,180
636280	Hanscom Dr	Biofiltration (Underdrains)	121
636280	Hill Dr	Biofiltration (Underdrains)	35
636280	Illinois Dr	Biofiltration (Underdrains)	70
636280	Indiana Ave	Biofiltration (Underdrains)	1,419
636280	Indiana Pl	Biofiltration (Underdrains)	2
636280	Indiana Ter	Biofiltration (Underdrains)	52
636280	la Bellorita St	Biofiltration (Underdrains)	236
636280	la Fremontia St	Biofiltration (Underdrains)	1,042
636280	la Manzanita St	Biofiltration (Underdrains)	154
636280	la Portada St	Biofiltration (Underdrains)	423
636280	la Terraza St	Biofiltration (Underdrains)	268
636280	Las Palmitas St	Biofiltration (Underdrains)	460
636280	Loma Vista Ct	Biofiltration (Underdrains)	188
636280	Long Driveway	Biofiltration (Underdrains)	32
636280	Los Alisos	Biofiltration (Underdrains)	206
636280	Los Espacios	Biofiltration (Underdrains)	55
636280	Los Laureles St	Biofiltration (Underdrains)	174
636280	Lyndon St	Biofiltration (Underdrains)	759
636280	Maple St	Biofiltration (Underdrains)	300
636280	Maycrest Ave	Biofiltration (Underdrains)	512
636280	Meridian Ave	Biofiltration (Underdrains)	5,851
636280	Meridian Pl	Biofiltration (Underdrains)	189
636280	Monterey Rd	Biofiltration (Underdrains)	2,019
636280	Mountain View Ave	Biofiltration (Underdrains)	101
636280	N Maycrest Ave	Biofiltration (Underdrains)	26
636280	N Van Horne Ave	Biofiltration (Underdrains)	3
636280	No Name St/large Aly	Biofiltration (Underdrains)	18
636280	Oak Crest Ave	Biofiltration (Underdrains)	479
636280	Oak St	Biofiltration (Underdrains)	921
636280	Orange Grove Ave	Biofiltration (Underdrains)	620
636280	Pacific Aly	Biofiltration (Underdrains)	341
636280	Pico Aly	Biofiltration (Underdrains)	260
636280	Pine St	Biofiltration (Underdrains)	375
636280	Rollin St	Biofiltration (Underdrains)	787
636280	Saint Albans Ave	Biofiltration (Underdrains)	83
636280	Santa Fe Ln	Biofiltration (Underdrains)	170
636280	Santa Teresa	Biofiltration (Underdrains)	1,144
636280	Summit Dr	Biofiltration (Underdrains)	383
636280	Throop Aly	Biofiltration (Underdrains)	295
636280	Valley View Rd	Biofiltration (Underdrains)	760
636280	Van Horne Ave	Biofiltration (Underdrains)	3
636280	Via del Rey	Biofiltration (Underdrains)	4,244
636280	Wolford Ln	Biofiltration (Underdrains)	79
636480	(unknown)	Bioretention (No Underdrains)	6,627
636480	Amberwood Dr	Bioretention (No Underdrains)	392
636480	Amherst Dr	Bioretention (No Underdrains)	916
636480	Ashbourne Dr	Bioretention (No Underdrains)	7
636480	Avon Pl	Bioretention (No Underdrains)	604
636480	Bank St	Bioretention (No Underdrains)	2,026
636480	Beacon Ave	Bioretention (No Underdrains)	408
636480	Beech St	Bioretention (No Underdrains)	1,313
636480	Brent Ave	Bioretention (No Underdrains)	2,391
636480	Buena Vista Ln	Bioretention (No Underdrains)	50
636480	Buena Vista St	Bioretention (No Underdrains)	1,067
636480	Bushnell Ave	Bioretention (No Underdrains)	1,343

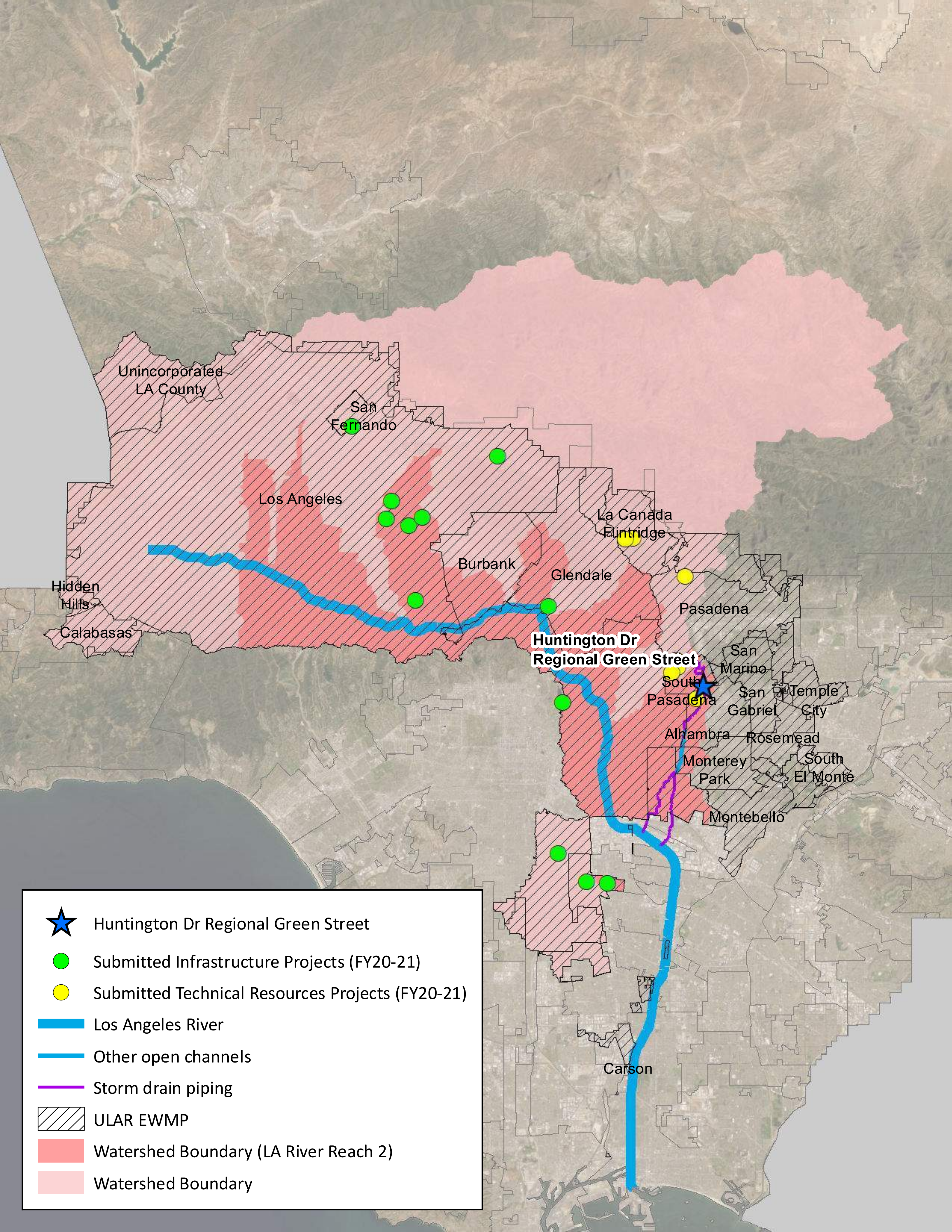
Subwatershed	Street Name	Drainage Configuration	Centerline Length (ft)
636480	Camden Pkwy	Bioretention (No Underdrains)	32
636480	Cedar Crest Ave	Bioretention (No Underdrains)	12
636480	Central Aly	Bioretention (No Underdrains)	82
636480	Chelten Way	Bioretention (No Underdrains)	1,017
636480	Chelton Way	Bioretention (No Underdrains)	1,017
636480	Clark Pl	Bioretention (No Underdrains)	71
636480	Columbia Aly	Bioretention (No Underdrains)	31
636480	Columbia Ln	Bioretention (No Underdrains)	31
636480	Crestlake Ave	Bioretention (No Underdrains)	856
636480	Diamond Ave	Bioretention (No Underdrains)	1,714
636480	Donaldo Ct	Bioretention (No Underdrains)	301
636480	E Huntington Dr	Bioretention (No Underdrains)	73
636480	Edgewood Dr	Bioretention (No Underdrains)	1,357
636480	Edison Ln	Bioretention (No Underdrains)	784
636480	el Centro St	Bioretention (No Underdrains)	2,204
636480	Elmpark St	Bioretention (No Underdrains)	521
636480	Empress Ave	Bioretention (No Underdrains)	851
636480	Exchange Ln	Bioretention (No Underdrains)	973
636480	Fair Oaks Aly	Bioretention (No Underdrains)	29
636480	Fair Oaks Ave	Bioretention (No Underdrains)	5,525
636480	Fairview Ave	Bioretention (No Underdrains)	2,676
636480	Fletcher Ave	Bioretention (No Underdrains)	3,297
636480	Foothill St	Bioretention (No Underdrains)	1,203
636480	Fremont Ave	Bioretention (No Underdrains)	8,733
636480	Fremont Ln	Bioretention (No Underdrains)	493
636480	Grace Dr	Bioretention (No Underdrains)	720
636480	Grevelia St	Bioretention (No Underdrains)	64
636480	Highland Aly	Bioretention (No Underdrains)	274
636480	Highland St	Bioretention (No Underdrains)	508
636480	Hope Ct	Bioretention (No Underdrains)	59
636480	Hope St	Bioretention (No Underdrains)	3,050
636480	Hopewell Ln	Bioretention (No Underdrains)	659
636480	Huntington Dr	Bioretention (No Underdrains)	6,220
636480	Huntington Ln	Bioretention (No Underdrains)	1,663
636480	la France Ave	Bioretention (No Underdrains)	1,957
636480	Laurel St	Bioretention (No Underdrains)	2,532
636480	Leman St	Bioretention (No Underdrains)	827
636480	Library Ln	Bioretention (No Underdrains)	608
636480	Lyndon St	Bioretention (No Underdrains)	2,497
636480	Magnolia Ln	Bioretention (No Underdrains)	346
636480	Magnolia St	Bioretention (No Underdrains)	790
636480	Maple St	Bioretention (No Underdrains)	2,121
636480	Maple Way	Bioretention (No Underdrains)	240
636480	Marengo Aly	Bioretention (No Underdrains)	27
636480	Marengo Ave	Bioretention (No Underdrains)	6,115
636480	Meridian Ave	Bioretention (No Underdrains)	1,487
636480	Milan Ave	Bioretention (No Underdrains)	5,750
636480	Mission Aly	Bioretention (No Underdrains)	253
636480	Mission St	Bioretention (No Underdrains)	3,765
636480	Mockingbird Ln	Bioretention (No Underdrains)	2
636480	Monterey Rd	Bioretention (No Underdrains)	3,571
636480	Mound Ave	Bioretention (No Underdrains)	2,619
636480	N Bushnell Ave	Bioretention (No Underdrains)	35
636480	N Electric Ave	Bioretention (No Underdrains)	35
636480	N Huntington Dr	Bioretention (No Underdrains)	988
636480	No Name St/large Aly	Bioretention (No Underdrains)	49
636480	North Aly	Bioretention (No Underdrains)	150
636480	Oak Meadow Ln	Bioretention (No Underdrains)	319
636480	Oak St	Bioretention (No Underdrains)	5,563
636480	Oaklawn Ave	Bioretention (No Underdrains)	1,359
636480	Oliver St	Bioretention (No Underdrains)	269
636480	Oneonta Aly	Bioretention (No Underdrains)	996
636480	Oneonta Knoll St	Bioretention (No Underdrains)	849
636480	Orange Grove Ave	Bioretention (No Underdrains)	88
636480	Oxley Aly	Bioretention (No Underdrains)	330
636480	Oxley St	Bioretention (No Underdrains)	3,589
636480	Ozmun Ct	Bioretention (No Underdrains)	49
636480	Pacific Aly	Bioretention (No Underdrains)	1,090
636480	Palermo Ln	Bioretention (No Underdrains)	624
636480	Park Ave	Bioretention (No Underdrains)	1,823
636480	Pico Aly	Bioretention (No Underdrains)	28

Subwatershed	Street Name	Drainage Configuration	Centerline Length (ft)
636480	Pine St	Bioretention (No Underdrains)	902
636480	Primrose Ave	Bioretention (No Underdrains)	1,958
636480	Prospect Cir	Bioretention (No Underdrains)	42
636480	Ramona Ave	Bioretention (No Underdrains)	2,033
636480	Raymond Hill Rd	Bioretention (No Underdrains)	242
636480	Raymond Ln	Bioretention (No Underdrains)	1,692
636480	Rollin St	Bioretention (No Underdrains)	2,438
636480	South Aly	Bioretention (No Underdrains)	93
636480	Spruce St	Bioretention (No Underdrains)	3,714
636480	Stratford Ave	Bioretention (No Underdrains)	5,319
636480	Stratford Ln	Bioretention (No Underdrains)	88
636480	Virginia Pl	Bioretention (No Underdrains)	265
636480	W Huntington Dr	Bioretention (No Underdrains)	684
636480	W State St	Bioretention (No Underdrains)	172
636480	Wayne Ave	Bioretention (No Underdrains)	2,102
636480	Winding Ln	Bioretention (No Underdrains)	43
636480	Windsor Pl	Bioretention (No Underdrains)	608
639580	(unknown)	Bioretention (No Underdrains)	59
639580	Collis Ave	Bioretention (No Underdrains)	608
639580	Hanscom Dr	Bioretention (No Underdrains)	12
639580	Harriman Ave	Bioretention (No Underdrains)	225
639580	Hill Dr	Bioretention (No Underdrains)	596
639580	Oak Hill Ave	Bioretention (No Underdrains)	17
639580	Oak Hill Pl	Bioretention (No Underdrains)	203
639580	Peterson Ave	Bioretention (No Underdrains)	184
639580	Warwick Pl	Bioretention (No Underdrains)	89
640780	Pine Crest Dr	Biofiltration (Underdrains)	142
640780	Short Way	Biofiltration (Underdrains)	5
640980	Arroyo Dr	Bioretention (No Underdrains)	26
640980	Arroyo Verde St	Bioretention (No Underdrains)	25
640980	Marmion Way	Bioretention (No Underdrains)	12
640980	Pasadena Ave	Bioretention (No Underdrains)	162
640980	York Blvd	Bioretention (No Underdrains)	13
641280	(unknown)	Bioretention (No Underdrains)	156
641280	Adelaine Ave	Bioretention (No Underdrains)	615
641280	Arroyo Dr	Bioretention (No Underdrains)	660
641280	Charter Oak St	Bioretention (No Underdrains)	811
641280	Forest Ave	Bioretention (No Underdrains)	668
641280	Grand Ave	Bioretention (No Underdrains)	1,022
641280	Hope Ct	Bioretention (No Underdrains)	32
641280	Indiana Ave	Bioretention (No Underdrains)	25
641280	Magnolia Ln	Bioretention (No Underdrains)	372
641280	Magnolia St	Bioretention (No Underdrains)	3,068
641280	Meridian Ave	Bioretention (No Underdrains)	411
641280	Mission St	Bioretention (No Underdrains)	2,769
641280	Orange Grove Ave	Bioretention (No Underdrains)	1,112
641280	Palm Ave	Bioretention (No Underdrains)	34
641280	Pasadena Ave	Bioretention (No Underdrains)	17
641280	Prospect	Bioretention (No Underdrains)	332
641280	Prospect Ave	Bioretention (No Underdrains)	1,076
641280	Santa Fe Ln	Bioretention (No Underdrains)	559
641380	(unknown)	Bioretention (No Underdrains)	718
641380	Adelaine Aly	Bioretention (No Underdrains)	55
641380	Adelaine Ave	Bioretention (No Underdrains)	996
641380	Alta Vista Ave	Bioretention (No Underdrains)	130
641380	Alta Vista Cir	Bioretention (No Underdrains)	23
641380	Arroyo Dr	Bioretention (No Underdrains)	699
641380	Cawston St	Bioretention (No Underdrains)	531
641380	Doran St	Bioretention (No Underdrains)	231
641380	el Centro St	Bioretention (No Underdrains)	2,670
641380	Indiana Ave	Bioretention (No Underdrains)	1,698
641380	Indiana Ct	Bioretention (No Underdrains)	259
641380	Jacobs Ln	Bioretention (No Underdrains)	280
641380	Martos Dr	Bioretention (No Underdrains)	148
641380	Monterey Rd	Bioretention (No Underdrains)	1,535
641380	Mountain View Ave	Bioretention (No Underdrains)	163
641380	Orange Grove Ave	Bioretention (No Underdrains)	950
641380	Orange Grove Pl	Bioretention (No Underdrains)	312
641380	Palm Ave	Bioretention (No Underdrains)	1,024
641380	Palm Ct	Bioretention (No Underdrains)	441
641380	Pasadena Ave	Bioretention (No Underdrains)	1,637

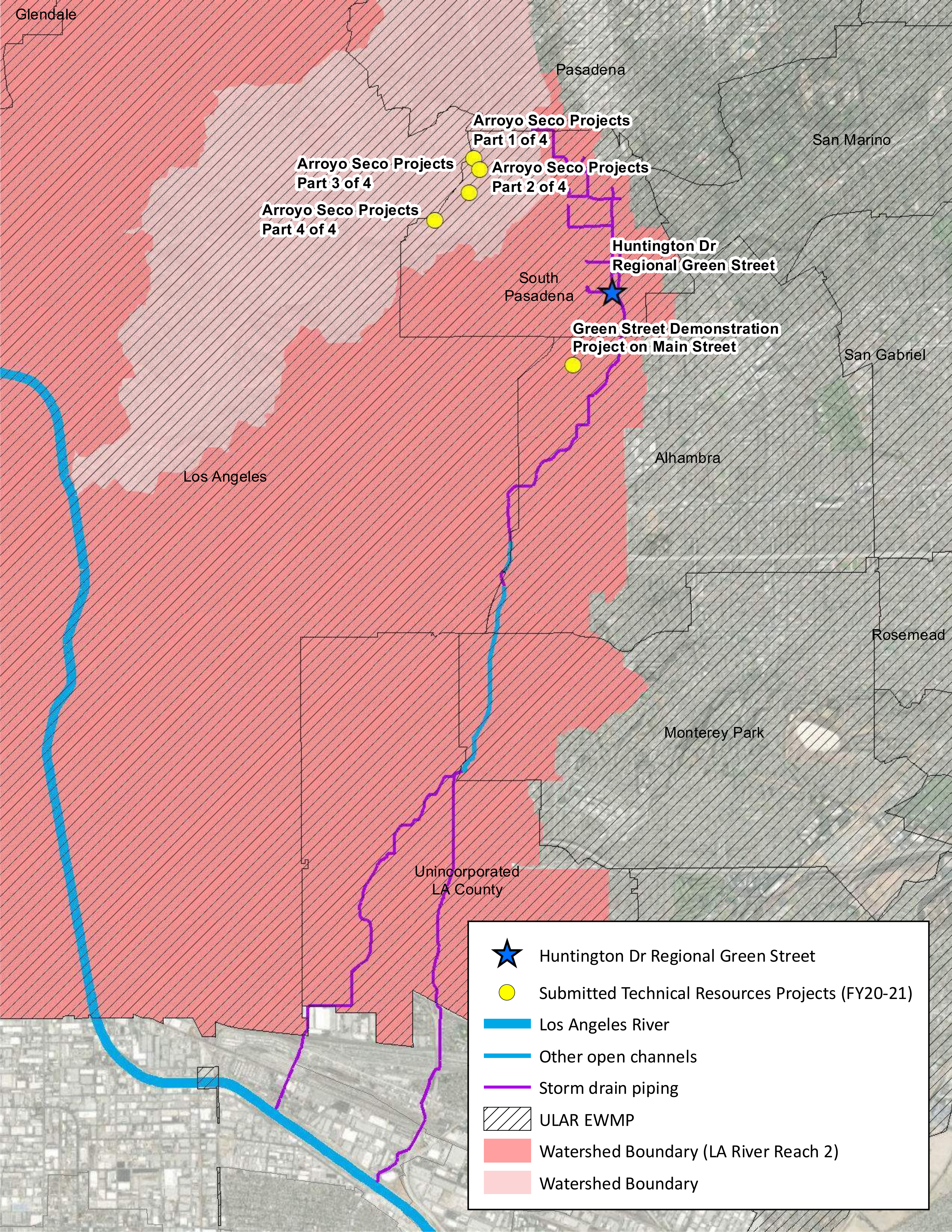
Subwatershed	Street Name	Drainage Configuration	Centerline Length (ft)
641380	Pico Aly	Bioretention (No Underdrains)	265
641380	Stoney Dr	Bioretention (No Underdrains)	47
641380	Throop Aly	Bioretention (No Underdrains)	345
641480	(unknown)	Biofiltration (Underdrains)	99
641480	Arroyo Dr	Biofiltration (Underdrains)	52
641480	Arroyo Verde Rd	Biofiltration (Underdrains)	623
641480	Blair Ave	Biofiltration (Underdrains)	50
641480	Brunswick Ave	Biofiltration (Underdrains)	138
641480	E Pasadena Ave E	Biofiltration (Underdrains)	1,137
641480	Hill Dr	Biofiltration (Underdrains)	179
641480	Kolle Ave	Biofiltration (Underdrains)	73
641480	Marmion Way	Biofiltration (Underdrains)	400
641480	Monterey Rd	Biofiltration (Underdrains)	1,978
641480	Pasadena Ave	Biofiltration (Underdrains)	1,019
641480	Pine Crest Dr	Biofiltration (Underdrains)	108
641480	Saint Albans Ave	Biofiltration (Underdrains)	252
641480	Short Way	Biofiltration (Underdrains)	107
641480	Sycamore Ave	Biofiltration (Underdrains)	326
641480	York Blvd	Biofiltration (Underdrains)	174
641580	Arroyo Dr	Bioretention (No Underdrains)	980
641580	Arroyo Sq	Bioretention (No Underdrains)	414
641580	Buena Vista St	Bioretention (No Underdrains)	425
641580	Floral Park Ter	Bioretention (No Underdrains)	799
641580	Grand Ave	Bioretention (No Underdrains)	1,426
641580	Hermosa Pl	Bioretention (No Underdrains)	316
641580	Hermosa St	Bioretention (No Underdrains)	1,549
641580	Hillside Rd	Bioretention (No Underdrains)	634
641580	Oliver St	Bioretention (No Underdrains)	269
641580	Orange Grove Ave	Bioretention (No Underdrains)	1,182
641580	Orange Grove Ter	Bioretention (No Underdrains)	306
641580	Paloma Dr	Bioretention (No Underdrains)	223
641580	Prospect Ave	Bioretention (No Underdrains)	175
641580	Prospect Cir	Bioretention (No Underdrains)	662
641580	Prospect Dr	Bioretention (No Underdrains)	237
641580	San Pasqual Ave	Bioretention (No Underdrains)	703
641580	Sterling Pl	Bioretention (No Underdrains)	180

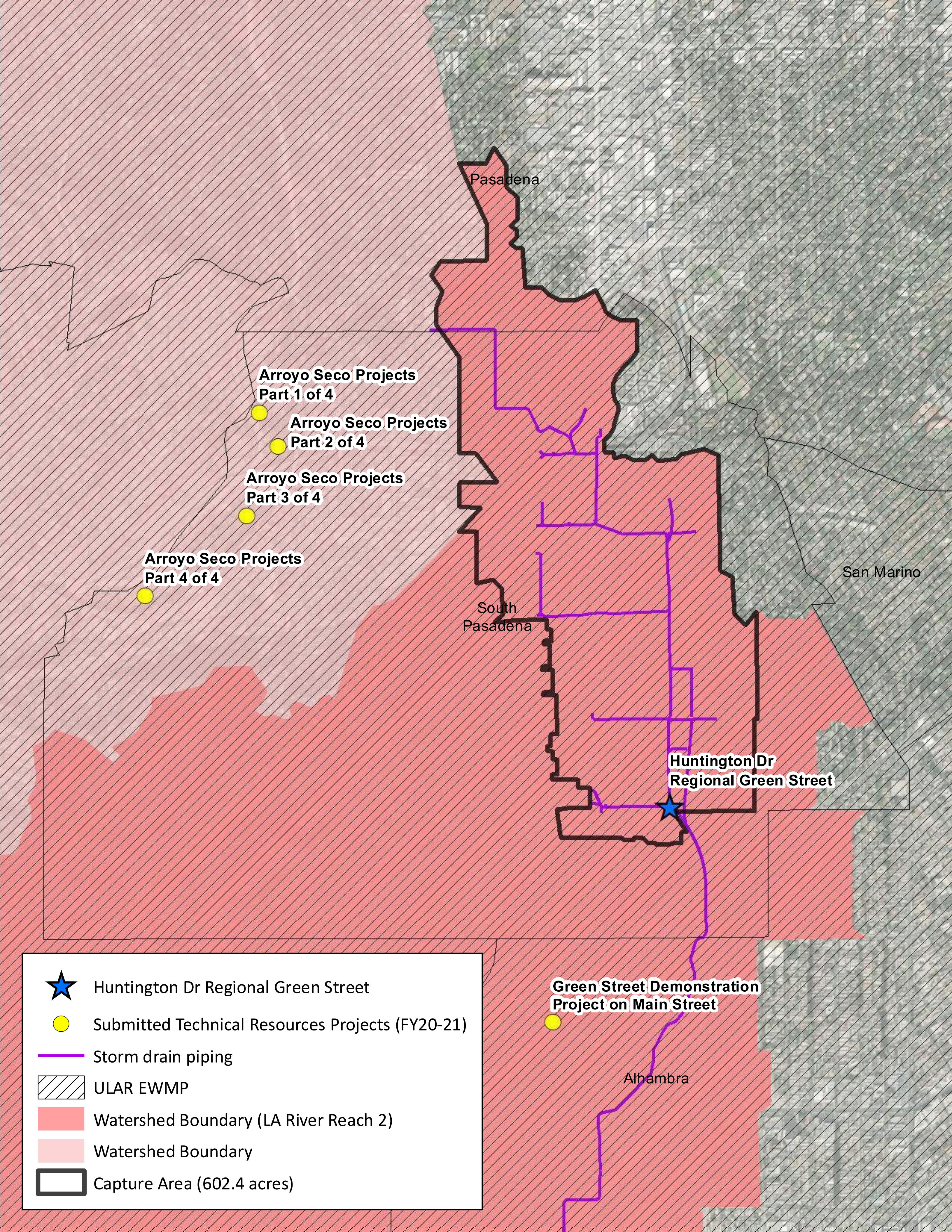
ATTACHMENTS FOR SECTION 2

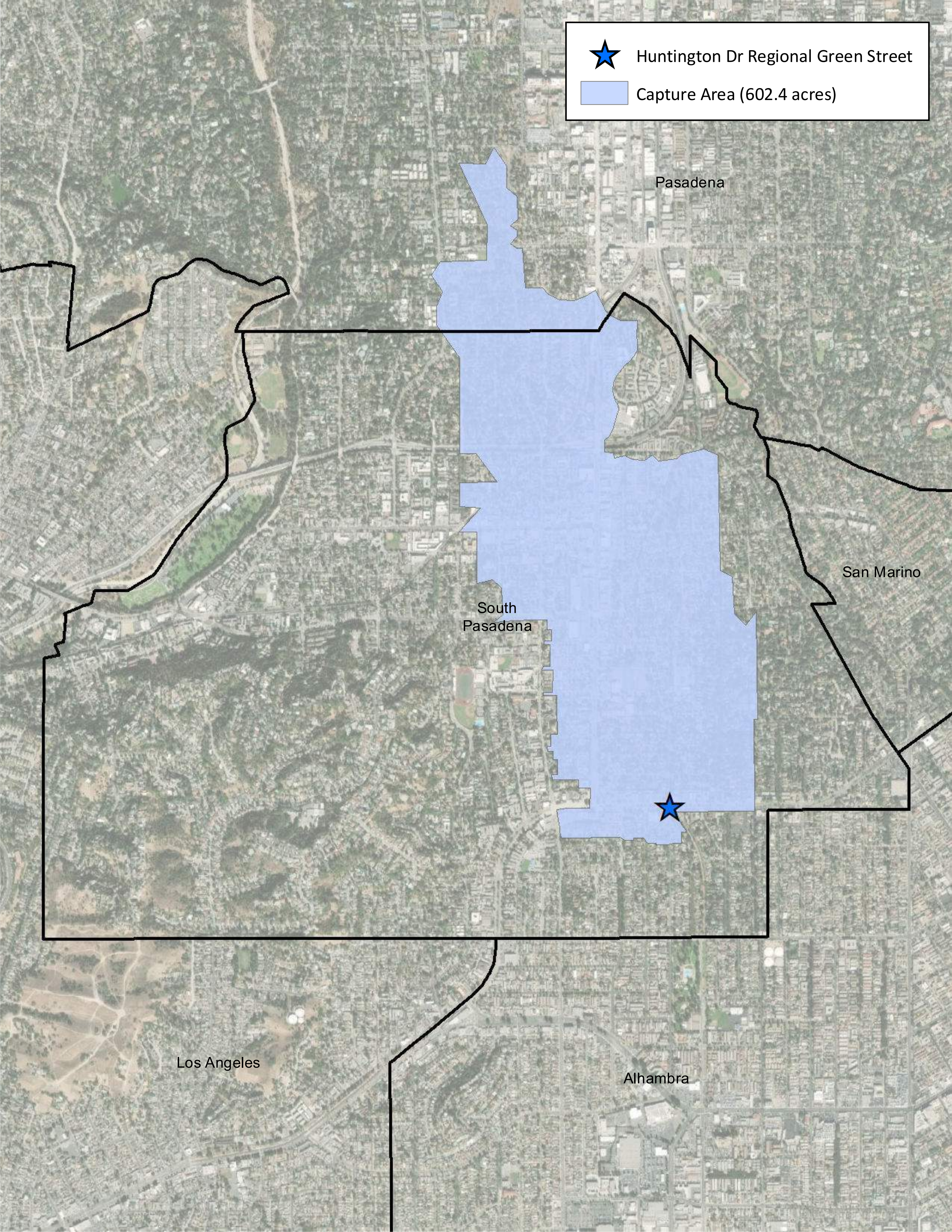
Design Elements

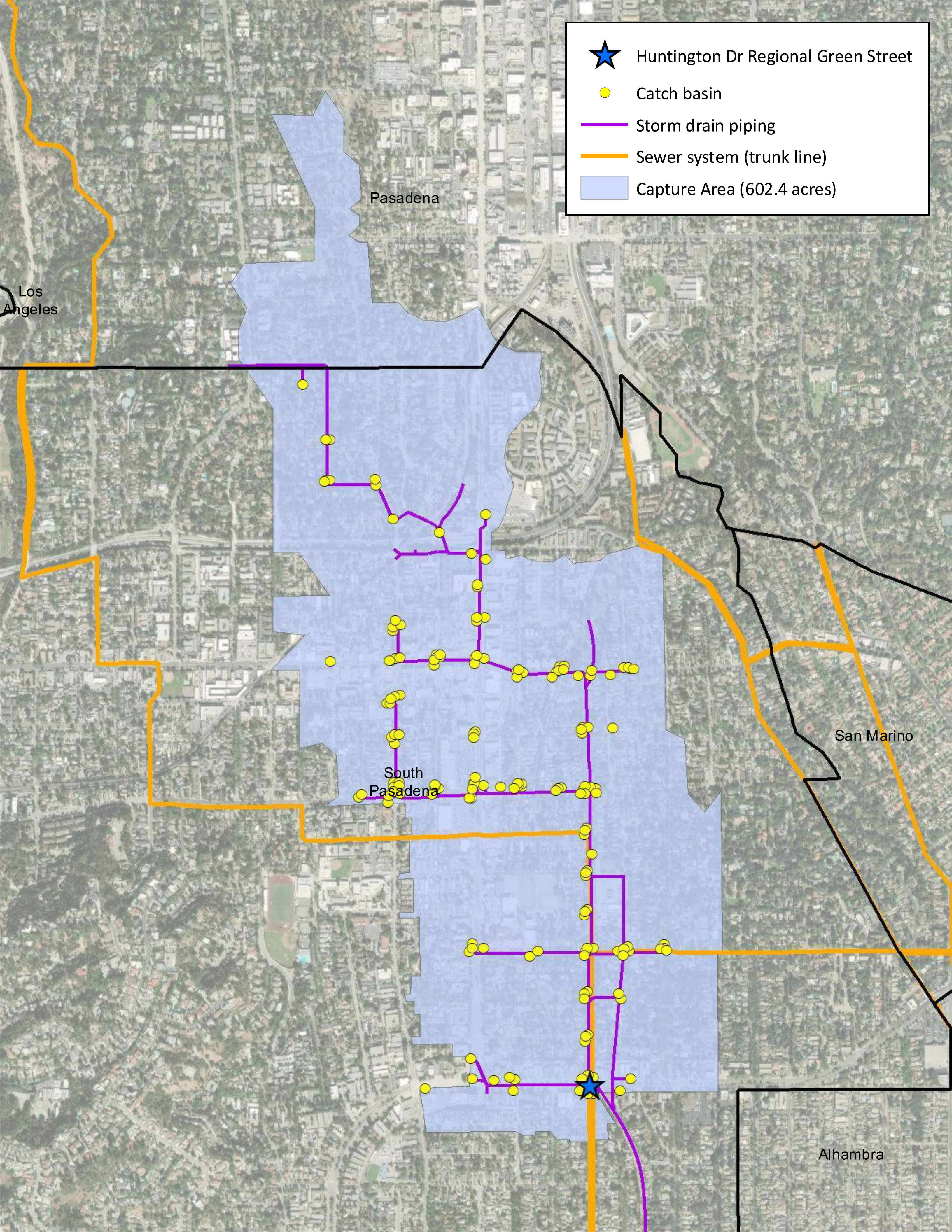


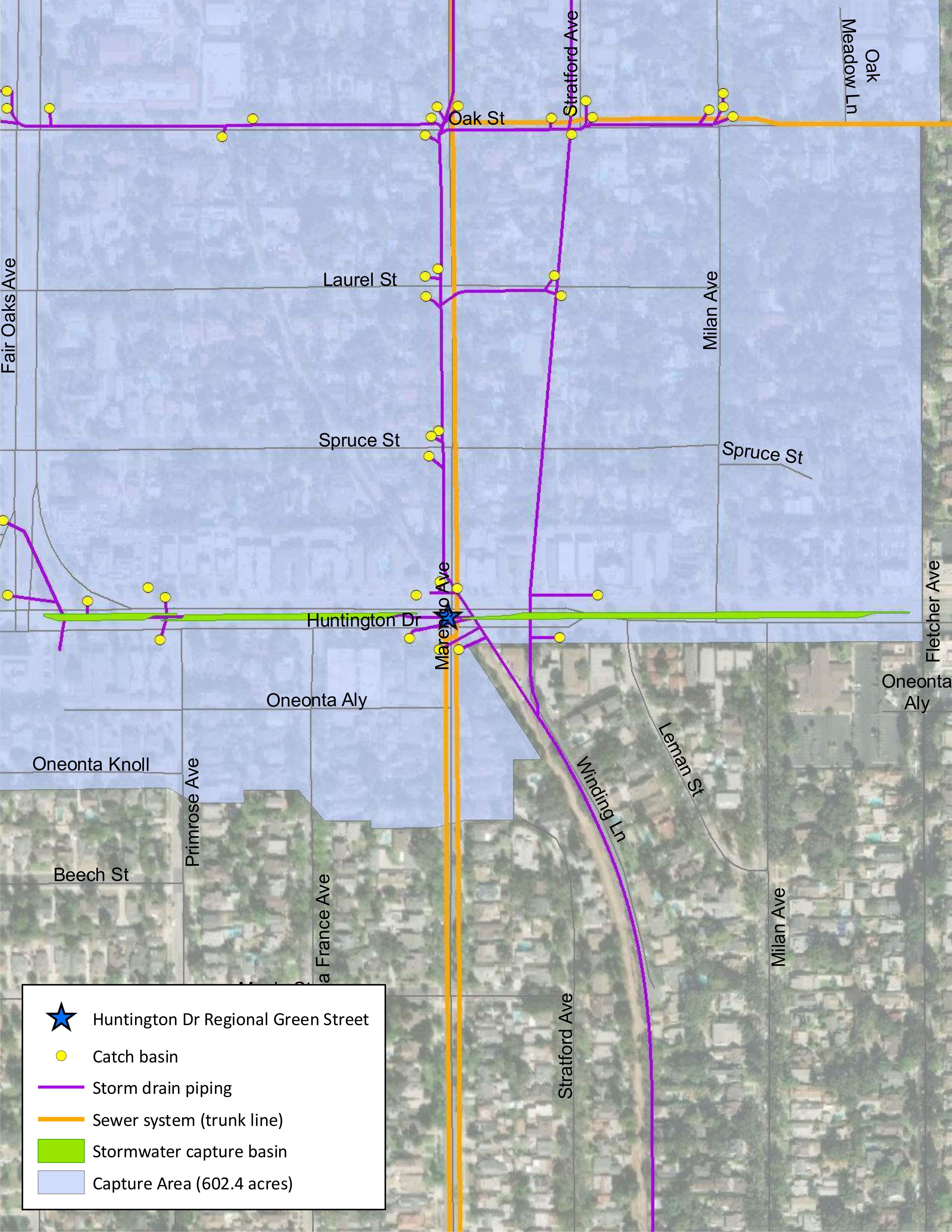
Unincorporated LA County
San Fernando
Los Angeles
La Canada Flintridge
Burbank
Glendale
Hidden Hills
Calabasas
Pasadena
Huntington Dr Regional Green Street
San Marino
South Pasadena
San Gabriel
Temple City
Alhambra
Rosemead
Monterey Park
South El Monte
Montebello
Carson
Huntington Dr Regional Green Street
Submitted Infrastructure Projects (FY20-21)
Submitted Technical Resources Projects (FY20-21)
Los Angeles River
Other open channels
Storm drain piping
ULAR EWMP
Watershed Boundary (LA River Reach 2)
Watershed Boundary


Glendale
Pasadena
San Marino
Arroyo Seco Projects
Part 1 of 4
Arroyo Seco Projects
Part 3 of 4
Arroyo Seco Projects
Part 2 of 4
Arroyo Seco Projects
Part 4 of 4
Huntington Dr
Regional Green Street
South
Pasadena
Green Street Demonstration
Project on Main Street
San Gabriel
Alhambra
Los Angeles
Rosemead
Monterey Park
Unincorporated
LA County
Huntington Dr Regional Green Street
Submitted Technical Resources Projects (FY20-21)
Los Angeles River
Other open channels
Storm drain piping
ULAR EWMP
Watershed Boundary (LA River Reach 2)
Watershed Boundary


Pasadena
Arroyo Seco Projects
Part 1 of 4
Arroyo Seco Projects
Part 2 of 4
Arroyo Seco Projects
Part 3 of 4
Arroyo Seco Projects
Part 4 of 4
San Marino
South
Pasadena
Huntington Dr
Regional Green Street
Green Street Demonstration
Project on Main Street
Alhambra
Huntington Dr Regional Green Street
Submitted Technical Resources Projects (FY20-21)
Storm drain piping
ULAR EWMP
Watershed Boundary (LA River Reach 2)
Watershed Boundary
Capture Area (602.4 acres)

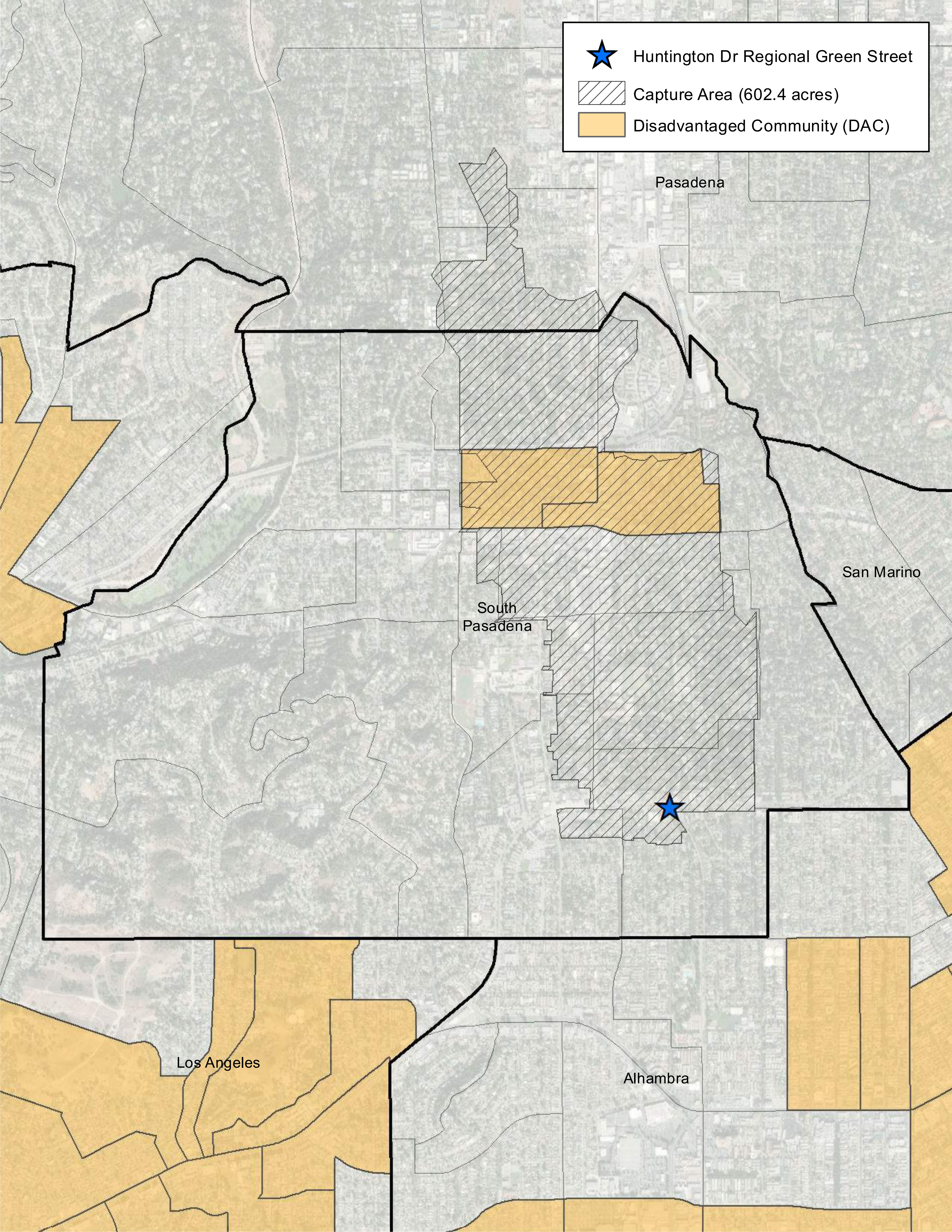

Huntington Dr Regional Green Street
Capture Area (602.4 acres)
Pasadena
San Marino
South Pasadena
Los Angeles
Alhambra


Huntington Dr Regional Green Street
Catch basin
Storm drain piping
Sewer system (trunk line)
Capture Area (602.4 acres)
Pasadena
Los Angeles
South Pasadena
San Marino
Alhambra


Oak Meadow Ln
Stratford Ave
Oak St
Laurel St
Fair Oaks Ave
Milan Ave
Spruce St
Spruce St
Marengo Ave
Huntington Dr
Fletcher Ave
Oneonta Aly
Oneonta Aly
Oneonta Knoll
Primrose Ave
Leman St
Winding Ln
Beech St
Milan Ave
Stratford Ave
Huntington Dr Regional Green Street
Catch basin
Storm drain piping
Sewer system (trunk line)
Stormwater capture basin
Capture Area (602.4 acres)


Fair Oaks Ave
South Pasadena
9,814 SQ FT
5,332 SQ FT
Huntington Dr
Marengo Ave
la France Ave
Primrose Ave
Oneonta Aly
Oneonta Knoll


Spruce St
Milan Ave
South Pasadena
18,199 SQ FT
Huntington Dr
Marengo Ave
Fletcher Ave
Leman St
Winding Ln
Milan Ave
Oneonta Aly



Huntington Dr Regional Green Street
Capture Area (602.4 acres)
Disadvantaged Community (DAC)
Pasadena
San Marino
South Pasadena
Los Angeles
Alhambra

United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-01-005 September 2001

Storm Water Technology Fact Sheet
On-Site Underground Retention/Detention

DESCRIPTION

One of the major components of storm water management is flow control, particularly in newly-developed areas where buildings, parking lots, roads, and other impervious surfaces replace open space. As imperviousness increases, there is less area available for infiltration, and the amount of runoff increases. This may cause streams to be more prone to flash floods. Many municipalities now require newly-developed areas to maintain pre-development runoff conditions and to implement measures to capture or control the increase in peak runoff for a design storm event.

Several different types of storm water Best Management Practices (BMPs), including retention/detention ponds, storm water wetlands, and underground storage structures, can provide storm water volume control. These BMPs capture flow and retain it until it infiltrates into the soil (storm water retention) or release it slowly over time, thereby decreasing peak flows and associated flooding problems (storm water detention). Several of these options, including storm water wetlands and large detention ponds, require relatively large land areas, making them less of an option in areas where land costs are high or where land availability is a problem. In many of these areas, such as parking lots for malls or other developed sites in highly urbanized areas, storing storm water underground on the site may be the best option.

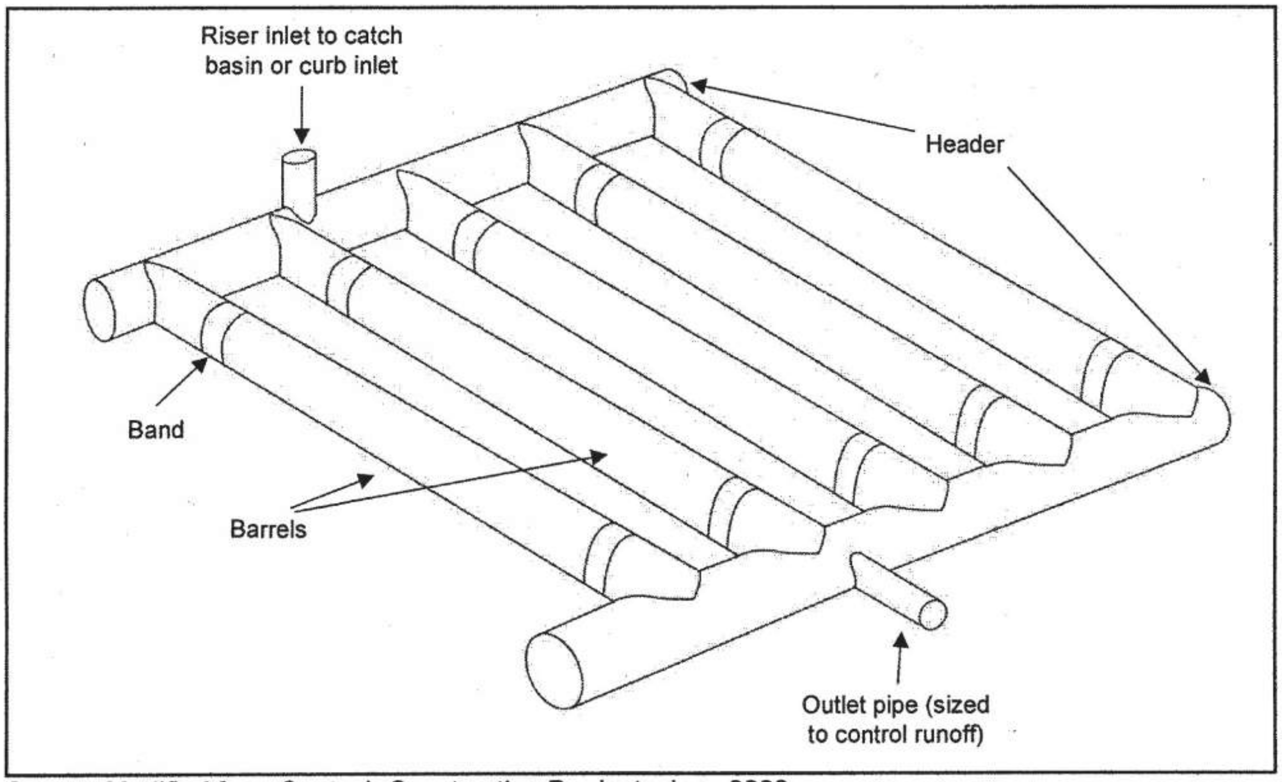
Underground storm water retention/detention systems capture and store runoff in large pipes or other subsurface structures (see Figure 1). Storm water enters the system through a riser pipe connected to a catch basin or curb inlet and flows into a series of chambers or compartments for storage. Captured runoff is retained throughout the storm event, and can be released directly back into surface waters through an outlet pipe. Outlet pipes are sized to release stored runoff at pre-development flow rates. This ensures that there is no net increase in peak runoff and that receiving waters are not adversely impacted by high flows from the site. Some systems are also designed to exfiltrate stored runoff into the surrounding soil, where it helps to recharge the groundwater table.

Underground retention/detention systems can be constructed from concrete, steel, or plastic materials. Each material has advantages and disadvantages and specific applicabilities, which are discussed in the following sections.

APPLICABILITY

Underground retention/detention systems are primarily used in newly-developed areas where land cost and/or availability are major concerns. They are not usually designed for retrofit applications. Most systems are built under parking lots or other paved surfaces in commercial, industrial, and residential areas. Perforated underground retention systems that release stored storm water into the subsoil are recommended only for areas with well-drained soils and where the water table is low enough to permit recharge. Some pretreatment such as sediment traps or sand filters may be necessary for infiltration to eliminate sediment and other solids that could clog the system.

On-site underground retention/detention systems provide peak runoff flow control and can store storm water for future release back into the environment. However, they are not designed



Source: Modified from Contech Construction Products, Inc., 2000.

FIGURE 1 SCHEMATIC OF PIPE-BASED UNDERGROUND STORM WATER DETENTION SYSTEM

specifically to enhance water quality; therefore, other storm water BMPs may be required to provide storm water treatment. Underground retention/ detention systems are often used in "treatment trains," which consist of a number of storm water BMPs that provide both storm water treatment and storage. For example, storm water entering the underground detention structure in Hauge Homestead Park in Everett, Washington, is first collected from a parking area through a catch basin, then flows through a series of vegetated swales, then into a storm water pipe with a sump, all of which filter out sediment and pollutants before the runoff reaches the detention chambers. Runoff is then released into a pond at a controlled rate, where further pollutant removal occurs (City of Everett, Washington, Department of Parks and Recreation, 2000).

ADVANTAGES AND DISADVANTAGES

This Section presents the overall advantages and disadvantages of on-site underground retention/detention systems. The advantages and disadvantages of specific designs and construction materials (concrete, steel, plastic) for underground retention/detention systems are discussed in the Design section.

Advantages

- The primary advantage of the on-site underground storm water retention/ detention system is that it captures and stores runoff, thus helping meet the requirement to maintain pre-development runoff conditions at newly-developed sites.

- These systems are ideal for highly urbanized areas, particularly in areas where land is expensive or may not be available for ponds or wetlands.

- These systems can be installed quickly. For example, construction and installation of a 6' by 4' by 156' concrete system was installed under a car dealership in Tennessee in 3 days (Sherman Dixie Concrete Industries, Inc., 2000).

- These systems are very durable. Once in the ground, most systems can last more than 50 years.

- Because these systems are underground, local residents are less likely to have access to them, making them safer than ponds or other aboveground storm water BMPs.

Disadvantages

- The primary disadvantage of the on-site underground storm water detention structures is that they are not designed to provide storm water quality benefits. However, if they are included in a treatment-train type system, underground detention systems can be an important part of an overall storm water management process.

- These systems may require more excavation than surface ponds or wetlands.

- Recharge of the groundwater from an underground retention unit may contribute to groundwater contamination if flow from the site is directly discharged into the retention system before pretreatment. Therefore, EPA does not recommend that percolation systems be designed for sites with coarse soils or high groundwater tables.

- These systems are more difficult to maintain and clean than aboveground systems.

DESIGN CRITERIA

On-site underground retention/detention systems are designed to provide a predetermined amount of storage volume within a specified area. System designs can range from simple storage pipes or chambers to complex systems consisting of multiple pipes or chambers, with accompanying joints, crossovers, multiple inlets and access points. At a minimum, each system must have an inlet, an outlet, and a structure to access the chamber (Pacific Corrugated Pipe, 2000). All other design elements are site, project, and material-specific, as described below.

Among the most important elements to consider when designing underground retention/detention systems are the size, shape, and physical characteristics of available space available for the system. These factors will influence how the system is constructed and what type of construction material is chosen. Depending on the specific application, design engineers have utilized different materials, including concrete pipes and other concrete structures, steel pipes, and plastic pipes, in designing underground retention/detention structures. Each material has different advantages and disadvantages under different scenarios. The type of material to be used in any individual application should be determined by site and application-specific conditions.

Site-specific considerations that may influence the type of material used in an individual application include:

- The depth and area of allowable excavation space. For example, to maintain the structural integrity of corrugated steel and high density polyethylene pipe systems, more fill is required below, between, and above the pipes than when using concrete.

- The shape of the area available for the system. For example, is the available space one continuous area where a large vault could be placed, or does it have angles which might make a pipe system more appropriate?

- The depth of the water table. For example, there are some concerns that plastic pipes may float upward in areas with high water tables.

- The construction costs (including material and labor costs) for different materials.

Table 1 summarizes the physical characteristics of these materials. Additional considerations include local ordinances, which may preclude the use of some types of materials for certain applications. For example, Fairfax County, Virginia, does not

TABLE 1 COMPARISON OF DESIGN CONSIDERATIONS FOR CONSTRUCTION MATERIALS FOR UNDERGROUND STORM WATER RETENTION/DETENTION SYSTEMS

	Construction Material		
	Concrete	**Plastic (HDPE)**	**Steel and Aluminum (CMP)**
Shapes	Rectangular vaults or circular pipes	Circular pipes	Circular pipes, semi-circular pipe-arches, or other special shapes
Spatial Requirements	Primarily continuous space with no angles	Can be fitted into irregular and angled spaces	Can be fitted into irregular and angled spaces
Rigidity/Flexibility	Very rigid, does not require fill to maintain rigidity; not flexible	Rigid, requires fill for stability; not flexible	Rigid, requires fill for stability; can withstand some shifting without breaking or buckling
Fill Requirements	Requires minimum fill above structure	Requires minimum fill between and above pipes	Requires minimum fill between and above pipes
Other Requirements	None	Requires minimum spacing between pipes. Water table must be below level of pipe	Requires minimum spacing between pipes
Available Sizes	Multiple sizes that can be pre-cast or cast-in-place	Multiple pipe diameters are available; all are pre-manufactured	12" to 144" diameters and pipe arches are available pre-assembled. Larger diameter pipe and pipe-arches are available for assembly on-site
Handling	Requires moving equipment	Can be moved by hand	Requires moving equipment

Source: Compiled by Parsons Engineering Science, Inc., 2000.

allow plastic pipes to be used for underground retention/detention systems for residential areas. In contrast, plastic pipe has been the favored option for systems built by the Department of Parks and Recreation in Everett, Washington.

Once appropriate construction materials are determined for a specific application, design must determine the amount of storage volume required by the system. As discussed above, many areas have adopted a policy of no net increase in runoff for a design storm event for newly-developed areas. Thus, the required storage volume is the difference between pre and post-development runoff. In other areas, local requirements dictate how much of a given storm must be captured and treated, and the required storage volume can be calculated using this value. For example, the City of Malibu, California requires post-construction treatment control BMPs to treat the first 0.75 inches of rainfall over a 24-hour period (City of Malibu, 2000b). In contrast, the Department of Public Works in Everett, Washington, requires systems to be designed for the 6-month, 24-hour storm (City of Everett, Washington, Department of Public Works, 2000).

After the required storage volume has been determined, the design engineer can examine the site to determine what configuration will maximize storage while minimizing the size of the excavated area. Concrete structures, such as box culverts, tend to provide greater storage volume per excavated area because of their rectangular shape (allowing more storage volume per cross-sectional area) and the fact that they can provide one continuous chamber. Pipe systems, on the other hand, tend to store less runoff per excavated area. There are several reasons for this. First, round pipes and pipe arches have less storage volume per cross-sectional area than do square structures, such as box culverts. In addition, pipes are often laid parallel or at intersecting angles, reducing the amount of storage per excavated area. Pipes also require specific amounts of space for fill between them. While this promotes the structural integrity of the pipes, it reduces the amount of excavated area available for storage. These requirements make the largest diameter pipe that meets the minimum cover requirements the most economical. For example, doubling the diameter of the pipe usually doubles the cost of the pipe, but quadruples the storage volume. In addition, the ability to angle and arrange pipes in series of different lengths may make them good choices when the space available for storage is not continuous. Several manufacturers have produced CD-ROMs to aid in the design and configuration of pipe systems.

PERFORMANCE

On-site runoff controls, such as underground storm water retention/detention systems, are designed to control storm water quantity and they have little impact on storm water quality. Thus, underground storm water retention/detention systems alone will not satisfy most local storm water regulations. For example, Fairfax County, Virginia, requires both storm water management (i.e., storm water volume control) and storm water BMPs (i.e., storm water quality control) (Fairfax County, Virginia, 2000). Therefore, most underground retention/detention systems are coupled with other water quality BMPs, such as catch basins, curb inlets, water quality inlets, sand filters, or sumps. This "treatment train" can help to improve the water quality of the overall storm water control system, particularly during the first part of a rain event when pollutants may be at their highest concentrations. BMPs may be located either upstream or downstream from the retention/detention system. Fairfax County, which reviews storm water plans for new development, encourages planners to include sand filters or other water quality control devices upstream of an underground detention system. The City of Malibu, California, recommends a treatment train system (City of Malibu, California, 2000b). One system that the city has looked at includes a sedimentation basin, a detention basin, then a sand filter (City of Malibu, California, 2000a). A new project in Hauge Homestead Park in Everett, Washington, includes storm water BMPs both upstream and downstream of the detention area.

When designing a treatment train, design engineers must ensure that downstream BMPs are designed for the appropriate flow from the underground retention/detention system. For example, the City of Alexandria, Virginia, found that long drawdown times from underground retention/detention systems could result in continuous flow into downstream sand filters, which could cause the resuspension of accumulated phosphorous (City of Alexandria, VA, 2000). Therefore, Alexandria does not recommend the use of sand filters downstream from most retention/detention systems.

While underground storm water retention/detention systems are not specifically designed to provide water quality benefits, they do often improve water quality. As storm water is retained before it is released back into the environment, suspended solids may settle out, thereby reducing the overall pollutant load. For example, in the City of Everett, Washington, local regulations require that at least 15 percent of the 6-month, 24-hour storm runoff be retained above ground, usually in a biofiltration area. The remainder of the runoff can be stored below ground, where suspended solids are allowed to settle out before the water is released back into the environment (City of Everett, Washington, Department of Public Works, 2000). However, unless the system is properly maintained, settled solids may eventually fill the system.

OPERATION AND MAINTENANCE

Once underground storm water retention/detention systems are installed, they require very little maintenance. They have no moving parts and remain intact for many years. A major concern with the use of corrugated steel or polyethylene pipes has been that the pipes might crack or buckle over time because of the weight of the soil surrounding them. However, a study of corrugated steel pipe (CSP) underground storm water detention structures in the Washington, D.C., metropolitan area conducted by the National Corrugated Steel Pipe Association (NCSPA)(NCSPA, 1999) found that all of the systems were performing well. None of the pipe systems inspected, some of which had been in place for up to 25 years, showed signs of buckling, cracking, or bending. In only one case had the joints of pipe sections separated.

Underground storm water retention/detention structures must be cleaned periodically to remove accumulated trash, grit, sediments, and other debris. The installation of catch basins or grates at the inlet will reduce trash accumulation, but suspended solids will still be carried into the storage area, where they may settle out and accumulate on the bottom of the structure. The structures need to be cleaned to remove this accumulated material, which should be tested to determine if it contains any toxic or hazardous materials, and then disposed according to local regulations regarding storm water residuals.

In Fairfax County, Virginia, where there are over 300 underground storm water retention/detention structures installed at commercial/industrial sites, private owners of the structures are required to sign a maintenance contract with the County that commits the owner to maintain the structure appropriately. Fairfax County also provides owners with a maintenance checklist and plans to inspect these structures regularly (i.e., at least once every five years) to ensure that they are functioning adequately. If an owner fails to maintain the structures, the maintenance agreement allows the County to perform the required maintenance at the expense of the owner.

The City of Everett, Washington, takes ownership of underground storm water detention systems constructed in residential developments under existing rights-of-way, such as sidewalks or streets. The city conducts annual inspections of system outlet structures and looks for an accumulation of sediment at the outlet as an indicator that the system needs to be cleaned. Crews are then dispatched to perform the clean-outs. The City also regularly inspects private systems and issue notices to owners when sediment accumulation is noted (City of Everett, Washington, Department of Public Works, 2000).

COSTS

Costs for underground storm water retention/detention structures are highly variable and depend primarily on the types of materials used (concrete vaults, metal or plastic pipes) and the amount of storage volume desired. The type of materials used will greatly affect construction and installation costs, because they dictate the size of the excavation required to achieve the necessary storage volume. As discussed in the Design section, to ensure their strength and rigidity, plastic and steel pipes have specific requirements for spacing, fill type and fill volume, all of which effect the size of the excavation. Concrete structures do not have the same level of fill requirements. Another consideration is the amount of time required to handle and assemble the various pieces of the system. Steel and plastic pipes tend to be lighter and easier to handle than concrete vaults; however, large diameter pipes and "pipe arch" structures (which are delivered as separate sheets and must be bolted in place) may increase handling time requirements.

While costs for specific types of underground detention systems can be highly variable, they can be very economical, especially compared with alternatives. The primary alternative to an underground storm water detention structures is an aboveground wet detention pond. While construction costs for ponds are generally lower than for underground storage units (ponds can cost between $17.50 and $35 per cubic meter of storage area [Center for Watershed Protection, 1998]), land used for a surface pond cannot be used for any other purpose. This is not true for underground retention/detention systems, where the land above can be utilized for parking lots or other purposes, maximizing the economic potential of the land. In Everett, Washington, underground detention structures are often used in conjunction with aboveground ponds in storm water management. While local regulations require some surface treatment of storm water, the majority of runoff can be stored underground, minimizing the need for large surface ponds that are both costly and require economically-valuable land. Everett also encourages the use of concrete underground storage systems, which allows the pond to actually be placed directly on top of the underground storage area, again making maximum use of the available land (City of Everett, Washington, Department of Public Works, 2000). Underground retention/detention systems can also be economical when compared to infiltration trenches. An engineering estimate prepared for a commercial installation in Glen Burnie, Maryland, showed that a 150,000 cubic feet detention system consisting of 60" corrugated steel pipe covered by stone would cost approximately $453,000 and occupy only 0.94 acres, while a stone infiltration trench that could store the same volume would occupy 1.43 acres and cost $576,000 (Contech, Inc., 2000). The major differences in cost between these two options were that using only stone required a larger excavation, and the stone fill and increased labor for placing the stone fill was more costly than the cost of material and labor for installing the pipe.

As discussed above, underground storm water retention/detention structures can vary greatly in cost, depending on the materials utilized, the excavation, construction, and installation costs, and the storage volume required. For example, construction of the underground storm water retention/detention segment of the Boneyard Creek project in Champaign, Illinois, which consisted of the installation of six 11-foot diameter corrugated steel pipes (comprising 24,600 cubic meters of storage) cost approximately $9 million, plus contingencies (City of Champaign, Illinois, 2000). When combined with a larger, aboveground storm water retention/detention pond, this project provides enough retention/detention for a 25-year storm event, preventing the perennial flooding of Champaign's Campustown section and saving local businesses from flood damage and lost business.

Engineer's estimates for installation of CSP systems in Arizona are approximately $84 per cubic meter of storage (Pacific Corrugated Pipe Co., 2000). For example, to capture the first inch of runoff from a one acre plot, 72 feet of 96-inch CSP would be installed at a cost of $8,650. Costs are scalable and increase proportionally to increases in the amount of land served or the amount of runoff stored.

High Density Polyethylene (HDPE) pipe was utilized to construct an underground storm water detention system at the T.F. Green Airport in Providence, Rhode Island. The parking lot was created when an existing neighborhood was demolished to create extra parking areas. The site had a high water table and no runoff was allowed to leave the site. The contractor designed five separate systems of 24-inch HDPE pipe, with the largest systems consisting of approximately 2,500 linear feet of pipe each, to contain the runoff. The total storage volume was 1,420 cubic meters. While the contractor determined that 36-inch pipe was the most cost effective option, this would have had required regrading before installation while maintaining three feet of soil between the pipe and the groundwater as required by Rhode Island regulations. The total project cost was $250,000, which included 9,200 linear feet of 24-inch HDPE pipe, inspection ports, filter fabric, filter sand bedding, nine inches of stone fill around each pipe, and almost three feet of fill over the pipes (D'Ambra Construction Co., Inc., 2000, and Vanasse Hangen Brustlin, Inc., 2000).

There are trade-offs in costs between pipes and other systems, such as concrete vaults. In some cases, costs for concrete storage structures can be lower than those for plastic or corrugated steel pipes. Because they require less area to achieve the same storage volume, less area may need to be excavated for concrete structures than for pipe systems. This may reduce excavation costs. Using complete precast concrete sections can decrease assembly time, further reducing costs. However, these low costs may be offset by the higher costs of handling concrete. Installation of a 156-foot long section of 6-foot by 4-foot concrete precast box culvert (106 cubic meters) at a car dealership in Knoxville, Tennessee, was completed in 3 days and cost approximately $85,000 (Sherman Dixie Concrete Industries, Inc., 2000).

<u>Case Study: Hauge Homestead Park, Everett, Washington</u>

The City of Everett, Washington, undertook a project to detain increased runoff generated from new facilities (including a dock, a pier, restrooms, and walkways) in Hauge Homestead Park on Silver Lake. Only 4 acres of land was available for the park, some of which was required for a wet detention pond to capture runoff generated from the facilities. However, because space was so limited, the Parks and Recreation Department wanted to minimize the size of the pond while still providing the required treatment. The solution was to build an underground storm water retention/detention system upstream of the pond to store excess runoff until it was released at a controlled rate into the pond. Because the flow into the pond was controlled, engineers could design a smaller pond that still achieved the same pollutant removal efficiency. The underground retention/detention system was composed of 350 feet of 36-inch HDPE pipe, which provided 2,847 cubic feet (80.6 cubic meters) of storage. When added to the 804 cubic feet of shallow pond and 1,869 cubic feet of deep pond, the storage capacity exceeded the 5,130 cubic feet required to handle a 25-year storm event. The total cost for the underground detention system, including materials and installation, was $28,190 (City of Everett, Washington, Department of Parks and Recreation, 2000).

<u>Case Study: Homestead Village Hotel, Brookfield, Wisconsin</u>

In order to meet the requirements for no net increases in runoff volume from the construction of the Homestead Village Hotel in Brookfield, Wisconsin, engineers designed an underground retention/detention system consisting of 549 feet of 72-inch concrete pipe. Many new development projects in the suburban Milwaukee area utilize retention/detention ponds to control runoff because land is usually available; however, in this case, the hotel was built into the side of a hill, and construction of a pond required re-grading the site and increased costs. Thus, the system was built in a ring around the hotel, with all roof and floor drains connected to the system. The designers chose concrete pipe for several reasons:

- The large size requirement (72 inch pipe);
- The owners wanted a 100-year plus product lifespan;
- Multiple openings were required in the pipe for the drain inlets and the designers felt that concrete pipe would maintain its strength under these conditions;
- This pipe required a relatively small amount of fill.
- Both HDPE pipe and CSP were eliminated as alternatives based on concerns that the soil conditions would corrode CSP pipe and seals required for HDPE pipe did not meet the State pressure-testing requirements.

The system storage capacity is 120,000 gallons, with outlets through 7-inch diffuser perforations and also through a 12-inch outlet pipe, which eventually flows into a roadside ditch, then into a nearby stream. Overall project costs were approximately $267,000, including sanitary and storm sewers (APS Concrete Products, Inc., 2000, and National Survey & Engineering, Inc., 2000). Material costs for the concrete pipe accounted for approximately $75,000 of this total.

<u>Case Study: Jordan Landing, West Jordan, Utah</u>

Jordan Landing is a retail mall in West Jordan, Utah, covering 80 acres and consisting of retail stores and parking lots. The complex had no requirement to detain runoff onsite. One option for runoff generated by the site was to divert the runoff to storm water structures downstream. However, these structures were not large enough to handle the increased flows, and the cost of constructing the piping to convey the runoff downstream and enlarging the downstream controls was deemed too high. Therefore, the owners opted to detain the runoff onsite.

Because space was at a premium on the site, the designers chose on underground retention/detention as the best option to control runoff. They considered several options for the detention system, including corrugated steel pipe, aluminum pipe, HDPE pipe, concrete vaults, and reinforced concrete boxes, before deciding that 48-inch aluminum pipe was the best option. The other options all had major drawbacks: CSP required an expensive coating to protect it from site soil conditions, significantly increasing costs; costs for HDPE pipe were high because the system design required numerous expensive "T" fittings; the only reinforced concrete boxes immediately available came in specific pre-manufactured sizes that did not fit the site (in some places on the site there was only six feet of allowable excavation); and concrete vaults were too large and expensive.

The selected system utilized helical aluminum pipes fastened with aluminum bands. The system was installed by first laying down the header pipes, which were designed so that the barrel pipes could be laid directly into them, saving costly fittings. The barrels were then fitted into the header, and bands were used to connect the pipes together.

Six separate galleries of aluminum pipe were initially constructed. A seventh was added later. Altogether, the project utilized 20,000 feet of pipe and achieved 7,120 cubic meters in storage volume. The overall construction costs for the project were $1.2 million (Nolte Associates, 2000).

A summary of comparative costing information for on-site underground storm water retention/detention systems is provided in Table 2.

REFERENCES

Other Related Fact Sheets

Handling and Disposal of Residuals
EPA 832-F-99-015
September, 1999

Water Quality Inlets
EPA 832-F-99-029
September 1999

Wet Detention Ponds
EPA 832-F-99-048
September 1999

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owmitnet/mtbfact.htm

1. Advanced Drainage Systems, Inc., 1997. Technical Note 2.120 Re: Storm Water Detention/Retention System Design.

2. Advanced Drainage Systems, Inc., 2000. Materials provided to Parsons Engineering Science, Inc., by Steven Marsh, Advanced Drainage Systems, Inc.

3. APS Concrete Products, Inc., 2000. Dennis Stevens, APS Concrete Products, Inc., personal communication with Parsons Engineering Science, Inc.

4. Center for Watershed Protection, 1998. *Costs and Benefits for Storm Water BMPs.*

TABLE 2 COMPARATIVE COST INFORMATION FOR ON-SITE UNDERGROUND STORM WATER RETENTION/DETENTION PROJECTS

	Boneyard Creek, Champaign, IL	Jordan Landing Mall, West Jordan, UT	T.F. Green Airport, Providence, RI	Hauge Homestead State Park, Everett, WA	Homestead Village Hotel, Brookfield, WI	Car Dealership, Knoxville, TN
Material	CSP	Aluminum	HDPE	HDPE	Concrete	Concrete Box Culvert
Length of Pipe (feet)	8,600	20,000	12,500	350	549	156
Diameter of Pipe (inches)	132	48	24	36	72	6' x 4' box
Maximum Instantaneous Storage Volume (cubic meters)	24,600	7,120	1,420	81	454	106
Overall Cost	$9,000,000	$1,200,000	$250,000	$28,190	$267,000	$85,000

Source: Compiled by Parsons Engineering Science, Inc., 2000.

5. City of Alexandria, VA, 2000. Bill Hicks, Department of Public Works, personal communication with Parsons Engineering Science, Inc.

6. City of Champaign, IL, 2000. Jeff Smith, Department of Public Works, personal communication with Parsons Engineering Science, Inc.

7. Contech Construction Products, Inc., 2000. Patrick Pusey and Dutch Van Schoonveld, Contech Construction Products, Inc., personal communication with Parsons Engineering Science, Inc.

8. D'Ambra Construction Co., Inc., 2000. John Oliver, D'Ambra Construction Co., Inc., personal communication with Parsons Engineering Science, Inc.

9. Dewberry & Davis, Inc., 2000. George Kovats, Dewberry & Davis, Inc., personal communication with Parsons Engineering Science, Inc.

10. Everett, Washington, Department of Parks and Recreation, 2000. Ryan Sass, City of Everett, Washington, Department of Parks and Recreation, personal communication with Parsons Engineering Science, Inc.

11. Everett, Washington, Department of Public Works, 2000. Jane Zimmerman, City of Everett, Washington, Department of Public Works, personal communication with Parsons Engineering Science, Inc.

12. Fairfax County, Virginia, 2000. Steve Aitcheson, Fairfax County Municipal Water Management, personal communication with Parsons Engineering Science, Inc.

13. Malibu, California, 2000a. Rick Morgan, City of Malibu Department of Public Works, personal communication with Parsons Engineering Science, Inc.

14. Malibu, California, 2000b. Rick Morgan, City of Malibu Department of Public Works, memorandum to applicants for new development regarding New Development Standards to Reduce Water Pollution, March 3, 2000.

15. National Corrugated Steel Pipe Association, 1999. "Condition Survey of Corrugated Steel Pipe Detention Systems."

16. National Survey & Engineering, Inc., 2000. Fred Spelshaus, National Survey & Engineering, Inc., personal communication with Parsons Engineering Science, Inc.

17. Nolte Associates, 2000. Paul Hacunda, Nolte Associates, personal communication with Parsons Engineering Science, Inc.

18. Pacific Corrugated Pipe Company, 2000. Darwin Dizon, Pacific Corrugated Pipe Company, personal communication with Parsons Engineering Science, Inc.

19. Sherman Dixie Concrete Industries, Inc., 2000. Al Hogan, Sherman Dixie Concrete Industries, Inc., personal communication with Parsons Engineering Science, Inc.

20. Thompson Culvert Company, 2000. Chris Hill, Thompson Culvert Company, personal communication with Parsons Engineering Science, Inc.

21. Vanasse Hangen Brustlin, Inc., 2000. Molly Rogers, Vanasse Hangen Brustlin, Inc., personal communication with Parsons Engineering Science, Inc.

ADDITIONAL INFORMATION

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ATTACHMENTS FOR SECTION 3:

Water Quality & Water Supply

ATTACHMENTS FOR SECTION 4:

Community

SAFE, CLEAN WATER PROGRAM

FEASIBILITY STUDY REPORT

Regional Program Projects Module

PROJECT NAME	Alhambra Wash Dry-Weather Diversion
PROJECT LEAD(S)	San Gabriel Valley Council of Governments (SGVCOG), Eric Shen
SCW WATERSHED AREA	Rio Hondo
PRELIMINARY SCORE	65
TOTAL SCW FUNDING REQUESTED	$ 2,572,180.00
YEAR 1 FUNDING REQUESTED	$ 275,300.00

Submitted On: Thursday, January 21, 2021

Created By: Mark Christoffels, Chief Engineer, San Gabriel Valley Council of Governments (Mark Christoffels)

OVERVIEW

The objective of the Regional Infrastructure Program under the Safe, Clean Water (SCW) Program is to plan, build, and maintain multi-benefit watershed-based projects that improve water quality and increase water supply and/or enhance communities. A Feasibility Study is required before a project can be submitted for consideration and scoring for funding through the Los Angeles Region Safe, Clean Water (SCW) Program's Regional Infrastructure Program. Each Feasibility Study should provide enough information about a potential project to allow the Watershed Area Steering Committee members to make an informed decision for as to which projects should move forward for consideration for funding. The Minimum Feasibility Study Requirements for the Scoring and Consideration of Regional Infrastructure Program Projects is available at: https://portal.safecleanwaterla.org/projects-module/.

This document is based upon an output from the web-based tool called the 'SCW Regional Projects Module' (https://portal.safecleanwaterla.org/projects-module/). This output summarizes the information and data provided to Regional Projects Module, and also provides an initial estimate of project scoring per the SCW Infrastructure Program Project Scoring Criteria.

IMPORTANT: *ALL SCORING ESTIMATES GENERATED BY THE PROJECTS MODULE ARE PRELIMINARY AND SUBJECT TO REVIEW AND REVISION BY THE SCORING COMMITTEE.*

ORGANIZATIONAL OVERVIEW:

1 GENERAL INFORMATION
- 1.1 Overview
- 1.2 Project Location
- 1.3 Project Description

2 DESIGN ELEMENTS
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- 2.2 Capture Area
- 2.3 Diversion
- 2.4 Site Conditions & Constraints
- 2.5 Monitoring
- 2.6 O & M

3 WATER QUALITY
- 3.1 MS4 Compliance
- 3.2 Dry Weather Info

4 WATER SUPPLY
- 4.1 Nexus
- 4.2 Benefit Magnitude
- 4.3 Cost Effectiveness

5 COMMUNITY INVESTMENT
- 5.1 Community Investment
- 5.2 Local Support

6 NATURE-BASED SOLUTIONS

7 COST & SCHEDULE
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8 ADDITIONAL FEASIBILITY INFO
- 8.1 Environmental Documents and Permits
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- 8.3 Alternatives Studied (optional)
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- 8.5 Legal Requirements and Obligations
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- 8.7 Other

9 SCORING

10 ATTACHMENTS

1 GENERAL INFORMATION

This section provides general information on the project including location and project description.

1.1 Overview

The following table provides an overview of the project and the Project Developer(s):

Project Name:	Alhambra Wash Dry-Weather Diversion
Project Description:	The multi-benefit Project will divert and treat dry-weather runoff from Alhambra Wash upstream of Rio Hondo to address bacteria.
SCW Watershed Area:	Rio Hondo
Call for Projects year:	FY21-22
Total SCW Funding Requested:	$ 2,572,180.00
Phase(s) this application is requesting SCW funding for:	Design, Construction
Project Weather Type:	Dry
Project Lead(s):	San Gabriel Valley Council of Governments (SGVCOG), Eric Shen
Additional Project Collaborators:	Los Angeles County Public Works (LACPW)
Additional Project Collaborators:	Cities of Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, and South Pasadena
Additional Project Collaborators:	CWE
Anticipated IPPD:	SGVCOG
Is this a non-municipal project?	No
Primary Contact (if differs from submitter):	Eric Shen
Primary Contact Email (if differs from submitter):	eshen@sgvcog.org
Secondary Contact (if differs from submitter):	Joseph Venzon, Associate Civil, LACDPW
Secondary Contact Email (if differs from submitter):	jvenzon@dpw.lacounty.gov

1.2 Project Location

The following table summarizes the project location:

Latitude:	34.05144
Longitude:	-118.0827
Street Address:	1827 Walnut Grove Avenue
City:	Rosemead
State:	CA
Zip Code:	91770
Municipality:	Rosemead

Please see the following attachment(s) for a project location map.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - Location Map.pdf	Map illustrates Project location. Parcel and land ownership details are included in other sections of Feasibility Study.

Will the project provide benefit to a Disadvantaged Community (DAC)?

Yes

If Yes, Distance to nearest DAC.

0.06

If Yes, Describe how the project will provide benefits to a DAC.

The Project includes the installation of trees and educational signage. The trees improve air quality, and provide shade which helps to reduce the heat island effect. The signage provides the community with educational information on the importance of water quality.

If Yes, Describe how the project will provide water quality benefits to a DAC.

The Project will improve water quality locally and in downstream water bodies, which are within DACs. Cleaner water results in a cleaner environment for the community.

If Yes, Describe how the project will provide water supply benefits to a DAC.

Water supply benefits are not claimed as part of the Project.

If Yes, Describe how the project will provide community investment benefits to a DAC.

Street trees are anticipated to be included as part of the Project on Rush Street, which will increase shade on sidewalks, reducing heat island effect and improving walkability. Trees and educational signage provide the community a benefit that encourages outdoor activities such as walking. Addition of greenery is also known to improve overall curb appeal, thereby becoming an economic benefit to the Community.

If Yes, Describe how the project engaged the benefitting DAC(s) to date.

Stakeholder have been engaged to date, while a public input process will be implemented during the design phase and through implementation.

Does this project comply with the anti-displacement policies of the Feasibility Study Requirements?

Yes

If Yes, Describe how anti-displacement policies were considered.

The Project is mostly located within public and/or Los Angeles County Flood Control District right-of-way. The private property that may be utilized is currently vacant and the Project will not displace any houses/homes. The Project promotes a healthy neighborhood in relation to environment and air quality through water quality enhancements and the potential for street trees.

1.3 Project Description

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - Illustrative Overview.pdf	The illustrative overview (fact sheet) summarizes key Project characteristics and includes illustrations of proposed improvements.

Which regional water management plan includes the proposed project (SWRP, E/WMP, IRWMP, or other [must identify and justify as equivalent per 18.07.B.1.c.3]):

The Upper Los Angeles River (ULAR) Enhanced Watershed Management Program (EWMP) identified the need for Low Flow Diversions (LFDs) to address the dry-weather bacteria Total Maximum Daily Load (TMDL) in the ULAR watershed. The San Gabriel Valley Council of Governments (SGVCOG) is implementing the Load Reduction Strategy (LRS) Projects for the Rio Hondo River and Tributaries, and as part of this larger effort is the Alhambra Wash Dry-Weather Diversion (Project). The Project was identified in the Rio Hondo LRS: Addendum to Revise Implementation Actions for Alhambra Wash, Eaton Wash, and Rubio Wash (referred to herein as the Rio Hondo LRS) (ULAR EWMP Group, 2017), an addendum to the Rio Hondo LRS for the Los Angeles River Watershed Bacteria TMDL (ULAR EWMP Group, et al., 2016).

Provide a detailed description and historical background of the project. Please also state which regional water management plan includes the proposed project (SWRP, E/WMP, IRWMP, or other [must identify and justify as equivalent per 18.07.B.1.c.3]):

The Project originated from the Rio Hondo LRS and was included in the ULAR EWMP, as further detailed above. The primary objective of the Project is to improve water quality in downstream receiving waters, specifically the Rio Hondo. Improving dry-weather water quality will assist in meeting the dry-weather objectives described in the Los Angeles River bacteria TMDL. Meeting TMDL objectives also aligns with the goals of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175, which was adopted by the Los Angeles Regional Water Quality Control Board (LARWQCB) and enacted on December 28, 2012. Secondary and other objectives include enhancing the local environment, which may be accomplished through planting of trees and/or constructing a swale, and providing educational opportunities to the community through engagement and educational signage.

The primary objective will be achieved through the implementation of a diversion, pretreatment system, and advanced treatment unit, which will capture and treat flows from over 11,000 acres. Flows will be diverted and treated using Ultraviolet (UV) light before being discharged downstream. Additional details pertaining to the Project layout are included in this submittal package.

The Project will comply with County-wide displacement policies and specific anti-displacement requirements associated with other funding sources. Additional discussion on the applicability of these policies is included above.

2 DESIGN ELEMENTS

This section provides an overview of the project design details.

2.1 Configuration

The following table is a summary of the project configuration:

Project Configuration Summary	
BMP Type:	Treatment Facility
Infiltration Footprint Area:	0.82 ac
Ponding Depth:	2.5 ft
Media Layer Depth:	0 ft
Media Layer Porosity:	0 ft
Underdrain Layer Depth:	0 ft
Underdrain Layer Porosity:	0 ft

Calculated Storage Volume	
Module-generated Storage Volume:	2.0500 ac-ft

Please upload a description and detailed schematic of the project layout including its anticipated footprint and key components such as, but not limited to: inlets, outlets, diversion point, recreational components, nature-based components, pumps, treatment facilities, underdrains, conveyance, above ground improvements, and other project components.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - Project Description.pdf	The Project Description summarizes the Project background, goals, and proposed improvements.
Alhambra Wash - Concept Schematic.pdf	The figure illustrates the anticipated treatment system. Additional details are included in the 30% plans. Nature-based solutions are illustrated separately in a schematic included below.

2.2 Capture Area

The size and land uses of the capture area upstream of a project plays an important role in its water quality and water supply benefits. The capture area information here is used by the Module for scoring:

Capture Area Summary

Capture Area:	11120 ac
Impervious Area:	6787 ac
Pervious Area:	4333 ac

The following table is a summary of the land use breakdown for the area that drains to the project:

Breakdown of Impervious Acreage in Capture Area		
Land Use Type	Percent Impervious	Acres
Agriculture	0.6 %	40.722
Commercial	26.5 %	1798.555
Institutional	6.7 %	454.72900000000004
Industrial	3 %	203.60999999999999
Multi Family Residential	24 %	1628.8799999999999
Single Family Residential	33 %	2239.71
Highways and Interstates	5.9 %	400.43300000000005
Vacant	0.3 %	20.361

The following table is a breakdown of the municipal jurisdictional areas within the project capture area:

Breakdown of the Municipal Jurisdictional Areas within the Project Capture Area		
Municipal	Tributary Percent	Acres
Alhambra	29.8 %	3313.76
Monterey Park	9.8 %	1089.76
Pasadena	25.6 %	2846.72
Rosemead	8.6 %	956.32
San Gabriel	9.4 %	1045.28
San Marino	12.8 %	1423.36
South Pasadena	1.6 %	177.92
Unincorporated (Los Angeles County)	2.4 %	266.88

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - DA Figure.pdf	This figure illustrates the tributary drainage area and municipalities within in.
Alhambra Wash - Land Use Figure.pdf	This figure illustrates the land use within the tributary drainage area.

Has a shapefile of the project capture area has been uploaded to the project?
Yes

2.3 Diversion

Diversion Structures generally apply to 'off-line' regional projects where stormwater is diverted from a major water conveyance (e.g., gravity main) and directed to the project at a predetermined maximum rate. Smaller distributed projects, like bioretention, do not normally utilize these devices.

Does the project have a diversion structure?

Yes

The following table provides details on the diversion type and maximum diversion rate:

Diversion Details	
Type of Diversion	Typical Max Diversion Rate (cfs)
Pumping	2.23 cfs

Estimated Average Inflow Captured by Project:

1.38 cfs

Description of Diversion:

The diversion structure is a rubber dam that runs along the width of Alhambra Wash. The rubber dam will impound dry-weather runoff within the channel, providing storage and allowing flows to pass through a steel grated inlet and into a diversion box when the pump system is operating. The pump system will be designed to receive rain gage data, potentially from throughout the tributary watershed. The pump will not operate if rain greater than 0.1 inches is measured within the site's drainage area. It is anticipated in the preliminary design that the height of the rubber dam, once inflated, will be up to half the channel depth, excluding freeboard, which is estimated to be up to 5 feet in Alhambra Wash. The steel grate will be traffic rated with at least H-20 loading rate to sustain loads from maintenance vehicles that would travel in the channel. The rubber dam can be deflated to allow vehicles to easily drive over it. Captured flows will travel through a diversion pipe to a proposed pump well. Portions of the channel may need to be replaced to install the rubber dam. The rubber dam will be strategically placed to minimize channel replacement required. The diversion pipe shall be installed beneath the channel. In addition to the rubber dam and diversion pipe installation, mechanical equipment must be installed to operate the rubber dam, including a compressor and electrical equipment. The rubber dam will be fixed to the channel bottom, and will require the installation of a control structure to which the compressed air line will connect.

Periodic maintenance will be necessary to maintain the effectiveness of the diversion structure. The steel grate and diversion box will require inspection to verify whether they are clogging. Sediment may accumulate behind the rubber dam and in the diversion box. Debris and sediment will require removal as necessary based on findings during regular inspections. It is anticipated that heavy storm events will flush some of these sediments downstream. The rubber dam will require inspection and restoration as necessary.

During wet-weather events the rubber dam will be deflated to mimic the existing channel bottom. Flows will bypass the diversion system and the rubber dam will be designed to minimize impacts to the Water Surface Elevation (WSE) during the design event (high storm flows). Hydraulic modeling will be used during the final design process to assess the impacts the diversion structure will have on the channel hydraulics.

2.4 Site Conditions & Constraints

Please provide an upload for each of the attachments below that describes the methods, outcomes and how the information will be incorporated into the project design.:

Alhambra Wash is a concrete-lined rectangular channel owned and maintained by the Los Angeles

County Flood Control District (LACFCD). The site is located in the City of Rosemead, near the intersection of Rush Street and Walnut Grove Avenue in the southern end of the City. The Project site is located near Rice Elementary School and a Walmart Supercenter. Coordination and additional planning will be required to minimize impacts to these facilities during construction.

A field survey for the Project site was conducted in November 2018. The topographic survey was performed using North American Vertical Datum of 1988 (NAVD 88) and North American Horizontal Datum of 1983. Approximately 6 acres was surveyed at the Alhambra Wash site and is comprised primarily of public right-of-way and flood control uses, except the parcel east of the channel, which is owned by Southern California Edison (SCE). The topography of the portion of Project site (under Rush Street) is relatively flat with graded slopes of less than 1%. The slope of the concrete-lined Alhambra Wash was confirmed to be 0.5%, consistent with what is shown on the as-built plans.

A geotechnical engineering analysis was performed by Terracon Consultants, Inc. for the Project in February 2019. The resulting report, Geotechnical Engineering Report: SGVGOC ACE Rio Hondo Load Reduction Strategy Design Project, summarizes the geotechnical findings, considerations, and recommendations relevant to the Project. Four test borings and one percolation boring were performed at the Alhambra Wash site. Test borings were drilled to approximate depths of 10 to 51.5 feet below ground surface (bgs). The infiltration rate observed onsite was 0.11 inches per hour. Groundwater was not encountered in any of the borings, while it is expected to be around 50 feet bgs based on historic well data in the surrounding area. Additional details are included in the Geotechnical Report.

Hydrology is not applicable to the Project, as the goal is to capture dry-weather runoff. Dry-weather flow data was available in the Project vicinity and was reviewed in detail to understand the anticipated dry-weather flow rates, trends, and changes over time. A model was developed to assess how the Project would perform based on historical data. A summary of the analysis performed is attached.

A utility search was performed to determine the existing utilities in and around the site at Alhambra Wash. Underground Service Alert (DigAlert) was used to identify potential utility owners within the Project area and Preliminary Utility Search Notices were sent to the potential owners identified. The utility search will be ongoing throughout the design process. A review of utility information collected shows minimal intrusion within LACFCD right-of-way; however, several private-, city-, and county-owned utility lines exist within the public right-of-way and adjacent private property that must be considered during the design process and avoided when possible.

The SCE parcel adjacent to the site may be acquired as part of the Project. A preliminary valuation was performed to identify ownership and explore different options. Opportunities to acquire the property versus obtaining an easement will be evaluated during the final design process. A preliminary valuation is available, while it is not attached to this submittal package.

Does the project involve LACFCD infrastructure, facilities, or right-of-way?

Yes

Please see the following attachments for additional details on geotechnical, hydrology, right-of-way and/or LACFCD, and utility conditions.

Attachments for this Section	
Attachment Name	**Description**
Alhambra Wash - Geotech Figure.pdf	This figure illustrates the locations of the explorations. The full report is included as a reference document at the end of this submittal package.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - Flow Ananlysis Summary.pdf	The flow analysis summary is also included in the Project's Feasibility Study and is focused on dry-weather runoff.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - Assessor Map.pdf	The parcel map associated with the Project area is included in this attachment.
Alhambra Wash - LACFCD Concept Review Email.pdf	Email confirming preparation of LACFCD conceptual review letter. This will be replaced with letter if received before submission. Otherwise, letter is anticipated shortly after this is submitted and will be made available during the evaluation period.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - Utility Figure.pdf	Major utilities are shown in this figure, while more detailed information is included in the 30% design plans.

2.5 Monitoring

This section provides an overview of monitoring data related to the project.

Has any monitoring data been compiled related to the project?

No

Please provide an overview of the monitoring performed to date:

N/A

Please upload a monitoring plan to measure the effectiveness of the proposed project once completed, including metrics specific to the identified benefits. Also attach supplemental information on monitoring conducted to date, if applicable.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - Monitoring Plan.pdf	This Preliminary Monitoring Plan summarizes the Project scope, benefits, and monitoring that may be implemented to assess benefit achievement following implementation.

2.6 O & M

Provide an overview of the plan for how operations and maintenance of the Project will be carried out. Identify the responsible party and describe any technical expertise required for O&M.

This Operation and Maintenance (O&M) Manual has been prepared to provide guidance for maintenance crews on the inspection and maintenance of proposed Project components. The manual outlines operation, inspection, and maintenance requirements and will include specifications, as-built plans, and maintenance/inspection logs following Project implementation. The manual follows the United States Army Corps of Engineers (USACE) format with some additional sections to meet the requirements of the Safe Clean Water Program. Specific inspection and maintenance tasks are presented in the attached O&M Manual along with the procedures for documentation of the work performed.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - O&M Manual.pdf	O&M Manual summarizes the operation, inspection, and maintenance procedures anticipated for the Project.
Alhambra Wash - Letter of Commitment.pdf	Commitment to operate and maintain system for useful life.

3 WATER QUALITY BENEFITS

This section provides an overview of project elements related to water quality benefits, including calculations used for Section A (Water Quality Benefits) of SCW Project Scoring Criteria.

3.1 MS4 Compliance

Please describe in detail how the project will support achievement of compliance with MS4 Permit including applicable TMDLs, role with Watershed Management Program, etc. Please clearly specify if this project is being developed as part of a Time Schedule Order for the MS4 Permit. SCW funds may be used for projects implemented pursuant to a TSO issued by the LA Regional Water Quality Control Board provided that, at the time the TSO is issued, the project is included in an approved watershed management program developed pursuant to the MS4 Permit:

The National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175, which was adopted by the Los Angeles Regional Water Quality Control Board (LARWQCB) and enacted on December 28, 2012, incorporated TMDLs. The MS4 Permit identifies the permittees that are responsible for compliance with the Los Angeles River (LAR) Watershed Bacterial Total Maximum Daily Load (Bacteria TMDL). The LAR Bacteria TMDL requires the responsible permittees to meet targets and waste load allocations for the indicator bacterium E. coli during wet-weather and dry-weather seasons. The Rio Hondo Load Reduction Strategy (LRS) was developed based on the Bacteria TMDL requirements and outlines a strategy for achieving compliance with dry-weather objectives. The Project was identified in the LRS as a critical project. The ULAR EWMP also identified the need for low flow diversions to address dry-weather pollutant loading in the ULAR watershed. The Project is not being implemented in response to an active Time Schedule Order (TSO).

3.2 Dry Weather Info

The following is justification for this project to be categorized as a Dry Weather project:

The Project is specifically designed to target 100% of the dry-weather flows in Alhambra Wash from the tributary drainage area. The proposed project is designed to treat and release the dry-weather flows, which meets one of the requirements for Dry-Weather BMPs as outlined in section A.2.1 of the score card.

Estimated Average Dry Weather Flow Rate:

1.38 cfs

The following method was used to estimate average captured flow:

The Rio Hondo LRS (including the addendum) included a detailed analysis of the Rio Hondo and it's tributaries, including Alhambra Wash. The Rio Hondo LRS established a diversion flow rate for Alhambra Wash (1,000 gpm or 2.23 cfs) that would be required to meet the dry-weather bacteria TMDL. A flow analysis was also developed based on data available from October 2000 to September 2015 to better understand the variability of flow rates anticipated within Alhambra Wash. The flow analysis summary was attached in an earlier section. The flow analysis will be important in designing the rubber dam diversion and sizing the treatment system. The in-line storage provided by the rubber dam will allow the treatment flow rate to be equalized and made more consistent to avoid cycling and start up challenges.

4 WATER SUPPLY BENEFITS

This section provides an overview of project elements related to water supply benefits, including calculations used for Section B (Significant Water Supply Benefits) of SCW Project Scoring Criteria.

4.1 Water Supply Nexus

Please describe and clearly justify the nexus between water supply and the stormwater and/or urban runoff that is captured/infiltrated/diverted by the Project:

Flows that will be captured by the Project will be treated and released back into Alhambra Wash. Flows from Alhambra Wash will continue downstream to the Rio Hondo where they will infiltrate. The original Project concept was to divert flows to the sanitary sewer system. Treating and releasing flows will allow the runoff to be infiltrated as opposed to removing it from the system.

Does this project capture water for onsite irrigation use?

No

Description of onsite use by the project:

N/A

Does this project capture water used for water recycling by a wastewater treatment facility?

No

Description of water recycling by the project:

N/A

Is the project connected to a managed water supply aquifer?

Yes

If Yes, managed Aquifer Name:

San Gabriel Valley Groundwater Basin

If this project is augmenting groundwater supply, please provide confirmation that the agency managing the groundwater basin concurs with the added benefit.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - GW Basin Figure.pdf	The figure illustrates the Project location relative to the groundwater basin. A letter is not included, as water supply benefits are not being claimed.

4.2 Benefit Magnitude

Project Scoring Criteria Section B is based upon estimates of annual average water supply benefit. Water supply benefit can include, but is not limited to, water diverted to a separate groundwater recharge facility, into a water treatment plant, to a sanitary sewer to be converted into recycled water, etc. This section provides documentation of estimates of annual average water supply benefit.

Average dry weather inflow to project:

1.38 cfs

Describe the methods used to estimate average dry weather inflow to the project:

The average dry-weather inflow to the Project was established based on the flow analysis described above and attached in another section of this submittal package. It is expected that the Project will capture approximately 996 acre-feet per year based on historical flow data.

The following tables present calculated annual inflow the project.

Note these estimates are based on an hourly 20-year hourly WMMS simulation performed by the Module, or as estimated by the Project Developer.

Module-generated annual average inflow to project:	N/A ac-ft
Use Project Developer estimate instead?	No
Custom Value specified by User:	N/A
Please provide a description of methods used to calculate water supply inflow values	N/A
Supporting PDF	See attached PDF if applicable.

The following tables present calculated annual average capture by the project, which is used for the Section B2 scoring calculation (Benefit Magnitude of SCW Scoring Criteria).

Note these estimates are based on an hourly 20-year hourly WMMS simulation performed by the Module, or as estimated by the Project Developer.

Module-generated annual average capture for water supply:	N/A ac-ft
Use Project Developer estimate instead?	No
Custom Value specified by User:	N/A

Please provide a description of methods used to calculate water supply benefit	N/A
Supporting PDF	See attached PDF if applicable.

4.3 Cost Effectiveness

Project Scoring Criteria Section B2 incorporates life-cycle costs. The cost-effectiveness for water supply benefit is calculated from other sections in the Module. The calculation for B2 scoring is based on a numerator of life-cycle cost (from Design Elements > Cost) and a denominator of annual average benefit magnitude (from Water Supply > Benefit Magnitude).

Module-generated water supply cost-effectiveness:	$ N/A per ac-ft
Use Project Developer estimate instead?	No
Custom Value specified by User:	$ N/A
Justification	N/A
Supporting PDF	See attached PDF if applicable.

5 COMMUNITY INVESTMENT & LOCAL SUPPORT BENEFITS

5.1 Community Investment

This section provides an overview of project elements related to community investment benefits, which are used in calculations for Section C (Community Investment Benefits) of SCW Project Scoring Criteria.

The following table details the project's community investment benefits:

Community Investment		
Investment Type	Applicable?	Detailed Description
Does this project improve flood management, flood conveyance, or flood risk mitigation?	No	N/A
Does this project create, enhance, or restore park space, habitat, or wetland space?	No	N/A
Does this project improve public access to waterways?	No	N/A
Does this project create or enhance new recreational opportunities?	Yes	Walking is a valuable recreational activity that helps maintain a healthy community and also serves as a non-vehicular form of transportation. Studies show that tree cover on sidewalks adjacent to roads improves walkability, reduces heat island effects, and improves air quality. Implementing street trees on Rush Street will enhance existing recreational activities (walking) and benefit the community, especially because pedestrian activity is expected at this location due to the proximity to Rice Elementary School. Additional discussion of EnviroAtlas is included in this application (with Nature-Based Solutions section).
Does this project create or enhance green spaces at school?	No	N/A
Does this project reduce heat local island effect and increase shade?	Yes	Planting trees along Rush Street will create/increase shade and thereby reduce the heat island effect. The number and type of trees will be determined through additional coordination with the City of Rosemead.

Does this project increase shade or the number of trees or other vegetation at the site location?	Yes	Tree planting is proposed along Rush Street, as mentioned above. The number and type of trees will be determined based on ongoing coordination with the City of Rosemead. A swale is also proposed as part of the Project and will be located adjacent to the left bank of Alhambra Wash. Native vegetation will be incorporated into the swale design.

5.2 Local Support

Please describe any prior outreach and engagement conducted for this project:

Outreach has been ongoing with government agencies and stakeholders. There have been meetings to discuss cost share, maintenance responsibilities, and review of potential project concepts.

Please describe the Outreach Plan for this project moving forward:

There is a plan for outreach to the public at various milestones of the Project, specifically during the design and construction phases. Outreach will be used to educate the community and solicit feedback for consideration. The Project is located within a DAC and the outreach efforts will be tailored to engage with the local community. Virtual outreach is anticipated at this time, while it may not be required in the future. Opportunities to use social media and other online engagement strategies will be considered as the Project moves forward. Outreach towards stakeholders will also continue throughout the life of the Project.

Does this demonstrate strong local, community-based support?

Yes

The following table details the support by local, community-based organizations for the project (also see attachments)**:**

Local Support		
Organization Name	Description	PDF
Los Angeles County Public Works	LACPW supports the Project and is a Project partner.	Alhambra Wash - Letter of Support LAC.pdf
Amigos de Los Rios	Amigos de Los Rios aims to create a network of parks and trails throughout the Los Angeles Basin in an effort to improve access to recreation, link communities to nature and each other, expand access to safe non-vehicular transportation, create culturally meaningful public spaces, and protect urban communities from the harmful effects posed by climate change. Amigos de Los Rios acknowledges the benefits of the Project and supports implementation.	Alhambra Wash - Letter of Support AdLR.pdf

6 NATURE-BASED SOLUTIONS

This section provides an overview of project elements that leverage nature-based solutions, which are used in calculations for Section D (Nature-Based Solutions) of SCW Project Scoring Criteria.

Does this project implement natural processes?

Yes

Natural Processes Description:

The pump well will include perforations that allow for infiltration to occur. This will allow the Project to mimic the natural occurrence of infiltration that existed before the region was developed. A swale will be located adjacent to the left bank of Alhambra Wash and/or street trees will be located on Rush Street, both of which will also support natural processes.

Does this project utilize natural materials?

Yes

Natural Materials Description:

Trees and planting materials for a bioswale are expected as part of the Project. Coordination is ongoing with the City of Rosemead regarding tree placement and type. The swale would use natural materials and native trees will be assessed for use on Rush Street (tree type will be based on the City of Rosemead preferences).

Description of how nature-based solutions are utilized to the maximum extent feasible. If nature-based solutions are not used, include a description of what options where considered and why they were not included.

The Project's main goal is to capture and treat dry-weather runoff from Alhambra Wash, which typically would not include any nature-based solutions. Efforts are being made to make this a multi-benefit project. The area surrounding the Project is in the City of Rosemead and coordination will be required to confirm improvements within their right-of-way (number of trees and tree types). A bioswale will be incorporated into the Project adjacent to the left bank of Alhambra Wash, as illustrated in the concept included in this application. The street trees and biowale are considered nature-based solutions. The swale would use natural and native materials to accommodate infiltration and mimic natural processes. The pump wet well will be perforated to promote infiltration, which mimics natural processes.

EnviroAtlas is a USEPA developed tool that combines spatial data, field research, and other sources of information to characterize the natural environment and health incomes, among other things. A community-based assessment was recently performed for Los Angeles County, which resulted in high-resolution data (can be reviewed here: https://www.epa.gov/enviroatlas/enviroatlas-interactive-map). EnviroAtlas indicates that the north side of Rush Street, where trees are proposed, has only 6-15% tree cover along the walkable portion of road. Pedestrians are expected along Rush Street, especially those walking to and from the adjacent elementary school. Trees provide shade and improve walkability and ultimately public health, as they help keep temperatures cooler and make walking more comfortable, which tends to lead to more walking.

The following table details the impermeable area removed by the project:

Removed Impermeable Area by Project

Pre-Project Impervious Area:	Post-Project Impervious Area:
0 ac	0 ac

7 COST & SCHEDULE

This section provides an overview of the project's funding and community support, which are used in calculations for Section E (Leverage Funds and Community Support) of SCW Project Scoring Criteria.

7.1 Cost & Schedule

Attachments for this Section	
Attachment Name	**Description**
Alhambra Wash - Preliminary Cost Opinion.pdf	Preliminary cost opinion includes construction breakdown and other costs.
Alhambra Wash - Schedule.pdf	Anticipated schedule from planning through construction completion.

The following tables provide details on the project's phase and annualized costs:

Phase Costs			
Phase	**Description**	**Cost**	**Completion Date**
Planning	Preliminary engineering and feasibility study	$ 125,000.00	06/2020
Design	Acquisition (purchase full/partial property or coordinate for easement)	$ 1,303,000.00	12/2021
Design	Design and permitting	$ 550,600.00	04/2023
Construction	Construction and construction management	$ 3,165,800.00	08/2024
Total Funding:		$ 5,144,400.00	

Annual Cost Breakdown	
Annual Maintenance Cost:	$ 81,000.00
Annual Operation Cost:	$ 34,000.00
Annual Monitoring Cost:	$ 50,000.00
Project Life Span:	30 years

The following table provide details on calculated life-cycle costs for the project (either calculated the Module, or estimated by the Project Developer)**.**

Note: these life-cycle costs are used in Section 4.3 of this output for Water Supply Benefit scoring.

Module-generated Life-Cycle Cost for Project*	$ 8,227,177.67
Module-generated Annualized Cost for Project*	$ 440,344.54
Use Project Developer estimate instead?	No
Custom Value specified by User:	N/A
Please provide a description of methods used to calculate Life Cycle costs, and attach supplemental information with details of the methodology, assumptions and calculations:	N/A
Supporting PDF	See attachment if applicable.

*Applies an annual discount rate as a static rate equal to 3.375%. The only costs not included in total life-cycle cost are the dismantling and replacement costs at the end of life.

7.2 Cost Share

Is additional funding being provided as a Cost Share for this project?

Yes

The following is a summary of what other sources of funding were explored and/or why funding could not be secured through these other sources:

It is acknowledged that eligible expenditures are only those incurred after November 7, 2018. Planning costs are not being requested as part of this application. Several agencies have entered into an agreement to fund the Rio Hondo LRS projects, including this Project. The Cities of Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, and South Pasadena, along with Unincorporated County, will be funding the cost share identified in this submittal package. Other funding sources have been evaluated, while no other funding has been secured.

The following table details the additional funding attained for the project:

Additional Funding				
Type of Cost Share	Sub-Phase Description	Funding Amount	Funding Status	PDF
MOUs	The MOU has been established. The funding agencies have paid for the planning phase of the Project and will fund additional implementation efforts into design and construction. This approach has been agreed upon, while the detailed cost breakdown will be established as design and implementation move forward.	$ 2,572,220.00	In Progress	Alhambra Wash - Cost Share MOU.pdf
Total Funding:		$ 2,572,220.00		

7.3 Funding Request

Total funding requested

$ 2,572,180.00

The following table shows the requested schedule of funding (by Year and Phase) to create a summary table. A breakdown for the first five years must be provided. The schedule of funding must also match the Requested Funding. In most cases, the entries will not add up to the estimated Life-Cycle cost, as Applicants are discouraged from including long-term O&M costs beyond five years in the funding request.

Funding Requested by Year & Phase			
Year	SCW Funding Requested	Phase	Efforts during Phase and Year
Year 1	$ 275,300.00	Design	Design and permitting (half of the expected cost).
Total Year 1	$ 275,300.00		
Year 2	$ 651,500.00	Design	Anticipated acquisition costs, which will be refined during the design and negotiation process (half of expected cost).
Total Year 2	$ 651,500.00		
Year 3	$ 822,690.00	Construction	Construction and construction management funding is being requested (about half of the expected costs) and is split over two years.
Total Year 3	$ 822,690.00		
Year 4	$ 822,690.00	Construction	Construction and construction management funding is being requested (about half of the expected costs) and is split over two years.
Total Year 4	$ 822,690.00		
Total Funding:	$ 2,572,180.00		

The Life-cycle costs do not match Total Funding Requested + Cost Share. For many projects this is acceptable because funding requests for O&M and monitoring funding are typically included for first 5-years only (rather than entire life cycle).

8 ADDITIONAL FEASIBILITY INFORMATION

This section presents additional information regarding project feasibility and technical details gathered during project design and feasibility assessment.

8.1 Environmental Documents and Permits

Environmental Documentation:

1. **Identify the lead agency for the Project per CEQA.**
2. **Identify environmental documentation (e.g. EIR, MND, ND, Exemption) that has been completed or will be prepared for the Project.**
3. **Discuss the current status and schedule for preparation and notification of environmental documentation.**
4. **State if NEPA is required and identify the lead agency under NEPA, and environmental document (e.g. EIS, FONSI, Categorical Exclusion) that has been completed or will be prepared for the Project.**

An Initial Study and Mitigated Negative Declaration (IS/MND) will be prepared to comply with California Environmental Quality Act (CEQA) with SGVCOG as the lead. As indicated in the schedule included in this Feasibility Study, CEQA documentation is expected to be completed by February 2022, following a 30-day public review. Following public review and revisions (as needed), the IS/MND and a Notice of Determination (NOD) will be approved and filed with the County Clerk. It is understood that LACFCD will be a responsible party, as the Project is within their facility. LACFCD will have the ability to review the CEQA documents before they go out for public review. The National Environmental Policy Act (NEPA) will be required as part of the Section 408 permitting process, as Alhambra Wash was originally constructed by USACE. USACE will lead the development of NEPA documentation based on information submitted to them as part of the permitting process.

Permitting:

- **Describe all permit requirements including for the Flood Control permit. Discuss anticipated challenges associated with obtaining permits ie. time and cost. A Flood Control Permit (obtained through epicla.lacounty.gov) is required for any project affecting LACFCD right-of-way and/or facility.**
- **If a Flood Control Permit is required:**
  - **Describe how the project will affect LACFCD right-of-way and/or facility.**
  - **Provide a planning-level schedule showing the time allotted for permit review and issuance in the context of the overall project planning and delivery process**.

The project will require permits/approvals from the following agencies:

USACE Section 408, due to USACE constructing the channel originally
USACE Section 404, due to improvements being proposed on an open channel
California Department of Fish and Wildlife (CDFW) Section 1602, due to improvements being proposed on an open channel
Regional Water Quality Control Board Section 401, due to improvements being proposed on an open channel
LACFCD, due to the project being located in Alhambra Wash, which they operate and maintain
City of Rosemead, due to the Project being located within City limits

The schedule has allotted time for each of these permits based on how long it has taken to permit similar projects. Engagement has been ongoing with some of the permitting agencies and will continue through the design process. Improvements to the channel will be focused on early in the design phase so that submittals may be made as soon as possible. One potential challenge anticipated is timelines in terms of the pandemic and modified working arrangements. Early coordination will help prevent these kinds of delays.

An assessment of permits required is included in the reference Feasibility Study and was not attached here to avoid duplication.

8.2 Vector Minimization

This following provides details on vector minimization strategies.

Does the project have vector minimization plan?

Yes

Provide a description of the vector minimization plan.

The attached Vector Minimization Plan is based on the Checklist for Minimizing Vector Production in Stormwater Management Structures developed by the State of California Health and Human Services Agency. The Plan identifies both wet and dry systems and strategies to mitigate the potential for vectors. The Plan indicates mosquitoes/vector screens/barriers shall be used in wet systems, including the pump well and valve vaults, as applicable.

Please see an attachment with proposed vector minimization plan.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - Vector Minimization Plan.pdf	The plan indicates how vector/mosquito concerns will be avoided/mitigated.

8.3 Alternatives Studied

Describe alternatives that were considered and evaluated as part of the Project development:

Several alternatives were evaluated as part of the planning process for the Project. The initial approach included a low flow diversion to the sanitary sewer. Coordination was ongoing with Los Angeles County Sanitation District and other stakeholders to evaluate how flows would be diverted to the sewer. Options to include storage were evaluated (in-line and off-line) along with different approaches for how flows would be discharged to the sewer. The ongoing operational costs associated with a sewer diversion made the life-cycle cost very expensive. As a result, additional approaches were evaluated.

The following additional approaches were analyzed based on the treatment approach, site requirements, O&M, cost, and permitting:

1. Advanced treatment for release
2. Title 22 treatment for discharge into existing recycled water system
3. Advanced treatment for groundwater injection

Partnering agencies met to discuss the various alternatives available and agreed that a treat and release approach would be the best way to move forward. The preferred approach would help achieve the pollutant reduction goals at a reduced ongoing cost compared to the sewer diversion. The treatment system would also allow treated flows to continue downstream into natural sections and infiltrate, which benefits the environment.

8.4 Effectiveness

Describe the effectiveness of similar types of projects already constructed if applicable:

Low Flow Diversion (LFD) systems have been used to address dry-weather and wet-weather runoff throughout the region.

LFDs often discharge diverted runoff to the sanitary sewer, while some projects include a treatment system. A similar treatment system was implemented on Malibu Creek and several others are planned. For example, dry-weather treatment systems are proposed on Ballona Creek, Sepulveda Channel, and Medea Creek. UV treatment is effective at reducing bacteria loading and is used in other applications, such as with stormwater capture and use systems, such as the one at Los Amigos Park in the City of Santa Monica, where runoff is captured, treated with UV, and used for spray irrigation and toilet flushing.

Several other dry-weather flow diversion projects are proposed in the Los Angeles River watershed. LFDs are effective in the built environment, as they require minimal space on the surface, and in some cases can even be buried, preserving surface uses.

8.5 Legal Requirements and Obligations

Describe any legal requirements or obligations that may arise as a result of constructing the Project and how these requirements will be satisfied:

No legal requirements or obligations are anticipated as a result of constructing this project.

8.6 Technical Reports

Please upload additional technical reports related to this project not provided above.

Attachments for this Section	
Attachment Name	Description
Ref - 30% Design Plans.pdf	30% design plans for the Project.
Ref - Feasibility Study No Attachments.pdf	The Project Feasibility Study summarizes the site conditions and several alternatives. Appendices exceed the size limitations and can be made available separately.
Ref - Geotech Report.pdf	Geotechnical Report with details of site conditions and recommendations.

8.7 Other

Provide any additional information related to the Project as necessary:

A map of local DAC areas is attached herein.

Attachments for this Section	
Attachment Name	Description
Alhambra Wash - DAC Figure.pdf	Figure illustrates DAC areas in the Project vicinity.

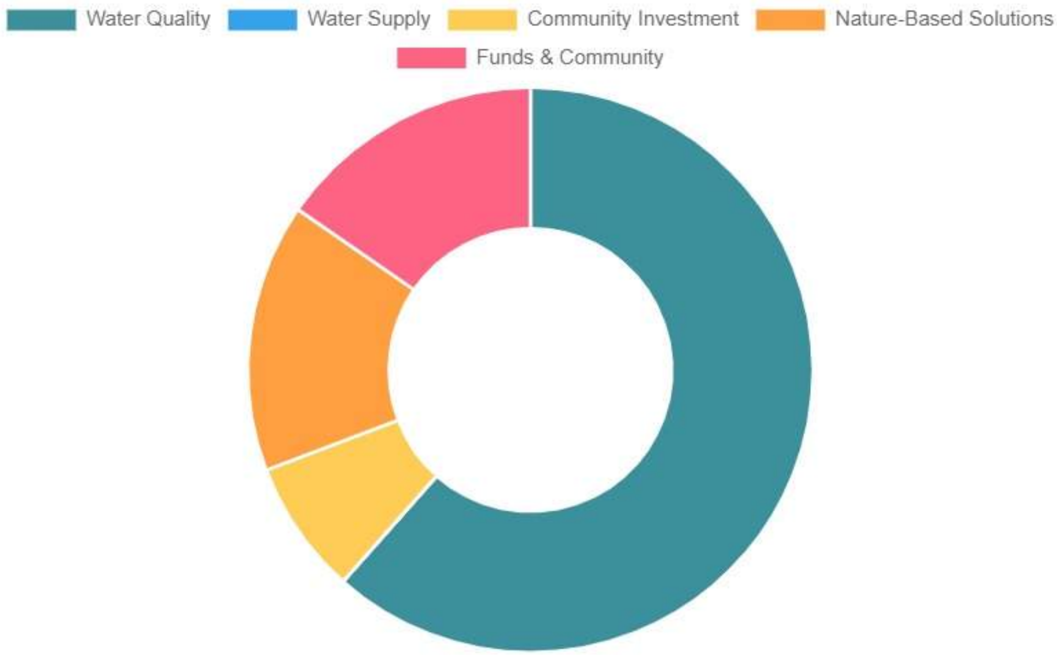
9 SCORING

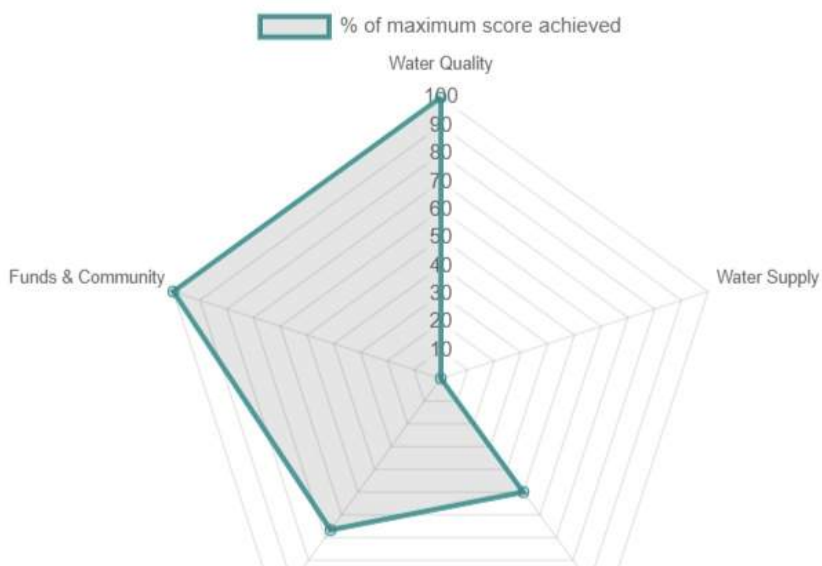
This section summarizes scoring calculations generated by the Module. All Regional Program Projects must meet the Threshold Score of 60 points or more using the following Project Scoring Criteria to be eligible for consideration.

Note: all scoring estimates are considered preliminary and subject to review and revision by the Scoring Committee.

Preliminary Estimated Project Score:
65 points

The following graphics summarize the project scoring. The first graphic shows the components of the project score, based on the different scoring sections. The second graphic shows the percent of maximum score achieved by the project within each scoring section.


Water Quality
Water Supply
Community Investment
Nature-Based Solutions
Funds & Community


% of maximum score achieved
Water Quality
Water Supply
Funds & Community
100
90
80
70
60
50
40
30
20
10
0

The following table details the scoring calculated for the project, along with the scoring thresholds from the SCW Project Scoring Criteria:

Scoring Section	Project Score	Max Score	Scoring Criteria Thresholds
Water Quality Wet + Dry Weather **Part 1**	N/A	20	Cost Effectiveness = (24-hour BMP Capacity) / (Construction Cost in $Millions) • <0.4 = 0 points • 0.4-0.6 = 7 points • 0.6-0.8) = 11 points • 0.8-1.0 = 14 points • >1.0 = 20 points
Water Quality Wet + Dry Weather **Part 2**	N/A	30	Primary Pollutant Reduction: • >50% = 15 points • >80% = 20 points Secondary Pollutant Reduction: • >50% = 5 points • >80% = 10 points
Water Quality Dry Weather Only **Part 1**	20	20	For dry weather BMPs only, Projects must be designed to capture, infiltrate, or divert 100% (unless infeasible or prohibited for habitat, etc.) of all tributary dry weather flows.
Water Quality Dry Weather Only **Part 2**	20	20	For Dry Weather BMPs Only. Tributary Size of the Dry Weather BMP: • <200 Acres = 10 points • >200 Acres = 20 points
Water Supply Part 1	N/A	13	• >$2500/ac-ft = 0 points • $2,000–2,500/ac-ft = 3 points • $1500-2,000/ac-ft = 6 points • $1000–1500/ac-ft = 10 points • <$1000/ac-ft = 13 points
Water Supply Part 2	N/A	12	• <25 ac-ft/year = 0 points • 25 - 100 ac-ft/year = 2 points • 100 - 200 ac-ft/year = 5 points • 200 - 300 ac-ft/year = 9 points • >300 ac-ft/year = 12 points
Community Investment	5	10	• One Benefit = 2 points • Three Benefits = 5 points • Six Benefits = 10 points

Nature Based Solutions	10	15	• Implements natural processes or mimics natural processes to slow, detain, capture, and absorb/infiltrate water in a manner that protects, enhances and/or restores habitat, green space and/or usable open space = 5 points • Utilizes natural materials such as soils and vegetation with a preference for native vegetation = 5 points • Removes Impermeable Area from Project (1 point per 20% paved area removed) = 5 points
Leveraging Funds Part 1	6	6	• >25% Funding Matched = 3 points • >50% Funding Matched = 6 points
Leveraging Funds Part 2	4	4	The Project demonstrates strong local, community-based support and/or has been developed as part of a partnership with local NGOs/CBOs.
Total	**65**	110 / 100	

10 ATTACHMENTS

Attachments are bundled and organized in the following pages, with cover pages between each subsection.

Please note – at a minimum, a feasibility study must attach the following:

- A Location Map
- A Schematic with Proposed Footprint and Key Components
- A Map of the Capture Area (Tributary Map)
- Technical Reports (e.g. soil report, hydrology report, hydraulic study, utility search, survey, PEIR, EIR, monitoring data, etc.)

ATTACHMENTS FOR SECTION 1.3:

PROJECT SUMMARY

Primary Components

The San Gabriel Valley Council of Governments (SGVCOG), on behalf of the County of Los Angeles (County) and the Cities of Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, South Pasadena, and Temple City is implementing the Load Reduction Strategy (LRS) Projects for the Rio Hondo River and Tributaries. The purpose of the Project is to help the agencies comply with the final dry-weather Water Quality Based Effluent Limitations (WQBELs), as specified by the Los Angeles River Bacteria Total Maximum Daily Load (TMDL). The Project includes the Alhambra Wash Dry-Weather Diversion, which will capture and treat runoff from Alhambra Wash, as shown in **Figure 1**. The Project's primary components will include:

- Diversion Structure
  - Rubber dam
  - Inlet structure
  - Diversion pipe
- Pump Station
- Pretreatment and Treatment System
- Building/Enclosure

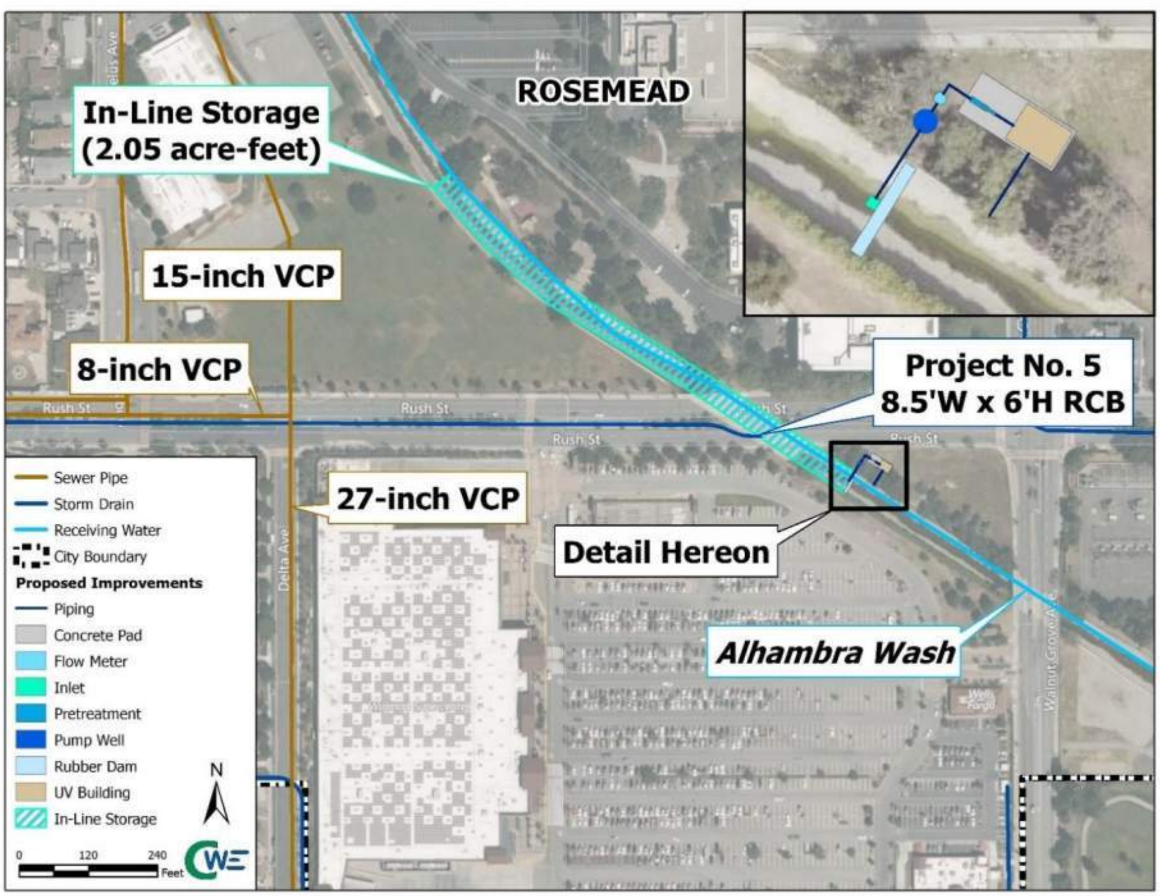


Figure 1 Alhambra Wash Proposed Conditions Schematic

Design Elements

The improvements proposed at Alhambra Wash are illustrated in **Figure 1** and located near the intersection of Rush Street and Walnut Grove Avenue. The location of individual components is described below. Some of the improvements are within the adjacent property, which is owned by Southern California Edison. Opportunities to acquire the full property, partial property, or an easement will be further evaluated during the final design phase.

- Diversion structure – rubber dam and grated drop inlet within the channel and direct runoff to a gravity-driven pipe
- Pump station – belowground structure downstream of diversion system
- Pretreatment system – anticipated aboveground downstream of pump station
- Treatment system – located in enclosure/building
- Enclosure/building – house UV treatment system and rubber dam control structure

The Project will capture and treat runoff generated within the 11,120-acre drainage area shown in **Figure 2**. The Project will capture dry-weather runoff with a peak diversion rate of 1,000 gallons per minute (gpm) or 2.23 cubic feet per second (cfs).

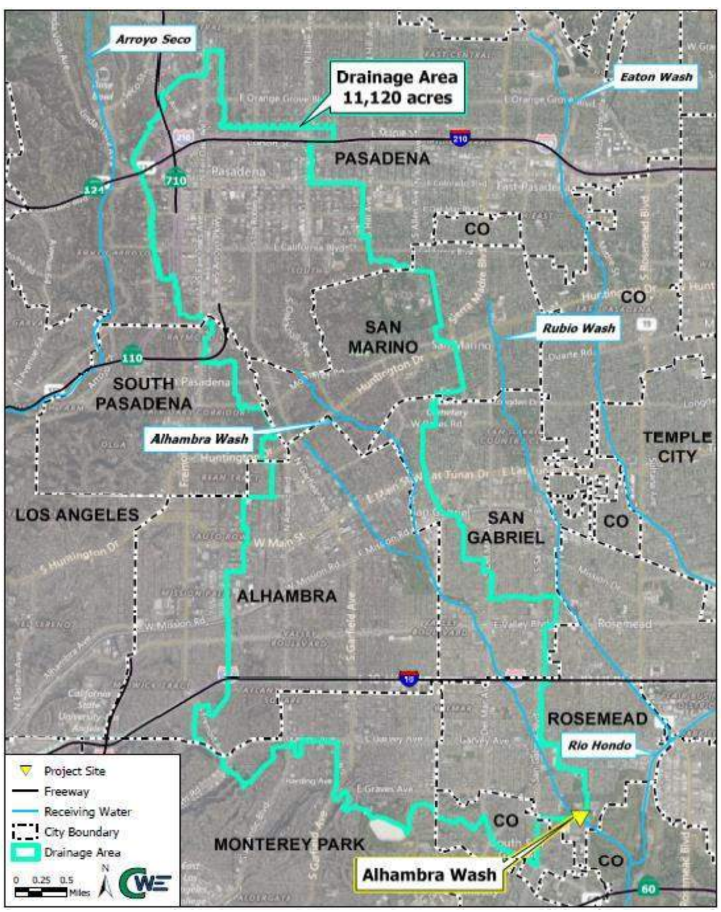


Figure 2 Project Location and Drainage Area Map

Benefits

The Project aims to achieve the water quality goals identified in the Rio Hondo LRS, Los Angeles River bacteria TMDL, Upper Los Angeles River (ULAR) Enhanced Watershed Management Program (EWMP), and Los Angeles County Municipal Separate Storm Sewer System (MS4) Permit by enhancing water quality locally and in downstream water bodies. The Project provides multiple benefits, which are summarized below:

- Improve water quality locally and in the Rio Hondo and Los Angeles River
  - Reduce bacteria loading and discharges from the drainage system
  - Contribute towards meeting the Los Angeles River dry-weather bacteria TMDL targets
- Provide benefits in addition to water quality (community benefits)
  - Outreach and educational opportunities for the local community
  - Inform community of water quality challenges and strategies to improve it
  - Installation of permanent educational signage
  - Potential inclusion of trees and/or swale to increase shade and reduce heat island effect

Outreach

To date, outreach on the Project has been limited to stakeholders. Several stakeholder meetings have been held, which have included the implementing Cities and other local agencies that may be impacted by the Project. Project information will be shared with the public during the engineering and construction phases to address concerns, answer questions, and give updates. Public outreach meetings are expected to be conducted virtually using an online platform. It is anticipated that the public and nearby residents will be notified about the meeting though online postings, postcards, and/or the local newspaper.

Estimated Project Scoring

The Project has an estimated score of 65 points. Most of the points are earned from the water quality (dry) section as shown in **Figure 3** for addressing bacteria loading and other pollutants within the Rio Hondo and Los Angeles River. **Table 1** summarizes the points earned and includes a description of how the points were determined in the Safe Clean Water Program Module. Additional details are included in the Feasibility Study and funding application.

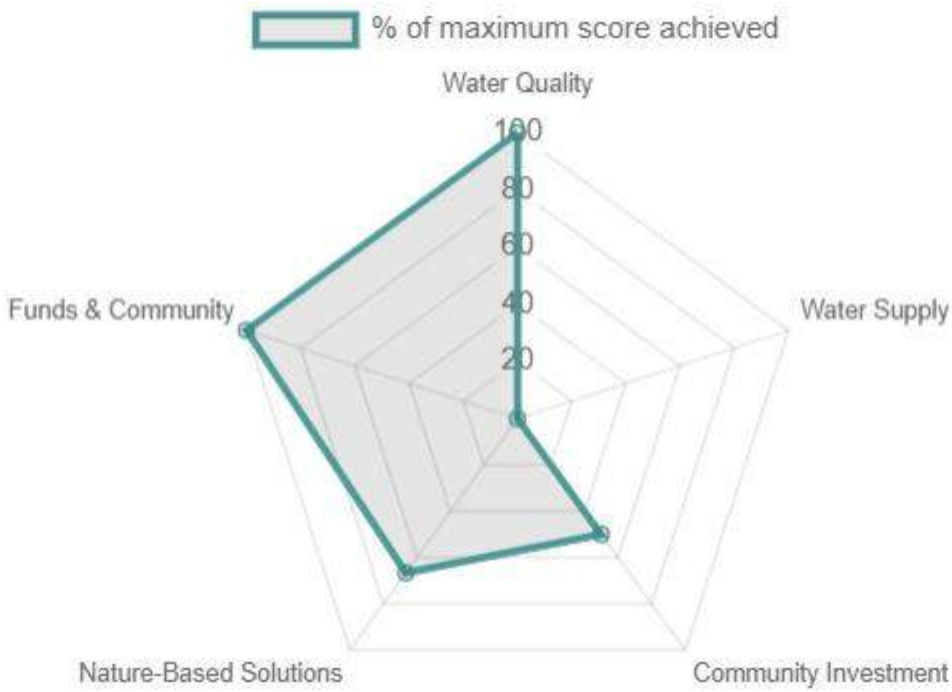


Figure 3 Maximum Score of Each Scoring Section

Table 1 Summary of Project Scoring in Safe Clean Water Program Module

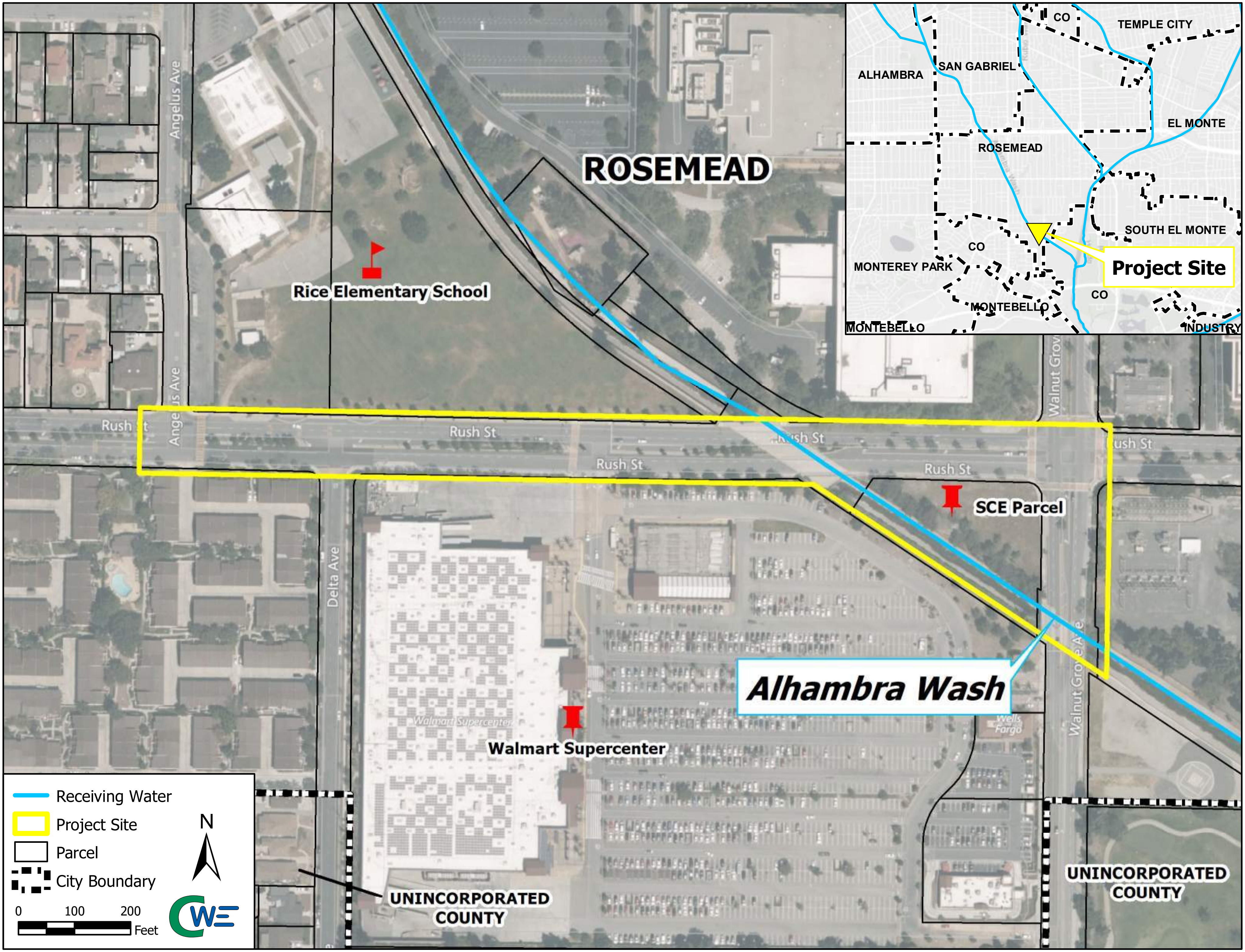
Category	Points	Description
Water Quality Wet + Dry (Part 1 and Part 2)	40	Project is expected to capture 100% of dry-weather runoff from a drainage area greater than 11,000 acres
Community Investment	5	Enhancing recreational opportunities, reducing heat island effect, and increasing shade through the planting of additional trees
Nature-Based Solutions	10	The pump well will promote infiltration, mimicing natural processes and natural materials will be used to plant trees and/or a swale
Leveraged Funding	10	At least 50% of the funding will be matched and the Project has support form local non-governmental organizations or community-based organizations
Total:	**65**	

ATTACHMENTS FOR SECTION 1.1:

OVERVIEW

ATTACHMENTS FOR SECTION 1.2:

PROJECT LOCATION



ROSEMEAD
Rice Elementary School
Angelus Ave
Rush St
Delta Ave
Walnut Grove Ave
SCE Parcel
Walmart Supercenter
Alhambra Wash
UNINCORPORATED COUNTY
UNINCORPORATED COUNTY
TEMPLE CITY
CO
ALHAMBRA
SAN GABRIEL
EL MONTE
ROSEMEAD
SOUTH EL MONTE
CO
MONTEREY PARK
Project Site
CO
MONTEBELLO
MONTEBELLO
INDUSTRY
Receiving Water
Project Site
Parcel
City Boundary
N
0
100
200
Feet

ATTACHMENTS FOR SECTION 2.1:

CONFIGURATION

1. Background

The San Gabriel Valley Council of Governments (SGVCOG), on behalf of the County of Los Angeles (County) and the Cities of Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, South Pasadena, and Temple City is implementing the Load Reduction Strategy Projects for the Rio Hondo River and Tributaries (Project). The Project was identified in the *Rio Hondo Load Reduction Strategy: Addendum to Revise Implementation Actions for Alhambra Wash, Eaton Wash, and Rubio Wash* (referred to herein as the Rio Hondo LRS) (ULAR EWMP Group, 2017), an addendum to the *Rio Hondo Load Reduction Strategy for the Los Angeles River Watershed Bacteria TMDL* [Total Maximum Daily Load] (ULAR EWMP Group, et al., 2016).

The Project is proposed in response to the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175, which was adopted by the Los Angeles Regional Water Quality Control Board (LARWQCB) and enacted on December 28, 2012. The MS4 Permit identifies the permittees that are responsible for compliance with the MS4 Permit requirements pertaining to the Los Angeles River (LAR) Watershed Bacterial Total Maximum Daily Load (Bacteria TMDL) Resolution No. R10-007. The LAR Bacteria TMDL requires the responsible permittees to meet targets and waste load allocations for the indicator bacterium *E. coli* during wet-weather and dry-weather seasons. The LAR Bacteria TMDL further presents the Load Reduction Strategy (LRS) as a method for achieving compliance and was used to satisfy TMDL requirements.

The Cities of Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, South Pasadena, and Temple City, along with Unincorporated County have thus entered into an agreement with the SGVCOG to implement the Project to address the LAR Bacteria TMDL, which includes implementation on Alhambra Wash, Eaton Wash, and Rubio Wash.

This Project Description is focused on the low flow diversion proposed on Alhambra Wash, which will address dry-weather bacteria discharges from more than 11,000 acres of tributary area. Seven agencies (Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, and South Pasadena – referred to as Cities), along with portions of Unincorporated County, contribute to flows that will be captured by the Project. The Cities and Unincorporated County are partnering to implement the Alhambra Wash diversion. **Figure 1-1** below illustrates the Alhambra Wash Project site and associated drainage area.

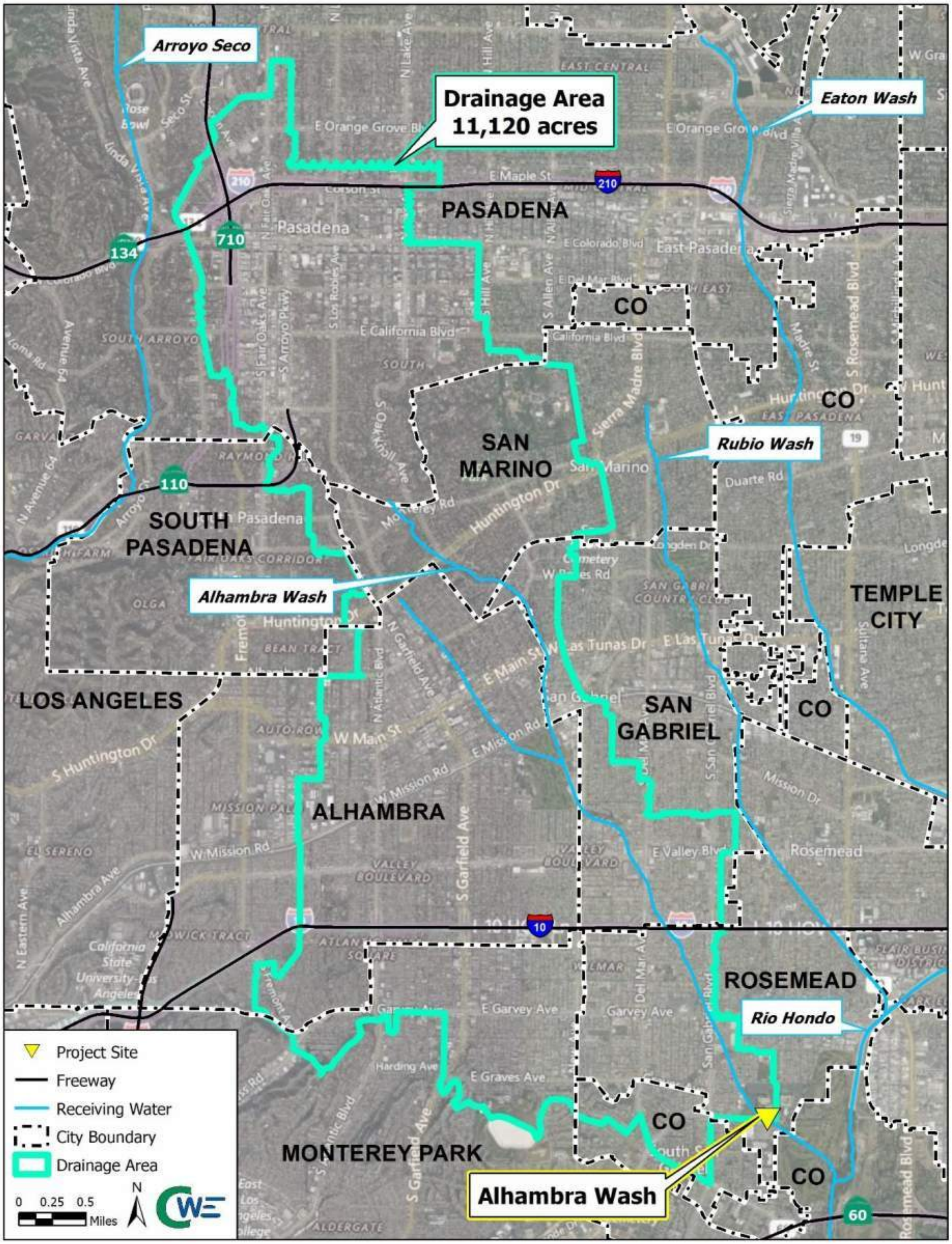


Figure 1-1 Alhambra Wash Drainage Area

2. Project Purpose and Goals

The Project is being implemented to meet water quality goals as identified in the Rio Hondo LRS and as required by the MS4 Permit. The Project provides multiple benefits, including water quality enhancements and community benefits. The Project will address dry-weather discharges into Alhambra Wash from the drainage area illustrated in **Figure 1-1**. The original LRS identified a diversion to the sanitary sewer on Alhambra Wash. The LRS alternative, along with several other alternatives, were evaluated as part of a Feasibility Study and it was determined that a treatment system would be most beneficial. **Figure 2-1** illustrates the general concept for the diversion on Alhambra Wash. Flows will be diverted from the channel, pretreated, and pumped to an advanced treatment system before being discharged back into the channel. An Ultraviolet (UV) treatment system is anticipated, which will kill bacteria and address other pollutants.

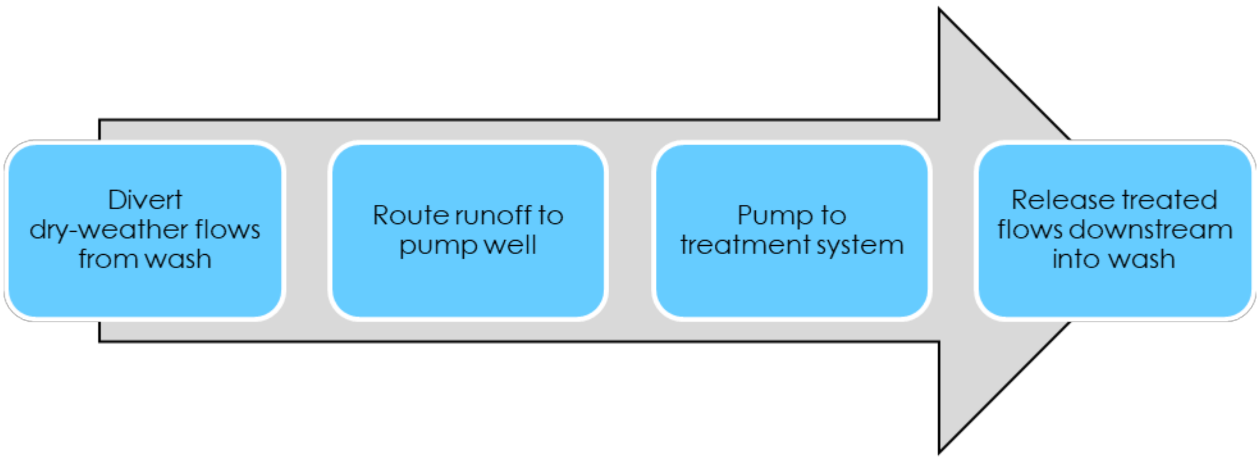


Figure 2-1 General Project Concept

The pump well will be perforated to allow for infiltration to occur, mimicking natural watershed processes. A large-scale infiltration system was not determined to be feasible due to limited available space. Opportunities to implement street trees and a swale are currently under evaluation and may be included. Coordination is ongoing with the local jurisdiction (City of Rosemead). Educational signage will be incorporated to create educational opportunities for the community.

The goals and objectives of the LRS are to reduce bacteria loading to the Rio Hondo, which the selected treatment approach will do. In summary, the Project goals are as follows:

- Enhance water quality locally and in downstream water bodies
- Reduce bacteria loading and contribute towards meeting LAR Bacteria TMDL targets (LRS objective)
- Provide community enhancements, such as street trees and/or swale
- Incorporate educational signage to educate the community

2.1 Outreach

To date, outreach on the Project has been limited to stakeholders. Several stakeholder meetings have been held, which have included the implementing Cities and other local agencies that may be impacted by the Project. Public outreach will occur during the design and construction process.

3. Proposed Improvements

As mentioned above, several alternatives were evaluated as part of the preparation of the Project Feasibility Study. Proposed improvements are based on the preferred alternative, which includes a channel diversion and advanced UV treatment system. The LRS defined peak discharge capacities at the site that must be addressed to reduce bacteria loading. Peak discharge rates are summarized in gallons per minute (gpm) and cubic feet per second (cfs) in **Table 3-1** below. The anticipated layout of the Alhambra Wash diversion and treatment system are illustrated in **Figure 3-1**.

Table 3-1 LRS-Defined Peak Discharge Rate

Site	LRS-Defined Peak Discharge Rate	
	(gpm)	(cfs)
Alhambra Wash	1,000	2.23

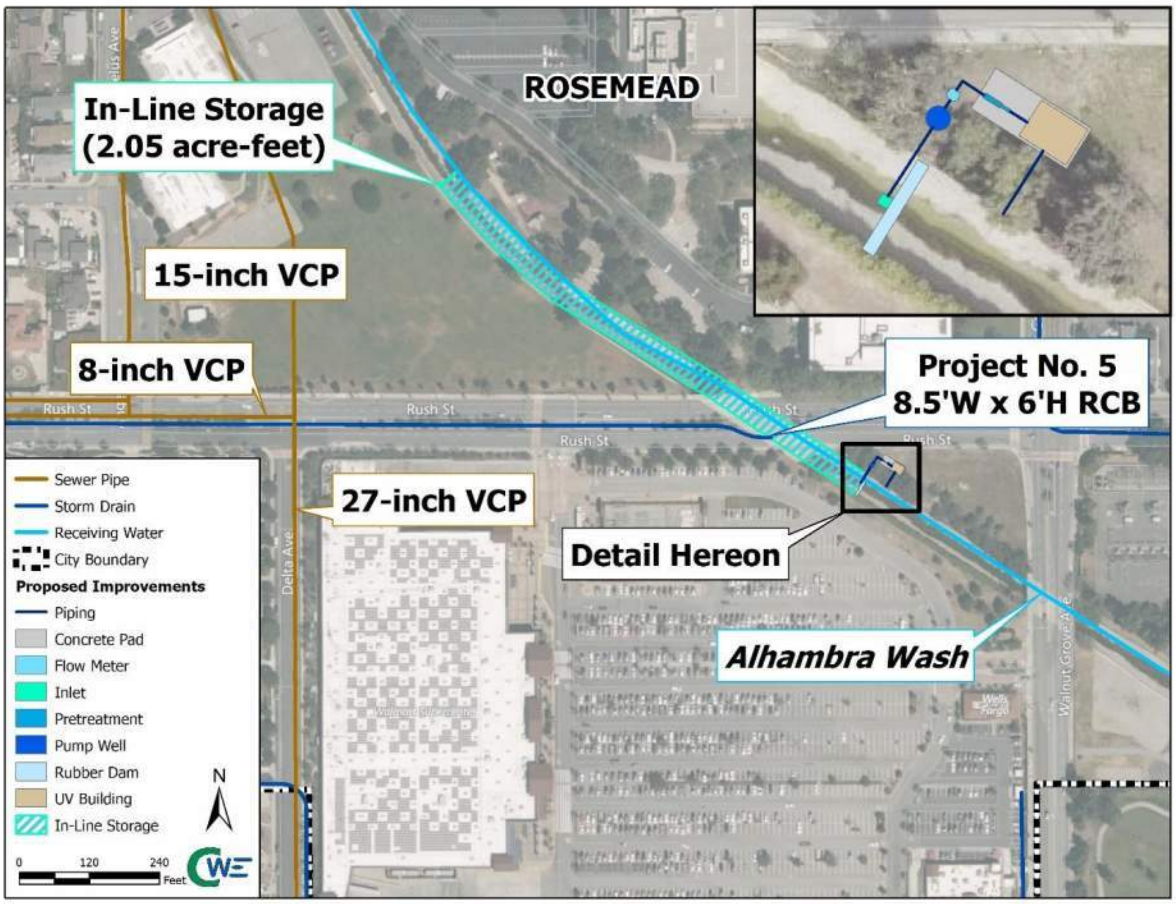


Figure 3-1 Alhambra Wash Diversion Concept

Runoff will be diverted from Alhambra Wash using a rubber dam and diversion system (inlet and pipe). The rubber dam allows runoff to accumulate in the channel before being diverted. This increases the capture efficiency and allows for in-line storage. Storage is helpful in providing flow equalization for the treatment system, allowing for a more consistent flow rate to be delivered for treatment. The rubber dam will provide up to 2.05 acre-feet of storage and the height of the dam will be finalized during the design process. Runoff will be pumped into a pretreatment system and then through the UV treatment system before being discharged back to Alhambra Wash. The UV system and other equipment will be housed in an enclosure/building.

Figure 3-2 illustrates a preliminary schematic of the rubber dam and inlet diversion system. This approach has been used throughout the region and has been approved by Los Angeles County Flood Control District (LACFCD) within the open channel systems they operate and maintain. The rubber dam will require the installation of a control structure to which the compressed air line will connect. The control structure will be located within the onsite enclosure/building.

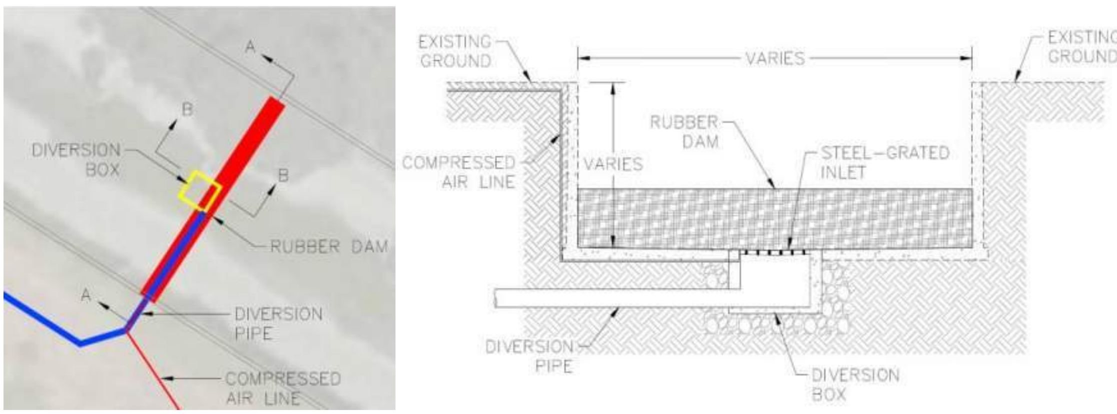


Figure 3-2 Rubber Dam and Diversion Box

During wet-weather events, the rubber dam will deflate and flatten to mimic the existing channel bottom, allowing runoff to bypass the diversion system. The rubber dam will not have a significant effect on the Water Surface Elevation (WSE) during the design event (high storm flows), while there will be some changes at the invert. Modeling during the final design will quantify the impact on the WSE. Alhambra Wash was originally constructed by the United States Army Corps of Engineers (USACE). Improvements within the channel right-of-way will be reviewed by both LACFCD and USACE during the design process. A detailed hydraulic analysis will be performed and submitted for review.

The pump system will lift diverted flows to the treatment system. As mentioned above, the pump system (and diversion) will be controlled by a rain gage, which is expected to be onsite. Weather data pertaining to the tributary drainage area may be incorporated into the control system, which will be determined during the final design phase. A summary of the key pump components is included in **Table 3-2**.

Table 3-2 Summary of Key Pump Components

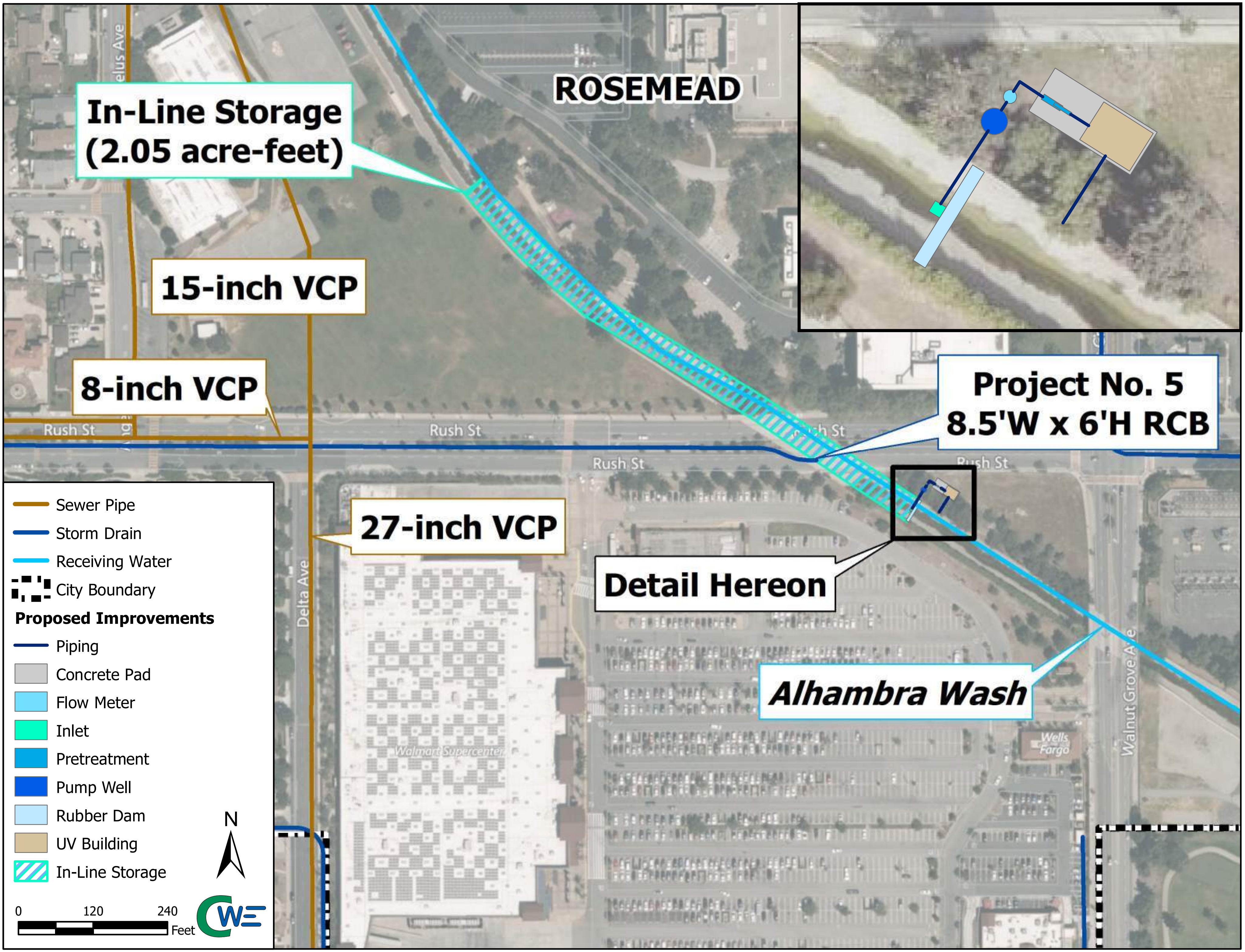
Component	Description
Pump well	➢ Concrete that can withstand H-20 loading (likely precast) ➢ Varying diameters, anticipated to be 10-12 feet ➢ Varying depths, anticipated to extend approximately 7 feet beneath channel bottom ➢ Perforations will allow for infiltration to occur

Component	Description
Pump/motor	➢ Submersible pump ➢ Requires a Variable Frequency Drive (VFD) to allow for varying flow rate to be pumped, up to the peak rates in **Table 3-1** ➢ Redundant pump proposed (two pump system with one operating at a time)
Valves/meters	➢ Various valves proposed to control pipe flow and prevent backflow ➢ Check valve will be placed on discharge line, potentially on vertical segment within wet well to eliminate need for valve vault ➢ Flow meter with separate vault required on force main to quantify flows captured and treated
Supervisory Control and Data Acquisition (SCADA)	➢ May be used to control system ➢ Will likely utilize/tie into LACFCD SCADA system
Electrical service	➢ Will requires separate service (likely from Southern California Edison [SCE]) ➢ May require local upgrades if capacity is not available (anticipated to require three phase, 480 volts) ➢ Panel will be required onsite

UV, coupled with the pretreatment device, will be used to actively remove microbial organism from diverted runoff. The pretreatment device will remove sediments and suspended solids. The diversion system will be designed to minimize the diversion of trash and debris. Site-specific monitoring will be performed during the design process to identify the influent water quality, which may influence the type of pretreatment used. It is currently anticipated that a fine mesh screen will be sufficient.

UV lamps will be used to expose flows to UV radiation, which will kill bacteria. The UV treatment equipment will be housed within an enclosure/building, as illustrated in the concept above. UV kills microorganisms when UV rays strike the cell. UV energy penetrates the outer cell membrane, passes through the cell body, and disrupts its DNA, which prevents reproduction. UV treatment does not alter water chemically; nothing is being added except energy. Microorganisms are not removed from the water, but deactivated. The degree of deactivation is directly related to the UV dose applied to the water. The dosage is a product of UV light intensity and exposure time, measured in watt per square centimeter. The required UV dosage is based on existing water quality and desired discharge quality. Additional water quality data and testing will be required to determine the appropriate dosage and pretreatment system.

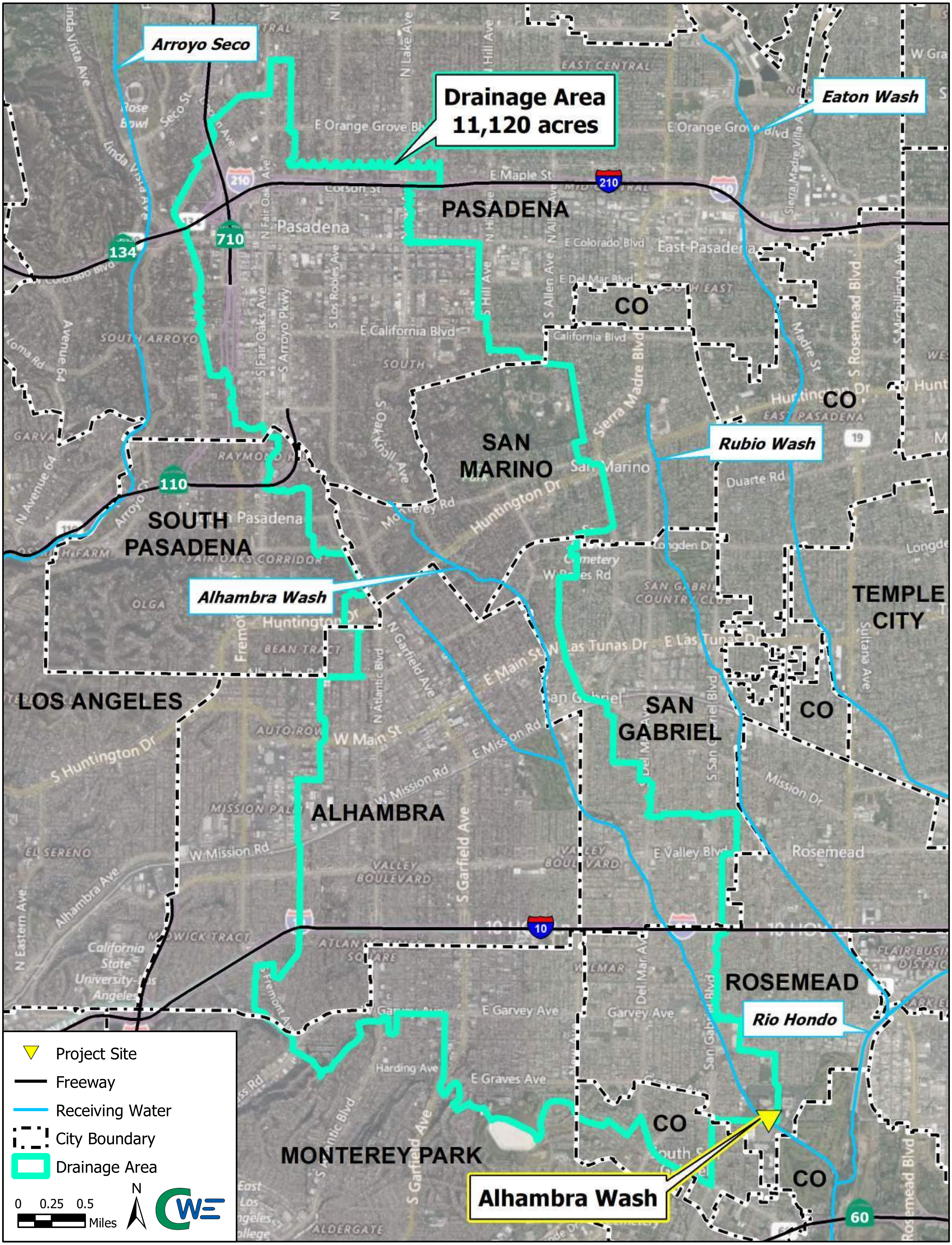
UV treatment is most effective when levels of turbidity and suspended solids are low, as cloudy water prevents UV rays from penetrating the full water column. Pretreatment will be used to remove the suspended solids, which could otherwise shield the bacteria, allowing it to move through the system without being exposed to the UV radiation. UV treatment does not provide any residual effects downstream. It is possible that bacteria could regrow within the washes downstream of treatment. The treatment system will require a connection to the sanitary sewer for backflushing.



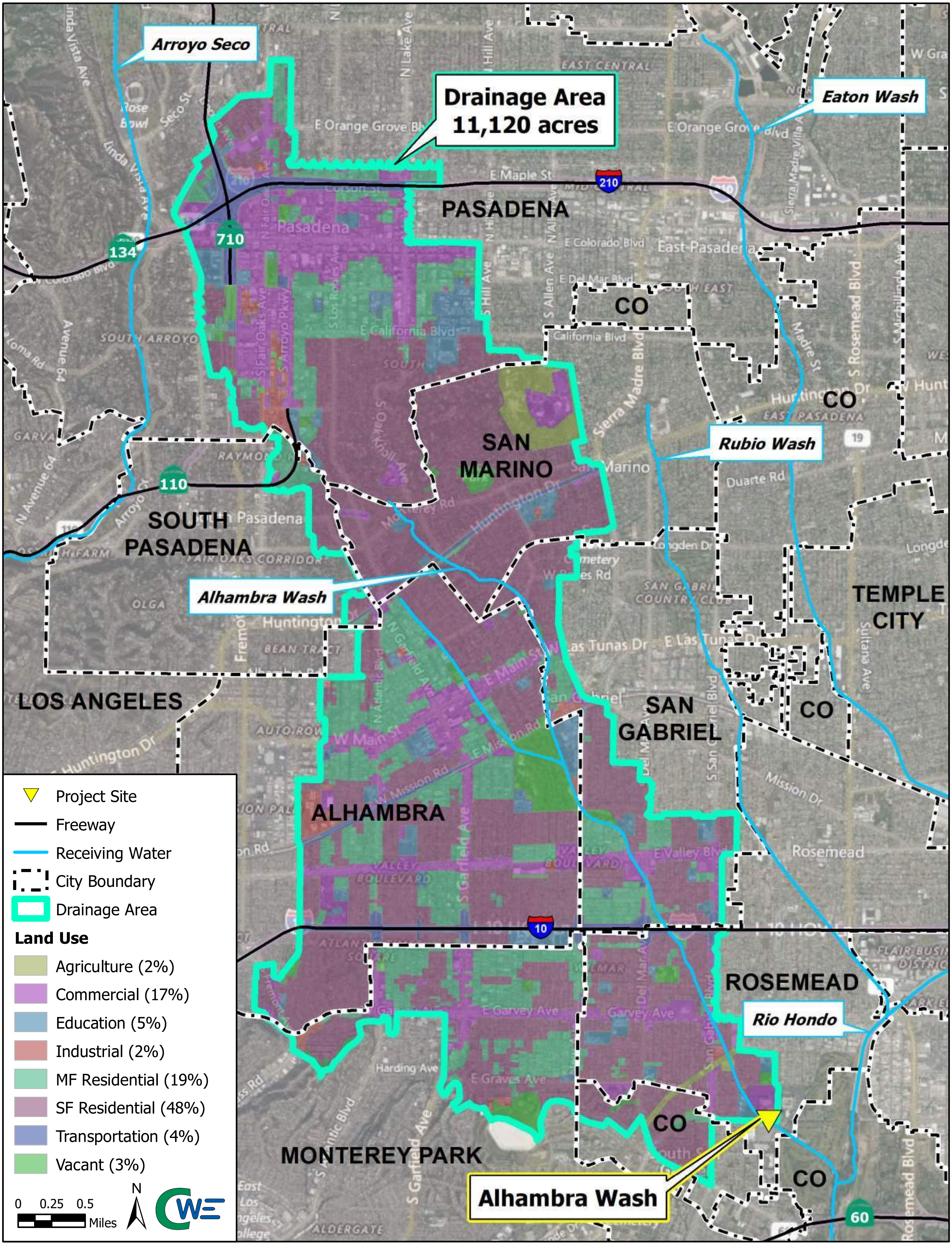
ROSEMEAD
In-Line Storage (2.05 acre-feet)
15-inch VCP
8-inch VCP
27-inch VCP
Project No. 5
8.5'W x 6'H RCB
Detail Hereon
Alhambra Wash
Rush St
Delta Ave
Walnut Grove Ave
Walmart Supercenter
Wells Fargo
Sewer Pipe
Storm Drain
Receiving Water
City Boundary
Proposed Improvements
Piping
Concrete Pad
Flow Meter
Inlet
Pretreatment
Pump Well
Rubber Dam
UV Building
In-Line Storage
N
0
120
240
Feet

ATTACHMENTS FOR SECTION 2.2:

CAPTURE AREA

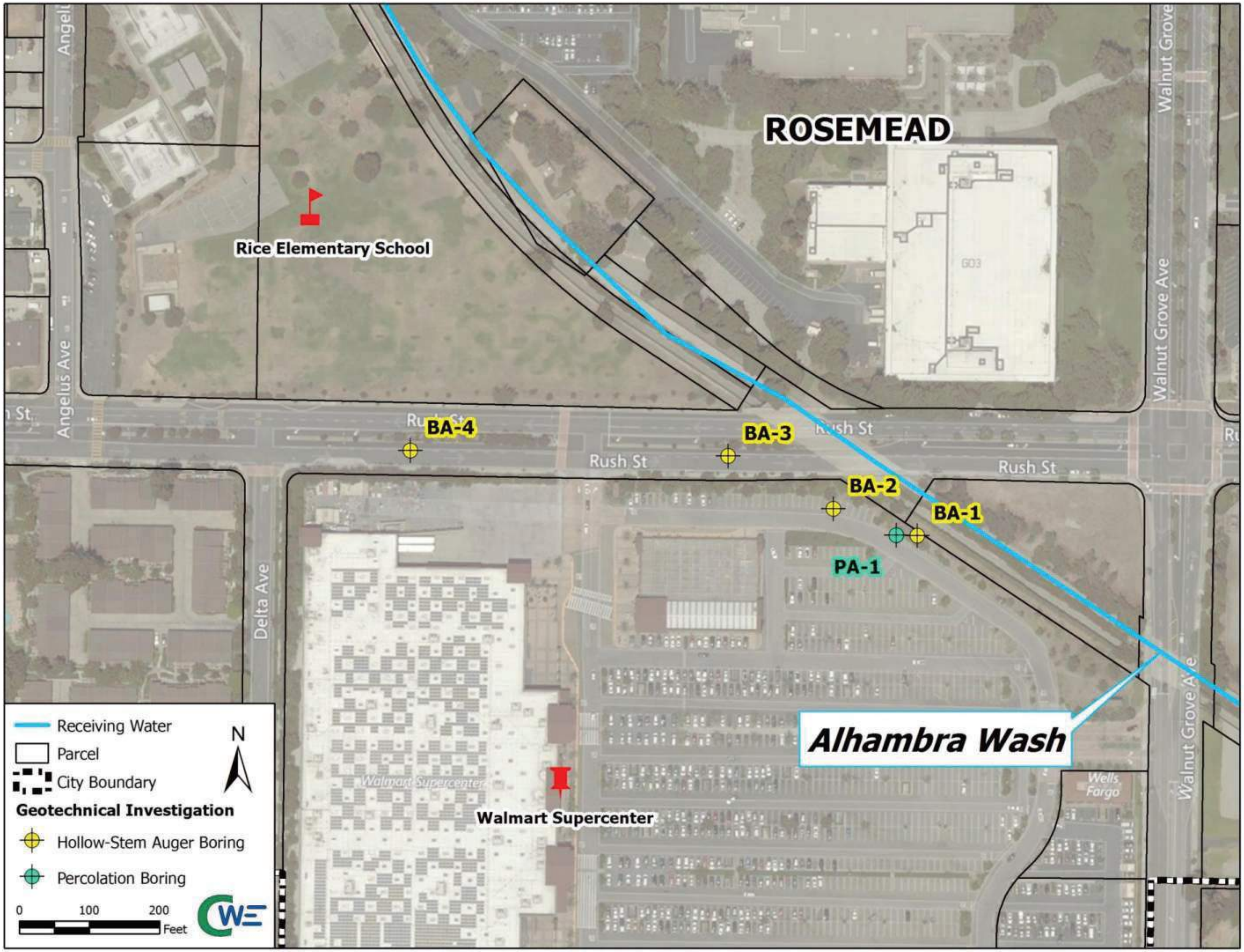


Drainage Area
11,120 acres
Arroyo Seco
Eaton Wash
Rubio Wash
Alhambra Wash
Rio Hondo
Alhambra Wash
PASADENA
SAN MARINO
SOUTH PASADENA
LOS ANGELES
ALHAMBRA
SAN GABRIEL
TEMPLE CITY
ROSEMEAD
MONTEREY PARK
CO
CO
CO
CO
CO
Project Site
Freeway
Receiving Water
City Boundary
Drainage Area
0 0.25 0.5
Miles
N


Drainage Area
11,120 acres
Arroyo Seco
Eaton Wash
Rubio Wash
Alhambra Wash
Rio Hondo
Alhambra Wash
PASADENA
SAN MARINO
SOUTH PASADENA
LOS ANGELES
TEMPLE CITY
SAN GABRIEL
ALHAMBRA
ROSEMEAD
MONTEREY PARK
CO
CO
CO
CO
CO
210
710
134
110
10
60
Project Site
Freeway
Receiving Water
City Boundary
Drainage Area
Land Use
Agriculture (2%)
Commercial (17%)
Education (5%)
Industrial (2%)
MF Residential (19%)
SF Residential (48%)
Transportation (4%)
Vacant (3%)
0 0.25 0.5
Miles
N
CWE

ATTACHMENTS FOR SECTION 2.4:

SITE CONDITIONS & CONSTRAINTS


ROSEMEAD
Rice Elementary School
Angelus Ave
Delta Ave
Walnut Grove Ave
Rush St
BA-4
BA-3
BA-2
BA-1
PA-1
Alhambra Wash
Walmart Supercenter
Wells Fargo
Receiving Water
Parcel
City Boundary
Geotechnical Investigation
Hollow-Stem Auger Boring
Percolation Boring
0
100
200
Feet
N

6. Flow Analysis

A detailed dry-weather flow analysis was requested by LACSD and the Main San Gabriel Basin Watermaster for Alhambra, Eaton, and Rubio Washes as part of the permitting and approval process with LACSD. The meeting with the watermaster is required as part of Senate Bill (SB) 485, which states:

> *Prior to initiating a stormwater or dry-weather runoff program or project within the boundaries of an adjudicated groundwater basin, a district shall consult with the relevant watermaster for a preliminary determination as to whether the project is inconsistent with the adjudication. If the watermaster deems the project to be inconsistent with the adjudication, the watermaster shall recommend, in writing, the measures that are necessary in order to conform the project to the adjudication.*

The detailed flow analysis evaluates historical flow data within each channel to determine what the discharge to the sewer would be like. This was requested by LACSD because the original capacity request was based on the sewer discharge rates approved by the LARWQCB as part of the Rio Hondo LRS and LACSD wanted to better understand impacts to their sewer system. Dry-weather flow is extremely variable and LACSD wanted to better understand how often flows would be discharged at the peak and at what times of the day. The flow analysis was also used to assess storage options and different discharge rates that would ultimately achieve the Rio Hondo LRS goals. The upstream portions of the tributary watersheds were evaluated to determine if natural flows are discharging to the washes and would be captured by the Project. The evaluation is included in **Appendix F** and no natural discharges were observed during the evaluation. This section summarizes the approach and findings of the detailed flow analysis performed.

6.1 Data Analysis Approach

Historical flow data was obtained for gaging stations on each wash. Historical rain data from the El Monte Fire Station rain gage was used to correlate flow data to storm events to differentiate them from dry-weather discharges. Days with measurable rain (greater than 0.1 inches) and days within 48 hours following a day with measurable rain were removed from the analysis. This procedure was based on a conservative analysis of the LAR Bacteria TMDL guidance, which exempts storm days and the following 48 hours from dry-weather bacterial load compliance. Flow data provided in hourly instantaneous readings from October 1, 2000 to September 30, 2015 served as the basis for the analyses performed. This date range corresponds to the date range used in the Rio Hondo LRS, which established the approved discharge flow rates. Additional flow data from October 1, 2015 to September 30, 2018 has been included in the seasonal data summary for comparison purposes.

The dry-weather flow rates based on the gaging data used in this analysis are referred to as "Discharge" flow rates, while the flow rates used in the Rio Hondo LRS are referred to as "LRS" flow rates. The Discharge flow rates (excluding the days removed due to rain) were capped at a rate equal to two times the LRS flow rates for the volume calculations, as it is unlikely flow rates greater than that are true dry-weather discharges. Possible sources for recorded measurements of high flows during dry-weather are errors in the flow measurements, flows associated with permitted discharges, or flows resulting from rain further upstream in the watershed, among other reasons. **Table 6-1** summarizes the LRS and capped Discharge flow rates by site.

Table 6-1 LRS and Discharge Flow Rates

Project Site	LRS Flow Rate		Capped Discharge Flow Rate	
	gpm	cfs	gpm	cfs
Alhambra Wash	1,000	2.23	2,000	4.46
Eaton Wash	630	1.40	1,260	2.80
Rubio Wash	800	1.78	1,600	3.56

A long-term "Discharge" hydrograph of dry-weather flow using the wet-weather exemptions and the high-flow caps described in the previous paragraphs were created, which were then compared to the LRS flow rate on a yearly basis to evaluate the amount of time that the low flow "Discharge" hydrograph exceeded the LRS flow rate, and to perform analyses of storage and pump size that would most efficiently convey dry-weather runoff to the sanitary sewer.

Discharge flow rates were compared to the LRS flow rates to better understand historical flow patterns. Seasonal and yearly average flow rates by day (8 am to 10 pm) and night (10 pm to 8 am) were quantified. The defined day and night hours are based on LACSD guidance, as different costs/rates apply to day versus night discharges. The model was used to identify the percentage of Discharge flow that was not captured by the Project at each site. Incorporating storage was assessed to identify if the LRS flow rates could be reduced, such that the same percentage of flows would be captured. It is important that the final design captures the same or more dry-weather flow as compared to the LRS flow rates, as these rates were approved by the LARWQCB and represent compliance with the dry-weather bacteria TMDL.

6.2 Comparison of Discharge and LRS Flow Rates

Historic flow rates were analyzed to determine how often dry-weather flow rates equaled the LRS flow rate, as shown in **Figure 6-1**. The measured flow rate was less than 50% of the LRS flow rate more than 90% of the time from 2015 to 2018 in Alhambra Wash. The opposite pattern is observed in Eaton Wash, with the measured flow rate increasing since 2015. The measured flow rate in Rubio Wash was less than 50% of the LRS flow rate more than 80% of the time from 2009 to 2018. The analysis shows that the LRS flow rate is greater than the observed flow rate most of the time, which aligns with the goal identified in the LRS to capture dry-weather flows.

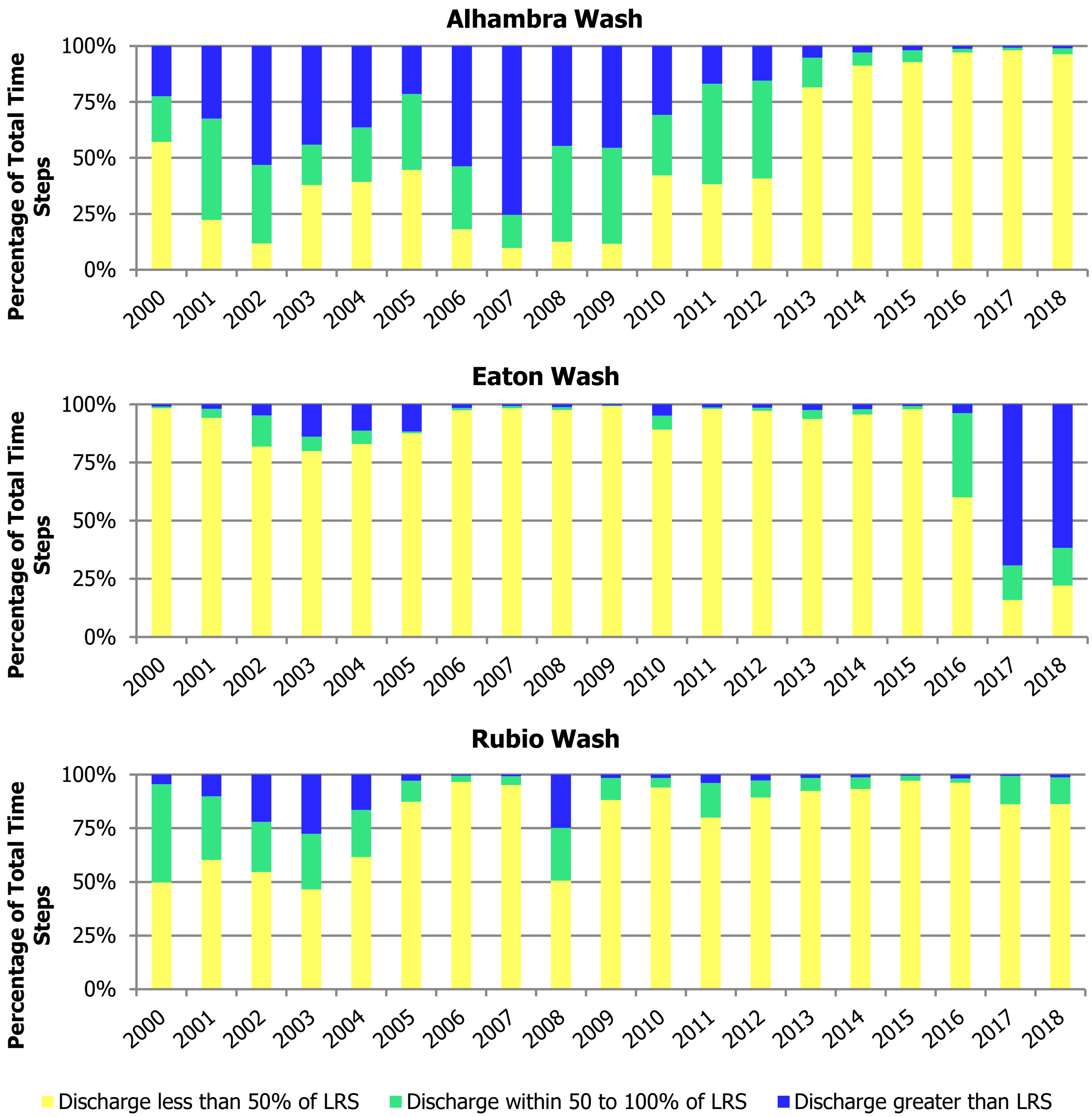


Figure 6-1 Comparing Discharge and LRS Flow Rates

6.3 Average Dry-Weather Discharge Flow Rates

The average Discharge flow rates for each wash were calculated by season on an annual basis, and by day versus night. Prior to 2015, the average Discharge flow rate for Alhambra Wash typically exceeded Eaton and Rubio Washes; however, since 2015, the Alhambra Wash flow rate has decreased and the Eaton Wash flow rate has increased. The average seasonal Discharge flow rates showed greater variation prior to 2008 for all three washes, with the average flow rates lower and with less variation since 2008. The average daytime flow rates were typically greater than the nighttime flow rates. Figures and additional information about average Discharge flow rates can be found in **Appendix G**.

6.4 Analysis 1: LRS Discharge with No Storage

After analyzing the Discharge flow rates for the three washes, the data was processed to determine the volume of water that would be captured by a dry-weather diversion with a capacity equal to the LRS flow rates. The volume represents how the diversions would have performed if they were constructed and in operation starting October 1, 2000 through September 30, 2015, which is consistent with the timeframe analyzed in the Rio Hondo LRS. **Table 6-2** summarizes the average annual captured volume that would have been diverted to the sewer during that timeframe based on the conditions described, the percentage of the total dry-weather runoff that would have been diverted, the percentage of the dry-weather runoff that would have bypassed the diversion, the maximum sewer discharge rate (equal to the LRS flow rate), and the average sewer discharge rate.

Table 6-2 Analysis 1 Volume Summary

Project Site	Average Annual Captured Volume	Diverted to Sewer	Bypass Volume	Maximum Sewer Discharge Flow Rate	Average Sewer Discharge Flow Rate
	acre-feet	%	%	gpm	gpm
Alhambra Wash	996	76.0%	24.0%	1,000	619
Eaton Wash	246	90.2%	9.8%	630	153
Rubio Wash	417	86.4%	13.6%	800	260

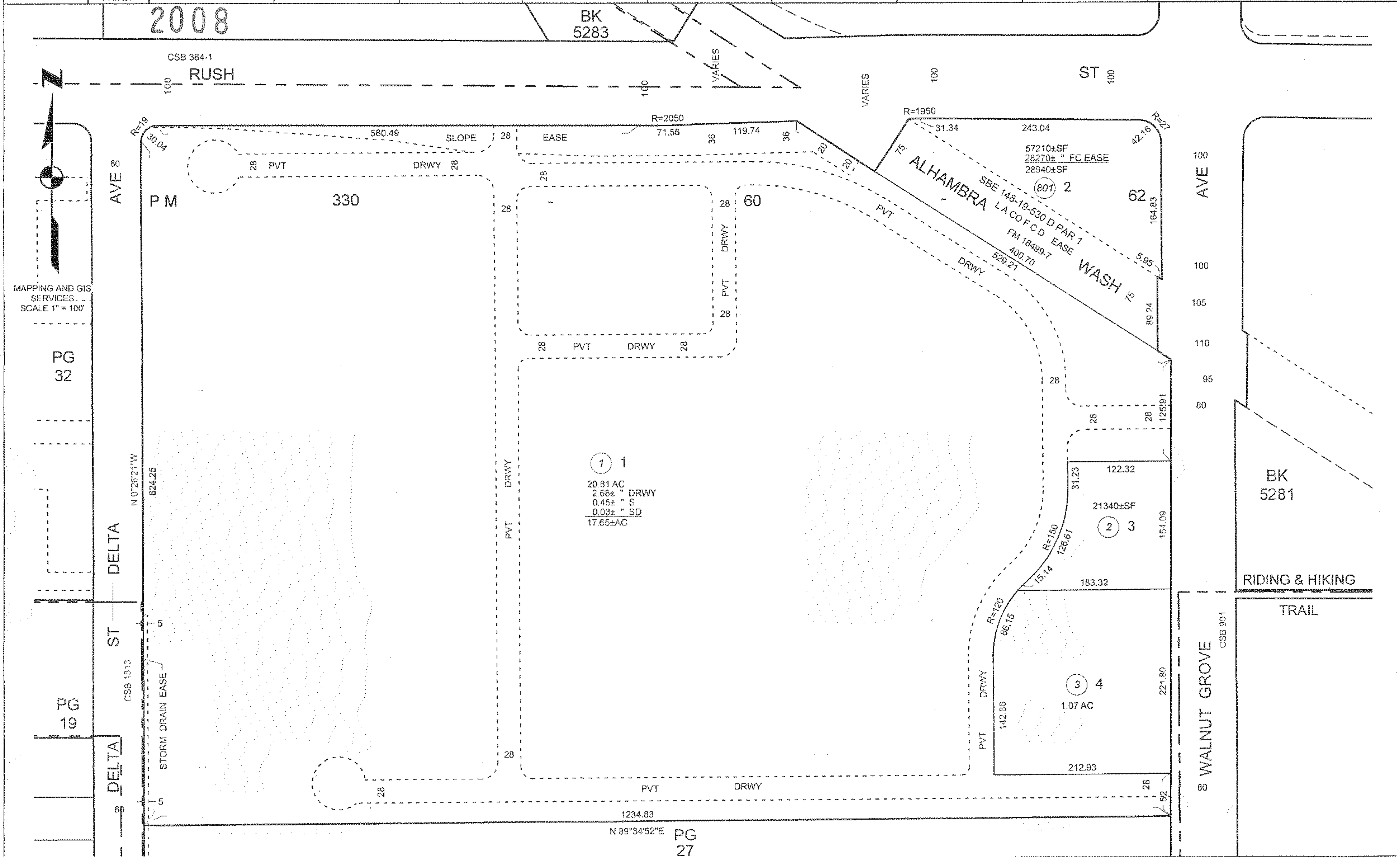
6.5 Analysis 2: Storage with Optimized Discharge Rates

Installing an inflatable rubber dam or subsurface structures could provide 2.05 acre-feet (ac-ft) of storage for Alhambra Wash, 1.87 ac-ft for Eaton Wash (in-line only), and 0.92 ac-ft for Rubio Wash. Additional information on the storage alternatives and layouts are included in **Section 4**. Incorporating storage and optimizing discharge flow rates can allow the same (or more) annual volume to be captured as without storage, but it allows the discharge into the sewer to proceed during nighttime hours (10 pm to 8 am), when the LACSD charges lower rates. In Alhambra Wash and Rubio Wash, in-line storage does not provide enough volume, so daytime discharges are still required, as shown in **Table 6-3**, while they are still significantly less than the daytime discharges. For Eaton Wash, no daytime discharge was needed to meet the volume requirement. The discharge rates require approval from LACSD, understanding that more capacity is available during nighttime hours. LACSD encouraged the use of some type of storage, as it will regulate discharge rates so that they are steadier as opposed to being highly variable. Additional off-line storage could be evaluated for Alhambra and Rubio Washes if the rates shown below are not approved by LACSD.

Table 6-3 Analysis 2 Volume Summary with Storage

Project Site	Storage Volume	Average Annual Captured Volume	Maximum Daytime Discharge Flow Rate	Maximum Nighttime Discharge Flow Rate	Average Sewer Discharge Flow Rate
	acre-feet	acre-feet	gpm	gpm	gpm
Alhambra Wash	2.05	996	767	1,200	619 (537 Day; 730 Night)
Eaton Wash	1.87	246	0	965	153 (366 Night)
Rubio Wash	0.92	417	225	1,436	260 (159 Day; 398 Night)

5279	33 SHEET	P. A. 5279-27	TRA 3920	REVISED 2005051706001001-27 2006101905014001-27	2006102305009001-27 2007090502-28				SEARCH NO		OFFICE OF THE ASSESSOR COUNTY OF LOS ANGELES COPYRIGHT © 2002



Katie Harrel - CWE

From:	Joshua Felton <JFelton@dpw.lacounty.gov>
Sent:	Wednesday, October 14, 2020 11:24 AM
To:	Katie Harrel - CWE
Cc:	Youssef Chebabi
Subject:	Re: SCWP Concept RH: Low Flow Diversions (Alhambra, Eaton, and Rubio Washes)

Good Morning Katie,

Letters of Approval have been drafted for the three individual projects within the Rio Hondo Low Flow Diversion Project. At this time, all Conceptual approval letters require review/final approval from Administration. A package has been sent up for review but we have not received word on status.

My section head does not expect Administration to provide final approval until late tomorrow, possibly later. There will also be communication with SCW team to inform them that these letters could possibly arrive after the Submission deadline as was the case last year.

I will provide additional details as they become available.

Thanks,

Joshua Felton
Senior Civil Engineering Assistant
Los Angeles County Public Works
Office: (626)458-5911

From: Katie Harrel - CWE <kharrel@cwecorp.com>
Date: Wednesday, October 14, 2020 at 11:14 AM
To: Joshua Felton <JFelton@dpw.lacounty.gov>
Subject: RE: SCWP Concept RH: Low Flow Diversions (Alhambra, Eaton, and Rubio Washes)

Hello Josh,

We wanted to check in on the status of the conceptual review letter. Thanks in advance!

Katie

From: Katie Harrel - CWE
Sent: Thursday, October 1, 2020 8:15 AM
To: 'Joshua Felton' <JFelton@dpw.lacounty.gov>
Subject: RE: SCWP Concept RH: Low Flow Diversions (Alhambra, Eaton, and Rubio Washes)

Hello Josh,

The attached drawings illustrate the proposed improvements. We have GIS schematics, but feel the versions attached include more detail. Let us know if anything else is needed.

Thank you,
Katie

From: Joshua Felton <JFelton@dpw.lacounty.gov>
Sent: Thursday, October 1, 2020 7:52 AM
To: Katie Harrel - CWE <kharrel@cwecorp.com>
Subject: Re: SCWP Concept RH: Low Flow Diversions (Alhambra, Eaton, and Rubio Washes)

Good Morning Katie,

I'm reaching out in regards to your request for Letters of Conceptual Approval. I am preparing the Letter and factsheet for Admin approval and was hoping you might be able to provide a schematic for each of the sites that illustrates the setup of the diversion? I looked through the feasibility study and found some maps but my administration is requesting something more detailed if available.

Hope to hear from you soon.

Joshua Felton
Senior Civil Engineering Assistant
Los Angeles County Public Works
Office: (626)458-5911

From: Julian Juarez <JJUAREZ@dpw.lacounty.gov>
Date: Wednesday, September 23, 2020 at 2:03 PM
To: Joshua Felton <JFelton@dpw.lacounty.gov>
Cc: Jonathan Lu <JLU@dpw.lacounty.gov>, Youssef Chebabi <YCHEBABI@dpw.lacounty.gov>
Subject: FW: SCWP Concept RH: Low Flow Diversions (Alhambra, Eaton, and Rubio Washes)

Josh,

You have to LOS request. Please handle the same as last year.

Best,

Julian Juarez
Senior Civil Engineer
Los Angeles County Public Works
626-458-7149 office
626-940-7912 cell

From: Katie Harrel - CWE <KHarrel@cwecorp.com>
Sent: Wednesday, September 23, 2020 1:38 PM
To: Julian Juarez <JJUAREZ@dpw.lacounty.gov>
Cc: Vik Bapna - CWE <VBapna@cwecorp.com>; Joseph Venzon <jvenzon@dpw.lacounty.gov>; Mark Christoffels

<mchristoffels@sgvcog.org>
Subject: RE: SCWP Concept RH: Low Flow Diversions (Alhambra, Eaton, and Rubio Washes)

CAUTION: External Email. Proceed Responsibly.

Hello Julian,

We wanted to confirm you received the original email below (attachments included again in case). Let us know if you have any questions.

Thanks,
Katie

From: Katie Harrel - CWE
Sent: Tuesday, September 15, 2020 5:20 PM
To: jjuarez@dpw.lacounty.gov
Cc: Vik Bapna - CWE <VBapna@cwecorp.com>; Joseph Venzon <jvenzon@dpw.lacounty.gov>; Mark Christoffels <mchristoffels@sgvcog.org>
Subject: SCWP Concept RH: Low Flow Diversions (Alhambra, Eaton, and Rubio Washes)

Hello Julian,

We are assisting the San Gabriel Valley Council of Governments (SGVCOG), along with several cities, with Safe Clean Water Program (SCWP) Infrastructure Program applications for low flow diversion projects on Alhambra, Eaton, and Rubio Washes. There are three projects in total, each with a similar concept for the same overall purpose (multi-benefit project to meet the Los Angeles River bacteria Total Maximum Daily Load [TMDL] for dry-weather). We wanted to submit concepts for review in accordance with the Feasibility Study Guidelines and we understand you are the contact for the Rio Hondo Watershed Area Steering Committee (WASC). We have attached a brief project description and 30% plans (the documents include information on each of the three locations).

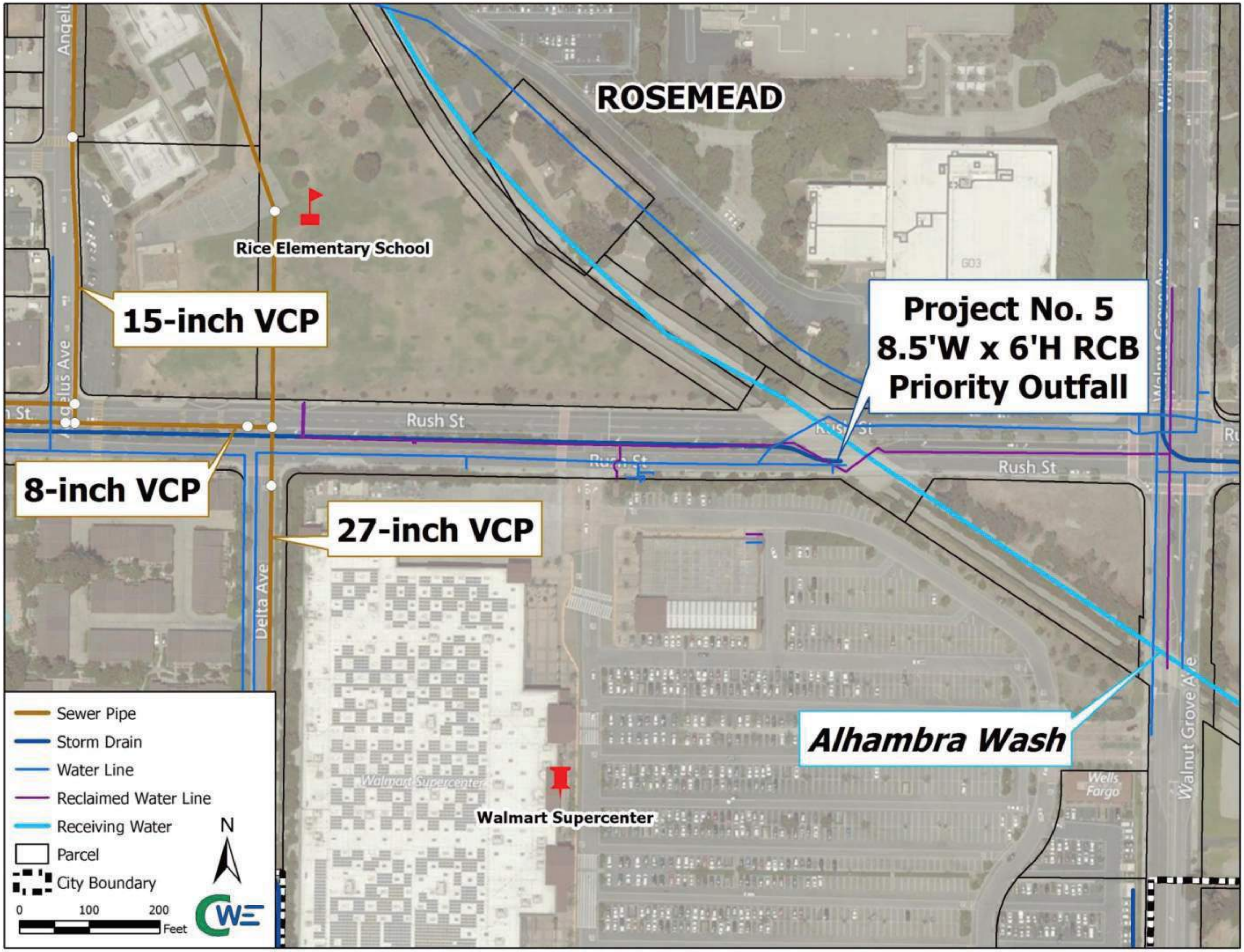
Each project location includes a connection to an open channel (Alhambra, Eaton, and Rubio Washes), each of which was originally constructed by the United States Army Corps of Engineers (USACE) and are operated and maintained by LACFCD. CWE has assisted several clients throughout Los Angeles County with similar permits/approvals through LACFCD and USACE. The detailed design plans will be submit through EPIC in the future. Please let us know if additional information is needed for us to meet the concept review requirements for the SCWP.

Thank you in advance!

Katie Harrel, PE, ENV SP, QSD
Special Projects Manager

Certified DBE, MBE, and SBE
1561 E. Orangethorpe Ave., Suite 240, Fullerton, CA 92831
D (714) 526-7500 x205 | M (714) 732-8180 | F (714) 526-7004 | kharrel@cwecorp.com
www.cwecorp.com

Let's connect!



ROSEMEAD
Rice Elementary School
15-inch VCP
8-inch VCP
27-inch VCP
Project No. 5
8.5'W x 6'H RCB
Priority Outfall
Alhambra Wash
Walmart Supercenter
Rush St
Angelus Ave
Delta Ave
Walnut Grove Ave
Wells Fargo
Sewer Pipe
Storm Drain
Water Line
Reclaimed Water Line
Receiving Water
Parcel
City Boundary
N
0
100
200
Feet