Enhanced Watershed Management Program (EWMP)

for the Upper Los Angeles River Watershed

Prepared for

Upper Los Angeles River Watershed Management Group

Preparation Leads

ch2m

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Acronyms and Abbreviations

ARBOR	Area with Restoration Benefits and Opportunities for Revitalization
BMP	best management practice
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
cfs	cubic feet per second
CIMP	Coordinated Integrated Monitoring Program
CTR	California Toxics Rule
CWA	Clean Water Act
EWMP	Enhanced Watershed Management Programs
EWMP Area	Upper Los Angeles River Watershed Management Area
EWMP Group	Upper Los Angeles River Watershed Management Group
GIS	geographic information system
HFS	High Flow Suspension
LA	Los Angeles
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LAR	Lost Angeles Region
LARWQCB	Los Angeles Regional Water Quality Control Board
LFD	Low Flow Diversion System
LID	Low Impact Development
LRS	load reduction strategy
LSPC	Loading Simulation Program – C+
MCM	minimum control measure
MS4	Municipal Separate Storm Sewer System
NGO	non-governmental organization
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PCB	polychlorinated biphenyls
RAA	Reasonable Assurance Analysis
RWL	receiving water limitation
SCMP	Stormwater Capture Master Plan

SUSTAIN	System for Urban Stormwater Treatment Analysis and Integration
TMDL	Total Maximum Daily Load
ULAR	Upper Los Angeles River
USEPA	U.S. Environmental Protection Agency
WBPC	water body-pollutant combination
WLA	wasteload allocation
WMMS	Watershed Management Modeling System
WQBEL	water quality based effluent limit
WQP	water quality priority

Executive Summary

The Municipal Separate Storm Sewer System (MS4) Permit Order No. R4-2012-0175 (Permit) for Los Angeles County provides an innovative approach to Permit compliance through development of Enhanced Watershed Management Programs (EWMP). Through a collaborative approach, an EWMP for the Upper Los Angeles River (ULAR) Watershed Management Area (EWMP area) was developed by the ULAR EWMP Group. The ULAR EWMP Group is comprised of the cities of Los Angeles (lead coordinating agency), Alhambra, Burbank, Calabasas, Glendale, Hidden Hills, La Cañada Flintridge, Montebello, Monterey Park, Pasadena, Rosemead, San Fernando, San Gabriel, San Marino, South El Monte, South Pasadena, and Temple City and the County of Los Angeles (Unincorporated County) and the Los Angeles County Flood Control District (LACFCD). By electing to comply with the optional compliance pathway in the MS4 Permit, the ULAR EWMP Group has leveraged this ULAR EWMP 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 planning area for the ULAR EWMP is the largest of all the EWMPs being developed in the Los Angeles (LA) region, representing 485 square miles of watershed and over 50 miles of mainstem LA River from its headwaters to just above the estuary. The LA River watershed has been subject to numerous water quality planning and compliance efforts, and the EWMP leveraged those efforts and identified additional projects to address water quality issues in the Upper LA River.

The vision for development of the EWMP was to utilize 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. This EWMP presents a toolbox of distributed and regional watershed control measures to address applicable stormwater quality regulations. Controlling pollutants in stormwater is a major challenge, and the EWMP Group members have been working towards improving stormwater quality for many years by implementing numerous stormwater capture projects across the watershed. State and federal regulations establish compliance timelines to address water quality issues, and this EWMP lays the path forward for implementation of additional water quality improvement projects.
For example, the Los Angeles River watershed is subject to a Total Maximum Daily Load (TMDL) for metals that requires compliance by 2028 and a bacteria TMDL that requires compliance by 2037. High levels of metals can negatively impact aquatic life (e.g., fish) in the rivers, creeks and estuary; elevated bacteria concentrations can pose a potential health risk to people that recreate in the watershed. This EWMP plan has been prepared to address water quality issues and comply with the Permit requirement and timelines in a quantitative manner.

ES.1 Elements of the EWMP

The objective of the EWMP Plan is to determine the network of control measures (often referred to as best management practices [BMPs]) that will achieve required pollutant reductions while also providing multiple benefits to the community and leveraging sustainable green infrastructure practices. This EWMP includes the following elements:

ES.1.1 Water Quality Priorities

The identification of Water Quality Priorities (Section 3 of the EWMP) was an important first step in the EWMP Plan development process. The Water Quality Priorities highlight the pollutants and waterbodies that are potentially not attaining water quality standards. The Water Quality Priorities are a driver of the control measures in the EWMP. For example, if a water quality objective is not being attained, additional pollutant reduction is required and thus more or larger control measures are needed to achieve those reductions. Over 170,000 data records of water quality monitoring data were compiled and analyzed to determine three categories of Water Quality Priorities based on whether TMDLs have been developed for waterbody-pollutants, whether water quality exceedances have occurred in the last 10 years, and whether the stormwater system is a likely source of these pollutants. The water quality prioritization process of the Permit determines the water body-pollutant combinations (WBPCs) that will be addressed by the EWMP. The Permit defines three categories of Water Quality Priorities:

- **Category 1** are pollutants subject to an established TMDL.
- **Category 2** are pollutants on the State Water Resources Control Board 2010 Clean Water Act Section 303(d) List of Impaired Water Bodies or those constituents that have sufficient exceedances to be listed.
- **Category 3** for pollutants with observed exceedances that are too infrequent to be listed, and parameters that are not considered typical pollutants.

The applicable TMDLs are the highest priority for stormwater quality compliance, and thus scheduling for addressing Water Quality Priorities was developed based on TMDL milestones (i.e., interim and numeric limits) and other representative Regional Board-adopted TMDLs. The scheduling of EWMP implementation is based on the milestones of the applicable metals, toxics and bacteria TMDLs, as follows:

- Achieve a 31 percent milestone for the Los Angeles River Metals TMDL by 2017;
- Achieve a 50 percent milestone for the Los Angeles River Metals TMDL by 2024;
- Achieve compliance (100 percent milestone) for the Los Angeles River Metals TMDL by 2028;
- Achieve compliance for the Los Angeles / Long Beach Harbors Toxics TMDL by 2032; and
- Achieve compliance for the Los Angeles River Bacteria TMDL by 2037.

ES.1.2 Watershed Control Measures

The Permit requires the identification of Watershed Control Measures, which are strategies and BMPs that will implemented through the EWMP, individually or collectively, at watershed-scale to address the Water Quality Priorities. Section 4 of the EWMP describes the regional projects and Section 5 of the EWMP describes the distributed BMPs. The total network of Low Impact Development (LID), green streets and regional BMPs is referred to as the EWMP Implementation Strategy. The BMP capacity to be implemented by 2037 has the equivalent capacity of 20 Rose Bowl stadiums. For EWMP development it was important to establish nomenclature / definitions of the various control measures. Distributed and regional control measures make up the EWMP Implementation Strategy (see figure below for an illustration of distributed versus regional approaches).

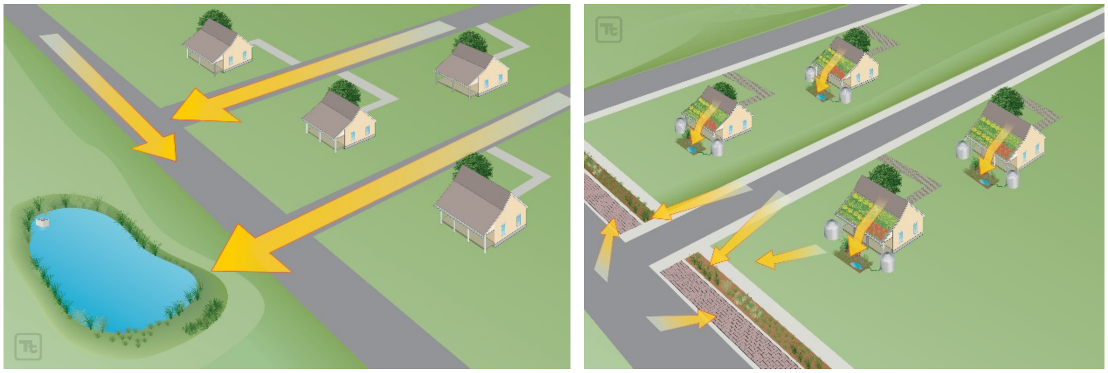


Illustration of Regional (left) **and Distributed** (right) **BMP Approaches**

The three main categories of structural BMPs include low-impact development, green streets, and regional projects, as defined below:

- **Low-Impact Development**: distributed structural practices that capture, infiltrate, and/or treat runoff at the parcel, normally less than 10 tributary acres (see LID illustration on next page). Common LID practices (discussed in Section 5) include bioretention, permeable pavement, and other infiltration BMPs that prevent runoff from leaving a parcel. Rainfall harvest practices such as cisterns can also be used to capture rainwater - that would otherwise run off a parcel - and use it to offset potable water demands. The types of LID incorporated into the EWMP are the LID ordinance, residential LID, and LID retrofits of public parcels. Since the vast majority (nearly 70 percent) of runoff from the developed portion of the watershed is generated from impervious areas on parcels, LID is a natural choice as a key EWMP strategy to treat runoff from parcel-based impervious areas. LID can be viewed as the "first line of defense" due to the fact that the water is treated on-site before it runs off from the parcel and travels downstream.

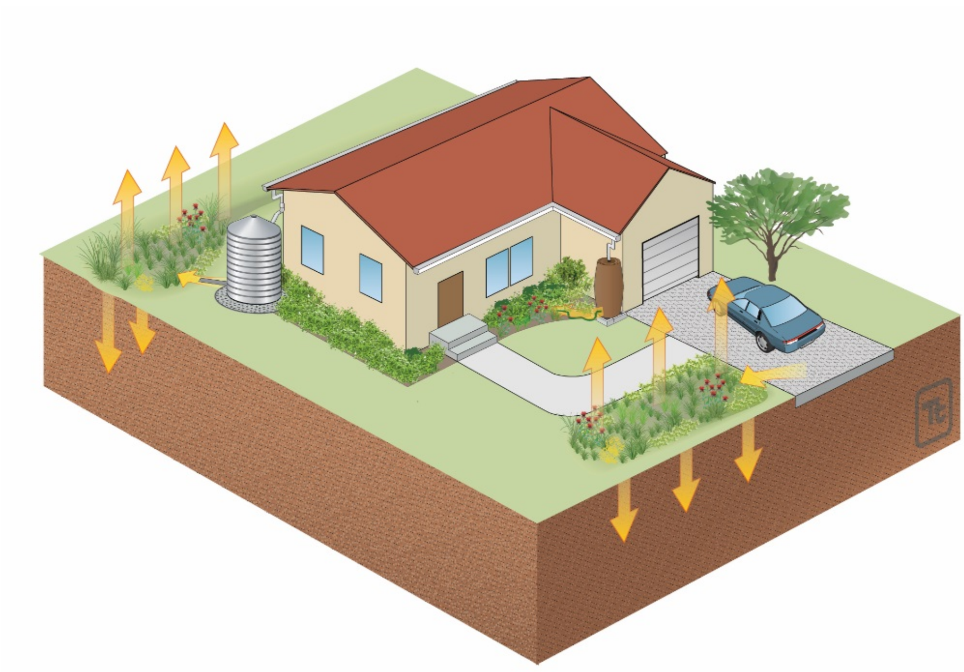
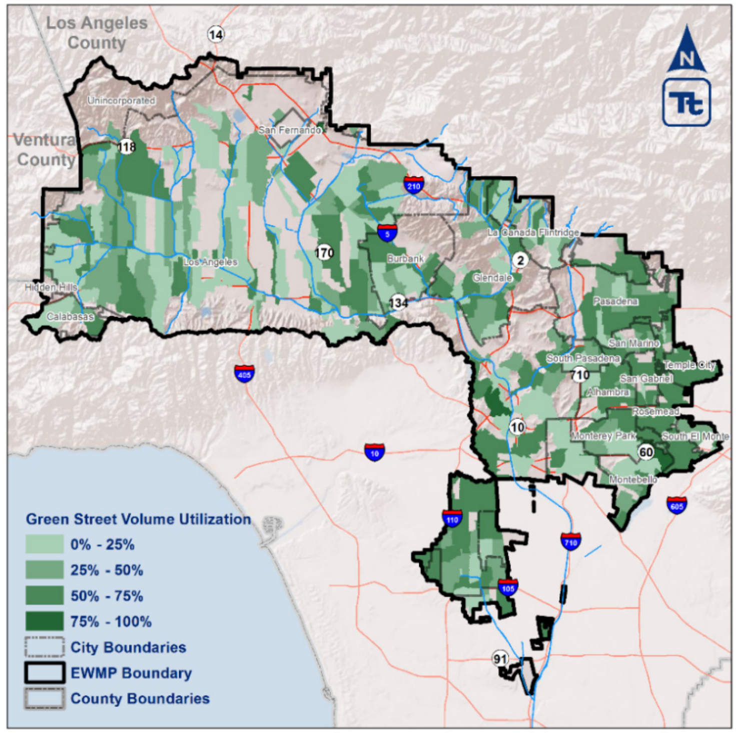
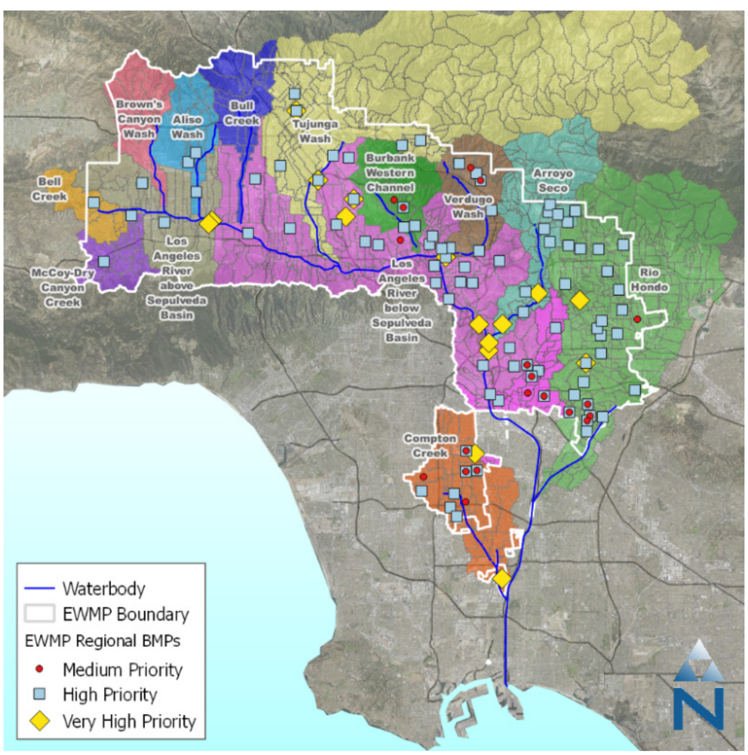


Illustration of LID implemented on a parcel (arrows indicate water pathways)

Green Streets: distributed structural practices that are typically implemented as linear bioretention/ biofiltration installed parallel to roadways (see illustration of a green street on the next page). These systems receive runoff from the gutter via curb cuts or curb extensions (sometimes called bump outs) and infiltrate it through native or engineered soil media. Permeable pavement can also be implemented in tandem or as a standalone practice, such as in parking lanes of roads. As shown in the figure to the right, a high percentage of streets are planned for green street retrofits for the EMWP Implementation Strategy. Green streets have been demonstrated to provide "complete streets" benefits in addition to stormwater management, including pedestrian safety and traffic calming, street tree canopy and heat island effect mitigation, increased property values, and even reduced crime rates.





Regional projects: Regional projects are centralized facilities located near the downstream ends of large drainage areas (typically treating 10s to 100s of acres; see illustration on the next page). Regional projects receive large volumes of runoff from extensive upstream areas and can provide a cost-effective mechanism for infiltration and pollutant reduction. . Runoff is typically diverted to regional projects after it has already entered storm drains. Routing offsite runoff to public parcels (versus treating surface runoff near its source, as with green streets and LID) often allows regional BMPs to be placed in cost-effective locations. The ULAR EWMP includes over 120 regional BMPs (see figure to left), including multi-benefit regional projects that retain the storm water volume from the 85th percentile, 24-hour storm. The EWMP also includes regional projects on private land to assure pollutant reductions are achieved.

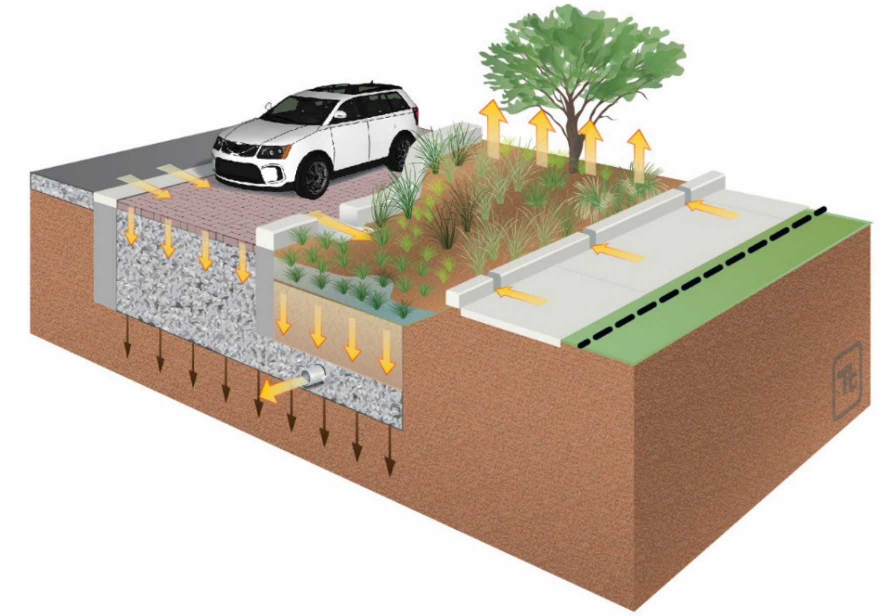


Illustration of a green street (arrows indicate water pathways)

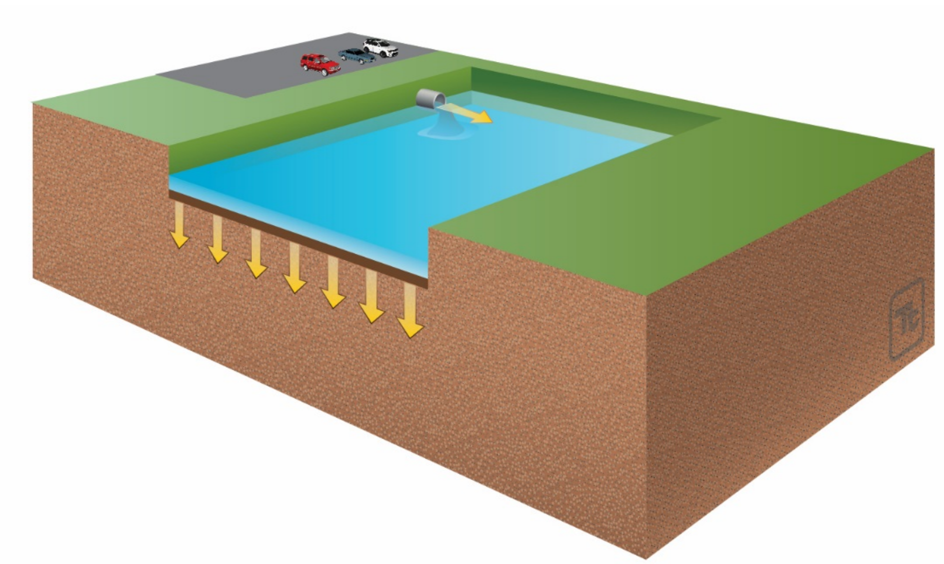


Illustration of a regional project (arrows indicate water pathways)

ES.1.3 Reasonable Assurance Analysis

A key element of each EWMP is the Reasonable Assurance Analysis (RAA) (presented in Section 6), which was used to quantitatively demonstrate that the EWMP Implementation Strategy will address the Water Quality Priorities. While the Permit prescribes the RAA as a quantitative demonstration that control measures will be effective, the RAA also uses a modeling process to identify and select potential control measures to be implemented by the EWMP. The Watershed Management Modeling System

(WMMS) is the basis for the modeling system used to conduct the RAA for the ULAR EWMP. WMMS is specified in the 2012 MS4 Permit as an approved tool to conduct the RAA. The LACFCD, through a joint effort with U.S. Environmental Protection Agency (USEPA), developed WMMS specifically to support informed decisions for managing stormwater.

The RAA demonstrates the calibrated modeling system is able to accurately predict flows and pollutant concentration in the LA River watershed. The RAA was developed based on complying with the applicable criteria for "limiting pollutants" during 90th percentile storm conditions. Limiting pollutants are the pollutants that drive BMP capacity (i.e., control measures that address the limiting pollutant will also address other pollutants). The limiting pollutants for ULAR are as follows:

- ***Wet weather*** – zinc and *E. coli*: according to the modeling analysis and review of monitoring data, control of zinc and *E. coli* requires BMP capacities that are the largest among the Water Quality Priority (WQP) pollutants, and thus control of zinc and *E. coli* has assurance of addressing the other ULAR wet weather Water Quality Priorities. The RAA for ULAR first identifies the control measures to attain zinc limits (during the zinc critical condition) and then identifies additional capacity, if any, needed to achieve *E.coli* limits.
- ***Dry weather*** – *E. coli*: among all the pollutants monitored during dry weather at mass emission stations in LA County, *E. coli* most frequently exceeds receiving water limitation (RWLs). During monitoring "snapshots" of over 100 outfalls along the LA River, over 85 percent of samples exceeded limits for *E. coli* during dry weather through the Bacteria Source Identification Study along the Los Angeles River (CREST, 2008). Among the dry weather WQP pollutants, achievement of dry weather RWLs for *E. coli* will be the most challenging.

The RAA was used to select the BMPs in the EWMP Implementation Strategy based on three primary elements:

- ***Opportunity*** **–** Where can these BMPs be located and how many can be accommodated?
- ***System Configuration*** **–** How is the runoff routed to and through the BMP and what is the maximum BMP size?
- ***Cost Functions*** **–** What is the relationship between BMP volume/footprint/design elements and costs?

The WMMS considered millions of BMP scenarios and the EWMP Implementation Strategy was selected based on the most cost-effective scenarios, while incorporating the input from the EWMP Group related to the needs and opportunities within the communities.

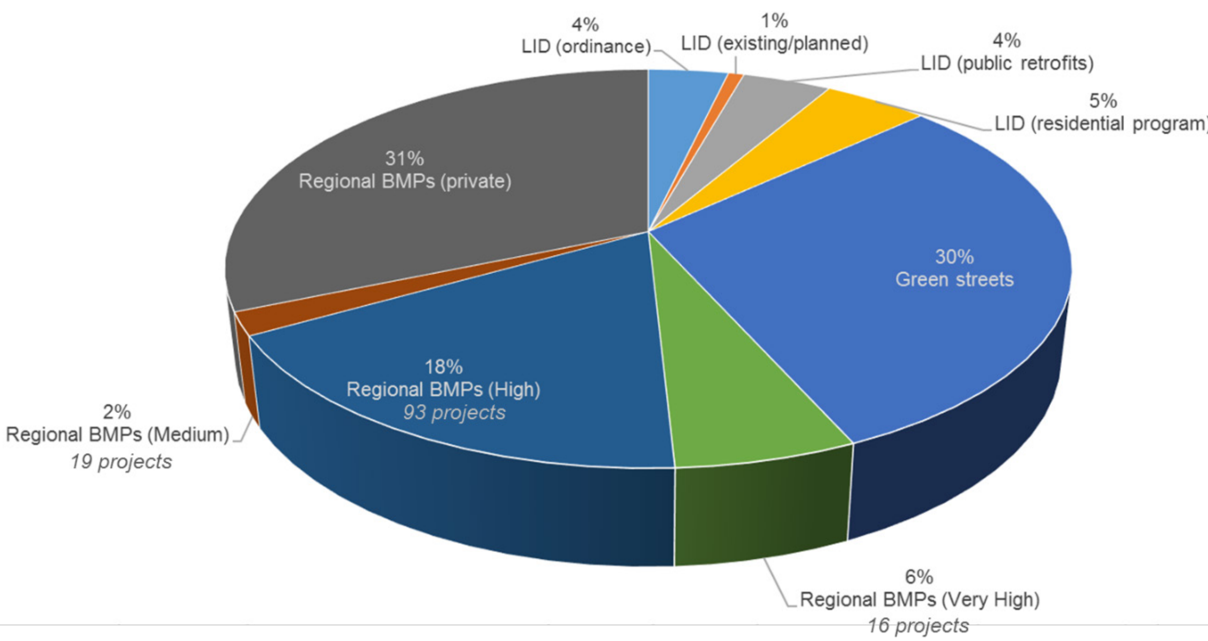
ES.1.4 Detailed EWMP Implementation Strategy and Compliance Schedule

The EWMP Implementation Strategy (presented in Section 7) is the "recipe for compliance" of each jurisdiction to address Water Quality Priorities and comply with the provisions of the MS4 Permit. The EWMP Implementation Strategy includes individual recipes for each of the 18 jurisdictions and each watershed/assessment area – Los Angeles River above Sepulveda Basin, Los Angeles River below Sepulveda Basin, Compton Creek, Rio Hondo, Verdugo Wash, Arroyo Seco, Burbank Western Channel, Tujunga Wash, Bull Creek, Aliso Wash, Bell Creek, McCoy-Dry Canyon, and Browns Canyon Wash. Implementation of the EWMP Implementation Strategy will provide a BMP-based compliance pathway for each jurisdiction under the MS4 Permit.

The EWMP Implementation Strategy is expressed in terms of [1] the volumes of stormwater and non-stormwater to be managed by each jurisdiction to address Water Quality Priorities, and [2] the control measures that will be implemented to achieve those volume reductions, as follows:

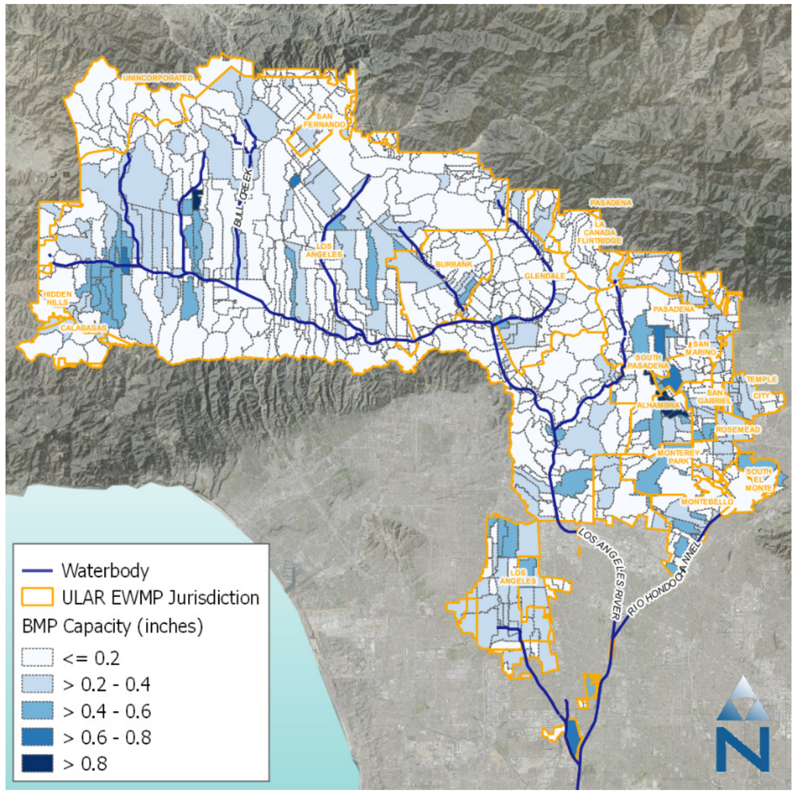
- **Compliance Targets**: for MS4 compliance determination purposes, the primary metric for EWMP implementation is the volume of stormwater managed by implemented control measures. The stormwater volume to be managed is considered the BMP performance goal for the EWMP.

- **EWMP Implementation Strategy**: the network of LID, green streets and regional BMPs that has reasonable assurance of achieving the Compliance Targets is referred to as the EWMP Implementation Strategy. The RAA modeling framework has been used to quantitatively demonstrate that the EWMP Implementation Strategy will address the Water Quality Priorities. The EWMP Implementation Strategy identifies the location and type of control measures to be implemented by each jurisdiction for compliance by 2037, which includes addressing all Water Quality Priorities including the limiting pollutants zinc and *E. coli*. The LID, green street and regional projects that will address the Water Quality Priorities is a network of control measures with the equivalent capacity of approximately 20 Rose Bowl stadiums. As shown in the figure below, for the set of BMPs to be implemented across the entire ULAR EWMP area by 2028, regional projects on public land make up 26 percent of the total control measure capacity. LID and green streets each make up 14 percent and 30 percent respectively. The EWMP Implementation Strategy will be validated and updated over time following review of water quality monitoring data through an adaptive management approach.

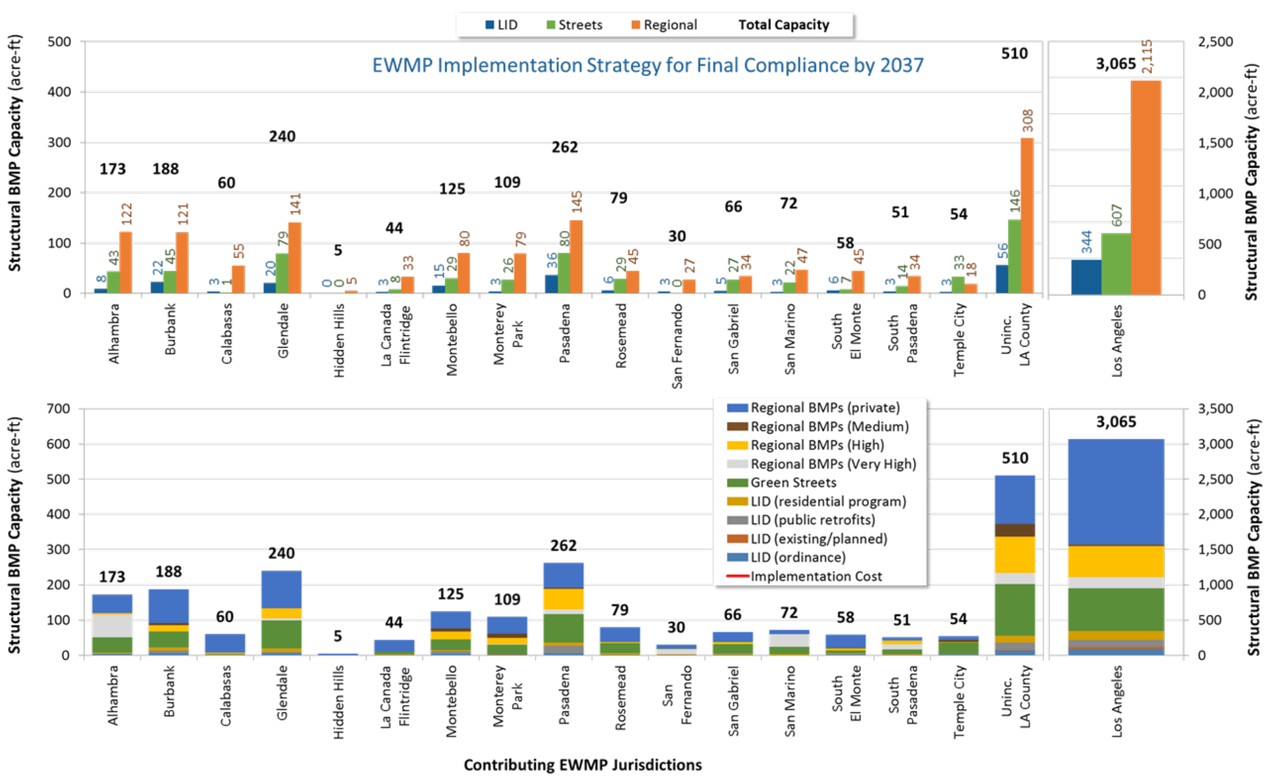


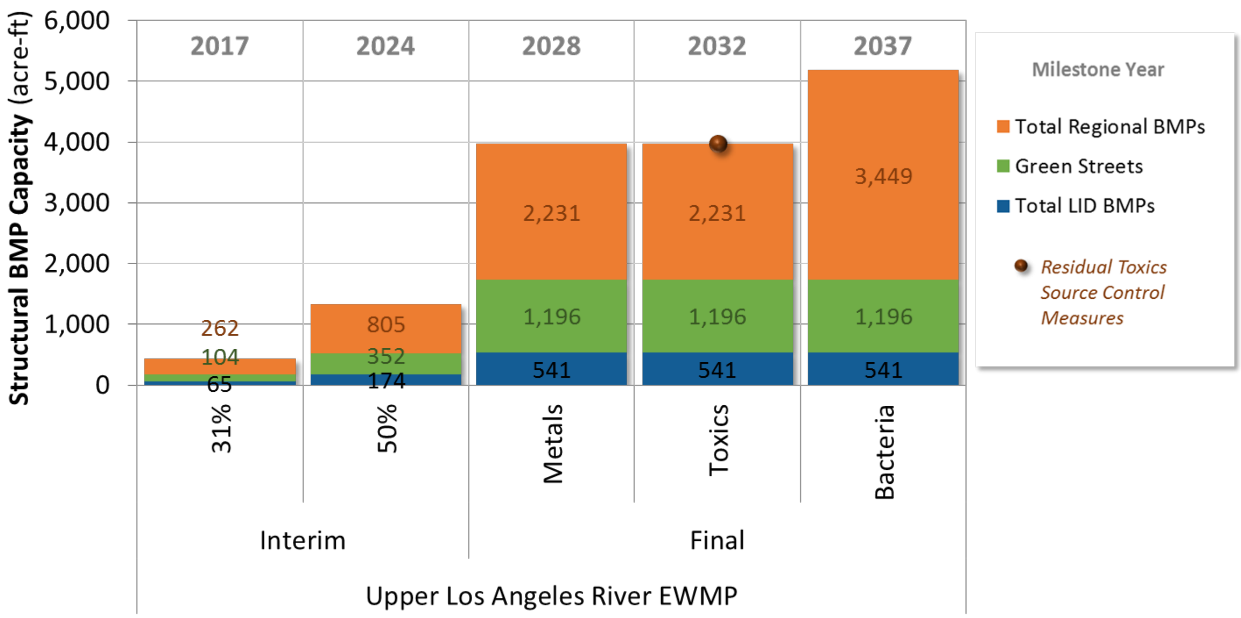
The EWMP Implementation Strategy is ultimately a recipe for compliance for each jurisdiction and subwatershed in the EWMP area. A total of 1,119 subwatersheds (see figure at top of next page) are provided a specific set of LID, green street and regional control measures. The BMP density is higher in some areas [dark blue] because either [1] relatively high load reductions are required, or [2] BMPs in those areas were relatively cost-effective (e.g., due to high soil infiltration rates).The EMWP Plan includes tabular versions of the map to the right in detailed appendices for each jurisdiction.

The total capacity of LID, green streets and regional BMPs to be implemented by each jurisdiction by 2037 (the compliance date for addressing *E. coli*) is shown in the bar chart at the bottom of this page. The strategy varies by jurisdiction depending on the pollutant reduction requirements and BMP preferences. The top panel groups the BMP types into LID, green streets and regional BMPs, while the bottom panel provides more resolution for the BMP sub-categories.



The pace of implementation for the EWMP Implementation Strategy is rapid due to the compliance dates specified in the LA River Metals TMDL (interim milestones in 2017 and 2024), Los Angeles Harbor Toxics TMDL (compliance by 2032) and Los Angeles River Bacteria TMDL (compliance by 2037). The scheduling of BMPs across all 18 jurisdictions to be implemented to achieve those milestones/compliance dates is shown in the figure on the next page.





ES.1.5 Adaptive Management Framework

One of the key components of the EWMP is the incorporation of an Adaptive Management Approach for evaluating monitoring data and "lessons learned" or experience gained during implementation to evaluate EWMP implementation progress. The Permit specifies that an adaptive management process will be revisited every two years to evaluate the EWMP and update the program. The EWMP strategy will evolve based on monitoring results by identifying updates to the EWMP Implementation Plan to increase its effectiveness.

ES.1.6 EWMP Implementation Costs and Financial Strategy

The costs to implement the EWMP will require orders of magnitude increases in stormwater program funding. The capital costs to address Water Quality Priorities by 2037 is estimated at over $6.0 billion, with total operations and maintenance costs exceeding $210 million per year once fully implemented (see table below). Expenditures for the EWMP Implementation Strategy will be coordinated with other regional efforts to improve habitat, promote greenways and increase access to the LA River and its tributaries. In order to garner community support for financing the costs, the multi-benefits of the LID, green streets and regional projects will be quantified including improved aesthetics, increased recreational opportunity, water supply augmentation and climate change resiliency. The financial strategy presented in this EWMP outlines a set of multiple approaches that allows each jurisdiction to consider and select the strategies that best fit their specific preferences.

Present to 31% Metals TMDL Milestone (2017)		31% Metals TMDL Milestone (2017) to 50% Metals TMDL Milestone (2024)		50% Metals TMDL Milestone (2024) to Compliance with Metals TMDL (2028)		50% Metals TMDL Milestone (2024) to Compliance with Bacteria TMDL (2037)		Total at	
Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
168.78	17.01	458.65	55.27	2,889.50	176.91	2,580.94	210.84	6,097.87	210.84

Costs in units of $ million

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Section 1 Introduction

This Enhanced Watershed Management Program for the Upper Los Angeles River (ULAR EWMP) describes a customized compliance pathway that participating agencies will follow to address the pollutant reduction requirements of the 2012 Municipal Separate Storm Sewer System (MS4) Permit (Order No. R4-2012-0175; National Pollutant Discharge Elimination System [NPDES] Permit No. CAS004001). By electing the optional compliance pathway in the MS4 Permit, the Upper Los Angeles River Watershed Management Group (EWMP Group) has leveraged this EWMP to facilitate a robust, comprehensive approach to stormwater planning for the Upper Los Angeles River watershed. This EWMP builds upon multiple previously-developed planning efforts[1] and identifies a detailed implementation strategy that provides not only water quality improvement but also environmental, aesthetic, recreational, water supply and/or other community enhancements. The strategy has been developed through an extensive stakeholder coordination process including three public workshops and numerous one-on-one meetings.

A total of 19 MS4 Permittees comprise the EWMP Group ("Group members" or "jurisdictions") including the cities of Los Angeles (lead coordinating agency), Alhambra, Burbank, Calabasas, Glendale, Hidden Hills, La Cañada Flintridge, Montebello, Monterey Park, Pasadena, Rosemead, San Fernando, San Gabriel, San Marino, South El Monte, South Pasadena, and Temple City, plus the County of Los Angeles, and the Los Angeles County Flood Control District (LACFCD)[2]. The City of South El Monte[3] joined the original 18 Group members through a letter of intent[4] submitted February 26, 2015.

The vision for development of the EWMP was to utilize 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. This EWMP presents a toolbox of distributed and regional watershed control measures (see **Figure 1-1**) to address applicable stormwater quality regulations including the following:

- **Low impact development:** control measures implemented on parcels to retain stormwater runoff during rain events. For the EWMP, the Group members' LID ordinances are also incorporated. In addition, residential LID programs are incorporated to incentivize adoption of rain cisterns and other methods to reduce runoff from residential properties, while also facilitating community engagement and awareness. Group members will also implement LID retrofits on public parcels.
- **Green streets:** the right-of-way along streets offers a significant opportunity to implement control measures on public land. The EWMP includes extensive green streets to retain runoff from

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[1] A Work Plan for the ULAR EWMP was submitted to the Regional Board in June 2014. The Work Plan described the work efforts and analyses that support this EMWP development."

[2] See Appendix 1A for background information on the Los Angeles County Flood Control District.

[3] A portion of South El Monte drains to the San Gabriel River watershed, which is covered by this ULAR EWMP. Details on the analyses and results for the San Gabriel River portion of South El Monte are provided in Appendix 1B.

[4] Letter of Intent to join EWMP and CIMP from Anthony Ybarra, City of South El Monte City Manager, to Sam Unger, California Regional Water Quality Control Board, Los Angeles Region Executive Officer, dated February 26, 2015.

roads and alleys. Green streets will potentially offer many other benefits to communities in terms of aesthetics, safety and increased property values.

- **Regional projects:** these control measures are an emphasis of the Permit because they are able to capture runoff from large upstream areas. The EWMP emphasizes implementation of regional projects, particularly those that are able to retain the 85th percentile, 24-hour storm event. The ULAR EWMP includes 128 regional BMPs, including multi-benefit regional projects that retain the storm water volume from the 85th percentile, 24-hour storm for the drainage areas tributary to the multi-benefit regional projects. In addition, the EWMP includes regional projects on private land to assure required pollutant reductions are achieved.
- **Institutional control measures:** these control measures can be cost-effective because they prevent transport of pollutants in the watershed without building structures. The MS4 Permit requires Group Members to implement minimum control measures (MCMs), which are a subset of institutional control measures that may be enhanced over the course of EWMP implementation.

Collectively, these measures make up the "EWMP Implementation Strategy" also referred to as the "recipe for compliance," for the Group members. The EWMP Implementation Strategy is quantitatively robust, as modeling was used to demonstrate that RWLs and/or WQBELs will be achieved by the identified control measures, via a Reasonable Assurance Analysis (RAA). Over time, through adaptive management, the EWMP Implementation Strategy will evolve based on monitoring results, lessons learned during implementation and other factors.

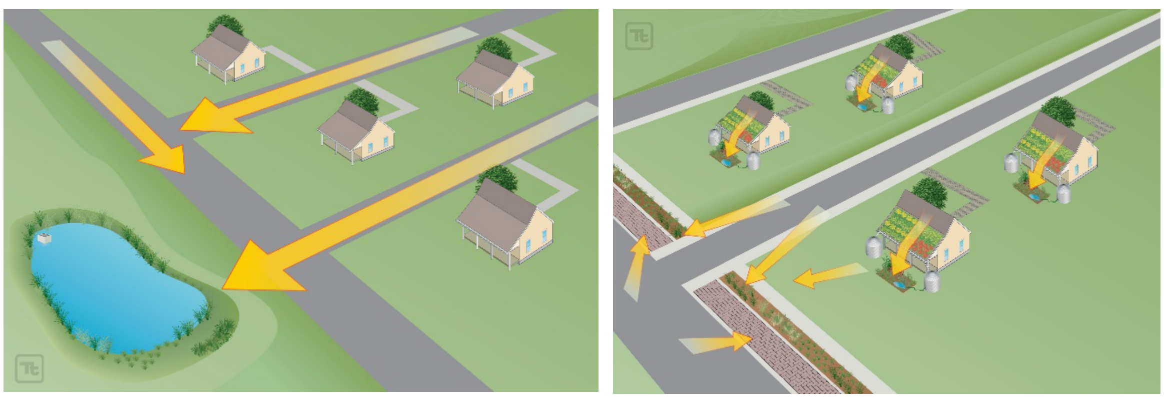

Figure 1-1. Conceptual Schematic of Regional (left) and Distributed (right) BMP Approaches

1.1 What Areas are Covered by this EWMP?

The area included in the ULAR EWMP is the largest of all the EWMP areas in Los Angeles County, approximately 485 square miles (**Figure 1-2**). The Los Angeles River is approximately 55 miles long, and five of six reaches lie within the ULAR EWMP area. The4 natural hydrology of the Los Angeles River watershed has been altered by channelization and the construction of dams and flood control reservoirs. The Los Angeles River and many of its tributaries are lined with concrete for most or all of their length. Soft-bottomed segments of the Los Angeles River occur where groundwater upwelling prevents armoring of the river bottom, most notably at the Glendale Narrows.

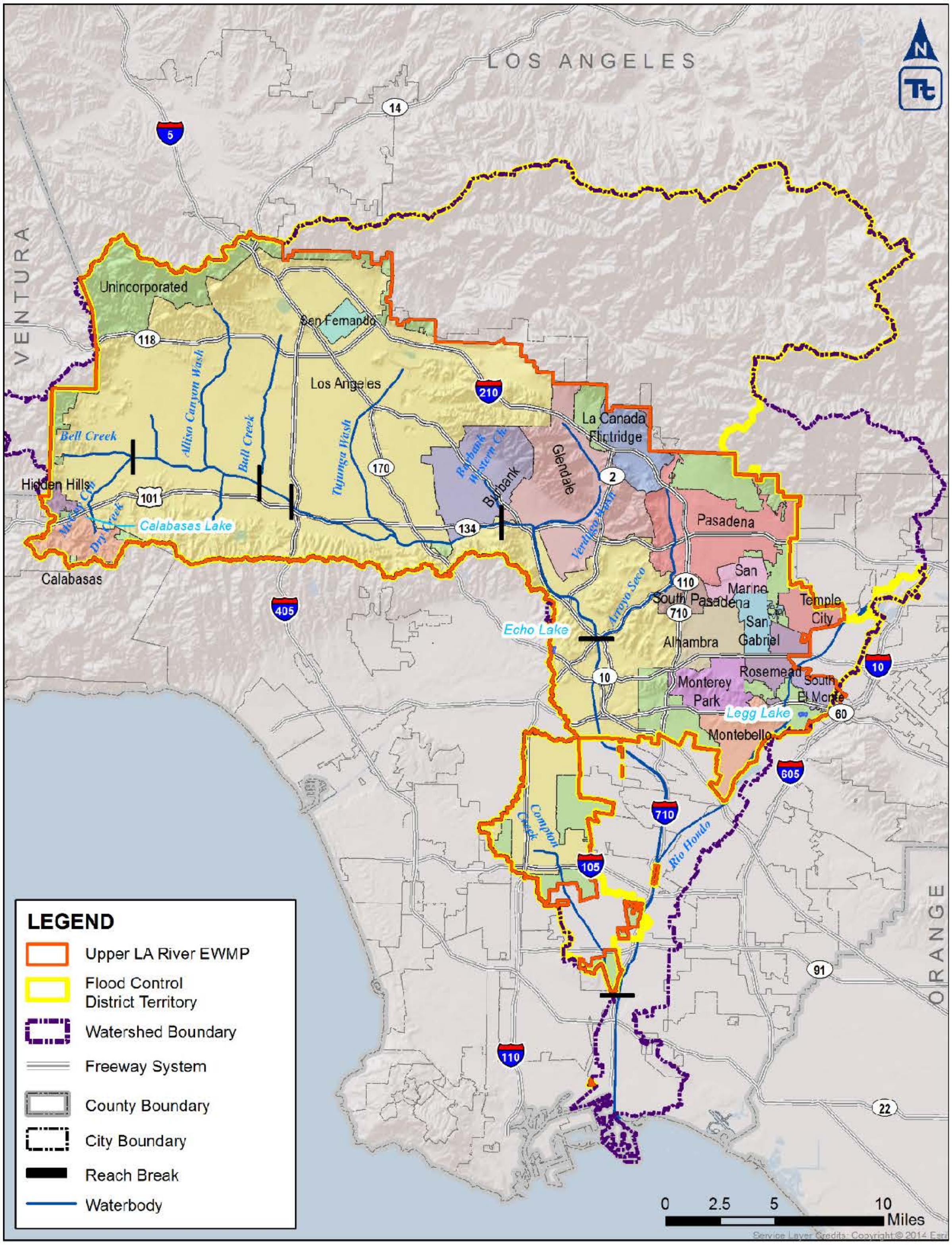

Figure 1-2. Upper Los Angeles River EWMP Area and Jurisdictions that Comprise the ULAR EWMP Group

The Los Angeles River is segmented into six reaches by the California Water Quality Control Plan, Los Angeles Region (Basin Plan) as follows: (listed from upstream to downstream; reach breaks are shown in **Figure 1-2**):

- Reach 6 begins at the headwaters of the Los Angeles River (the confluence of Arroyo Calabasas and Bell Creek) and extends to Balboa Boulevard.
- Reach 5 runs from Balboa Boulevard through the Sepulveda Basin.
- Reach 4 runs from Sepulveda Dam to Riverside Drive.
- Reach 3 runs from Riverside Drive to Figueroa Street.
- Reach 2 runs from Figueroa Street to Carson Street.
- Reach 1 runs from Carson Street to the estuary.

Major tributaries to ULAR EWMP area include Aliso Canyon Creek, Bell Creek, Bull Creek, Tujunga Wash, Burbank Western Channel, Arroyo Seco, Rio Hondo, and Compton Creek. The major water bodies in the ULAR EWMP area are summarized in **Table 1-1**. The ULAR EWMP area also includes Lake Calabasas, Echo Park Lake, and Legg Lake.

Table 1-1. Waterbodies within the ULAR EWMP Area

Waterbody	Associated Major Tributaries
LA River Reach 6	Dry Canyon Creek McCoy Creek Bell Creek Aliso Canyon Wash
LA River Reach 5	Bull Creek
LA River Reach 4	Pacoima Wash Tujunga Wash
LA River Reach 3	Burbank West Channel Verdugo Wash Arroyo Seco
LA River Reach 2	Rio Hondo Reach 2 and 3 Compton Creek
Echo Park Lake	
Legg Lake	
Calabasas Lake	

Collectively, the ULAR EWMP area makes up over 58 percent of the total LA River watershed area. A breakdown of the areas associated with the participating MS4 Permittees is provided in **Table 1-2**. All drainage infrastructure operated and maintained by the LACFCD within the ULAR EWMP area have been covered under this EWMP. It should be noted that agencies participating in the ULAR EWMP have no jurisdiction over the land owned by the State of California (i.e., California Department of Fish and Wildlife [CDFW], the State Lands Commission, and California Department of Transportation [Caltrans]) and the U.S. Government.

Table 1-2. ULAR EWMP Agencies and Land Areas

Agency	Land Area (Acres)	% of EWMP Area
City of Los Angeles	181,288.00	58.48
County of Los Angeles	41,048.07	13.24
LACFCD	NA	N/A
City of Alhambra	4,884.31	1.58
City of Burbank	11,095.20	3.58
City of Calabasas	4,005.68	1.29
City of Glendale	19,587.50	6.32
City of Hidden Hills	961.03	0.31
City of La Canada Flintridge	5,534.46	1.79
City of Montebello	5,356.38	1.73
City of Monterey Park	4,951.51	1.60
City of Pasadena	14,805.30	4.78
City of Rosemead	3,310.87	1.07
City of San Fernando	1,517.64	0.49
City of San Gabriel	2,644.87	0.85
City of San Marino	2,409.64	0.78
City of South El Monte	1,823.94	0.59
City of South Pasadena	2,186.20	0.71
City of Temple City	2,576.50	0.83
Area of ULAR EWMP Agencies	**309,987.10**	**100**

1.2 Which Regulations are Motivating the EWMP?

While the EWMP comprises a multi-faceted document/program that is far broader than stormwater compliance, its fundamental purpose is to respond to regulatory requirements. Elements of the regulatory framework, including the MS4 Permit and applicable schedules for total maximum daily loads (TMDLs), are described in the following subsections.

1.2.1 Major Elements of the 2012 MS4 Permit

The Los Angeles Regional Water Quality Control Board (LARWQCB) adopted Waste Discharge Requirements for MS4 discharges within the Coastal Watersheds of Los Angeles County, except those discharges originating from the City of Long Beach MS4 (Order No. R4-2012-0175; NPDES Permit No. CAS004001) on November 8, 2012 (referred to herein as the MS4 Permit or Permit). The MS4 Permit, which became effective on December 28, 2012, applies to the LACFCD, County of Los Angeles and 84 incorporated cities within Los Angeles County, including cities in the ULAR watershed. The MS4 Permit replaces the 2001 MS4 permit.

The 2012 MS4 Permit contains effluent limitations, receiving water limitations (RWLs), minimum control measures (MCMs), and TMDL provisions, and outlines the process for developing watershed management programs, including the EWMP. The MS4 Permit incorporates the TMDL Wasteload

Allocations (WLAs) applicable to dry- and wet- weather as water quality based effluent limits (WQBELs) and/or RWLs. Section V.A of the Permit requires compliance with the WQBELs as outlined by the respective TMDLs. The EWMP provides a compliance pathway for attaining these limitations, as described in the next subsection.

The MS4 Permit also requires Permittees to implement MCMs to protect water quality in receiving waters (Part VI.D). Unlike previous Permits, the 2012 Permit allows for the modification of MCMs to more effectively address the highest priority water quality conditions. Permittees can evaluate current MCMs, identify potential modifications that will address Water Quality Priorities, and provide justification for modification and/or elimination of any MCM that is determined to not be applicable to the Permittee (with the exception of MCMs in the Planning and Land Development Program, which may not be eliminated). At this time, no Group members have elected to formally customize their MCMs, but may choose to do so over the course of EWMP implementation. Customization may include replacement of an MCM for a more effective measure, reduced implementation of an MCM, augmented implementation of the MCM, focusing the MCM on the water quality priority (WQP), or elimination of an MCM.

1.2.2 Role of EWMP for Permit Implementation

The EWMP provides a compliance pathway for attaining RWLs and WQBELs limitations. The definition of an EWMP, provided in Permit Section VI.C.1.g., is as follows:

"EWMP is one that comprehensively evaluates opportunities, within the participating Permittees' collective jurisdictional area in a Watershed Management Area, for collaboration among Permittees and other partners on multi-benefit regional projects that, wherever feasible, retain (i) all non-storm water runoff and (ii) all storm water runoff from the 85th percentile, 24-hour storm event for the drainage areas tributary to the projects, while also achieving other benefits including flood control and water supply, among others. In drainage areas within the EWMP area where retention of the 85th percentile, 24-hour storm event is not feasible, the EWMP shall include a Reasonable Assurance Analysis (RAA) to demonstrate that applicable WQBELs and RWLs shall be achieved through implementation of other watershed control measures. An EWMP shall:

i. Be consistent with the provisions in Part VI.C.1.a.-f and VI.C.5-C.8;

ii. Incorporate applicable State agency input on priority setting and other key implementation issues;

iii. Provide for meeting water quality standards and other CWA obligations by utilizing provisions in the CWA and its implementing regulations, policies and guidance;

iv. Include multi-benefit regional projects to ensure that MS4 discharges achieve compliance with all WQBELs set forth in Part VI.E. and do not cause or contribute to exceedances of receiving water limitations in Part V.A. by retaining through infiltration or capture and reuse the storm water volume from the 85th percentile, 24-hour storm for the drainage areas tributary to the multi-benefit regional projects.;

v. In drainage areas where retention of the storm water volume from the 85th percentile, 24-hour event is not technically feasible, include other watershed control measures to ensure that MS4 discharges achieve compliance with all interim and WQBELs set forth in Part VI.E. with compliance deadlines occurring after approval of a EWMP and to ensure that MS4 discharges do not cause or contribute to exceedances of receiving water imitations in Part V.A.;

vi. Maximize the effectiveness of funds through analysis of alternatives and the selection and sequencing of actions needed to address human health and water quality related challenges and non-compliance;

vii. Incorporate effective innovative technologies, approaches and practices, including green infrastructure;

viii. Ensure that existing requirements to comply with technology-based effluent limitations and core requirements (e.g., including elimination of non-storm water discharges of pollutants through the MS4, and controls to reduce the discharge of pollutants in storm water to the maximum extent practicable) are not delayed;

ix. Ensure that a financial strategy is in place."

The ULAR EWMP meets all of these requirements as prescribed by the Permit.

1.2.3 Applicable TMDLs and Implementation Schedules

A primary driver of the extent and scheduling of control measures that make up the EWMP Implementation Strategy are the applicable TMDLs in the LA River watershed. Section 303(d) of the Clean Water Act (CWA) requires states to prepare a list of water bodies that do not meet water quality standards and establish for each of these water bodies load and waste load allocations (load refers to pollutants), that is, a TMDL that will ensure attainment of water quality standards. A TMDL represents an amount of pollution that can be released by anthropogenic and natural sources of a watershed into a specific water body without causing a decline in water quality and beneficial uses. Unlike federal law, State law requires Regional Boards to include an implementation plan for TMDLs and these plans generally include compliance schedules.

A summary of the existing TMDLs for the ULAR is presented in the following tables:

- **Table 1-3** presents TMDLs developed for water bodies within the ULAR EWMP area and also TMDLs for downstream waterbodies.
- **Table 1-4** (mainstem and tributaries) and **Table 1-5** (lakes) show where the Permit assigns WQBELs, RWLs, or WLAs to Permittees within the ULAR EWMP area. The numeric WQBELs and RWLs as well as the WLAs for the USEPA TMDLs listed in **Table 1-3** and **Table 1-4** can be found in Attachments N and O of the Permit.
- A summary of the WLAs contained within these TMDLs applicable to participants in the ULAR EWMP area is provided in **Appendix 1.A**. These WLAs provide the overall water quality targets to be achieved through implementation of the EWMP and are key considerations for the RAA.
- Some of the Regional Board-adopted TMDLs presented in **Table 1-3** required responsible parties to submit a TMDL Implementation Plan to describe how they would achieve compliance with the WLAs. The cities of Los Angeles, Alhambra, Burbank, Calabasas, Glendale, Hidden Hills, La Cañada Flintridge, Montebello, Monterey Park, Pasadena, Rosemead, San Fernando, San Gabriel, San Marino, South Pasadena, and Temple City, and Caltrans submitted TMDL Implementation Plans to address the impairments contained within the Metals TMDL. Additionally, the County of Los

Angeles and LACFCD submitted an integrated TMDL Implementation Plan to address multiple impairments. Once approved, the ULAR EWMP will take the place of those individual TMDL Implementation Plans.

Table 1-3. TMDLs Applicable to the Upper Los Angeles River Watershed Management Area Group

TMDL	LARWQCB Resolution Number	Effective Date and/or EPA Approval Date
LA River Nitrogen Compounds and Related Effects	2003-009	03/23/2004
	2012-010 (amended)	08/07/2014
Legg Lake Trash TMDL	2007-010	03/06/2008
LA River Trash	2007-012	09/23/2008
LA River Metals TMDL	2007-014	10/29/2008
	2010-003 (amended)	11/03/2011
LA River Bacteria TMDL	2010-007	03/23/2012
Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL	2011-008	03/23/2012
Los Angeles Area Lakes TMDLs for Lake Calabasas, Echo Park Lake, and Legg Lake	NA (USEPA TMDL)	03/26/2012

Table 1-4. Applicability of WQBELs and RWLs Associated with TMDLs as Identified in the Permit

TMDL	Constituent	LA River Reaches 1 – 6	Compton Creek	Rio Hondo R1 – R3	Arroyo Seco	Verdugo Wash	Burbank Western Channel	Tujunga Wash	Bell Creek	Bull Creek Aliso Canyon Wash McCoy Canyon Dry Canyon
LAR Trash	Trash	E	E	E	E	E	E	E	E	E
LAR Nutrients	Ammonia -N	E	E	E	E	E	E	E	E	E
	Nitrate – N	E	E	E	E	E	E	E	E	E
	Nitrite – N	E	E	E	E	E	E	E	E	E
	Nitrate as N + Nitrite as N	E	E	E	E	E	E	E	E	E
LAR Metals	Copper and Lead (dry and wet weather)	E	E	E[1]	E	E	E	E	E	--
	Zinc (dry weather)	--	--	E[1]	--	--	--	--	--	--
	Zinc (wet weather)	E	E	E	E	E	E	E	E	--
	Cadmium (wet weather)	E	E	E	E	E	E	E	E	--
DC and LA/LB Harbors Toxics	Sediment: DDTs, PCBs, Copper, Lead, Zinc, PAHs	--	--	--	--	--	--	--	--	--
LAR Bacteria	E. coli	E/R	E/R	E/R	E/R	E/R	E/R	E/R	E/R	E/R

Note that unless explicitly stated as sediment, constituents are associated with the water column

E – Effluent limit established based on a TMDL.

R – Receiving water limit established based on a TMDL.

1 – The dry weather metals limits only apply to Rio Hondo Reach 1.

Table 1-5. Applicability of Water Quality Based Effluent Limitations and/or Wasteload Allocations Associated with TMDLs for Lakes as Identified in the Permit

TMDL	Constituents	Lake		
		Legg	Calabasas	Echo Park
Legg Lake Trash TMDL	Trash	E		
USEPA Lakes TMDLs	Total-P	WLA	WLA	WLA
	Total-N	WLA	WLA	WLA
	Trash			WLA
	PCBs (water and sediment)			WLA
	Chlordane (water and sediment)			WLA
	Dieldrin (water and sediment)			WLA

Note that unless explicitly stated as sediment, constituents are associated with the water column.

E – Effluent limit established based on a TMDL.

PCB – polychlorinated biphenyls

WLA – Wasteload Allocation assigned in a USEPA TMDL, but not included as effluent or receiving water limitations.

1.3 EWMP Overview

The remainder of this EWMP includes the following sections:

- **Section 2 – Legal Authority:** Presents the legal authority of each participating Permittee to implement or compel implementation of watershed control measures.
- **Section 3 – Priorities for Water Quality Compliance:** Presents the process to identify and prioritize water quality impairments in the watershed based on review of available monitoring data. The water quality prioritization process of the Permit was used to determine the water body-pollutant combinations (WBPCs) that will be addressed by the EWMP. Note the EWMP Group has also developed a Coordinated Integrated Monitoring Program (CIMP) to collect water quality data and measure the effectiveness of the EWMP.
- **Section 4 – Overview of EWMP Control Measures: Regional Projects and Integration with Related Planning Efforts:** Provides an overview of the benefits and role of regional projects in the EWMP and the detailed screening and analysis process used to prioritize regional project opportunities in the ULAR watershed. In addition, this section highlights *signature* regional projects that have been evaluated through detailed conceptual level designs by each of the EWMP Group members. ly, EWMP incorporates and will align with other regional planning efforts underway by many other agencies and organizations (e.g., the LA River Ecosystem Restoration Feasibility Study and the Stormwater Capture Master Plan),
- **Section 5 – Overview of EWMP Control Measures: Green Infrastructure and Institutional Control Measures:** Complementary to the regional BMP program introduced in Section 4, robust green infrastructure programs will be critical to achieving water quality compliance in the Upper LA River watershed. This section provides a summary of the green infrastructure programs within the EWMP and highlights several signature projects as an example of the types of efforts that are upcoming and ongoing.

- **Section 6 – Reasonable Assurance Analysis Approach:** A key element of the EWMP is the RAA, which is prescribed by the Permit as a process to demonstrate "that the activities and control measures…will achieve applicable WQBELs and/or RWLs with compliance deadlines during the Permit term." This section details how the RAA was used to evaluate the many different scenarios/combinations of institutional, distributed and regional control measures that could potentially be used to comply with the RWLs and WQBELs of the Permit, and was then used to select the control measures specified in the EWMP Implementation Strategy.

- **Section 7 – Detailed EWMP Implementation Strategy and Compliance Schedule:** Outlines the output of the RAA process, referred to as the EWMP Implementation Strategy. This strategy can be thought of as the "recipe for compliance" for each jurisdiction to address Water Quality Priorities and comply with the provisions of the MS4 Permit. Through the RAA, a series of quantitative analyses were used to identify the capacities of Low Impact Development (LID), green streets and regional BMPs that comprise the EWMP Implementation Strategy and assure those control measures will address the Water Quality Priorities.

- **Section 8 – Compliance Determination and Adaptive Management Framework:** Provides an overview of the compliance determination process and the adaptive management framework. The adaptive management process will be revisited every two years to evaluate the EWMP and update the program as necessary. As part of the process, the EWMP may be adapted and modified over time to become more effective as new program elements are implemented and information is gathered

- **Section 9 – EWMP Implementation Costs and Financial Strategy:** Presents the financial strategy for addressing the additional costs of compliance with the 2012 MS4 Permit as a result of the extensive set of BMPs required for compliance. In the context of the EWMP, the financial strategy is deemed to represent the strategic options available to the Permittees for financing the program costs associated with the new MS4 Permit.

- **Section 10 – References:** Contains a list of references cited in the EWMP.

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Section 2
Legal Authority

2.1 Permit Section VI.A.2.a

Pursuant to Part VI.A.2.a of Order No. R4-2012-0175 (the "Order"), "each Permittee must establish and maintain adequate legal authority, within its respective jurisdiction, to control pollutant discharges into and from its MS4 through ordinance, statue, permit, contract or similar means." Each Permittee in the ULAR EWMP area has established ordinances within their own jurisdiction addressing the control of urban runoff to meet all of the requirements imposed by Part VI.A.2.a:

i. Control the contribution of pollutants to its MS4 from storm water discharges associated with industrial and construction activity and control the quality of storm water discharged from industrial and construction sites. This requirement applies both to industrial and construction sites with coverage under an NPDES permit, as well as to those sites that do not have coverage under an NPDES permit.

ii. Prohibit all non-storm water discharges through the MS4 to receiving waters not otherwise authorized or conditionally exempt pursuant to Part III.A;

iii. Prohibit and eliminate illicit discharges and illicit connections to the MS4;

iv. Control the discharge of spills, dumping, or disposal of materials other than storm water to its MS4;

v. Require compliance with conditions in Permittee ordinances, permits, contracts or orders (i.e., hold dischargers to its MS4 accountable for their contributions of pollutants and flows);

vi. Utilize enforcement mechanisms to require compliance with applicable ordinances, permits, contracts, or orders;

vii. Control the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements among Copermittees;

viii. Control of the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements with other owners of the MS4 such as the State of California Department of Transportation;

ix. Carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with applicable municipal ordinances, permits, contracts and orders, and with the provisions of this Order, including the prohibition of non-storm water discharges into the MS4 and receiving waters. This means the Permittee must have authority to enter, monitor, inspect, take measurements, review and copy records, and require regular reports from entities discharging into its MS4;

x. Require the use of control measures to prevent or reduce the discharge of pollutants to achieve water quality standards/receiving water limitations;

xi. Require that structural BMPs are properly operated and maintained; and

xii. Require documentation on the operation and maintenance of structural BMPs and their effectiveness in reducing the discharge of pollutants to the MS4.

2.2 Permit Section VI.A.2.b

Pursuant to Part VI.A.2.b of the Permit, EWMP participants are required to submit an annual statement certified by its chief legal counsel that “the Permittee has the legal authority within its jurisdiction to implement and enforce the requirements contained in 40 CFR §122.26(d)(2)(i)(A-F) and this Order.” Furthermore, Order Part VI.A.2.b.i requires “citation of applicable municipal ordinance or other appropriate legal authorities and their relationship to the requirements of 40 CFR §122.26(d)(2)(i)(A-F) and of this Order.”

The Permittees have issued statements certifying the above and adopted ordinances related to the regulation of urban runoff to control and prohibit discharges of pollutants into the MS4 and to comply with the requirements of the Permit applicable to it, as well as, to the extent applicable, 40 CFR §122.26(d)(2)(i)(A-F). The legal authority certifications for each Permittee are contained in **Appendix 2A**.

Section 3
Priorities for Water Quality Compliance

The requirement to identify Water Quality Priorities is an important first step in the EWMP process. The Water Quality Priorities highlight the pollutants and waterbodies that are potentially not attaining water quality standards[5]. The Water Quality Priorities are a driver of the control measures in the EWMP. For example, if a water quality objective is not being attained, additional pollutant reduction is required and thus more or larger control measures are needed to achieve those reductions. The following section summarizes the approach to identifying Water Quality Priorities as well as the outcome of the analysis. **Appendix 3.A** contains a detailed description of the analysis and results.

This section also includes the compliance schedule for Water Quality Priorities for which a compliance schedule was developed including USEPA TMDLs, 303(d) listings, and other RWL exceedances in the ULAR EWMP area. The applicable TMDLs are the highest priority for stormwater quality compliance, and thus scheduling for addressing Water Quality Priorities was developed based on TMDL milestones (i.e., interim and numeric limits) and other representative LARWQCB adopted TMDLs where appropriate (see **Table 3-1** and **Table 3-2;** also see Section 1.3.3). Interim and compliance dates in the LAR Bacteria TMDL, LAR Metals TMDL, Harbors Toxics TMDL, LAR Trash TMDL, Machado Lake Nutrient TMDL, and the Machado Lake Toxics TMDL are the primary drivers for the RAA and EWMP implementation schedule.

The Water Quality Priorities provide the basis for prioritizing implementation activities within the EWMP and the selection and scheduling of BMPs through the RAA. The Permit defines three categories of Water Quality Priorities, as shown in **Table 3-3**. The Permit establishes a four-step process that leads to prioritization and sequencing of the water quality issues within each watershed, ultimately leading to an organized list of Water Quality Priorities, as follows:

- **Step 1:** Water quality characterization (Permit VI.C.5.a.i, pg. 58) based on available monitoring data, TMDLs, 303(d) lists, stormwater annual reports, etc.;
- **Step 2:** Water body-pollutant classification (Permit VI.C.5.a.ii, pg. 59), to identify water body-pollutant combinations that fall into three Permit defined categories;
- **Step 3:** Source assessment (Permit VI.C.5.a.iii, pg. 59) for the water body-pollutant combinations in the three categories; and
- **Step 4:** Prioritization of the water body-pollutant combinations (Permit VI.C.5.a.iv, pg. 60).

These steps are described in the following subsections. This EWMP addresses and provides compliance coverage for all pollutants analyzed as part of the Water Quality Priorities process, including Category 1, 2, and 3 WBPCs.

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[5] Each water quality standard includes a beneficial use (e.g., the Basin Plan designates most waterbodies as subject to water contact recreational use) and a corresponding water quality objective to protect that use (e.g., the Basin Plan specifies that concentrations of *E. coli* must be less than 235 MPN per 100mL to protect water contact recreational uses). Water quality standards also incorporate an antidegradation requirement.

Table 3-1. Category 1 Water Quality Priorities and summary of Compliance Dates and Milestones for TMDLs in the ULAR EWMP area

TMDL	Waterbodies[1]	Constituents	Compliance Goal	Weather Condition	Compliance Dates and Compliance Milestones (Bolded numbers indicated milestone deadlines within the current Permit term)[1]									
					2012	2013	2014	2015	2016	2020	2024	2028	2032	2037
LAR Nutrients	All Waterbodies	Ammonia-N, Nitrate-N, Nitrite-N, Nitrate-N+Nitrite-N	Meet WQBELs	All	**Pre 2012**									
LAR Trash	All Waterbodies	Trash	% Reduction	All	**9/30**	**9/30**	**9/30**	**9/30**	**9/30**					
					70%	**80%**	**90%**	**96.7%**	**100%**					
Legg Lake Trash	Legg Lake	Trash	% Reduction	All	**3/6**	**3/6**	**3/6**	**3/6**	**3/6**					
					20%	**40%**	**60%**	**80%**	**100%**					
LAR Metals[2]	Reach 1 through 6, CC, RH, AS,	Copper, Lead, Zinc (only RH)	% of MS4 area Meets WQBELs	Dry	**1/11**					**1/11**	**1/11**			
	VW, BWC, TW, ACW, MC, DC, BeC and BuC				**50%**					**75%**	**100%**			
	All Waterbodies	Copper, Lead, Zinc, Cadmium	% of MS4 area Meets WQBELs	Wet	**1/11**						**1/11**	**1/11**		
					25%						**50%**	**100%**		
LAR Bacteria (Wet Weather)	All Waterbodies	E. coli	Meet WQBELs	Wet										**3/23**
Harbors Toxics	Estuary	Sediment: DDTs, PCBs, Copper, Lead, Zinc, PAHs	Meet WQBELs	All	**3/23**								**3/23**	
					Interim									
USEPA Lakes	Lake Calabasas	Total-P, Total-N	Meet WLAs	All	USEPA TMDLs, which do not contain interim milestones or implementation schedule. The Permit (Part VI.E.3.c, pg. 145) allows MS4 Permittees to propose a schedule in an EWMP.									
	Legg Lake	Total-P, Total-N	Meet WLAs	All										
	Echo Park Lake	Total-P, Total-N, Trash Water and Sediment: PCBs, Chlordane, Dieldrin	Meet WLAs	All										

[1]The Permit term is assumed to be five years from the Permit effective date or December 27, 2017.

[2]CC (Compton Creek), RH (Rio Hondo), AS (Arroyo Seco), VW (Verdugo Wash), BWC (Western Channel), TW(Tujunga Wash), ACW (Aliso Canyon Wash), MC (McCoy Canyon Creek), DC (Dry Canyon Creek), BeC (Bell Creek), and BuC (Bull Creek)

Table 3-2. Dry Weather Compliance Milestones for the LAR Bacteria TMDL Applicable to ULAR EWMP Group
(with and without the use of a Load Reduction Strategy [LRS])

Waterbodies		Compliance Dates and Compliance Milestones											
		2022	2023	2024	2025	2028	2029	2030	2031	2032	2035	2036	2037
Compton Creek	w/o LRS				3/23								
	w LRS				3/23					3/23			
					Interim								
Segment B	w/o LRS	3/23											
	w LRS	3/23				3/23							
		Interim											
Rio Hondo and Arroyo Seco	w/o LRS		3/23										
	w LRS		3/23					3/23					
			Interim										
Segment C	w/o LRS							3/23					
	w LRS							3/23					3/23
								Interim					
Tujunga Wash, Burbank Western Channel, and Verdugo Wash	w/o LRS							3/23					
	w LRS							3/23					3/23
								Interim					
Segment D	w/o LRS							3/23					
	w LRS							3/23					3/23
								Interim					

Table 3-2. Dry Weather Compliance Milestones for the LAR Bacteria TMDL Applicable to ULAR EWMP Group
(with and without the use of a Load Reduction Strategy [LRS])

Waterbodies		Compliance Dates and Compliance Milestones											
		2022	2023	2024	2025	2028	2029	2030	2031	2032	2035	2036	2037
Bull Creek	w/o LRS							3/23					
	w LRS							3/23					3/23
								Interim					
Segment E	w/o LRS				3/23								
	w LRS				3/23				3/23				
					Interim								
Dry Canyon Creek, McCoy Creek, Bell Creek, and Aliso Canyon Wash	w/o LRS						3/23						
	w LRS						3/23				3/23		
							Interim						

Table 3-3. Water Body-Pollutant Classification Categories (Permit Section IV.C.5.a.ii)

Category	Water Body-Pollutant Combinations (WBPCs) Included
1 Highest Priority	WBPCs for which TMDL WQBELs and/or RWLs are established in Part VI.E and Attachment L and O of the MS4 Permit.
2 High Priority	WBPCs for which data indicate water quality impairment in the receiving water according to the State's Listing Policy, regardless of whether the pollutant is currently on the 303(d) List and for which the MS4 discharges may be causing or contributing to the impairment.
3 Medium Priority	WBPCs for which there are insufficient data to indicate impairment in the receiving water according to the State's Listing Policy, but which exceed applicable receiving water limitations contained in the MS4 Permit and for which MS4 discharges may be causing or contributing to the exceedance.

3.1 Water Quality Characterization (Step 1)

Data were compiled to identify constituents exceeding applicable water quality objectives. Over 170,000 data records were reviewed as part of the data analysis. **Figure 3-1** presents the site locations for the data received and used for the water quality characterization process.

Applicable water quality objectives were compiled from the California Toxics Rule (CTR), the Basin Plan, and relevant TMDLs. Applicable water quality objectives from the CTR and Basin Plan were selected based on the beneficial uses identified in the Basin Plan. Generally, the water quality objectives utilized included those established for the protection of aquatic life, contact recreation and human health related to the consumption of organisms. **Appendix 3.B** presents additional details on the data analysis approach and results. Additionally, a characterization was conducted on stormwater and non-stormwater discharges from the MS4 associated with constituents identified in a TMDL, a 303(d) listing, or through the receiving water data analysis. Discharge characterization data were also reviewed and are summarized in **Appendix 3.C**.

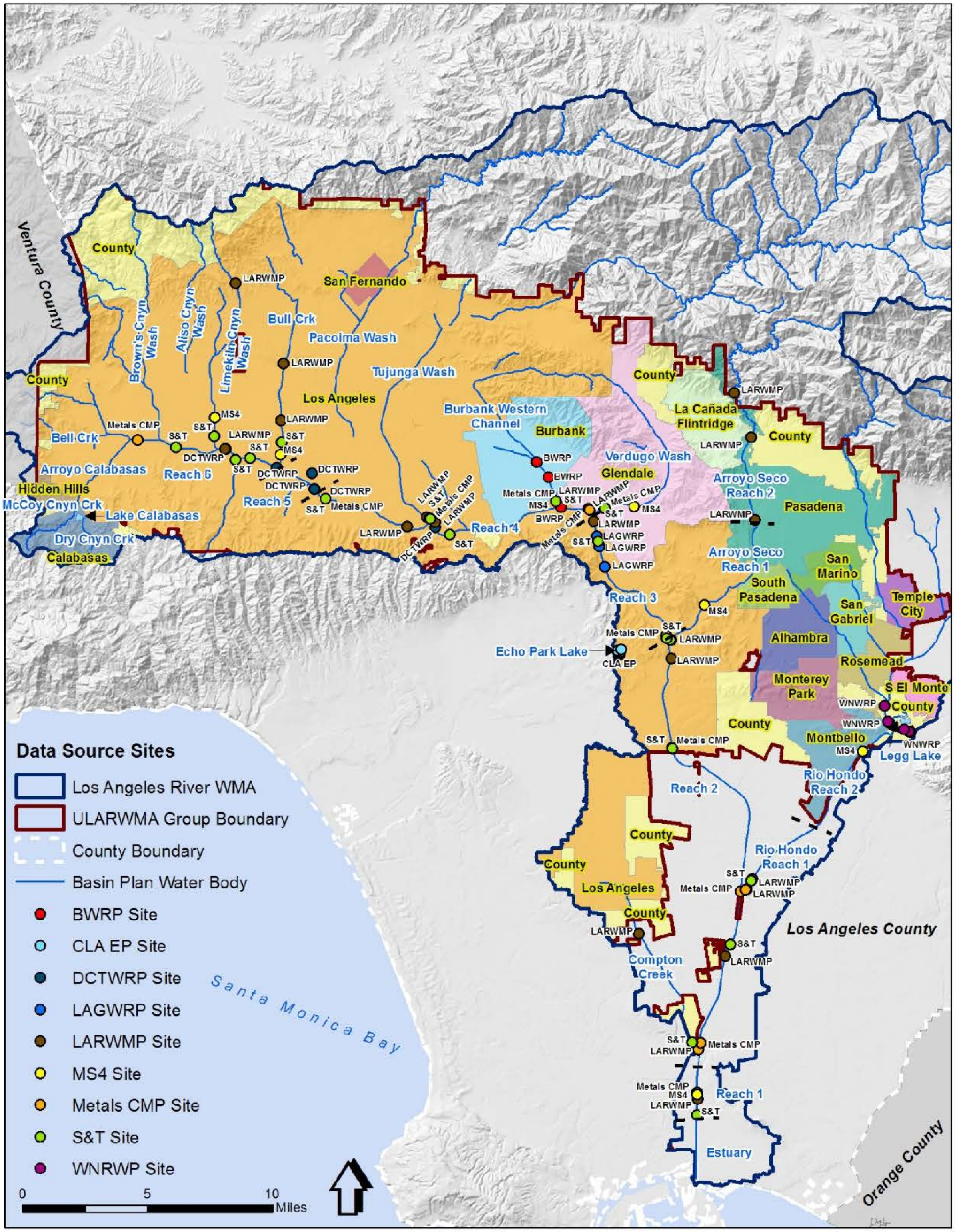

Figure 3-1. Monitoring Site Locations for Data Utilized in the Water Quality Priorities Process

BWRP = Burbank Water Reclamation Plant, CLA EP = City of LA Echo Park Lake, DCTWRP = City of LA Donald C. Tillman Water Reclamation Plan, LAWRP = LA Glendale Water Reclamation Plant, MS4 = LA County M4 Permit, Metals CMP = Metals TMDL Coordinated Monitoring Program, S&T = City of LA Status and Trends, WNWRP = LA County Sanitation District's Wittier Narrows Water Reclamation Plant.

3.2 Water Body Pollutant Classification (Step 2)

Based on available information and data analysis, WBPCs were classified in one of the three Permit categories, as described in **Table 3-1**. To further support development of the EWMP, the three Permit categories were further subdivided into *subcategories* (described in **Table 3-4**) and each WBPC was assigned to an appropriate subcategory. **Table 3-5**, **Table 3-6** and **Table 3-7** present the ULAR WMG WBPCs in Categories 1, 2 and 3 for the associated Los Angeles River mainstem, Los Angeles River Reaches 1-4 tributaries, and Los Angeles River Reaches 5 and 6 tributaries, respectively. **Table 3-8** presents a summary of the ULAR WMG WBPCs categories for Lake Calabasas, Legg Lake, and Echo Park Lake. The interim and WQBELs and RWLs for Category 1 pollutants are presented in Attachment O of the MS4 Permit. The applicable RWLs for each identified Category 2 and 3 pollutant are presented in **Appendix 3.A**. Summary tables presenting the data analysis to support the placement of WBPCs into the various subcategories are presented in **Appendix 3.B**.

Table 3-4. Details for Water Body-Pollutant Classification Subcategories

Category	WBPCs	Description
1	Category 1A: WBPCs with past due or current Permit term TMDL deadlines with exceedances in the past 5 years.	WBPCs with TMDLs with past due or current Permit term interim and/or limits. These pollutants are the highest priority for the current Permit term.
	Category 1B: WBPCs with TMDL deadlines beyond the Permit term with exceedances in the past 5 years.	The Permit does not require the prioritization of TMDL interim and/or deadlines outside of the Permit term or USEPA TMDLs, which do not have implementation schedules. To ensure EWMPs consider long term planning requirements and utilize the available compliance mechanisms, these WBPCs should be considered during BMP planning and scheduling, and during CIMP development.
	Category 1C: WBPCs addressed in USEPA TMDL without a Regional Board adopted Implementation Plan.	
	Category 1D: WBPCs with past due or current Permit term TMDL deadlines but have had no exceedances in the past 5 years.	WBPCs where specific actions may end up not being identified because recent exceedances have not been observed and specific actions may not be necessary. The CIMP should address these WBPCs to support future re-prioritization.
2	Category 2A: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements with exceedances in the past 5 years.	WBPCs with confirmed impairment or exceedances of RWLs. WBPCs in a similar class[1] as those with TMDLs are identified. WBPCs currently on the 303(d) List are differentiated from those that are not to support utilization of EWMP compliance mechanisms.
	Category 2B: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements that are not a "pollutant"[2] (e.g., toxicity).	WBPCs where specific actions may not be identifiable because the cause of the impairment or exceedances is not resolved. Either routine monitoring or special studies identified in the CIMP should support identification of a "pollutant" linked to the impairment and re-prioritization in the future.
	Category 2C: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements but there have been no exceedances in the past 5 years.	WBPCs where specific actions for implementation may end up not being identified because recent exceedances have not been observed (and thus specific BMPs may not be necessary.) Pollutants that are in a similar class[1] as those with TMDLs are identified. Either routine monitoring or special studies identified in the CIMP should ensure these WBPCs are addressed to support re-prioritization in the future.
3	Category 3A: All other WBPCs that have exceeded in the past 5 years.	Pollutants that are in a similar class[1] as those with TMDLs are identified.
	Category 3B: All other WBPCs that are not a "pollutant"[2] (e.g., toxicity).	WBPCs where specific actions may not be identifiable because the cause of the impairment or exceedances is not resolved. Either routine monitoring or special studies identified in the CIMP should support identification of a "pollutant" linked to the impairment and re-prioritization in the future.

Table 3-4. Details for Water Body-Pollutant Classification Subcategories

Category	WBPCs	Description
	Category 3C: All other WBPCs that have exceeded in the past 10 years, but not in past 5 years.	Pollutants that are in a similar class[1] as those with TMDLs are identified.

1 – Pollutants are considered in a similar class if they have similar fate and transport mechanisms, can be addressed via the same types of control measures, and within the same timeline already contemplated as part of the EWMP for the TMDL. (Permit pg. 49, footnote 21).

2 – While pollutants may be contributing to the impairment, it currently is not possible to identify the specific pollutant/stressor.

Table 3-5. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for Mainstem Reaches

Constituents	LA River						
	1	2	3 (below LAG)	3 (above LAG)	4	5	6
Category 1A: WBPCs with past due or current Permit term TMDL deadlines with exceedances in the past 5 years. (I = Interim and F = Limits)							
Cadmium Total	I (Wet)						
Copper Dissolved	I (Wet)	I (Wet)			I (Wet)	I (Dry)	I (Wet)
Copper Total	I (Wet)	I (Wet)	I (Wet)		I (Wet)	I (Dry)	
Lead Dissolved	I (Wet/Dry)	I (Wet/Dry)	I (Wet/Dry)		I (Wet/Dry)		
Lead Total	I (Wet)	I (Wet)		I (Dry)			
Zinc Dissolved	I (Wet)	I (Wet)			I (Wet)		I (Wet)
Zinc Total	I (Wet)	I (Wet)	I (Wet)		I (Wet)		I (Wet)
Trash	I/F	I/F	I/F	I/F	I/F	I/F	I/F
Sediment: DDTs, PCBs, PAHs[1]	I						
Sediment: Copper, Lead, Zinc[1]	I						
Category 1B: WBPCs with TMDL deadlines beyond the Permit term with exceedances in the past 5 years. (I = Interim and F = Limits)							
E. Coli	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)
Cadmium Total	F (Wet)						
Copper Dissolved	F (Wet)	F (Wet)			F (Wet)	F (Dry)	F (Wet)
Copper Total	F (Wet)	F (Wet)	F (Wet)		F (Wet)	F (Dry)	
Lead Dissolved	F (Wet/Dry)	F (Wet/Dry)	F (Wet/Dry)		F (Wet/Dry)		
Lead Total	F (Wet)	F (Wet)		F (Dry)			
Zinc Dissolved	F (Wet)	F (Wet)			F (Wet)		F (Wet)
Zinc Total	F (Wet)	F (Wet)	F (Wet)		F (Wet)		F (Wet)
Sediment: DDTs, PCBs, PAHs[1]	F						
Sediment: Copper, Lead, Zinc[1]	F						
Category 1C: WBPCs addressed in USEPA TMDL without a Regional Board Adopted Implementation Plan. (WLA = Waste Load Allocation in USEPA TMDL)							
None							
Category 1D: WBPCs with past due or current Permit term TMDL deadlines but have not exceeded in past 5 years.							
Cadmium Total		I (Wet NS)	I (Wet)	I (Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)
Copper Dissolved	I (Dry)	I (Dry)	I (Wet/Dry)	I (Dry/Wet NS)	I (Dry)	I (Wet NS)	I (Dry)
Copper Total	I (Dry)	I (Dry)	I (Dry)	I (Wet/Dry)	I (Dry)	I (Wet NS)	I (Wet/Dry)
Lead Dissolved				I (Dry/Wet NS)		I (Dry/Wet NS)	I (Wet/Dry)

Table 3-5. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for Mainstem Reaches

Constituents	LA River						
	1	2	3 (below LAG)	3 (above LAG)	4	5	6
Lead Total	I (Dry)	I (Dry)	I (Wet/Dry)	I (Wet)	I (Wet/Dry)	I (Dry/Wet NS)	I (Wet/Dry)
Zinc Dissolved			I (Wet)	I (Wet NS)		I (Wet NS)	
Zinc Total				I (Wet)		I (Wet NS)	
Ammonia as N	F (Dry/Wet)	F (Dry/Wet NS)	F (Dry/Wet)	F (Dry/Wet)	F (Dry/Wet)	F (Dry/Wet)	F (Dry/Wet)
Nitrate as N	F	F	F	F	F	F	F
Nitrite as N	F	F	F	F	F	F	F
Nitrogen (NO3-N+NO2-N)	F	F	F	F	F	F	F
Category 2A: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements with exceedances in the past 5 years.							
2,3,7,8-TCDD (Dioxin)			Dry				
Bis(2-ethylhexyl)Phthalate	Dry						
Diazinon						Dry	
Selenium						Dry	Dry
Chloride						Dry	Dry
Sulfate						Dry	Dry
TDS						Dry	
Cyanide	303 Dry/Wet						
Category 2B: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements that are not a "pollutant"[2] (i.e., toxicity) with exceedances in the past 5 years.							
pH	Dry	Dry					
Category 2C: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements but have not exceeded in past 5 years.							
Mercury Total	Dry	Dry/Wet (NS)	Dry	Dry	Dry/Wet (NS)		Dry
Thallium Total							Dry (NS)
TDS							Dry (NS)
Oil		Delist				Delist	
Diazinon	Wet (Delist)						
Category 3A: All other WBPCs with exceedances in the past 5 years.							
2,3,7,8-TCDD (Dioxin)			Wet	Wet			
Bis(2-ethylhexyl)Phthalate	Wet						
Diazinon					Dry		
Dibenzo(a,h)Anthracene						Dry	

Table 3-5. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for Mainstem Reaches

Constituents	LA River						
	1	2	3 (below LAG)	3 (above LAG)	4	5	6
Indeno(1,2,3-cd)Pyrene						Dry	
4,4-DDD						Dry	
4,4-DDE						Dry	
Nickel Total						Dry	
Selenium Total	Dry						
Zinc Dissolved	Dry						
Zinc Total	Dry		Dry				
Sulfate					Dry		
Cyanide					Dry	Dry	
Category 3B: All other WBPCs that are not a “pollutant”[2] (i.e., toxicity) with exceedances in the past 5 years.							
pH	Wet	Wet (NS)	Dry	Dry		Dry	
Dissolved Oxygen	Wet		Dry		Dry	Dry	Dry
Category 3C: All other WBPCs that have exceeded in the past 10 years, but not in past 5 years.							
2,3,7,8-TCDD (Dioxin)				Dry			Dry (NS)
Benzo(a)Anthracene			Dry				
Bis(2-ethylhexyl)Phthalate			Dry	Dry		Dry	
Chrysene			Dry		Dry		Dry (NS)
Dibenzo(a,h)Anthracene			Dry	Dry			
Dichlorobromomethane			Wet				
Indeno(1,2,3-cd)Pyrene			Dry	Dry			
Heptachlor						Dry	
Mercury Total	Wet		Wet	Wet		Dry	Wet (NS)
Nickel Total				Dry			
Selenium Total				Dry	Dry		
Thallium Total	Dry	Dry (NS)	Dry	Dry	Dry		
Zinc Total					Dry		
Sulfate				Dry			
TDS					Dry		
Chlorine (Total)			Dry	Dry	Dry	Dry	Dry

Table 3-5. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for Mainstem Reaches

Constituents	LA River						
	1	2	3 (below LAG)	3 (above LAG)	4	5	6
Cyanide			Dry	Dry			Dry

1 – Pollutants associated with the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL were identified as applicable to Reach 1 of the LA River as the nearest downstream receiving water segment from the EWMP area.
2 – While pollutants may be contributing to the impairment, it currently is not possible to identify the specific pollutant/stressor.
Note that unless explicitly stated as sediment, constituents are associated with the water column.
I/F = Denotes where the Permit includes interim (I) and/or (F) effluent and/or receiving water limitations.
NS = Not sampled
Dry/Wet = Weather condition was based on the designation provided by the sampling program. If no information was provided by the sampling program, flow records were reviewed and where flow was greater than 500 cubic feet per second (cfs) identified in the LA River Metals TMDL as a wet weather event, the sample was identified as a wet weather sample.
303 = WBPC on the 2010 303(d) List where the listing was confirmed during data analysis.
Delist = WBPC on the 2010 303(d) List that meets the delisting requirements.

Table 3-6. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for LA River Reaches 1-4 Tributaries

Constituents	Compton Creek	Rio Hondo			Arroyo Seco	Verdugo Wash	Burbank Western Channel	Tujunga Wash
		1	2	3				
Category 1A: WBPCs with past due or current Permit term TMDL deadlines with exceedances in the past 5 years.								
Copper Dissolved		I (Dry)					I (Dry)	I (Dry)
Copper Total	I (Dry)	I (Dry)				I (Wet) NS)	I (Dry)	I (Dry)
Lead Dissolved		I (Dry)			I (Wet/Dry)			
Lead Total	I (Dry)	I (Dry)						I (Dry)
Zinc Total		I (Dry)						
Ammonia as N								F (Dry)
Nitrate as N							F (Dry)	
Nitrite as N					F (Dry)		F (Dry)	
Trash	I/F	I/F	I/F		I/F	I/F	I/F	I/F
Category 1B: WBPCs with TMDL deadlines beyond the Permit term with exceedances in the past 5 years.								
E. Coli	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)
Copper Dissolved		F (Dry)					F (Dry)	F (Dry)
Copper Total	F (Dry)	F (Dry)				F (Wet) NS)	F (Dry)	F (Dry)
Lead Dissolved		F (Dry)			F (Wet/Dry)			
Lead Total	F (Dry)	F (Dry)						F (Dry)
Zinc Dissolved								
Zinc Total		F (Dry)						
Category 1C: WBPCs addressed in USEPA TMDL without a Regional Board Adopted Implementation Plan. (WLA = Waste Load Allocation in USEPA TMDL)								
None								
Category 1D: WBPCs with past due or current Permit term TMDL deadlines but have not exceeded in past 5 years.								
Cadmium Total	I (Wet NS)	I (Wet NS)	I (Wet NS)		I (Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)
Copper Dissolved	I (Dry/Wet NS)	I (Wet NS)	I (NS)		I (Wet/Dry)	I (Wet)/(Dry NS)	I (Wet NS)	I (Wet NS)
Copper Total	I (Wet NS)	I (Wet NS)	I (NS)		I (Wet/Dry)	I (Dry NS)	I (Wet NS)	I (Wet NS)
Lead Dissolved	I (Dry/Wet NS)	I (Wet NS)	I (NS)			I (Wet/Dry NS)	I (Dry/Wet NS)	I (Dry)/Wet NS)

Table 3-6. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for LA River Reaches 1-4 Tributaries

Constituents	Compton Creek	Rio Hondo			Arroyo Seco	Verdugo Wash	Burbank Western Channel	Tujunga Wash
		1	2	3				
Lead Total	I (Wet NS)	I (Wet NS)	I (NS)		I (Wet/Dry)	I (Wet/Dry NS)	I (Dry/Wet NS)	I (Wet NS)
Zinc Dissolved	I (Wet NS)	I (Dry/Wet NS)	I (Wet NS)		I (Wet)	I (Wet)	I (Wet NS)	I (Wet NS)
Zinc Total	I (Wet NS)	I (Wet NS)	I (Wet NS)		I (Wet)	I (Wet)	I (Wet NS)	I (Wet NS)
Ammonia as N	F (Dry/Wet NS)	F (Dry/Wet NS)	F (NS)		F (Dry/Wet NS)	F (NS)	F (NS)	F (Wet NS)
Nitrate as N	F	F	F (NS)		F	F (NS)	F (Wet)	F
Nitrite as N	F	F	F (NS)		F (Wet NS)	F (NS)	F (Wet)	F
Nitrogen (NO3-N+NO2-N)	F	F	F (NS)		F	F (NS)	F	F
Category 2A: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements with exceedances in the past 5 years.								
2,3,7,8-TCDD (Dioxin)							Dry	
Bis(2-ethylhexyl)Phthalate							Dry	
Chlorodibromomethane							Dry	
Chloride								Dry
Copper Total				Dry				
Cyanide			303 Dry (NS)					
Category 2B: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements that are not a “pollutant”[1] (i.e., toxicity) with exceedances in the past 5 years.								
Benthic-Macroinvertebrates	303				303			
Dissolved Oxygen				Dry				
pH				Dry				
Category 2C: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements but have not exceeded in past 5 years.								
Bis(2-ethylhexyl)Phthalate			Dry /Wet (NS)		Wet (NS)	Dry/Wet (NS)	Wet (NS)	
Selenium Total							Delist	
Chlorine (Total)							Wet	
Cyanide							Delist	
Category 3A: All other WBPCs with exceedances in the past 5 years.								
Benzo(a)Pyrene				Dry			Dry	
Benzo(b)Fluoranthene							Dry	

Table 3-6. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for LA River Reaches 1-4 Tributaries

Constituents	Compton Creek	Rio Hondo			Arroyo Seco	Verdugo Wash	Burbank Western Channel	Tujunga Wash
		1	2	3				
Benzo(k)Fluoranthene				Dry				
Chrysene				Dry				
Diazinon				Dry				
Dibenzo(a,h)Anthracene				Dry				
Indeno(1,2,3-cd)Pyrene				Dry				
Chlorpyrifos	Dry							
Mercury Total							Dry	
Zinc Total								Dry
Chloride	Dry						Dry	
TDS							Dry	Dry
Chlorine (Total)							Dry	
Category 3B: All other WBPCs that are not a "pollutant"[1] (i.e., toxicity) with exceedances in the past 5 years.								
pH			Dry (NS)/Wet (NS)				Dry/Wet (NS)	
Category 3C: All other WBPCs that have exceeded in the past 10 years, but not in past 5 years.								
beta-BHC							Dry	
Bis(2-ethylhexyl)Phthalate					Dry (NS)			
Diazinon			Wet (NS)					
Heptachlor							Dry	
Cadmium Total							Dry	Dry
Copper Dissolved			Dry (NS)					
Copper Total			Dry (NS)					
Lead Total			Dry (NS)					
Mercury Total	Dry/Wet (NS)			Dry	Wet (NS)	Wet (NS)	Wet (NS)	Dry
Thallium Total							Dry	
Zinc Total						Dry (NS)	Dry	
Chloride				Dry				

1 – While pollutants may be contributing to the impairment, it currently is not possible to identify the specific pollutant/stressor.
I/F = Denotes where the Permit includes interim (I) and/or (F) effluent and/or receiving water limitations.
NS = Not sampled
Dry/Wet = Weather condition was based on the designation provided by the sampling program. If no information was provided by the sampling program, flow records were reviewed and where flow was greater than 500 cubic feet per second (cfs) identified in the LA River Metals TMDL as a wet weather event, the sample was identified as a wet weather sample.
303 = WBPC on the 2010 303(d) List where the listing was confirmed during data analysis.
Delist = WBPC on the 2010 303(d) List that meets the delisting requirements.

Table 3-7. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for LA River Reaches 5 and 6 Tributaries

Constituents	Bell Creek	Bull Creek	Caballero Creek	Aliso Canyon Wash	McCoy Canyon	Dry Canyon
Category 1A: WBPCs with past due or current Permit term TMDL deadlines with exceedances in the past 5 years.						
Trash	I/F	I/F	I/F	I/F	I/F	I/F
Category 1B: WBPCs with TMDL deadlines beyond the Permit term with exceedances in the past 5 years.						
E. Coli	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)	I/F (Wet/Dry)
Category 1C: WBPCs addressed in USEPA TMDL without a Regional Board Adopted Implementation Plan. (WLA = Waste Load Allocation in USEPA TMDL)						
None						
Category 1D: WBPCs with past due or current Permit term TMDL deadlines but have not exceeded in past 5 years.						
Cadmium Total	I (Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)
Copper Dissolved	I (NS)	I (Dry/Wet NS)	I (NS)	I (Dry)/(Wet NS)	I (NS)	I (NS)
Copper Total	I (NS)	I (Dry/Wet NS)	I (NS)	I (Dry)/(Wet NS)	I (NS)	I (NS)
Lead Dissolved	I (NS)	I (Dry/Wet NS)	I (NS)	I (Dry/Wet NS)	I (NS)	I (NS)
Lead Total	I (NS)	I (Dry/Wet NS)	I (NS)	I (Dry/Wet NS)	I (NS)	I (NS)
Zinc Dissolved	I (Wet NS)	I (Dry/Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)
Zinc Total	I (Wet NS)	I (Dry)/(Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)	I (Wet NS)
Ammonia as N	F (NS)	F (Dry/Wet NS)	F (NS)	F (Dry/Wet NS)	F (NS)	F (NS)
Nitrate as N	F (NS)	F	F (NS)	F	F (NS)	F (NS)
Nitrite as N	F (NS)	F	F (NS)	F	F (NS)	F (NS)
Nitrogen (NO3-N+NO2-N)	F (NS)	F	F (NS)	F	F (NS)	F (NS)
Category 2A: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements with exceedances in the past 5 years.						
None						
Category 2B: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements that are not a "pollutant"[1] (i.e., toxicity) with exceedances in the past 5 years.						
None						
Category 2C: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements but have not exceeded in past 5 years.						
Bis(2-ethylhexyl)Phthalate		Dry (NS)/Wet		Dry (NS)/Wet		
Selenium Total			Dry (NS)	Dry		
Category 3A: All other WBPCs with exceedances in the past 5 years.						
Sulfate				Dry		
TDS				Dry		
Category 3B: All other WBPCs that are not a "pollutant"[1] (i.e., toxicity) with exceedances in the past 5 years.						
None						

Table 3-7. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories for LA River Reaches 5 and 6 Tributaries

Constituents	Bell Creek	Bull Creek	Caballero Creek	Aliso Canyon Wash	McCoy Canyon	Dry Canyon
Category 3C: All other WBPCs that have exceeded in the past 10 years, but not in past 5 years.						
Diazinon				Wet (NS)		
Cadmium Total			Dry (NS)			
Copper Total			Dry (NS)			
Lead Total			Dry (NS)			
Mercury Total			Dry (NS)			
Nickel Total			Dry (NS)			
Zinc Total			Dry (NS)			
Cyanide		Wet (NS)		Wet (NS)		

1 – While pollutants may be contributing to the impairment, it currently is not possible to identify the specific pollutant/stressor.
I/F = Denotes where the Permit includes interim (I) and/or (F) effluent and/or receiving water limitations.
NS = Not sampled
Dry/Wet = Weather condition was based on the designation provided by the sampling program. If no information was provided by the sampling program, flow records were reviewed and where flow was greater than 500 cubic feet per second (cfs) identified in the LA River Metals TMDL as a wet weather event, the sample was identified as a wet weather sample.
303 = WBPC on the 2010 303(d) List where the listing was confirmed during data analysis.
Delist = WBPC on the 2010 303(d) List that meets the delisting requirements.

Table 3-8. Summary of Upper Los Angeles River WMA Water Body-Pollutant Categories Associated with Lakes

Constituent	Lake		
	Legg	Calabasas	Echo Park
Category 1A: WBPCs with past due or current Permit term TMDL deadlines with exceedances in the past 5 years.			
Trash	I/F	--	--
Category 1C: WBPCs addressed in USEPA TMDL without a Regional Board Adopted Implementation Plan.			
Total-P	X	X	X
Total-N	X	X	X
Trash	--	--	X
PCBs (water and sediment)	--	--	X
Chlordane (water and sediment)	--	--	X
Dieldrin (water and sediment)	--	--	X

I/F – Denotes where the Permit includes interim (I) and/or (F) limitations.
Note that unless explicitly stated as sediment, constituents are associated with the water column

3.3 Source Assessment (Step 3)

Following classification of WPBCs into Category 1, 2 and 3, the next step in the prioritization process is to conduct a source assessment. The Permit requires that a source assessment be conducted to identify potential sources within the watershed for the WBPCs in Categories 1-3, utilizing existing information. The source assessment also evaluates whether pollutants likely originate from the MS4 versus other sources. Pollutant exceedances may come from point or non-point sources, described below. Often, however, non-point source discharges may flow through the MS4 and thus become associated with the MS4 and subject to the MS4 Permit requirements. A detailed source assessment for the ULAR watershed is provided in **Appendix 3.D**.

3.4 Prioritization (Step 4)

The Permit outlines a prioritization process that defines how pollutants in the various categories will be considered in scheduling. The factors to consider in the scheduling include the following based on the compliance approaches outlined in the Permit:

- Regional Board-adopted TMDLs with past due interim and/or limits and those with interim and/or limits within the Permit term (schedule according to TMDL schedule)
- Regional Board-adopted TMDLs with interim and/or limits outside the Permit term (schedule according to TMDL schedule)
- Other receiving water exceedances.

USEPA TMDLs, 303(d) listings without a TMDL adopted, and other exceedances of RWLs do not contain milestones or an implementation schedule. As such, these Water Quality Priorities do not have a defined schedule for attainment/implementation. To address this issue for USEPA TMDLs, Part VI.E.3.c of the Permit (page 145) allows MS4 Permittees to propose a schedule in the EWMP. To address this issue for exceedances of RWLs associated with WBPCs not addressed through a TMDL (i.e., 303(d) listings and other exceedances of RWLs), Part VI.C.2.a of the Permit (page 49) specifies how interim numeric milestones and compliance schedules must be set for each WBPC based on its placement in one of the following groups that were developed as part of the EWMP:

- **Group 1**: Pollutants that are in the same class[6] as those addressed in a TMDL in the watershed and for which the water body is identified as impaired on the 303(d) List as of December 28, 2012;
- **Group 2**: Pollutants that are not in the same class as those addressed in a TMDL for the watershed, but for which the water body is identified as impaired on the 303(d) List as of December 28, 2012;
- **Group 3**: Pollutants for which there are exceedances of RWLs, but for which the water body is not identified as impaired on the 303(d) List as of December 28, 2012; or
- **USEPA TMDL**: Pollutants addressed by USEPA TMDL without an implementation plan/schedule.

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[6] As defined in Part VI.C.2.a.i of the Permit (page 49), "Pollutants are considered in a similar class if they have similar fate and transport mechanisms, can be addressed via the same types of control measures, and within the same timeline already contemplated as part of the Watershed Management Program for the TMDL."

The process for setting numeric milestones and compliance schedules for the remaining Water Quality Priorities (those not addressed by a Regional Board-adopted TMDL) is dependent upon whether or not the water body is identified as impaired on the 303(d) list as of December 28, 2012, and if the pollutants are considered to be in the same class as those pollutants addressed in a TMDL for the watershed. A detailed description of the prioritization process and outcomes for the ULAR watershed is provided in **Appendix 3.A**.

3.5 Numeric Milestones and Compliance Schedule

Part VI.C.5.c of the Permit discusses the compliance schedule requirements associated with the EWMP. The compliance schedule for the ULAR EWMP was developed based on TMDL milestones (i.e., interim and numeric limits) and other representative Regional Board adopted TMDLs where appropriate (i.e., for the lakes addressed by USEPA TMDLs). Interim and compliance dates in the LARWQCB adopted TMDLs are the primary drivers for the ULAR RAA and EWMP implementation schedule (presented in **Table 3-1**). **Table 3-13** presents the compliance schedule for USEPA TMDLs, 303(d) listings, and other RWL exceedances which fall under Category 1 and Category 2. For simplicity, only the year of each milestone is shown; however, the exact date remains consistent with the milestone dates included in the relevant LARWQCB adopted TMDL (presented in **Table 3-1**).

Category 2 WBPCs that meet the requirements to be removed from the 303(d) List and Category 3 WBPCs are the lowest priority given their relatively low exceedance frequency. However, for these WBPCs, where MS4 discharges may have caused or contributed to the exceedances, a schedule has been established to support continual attainment of the RWLs. The interim and schedule milestones are based on the dry and wet weather schedule for the LA River Metals TMDL. The dry and wet weather Category 3 WBPCs milestones are January 11, 2024 and January 11, 2028, respectively. **Table 3-14** presents the compliance schedule for the Category 2 WBPCs that meet the requirements to be removed from the 303(d) List and Category 3 WBPCs. **Table 3-15** presents the list of the remaining Category 2 and 3 WBPCs where either MS4 discharges are not considered to be a source or the WBPC is a condition rather than a "pollutant" with the potential to be discharged from the MS4. Available data will be assessed and if the MS4 discharges are identified as causing or contributing to exceedances for WBPCs identified in **Table 3-15,** the EWMP will be revised consistent with Part VI.c.2.a.iii (page 51) of the Permit.

A detailed description of the process and outcomes for identifying the numeric milestones and compliance schedule for the ULAR watershed is provided in **Appendix 3.A**.

Table 3-13. Compliance Schedule for Category 1 and 2 Water Quality Priorities that are not Included in a Regional Board Adopted TMDL

Constituent	WQP Category and Water Body	Compliance Schedule Source	Weather Condition	Compliance Dates and Compliance Milestones (Bolded numbers indicated milestone deadlines within the current Permit term)[1, 2]									
				2013	2014	2015	2016	2019	2020	2024	2028	2032	2037
2,3,7,8-TCDD (Dioxin)	C2: Reach 3 C2: Burbank Western Channel	LAR Metals TMDL	Dry						75%	100%			
			Wet							50%	100%		
Mercury Total	C2: LAR Reach 1 C2: LAR Reach 2 C2: LAR Reach 3 C2: LAR Reach 4 C2: LAR Reach 6	LAR Metals TMDL	Dry						75%	100%			
			Wet							50%	100%		
Copper	C2: RH Reach 3	LAR Metals TMDL	Dry						75%	100%			
			Wet							50%	100%		
Thallium Total	C2: LAR Reach 6	LAR Metals TMDL	Dry						75%	100%			
Diazinon	C2: Reach 5	Harbors Toxics	All										
Total Phosphorus	C1 (USEPA): Legg Lake C1 (USEPA): Lake Calabasas C1 (USEPA): Echo Park Lake	Machado Lake Nutrient TMDL	All			**Base-line**	**Interim**		50%	100%			
Total Nitrogen	C1 (USEPA): Legg Lake C1 (USEPA): Lake Calabasas C1 (USEPA): Echo Park Lake	Machado Lake Nutrient TMDL	All			**Base-line**	**Interim**		50%	100%			
Trash	C1 (USEPA): Echo Park Lake	LAR Trash TMDL	All	**80%**	**90%**	**96.7%**	**100%**						
PCBs (water and sediment)	C1 (USEPA): Echo Park Lake	Machado Lake Toxics TMDL	All				**Interim**						
Chlordane (water and sediment)	C1 (USEPA): Echo Park Lake	Machado Lake Toxics TMDL	All				**Interim**						
Dieldrin (water and sediment)	C1 (USEPA): Echo Park Lake	Machado Lake Toxics TMDL	All				**Interim**						

[1]The Permit term is assumed to be five years from the Permit effective date or December 27, 2017.

[2] Attainment of the percentages may be demonstrated either as a reduction in exceedance frequency at time of EWMP approval or percent area meeting the RWL. In the case of the USEPA adopted TMDLs attainment will can be demonstrated through reduction from the baseline at the time of TMDL promulgation or percent area meeting the WQBEL or RWL.

Table 3-14. Compliance Schedule based on the LA River Metals TMDL for Category 2 and 3 Water Quality Priorities that Do Not Meet the 303(d) Listing Requirements

Constituent	WQP Category and Water Body	Weather Condition	Dry Weather Schedule		Wet Weather Schedule		Notes
			Interim		Interim		
			2020	2024	2024	2028	
2,3,7,8-TCDD (Dioxin)	C3: LAR Reach 6	Dry	75%	100%			Only 1 of 4 exceedances in last 10 years in LAR Reach 6
Mercury Total	C3 (Dry): LAR Reach 5 C3 (Dry/Wet): CC C3 (Dry): RH Reach 3 C3 (Wet): AS C3 (Wet): VW C3 (Dry/Wet): BWC C3 (Dry): TW C3 (Dry): Caballero Creek	Dry/Wet	75%	100%	50%	100%	Only 6 of 156 exceedances in last 10 years in LAR Reach 5, 1 of 16 exceedances in last 10 years in CC during dry weather, 1 of 2 exceedances in last 10 years in CC during wet weather, 2 of 74 exceedances in last 10 years in RH Reach 3, 1 of 6 exceedances in last 10 years in AS, 1 of 6 exceedances in last 10 years in VW, 17 of 244 exceedances in last 10 years in BWC during dry weather, 1 of 7 exceedances in last 10 years in BWC during wet weather, 1 of 15 exceedances in last 10 years in TW, and 1 of 12 exceedances in last 10 years in Caballero Creek
Thallium Total	C3: LAR Reach 1 C3: LAR Reach 2 C3: LAR Reach 3 C3: LAR Reach 4 C3: BWC	Dry	75%	100%			Only 3 of 91 exceedances in last 10 years in LAR Reach 1, 2 of 112 exceedances in last 10 years in LAR Reach 2, 4 of 177 exceedances in last 10 years in LAR Reach 3, 2 of 128 exceedances in last 10 years in LAR Reach 4, and 1 of 61 exceedances in last 10 years in BWC
Dibenzo(a,h) Anthracene	C3: LAR Reach 3 C3: LAR Reach 5 C3: RH Reach 3	Dry	75%	100%			Only 8 of 122 exceedances in last 10 years in LAR Reach 3, 1 of 75 exceedances in last 10 years in LAR Reach 5, and 2 of 43 exceedances in last 10 years in RH Reach 3
Indeno(1,2,3-cd)Pyrene	C3: LAR Reach 3 C3: LAR Reach 5 C3: RH Reach 3	Dry	75%	100%			Only 3 of 56 exceedances in last 10 years in LAR Reach 3, 1 of 75 exceedances in last 10 years in LAR Reach 5, and 1 of 36 exceedances in last 10 years in RH Reach 3
4,4-DDD	C3: LAR Reach 5	Dry	75%	100%			Only 2 of 72 exceedances in last 10 years in LAR Reach 5
4,4-DDE	C3: LAR Reach 5	Dry	75%	100%			Only 4 of 72 exceedances in last 10 years in LAR Reach 5
Nickel	C3: LAR Reach 3 C3: LAR Reach 5 C3: Caballero Creek	Dry	75%	100%			Only 2 of 140 exceedances in last 10 years in LAR Reach 3, 1 of 72 exceedances in last 10 years in LAR Reach 5, and 1 of 41 exceedances in last 10 years in Caballero Creek
Benzo(a)Anthracene	C3: LAR Reach 3	Dry	75%	100%			Only 1 of 75 exceedances in last 10 years in LAR Reach 3

Table 3-14. Compliance Schedule based on the LA River Metals TMDL for Category 2 and 3 Water Quality Priorities that Do Not Meet the 303(d) Listing Requirements

Constituent	WQP Category and Water Body	Weather Condition	Dry Weather Schedule		Wet Weather Schedule		Notes
			Interim		Interim		
			2020	2024	2024	2028	
Chrysene	C3: LAR Reach 3 C3: LAR Reach 4 C3: LAR Reach 6 C3: RH Reach 3	Dry	75%	100%			Only 1 of 75 exceedances in last 10 years in LAR Reach 3, 1 of 38 exceedances in last 10 years in LAR Reach 4, 1 of 15 exceedances in last 10 years in LAR Reach 6, and 1 of 43 exceedances in last 10 years in RH Reach 3
Heptachlor	C3: LAR Reach 5 C3: BWC	Dry	75%	100%			Only 2 of 72 exceedances in last 10 years in LAR Reach 5 and 1 of 131 exceedances in last 10 years in BWC
Copper[4]	C3: RH Reach 2 C3: Caballero Creek	Dry	75%	100%			Only 1 of 2 exceedances in last 10 years in RH Reach 2 and 4 of 41 exceedances in last 10 years in Caballero Creek
Benzo(a)Pyrene	C3: RH Reach 3 C3: BWC	Dry	75%	100%			Only 1 of 43 exceedances in last 10 years in RH Reach 3 and 2 of 137 exceedances in last 10 years in BWC
Benzo(b)Fluoranthene	C3: BWC	Dry	75%	100%			Only 5 of 135 exceedances in last 10 years in BWC
Benzo(k)Fluoranthene	C3: RH Reach 3	Dry	75%	100%			Only 1 of 43 exceedances in last 10 years in RH Reach 3
Chlorpyrifos	C3: CC	Dry	75%	100%			Only 1 of 4 exceedances in last 10 years in CC
beta-BHC	C3: BWC	Dry	75%	100%			Only 1 of 131 exceedances in last 10 years in BWC
Cadmium	C3: BWC C3: TW C3: Caballero Creek	Dry	75%	100%			Only 1 of 298 exceedances in last 10 years in BWC, 1 of 38 exceedances in last 10 years in TW, and 2 of 41 exceedances in last 10 years in Caballero Creek
Lead[4]	C3: RH Reach 2 C3: Caballero Creek	Dry	75%	100%			Only 1 of 2 exceedances in last 10 years in RH Reach 2 and 2 of 41 exceedances in last 10 years in Caballero Creek
Zinc[3]	C3: LAR Reach 1	Dry	75%	100%			Meets criteria to de-list for dry weather impairment[2] and wet weather impairment is being addressed by the LAR Metals TMDL
	C3: LAR Reach 3 C3: LAR Reach 4 C3: VW C3: BWC C3:TW C3: Caballero Creek	Dry	75%	100%			Only 7 of 415 exceedances in last 10 years in LAR Reach 3, 1 of 284 exceedances in last 10 years in LAR Reach 4, 1 of 41 exceedances in last 10 years in VW, 2 of 321 exceedances in last 10 years in BWC, 4 of 70 exceedances in last 10 years in TW, and 2 of 41 exceedances in last 10 years in Caballero Creek
Diazinon	C2: LAR Reach 1	Wet			50%	100%	Meets criteria to de-list

Table 3-14. Compliance Schedule based on the LA River Metals TMDL for Category 2 and 3 Water Quality Priorities that Do Not Meet the 303(d) Listing Requirements

Constituent	WQP Category and Water Body	Weather Condition	Dry Weather Schedule		Wet Weather Schedule		Notes
			Interim		Interim		
			2020	2024	2024	2028	
	C3 (Dry): LAR Reach 4 C3 (Wet): RH Reach 2 C3 (Dry): RH Reach 3 C3 (Wet): ACW	Dry/Wet	75%	100%	50%	100%	Only 1 of 7 exceedances in last 10 years in LAR Reach 4, 1 of 4 exceedances in last 10 years in RH Reach 2, 3 of 60 exceedances in last 10 years in RH Reach 3, and 1 of 4 exceedances in last 10 years in ACW

1 – CC (Compton Creek), RH (Rio Hondo), AS (Arroyo Seco), VW (Verdugo Wash), BWC (Burbank Western Channel), TW(Tujunga Wash), ACW (Aliso Canyon Wash), MC (McCoy Canyon Creek), DC (Dry Canyon Creek), BeC (Bell Creek), and BuC (Bull Creek)

2 –Attainment of the percentages may be demonstrated either as a reduction in exceedance frequency at time of EWMP approval or percent area meeting the RWL.

3 – The LAR Metals TMDL states that "Dry-weather impairments related to zinc only occur in Rio Hondo Reach 1". As a result, dry weather impairments related to zinc in other water bodies are not addressed by the Regional Board adopted TMDL and are, therefore, addressed by this EWMP.

4 – The LAR Metals TMDL does not address dry weather impairments related to copper or lead in Rio Hondo Reach 2, Rio Hondo Reach 3, or Caballero Creek.

Table 3-15. Water Quality Priorities where either MS4 discharges are not Considered to be a Source or the Water Body Pollutant Combination is a Condition Rather than a "pollutant" with the Potential to be Discharged from the MS4[1]

Constituent	WQP Category and Water Body	Weather Condition	Notes
Chloride	C2: LAR Reach 5 C2: LAR Reach 6 C3: CC C3: RH Reach 3 C3: BWC C2: TW	Dry	MS4 determined to not be a source that may be causing or contributing to observed exceedances (determined to be a natural source, per Source Assessment). [2]
Cyanide	C2: LAR Reach 1 C2: RH Reach 2	All	MS4 determined to not be a source that may be causing or contributing to observed exceedances (known to have potential laboratory analysis quality assurance/quality control issues). [2]
	C2: BWC	Dry	
	C3 (Dry): LAR Reach 3 C3 (Dry): LAR Reach 4 C3 (Dry): LAR Reach 5 C3 (Dry): LAR Reach 6 C3 (Wet): BuC C3 (Wet): ACW	Dry/Wet	

Table 3-15. Water Quality Priorities where either MS4 discharges are not Considered to be a Source or the Water Body Pollutant Combination is a Condition Rather than a "pollutant" with the Potential to be Discharged from the MS4[1]

Constituent	WQP Category and Water Body	Weather Condition	Notes
Sulfate	C3: LAR Reach 3 C3: LAR Reach 4 C2: LAR Reach 5 C2: LAR Reach 6 C3: ACW	Dry	MS4 determined to not be a source that may be causing or contributing to observed exceedances (determined to be a natural source, per Source Assessment). [2]
TDS	C3: LAR Reach 4 C2: LAR Reach 5 C2: LAR Reach 6 C3: BWC C3: TW C3: ACW	Dry	MS4 determined to not be a source that may be causing or contributing to observed exceedances (determined to be a natural source, per Source Assessment). [2]
Bis(2-ethylhexyl)Phthalate	C2: LAR Reach 1 C2: RH Reach 2 C2: AS C2: VW C2: BWC C2: BuC C2: ACW C3: LAR Reach 3 C3: LAR Reach 5	Dry/Wet	MS4 determined to not be a source that may be causing or contributing to observed exceedances (known to have potential laboratory analysis quality assurance/quality control issues). [2]
Oil	C2: LAR Reach 2 C2: LAR Reach 5	Dry/Wet	MS4 determined to not be a source that may be causing or contributing to observed exceedances (determined to be a natural source, as described in Appendix 3.B) [2]
Chlorine (Total)	C3: LAR Reach 3 C3: LAR Reach 4 C3: LAR Reach 5 C3: LAR Reach 6 C2: BWC	Dry/Wet	MS4 determined to not be a source that may be causing or contributing to observed exceedances (water reclamation plant effluent is identified source). [2]
Dichlorobromomethane	C3: LAR Reach 3	Dry/Wet	MS4 determined to not be a source that may be causing or contributing to observed exceedances (water reclamation plant effluent is identified source). [2]
Chlorodibromomethane	C3: BWC	Dry/Wet	MS4 determined to not be a source that may be causing or contributing to observed exceedances (water reclamation plant effluent is identified source). [2]
Selenium	C3: LAR Reach 1 C3: LAR Reach 3 C3: LAR Reach 4 C2: LAR Reach 5	Dry/Wet	MS4 determined to not be a source that may be causing or contributing to observed exceedances. As noted in the LAR Metals TMDL, selenium originates from natural sources. [2]

Table 3-15. Water Quality Priorities where either MS4 discharges are not Considered to be a Source or the Water Body Pollutant Combination is a Condition Rather than a "pollutant" with the Potential to be Discharged from the MS4[1]

Constituent	WQP Category and Water Body	Weather Condition	Notes
	C2: LAR Reach 6 C2: BWC C2: Caballero Creek C2: ACW		
pH	C2: LAR Reach 1 C2: LAR Reach 2 C3: LAR Reach 3 C3: LAR Reach 5 C2: LAR Reach 6 C3: RH Reach 2 C2: RH Reach 3 C3: BWC	Dry/Wet	Reflective of a condition of pollution, not necessarily a result of MS4 discharge.
Dissolved Oxygen	C3: LAR Reach 1 C3: LAR Reach 3 C3: LAR Reach 5 C3: LAR Reach 6 C2: RH Reach 3	Dry/Wet	Reflective of a condition of pollution, not necessarily a result of MS4 discharge.
Benthic-Macroinvertebrates	C2: CC C2: AS	Dry	Reflective of a condition of pollution, not necessarily a result of MS4 discharge.

1 – CC (Compton Creek), RH (Rio Hondo), AS (Arroyo Seco), VW (Verdugo Wash), BWC (Burbank Western Channel), TW(Tujunga Wash), ACW (Aliso Canyon Wash), MC (McCoy Canyon Creek), DC (Dry Canyon Creek), BeC (Bell Creek), and BuC (Bull Creek).

2 – Available data will be assessed to determine if MS4 discharges are causing or contributing to exceedances.

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Section 4
Overview of EWMP Control Measures: Regional Projects and Integration with Related Planning Efforts

The Permit places heavy emphasis on regional projects as multi-benefit components of the EWMP[7]. This section provides an overview of the benefits and role of regional projects in the EWMP and the detailed screening and analysis process used to prioritize regional project opportunities in the ULAR watershed. In addition, this section highlights *signature* regional projects that have been evaluated through detailed conceptual level designs by each of the EWMP Group members. This section also describes how the EWMP can be integrated with efforts underway by many other organizations to increase water supplies and make the river more safe, accessible, healthy and beautiful (e.g., the LA River Ecosystem Restoration Feasibility Study and the Stormwater Capture Master Plan). This section provides a high-level summary while the details of the EWMP Implementation Strategy and RAA results are provided in later sections of the EWMP. A separate overview of green infrastructure and institutional control measures is provided in Section 5.

4.1 What are the Benefits of Regional Projects?

Regional projects are centralized facilities located near the downstream ends of large drainage areas (typically treating 10s to 100s of acres). Regional projects receive large volumes of runoff from extensive upstream areas and can provide a cost-effective mechanism for infiltration and pollutant reduction. Runoff is typically diverted to regional projects after it has already entered storm drains and engineered channels. Routing offsite runoff to public parcels (versus treating surface runoff near its source, as with green streets and LID) often allows regional BMPs to be placed in cost-effective locations with the best available BMP opportunity. The regional project program will consider the interactions between BMPs and their environmental factors as well as synergies and integration with concurrent drinking water, wastewater, and other engineering programs.

Regional BMP Program Highlights:

- Implements large-scale BMPs on parcels
- High potential for significant load reduction
- Strategic selection of sites can yield cost savings
- Multi-benefits include water supply augmentation
- Integration with park enhancements key for funding
- Acquisition of parcels likely needed in the future

It is important to emphasize that regional projects offer a variety of benefits beyond simply water quality improvement. Other benefits may include water supply augmentation, community enhancement, and habitat restoration. The ability to meet many needs with a single project makes regional projects attractive from a water quality efficiency standpoint and also provides significant opportunity to showcase the potential community-wide benefits of stormwater capture projects. These opportunities can be used to educate the public about the value of

[7] For example, the compliance determination of the Permit specifies that retention of the stormwater volume associated with the 85th percentile, 24-hour storm (design storm) achieves compliance with TMDL RWLs and WQBELs for upstream areas.

the EWMP effort, generate funding interest, and make significant progress toward multi-agency objectives (e.g., park improvements, flood control facility rehabilitation, etc.).

Regional projects can provide many other amenities to the community, including the following:

- Development and/or improvement of park facilities promote recreation and enhances accessibility. Underground systems can allow the beneficial use of a site to be maintained while simultaneously managing stormwater.
- Where conditions restrict infiltration, runoff can be captured, stored, and used to offset potable water use for activities like toilet flushing and irrigation.
- Naturalized systems like infiltration basins and stormwater wetlands can enhance plant and bird habitat and allow educational opportunities through the creation of "outdoor classrooms."

Given these multi-benefit attributes, the EWMP development process placed special emphasis on regional project selection.

4.2 What Types of Regional Projects are Included in the EWMP?

A wide array of regional project types were considered for inclusion in the EWMP Implementation Strategy. **Appendix 4.A** includes a series of example "BMP fact sheets" that present the different types of regional projects, including the following (illustrated in **Figure 4-1**):

- Surface infiltration basin,
- Subsurface infiltration gallery
- Surface detention basin,
- Subsurface detention gallery, and
- Constructed wetland, flow-through/linear wetland

Through detailed screening processes, water quality modeling, and feasibility analyses (described in subsequent subsections), regional projects[8] were selected and placed into one of four categories, as follows:

- **Very High:** projects located on parcels owned by EWMP Group members and considered to be the highest priority for EWMP implementation schedule. Several of these projects are considered "signature projects" and were subject to further conceptual designs.
- **High:** projects located on parcels owned by the EWMP Group members and considered the next-highest priority for the EWMP implementation schedule.
- **Medium:** projects located on parcels owned by other agencies (e.g., school districts) but evaluated for EWMP implementation. Not all EWMP Group members included Medium projects

[8] While the Permit emphasizes Regional EWMP Projects that can retain the 85th percentile, 24-hour storm from its upstream drainage area, WMG members determined that it would be useful to identify and include the broadest group of all potential regional BMP projects and locations, and not simply the subset of projects that could capture the 85th percentile storm.

in their EWMP Implementation Strategy.

- **Regional BMPs on private land:** in cases where the water quality modeling required more pollutant reduction than could be achieved with the identified BMP opportunities for LID, green infrastructure and regional BMPs on public land. Regional projects on private land were generally given the lowest priority for implementation, although there are some significant opportunities to integrate LA River restoration efforts that will include land acquisition (as described in a subsection below), in which case regional BMPs on (currently) private land could be prioritized for implementation earlier in the schedule. Beyond the exceptionally high cost compared to public BMPs, implementation of private regional BMPs could be very challenging due to potential public resistance to land acquisition by municipalities (e.g., condemning properties would almost certainly be met with high resistance from the public). Over the course of implementation, it is likely that the actual implemented capacity of private regional BMPs will be lower than shown in the EWMP, as the EWMP Group members will seek additional opportunities on public land including coordination with schools and public-private partnerships. Coordination with schools will be a key factor for reducing private regional BMPs, as a substantial portion of public acreage in the EWMP area is school property. Some coordination with schools has already begun, and the EWMP Group looks forward to discussing with the Regional Board potential approaches and incentives to encourage school participation.

4.3 What is the Role of Regional Projects in the EWMP?

Regional projects provide a significant portion of the pollutant reduction to be achieved by the EWMP Implementation Strategy. As shown in **Figure 4-2**, a total of 16 Very High, 93 High and 19 Medium projects are included in the EWMP Implementation Strategy[9]. Combined, as shown in **Figure 4-3**, regional projects on public land make up 29% of the total control measure capacity in the EWMP to be implemented by 2028. Regional projects on private land make up an additional 27% of the EWMP capacity[10]. Combined, regional projects represent 56% of the EWMP control measure capacity to be implemented by 2028. The total network of LID, green streets and regional BMPs in the EWMP Implementation Strategy represents approximately 20 Rose Bowls of BMP capacity.

The EWMP includes a robust adaptive management program that will continue to identify and prioritize the best locations, sizes, and types of BMPs for pollutant reduction. Over time, if additional parcels are identified that could provide cost-effective opportunities for implementing regional

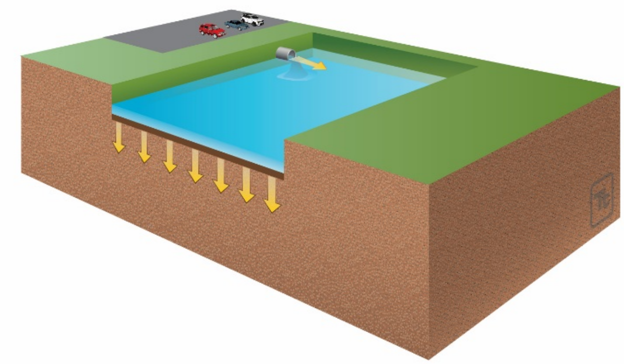
[9] The RAA incorporated a specific footprint, depth and drainage area for each of these projects (as described in Section 6), but most were not subject to specific concepts (e.g., infiltration basin or underground gallery). Pursuit of higher-resolution design concepts and analysis of 85th-percentile design storm capture potential will take place at EWMP Group Member-specific rates that are proportional to the proposed schedule in Section 7. Note that the signature regional projects were subject to detailed conceptual level designs that can serve as “templates” for rapid design and implementation of the remaining regional projects.

[10] The capacities shown in **Figure 4-3** are for implementation through 2028, which is the wet weather compliance date for the LA River Metals TMDL. The milestone date of 2028 is emphasized because it sets the implementation pathway for the next 10+ years. Between 2028 and 2037, an additional capacity of regional BMPs on private land is included for implementation of the LA River Bacteria TMDL. The EWMP assumes approximately 400 acres of total BMP footprint for private regional BMPs will be implemented between 2028 and 2037 to address the Bacteria TMDL. That private regional BMP capacity may be reduced if additional public land opportunities are identified over the course of EWMP implementation and adaptive management.

projects (e.g., school district properties), then regional projects would make up an even larger component of the EWMP.

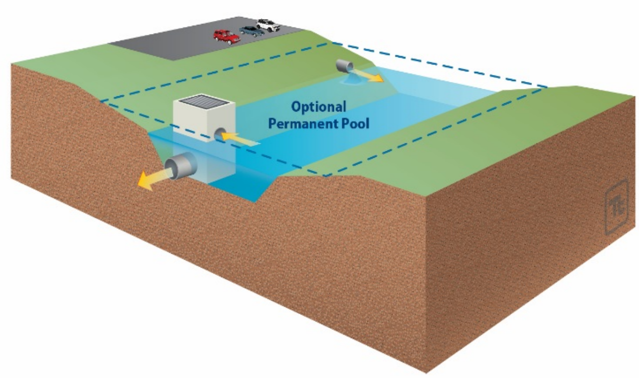
Infiltration Basins

Infiltration facilities are designed to decrease runoff volume through groundwater recharge and improve water quality through filtration and sorption. Infiltration facilities can be open-surface basins or subsurface galleries.



Detention Basins

Detention facilities are designed to detain runoff and improve water quality primarily through pollutant settling. Detention facilities can be open-surface practices or subsurface galleries and can be dry during non-rainy seasons or wet year-round.



Constructed Wetlands

Constructed wetlands are engineered, shallow-marsh systems designed to control and treat stormwater runoff. Particle-bound pollutants are removed through settling, and other pollutants are removed through biogeochemical activity.

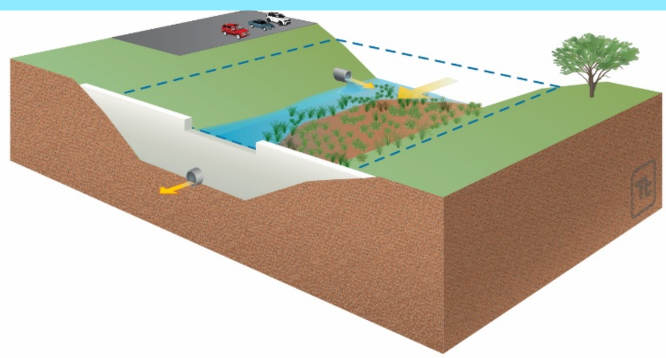


Figure 4-1. Examples of Types of Regional Projects to be used for EWMP Implementation

(more details provided in Appendix 4.A)

4.4 How were Regional BMPs Selected for the EWMP?

The EWMP Group developed and implemented a process for identifying opportunities for regional projects during 2014. The process for identifying potential regional project locations and selecting the preliminary list of potential regional projects in the watershed is depicted below. Details of the process are provided in **Appendix 4.B**.

Emphasis was placed on developing and implementing a process for Step 2, Identify New/Additional Regional Projects. All public parcels within the watershed were evaluated according to geographic information system (GIS) criteria such as: parcel ownership, land use, parcel size, slope, proximity to 36" storm drain or open channel, tributary drainage area and other criteria described in more detail in **Appendix 4.B**.

The outcome of this process was identification of close to 700 *opportunities* throughout the watershed and initially ranked into three categories: Very High (18), High (109) and Medium (568), based on criteria summarized in **Appendix 4.B**. These regional project opportunities are depicted in **Figure 4-4**. Of these, nearly all of the Very High and High opportunities were evaluated by the RAA and selected for inclusion in the EWMP based on cost-benefit optimization. Most agencies determined that Medium opportunities, because they would include siting regional projects located on other agencies land, should be evaluated for inclusion in the EWMP over the course of adaptive management (rather than including them in the 2015 submittal).

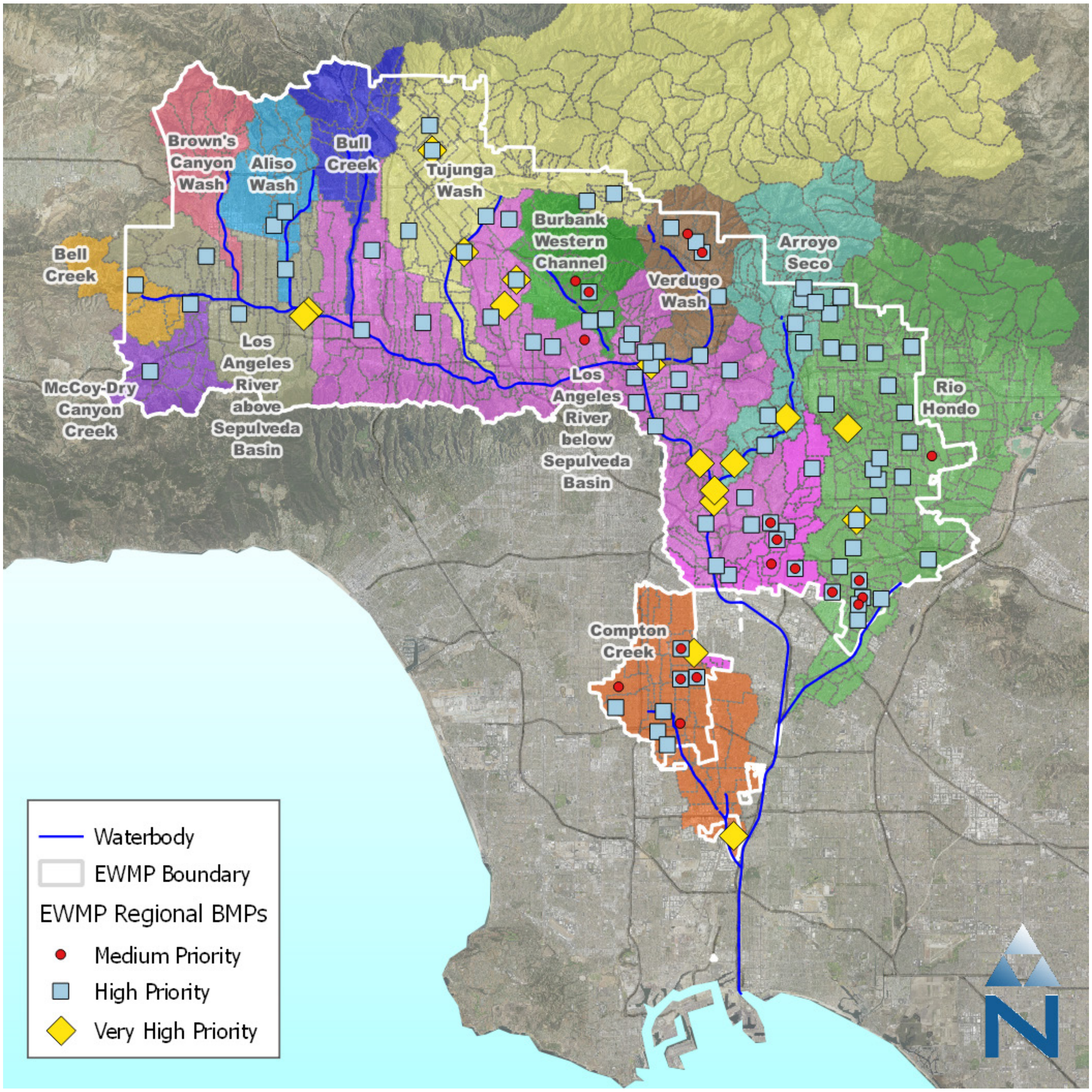


Figure 4-2. Regional Projects included in the ULAR EWMP Implementation Strategy

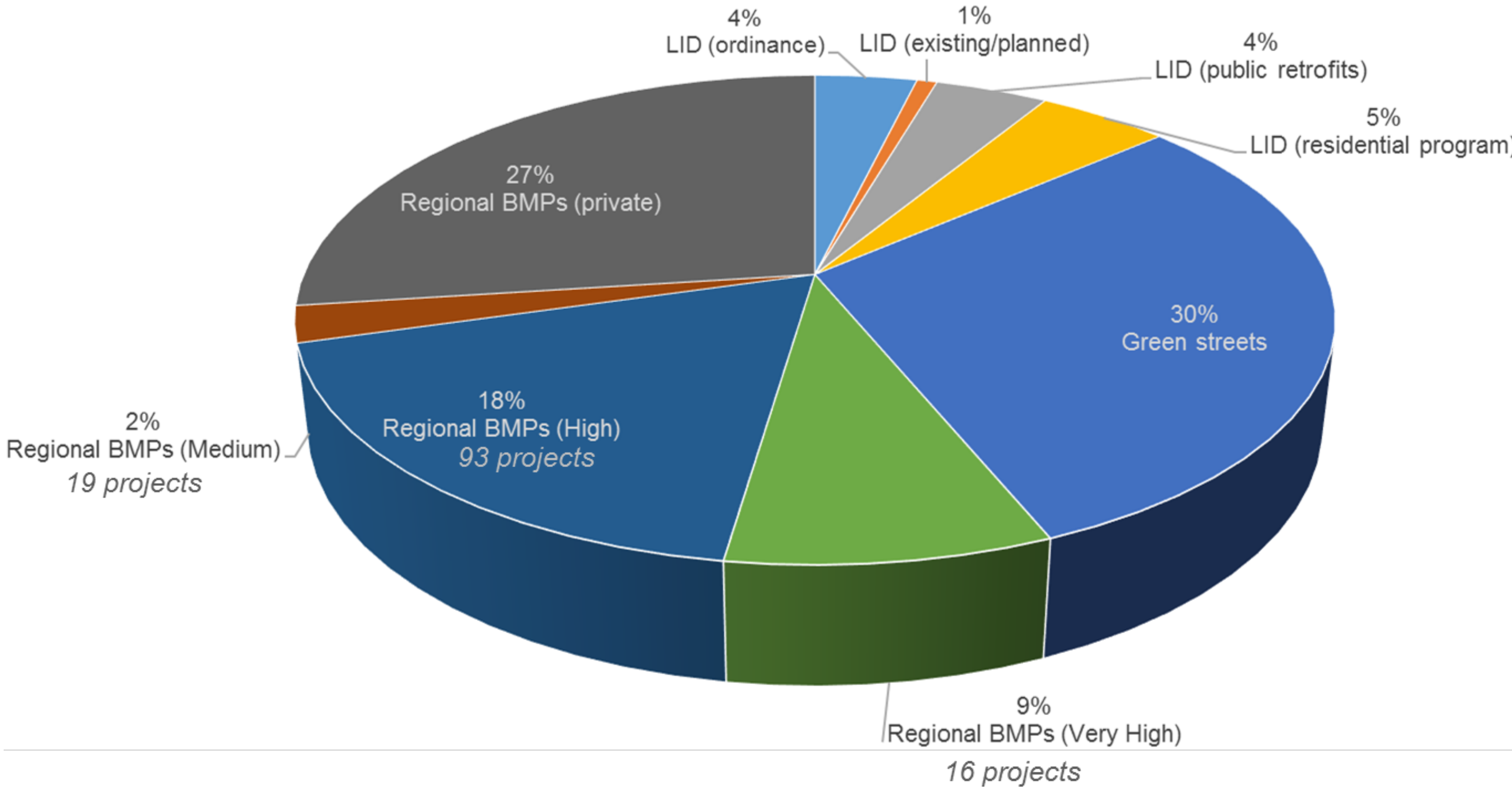


Figure 4-3. Relative Capacities of Different Control Measure Categories to be implemented by the ULAR EWMP by 2028.[11]

[11] All of the additional control measure capacity between 2028 and 2037 is represented as private regional projects. Note that the actual quantity of private regional projects is yet to be determined through partnerships with public and private land owners; given the RAA modeling assumptions, the quantity of private regional BMPs amounts to approximately 360 acres of regional BMP footprint by 2028 and an additional 400 acres by 2037.

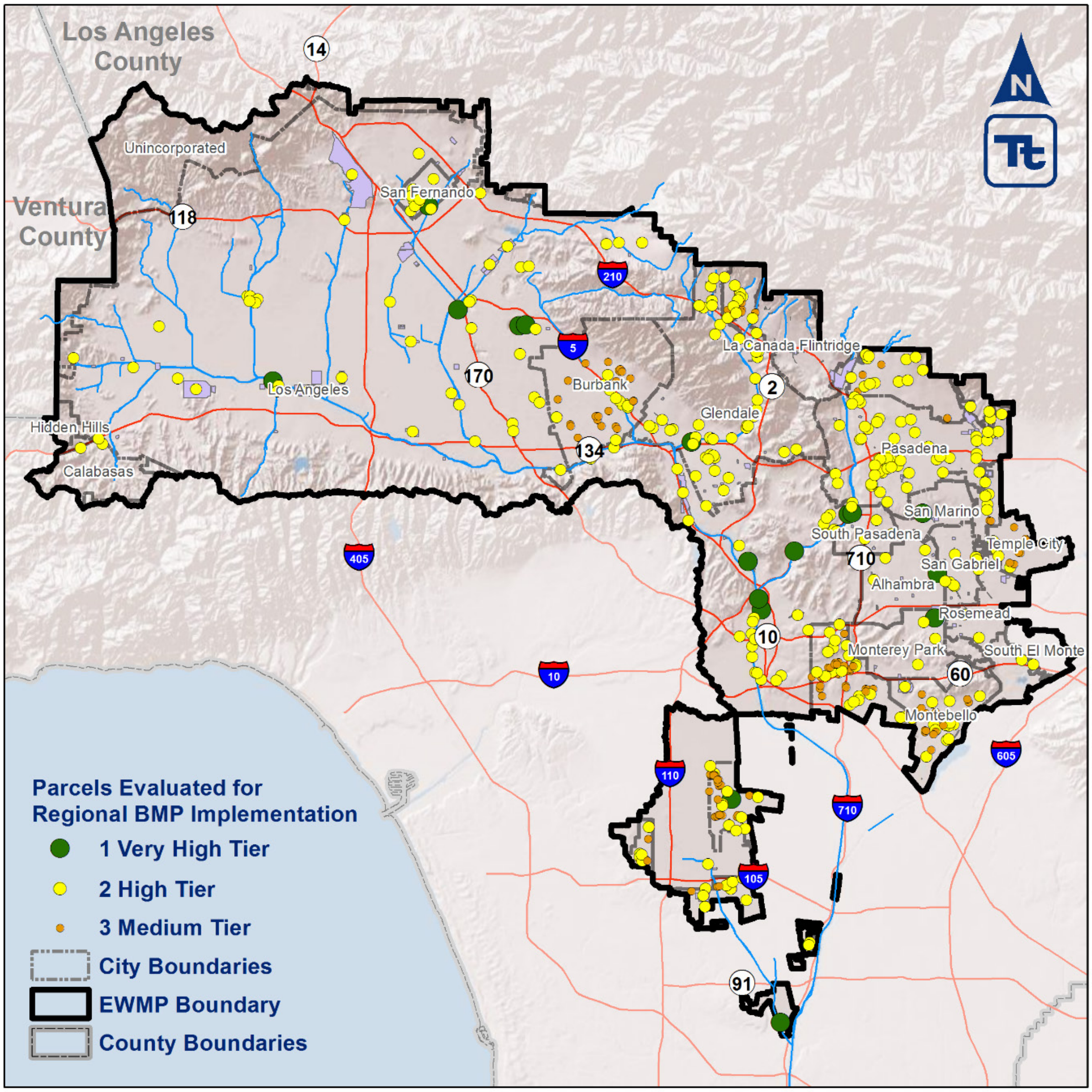


Figure 4-4. Regional Project Opportunities in the ULAR Watershed Considered by the RAA

4.5 Which Signature Regional Projects are included in the EWMP?

A key outcome of the regional project selection process was identification of eight signature regional projects, as listed in **Table 4-1**. These signature projects were subjected to more detailed environmental, geotechnical and engineering feasibility analysis. The evaluation methodology and a more detailed description of these analyses and results is presented in **Appendix 4.C**. Key design parameters considered for each signature project are presented in **Table 4-2**. Each of the signature regional projects will achieve multiple benefits including water supply, groundwater recharge, flood control, recreation and/or habitat.

The signature regional projects emphasize subsurface retention and infiltration as primary functionality. On the following pages (**Figures 4-5** through **4-35**), example "project fact sheets" are presented for the signature projects. The following items are included for each project fact sheet:

- Summary description of the recommended BMP project; BMP parameters; and a description of potential benefits
- Summary fact sheet
- Figure showing a plan view of the project site, showing the identified BMP opportunity area(s) and surrounding storm drain infrastructure
- Figure showing a plan view of the maximum and alternative drainage areas delineated for the project site
- Figure presenting preliminary design concepts.

It should be noted that all of these regional projects are concepts at this stage and subject to change, but that each of the respective EWMP Group members have provided significant input and review of these concepts.

Several of the signature regional projects meet the EWMP definition of a regional project that captures the 85th percentile, 24-hour (design) storm event (**Table 4-1**). During the engineering evaluation of optimum stormwater capture events, it was also determined that there are unique situations where it is advisable to consider capturing much larger tributary areas upstream of the regional project site in order to maximize capture of dry weather flows. Also, some sites are constrained by the size of the BMP footprint available at the site, which prevents capture of the entire 85th percentile storm event. It is important to recognize there are many situations in which regional projects that are sized smaller than the design storm may actually provide more pollutant reduction benefit if they manage a larger area than a regional project at the same location that captures the 85th percentile storm event from a smaller drainage area. It is also important to note that no one signature project is required to meet EWMP goals and rather that – as indicated in Figure 4-3 – they are part of a larger, multi-program implemenation strategy.

The following subsections present project fact sheets for the signature regional projects.

Table 4-1. Signature Regional Projects in the ULAR EWMP

Regional Project	Responsible EWMP Group Members in Design Drainage Area	BMP Type	Design Drainage Aarea (acres)	Available BMP Volume (AF)	Recommended BMP Volume (AF)	Approximate Rainfall Event Depth Captured Based on Recommended Volume[2] (inch)	Retains the 85th Percentile, 24-Hour Storm Event?
Alhambra Golf Course	Alhambra, Pasadena, San Marino, South Pasadena	Subsurface Retention & Infiltration	1,145	255	74.7	1.3	Yes
Fremont Park[1]	Glendale	Subsurface Retention & Infiltration	206	8	8.0	0.6	No
Roosevelt Park	County of Los Angeles	Subsurface Retention & Infiltration	2,250	200	138.2	0.1	No
Sierra Vista Park	Monterey Park	Subsurface Retention & Infiltration	800	14	10.0	0.2	No
San Fernando Regional Park[1]	San Fernando	Subsurface Retention & Infiltration	423	54	22.6	1.0	Yes
Lacy Park	San Marino, Pasadena	Subsurface Retention & Infiltration	1,067	48	46.4	0.9	Yes
Lower Arroyo Park[1]	South Pasadena, (Los Angeles marginally contributes area)	Subsurface Retention & Infiltration	145	265	3.7	0.8	Yes
North Hollywood Park[1]	Los Angeles	Subsurface Retention & Infiltration	5,122	156	38.0	0.2	No

[1] Maximum drainage areas to these locations could have directly managed the receiving water, but this option was not considered.

[2] Control measures were sized using long-term continuous simulations - tabulated rainfall depths were therefore approximated based on storage capacity and impervious drainage area (ignoring long-term antecedent conditions).

Table 4-1. Signature Regional Projects in the ULAR EWMP (continued)

Regional Project	Near-Term Pre-Design Milestones			Anticipated Schedule After Pre-Design			Summary of Multi-Benefits
	Confirm Further Pursuit of Project	Responsible Jurisdictions Establish Cost-Sharing Mechanism	Identify, Evaluate, and Apply for Additional Funding Sources	Design (years)	Bid (years)	Construction (years)	
Alhambra Golf Course	December 2017	December 2017	December 2017	2	0.5	5.0	Groundwater recharge (San Gabriel Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Fremont Park	December 2017	n/a	December 2017	1	0.5	1.5	Groundwater recharge (San Fernando Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Roosevelt Park	December 2017	n/a	December 2017	2	0.5	2.0	Groundwater recharge (Central Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Sierra Vista Park	December 2017	n/a	December 2017	1	0.5	2.0	Groundwater recharge (San Gabriel Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
San Fernando Regional Park	December 2017	n/a	December 2017	2	0.5	4.0	Groundwater recharge (San Fernando Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Lacy Park	December 2017	December 2017	December 2017	2	0.5	5.0	Groundwater recharge (Raymond Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Lower Arroyo Park	December 2017	December 2017	December 2017	1	0.5	0.75	Groundwater recharge (on boundary of San Gabriel and Raymond Basins), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
North Hollywood Park	December 2017	n/a	December 2017	2	0.5	5.0	Groundwater recharge (San Fernando Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education

Table 4-2. Key Design Parameters for Signature EWMP Projects

Project Site Parameters	**Total (Maximum) Drainage Area**	The area in acres of the maximum drainage area delineated for each project site. The drainage area delineation is described in Section 2 of the Appendix 4.C.
	Alternative (Minimum) Drainage Area	The area in acres of the alternative drainage area delineated for each project site. The drainage area delineation is described in Section 2 of Appendix 4.C.
	Maximum Required BMP Volume	The BMP volume in acre-feet that is required to retain the 85th percentile design storm volume generated from the maximum drainage area.
	Alternative Required BMP Volume	The BMP volume in acre-feet that is required to retain the 85th percentile design storm volume generated from the alternative drainage area.
	Groundwater Depth	The groundwater depth in feet from the ground surface. Groundwater depths were determined using groundwater contours and ground elevation GIS data provided by the lead agency.
	Maximim BMP Opportunity Area	The area in acres of the BMP opportunity area(s) identified during the field investigations and follow-up discussions. This process is described in Section 2 of Appendix 4.C.
BMP Design Parameters		
	Recommended Maximum BMP Depth (below ground surface)	The depth in feet of the recommended BMP project. This depth is based on groundwater depth and practical project design characteristics, as discussed in Section 2 of Appendix 4.C.
	Available BMP Volume	The BMP volume in acre-feet that is potentially available at the project site. This volume is based on the BMP opportunity area and recommended depth presented above, as discussed in Section 2 of Appendix 4.C.
	Recommended Active BMP Volume	The recommended BMP volume in acre-feet. This volume is recommended based on the hydrologic modeling and optimization results as discussed in Section 2 of Appendix 4.C.

Note: Maximum depth in the tables below represents depth below ground surface, whereas the BMP storage depth in the fact sheets represents the active storage depth within the BMP relative to the subgrade.

4.5.1 North Hollywood Park

North Hollywood Park is located within the City of Los Angeles in an area that drains to Tujunga Wash. Park facilities include an auditorium, baseball diamonds, basketball courts, playground, indoor gym, picnic tables, seasonal pool, and tennis courts. The potential BMP type is proposed as a below-ground retention/infiltration basin situated beneath open field space in the south and central areas of the park.

No maximum drainage area was identified for this site since it is located adjacent to a receiving waterbody, Tujunga Wash. After review of available site opportunities and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 5,122 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 the 85th percentile design storm flows contributed from the smaller alternative drainage area. As a result, the recommended active volume of the BMP is 38 acre feet.

Table 4-3 summarizes key conceptual design parameters of the BMP proposed at North Hollywood Park. **Figure 4-5** presents summary facts of the North Hollywood Park signature project. **Figures 4-6** to **4-8** provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

Table 4-3. Key Design Parameters for North Hollywood Park

Summary of North Hollywood Park (NHP)		
Project Site Parameters	Total (Maximum) Drainage Area	5,122 ac
	Alternative (Minimum) Drainage Area	5,122 ac
	Maximum Recommended BMP Volume	N/A
	Alternative Recommended BMP Volume	38.0 ac-ft
	Groundwater Depth	65 ft
	Maximum BMP Opportunity Area	7.8 ac
BMP Design Parameters		
	Recommended Maximum BMP Depth (below ground surface)	20 ft
	Available BMP Volume	156 ac-ft
	Recommended Active BMP Volume	**38.0 ac-ft**

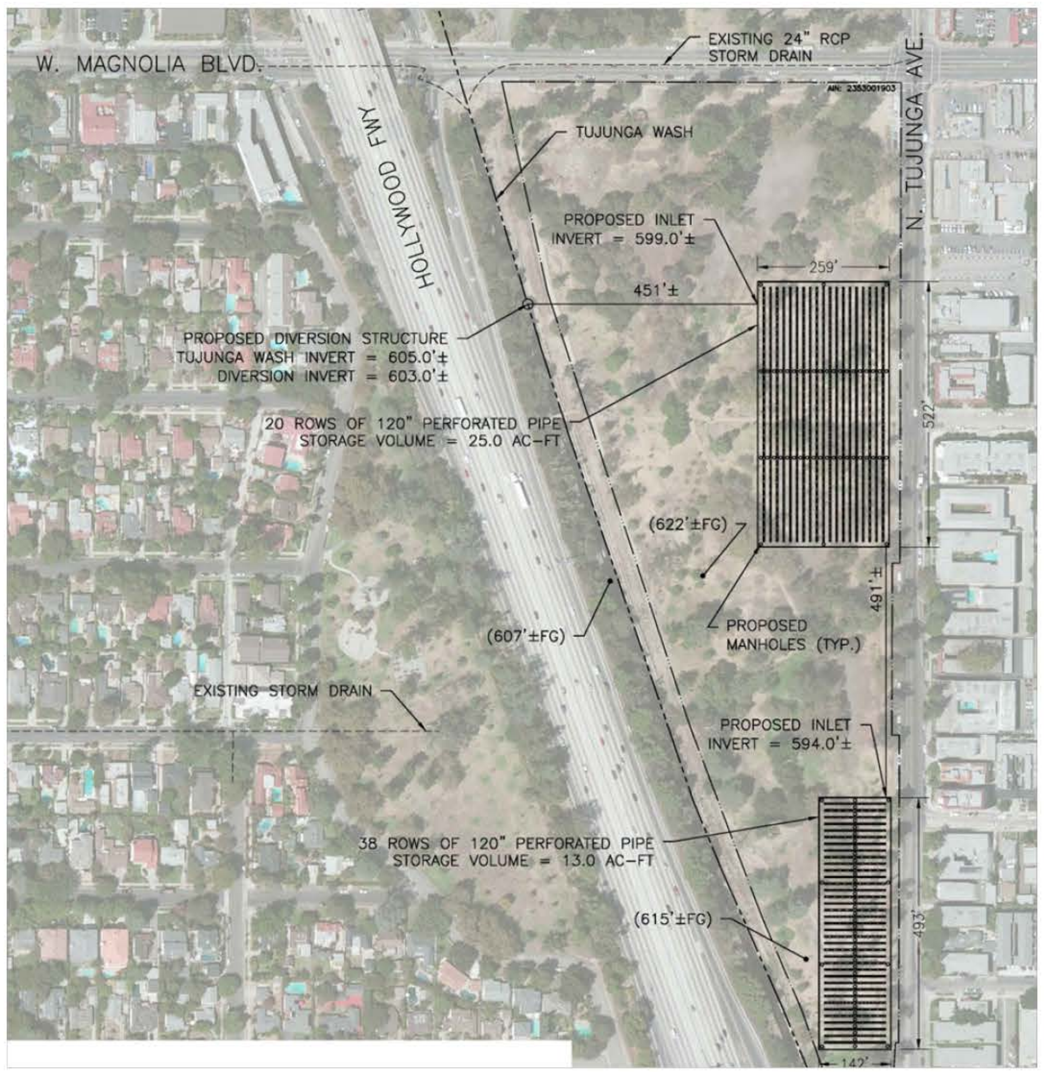
Upper Los Angeles River Enhanced Management Program
Signature Project: North Hollywood Park
FACT SHEET PN 182198

Note: Figures are not to scale

Site Location			
Site Location, City	Los Angeles	Site Name	North Hollywood Park
Latitude	34° 10′ 2.802″ N	Longitude	118° 22′ 49.285″ W
Landuse	Open Space	Street Address	11430 Chandler Blvd
Major Watershed	Upper Los Angeles River	Land Owner	City of Los Angeles
Existing Land Use of Site: Park			

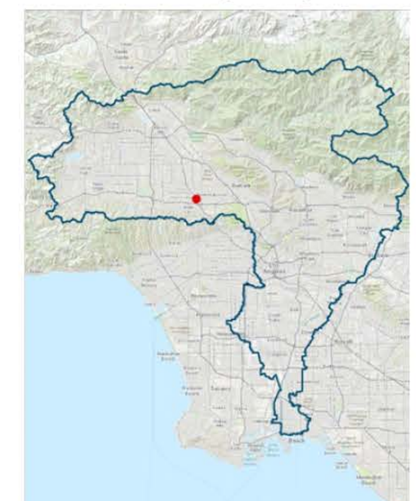
Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Min, ac	5,122 /5,122	Proposed Retrofit	Subsurface Infiltration
Hydrologic Soil Group	Tujunga Fine Sandy Loam	Recommended BMP Footprint, ft²	205204
Soil Infiltration Rate, in/hr	0.80	Available BMP Volume, ac-ft	156
Manages 85th Percentile, 24 hr Design Storm Event?	No	BMP Water Storage Depth, ft	11
Recommended Active BMP Volume, ac-ft	38	Gravel Depth, ft	1
Approximate Rainfall Event Depth Captured Based on Recommended Volume, inch = 0.2			

Budget- Level estimates for both soft and hard costs	$50,137,000	Schedule	2 years design, 6 months bid, 5.00 years construction (7 ½ years total)



Rendered Improvements

Drainage Map



Watershed and Vicinity

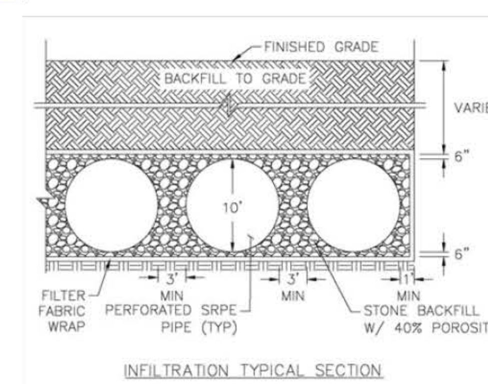


Figure 4-5. Summary Facts: North Hollywood Park Signature Project

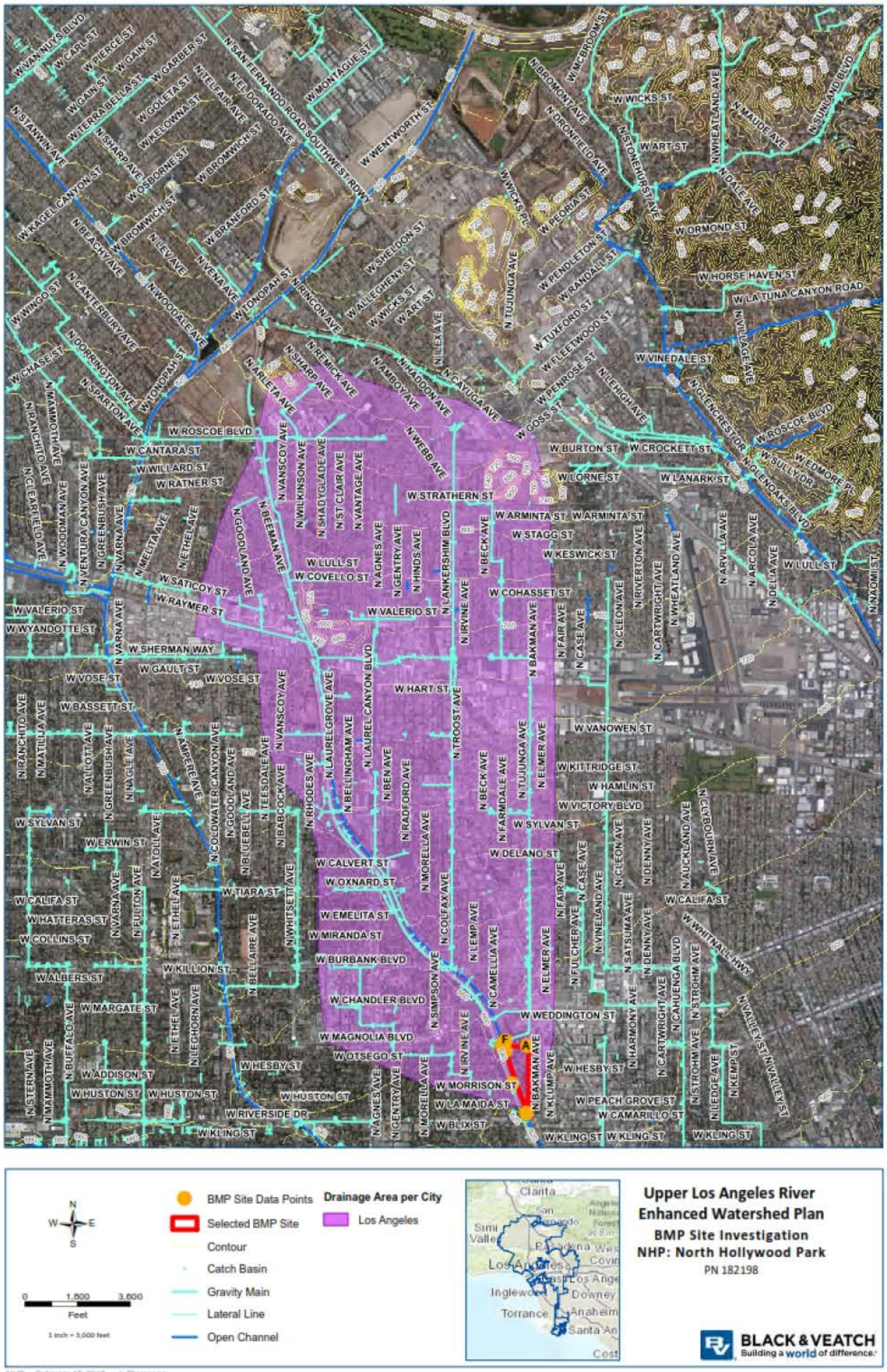


Figure 4-6. North Hollywood Park Subsurface Infiltration Drainage Area

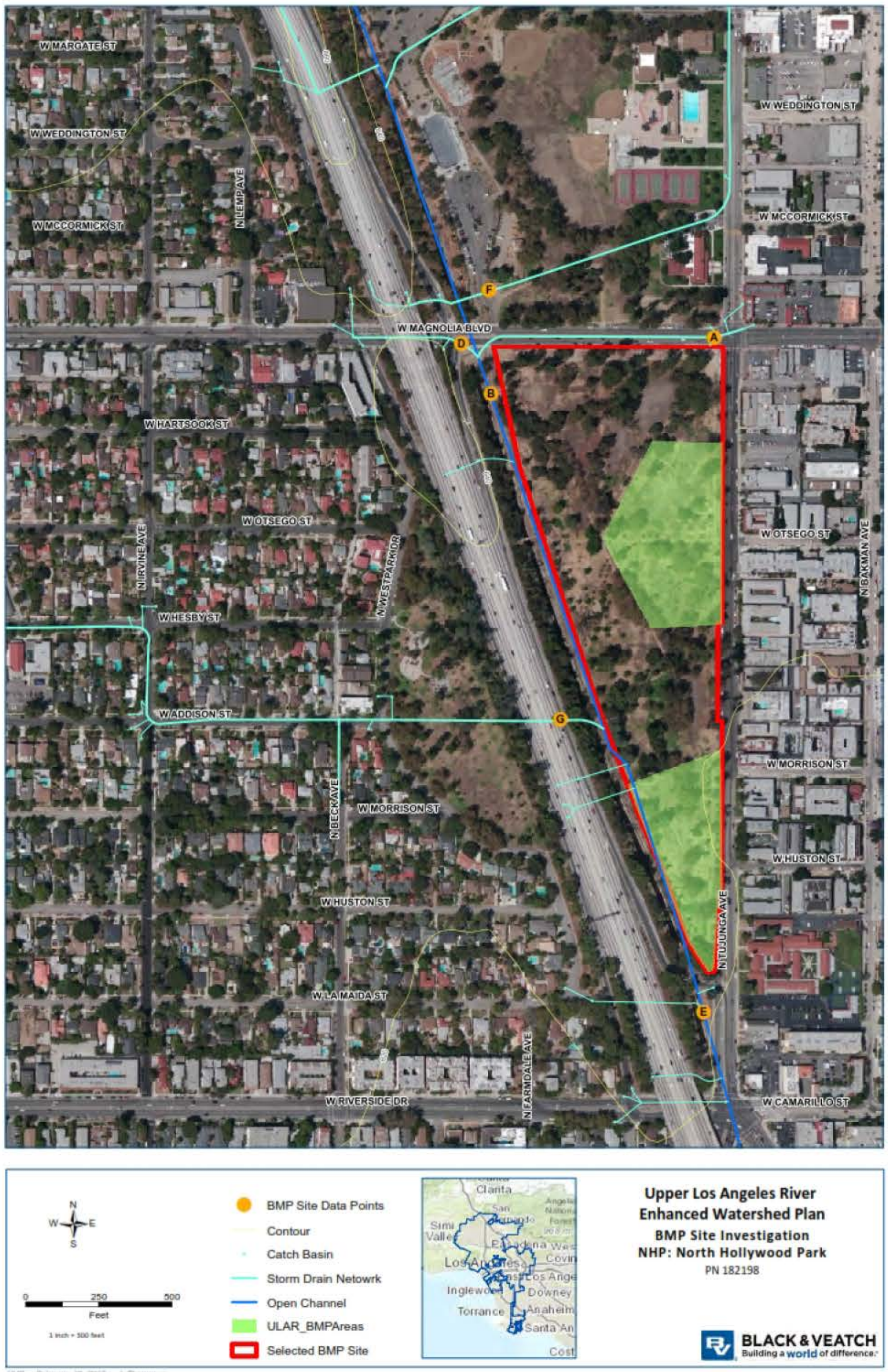


Figure 4-7. North Hollywood Park Subsurface Infiltration Site Location

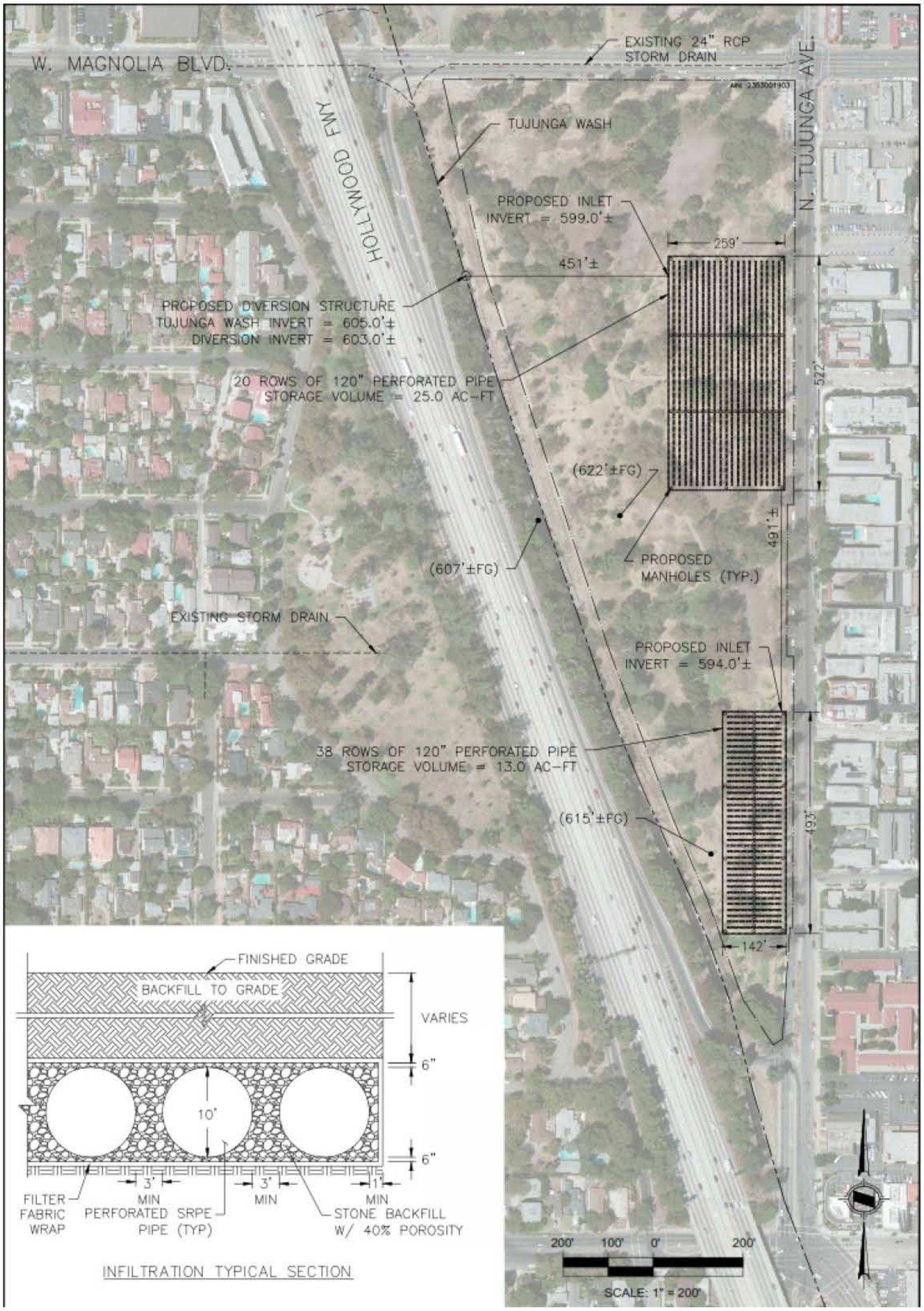


Figure 4-8. North Hollywood Park Subsurface Infiltration Concept

4.5.2 Almansor Park

The Alhambra Golf Course and Almansor Park are located in the City of Alhambra in an area that drains to Alhambra Wash. The Park consists of open grass fields, picnic tables with covered shelters, playgrounds, baseball fields, tennis courts, meeting/activity rooms, restrooms, and basketball court. During the site visit it was noted that the trail around the perimeter of Almansor Park is popular among residents. The potential BMP is proposed as a below-ground retention/infiltration basin situated beneath the baseball fields and open space in the southwest portions of the park.

The maximum drainage area for this project site is approximately 1,145 acres. After review of available site opportunities and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 51 acres.

After reviewing the hydrologic model results and estimated runoff volumes for the various diversion scenarios, it was determined that a retention/infiltration BMP sized to accommodate all inline flows contributed from the maximum drainage area is best suited for this project site. As a result, the recommended active volume of the BMP is 74.7 acre-feet.

Table 4-4 below summarizes key conceptual design parameters of the BMP proposed at Amansor Park. **Figure 4-9** presents summary facts of the Almansor Park signature project. **Figures 4-10** to **4-12** provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

Table 4-4. Key Design Parameters for Almansor Park

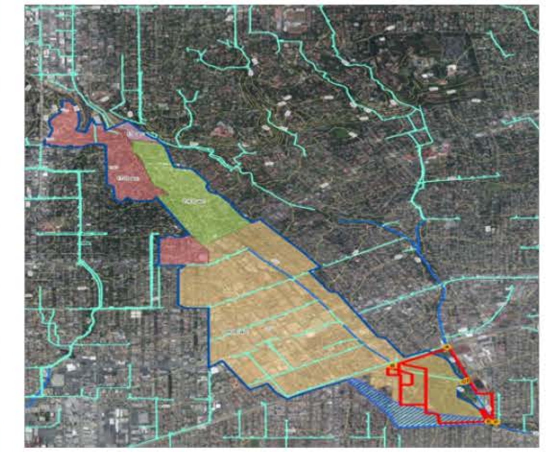
Summary of Almansor Park (AL01)		
Project Site Parameters	Total (Maximum) Drainage Area	1,145 ac
	Alternative (Minimum) Drainage Area	51 ac
	Maximum Recommended BMP Volume	49.0 ac-ft
	Alternative Recommended BMP Volume	0.515 ac-ft
	Groundwater Depth	165 ft
	Maximum BMP Opportunity Area	10.2 ac
BMP Design Parameters		
	Recommended Maximum BMP Depth (below ground surface)	25 ft
	Available BMP Volume	255 ac-ft
	Recommended Active BMP Volume	**74.7 ac-ft**

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

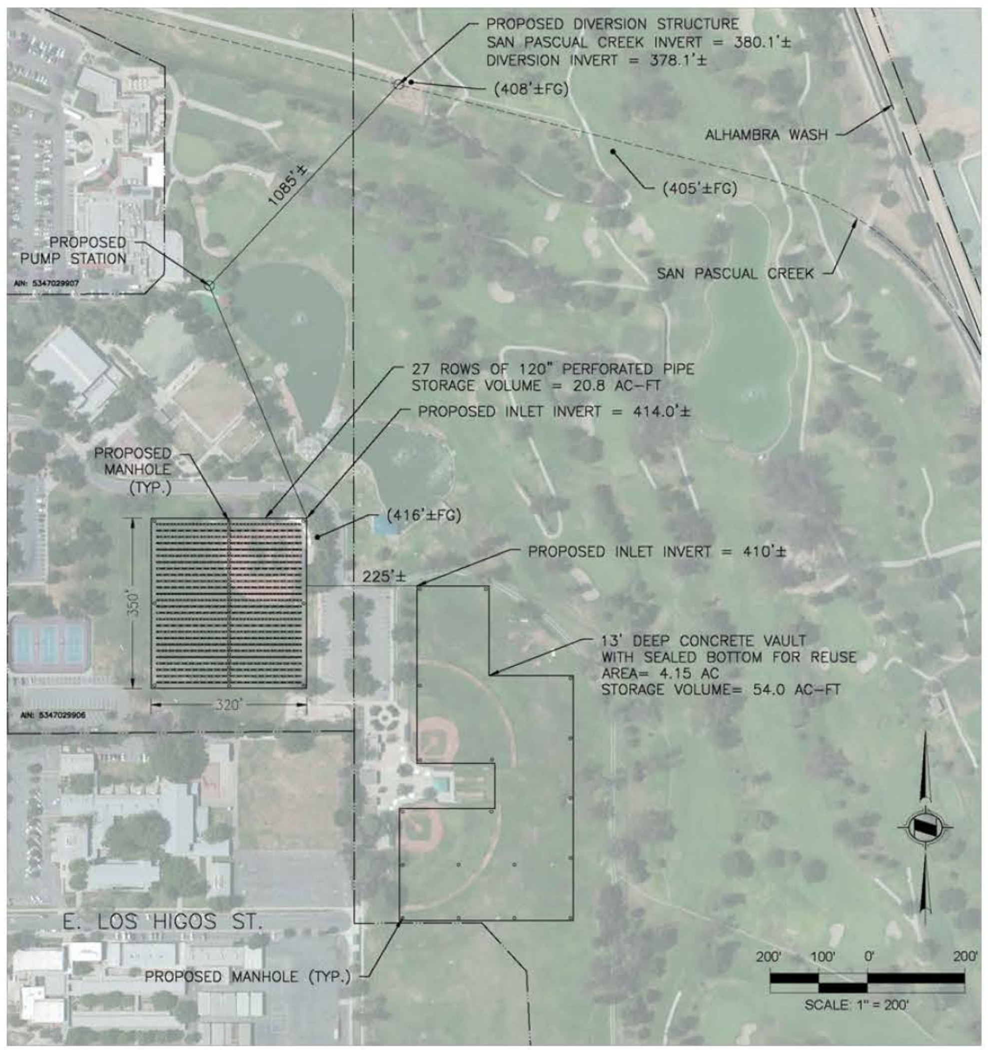
Site Location			
Site Location, City	Alhambra	Site Name	Almansor Park
Latitude	34° 5′ 24.19″ N	Longitude	118° 7′ 1.0020″ W
Landuse	Open Space	Street Address	630 S Almansor Street
Major Watershed	Upper Los Angeles River	Land Owner	City of Alhambra
Existing Land Use of Site: Park			

Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Min, ac	1,145/ 51	Proposed Retrofit	Subsurface Infiltration
Hydrologic Soil Group	Ramona Loam, Ramona Sandy Loam, Tujunga Fine Sandy Loam	Recommended BMP Footprint, ft²	292,774
Soil Infiltration Rate, in/hr	0.70	Available BMP Volume, ac-ft	255
Manages 85th Percentile, 24 hr Design Storm Event?	Yes	BMP Water Storage Depth, ft	11 and 13
Recommended Active BMP Volume, ac-ft	74.7	Gravel Depth, ft	1
Approximate Rainfall Event Depth Captured Based on Recommended Volume, inch = 1.3			

Budget- Level estimates for both soft and hard costs	$99,983,000	Schedule	2 years design, 6 months bid, 5.00 years construction (7 ½ years total)

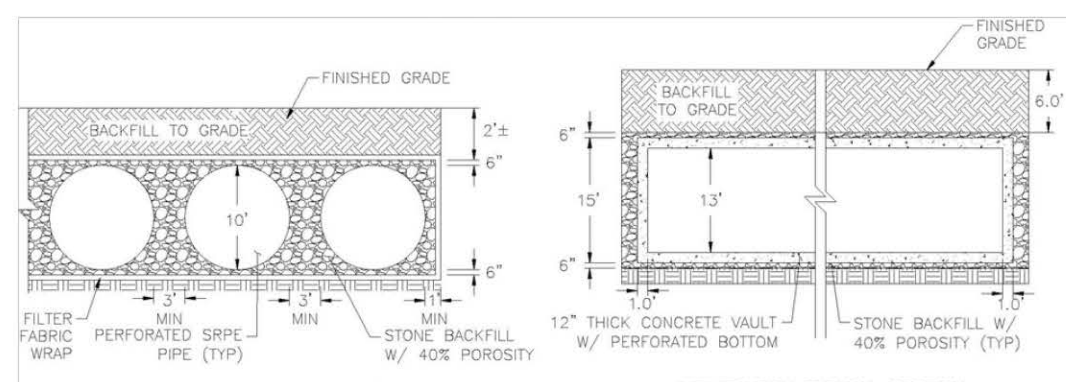


Drainage Map



Rendered Improvements

Watershed and Vicinity



Note: Figures are not to scale

Figure 4-9. Summary Facts: Almansor Park Signature Project

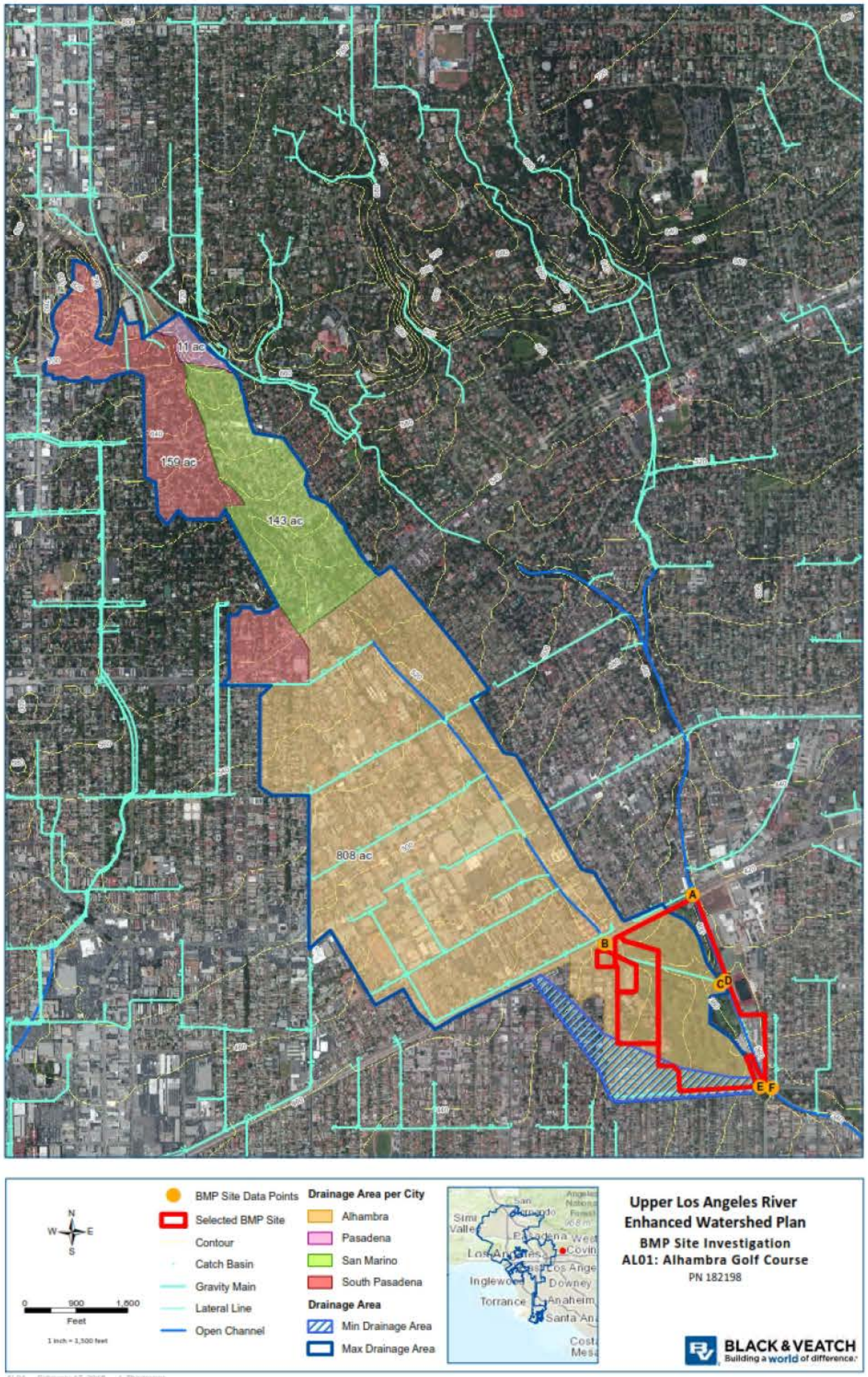


Figure 4-10. Almansor Park Surface and Subsurface Drainage Area

Figure 4-11. Almansor Park Surface and Subsurface Infiltration Site

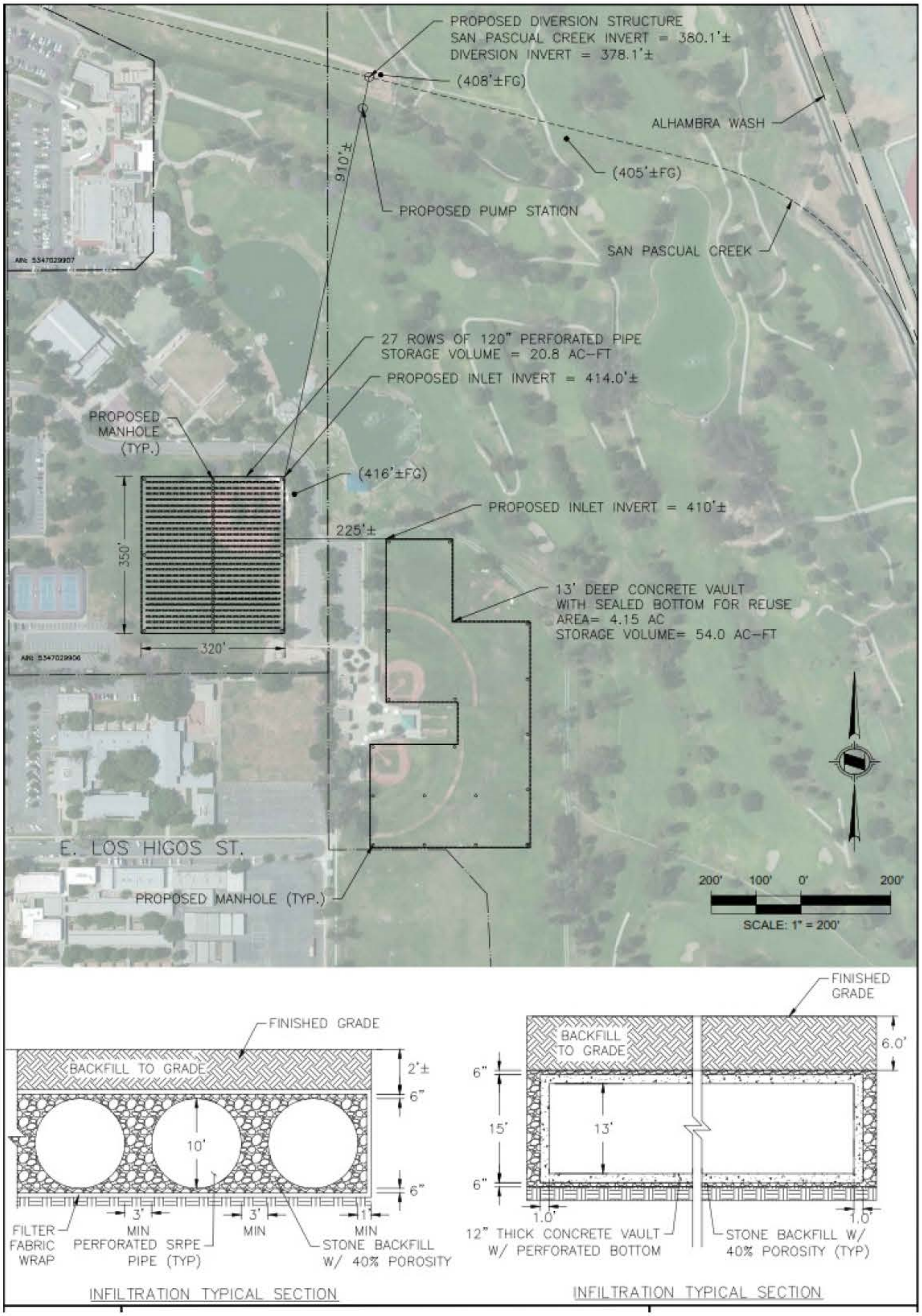


Figure 4-12. Almansor Park Infiltration Concept

4.5.3 Fremont Park

Fremont Park is located in Glendale in an area that drains to Verdugo Wash. The park is approximately 8 acres and consists of basketball courts, horseshoe courts, tennis courts, volleyball courts, playground equipment, and a wading pool. The potential BMP is proposed as a below- ground retention/infiltration basin situated beneath the open field space in the southeast corner of the park site.

No maximum drainage area was identified for this site since it is located adjacent to a receiving waterbody, Verdugo Wash. After review of available site opportunities and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 206 acres. A considerable part of this alternative watershed area is comprised of Caltrans right-of-way for the CA-134 Freeway.

After reviewing the hydrologic model results and estimated runoff volumes for the various diversion scenarios, it was determined that this site is not suited for accommodating the 85th percentile design storm runoff volume contributed from the smaller drainage area. As a result, a BMP implemented at this site will provide important water quality benefits; however, it will not qualify as a regional project. As such, the recommended active volume of the BMP is 8.0 acre-feet.

Table 4-5 below summarizes key conceptual design parameters of the BMP proposed at Fremont Park **Figure 4-13** presents summary facts of the Fremont Park signature project. **Figures 4-14** to **4-16** provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

Table 4-5. Key Design Parameters for Fremont Park

Summary of Fremont Park (GL01)		
Project Site Parameters	Total (Maximum) Drainage Area	206 ac
	Alternative (Minimum) Drainage Area	206 ac
	Maximum Recommended BMP Volume	N/A
	Alternative Recommended BMP Volume	16.0 ac-ft
	Groundwater Depth	50 ft
	Maximum BMP Opportunity Area	0.53 ac
BMP Design Parameters		
	Recommended Maximum BMP Depth (below ground surface)	20 ft
	Available BMP Volume	8 ac-ft
	Recommended Active BMP Volume	**8.0 ac-ft**

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

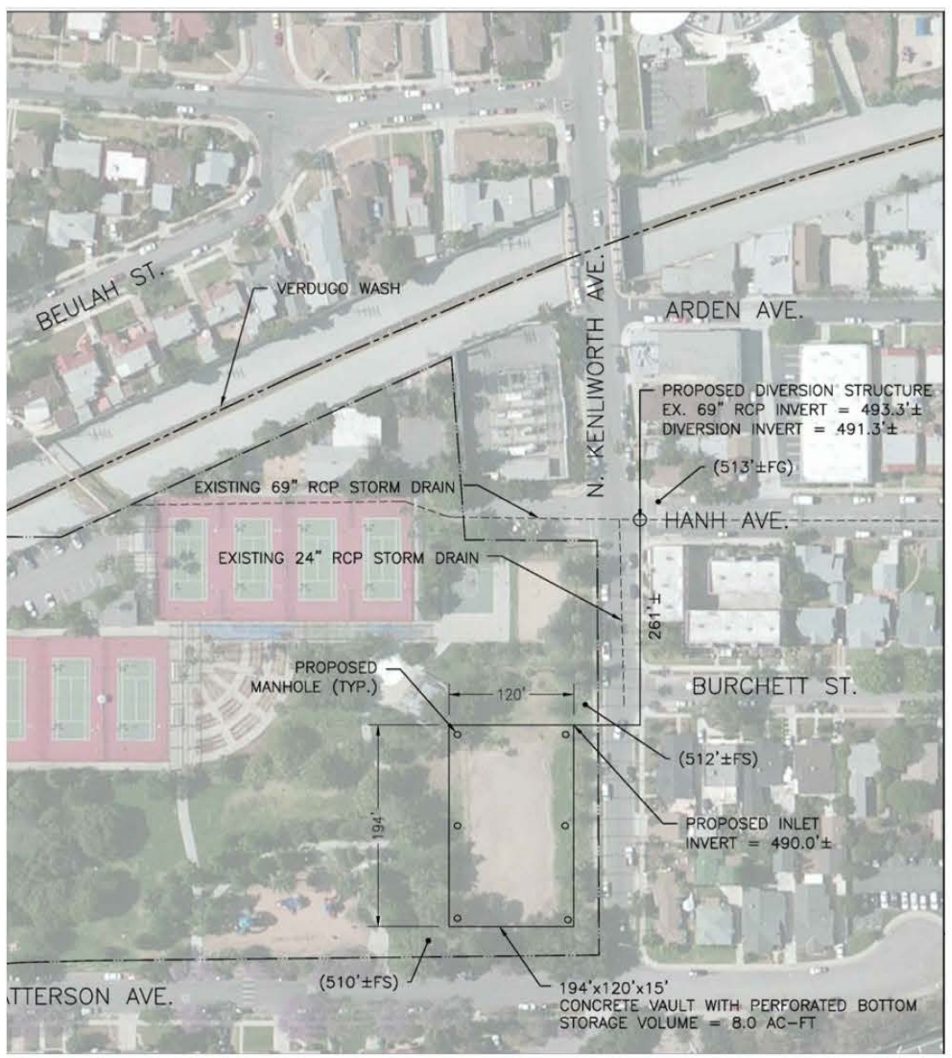
Site Location			
Site Location, City	Glendale	Site Name	Fremont Park
Latitude	34° 9′ 25.779″ N	Longitude	118° 16′ 5.1528″ W
Landuse	Open Space	Street Address	600 Hahn Avenue
Major Watershed	Upper Los Angeles River	Land Owner	City of Glendale
Existing Land Use of Site: Park			

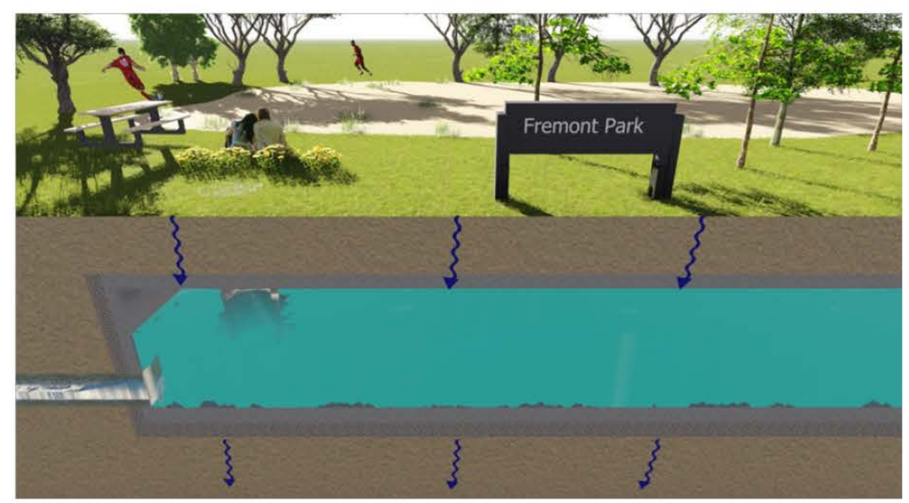
Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Min, ac	206/206	Proposed Retrofit	Subsurface Infiltration
Hydrologic Soil Group	Hanford Fine Sandy Loam	Recommended BMP Footprint, ft^2	23280
Soil Infiltration Rate, in/hr	0.30	Available BMP Volume, ac-ft	8
Manages 85th Percentile, 24 hr Design Storm Event?	No	BMP Water Storage Depth, ft	15
Recommended Active BMP Volume, ac-ft = 8		Gravel Depth, ft	0
Approximate Rainfall Event Depth Captured Based on Recommended Volume, inch = 0.6			

Budget- Level estimates for both soft and hard costs	$10,159,000	**Schedule**	1 year design, 6 months bid, 1 year 6 months construction (3.00 years total)

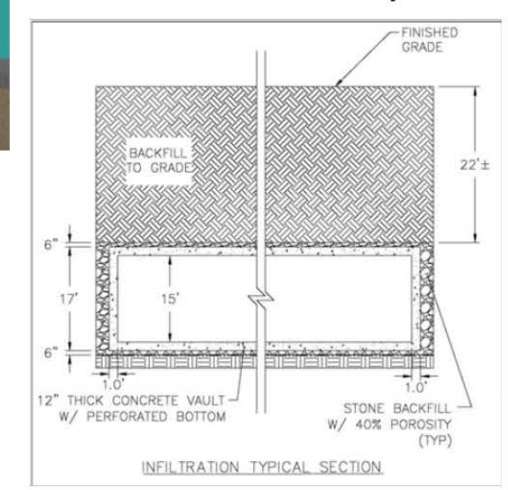
Drainage Map

Watershed and Vicinity





Rendered Improvements



Note: Figures are not to scale

Figure 4-13. Summary Facts: Fremont Park Signature Project

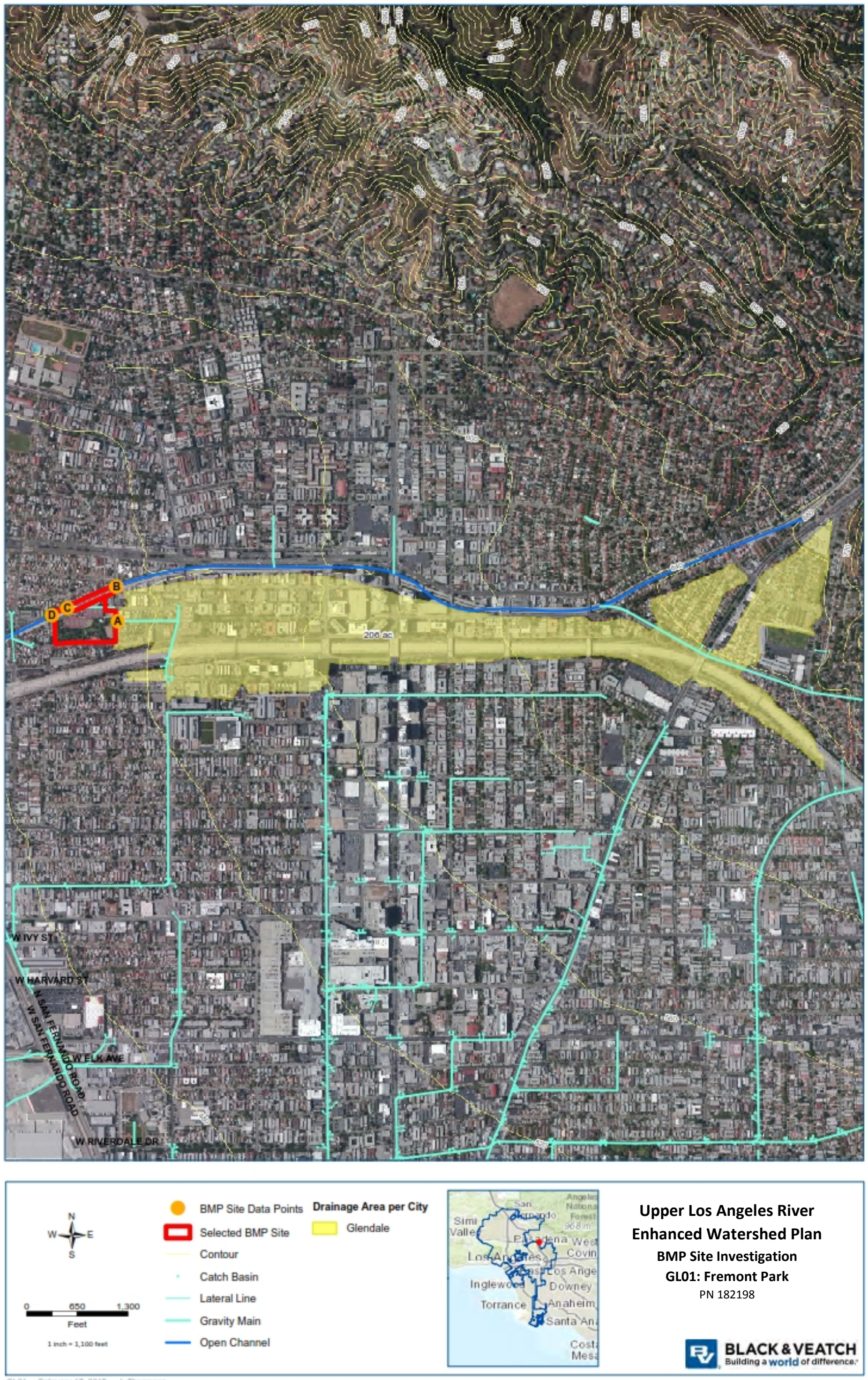


Figure 4-14. Fremont Park Subsurface Infiltration Drainage Area

Figure 4-15. Fremont Park Subsurface Infiltration Site Location

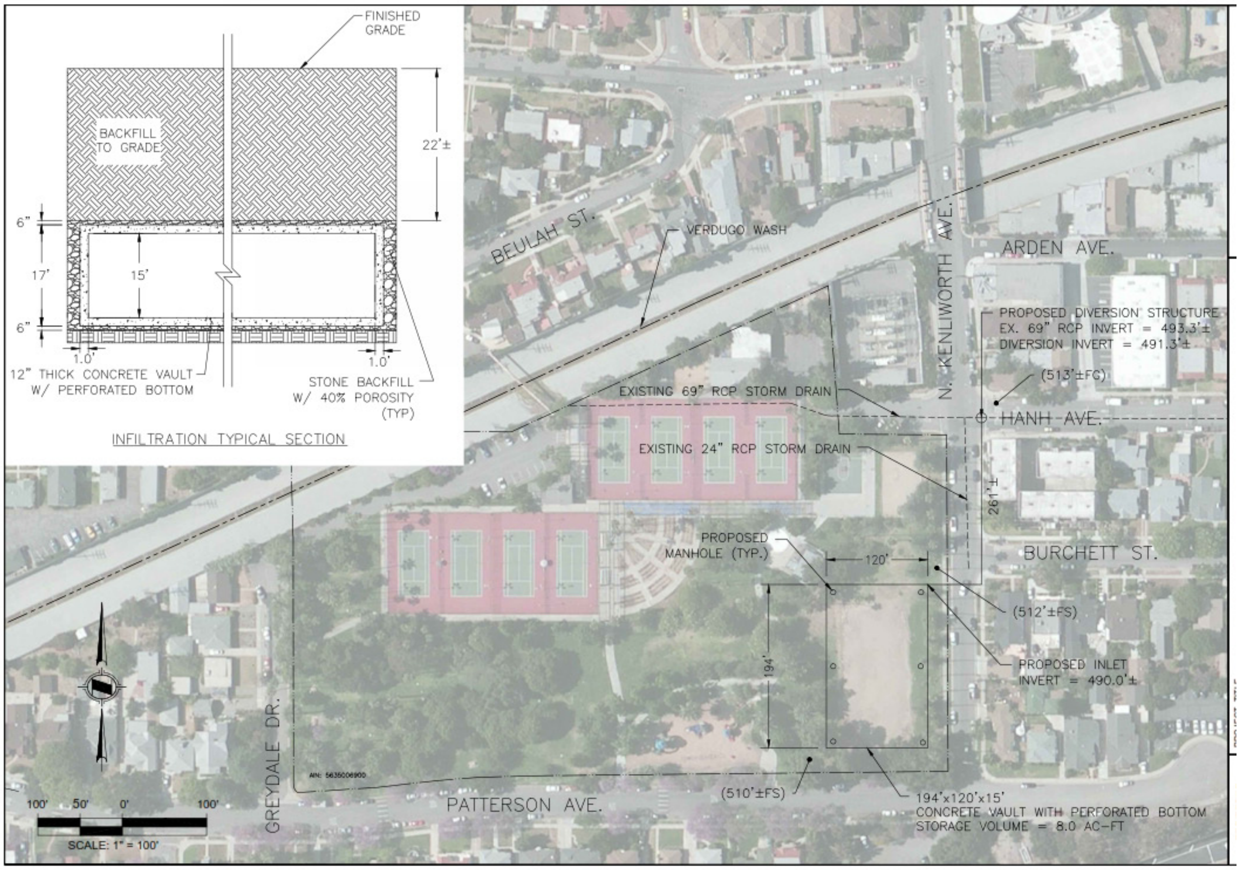


Figure 4-16. Fremont Park Subsurface Infiltration Concept

4.5.4 Roosevelt Park

Roosevelt Park is located in unincorporated Los Angeles County. The park is a large facility that includes basketball courts, picnic facilities with barbecue grills, playground equipment, a senior center, community room, computer center, fitness zone, and gym. The County investigated several BMP options including an infiltration basin near the north end of the park and dry wells to the east and west of the park.

The maximum drainage area for this project site is approximately 2,250 acres. After review of the available site information and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 190 acres.

After reviewing the hydrologic model results and estimated runoff volumes for the various diversion scenarios, it was determined that this site is suitable for a BMP sized to accommodate more than the 85th percentile design storm runoff volume contributed from the maximum drainage area. As a result, the recommended active volume of the BMP was initially suggested as 138.2 acre feet.

After reviewing this recommendation the County requested that a BMP with 8.4 AF be implemented at this location.

Table 4-6 below summarizes key conceptual design parameters of the BMP proposed at Roosevelt Park. **Figure 4-17** presents summary facts of the Roosevelt Park signature project. **Figures 4-18** to **4-19** provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

Table 4-6. Key Design Parameters for Roosevelt Park

Summary of Roosevelt Park (LAC01)		
Project Site Parameters	Total (Maximum) Drainage Area	2,250 ac
	Alternative (Minimum) Drainage Area	190 ac
	Maximum Recommended BMP Volume	82.4 ac-ft
	Alternative Recommended BMP Volume	8.4 ac-ft
	Groundwater Depth	80 ft
	Maximum BMP Opportunity Area	10 ac
BMP Design Parameters		
	Recommended Maximum BMP Depth (below ground surface)	20 ft
	Available BMP Volume	200 ac-ft
	Recommended Active BMP volume	**8.4 ac-ft**

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

Note: Figures are not to scale

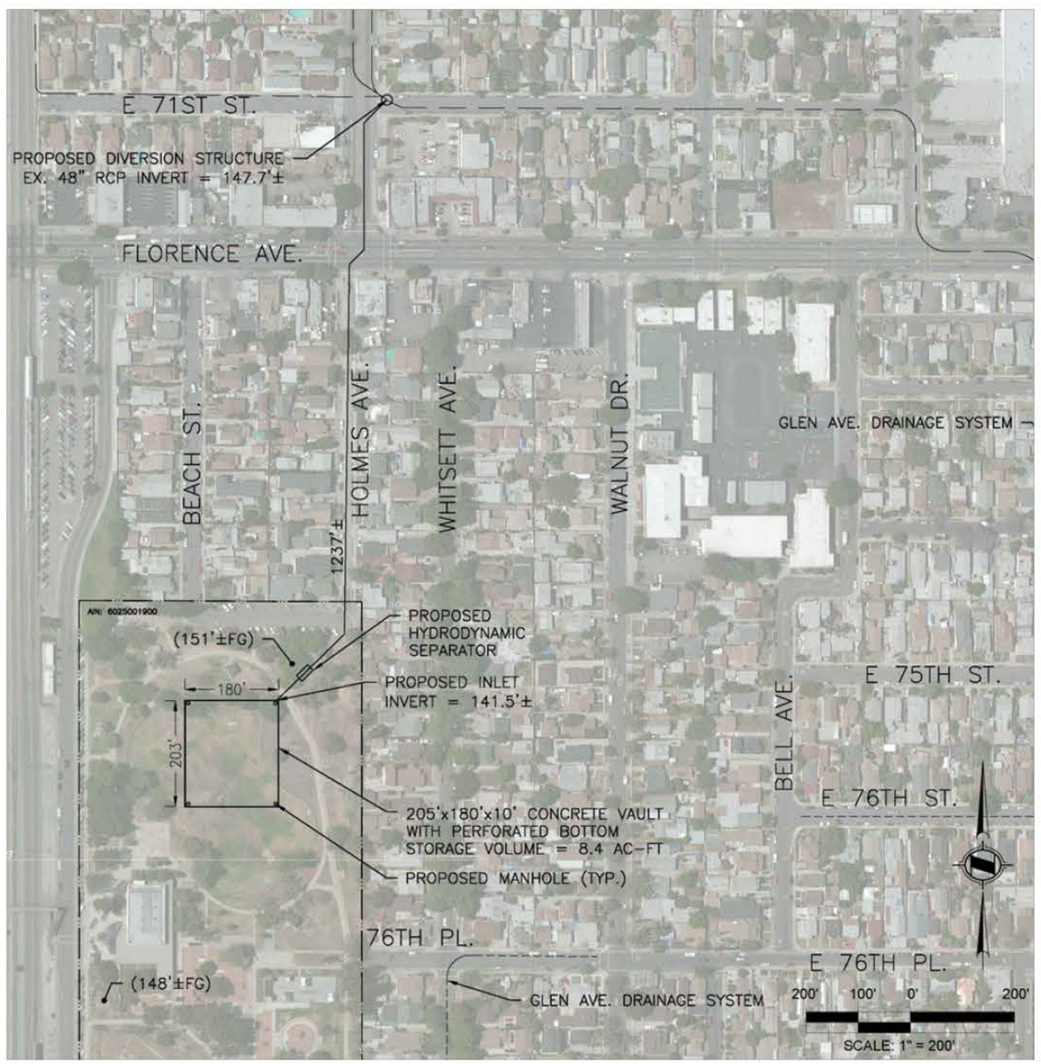
Site Location			
Site Location, City	Los Angeles	Site Name	Roosevelt Park
Latitude	33°58' 11.08" N	Longitude	118° 14' 33.885" W
Landuse	Open Space	Street Address	7600 Graham Ave
Major Watershed	Upper Los Angeles River	Land Owner	County of Los Angeles
Existing Land Use of Site: Park			

Watershed Characteristics	
Drainage Area Max/Min, ac	2250/190
Hydrologic Soil Group	Chino Silt Loam, Hanford Fine Sandy Loam
Soil Infiltration Rate, in/hr	0.30
Manages 85th Percentile, 24 hr Design Storm Event?	No
Recommended Active BMP Volume, ac-ft	138.2
Approximate Rainfall Event Depth Captured Based on Recommended Volume, inch = 0.1	

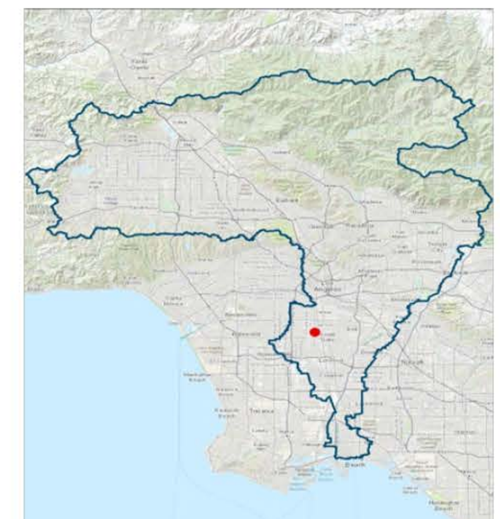
Retrofit Characteristics	
Proposed Retrofit	Subsurface Infiltration
Recommended BMP Footprint, ft²	36540
Available BMP Volume, ac-ft	200
BMP Water Storage Depth, ft	10
Gravel Depth, ft	0

Budget- Level estimates for both soft and hard costs	$7,030,000	Schedule	2 years design, 6 months bid, 2.00 years construction (4 ½ years total)

Drainage Map



Rendered Improvements



Watershed and Vicinity

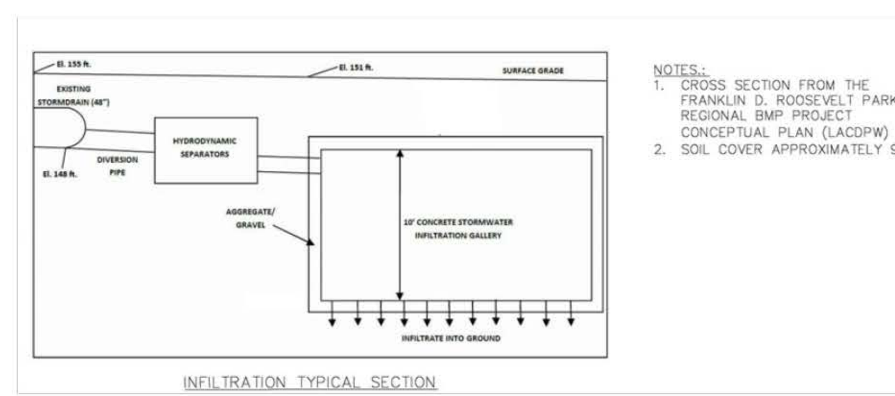


Figure 4-17. Summary Facts: Roosevelt Park Signature Project

Figure 4-18. Roosevelt Park Subsurface Infiltration Drainage Area

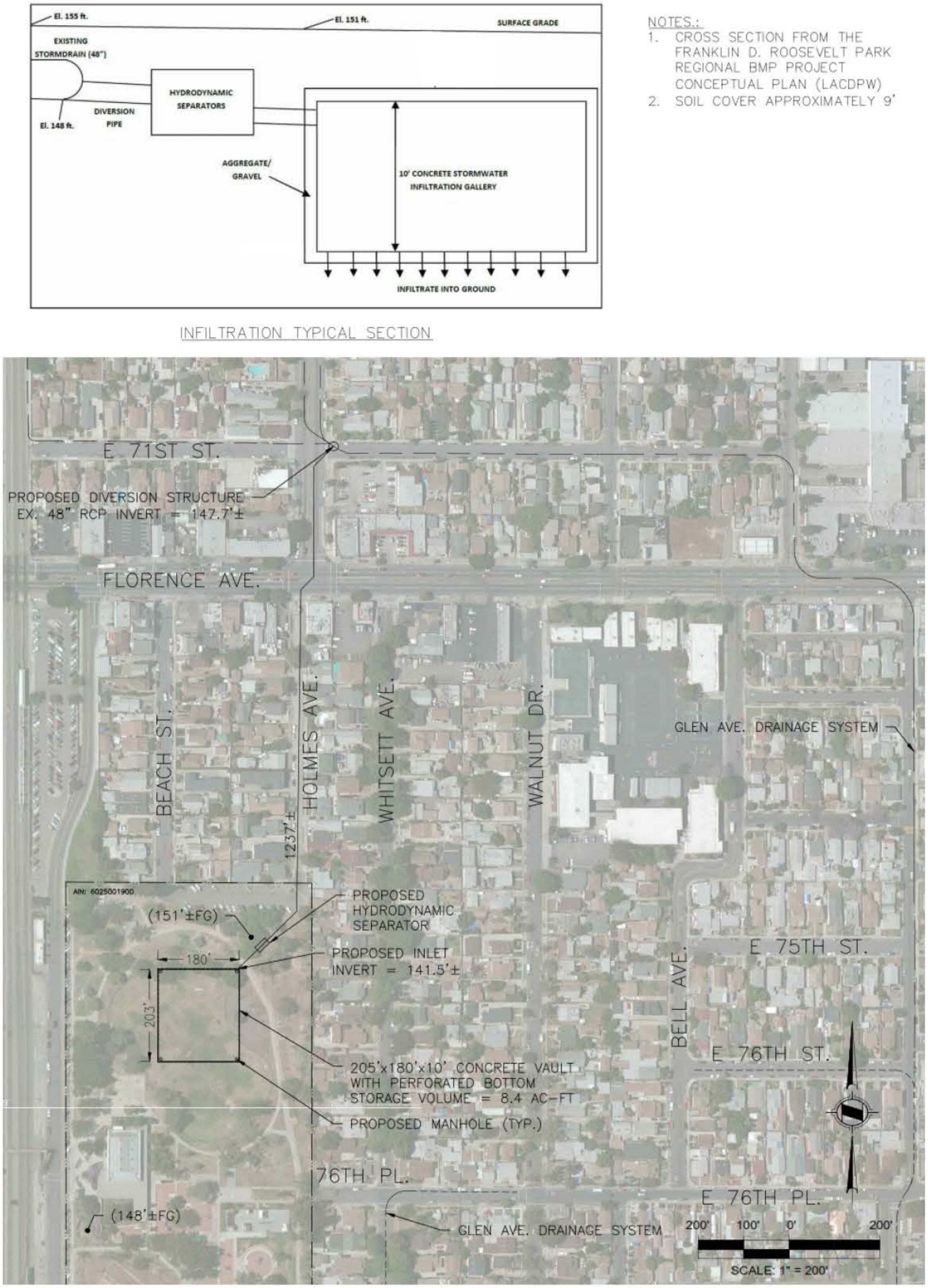


Figure 4-19. Roosevelt Park Subsurface Infiltration Concept

4.5.5 Sierra Vista Park

Sierra Vista Park is located within the City of Monterey Park. The park includes a senior/community center, baseball diamond, basketball court, picnic shelters, tennis courts, restrooms, and playground equipment. The potential BMP type is proposed as a below-ground retention/infiltration basin situated beneath the baseball diamond in the southwest corner of the site.

The maximum drainage area for this project site is 2,928 acres. After review of available site information and surround infrastructure data, a smaller (alternative) drainage area was delineated, encompassing approximately 800 acres.

After reviewing the hydrologic model results and estimated runoff volumes for the various diversion scenarios, it was determined that this site cannot accommodate the 85th percentile design storm flows from the smaller drainage area. Thus, it is recommended that the BMP be sized for retention/infiltration of approximately 10 acre-feet of runoff, which will be conveyed to the BMP via a 20 cubic feet per second (cfs) pumped diversion. 20 cfs is viewed as a maximum realistic peak pumped flowrate.

Table 4-7 below summarizes key conceptual design parameters of the BMP proposed at Sierra Vista Park. **Figure 4-20** presents summary facts of the Sierra Vista Park signature project. **Figures 4-21** to **4-23** provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

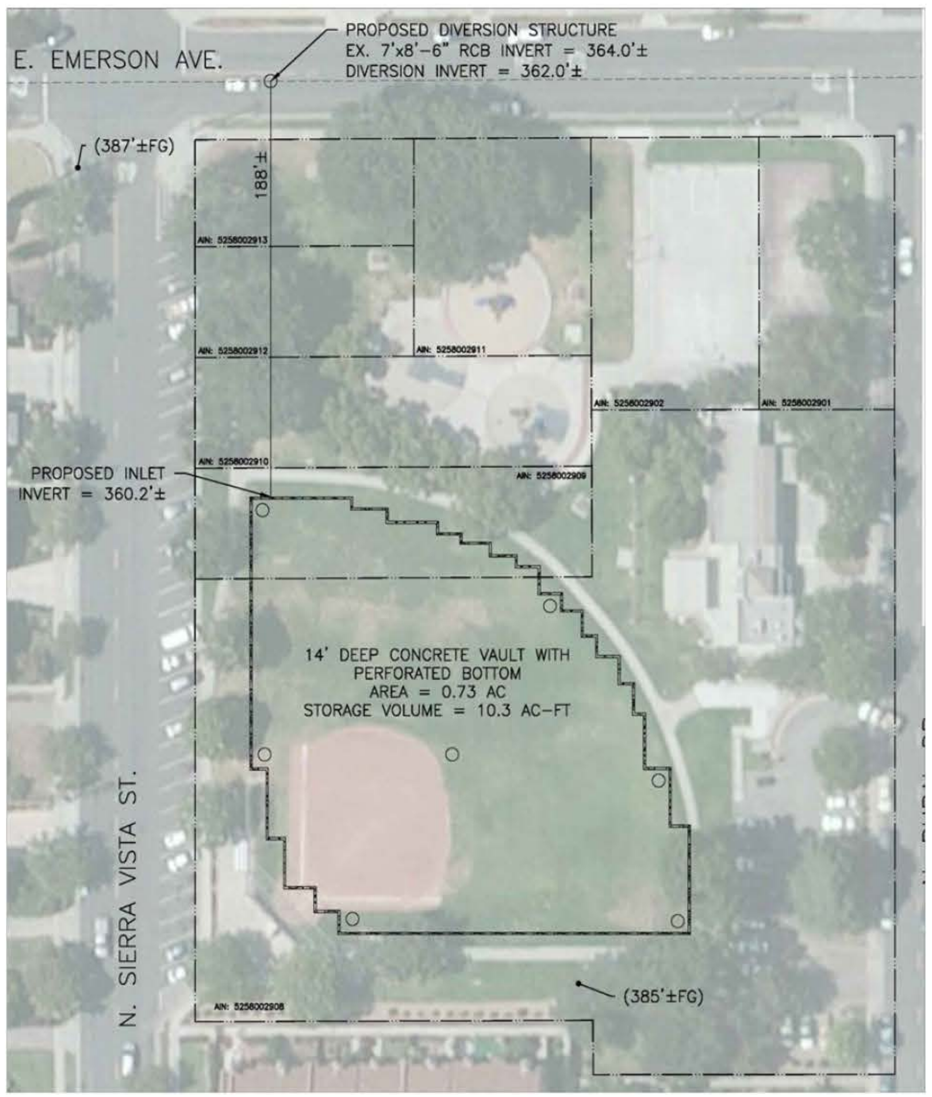
Table 4-7. Key Design Parameters for Sierra Vista Park

Summary of Sierra Vista Park (MP01)		
Project Site Parameters	Total (Maximum) Drainage Area	2,928 ac
	Alternative (Minimum) Drainage Area	800 ac
	Maximum Recommended BMP Volume	178.6 ac-ft
	Alternative Recommended BMP Volume	48.6 ac-ft
	Groundwater Depth	80 ft
	Maximum BMP Opportunity Area	7.3 ac
BMP Design Parameters		
	Recommended Maximum BMP Depth (below ground surface)	20 ft
	Available BMP Volume	14 ac-ft
	Recommended Active BMP Volume	**10.0 ac-ft**

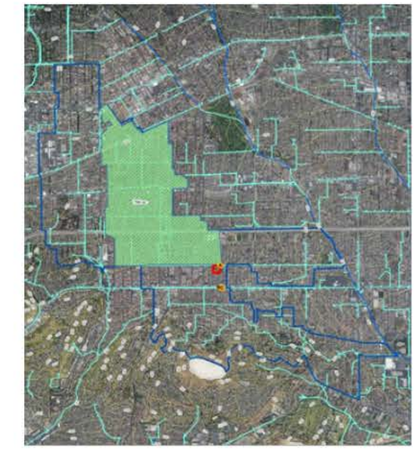
Site Location			
Site Location, City	Monterey Park	Site Name	Sierra Vista Park
Latitude	34° 3′ 57.387″ N	Longitude	118° 6′ 51.3252″ W
Landuse	Open Space	Street Address	311 N Rural Drive
Major Watershed	Upper Los Angeles River	Land Owner	City of Monterey Park
Existing Land Use of Site: Park			

Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Alternative, ac	2,928/800	Proposed Retrofit	Subsurface Infiltration
Hydrologic Soil Group	Ramona Loam, Yolo Loam	Recommended BMP Footprint, ft²	31799
Soil Infiltration Rate, in/hr	0.30	Available BMP Volume, ac-ft	14
Manages 85th Percentile, 24 hr Design Storm Event?	No	BMP Water Storage Depth, ft	14
Recommended BMP Volume, ac-ft	10.0	Gravel Depth, ft	0
Approximate Rainfall Event Depth Captured Based on Recommended Volume, inch = 0.2			

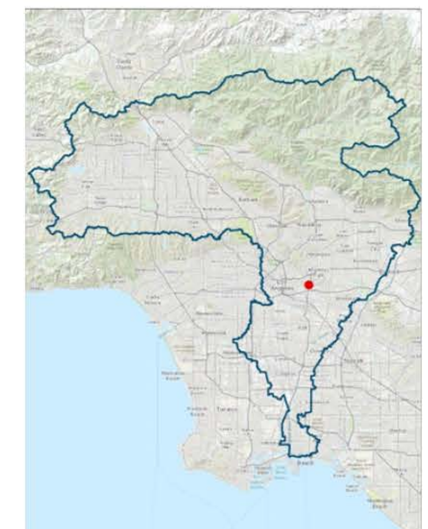
Budget- Level estimates for both soft and hard costs	$13,077,000	**Schedule**	1 year design, 6 months bid, 2.00 years construction (3 ½ years total)



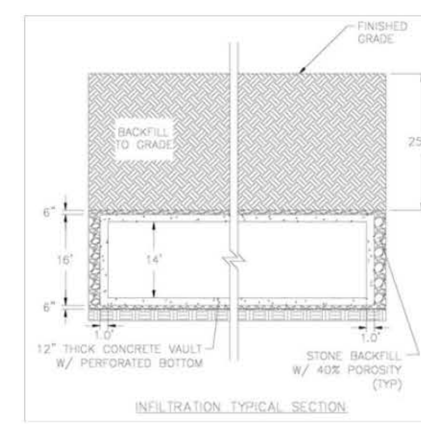
Rendered Improvements



Drainage Map



Watershed and Vicinity



Upper Los Angeles River Enhanced Management Program
Signature Project: Sierra Vista Park
FACT SHEET PN 182198

Note: Figures are not to scale

Figure 4-20. Summary Facts: Sierra Vista Park Signature Project

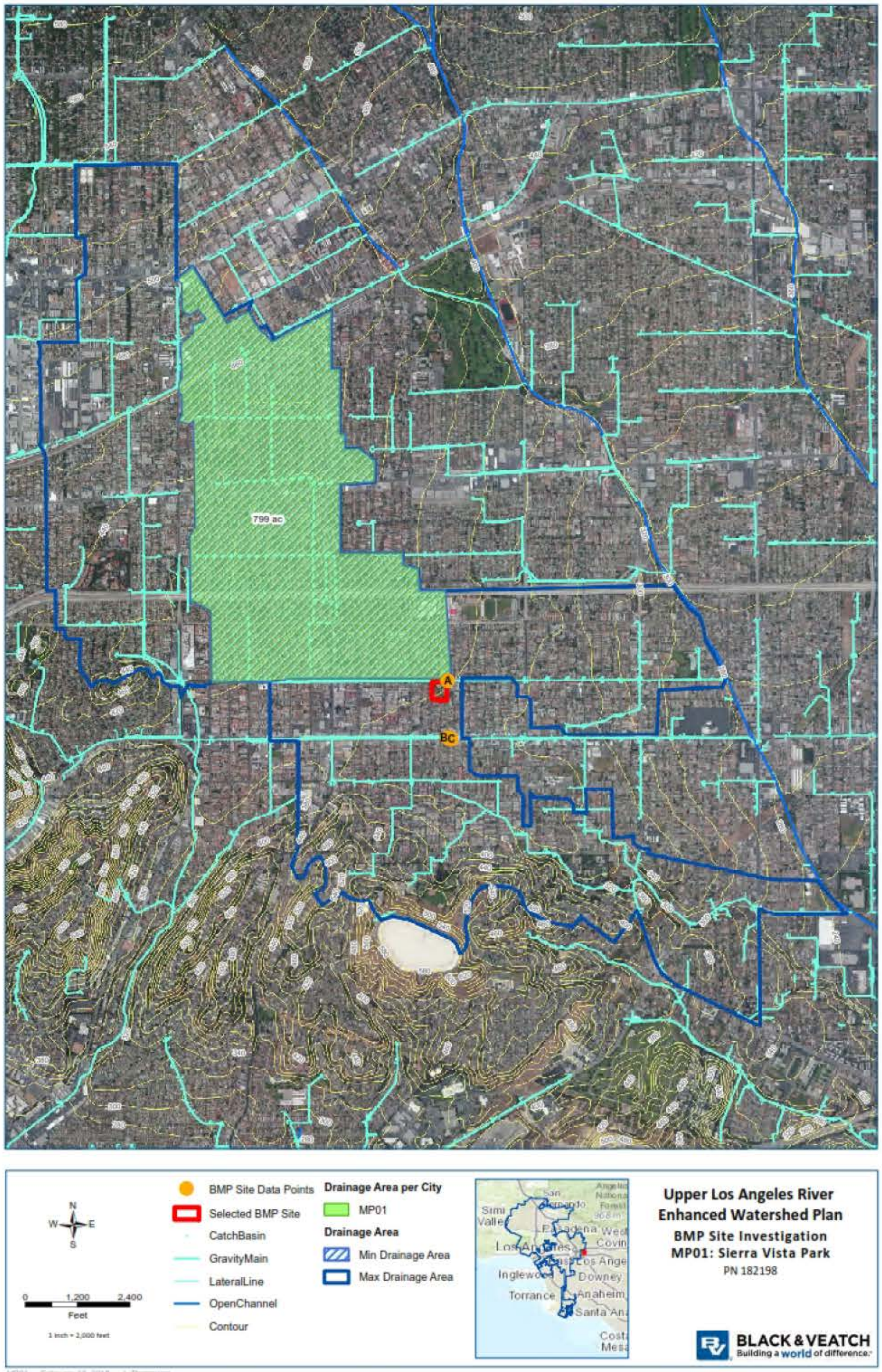


Figure 4-21. Sierra Vista Park Drainage Area

Figure 4-22. Sierra Vista Park Site Location

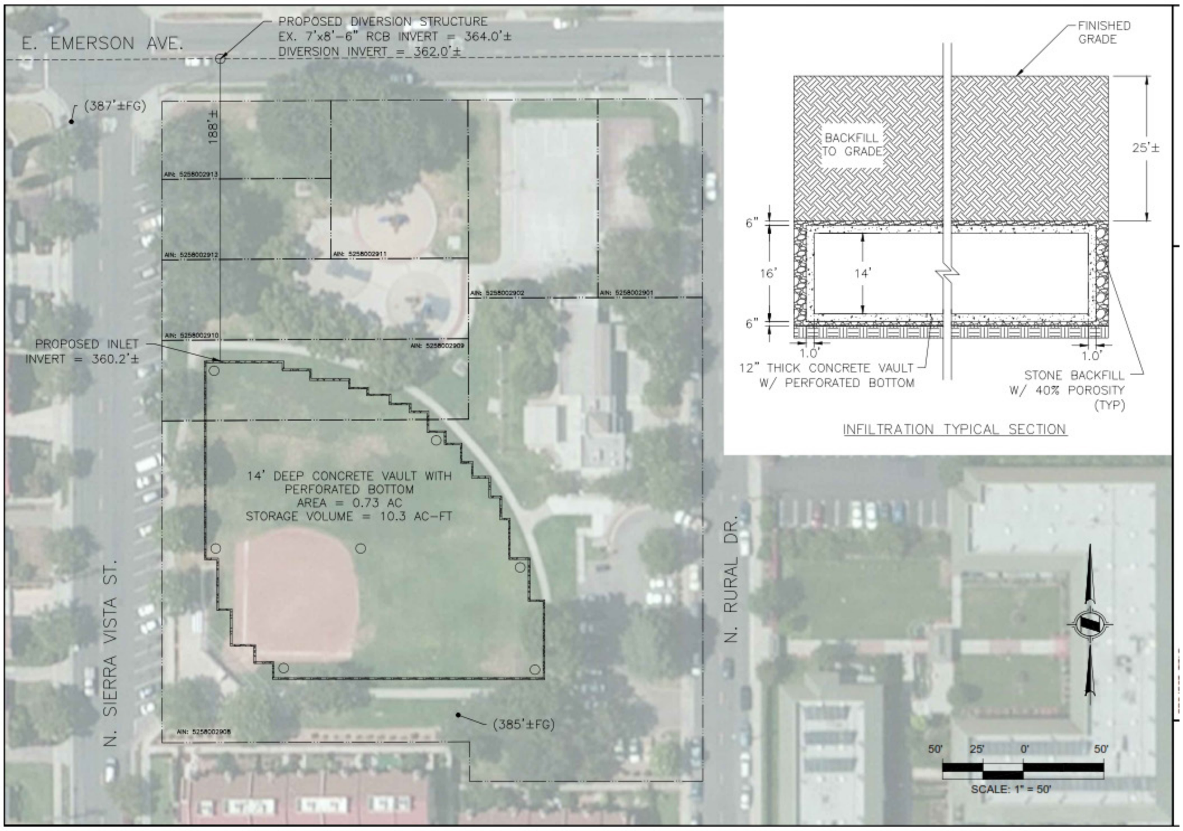


Figure 4-23. Sierra Vista Park Subsurface Infiltration Concept

4.5.6 San Fernando Regional Park

The park representing the San Fernando Regional Park is located within the City of San Fernando. The park includes open field space, baseball diamonds, community center, and pool facilities. The potential BMP type is proposed as a below-ground retention/infiltration basin situated beneath the open fields and baseball diamond at the southwest end of the park.

No maximum drainage area was identified for this site since it is located adjacent to a receiving waterbody, Pacoima Wash. After review of available site opportunities and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 423 acres.

After reviewing the hydrologic model results and estimated runoff volumes for the various diversion scenarios, it was determined that this site is suitable for an underground retention/infiltration BMP sized to accommodate more than the 85th percentile design storm runoff volume contributed from the smaller drainage area. As a result, the recommended active volume of the BMP is 22.6 acre-feet.

Table 4-8 below summarizes key conceptual design parameters of the BMP proposed at San Fernando Regional Park. **Figure 4-24** presents summary facts of the San Fernando Regional Park signature project. **Figures 4-25** to **4-27** provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

Table 4-8. Key Design Parameters for San Fernando Regional Park

<table>
<tr><th></th><th colspan="2">Summary of San Fernando Regional Park (SF01)</th></tr>
<tr><td rowspan="6">Project Site Parameters</td><td>Total (Maximum) Drainage Area</td><td>N/A</td></tr>
<tr><td>Alternative (Minimum) Drainage Area</td><td>423 ac</td></tr>
<tr><td>Maximum Recommended BMP Volume</td><td>N/A</td></tr>
<tr><td>Alternative Recommended BMP Volume</td><td>11.3 ac-ft</td></tr>
<tr><td>Groundwater Depth</td><td>50 ft</td></tr>
<tr><td>Maximum BMP Opportunity Area</td><td>2.7 ac</td></tr>
<tr><td rowspan="4">BMP Design Parameters</td><td></td><td></td></tr>
<tr><td>Recommended Maximum BMP Depth (below ground surface)</td><td>20 ft</td></tr>
<tr><td>Available BMP Volume</td><td>54 ac-ft</td></tr>
<tr><td>Recommended Active BMP Volume</td><td>22.6 ac-ft</td></tr>
</table>

Upper Los Angeles River Enhanced Management Program
Signature Project: San Fernando Regional Park
FACT SHEET PN 182198

Note: Figures are not to scale

Site Location			
Site Location, City	San Fernando	Site Name	San Fernando Regional Park
Latitude	34° 16′ 53.01″ N	Longitude	118° 25′ 59.833″ W
Landuse	Open Space	Street Address	208 Park Avenue
Major Watershed	Upper Los Angeles River	Land Owner	City of San Fernando
Existing Land Use of Site: Park			

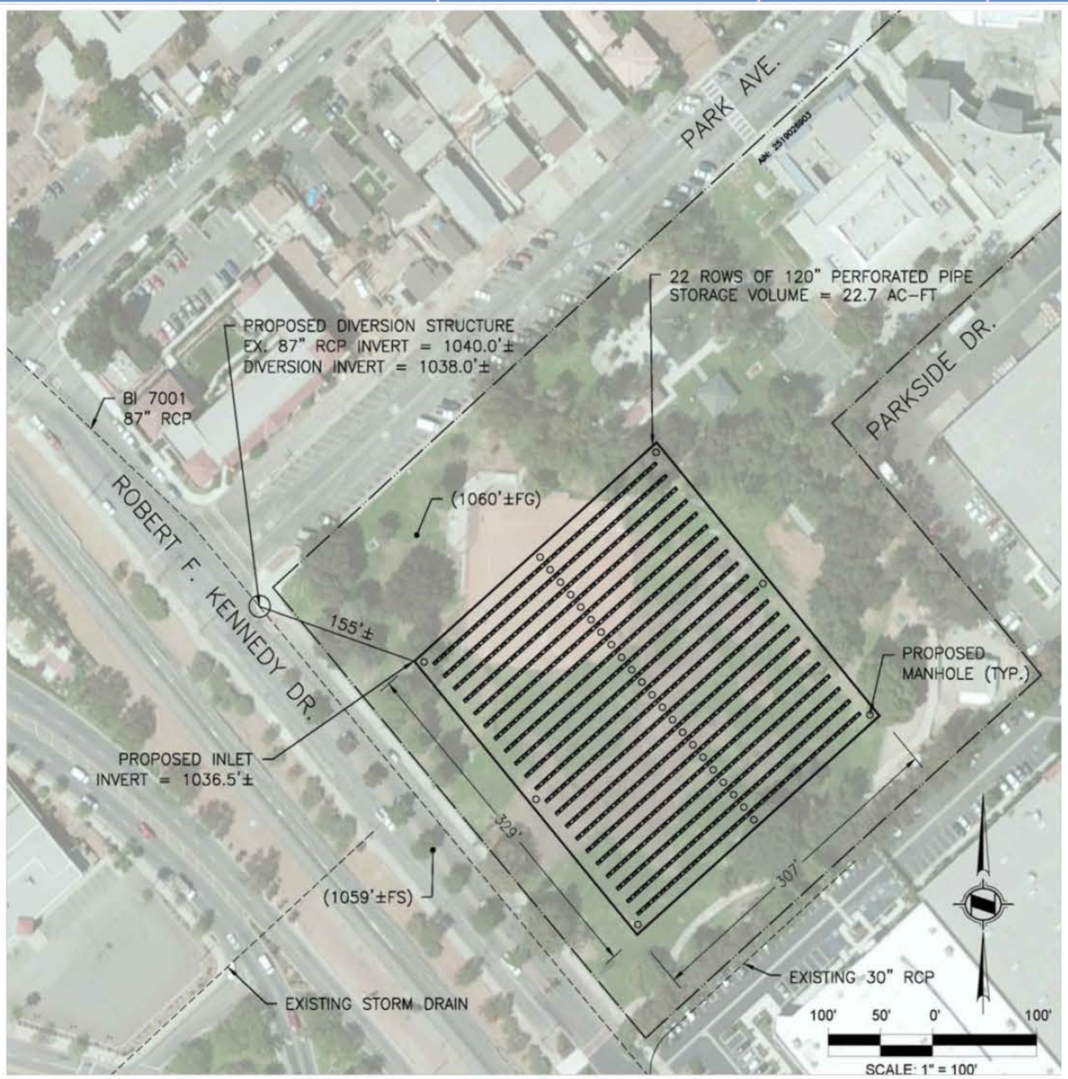
Watershed Characteristics	
Drainage Area Max/Min, ac	423/423
Hydrologic Soil Group	Tujunga Fine Sandy Loam
Soil Infiltration Rate, in/hr	0.80
Manages 85th Percentile, 24 hr Design Storm Event?	Yes
Recommended Active BMP Volume, ac-ft	22.6
Approximate Rainfall Event Depth Captured Based on Recommended Volume, inch = 1.0	

Retrofit Characteristics	
Proposed Retrofit	Subsurface Infiltration
Recommended BMP Footprint, ft^2	101003
Available BMP Volume, ac-ft	54
BMP Water Storage Depth,, ft	13
Gravel Depth, ft	1

Budget- Level estimates for both soft and hard costs	$29,273,000	**Schedule**	2 years design, 6 months bid, 4.00 years construction (6 ½ years total)

Drainage Map

Watershed and Vicinity



Rendered Improvements

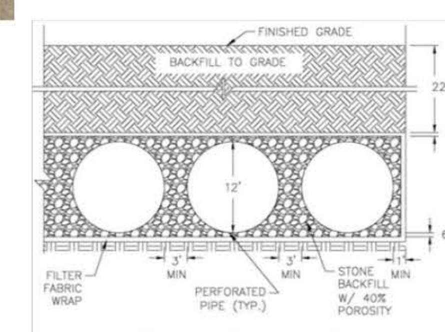


Figure 4-24. Summary Facts: San Fernando Park Signature Project

Figure 4.25. San Fernando Regional Park Subsurface Infiltration Drainage Area

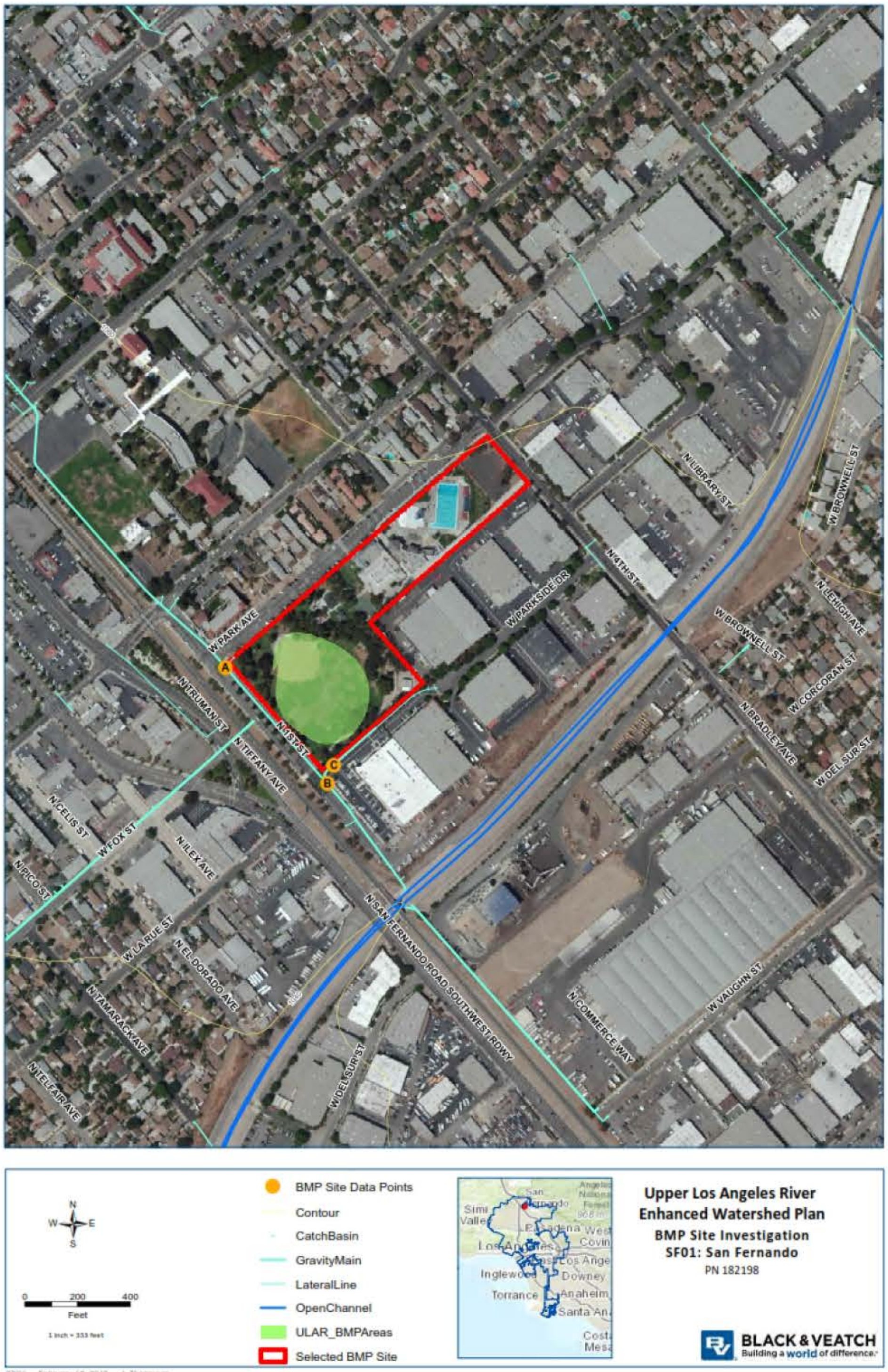


Figure 4.26. San Fernando Regional Park Subsurface Infiltration Site Location

Figure 4-27. San Fernando Park Subsurface Infiltration Concept

4.5.7 Lacy Park

Lacy Park is a public park located within the City of San Marino in an area that drains to the ULAR. Park features include a picnic area heavily used by residents, open green space, two walking trails, and tennis courts. The potential BMP type proposed is a below-ground retention/infiltration basin situated in the center of the park beneath a depressed area of land that used to be a natural lake.

The maximum drainage area for this project site is approximately 1,067 acres. After review of available site information and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 928 acres.

After reviewing the hydrologic model results and estimated runoff resulting from the various diversion scenarios, it was determined that this is suitable for an underground retention/infiltration BMP sized to accommodate the 85th percentile design storm runoff volume contributed from the maximum drainage area. As a result, the recommended active volume of the BMP is 46.4 acre-feet.

Table 4-9 below summarizes key conceptual design parameters of the BMP proposed at the Lacy Park. **Figure 4-28** presents summary facts of the Lacy Park signature project. **Figures 4-29** to **4-31** provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

Table 4-9. Key Design Parameters for Lacy Park

Summary of Lacy Park (SM01)		
Project Site Parameters	Total (Maximum) Drainage Area	1,067 ac
	Alternative (Minimum) Drainage Area	928 ac
	Maximum Recommended BMP Volume	48 ac-ft
	Alternative Recommended BMP Volume	46.4 ac-ft
	Groundwater Depth	145 ft
	Maximum BMP Opportunity Area	2.4 ac
BMP Design Parameters		
	Recommended Maximum BMP Depth (below ground surface)	20 ft
	Available BMP Volume	48 ac-ft
	Recommended Active BMP Volume	**46.4 ac-ft**

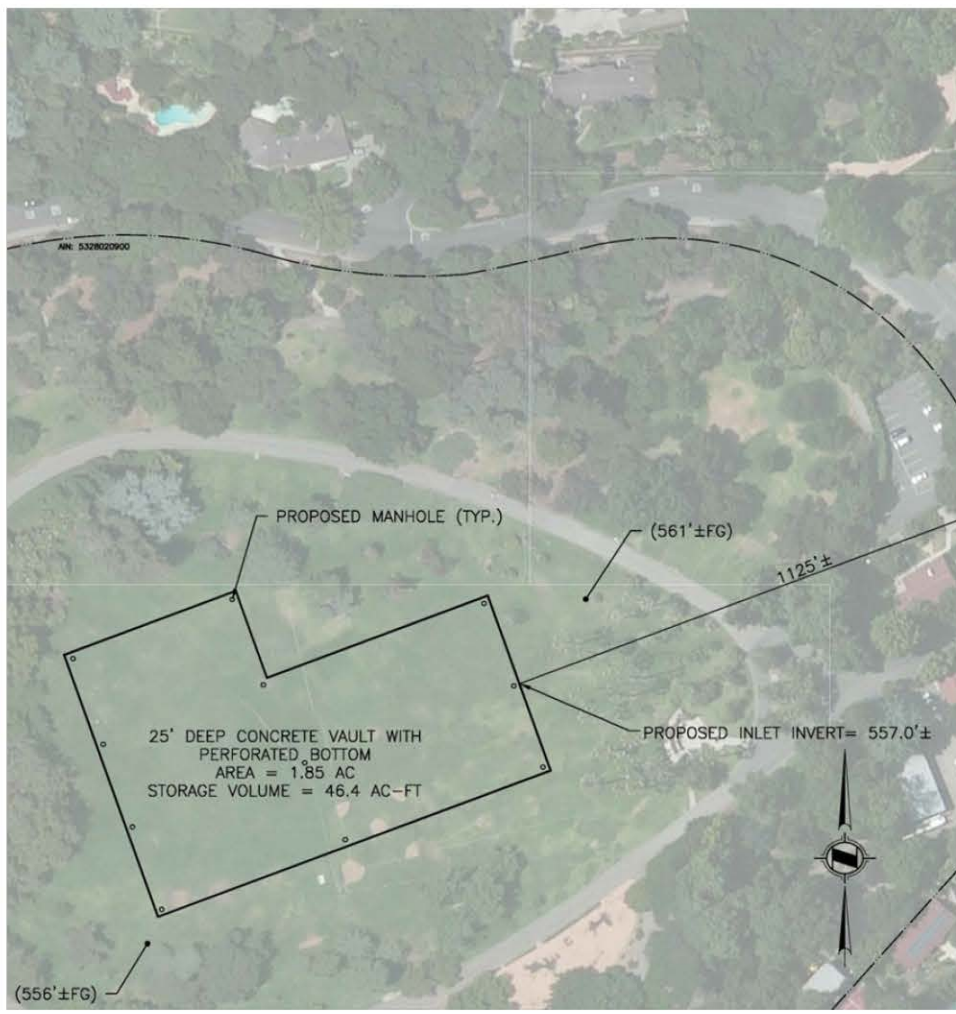
Upper Los Angeles River Enhanced Management Program
Signature Project: Lacy Park
FACT SHEET PN 182198

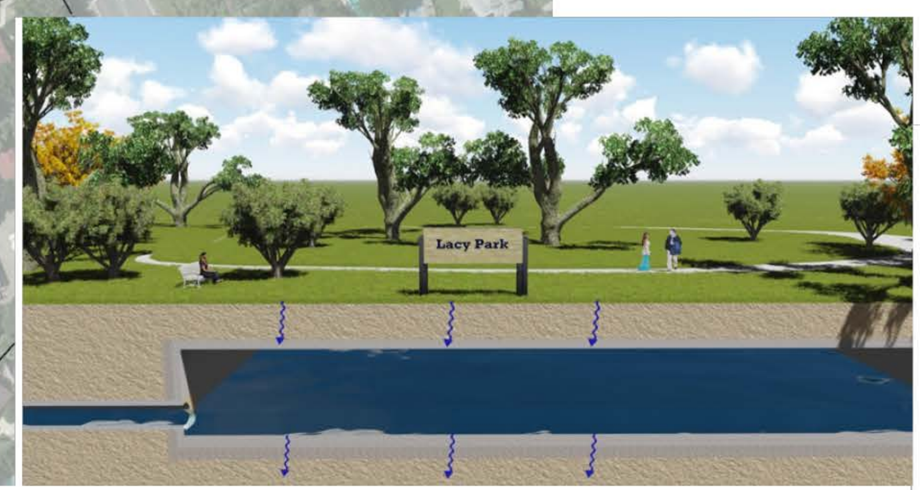
Note: Figures are not to scale

Site Location			
Site Location, City	San Marino	Site Name	Lacy Park
Latitude	34° 7' 13.501" N	Longitude	118° 7' 12.4860" W
Landuse	Open Space	Street Address	1485 Virginia Road
Major Watershed	Upper Los Angeles River	Land Owner	City of San Marino
Existing Land Use of Site: Park			

Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Min, ac	1,067/928	Proposed Retrofit	Subsurface Infiltration
Hydrologic Soil Group	Ramona Loam, Ramona Sandy Loam	Recommended BMP Footprint, ft²	80586
Soil Infiltration Rate, in/hr	0.39	Available BMP Volume, ac-ft	48
Manages 85th Percentile, 24 hr Design Storm Event?	Yes	BMP Water Storage Depth, ft	25
Recommended Active BMP Volume, ac-ft	46.4	Gravel Depth, ft	0
Approximate Rainfall Event Depth Captured Based on Recommended Volume, inch = 0.9			

Budget- Level estimates for both soft and hard costs	$55,145,000	**Schedule**	2 years design, 6 months bid, 5.00 years construction (7 ½ years total)





Rendered Improvements

Drainage Map

Watershed and Vicinity

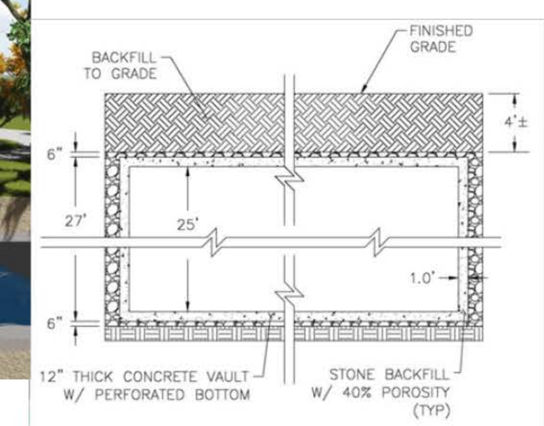


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Figure 4-28. Summary Facts: Lacy Park Signature Project

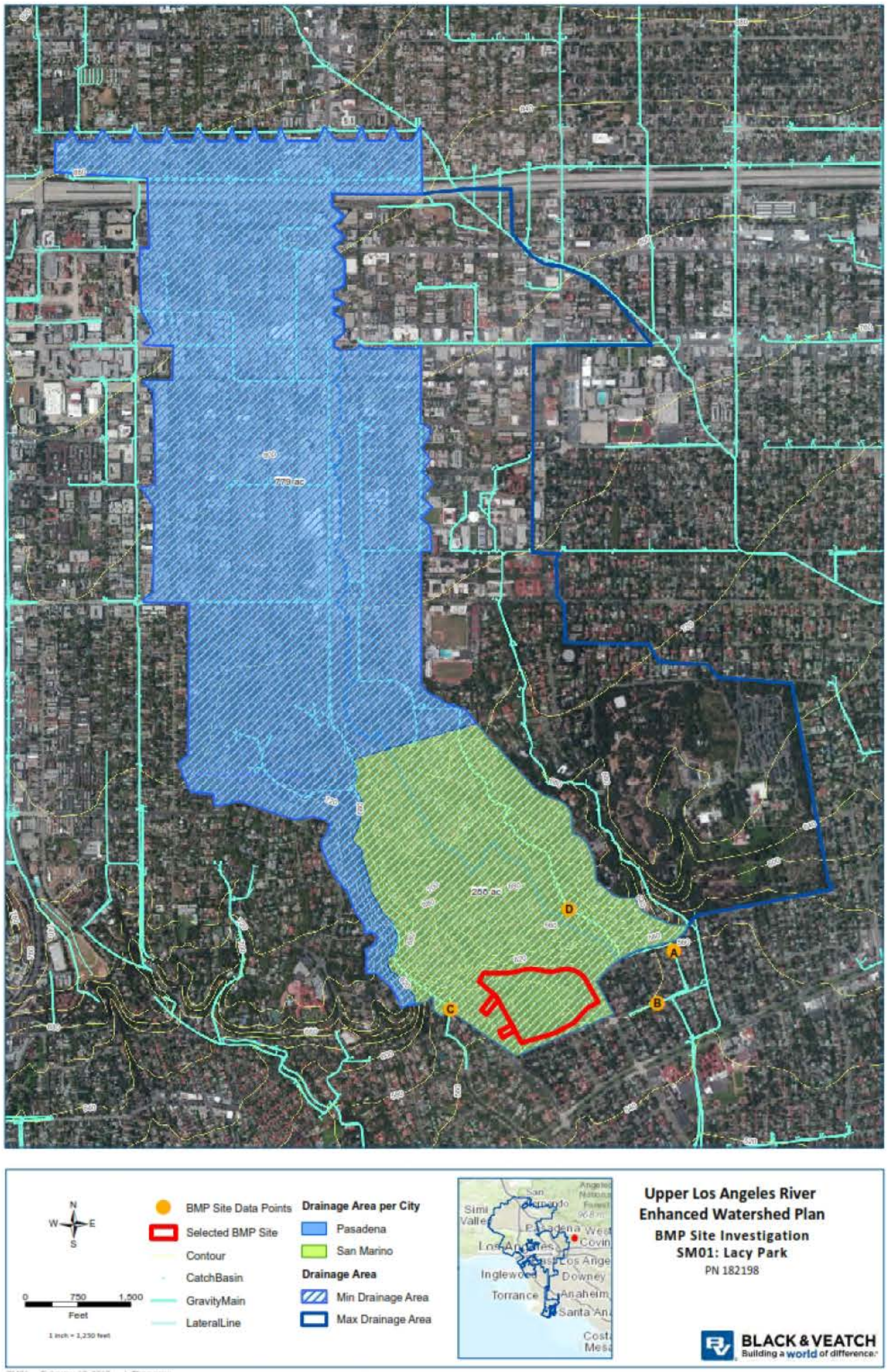


Figure 4-29. Lacy Park Drainage Area

Figure 4-30. Lacy Park Site Location

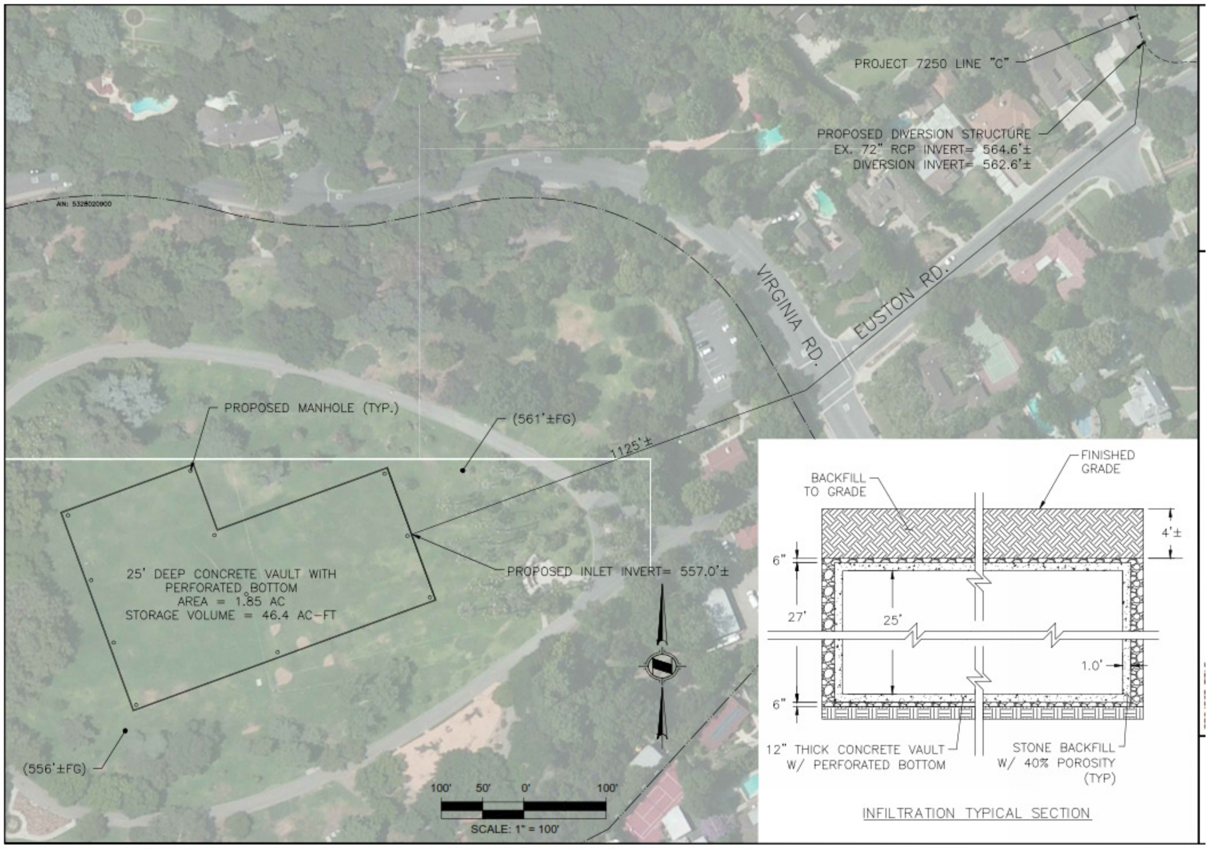


Figure 4-31. Lacy Park Subsurface Infiltration Concept

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 85^{th} 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**

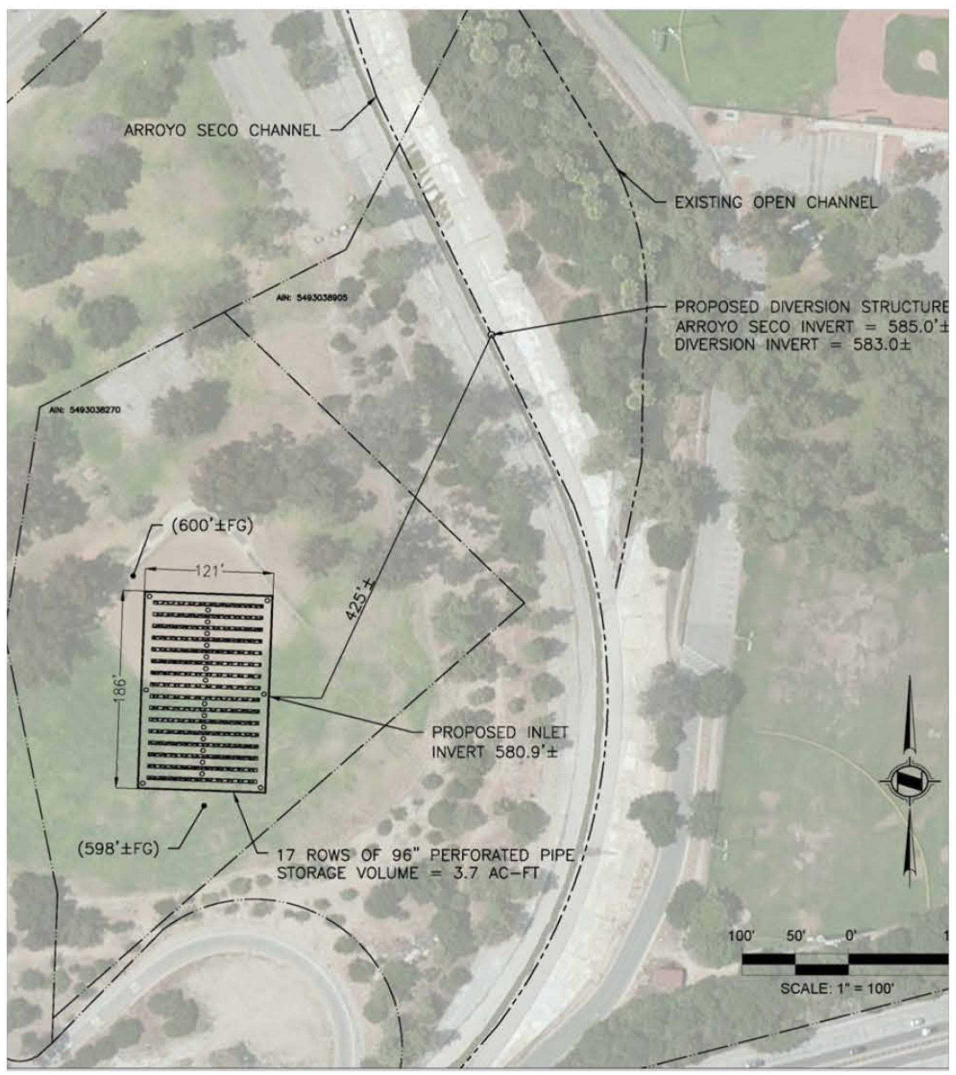
Upper Los Angeles River Enhanced Management Program
Signature Project: Lower Arroyo Park
FACT SHEET PN 182198

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

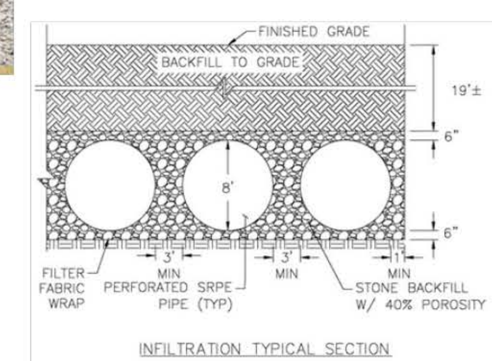


Figure 4-32. Summary Facts: Lower Arroyo Park Signature Project

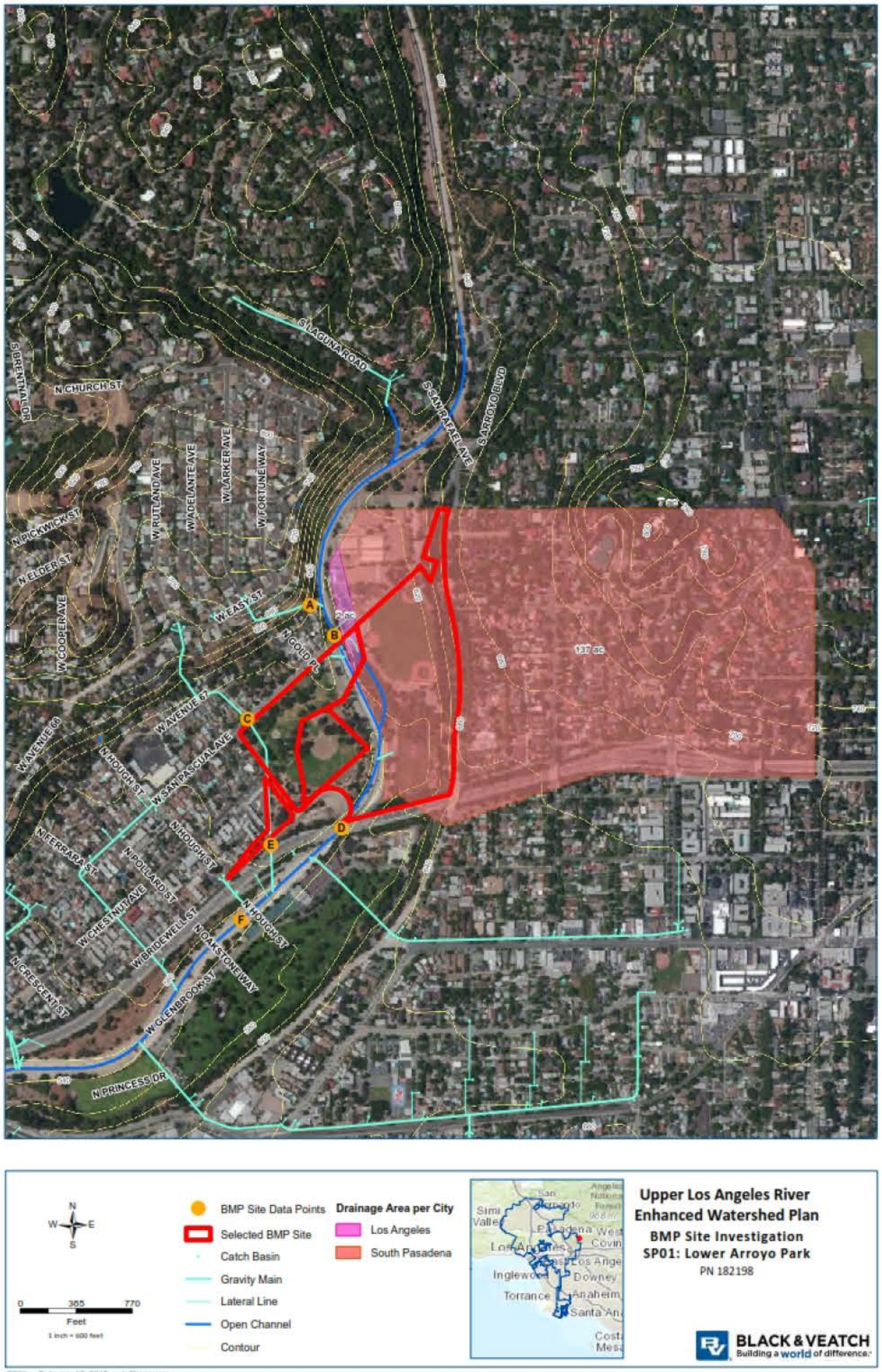


Figure 4-33. Lower Arroyo Park Subsurface Infiltration Drainage Area

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

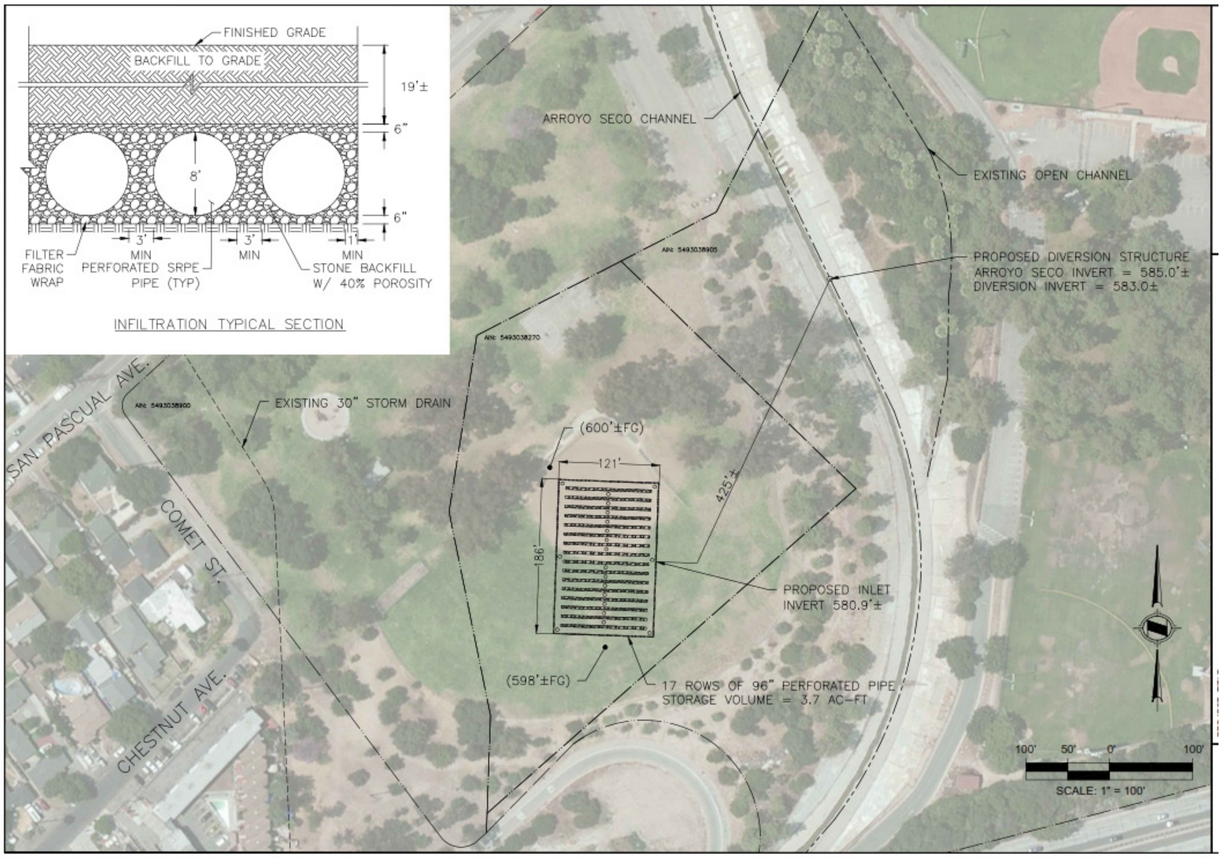


Figure 4-35. Lower Arroyo Park Subsurface Infiltration Concept

4.6 How is the EWMP Integrated with Previous, Ongoing and Future Water Quality Planning Efforts?

The EWMP includes a compilation of numerous previous stormwater compliance planning documents created for the ULAR, and the EWMP represents the "master stormwater compliance plan" moving forward. As such, it is important to recognize and, to the extent practicable, incorporate other planning efforts in the LA River watershed. This section provides a brief overview of the previous planning documents incorporated into the EWMP and considers how the EWMP will be integrated into other efforts to restore and provide access to the Los Angeles River and increase the reliability of local water supplies.

4.6.1 Previous Water Quality Planning Efforts

The process of developing a set of regional project opportunities described above included a review and analysis of many local and regional planning efforts underway by many other agencies and organizations throughout the watershed. The previously developed plans reviewed during EWMP development include the following:

- Implementation Plans for the LA River and Tributaries Metals TMDLs:
  - *City of Los Angeles Draft Implementation Plan, 2010*

  - *Calabasas Metals TMDL Implementation Plan, 2010*
  - *Hidden Hills Metals TMDL Implementation Plan, 2010*
  - *La Cañada Flintridge Metals TMDL Implementation Plan, 2010*
  - *Multi-* Pollutant TMDL Implementation Plan for the Unincorporated County Area of the Los Angeles River Watershed, 2010
- *Los Angeles River Revitalization Plan*, 2011
- *USACE Ecosystem Restoration Feasibility Study* (Draft), 2013
- *Los Angeles River Master Plan*, 1996
- *Arroyo Seco Watershed Management Plan*, 2006
- *Tujunga-Pacoima Watershed Management Plan*, 2008
- *Sun Valley Watershed Management Plan*, 2004
- *Greater Los Angeles Integrated Regional Water Management Plan* (LA IRWMP), 2006
- *Greater Los Angeles Integrated Regional Water Management Plan* (LA IRWMP), 2013
- *City of Los Angeles Proposition O Monthly Report*, October 2013
- *Upper Los Angeles River Watershed Report, Phase III - A Prioritized Approach to Selecting Runoff Capture Projects* (December 2013)
- *Water Quality Compliance Master Plan for Urban Runoff* (May 2009)

The list of over 100 regional projects identified for the EWMP includes many of the projects described in these planning documents. In some cases, the project opportunities identified in previous planning documents are outside of the ownership or jurisdiction of the EWMP Group members. While most jurisdictions decided to not include non-agency owned parcels in the regional project selection process, a database of non-owned opportunities was developed and is available as a reference document for future use by EWMP Group members. Over the course of adaptive management, non-agency owned opportunities can be evaluated for inclusion in the EWMP implementation Strategy.

Furthermore, over the course of adaptive management there may be many opportunities discovered to combine new project concepts with existing infrastructure. As an example, shown in Appendix 4D are three concept designs by City of Los Angeles for leveraging existing pump stations to manage and treat stormwater using innovative retrofits.

4.6.2 Los Angeles River Restoration and Revitalization Efforts

There are multiple initiatives in the LA River watershed to restore habitat, increase public access to waterways and develop greenways that provide new recreational opportunities. Leaders of these efforts are numerous, including, The LA River Corp, Santa Monica Mountains Conservancy, Mountains Recreation and Conservation Authority, Amigos de los Rios, The River Project, Tree People, Friends of the LA River, Council for Watershed Health, and many others. As the EWMP Implementation Strategy is pursued, it will be important to integrate stormwater quality / compliance with these other efforts to make the river more safe, accessible, healthy and beautiful. A key consideration will be the component of the EWMP Implementation Strategy achieved by *regional projects on private land*. As shown in **Figure 4-2**, regional projects on private land are a major component of the EWMP Implementation Strategy and thus there may be much potential to leverage acquired land to achieve stormwater compliance goals. Over time, the regional BMP programs will seek to identify additional public opportunities and identify strategic locations to acquire land for siting stormwater control measures. As land acquisition efforts are pursued, they will likely consider the potential multiple benefits of habitat protection, increasing public access, providing recreation opportunities and perhaps even restoring floodplains in certain areas.

To illustrate how the effort to identify regional projects on private land could be integrated with related restoration efforts, consider Los Angeles River Ecosystem Restoration Feasibility Study [12]. The study, which is a partnership between the City of Los Angeles Bureau of Engineering and the US Army Corps of Engineers, includes an evaluation of alternatives for the purpose of restoring 11 miles of the Los Angeles River from approximately Griffith Park to downtown Los Angeles, while maintaining existing levels of flood risk management in this highly urbanized watershed. Restoration measures considered include:

- Creation and reestablishment of historic riparian strand and freshwater marsh habitat to support increased populations of wildlife and enhance habitat connectivity;
- Increasing opportunities for connectivity to ecological zones, such as the Santa Monica Mountains, Verdugo Hills, Elysian Hills, and San Gabriel Mountains;
- Reintroduction of ecological and physical processes, such as a more natural hydrologic and hydraulic regime that reconnects the river to historic floodplains and tributaries, reduced flow velocities, increased infiltration, improved natural sediment processes, and improved water quality; and
- Evaluating opportunities for passive recreation that is compatible with the restored environment.

The study also identifies a more focused study area of the Los Angeles River as the "Area with Restoration Benefits and Opportunities for Revitalization" (ARBOR) Reach, which extends from the Headworks at the upstream end to First Avenue at the downstream end. Within the ARBOR area, the following project opportunities have been highlighted:

- Piggyback Yard
- Arroyo Seco Land
- Verdugo Wash Land

These areas are key candidates for future integration with the EWMP process, especially pursuit of regional projects on private land. Future efforts to achieve the vision for the ARBOR Reach will likely include land acquisition. Shown in **Figure 4-36** are the City of Los Angeles subwatersheds in the ARBOR Reach that include regional projects on private land as a part of the EWMP Implementation

[12] http://www.spl.usace.army.mil/Portals/17/docs/publicnotices/DraftIntegratedReport.pdf

Strategy. As the EWMP is implemented, opportunities to integrate regional projects into the restoration efforts along the ARBOR Reach will be pursued.

A similar EWMP integration effort will need to take place for the other types of restoration and public access initiatives, as mentioned above.

4.6.3 Stormwater Capture Master Plan (City of Los Angeles Department of Water and Power)

The City of Los Angeles Department of Water and Power is undertaking the Stormwater Capture Master Plan (SCMP)[13], a significant regional planning effort to identify opportunities to increase stormwater capture throughout the City. Goals and activities include:

- Increase reliability and sustainability of local water supply
- Enhance stormwater capture for water supply
- Quantify potential stormwater capture both short term (2035) and long term (2099)
- Define and prioritize groundwater aquifers 'well suited' for infiltration
- Evaluate inflows and outflows of stormwater.
- Evaluate effectiveness of stormwater BMPs

Many of the projects identified by the SCMP will have positive benefits on water quality, and over the course of EWMP adaptive management, those projects and benefits may be incorporated into the EWMP. The City of Los Angeles is developing a One Water LA strategy[14] to integrate drinking water, wastewater and stormwater goals, and integration of the EWMP and SCMP will be key consideration. One project from the SCMP that has already been integrated into the ULAR EWMP is the Strathern Park, see **Figure 4-37** for a description of the concept.

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[13] https://www.ladwp.com

[14] http://www.lacitysan.org/irp/OneWater.htm

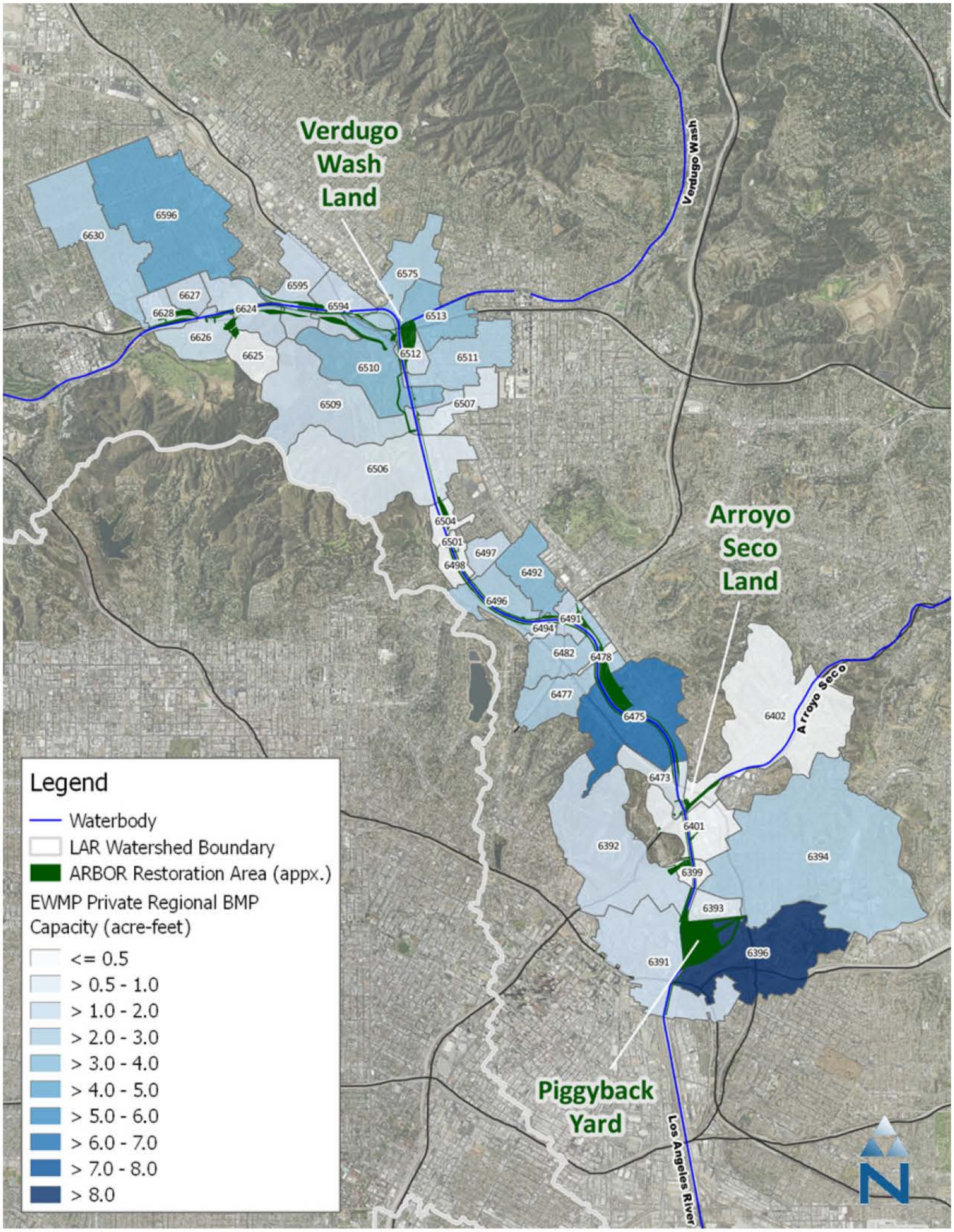

Figure 4-36. LA River ARBOR / Restoration Areas and Nearby Areas where Regional Projects on Private Land are a Component of the EWMP Implementation Strategy

This Project will excavate three infiltration basins with a surface area of approximately 10.5 acres to provide additional storage and infiltration. The basins will be 5 to 10 feet deep and will receive runoff from the Tujunga Spreading Grounds and a nearby storm drain. The connection to the Tujunga Spreading Grounds allows it to receive large flows to supplement surface drainage such as releases from the Big Tujunga and Hansen Dam. The groundwater recharge will benefit the long-term sustainability of the San Fernando Groundwater Basin, increase local groundwater supplies by 500 to 1,000 acre-feet per year, and reduce the region's reliance on water imports.

This Project is not to be confused with the County of Los Angeles' Rory M. Shaw Wetlands Park Project which is located at a park site west of the Rory M. Shaw Wetlands Park.

Proposed connection from Tujunga Spreading Grounds and modifications at Strathern Park, future site of a stormwater capture and infiltration project.

Figure 4-37. Concept for Strathern Park, future site of a stormwater capture and infiltration project that is integrated into ULAR EWMP

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Section 5
Overview of EWMP Control Measures: Green Infrastructure and Institutional BMPs

Complementary to the regional BMP program introduced in Section 4, robust green infrastructure programs will be critical to achieving water quality compliance in the ULAR watershed. While the regional BMP program is structured around large projects that are likely to be *individually* planned and designed specifically for available parcels, the green infrastructure component will implement vast numbers of distributed control measures in available rights-of-way and on both private and public parcels (where regional BMPs are not feasible/desirable). This section provides an overview of the green infrastructure programs within the EWMP and highlights several signature projects as an example of the types of efforts that are upcoming and ongoing. The details of the EWMP Implementation Strategy and RAA results are provided in later sections of the EWMP.

5.1 What Types of Green Infrastructure Control Measures are included in the EWMP?

The ULAR EWMP includes two primary types of green infrastructure – LID and green streets – as illustrated below. **Appendix 5.A** provides fact sheets explaining both green streets and LID practices.

Low-Impact Development: these are distributed structural practices that capture, infiltrate, and/or treat runoff at the parcel-scale (normally less than 10 tributary acres (**Figure 5-1**). Common LID practices include bioretention, permeable pavement, and other infiltration BMPs that prevent runoff from leaving a parcel. Rainfall harvest practices such as cisterns can also be used to capture rainwater - that would otherwise run off a parcel - and use it to offset potable water demands. The types of LID incorporated into the EWMP are the LID ordinance, residential LID, and LID retrofits of public parcels.

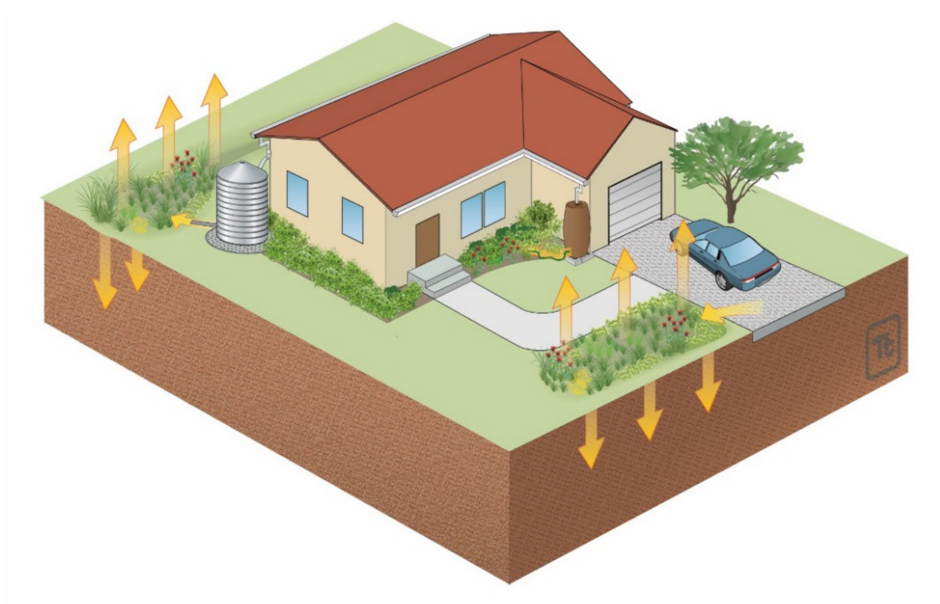


Figure 5-1. Conceptual schematic of LID implemented at the site scale
(arrows indicate water pathways)

Green Streets: these are distributed structural practices that are typically implemented as linear bioretention/biofiltration practices installed parallel to roadways. Systems receive runoff from the gutter via curb cuts or curb extensions[15] (sometimes called bump outs) and infiltrate it through native or engineered soil media. Permeable pavement can also be implemented in tandem, or as a standalone practice, in parking lanes of roads (**Figure 5-2**).

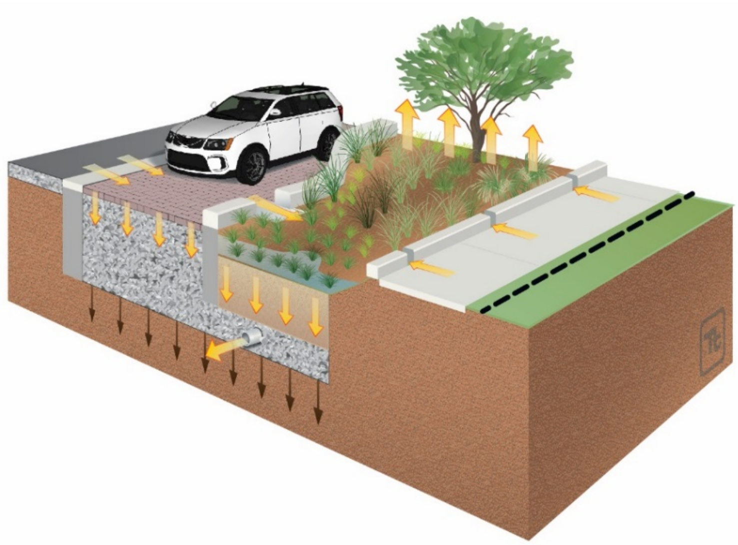


Figure 5-2. Conceptual schematic of green street

(arrows indicate water pathways)

5.2 What is the Role of Green Infrastructure in the EWMP?

Green infrastructure will be responsible for a major portion of the pollutant reduction to be achieved by the EWMP. Green infrastructure makes up over 58 percent of the control measure capacity in the EWMP to be implemented by 2028, as shown in **Figure 5-3** (LID and green streets each make up 40 percent and 18 percent, respectively). The total network of LID, green streets and regional BMPs in the EWMP Implementation Strategy represents approximately 20 Rose Bowls of BMP capacity. Given the large number of green infrastructure control measures that make up the EWMP Implementation Strategy, it is envisioned that green infrastructure will be implemented through "programs," namely watershed-scale LID and green street programs. These programs will consider the following objectives:

- **Identify and prioritize opportunities –** Individual green infrastructure projects and programs can vary widely in cost efficiency and site applicability. Assessing and comparing individual project opportunities (e.g., Street A vs. Street B) or programs (e.g. residential LID vs. green streets) will help to define the most cost effective decisions.

- **Generate demonstration projects –** A series of early-stage demonstrations will serve several key purposes: (1) facilitate public interest, education, and support in the programs; (2) collect

[15] While the RAA assumed green streets are engineered with bioretention cells, there is potential for less-engineered options ("parkway basins") to be an element of the EWMP Implementation Strategy. Parkway basins are described as an element of the residential LID program, since to date they have been a component of residential LID demonstration projects in the LA River watershed.

BMP performance data for future adaptive management; and (3) explore and document implementation alternatives and lessons learned.

- **Establish standards –** Since many green infrastructure opportunities are situated in common or standard spaces (e.g., rights of way), design standards and templates would streamline design processes and increase the certainty that EWMP pollutant reduction goals are achieved.
- **Systematize implementation –** Due to the large number of discrete individual green infrastructure opportunities and the heavy reliance on these practices to address Water Quality Priorities, the EWMP includes a rapid rate of green infrastructure implementation. The implementation process will need to encourage rapid adoption by stakeholders (e.g., residential property owners), to establish streamlined project planning processes, and to cleanly integrate with existing capital improvement programs.

Not only are these green infrastructure programs critical to the success of the EWMP, they provide an excellent opportunity for multiple benefits to the local community. For example, the City of Los Angeles has already adopted a number of green infrastructure-based programs that promote water quality improvement as a primary or secondary objective. For instance, **Table 5-1** provides an overview of the many street programs that the City of Los Angeles and its partners participate in. Recently, the City of Los Angeles adopted an ordinance that incorporates green infrastructure requirements for streets projects. These types of programs and ordinances represent the initial stages of developing a comprehensive infrastructure program specifically designed to meet water quality objectives.

Table 5-1. Summary of the City of Los Angeles' Green Infrastructure-related Streets Programs

Street Program	Description of Program & Objectives	Includes Stormwater Elements	Identifies & Prioritizes Opportunities	Demonstration Projects	Establishes Standards	Systematizes Implementation
Green Streets	Designs streets & sidewalks to capture and/or infiltrate runoff in drought-tolerant bioswales and permeable pavement.	X	X	X	X	X
Great Streets	Active mayoral initiative in early stages of design and planning.		X	X	X	
Complete Streets	Planning and guidance document with conceptual designs for streets. Complete Streets Design Guide is Companion to Mobility Plan 2035	X			X	X
Green Alleys Program	Sister to Green Streets Program. Effort began as a study led by USC and NGO partners.	X	X	X	X	X
GRASS Program	Collaboration between LASAN, Cal Poly, and UCLA. Task to create a priority grid of stormwater capture greenways.	X	X	X		
Water LA	An NGO-led effort, this program promotes "urban acupuncture" that includes installing shallow infiltration basins in the parkways of residential neighborhoods.	X	X	X	X	X

NGO – non-governmental organization

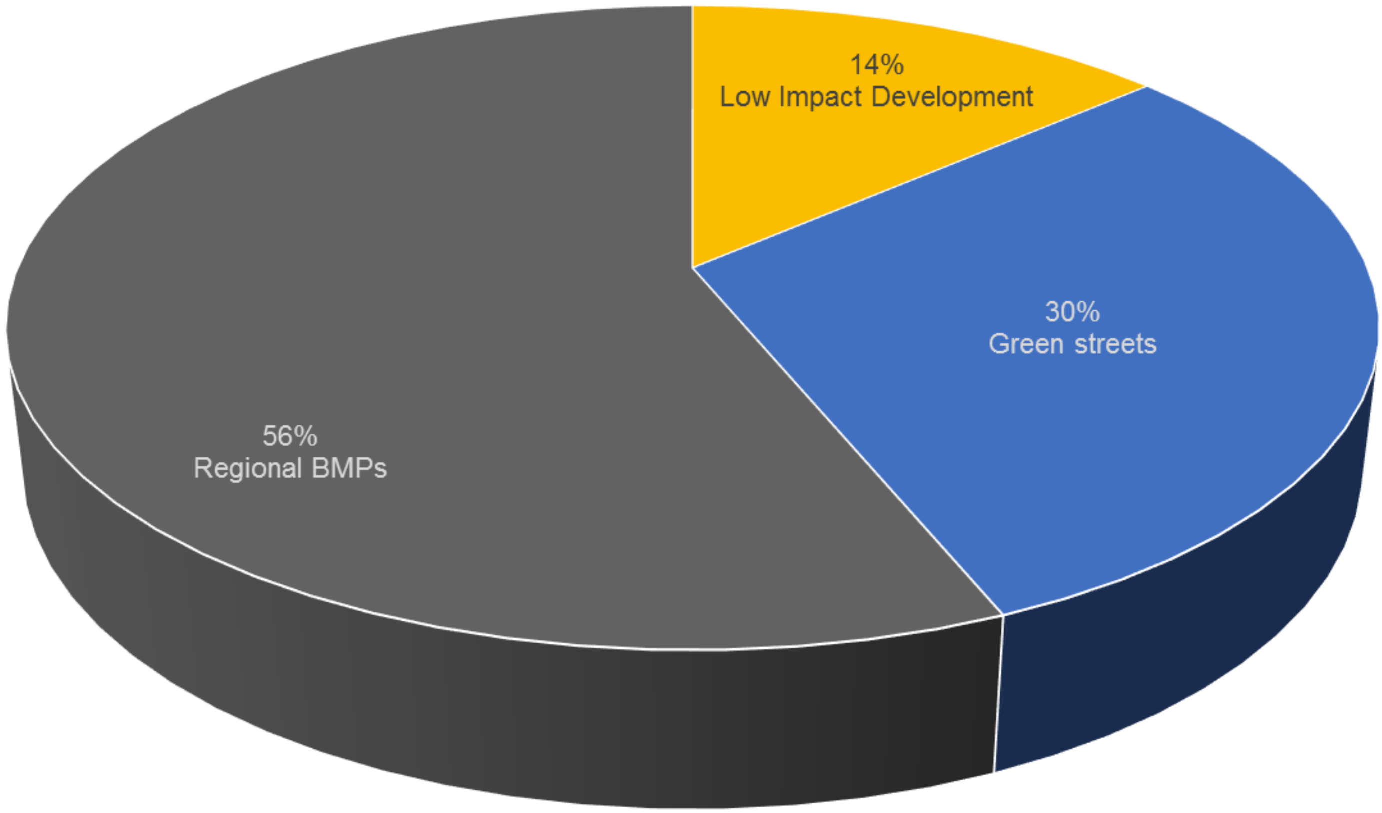


Figure 5-3. Relative Capacity of LID, Green Streets and Regional Control Measures to be implemented by the ULAR EWMP by 2028

5.3 How are Green Streets integrated into the EWMP?

The right-of-way along streets may be the most extensive opportunity for the ULAR EWMP Group to implement BMPs on public land. In developed areas, curb and gutter in the road provide an opportunity to intercept both dry and wet weather runoff prior to entering the storm drain system and treat it within the extents of the public right-of-way. Green streets have been demonstrated to provide "complete streets" benefits in addition to stormwater management, including pedestrian safety and traffic calming, street tree canopy and heat island effect mitigation, increased property values, and even reduced crime rates. Details on green street BMPs, including the additional benefits, are presented in **Appendix 4.A**.

Green Street Program Highlights:

- Implements green infrastructure in the rights-of-way
- High potential for significant load reduction
- Agencies retain ownership and O&M burden
- Design/construction standards can yield efficiency
- Strategic selection of streets can yield cost savings
- Opportunity for integration with capital improvement projects
- Data limitations currently hamper decision making

To quantify the potential benefit of green streets for pollutant reduction and integrate them into the EWMP Implementation Strategy, all available streets throughout the watershed were screened to define the maximum available green street length, as shown in **Figure 5-4**. The RAA evaluated a series of detailed green street implementation parameters (described in detail in the RAA, Section 6.3), and determined the percent of available street opportunities to be retrofitted with green infrastructure to meet EWMP objectives, as shown in **Figure 5-5**. While it is anticipated that the implementation of green streets will evolve over the course of adaptive management, the EWMP Implementation Strategy provides the foundation of a robust watershed-wide green streets program going forward.

Typical residential green street

Because the green streets program will carry significant responsibility for achieving EWMP goals (as demonstrated by the extensive rate of implementation Figure 5-6), certain data limitations inherent to watershed-scale modeling must first be addressed during near-term planning. For example, street-scale design parameters including soil characteristics, microtopography, gutter slopes, utility conflicts, inlet hydraulics, and refined drainage areas must be defined using higher-resolution datasets; many of these data necessary to make informed decisions at the street-scale do not currently exist for the extents of the watershed and must therefore be generated. Comprehensive and quantitative rating systems can then be used to evaluate the performance of specific green street opportunities – in the context of EWMP objectives – alongside co-scheduled capital projects (e.g. road rehabilitation or utility improvements). Over time, this adaptive management strategy will transform the EWMP Implementation Strategy into a more focused green street "master plan."

As green street programs proceed, efforts must also be balanced with other programs, especially the residential LID program and the regional BMP program. For example, downstream of places where the residential LID program is heavily implemented, or upstream of locations where large regional projects are constructed, the need for green street retrofits will be reduced. Conversely, if higher resolution planning reveals that the RAA-prescribed green street implementation is infeasible in some areas, then upstream or downstream BMP requirements will be adjusted to compensate for the lack of local opportunities. As with the other programs, it will be important to track the details of green street implementation, such as street length, retention design characteristics, and drainage area to compare to the assumptions used in and performance predicted by the RAA. Further, the program should identify opportunities to reduce the O&M burden and engage stakeholders, such as through partnerships with homeowners and stewardship programs with business owners.

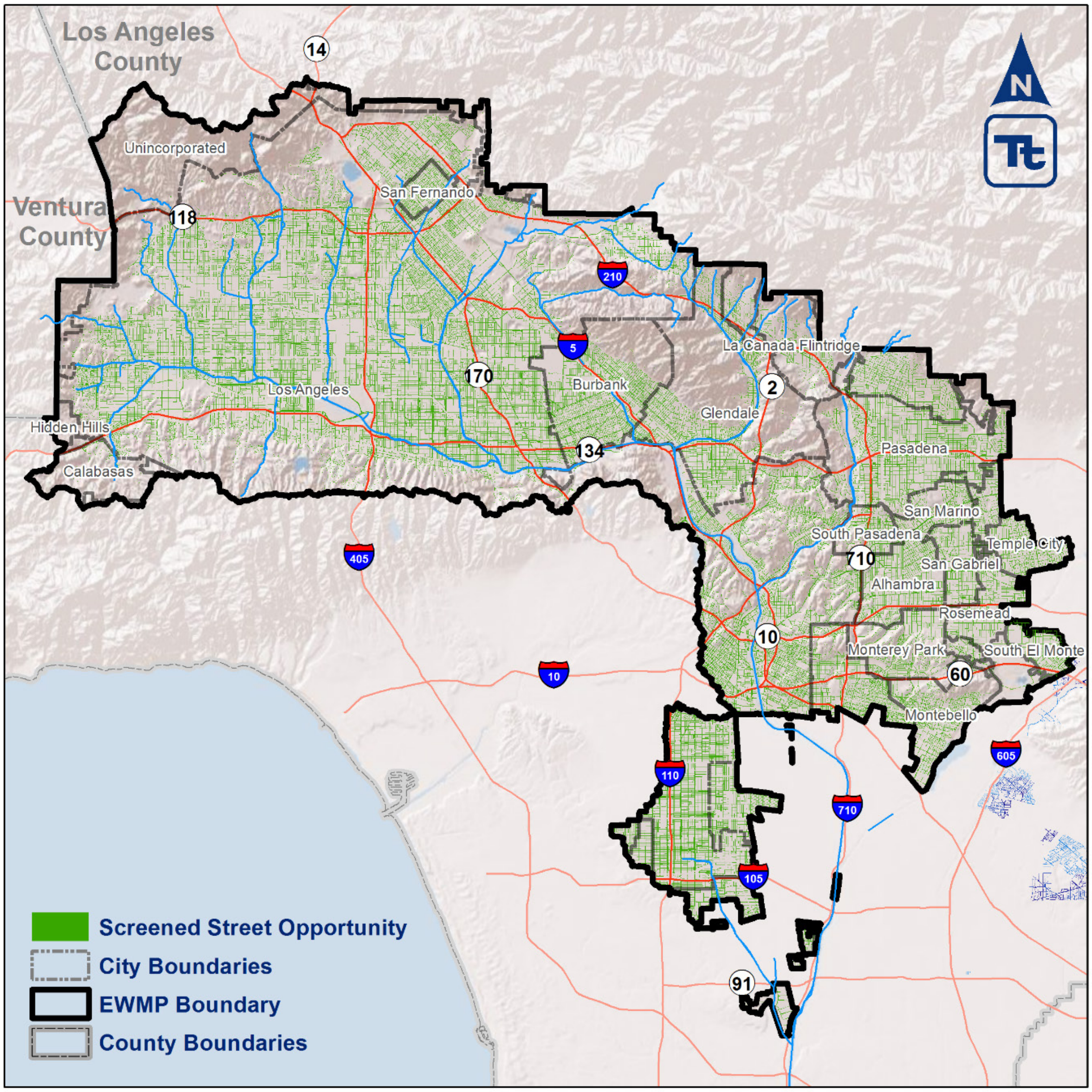


Figure 5-4. Green Street Screened Opportunities in the Upper Los Angeles River EWMP Area

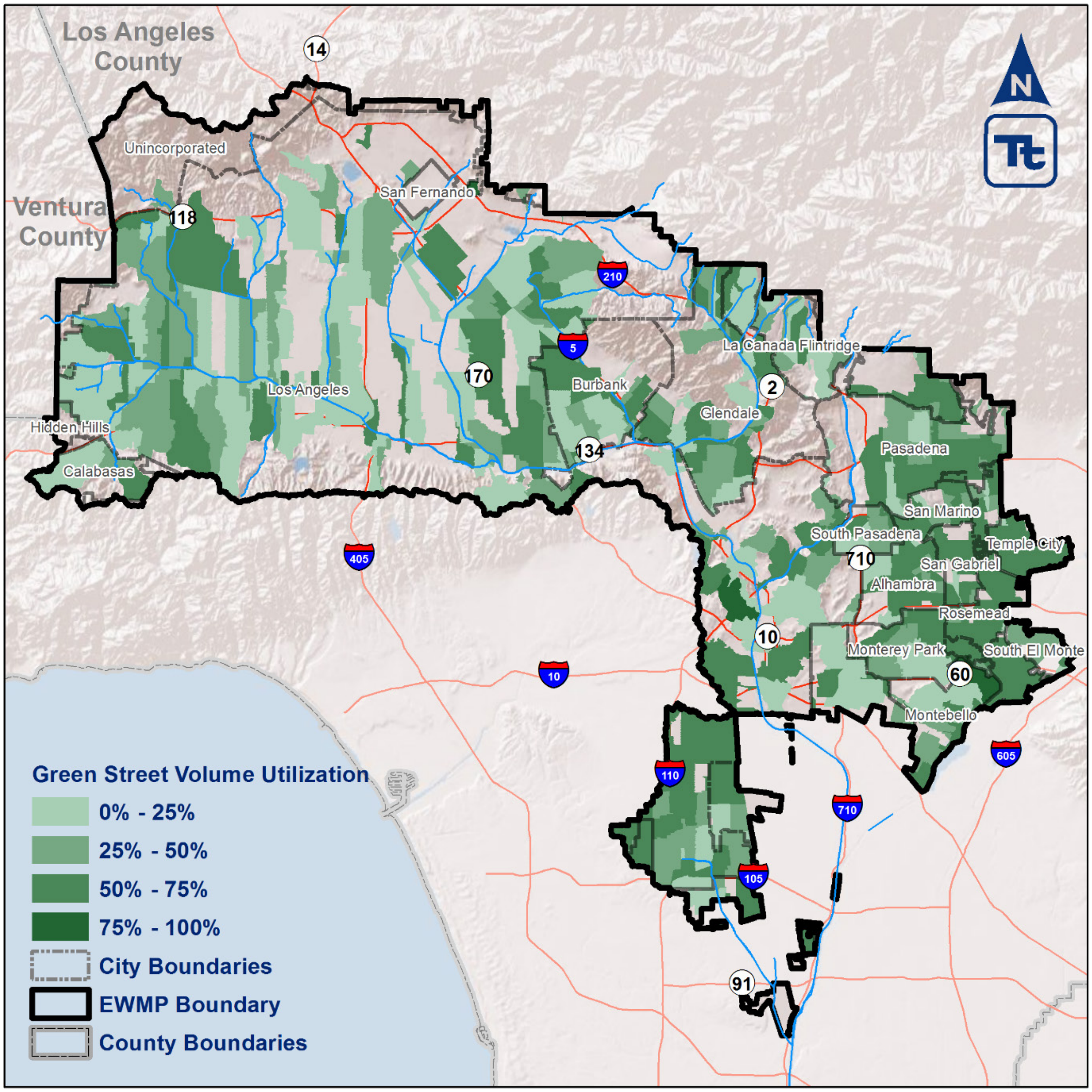


Figure 5-5. Percent of Required Green Street Implementation in the Upper Los Angeles River EWMP Area Relative to Total Available Capacity

(i.e. percent utilization was calculated as the EWMP-prescribed BMP volume divided by the total available BMP volume)

5.4 How is Low Impact Development integrated into the EWMP?

The LID program is an important component of the EWMP. While individually, LID projects are smaller than regional projects, when deployed across numerous parcels throughout the watershed, they can collectively make significant progress towards improving water quality and achieving RWLs. Since the vast majority (nearly 70 percent) of runoff from the developed portion of the watershed is generated from impervious areas on parcels, LID is a natural choice as a key EWMP strategy to treat runoff from parcel-based impervious areas. LID can be viewed as the “first line of defense” due to the fact that the water is treated on-site before it runs off from the parcel and travels downstream. Especially for areas where regional opportunities do not exist downstream, LID is an effective strategy that will only be limited by the extent of implementation. An overview of key components of the LID program is provided below. Technical details about how the BMP opportunities were identified and how each BMP was modeled in the RAA are provided in Section 6.3.

5.4.1 LID Ordinance (Redevelopment)

The MS4 Permit and local ordinances now require significant development and redevelopment projects to incorporate LID concepts into their site design. For development and redevelopment[16] projects, this means that the runoff normally generated by the parcel will be routed to individual BMPs, greatly improving runoff water quality and supporting attainment of EWMP objectives. The key advantage to the EWMP Group members is that LID implemented by new/redevelopment is 100 percent funded by the developer. As such, the RAA assumes that a certain percentage of parcels are redeveloped over the course of the compliance period based on projected growth rates.

Biofiltration in a redeveloped shopping center parking lot

Under the LID ordinance, the EWMP Group retains the responsibility of reviewing and approving calculations, engineering plans, and specifications provided by developers. As the LID ordinance program matures, it will be important to maintain a robust set of engineering standards to ensure that BMPs are being sized, sited, and designed properly. As development and redevelopment occur throughout the watershed, it will be important for the EWMP Group members to track BMP implementation and compare to the projections made by the RAA. Ultimately, a strong LID ordinance program provides a cost-effective strategy to continually make progress towards EWMP goals.

LID Ordinance Highlights:

- Redevelopment projects improve water quality
- Costs to EWMP Group members are minimal
- Requires strong standards and oversight
- Benefit is proportional to growth / number of redeveloped parcels

[16] New development will also require post-construction BMPs, but is not included in the RAA because post-construction BMPs are assumed to restore predevelopment water quality (therefore resulting in no net improvement in water quality like when parcels are redeveloped and *existing* impervious area is treated).

5.4.2 Residential LID

Residential LID retrofit in the form of a xeriscaped infiltration swale

Accounting for approximately 25 percent of all developed impervious area in the watershed, residential parcels represent an important opportunity for LID implementation. Runoff from residential parcels is often directly-connected to a curb and gutter or other conveyance system on the street. Treating runoff through a voluntary program at the residential parcel scale can significantly offset the need for regional or green infrastructure BMPs and could reduce the overall operations and maintenance burden on the EWMP Group members. The RAA assumes that a residential LID program will be initiated within the watershed to encourage and incentivize residential homeowners to retrofit their properties with LID features such as rain tanks (Section 6.3). The goal is to annually enroll 1% of residential parcels in the residential LID program (after a 2-year startup process).

Residential LID Program Highlights:

- Incentivizes installation of BMPs on residential land (rain tanks, hardscape removal, etc.)
- Offsets more expensive BMPs downstream
- NGO partners can help develop/administer program
- Homeowner engagement and stewardship is critical
- Benefit based on rate of adoption by homeowners

A well-designed residential LID program will thoroughly engage individual homeowners to establish a sense of stewardship and ownership as they transform small areas of their property into stormwater treatment elements. Partnering with key non-governmental organizations can be an effective strategy to rapidly develop an effective program that includes community engagement and even preparation of standard plans and procedures. Under Water LA, demonstration projects by The River Project in the LA River watershed (www.theriverproject.org) have successfully shown that residents are willing to actively engage and reduce their contribution to stormwater runoff. These "urban acupuncture" demonstration projects have included rain tanks, rain grading, and pervious surfaces to prevent runoff from leaving the homeowner's parcel, along with parkway basins that intercept runoff from the street and infiltrate it in the right-of-way.

Community members engaged in "urban acupuncture" (residential LID) demonstration projects

Incentive programs can potentially be aligned with existing water conservation programs such as turf replacement or xeriscaping incentives. As with other BMP programs, it will be important to track the number and design of BMPs implemented as part of this program in order to compare to projections made by the RAA.

5.4.3 LID on Public Parcels (retrofits)

Although public parcels represent less than 1 percent of all impervious land use in the watershed, they provide key opportunities to implement LID. These opportunities provide several key advantages, including the ability to coordinate efforts with already-planned infrastructure upgrades (e.g., parking lot rehabilitations), avoidance of land acquisition costs, and the opportunity for public engagement and education.

Bioretention and permeable pavement at the Los Angeles Zoological Park

Sites that attract significant public traffic, such as libraries, City Hall, and parks can also provide excellent forums to demonstrate LID practices. Not only will these demonstrations help the Group members to achieve the goals of the EWMP, if done properly they can advance the public's understanding, acceptance, and support for these types of projects which will be critical to changing public behavior and also to developing financial funding strategies for larger efforts (such as green streets and regional projects).

Public Parcel LID Program Highlights:

- Implements LID on public parcels through retrofits
- Key opportunities for public education
- Readily integrated into planned site rehabilitation
- Can be leveraged to generate public support/funding
- Dependent on number of viable public parcels

Recently constructed biofiltration in a parking lot

5.4.4 Existing and Planned BMPs

In addition to the above three programs, the EWMP incorporates ongoing structural BMP activities that have recently been or are currently taken place. An inventory of existing and planned structural BMPs within each jurisdiction was developed to account for these activities. Existing and planned BMPs were identified through a data request distributed to the WMG agencies and a literature review to identify BMPs within the ULAR EWMP area (as presented in **Appendix 6.F**).

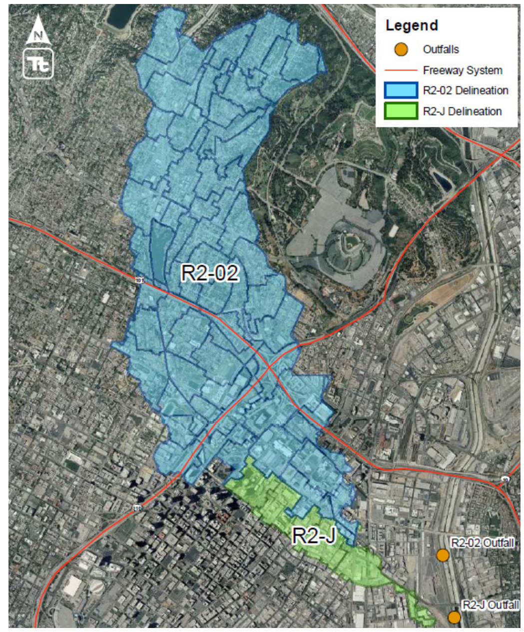
5.5 What are Some Example Green Infrastructure Projects that Support the EWMP?

While Section 4 of this EWMP places a focus on specific regional projects that were identified, selected, and prepared as part of the EWMP development effort, green infrastructure efforts are outlined through more of a programmatic lens. Unlike large regional projects, which require significant design efforts and can individually treat large drainage areas, green infrastructure projects are best discussed at a smaller scale, with the understanding that the smaller projects can be replicated throughout the watershed. To support this message, the following pages briefly introduce a handful of projects that illustrate the initial stages of the Group Members' efforts to support existing green infrastructure programs and stimulate the further development of a robust suite of green infrastructure programs specifically designed to meet EWMP and other Group Member objectives.

5.5.1 Plans to Address Dry- and Wet-Weather Urban Runoff for Downtown Los Angeles, Subwatersheds R2-02 and R2-J

At a Glance:

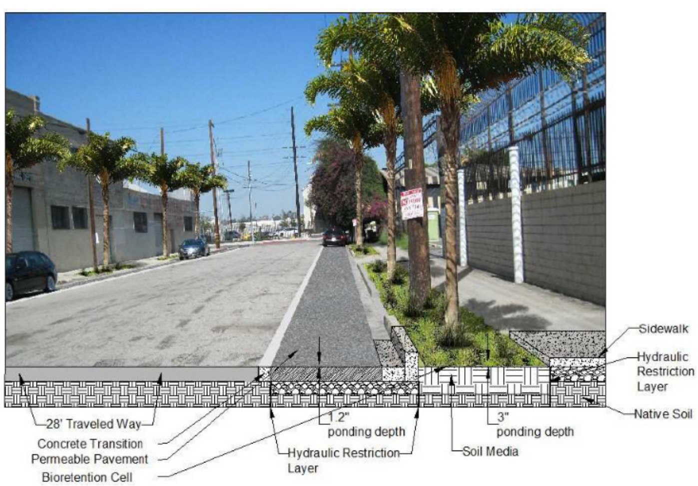
- ***Location:*** 2 Subwatersheds in Downtown Los Angeles
- ***Control Measures:*** Dry-weather Diversion, Green Streets
- ***Expected Completion:*** TBD
- ***Approx. Cost:*** *$10.7M*



Treated subwatersheds

Following a Bacteria Source Identification Study of 110 outfalls conducted by the City of Los Angeles, subwatersheds R2-02 and R2-J, were highlighted as having some of the largest water quality impacts. The proposed projects would treat dry- and wet-weather flows from the two subwatersheds with both conventional and green infrastructure approaches. Dry-weather flows will be treated with a Low Flow Diversion System (LFD) and a Reuse and Removal Urban Flow, similar to those installed along Santa Monica Bay, and wet-weather flows will be treated with green infrastructure implemented in the street right-of-way. The proposed projects will be implemented in two phases with BMPs to treat dry- and wet-weather flows in the R2-J subwatershed in Phase I and in the R2-02 subwatershed in Phase II.

Dry-weather flow will be treated with a combination of a LFD and a Reuse and Removal Urban Flow intended to intercept flow from storm drains prior to discharging into the LA River. Runoff from the R2-J subwatershed will be diverted to a Reuse and Removal Urban Flow in Phase I. The system's primary function will be the use of runoff for irrigation of the green infrastructure (using a system of pumps), with diversion of excess flow to the sewer system.



Green Street configuration

The R2-02 drainage area will be treated with an LFD system, which will divert runoff using gravity flow from the storm drain that collects runoff through a newly installed diversion pipe to be implemented in Phase II.

Wet-weather flow is treated by green streets, which will effectively reduce runoff volumes and pollutants loads by replicating natural hydraulic processes. Green streets have also been shown to have multiple economic, social, and additional environmental benefits.

5.5.2 Plans to Address Dry- and Wet-Weather Urban Runoff for Downtown Los Angeles, Subwatershed R2-G

At a Glance:

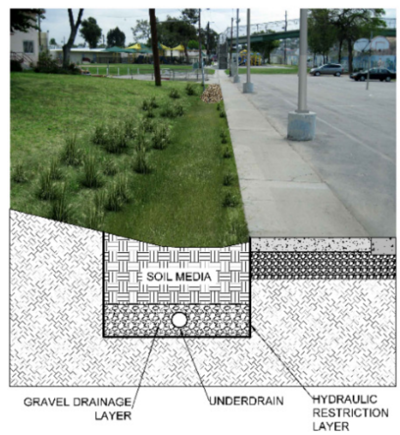
- ***Location:*** *R2-G Subwatershed, Downtown Los Angeles, CA*
- ***Control Measures:*** Low Flow Diversion, Green Infrastructure
- ***Expected Completion:***
- ***Approx. Cost:*** *$3.77M*

Proposed LFD location

This project will support the City of Los Angeles's efforts to address dry weather discharges and meet TMDL requirements in Reach 2 of the LA River, while providing multiple other benefits associated with green infrastructure. The R2-G subwatershed is serviced by approximately 630 catch basins that drain to a network of both city and county storm drains that discharge to the LA River.

Dry-weather flow from two parallel City-owned storm drains at Mission Road will be intercepted by the installation of a diversion weir sized to minimize any hydraulic head losses to the existing system. The storm drains consist of a 90-inch reinforced concrete arch (north drain) and an 84-inch by 120-inch reinforced concrete box (south drain). This diverted flow will travel by gravity to the trunk sanitary sewer, Northeast Interceptor Sewer, located at the intersection of the US 101 freeway and Mission Road for treatment at the Hyperion Treatment Plant.

The wet-weather implementation strategy proposes incorporating treatment through green infrastructure installed throughout the Ramona Gardens community. Wet-weather flows will be diverted from the street and the surrounding land into permeable pavement and bioretention BMPs implemented in the right-of-way and on adjacent public parcels. Total watershed impacts include reduction in stormwater volume and removal of various pollutants. The project will also provide pedestrian safety and traffic calming benefits near a local schools and playgrounds.



Rendering of a proposed bioswale at a local playground (top) and rendering of a proposed permeable alley (bottom)

5.5.3 Brandon Street and Green Street Road Improvement Project

At a Glance:

- ***Location:*** *Brandon Street and Green Street, Unincorporated Pasadena Community*
- ***Control Measures:*** Bioretention, Permeable Pavement, Infiltration Basin
- ***Expected Completion:*** Completed 2014
- ***Approx. Cost:*** *$2M*

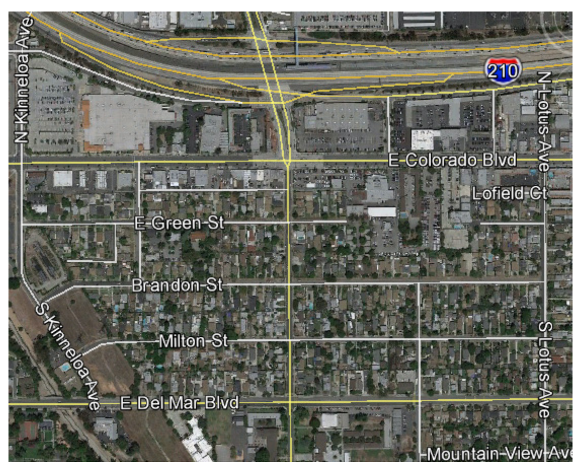
Newly constructed bioretention cells along Brandon Street

The Brandon Street and Green Street Road Project is an urban residential roadway improvement project by the Los Angeles Department of Public Works which incorporated a variety of sustainable low impact development (LID) features for roadway design and storm-water management and treatment. The approximately $2 million project improved a three-quarter mile stretch of roadway.

Brandon Street and Green Street Project was originally conceived as a traditional road improvement project with a small drainage component. The Project was re-designed to feature sustainable design methodologies that enhance community aesthetics, improve pedestrian safety, and provide sustainable storm-water management through infiltration features. The LID features include parkways with bio-retention planters, narrowed traffic roadways, larger curb returns with ADA compliant curb ramps, porous concrete gutters and porous sidewalks, permeable pavers at crosswalk locations, and an underground storm-water infiltration basin to capture runoff. The extensive infiltration capacity of these LID devices allowed the original proposed storm drain to be deleted from the project.

An estimated annual recharge of 3.75 acre-feet of storm-water is projected for the improvements, and has been demonstrated to function during storm events. Runoff from a major event in December, 2014, were so successfully infiltrated by the porous gutters and bioretention planters on Green Street that at the downstream end of the block the gutter flow was almost completely eliminated.

Green Street infiltration basin under construction (Source: Google Earth)



Project location (Source: Google Earth)

5.5.4 Arroyo Seco Urban Runoff Project No. 1

At a Glance:

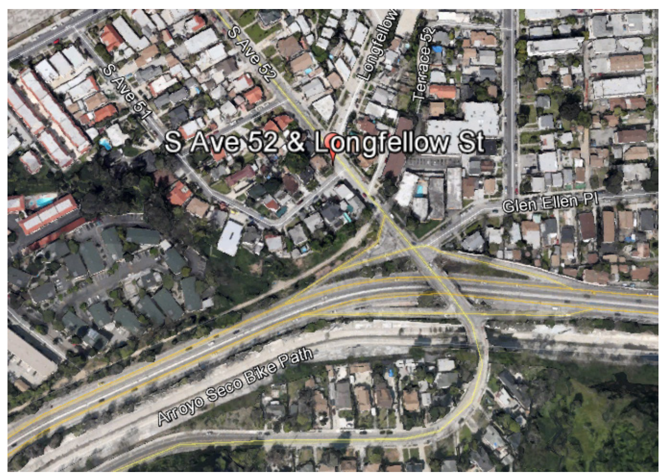
- ***Location:*** *Longfellow Street and Avenue 52*
- ***Control Measures:*** Bioretention, Permeable Pavement
- ***Expected Completion:*** Spring 2017
- ***Approx. Cost:*** *$280,850*

Example of bioretention and permeable pavement retrofits during construction, San Diego, CA

Urban runoff mitigation in this area would contribute to the reduction of bacteria and pollutants in the Arroyo Seco tributary. To achieve compliance with the LA River Bacteria TMDL, the proposed project involves curb cuts to the existing sidewalk and installing bioretention cells throughout sidewalk sections. Remaining sidewalk area is to be retrofit with permeable pavement and the interior portions of the cells would remain vegetated with native shrubs and grasses.

Concept designs for Arroyo Seco Load Reduction Strategy projects are presented in Appendix 5B.

Existing intersection of proposed project site, oriented northwest on South Avenue 52 (Source: Google Earth)



Proposed project location proximate to Arroyo Seco tributary (Source: Google Earth)

5.5.5 Arroyo Seco Urban Runoff Project No. 2

At a Glance:

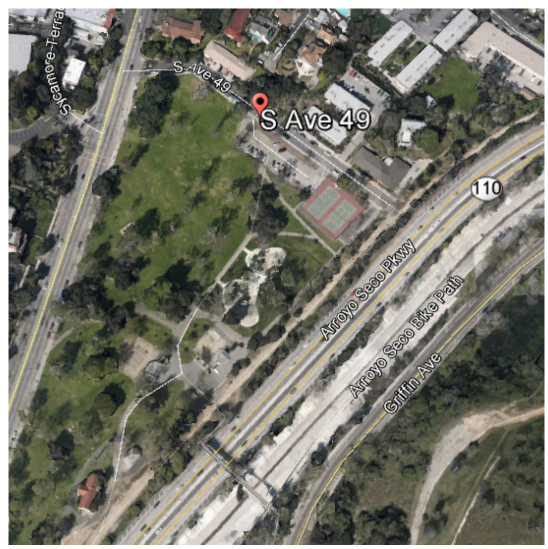
- ***Location:*** *Arroyo Seco and Avenue 49*
- ***Control Measures:*** Infiltration treatment train
- ***Expected Completion:*** Winter 2019
- ***Approx. Cost:*** *$6.65M*

Example subsurface infiltration gallery (source: City of Los Angeles)

Urban runoff mitigation in this area would contribute to the reduction of bacteria and pollutants in the Arroyo Seco tributary. To achieve compliance with the LA River Bacteria TMDL, the proposed project involves infiltration of dry and wet weather stormwater and would provide service to 200 acres of drainage area. The available park land would be restored to its original condition to resume the use of the park. A stormwater runoff treatment train involving a set of BMPs will aid in the removal of trash, bacteria, and metals.

Concept designs for Arroyo Seco Load Reduction Strategy projects are presented in Appendix 5B.

Existing condition of South Avenue 49 adjacent to the park, oriented SE towards Arroyo Seco (Source: Google Earth)



Proposed project location proximate to Arroyo Seco (Source: Google Earth)

5.5.6 Arroyo Seco Urban Runoff Project No. 3

At a Glance:

- ***Location:*** *Arroyo Seco and Via Mirasol*
- ***Control Measures:*** Retention/Detention Basin
- ***Expected Completion:*** Winter 2019
- ***Approx. Cost:*** *$5.12M*

Urban runoff mitigation in this area would contribute to the reduction of bacteria and pollutants in the Arroyo Seco tributary. To achieve compliance with the LA River Bacteria TMDL, the proposed project will install a detention/retention basin on identified parkland in Hermon Dog Park. Stormwater flow would be diverted from an existing storm drain to the newly constructed detention/retention basin for infiltration and subsurface use.

Concept designs for Arroyo Seco Load Reduction Strategy projects are presented in Appendix 5B.

Existing condition of Dog Park on Via Mirasol, oriented north towards Arroyo Seco (Source: Google Earth)

Proposed project location
(Source: Google Earth)

5.5.7 Arroyo Seco Urban Runoff Project No. 4

__At a Glance__:

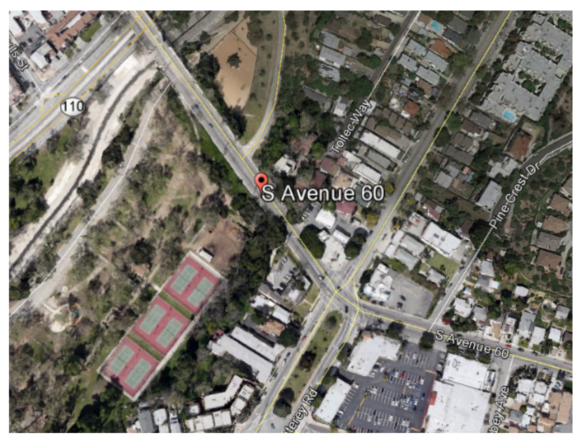
- ***Location:*** *Arroyo Seco and South Avenue 60*
- ***Control Measures:*** Storage Tank, Subsurface Water Irrigation and Infiltration
- ***Expected Completion:*** Winter 2019
- ***Approx. Cost:*** *$4.8M*

A subsurface storage tank and treatment system being installed (source: Neal Shapiro, City of Santa Monica)

Urban runoff mitigation in this area would contribute to the reduction of bacteria and pollutants in the Arroyo Seco tributary. To achieve compliance with the LA River Bacteria TMDL, the proposed project includes the construction of the following treatment control structures: a diversion/maintenance structure, a trash/sedimentation tank system for the removal of trash, metals, and toxics, connecting pipes, a storage tank, and a control and pump system for subsurface water irrigation and infiltration.

Concept designs for Arroyo Seco Load Reduction Strategy projects are presented in Appendix 5B.

Existing condition of South Avenue 60 oriented NW towards Arroyo Seco
(Source: Google Earth)



Proposed project location
(Source: Google Earth)

5.5.8 Arroyo Seco Urban Runoff Project No. 5

At a Glance:

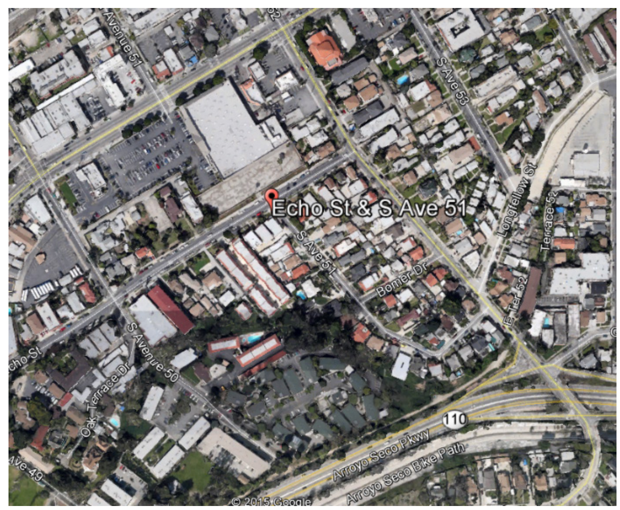
- ***Location:*** *South Ave 51 and Echo*
- ***Control Measures:*** Bioswale, Curbside Grating
- ***Expected Completion:*** Winter 2019
- ***Approx. Cost:*** *$4.8M*

Streetside bioswale

Urban runoff mitigation in this area would contribute to the reduction of bacteria and pollutants in the Arroyo Seco tributary. To achieve compliance with the LA River Bacteria TMDL, the proposed project includes the construction of vegetated bioswales along 51st Street, which is located south of Echo Street in the Arroyo Seco subwatershed. Along with three parkway bio-swales, installation of curbside grating basins and planting of native vegetation will also be implemented.

Concept designs for Arroyo Seco Load Reduction Strategy projects are presented in Appendix 5B.

Existing condition of South Avenue 51 oriented NW towards Echo Street
(Source: Google Earth)



Proposed project location
(Source: Google Earth)

5.5.9 Residential Neighborhood "Pilot-to-Scale" Landscape Transformation Project

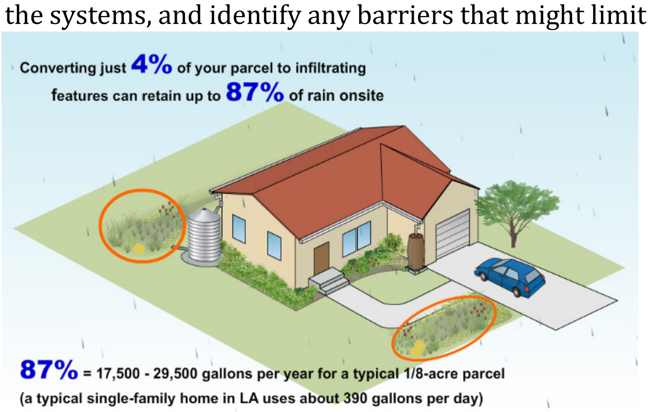
At a Glance:

- ***Locations:*** Neighborhoods in the Upper LA and the Ballona Creek/Dominguez Channel Watersheds
- ***Control Measures:*** Infiltration and capture practices on private residential properties
- ***Expected Completion:*** TBD
- ***Approx. Cost:*** *TBD*

As discussed in the Residential LID section above, these programs are ideally suited for partnerships with key NGOs to support the program design and implementation. One of these key NGOs, TreePeople, has recently completed an exploratory effort to evaluate the potential for cross-agency collaboration to promote and incentivize residential stormwater capture and treatment projects throughout the Los Angeles area. In addition to several key findings on the collaboration itself, a hydrologic analysis was performed to preliminarily approximate the potential range of impact a widely-implemented program might have. The results of the scaling analysis estimate that hypothetical implementation rates between 25% and 50% of all residential properties in the Upper LA Watershed could yield 21,017 to 42,034 acre-feet per year; similarly the Ballona Creek Watershed could yield 3,665 to 7,872 acre-feet per year.

Building upon this analysis and the collaborative work already completed, TreePeople proposes two residential neighborhood landscape transformation areas to capture stormwater in the following Upper LA Watershed candidate neighborhoods: Pacoima, Sylmar, and Sun Valley; and/or in the following Ballona Creek/Dominquez Channel Watershed: Mar Vista, and Culver City. The landscape transformation would implement a small number of residential-scale stormwater capture BMPs (e.g., rain gardens and bioretention basins for infiltration and cisterns and rain tanks for capture and use), entirely on private residential properties. Key elements of the proposed design include the evaluation of active control configurations and detailed BMP performance and operations monitoring.

The purpose of this project is twofold: (1) to further demonstrate and quantify the viability of a residential BMP retrofit program – especially as an alternative or complement to capital projects such as regional BMPs or green streets; and (2) fully explore (in a test environment) the feasibility and potential depth of cross-agency collaboration and cooperation in executing a tangible, in-the-ground, program-level project. Several elements of the program will be explored, including the costs of implementation, the depth of homeowner engagement, BMP effectiveness, and varied physical configurations. Ultimately, the pilot-to-scale project will retrofit a number of private parcels, evaluate the cost and performance of the systems, and identify any barriers that might limit the extent or effectiveness of scaling up the program. Based on the findings of the study, a range of potential implementation scenarios will be summarized to estimate the total potential impact in terms of program cost, water quality improvement, and water supply augmentation. A full account of the collaborative effort will also be provided and summarized to provide meaningful feedback and guidance on how to further improve the management of a mutually beneficial cross-agency program.



5.6 How are Institutional Control Measures incorporated into the EWMP?

Institutional BMPs are non-constructed control measures that limit the amount of stormwater runoff or pollutants that are transported within the MS4 area. If institutional control measures are effective, they ultimately offset the need for more expensive structural control measures. Most institutional BMPs are implemented to meet requirements for MCMs in the MS4 Permit.

The MS4 Permit categorizes institutional BMPs and MCMs into the following six program categories:

- Development Construction Program
- Industrial/Commercial Facilities Program
- Illicit Connection and Illicit Discharges Detection and Elimination Program
- Public Agency Activities Program
- Public Information and Participation Program
- Planning and Land Development Program

Specific institutional BMPs currently implemented by the ULAR EWMP Group members as part of these stormwater program categories are reported in the Los Angeles County MS4 Permit Unified Annual Report [17].

The MCMs that were implemented as part of the 2001 Permit are assumed to be a component of the "baseline" condition for the EWMP and RAA. The 2012 Permit includes an extensive list of additional MCMs that are required to be implemented by the MS4s, which are assumed by the RAA to provide a 5% reduction in pollutants. A summary of these changes in Permit requirements is provided in **Appendix 5.A.**, and key items are noted below:

Table 5-2. Permit Requirements

MCM	ADDITIONAL REQUIREMENT IN 2012 PERMIT vs 2001 PERMIT
Progressive Enforcement	Develop and maintain a Progressive Enforcement Policy to track compliance, including: 1) follow-up inspection, 2) enforcement action, 3) records retention, 4) referral of violations, 5) investigation of complaints, 6) assistance with Regional Board enforcement actions
Public Information and Participation Program (PIPP)	More robust public participation program that measurably increases knowledge and changes behavior, and involves a diversity of socio-economic and ethnic communities
Industrial/Commercial Facilities Program	Added education component to notify of BMP requirements applicable to the site Expanded inspection to all commercial and industrial facilities that may contribute substantial pollutants
Planning and Land Development Program	Updated ordinance/design standards to conform with new requirements (LID and hydromodification) Increased performance measure to require onsite retention or bioretention/biofiltration

[17] Los Angeles County provides access to Permittee Annual Reports at the following website: http://ladpw.org/wmd/NPDESRSA/AnnualReport/

Table 5-2. Permit Requirements

MCM	ADDITIONAL REQUIREMENT IN 2012 PERMIT vs 2001 PERMIT
	Provision for alternative compliance measures due to technical infeasibility of onsite retention, or opportunity for groundwater replenishment at offsite location
Planning and Land Development Program	Updated ordinance/design standards to conform with new requirements (LID and
Development Construction Program	For sites disturbing less than an acre, added requirement to inspect construction sites based upon water quality threat The use of BMPs are tailored to the risks posed by the project, ranked from Low Risk (Risk 1) to High Risk (Risk 3) Increased frequency of inspections, at least once every 2 weeks for high threat sites, at least monthly for lower threat sites, and during all phases of construction (at least three times)
Public Agency Activities Program	Added requirement to maintain an updated inventory of all public facilities that are potential sources of stormwater pollution and inventory of existing development for retrofitting opportunities.
Illicit Connections and Illicit Discharges Elimination Program	Required to implement a spill response plan for all sewage and other spills that may discharge into its MS4

In addition, four of the ULAR jurisdictions have elected to implement additional institutional control measures to achieve a total 10% reduction. The jurisdictions and their planned additional institutional control measures are detailed in the EWMP Implementation Strategy section (7.5). Over time, it is anticipated that additional ULAR jurisdictions will implement enhanced institutional control measures and offset the need for structural control measures.

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Section 6
Reasonable Assurance Analysis (RAA)

A key element of the EWMP is the RAA, which is prescribed by the Permit as a process to demonstrate "that the activities and control measures…will achieve applicable WQBELs and/or RWLs with compliance deadlines during the Permit term" (Permit section C.5.b.iv.(5), page 63). In 2014, the Regional Board issued RAA Guidelines (Regional Board, 2014), which outline expectations for developing RAAs, and those guidelines were followed closely during development of this RAA. While the Permit prescribes the RAA as a quantitative *demonstration* that control measures will be effective, the RAA also promotes a modeling process to support the EWMP Group with *selection* of control measures. In particular, the RAA was used to evaluate the many different scenarios/combinations of institutional, distributed and regional control measures (described in Section 4) that could potentially be used to comply with the RWLs and WQBELs of the Permit, and was then used to select the control measures specified in the EWMP Implementation Strategy (described in Section 7).

This section describes key elements of the RAA including the following:

- Modeling system used for the RAA (6.1)
- Baseline critical conditions and required pollutant reductions (6.2)
  - Baseline model calibration (6.2.1)
  - Water quality targets (6.2.2)
  - Critical conditions for wet weather and dry weather (6.2.3)
  - Selection of limiting pollutants (6.2.4)
  - Required interim and   pollutant reduction (6.2.5)
- Representation of control measures in RAA (6.3)
- Approach for selecting control measures for the EWMP Implementation Strategy (6.4)

As referenced throughout this section, many details of the RAA are provided in the RAA Appendix which is attached as **Appendix 6** (including several sub-appendices 6.A thru 6.I). Additional information on the RAA requested by the Regional Board during draft EWMP review is provided in Appendix 6.I.

6.1 Modeling System

The Watershed Management Modeling System (WMMS) is the modeling system used to conduct the RAA for the ULAR EWMP. WMMS is specified in the Permit as an approved tool to conduct the RAA. The LACFCD, through a joint effort with USEPA, developed WMMS specifically to support informed decisions for managing stormwater. The WMMS is a comprehensive watershed model of the entire Los Angeles County area that includes the unique hydrology and hydraulics features and characterizes water quality loading, fate, and transport for all of the key TMDL constituents (Tetra Tech 2010a, 2010b). The ultimate goal of WMMS is to identify cost-effective water quality improvement projects through an integrated, watershed-based approach. A version of WMMS[18] is available for public download from Los Angeles County Department of Public Works website (http://dpw.lacounty.gov/wmd/wmms/res.aspx).

The WMMS domain encompasses Los Angeles County's coastal watersheds of approximately 3,100 square miles, representing 2,566 subwatersheds. Of those, the ULAR EWMP area encompasses 1,129 subwatersheds[19] (**Figure 6-1**).

The WMMS is a suite of three modeling tools to support BMP planning:

1. A watershed model for prediction of baseline hydrology and pollutant loading (Loading Simulation Program – C+ [LSPC]);
2. A model for simulating the performance of control measures in terms of flow, concentration and load reduction (System for Urban Stormwater Treatment Analysis and Integration [SUSTAIN]); and
3. A tool for running millions of potential scenarios and optimizing/selecting control measures based on cost-effectiveness (also within SUSTAIN).

The LSPC and SUSTAIN models within WMMS are described in more detail in the following subsections.

6.1.1 LSPC

The watershed model included within WMMS is the LSPC (Tetra Tech and USEPA 2002; USEPA 2003; Shen et al. 2004). LSPC is a watershed modeling system for simulating watershed hydrology, erosion, and water quality processes, as well as in-stream transport processes. LSPC also integrates GIS, comprehensive data storage and management capabilities, and data analysis/post-processing system into a convenient Windows-based environment. The algorithms of LSPC are identical to a subset of those in the Hydrologic Simulation Program–FORTRAN model with selected additions, such as algorithms to dynamically address land use change over time. USEPA's Office of Research and Development (Athens, Georgia) first made LSPC available as a component of USEPA's National TMDL Toolbox (http://www.epa.gov/athens/wwqtsc/index.html). LSPC has been further enhanced with expanded capabilities since its original public release.

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[18] The version of WMMS used for this RAA was enhanced from the version available for download. Enhancements include updates to calibration parameters according to the RAA Guidelines (Regional Board, 2014), more refined BMP routing assumptions, and application of an updated two-tier, jurisdiction-based BMP optimization approach.

[19] The subwatersheds in WMMS were further segregated into the subwatersheds within each jurisdiction ("jurisheds") to allow for development of jurisdiction-specific implementation strategies. The 1,129 subwatersheds in ULAR EWMP area are after jurisdictional segregation of 783 subwatersheds in WMMS.

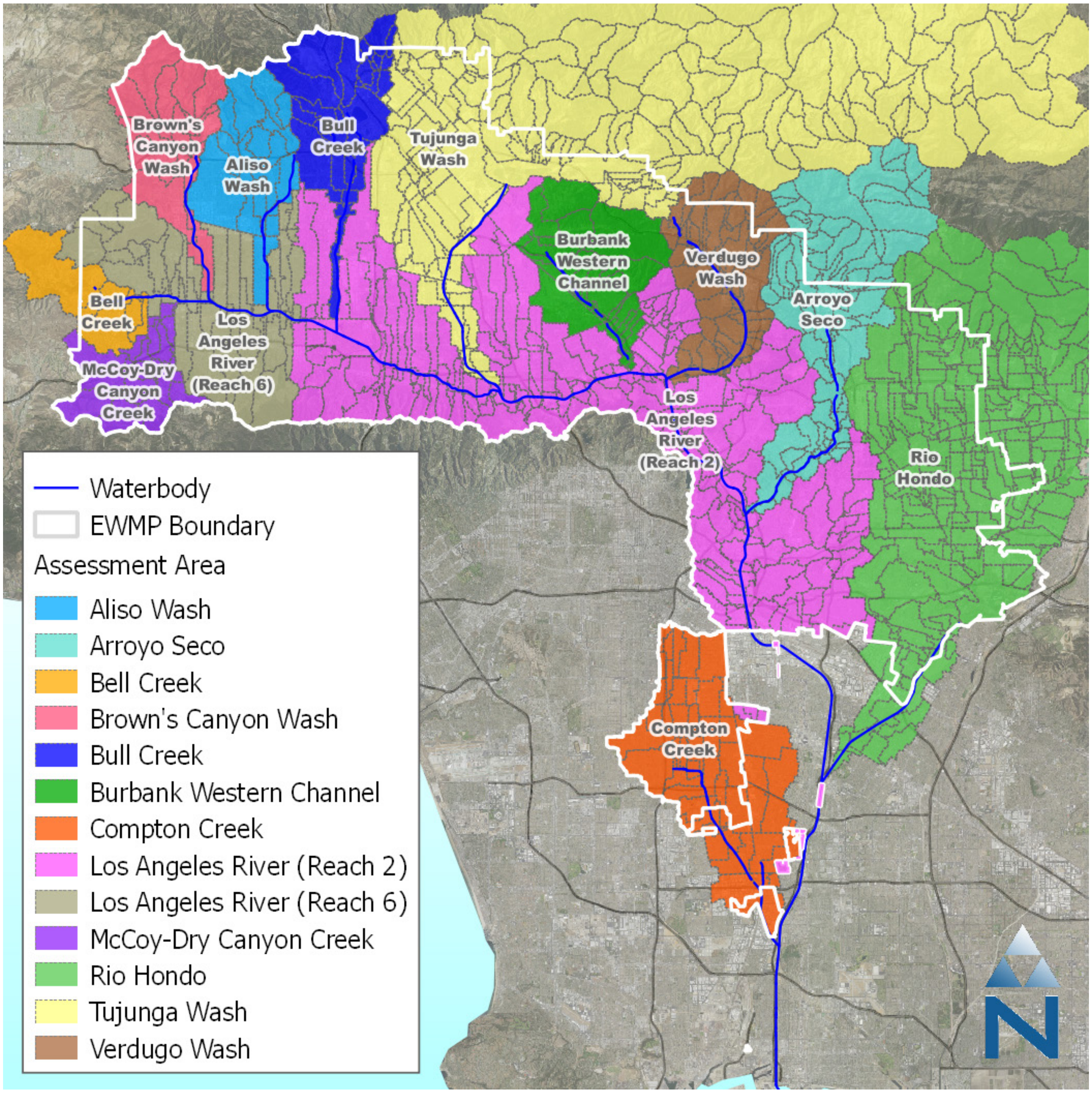

Figure 6-1. ULAR EWMP Area and 1,129 Subwatersheds Represented by WMMS.

6.1.2 SUSTAIN

SUSTAIN was developed by the USEPA to support practitioners in developing cost-effective management plans for municipal stormwater programs and evaluating and selecting BMPs to achieve water quality goals (USEPA, 2009; http://www2.epa.gov/water-research/system-urban-stormwater-treatment-and-analysis-integration-sustain). SUSTAIN was specifically developed as a decision-support system for selection and placement of BMPs at strategic locations in urban watersheds (see **Figure 6-2**). It includes a process-based continuous simulation BMP module for representing flow and pollutant transport routing through various types of structural BMPs. This simulation provides the *primary application* of SUSTAIN – simulating the performance of selected stormwater control measures.

The *secondary application* of SUSTAIN is BMP selection, which is based on cost-benefit of different BMP alternatives. The SUSTAIN model in WMMS includes a cost database[20] comprised of typical BMP cost data from a number of published sources including BMPs constructed and maintained in Los Angeles County (Tetra Tech 2010a, 2010b). SUSTAIN considers certain BMP properties as "decision variables," meaning they are allowed to vary within a given range during model simulation to support BMP selection and placement optimization. As BMP sizes and locations change, so do cost and performance. SUSTAIN runs iteratively to generate a cost-effectiveness curve comprised of millions of BMP scenarios (e.g., the model was used for the EWMP to evaluate the different combinations of green infrastructure as compared to regional BMPs, and provides a recommendation on the most cost-effective scenario)[21].

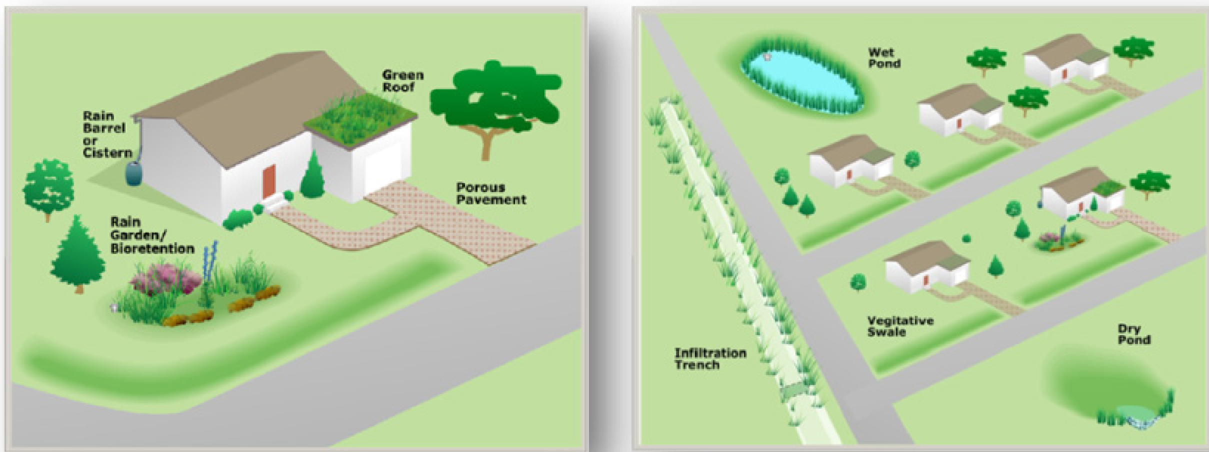

Figure 6-2. SUSTAIN Model Interface Illustrating BMP Opportunities in Watershed Settings.

6.2 Baseline Critical Conditions and Required Pollutant Reductions

6.2.1 Assessment areas

This section describes the application of the LSPC model to simulate current conditions, identify critical conditions and calculate required pollutant reductions. The calculated required pollutant reductions drive the extent of the control measures to be implemented by the EWMP under the EWMP Implementation Strategy.

6.2.2 Calibration

A fundamental element of the RAA is simulating baseline / existing conditions in the watershed prior to implementation of control measures. For the ULAR RAA, baseline conditions were simulated using the LSPC watershed model in WMMS, including predictions of flow rate and pollutant concentrations over a 10-year period, as follows:

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[20] The BMP cost database from WMMS was updated for this EWMP, as described in Section 6.6.

[21] For the EWMP, optimization was conducted at the jurisdictional-level using SUSTAIN as opposed to the watershed-level using the Nonlinearity-Interval Mapping Scheme (NIMS) component of WMMS.

- The simulation period is October 1, 2001 to September 20, 2011[22].
- Simulated pollutants include total suspended solids, *E. coli*, total copper, total zinc, total lead, total nitrogen and total phosphorous.
- Discharges from publicly owned treatment works are represented including Tillman, Glendale and Burbank Water Reclamation Plants.
- An hourly time step was used to simulate the flow rate and pollutant concentration at each of the 1,129 subwatershed outlets (see **Figure 6-1**) and the resultant downstream receiving water conditions.

To encourage accurate representation of existing/baseline conditions, the RAA Guidelines provide "model calibration criteria" for demonstrating the baseline predictions are accurate and to ensure the "calibrated model properly assesses all the variables and conditions in a watershed system" (Regional Board, 2014). Detailed hydrology and water quality calibrations were performed for the ULAR RAA, as follows (see **Figure 6-3** for a map of water quality and hydrology calibration stations):

- Water quality calibration: the water quality calibration process for the ULAR RAA leveraged two primary monitoring datasets: (1) small-scale, land use-specific water quality monitoring data collected by the Southern California Coastal Water Research Program (LACDPW, 2010b) and (2) large-scale receiving water monitoring data collected by the Coordinated Monitoring Program for the Los Angeles River Metals TMDL and mass emission monitoring by Los Angeles County Department of Public Works (LACDPW) at stations in LA River including Wardlow Road (S10).
- Hydrology calibration: nine LACDPW streamflow gages, three on the LA River mainstem and six on tributaries, were used for the hydrology calibration. Several additional gages were referenced along Rio Hondo to balance calibration of undeveloped headwaters, spreading grounds and flow diversions.

The comparison of the calibrated hydrology model to the RAA Guidelines is shown in **Table 6-1**, and the water quality calibration is shown in **Table 6-2**. Additional details of the baseline model development and calibration are presented in **Appendix 6.A**. The baseline (LSPC) model performs quite well for representing existing hydrologic and water quality conditions.

For each hydrology station, at least one of the following calibration metrics achieved an assessment of "Fair" or better: Total Annual Volume, Highest 10% of Flows or Annual Storm Volume. The ULAR watershed has distinctive features that influence hydrology, including debris basins, diversions, deficient pipes, and spreading grounds. The watersheds least influenced by such features included Arcadia Wash, Eaton Wash, and Verdugo Wash, which all produced "Very Good" single-digit percent differences over the 10 years for all metrics. Differences in modeled versus observed flows were largely due to hydromodification features or structures that were not always explicitly represented in the model. For example, the Santa Anita Wash was heavily impacted by debris basins, whereas Arcadia and Eaton washes were not. The model simulated average impacts for those debris basin areas produced "Very Good" metrics for Total Annual Volume and Annual Storm Volume respectively, even though the top 10% of flows underpredicted. That happened because averaging disproportionally affected that

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[22] All stormwater control measures implemented prior to September 30, 2011 are assumed to be implicitly represented within the baseline conditions.

particular metric more than the others (due to the non-linearity of the impact). Similarly, results for Compton Creek and Wardlow were affected by deficient pipes and spreading ground/inter-basin transfer impacts, respectively. For all these cases, predicted runoff into the EWMP BMPs is less affected than predicted instream flows, which are influenced by hydromodification features in the flow routing network (whereas runoff from urban areas is not impacted by these features).

For the stations (Table 6-1) and pollutants (Table 6-2) where the calibration performance assessment was Fair, steps will be taken to compile additional data prior to future baseline model updates. The next update will occur during the adaptive management process, no later than June 20, 2021. Types of data that may be targeted for baseline model updates include the following:

- Data collected under the CIMP including flow rates and concentrations during dry and wet weather conditions measured at receiving water and outfall stations,
- Water quality data collected outside of the CIMP at stations in the ULAR watershed including data collected by City of LA Donald C. Tillman Water Reclamation Plant and LA Glendale Water Reclamation Plant, and
- Operations data (outflows) for impoundments in the ULAR watershed.

Table 6-1. Summary of Hydrology Calibration Performance by Baseline Model

Location	Model Period	Hydrology Parameter	Modeled vs. Observed	RAA Guidelines Performance Assessment
Los Angeles River at Wardlow Avenue	10/1/2002 – 9/30/2011	Total Annual Volume	20.1%	Fair
		Highest 10% of Flows	6.0%	Very Good
		Annual Storm Volume	19.6%	Fair
Los Angeles River at Tujunga Wash	10/1/2002 – 9/30/2011	Total Annual Volume	5.2%	Very Good
		Highest 10% of Flows	-22.1%	Fair
		Annual Storm Volume	-2.8%	Very Good
Los Angeles River at Arroyo Seco	10/1/2002 – 9/30/2011	Total Annual Volume	17.9	Fair
		Highest 10% of Flows	-3.8%	Very Good
Santa Anita Wash at Longdem Avenue	10/1/2002 – 9/30/2011	Total Annual Volume	-7.3%	Very Good
		Highest 10% of Flows	-22.9%	Fair
		Annual Storm Volume	-1.4%	Very Good
Arcadia Wash Below Grand Avenue	10/1/2002 – 9/30/2011	Total Annual Volume	3.5%	Very Good
		Annual Storm Volume	-8.5%	Very Good
Eaton Wash Below Grand Avenue	10/1/2002 – 9/30/2011	Total Annual Volume	7.9%	Very Good
		Annual Storm Volume	7.5%	Very Good
Verdugo Wash at Estelle Avenue	10/1/2002 – 9/30/2011	Total Annual Volume	-5.8%	Very Good
		Highest 10% of Flows	-9.0%	Very Good
Burbank Western Channel at Riverside Drive	10/1/2002 – 9/30/2011	Total Annual Volume	-16.6%	Fair
		Annual Storm Volume	0.4%	Very Good
Compton Creek Near Spring Street	10/1/2002 – 9/30/2011	Total Annual Volume	0.8%	Very Good
		Highest 10% of Flows	-14.2%	Good
		Annual Storm Volume	-4.8%	Very Good

Note: for each station, at least one of the following calibration metrics achieved an assessment of “Fair” or better: Total Annual Volume, Highest 10% of Flows or Annual Storm Volume.

Table 6-2. Summary of Water Quality Calibration Performance by Baseline Model

Water Quality Parameter	Sample Count	Modeled vs. Observed Load (% Error)	RAA Guidelines Performance Assessment
Total Sediment	80	9.0%	Very Good
Total Copper	54	-19.7%	Good
Total Zinc	54	-27.2%	Fair
Total Lead	49	-32.1%	Fair
E. coli *	49	-33.4%	Fair
Total Phosphorous	49	-12.9%	Very Good

* *E. coli* was assumed to have a 1:1 translator with fecal coliform.

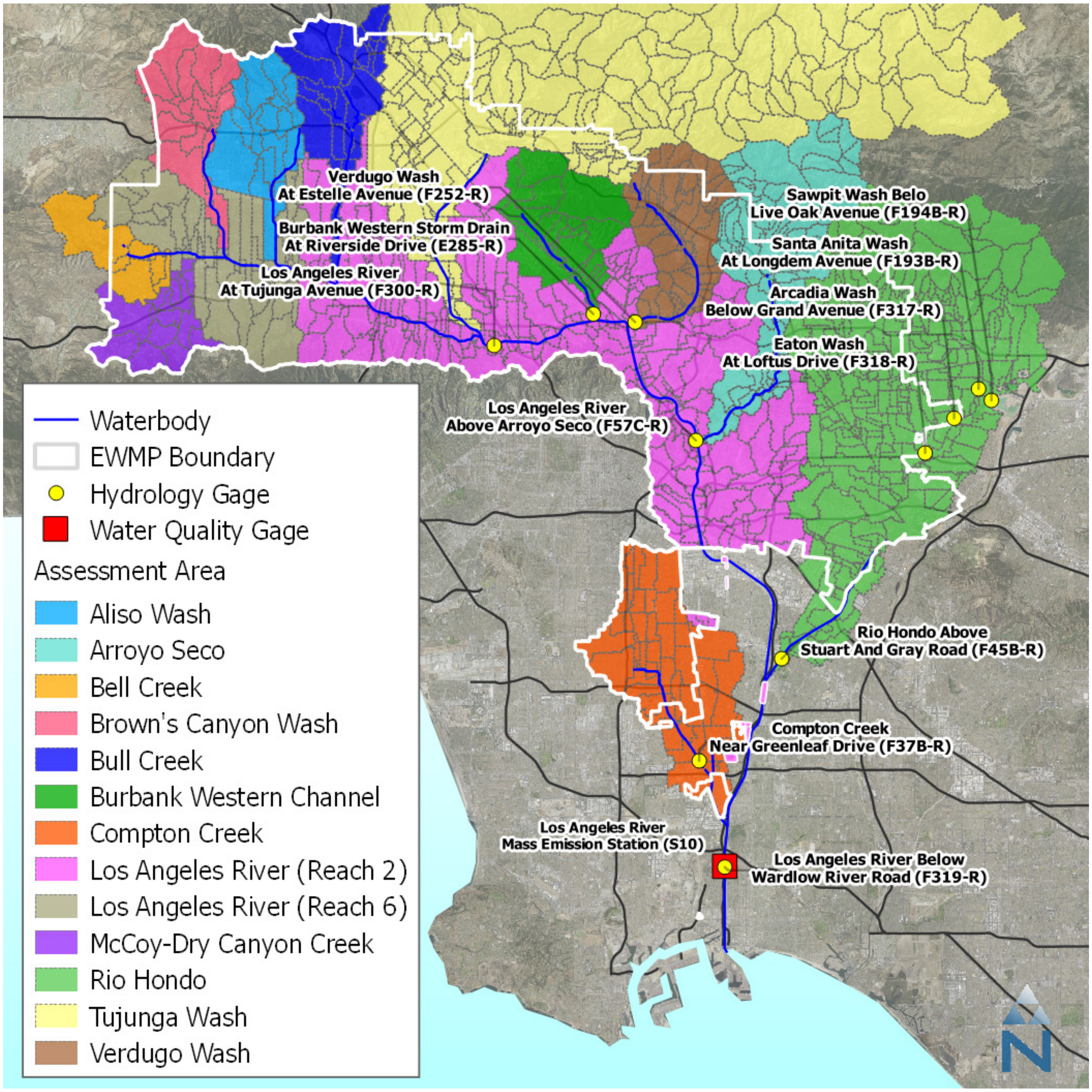


Figure 6-3. Hydrology and Water Quality Calibration Stations for ULAR RAA.

6.2.3 Non-stormwater (dry weather) simulations

Two components of the ULAR EWMP provide assurance that non-stormwater discharges will be addressed:

1. The Load Reduction Strategy (LRS) process of the LA River Bacteria TMDL is incorporated into the EWMP. Following the LRS process provides assurance that bacteria WQBELs/RWLs will be achieved by the EWMP. Because *E. coli* is a limiting pollutant (as described in Section 6.5.3), the LRS also addresses other dry weather Water Quality Priorities.

2. The wet weather control measures in the ULAR EWMP will provide significant reductions in non-stormwater. A separate RAA was performed for dry weather conditions to demonstrate that EWMP control measures will address non-stormwater discharges that are effectively prohibited.

The subsections below describe these two components of the dry weather RAA.

6.2.3.1 Load Reduction Strategy Approach

The LRS process identified in the LA River Bacteria TMDL is based on Monte Carlo modeling that simulates that loading of *E. coli* from outfalls along each segment or tributary of the LA River. The schedule for the LRS process is phased, with Segment B of the LA River being addressed first and Segment C being addressed last. For each segment, the Monte Carlo model is driven by outfall monitoring data, consisting of at least six "snapshot" monitoring events where every outfall observed to be flowing is subject to flow rate and *E. coli* concentration monitoring. The Monte Carlo model is used to compare the current *E. coli* loading to the TMDL wasteload allocation, consider alternatives for control measures that would achieve the wasteload allocation, and select an implementation strategy. Shown in **Figure 6-4** is an example Monte Carlo output for a selected LRS. The details of the LRS process including the required Monte Carlo modeling can be found in Appendix 1 of Section 8 of the CREST Bacteria TMDL Technical Report – Dry Weather Implementation Plan.

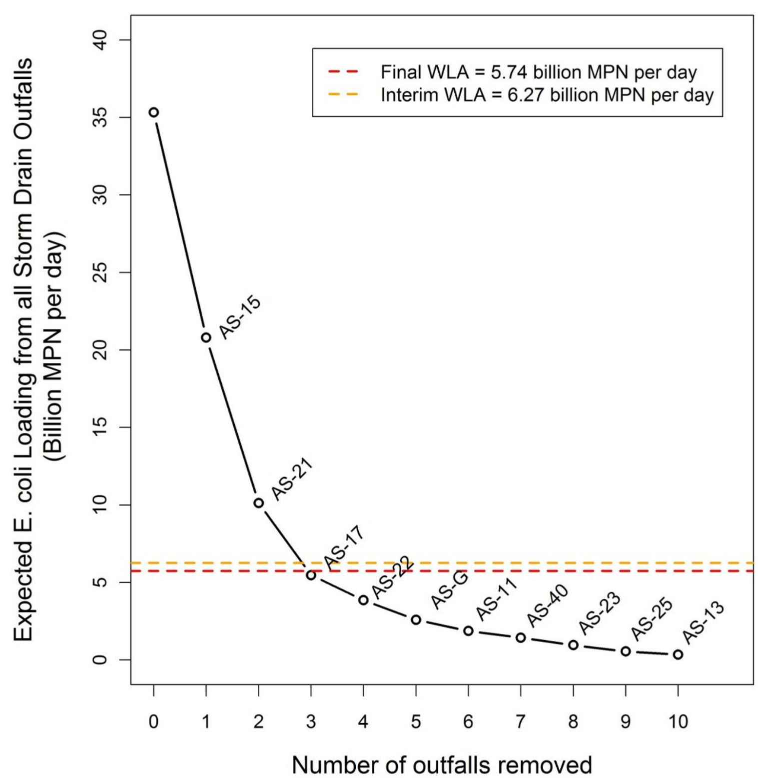


Figure 6-4. Example Monte Carlo Model Output for a Bacteria TMDL Load Reduction Strategy

This example Monte Carlo model output is for the City of Los Angeles jurisdiction in Arroyo Seco. The LRS by the City of LA is based on addressing *E. coli* loading from three "Priority Outfalls" AS-15, AS-21 and AS-17. By addressing these three outfalls, the LRS has reasonable assurance of achieving the TMDL wasteload allocations (dotted lines). The EWMP Implementation Strategy in Section 7 presents the LRS control measures for Segment B and Arroyo Seco.

6.2.3.2 Effect of Wet Weather Control Measures on Non-stormwater

To demonstrate that non-stormwater is addressed by the ULAR EWMP, a non-stormwater model was developed. A detailed description of the non-stormwater simulation is provided in **Appendix 6.B**.

The MS4 Permit effectively prohibits discharges of non-stormwater[23] and states that EWMPs shall "ensure that discharges…do not include non-stormwater discharges that are effectively prohibited." In addition, the MS4 Permit includes dry weather WQBELs for LA River Metals and Bacteria TMDLs. A baseline non-stormwater model was developed for the ULAR EWMP based on the following components:

- **Simulation of non-stormwater sources that generate dry weather runoff:** the primary source of non-stormwater is outdoor water use. As such, the dry weather RAA is based on a simulation of non-stormwater whose *source* is outdoor water use[24] in each of the subwatersheds within the EWMP area and whose *sink* is evapotranspiration and retention by wet weather EWMP control measures.
- **Non-stormwater generated by outdoor water use based on extensive literature review:** the amount of non-stormwater generated in each ULAR subwatershed was estimated as the product of [1] the estimated population based on U.S. census blocks and [2] the estimated per capita outdoor water use based on compilation of 25 estimates relevant to southern California (see **Figure 6-5**). The use of median historical outdoor water use is likely conservatively high, as outdoor water use has likely fallen substantially during the recent drought periods.
- **Thirty (30) day simulation of critical dry period:** the period of the simulation was a critical dry period identified in the average water year (August 21, 2007 to September 20, 2007). This portion of the year (late August to September) historically receives the least amount of rainfall. The evapotranspiration during this period provides the weather boundary condition for the non-stormwater simulation.

While the critical conditions for dry and wet weather are uniquely defined, it is important that dry and wet weather conditions not be evaluated in separate silos – the EWMP includes a large network of wet weather BMPs that will eliminate a majority of non-stormwater discharges. The dry weather RAA quantifies the reduction of wet weather BMPs on non-stormwater discharges, and assures that TMDL milestones are attained on the required implementation timeline. The EWMP Implementation Strategy for non-stormwater is presented in **Section 7.5**.

[23] Non-stormwater does not include all dry weather runoff. For example, permitted dry weather discharges (e.g., dewatering) and groundwater baseflow are exempted/allowed by the Permit.

[24] By focusing on the non-stormwater portion of dry weather runoff, the non-stormwater analysis and dry weather RAA are focused on the portion of dry weather runoff that is required to be controlled by MS4s. Non-stormwater volumes are not necessarily equal to dry weather runoff volumes in the EWMP area. Non-stormwater is the portion of dry weather runoff that is effectively prohibited by the Permit. Dry weather runoff would also include groundwater that is discharged through the MS4 system (if any), which is allowed by the Permit.

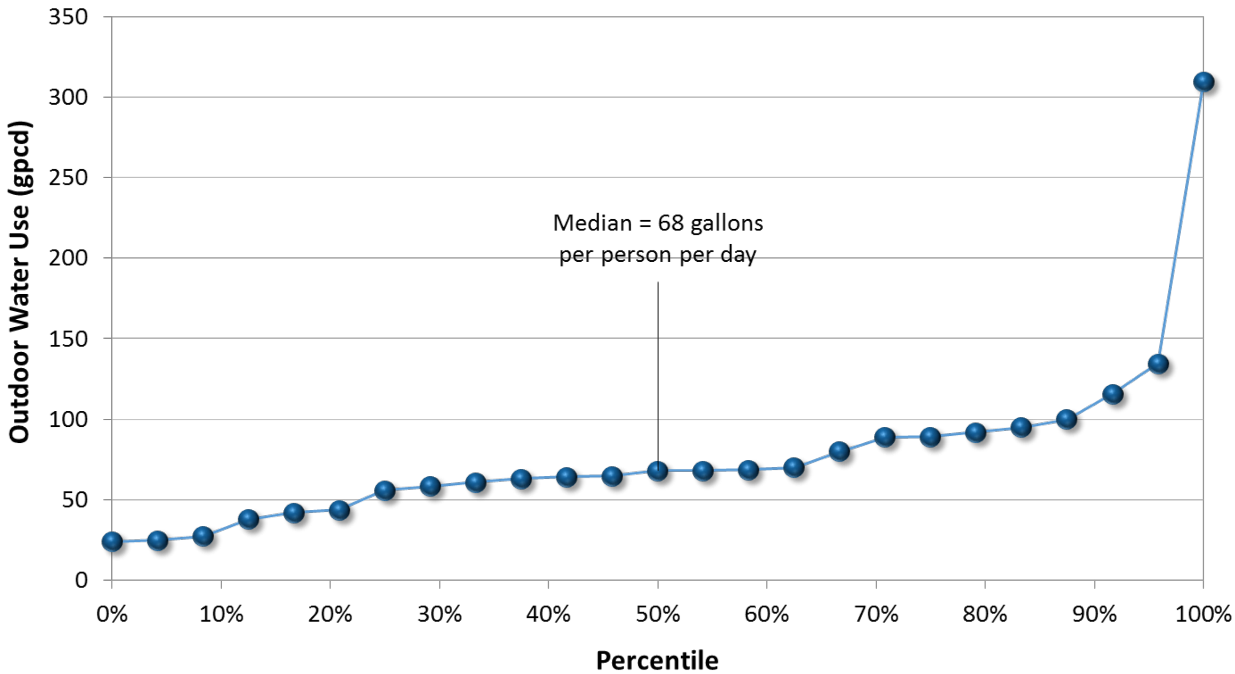


Figure 6-5. Outdoor Water Use Estimates from Literature Review

6.2.4 Water Quality Targets

The RAA is designed to achieve the RWLs and WQBELs of the MS4 Permit, which are derived from applicable TMDLs (see Attachment M of the Permit) and the Basin Plan (see Receiving Water Limitations, Section V of the Permit). In particular, the RAA addresses the Water Quality Priorities identified in Section 2. The RWLs and WQBELs serve as the "water quality targets", or loads or concentrations to be achieved through implementation of the control measures specified by the EWMP. Not all pollutants are directly modeled; the pollutants that are the most problematic and generally require the most stormwater treatment are directly modeled – total solids, zinc, copper, lead, nitrogen, phosphorous, and *E. coli*. The targets for *modeled* pollutants are listed in **Table 6-3**, organized by pollutant class. For the remaining (non-modeled) Water Quality Priorities, the RAA uses analyses of monitoring data to demonstrate that control of one or more "limiting pollutants" will address the non-modeled pollutants (as discussed in the next subsection).

Table 6-3. Targets for Modeled Water Quality Priority Pollutants

Pollutant Class	Pollutant	Target for RAA (units are µg/L except when noted otherwise)				Assessment Area where Target was Evaluated
		Dry Weather	Source	Wet Weather	Source	
Metals	Zinc, Copper, Lead	See Part C.2.b of Attachment O of Permit	Permit / Metals TMDL	See Part C.2.d of Attachment O of Permit	Permit / Metals TMDL	All Assessment Areas
Bacteria	*E. coli*	WLA determined by Load Reduction Strategy	Bacteria TMDL	235 MPN per 100 mL [1]	Bacteria TMDL	All Assessment Areas
Organics and Legacy Pollutants	Total DDTs	0.057 grams per year [2,3]			Harbor Toxics TMDL	Average Annual Loading from EWMP Area (assessed at most downstream end of LA River below Sepulveda Basin)
	Total PCBs	0.185 grams per year [2,3]				
	Total PAHs	1.32 kilograms per year [2,3]				
	Total PCBs	0.17 ng/L[2]			Echo Park Lake TMDL	Subwatersheds that drain to Echo Park Lake
	Chlordane	0.59 ng/L[2]				
Nutrients	Total Nitrogen	Average annual loading specified in Section G of Attachment O of Permit			LA Area Lakes TMDL	Subwatersheds that drain to Echo Park, Calabasas and Legg Lakes.
	Total Phosphorous					

1 – Per the Bacteria TMDL, the target incorporates 10 Allowable Exceedance Days in waterbodies subject to the High Flow Suspension (HFS) and 15 Allowable Exceedance Days in waterbodies not subject to HFS. All assessment areas except Compton Creek and Arroyo Seco are subject to the HFS.

2 – The loading of these pollutants was modeled by simulating TSS loading and estimating baseline stormborne sediment concentrations. Baseline stormborne sediment concentrations were estimated based on summary statistics from stormborne sediment collected in Ballona Creek watershed, as reported in appendix of Ballona Creek EWMP Work Plan. For chlordane, the assumed baseline concentration is 0.026 ug/g based on the average concentration of stormborne sediments collected in Ballona Creek. For DDTs, the assumed baseline concentration is 0.036 ug/g based on the average concentration reported. For PCBs, the assumed baseline concentration is 0.017 ug/g based on the maximum concentration reported (there were too few detections to report an average). For PAHs, the assumed concentration is 0.153 ug/g based on the maximum concentration reported (there were too few detections to report an average). No data were available for dieldrin.

3 – The MS4 WLA for Los Angeles River for LA County et al. was multiplied by 57.77% to represent the portion of the LAR watershed that is the ULAR EWMP area.

6.2.5 Critical Conditions and Required Reductions

This following subsections describe the critical conditions for wet weather (stormwater) and dry weather (non-stormwater).

6.2.5.1 Wet Weather Critical Conditions

A key consideration of the RAA is the "critical condition" under which water quality targets must be achieved. Stormwater management for different size storms generally requires different size BMPs. For example, for most pollutants management of a 90th percentile storm requires larger BMPs than management of a median (50th percentile) storm. The RAA Guidelines specify the RAA for compliance should be based on critical conditions, for example, the 90th percentile flow rates and/or the critical conditions specified by applicable TMDLs (Regional Board, 2014). For the ULAR RAA, three primary *wet weather* critical conditions were considered as follows:

1. **90th percentile <u>metals</u> Exceedance Volume:** the LA River Metals TMDL uses the 90th percentile daily flow rate to define the wet weather condition. In turn, the ULAR RAA analyzes the volume of runoff during each rolling 24-hour period[25] of the 10-year simulation when water quality targets were exceeded, referred to as the "Exceedance Volume" (see **Figure 6-6**). The storm that produces the 90th percentile Exceedance Volume[26] is the critical condition for metals and the overall primary critical condition for management[27] of stormwater by ULAR EWMP. The Exceedance Volume differs for each metal (zinc, copper and lead) and for different subwatersheds (end-of-pipe) and assessment areas (instream) depending on land use, imperviousness, slope, etc. Shown in **Table 6-4** are the summary statistics for zinc Exceedance Volumes in ULAR. The table shows the 90th percentile volume is indeed a critical condition, with volumes being up to ~10 times larger than the median volumes. The EWMP manages (retains and treats) the Exceedance Volume from each of the 1,129 subwatersheds in the ULAR area to achieve metals RWLs.

2. **Critical <u>bacteria</u> storm:** for addressing *E. coli* impairments, the "critical bacteria storm" is the 90th percentile wet day when bacteria RWLs apply. According to the LA River Watershed Bacteria TMDL, bacteria RWLs do *not* apply during days subject to the High Flow Suspension (HFS) or on Allowable Exceedance Days. The bacteria TMDL allocates 15 Allowable Exceedance Days per year in waterbodies that are *not* subject to the High Flow Suspension

[25] A duration of 24-hours was selected for several reasons. First, the LA River Metals TMDL uses a daily flow rate as the critical condition and thus 24-hours is an analogous duration. Second, the 24-hour duration allows the Exceedance Volume to be directly compared to the runoff volume from the 85th percentile, 24-hour storm. ly, stormwater control measures are generally sized to manage an individual storm – and thus the 24-hour Exceedance Volume is much more relevant to BMP sizing than an annual runoff volume.

[26] The Exceedance Volume is an appropriate metric for RAA critical conditions because the *volume* of stormwater to be managed ultimately drives the capacity of control measures in the EWMP. The Exceedance Volume allows the volume to be defined based on applicable RWLs and assures attainment of RWLs. For example, a storm that generates a large volume of stormwater runoff with pollutant concentrations slightly above the RWLs is more difficult to manage than a storm that generates a small volume of runoff with concentrations that greatly exceeds the RWLs. Also, the Exceedance Volume reflects the effect of varying water quality targets / RWLs – if a target / RWL is increased then the volume of stormwater to be managed is decreased.

[27] The term "manage" incorporates both retention and treatment approaches. Retention of the Exceedance Volume assures attainment of RWLs. Treatment of the Exceedance Volumes to concentrations below the RWLs also assures RWL attainment. Furthermore, institutional control measures reduce pollutant build-up on watershed surfaces and thus can also decrease the Exceedance Volume.

(HFS) and 10 per year in waterbodies that are subject to the HFS. To identify the critical bacteria storm, within each water year between 2002 and 2012, the 11th- or 16th- wettest day was determined (the first day that RWLs apply) in each waterbody/assessment area. For the 10-year simulation, there are 10 of those days (one per year) for each waterbody and the 2nd wettest is the critical bacteria storm (the 2nd highest of 10 values is the 90th percentile). The simulated critical bacteria storm is a 24-hour storm. The EWMP retains[28] the runoff from the critical bacteria storm (from each subwatershed outlet, prior to discharge to receiving waters) to achieve *E. coli* WQBELs.

3. **Annual average <u>toxics</u> loading**: the Los Angeles River Harbor and USEPA Urban Lakes TMDLs (toxics/legacy pollutants) use annual average loading as the critical condition. For the RAA, the average year was defined as the 2007-08 Water Year. The pollutant loading that occurs over the course of 2007-08 is considered the average annual pollutant loading for the RAA. The EWMP manages (retains and treats) the annual runoff from in the ULAR EWMP area to achieve WQBELs for toxics/legacy pollutants. Some sources of toxics, however, are not due to runoff (e.g., contaminated sediments) and thus EWMP Implementation Strategy includes a defined schedule to address "residual" toxics sources after runoff is managed.

Additional information regarding the RAA critical conditions including comparison of Exceedance Volume approach to other 90th percentile metrics is provided in Appendix 6.I. The appendix also presents the reductions of sediment on an annual average basis that will be achieved by the control meaures in the EWMP Implementation Strategy, and demonstrates those reductions are greater than the targets of the USEPA Urban Lakes TMDL for the subwatersheds to the applicable urban lakes.

[28] Addressing bacteria though retention of the critical bacteria storm has several benefits for the RAA. First, the RAA for bacteria is essentially based on *hydrology* rather than prediction of bacteria concentrations / loads which can be challenging given the variability of bacteria concentrations in the environment and multitude of potential bacteria sources. By emphasizing *retention* prior to discharge to receiving waters, the RAA acknowledges that few stormwater control measures are able to reliably treat bacteria to concentrations below applicable RWLs. In essence, the entire volume of runoff from the critical bacteria storm is assumed to be an Exceedance Volume. Note the depth of rainfall that generates the critical bacteria storm varies by subwatershed based on historic rainfall at rain gages in the EWMP area (e.g., generally larger storms at higher elevations and smaller storms at lower elevations).

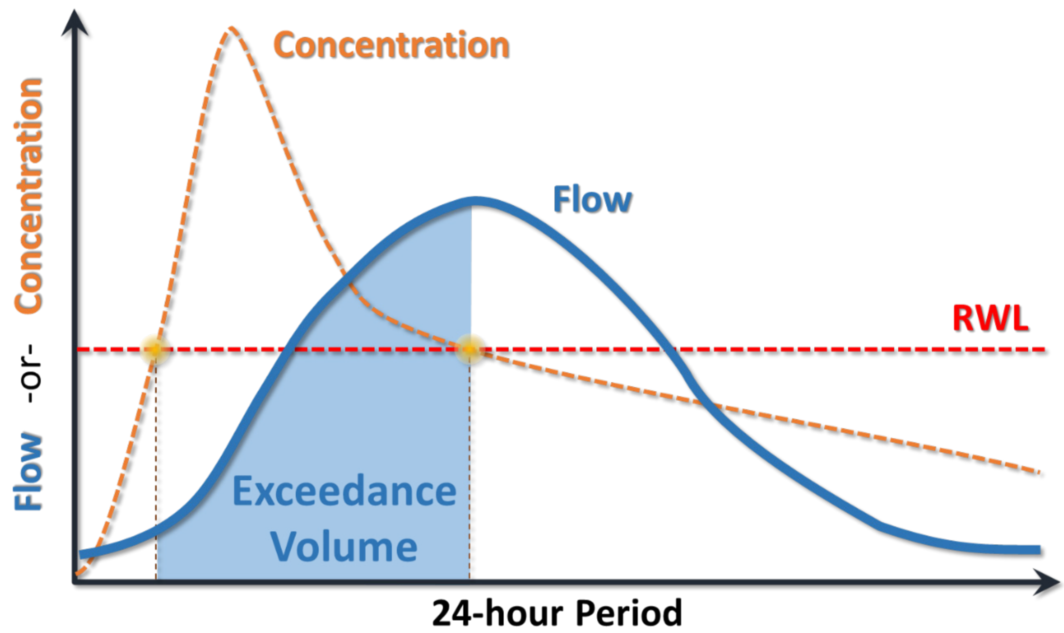


Figure 6-6. Illustration of How Metals Exceedance Volume is Calculated for Critical Condition Determination

Table 6-4. Zinc Exceedance Volume Summary Statistics for Upper Los Angeles River (acre-feet)

Condition and Pollutant Addressed	RAA Assessment Area												
	Compton Creek	Rio Hondo	Los Angeles River Reach 2	Arroyo Seco	Verdugo Wash	Burbank Western Channel	Tujunga Wash	Bull Creek	Los Angeles River Reach 6	Aliso Wash	Browns Canyon Wash	McCoy-Dry Canyon Creek	Bell Creek
Number of rolling, 24-hour periods with an EV in 10-year simulation (out of a total of 87,660 periods)	7,254	6,217	4,172	2,943	5,363	5,408	2,289	6,075	5,532	6,325	4,344	5,245	4,752
Average EV	192	533	1,808	100	82	68	360	68	310	53	40	32	34
10th percentile EV	10	119	320	18	12	9	63	11	37	4	7	4	2
25th percentile EV	20	179	806	40	22	18	168	19	70	9	11	8	5
Median EV	64	320	1,310	85	43	36	301	42	169	23	22	19	16
75th percentile EV	229	675	2,279	146	97	82	471	86	408	74	47	43	42
90th percentile EV	626	1,215	3,925	197	177	176	747	167	784	136	85	81	70

Note: The storm that generates the 90^{th} percentile zinc EV is the critical condition for metals compliance. The storm that generates the average zinc EV is the interim condition for metals.

6.2.5.2 Dry Weather Critical Conditions

For demonstration of the effect of wet weather control measures on non-stormwater, the dry weather critical condition was based on two factors (see Section 6.2.3): [1] median outdoor water use, which is conservatively high considering recent water conservation efforts due to drought conditions and [2] a critical dry period identified in late August to September. The LRS analyses are based on the dry weather critical conditions of the LA River Bacteria TMDL.

6.2.6 Limiting Pollutant Analysis

The RAA Guidelines allow the EWMP to be developed with consideration of a "limiting pollutant", or the pollutant that drives BMP capacity (i.e., control measures that address the limiting pollutant will also address other pollutants). The detailed limiting pollutant selection and justification for each WQP pollutant is provided in **Table 6-5**. The limiting pollutants are as follows:

- **Wet weather – zinc and *E. coli***: according to the Exceedance Volume analysis and review of monitoring data, control of zinc and *E. coli* requires BMP capacities that are the largest among the WQP pollutants, and thus control of zinc and *E. coli* has assurance of addressing the other ULAR wet weather Water Quality Priorities. The RAA for the ULAR EWMP first identifies the control measures to attain zinc RWLs (during the zinc critical condition) and then identifies additional capacity, if any, needed to achieve bacteria WQBELs (through retention of the critical bacteria storm) as shown in **Figure 6-7**.

- **Dry weather – *E. coli***: among all the pollutants monitored during dry weather at mass emission stations in LA County, *E. coli* most frequently exceeds RWLs. During monitoring "snapshots" of over 100 outfalls along the LA River, over 85% of samples exceeded WQBELs for *E. coli* during dry weather (CREST, 2008). As presented in **Appendix 2.A**, of all the constituents analyzed in Reach 2 of the LA River, *E. coli* has the highest dry weather exceedance rate with 95% of samples (568 of 591) exceeding. The average concentration of 2,670 MPN per 100 milliliters is approximately 20 times higher than the RWL. This same relative comparison of *E. coli* to other pollutants is reflected in the other reaches of the LA River and tributaries. Among the dry weather WQP pollutants, achievement of dry weather RWLs for *E. coli* will be the most challenging.

As shown in **Figure 6-7**, the RAA sequentially addresses the limiting pollutants in stormwater (wet weather RAA) and non-stormwater (dry weather RAA) based on the limiting pollutant analysis.

It is important to distinguish between reasonable assurance and required implementation actions when considering limiting pollutants. While control of zinc and *E. coli* has reasonable assurance of addressing other Water Quality Priorities, it is not *necessary* to fully control zinc and *E. coli* to address the other Water Quality Priorities. For example, as shown in **Table 6-5**, exceedances of metals during dry weather are rare and thus existing MCMs and control measures have reasonable assurance of attaining metals RWLs during dry weather. Similarly, for Category 2 and 3 WBPCs, which also have very low exceedance frequencies, the MCMs and associated control measures have reasonable assurance of attaining RWLs. As such, if exceedances of metals during dry weather or exceedances of Category 2 or 3 WBPCs identified in **Table 3-14** occur during EWMP implementation, then compliance determination should *not* be based on the status of implementation of zinc and *E. coli* control measures. Instead, compliance determination should be based on evaluation of whether the existing level of implementation for MCMs and control measures (as of June 2015) has been maintained and adapted, as necessary, to meet interim and limitations. As important, compliance should be determined separately for each constituent and condition (wet or dry).

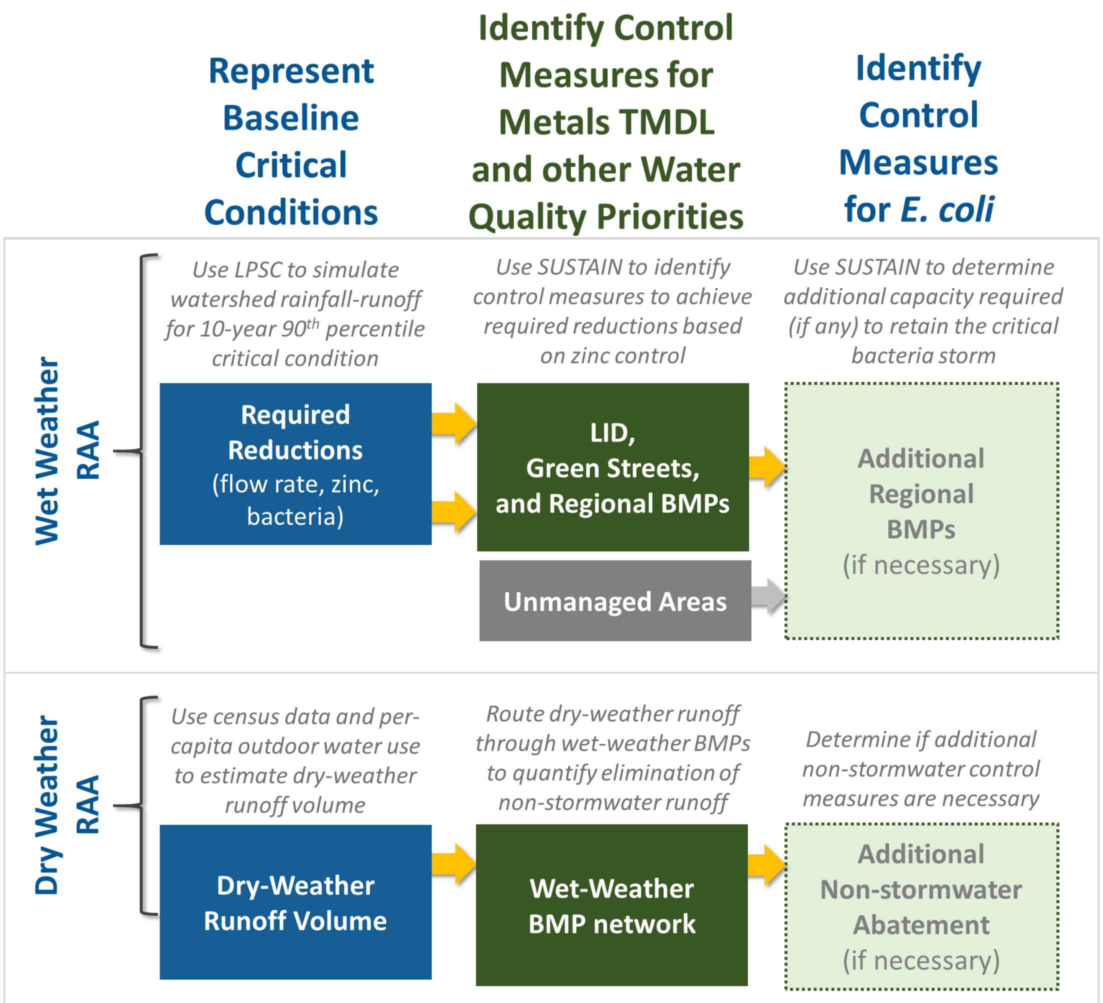


Figure 6-7. RAA Process for Establishing Critical Conditions and Addressing Water Quality Priorities

Table 6-5. Limiting Pollutant Selection and Justification for RAA

<table>
<tr><th rowspan="2">Pollutant Class</th><th rowspan="2">Pollutant</th><th colspan="4">RAA approach to Addressing Pollutant</th></tr>
<tr><th>Wet Weather RWLs: Addressed by</th><th>Justification for control approach</th><th>Dry Weather RWLs: Addressed by</th><th>Justification for control approach</th></tr>
<tr><td>Bacteria</td><td>E. coli</td><td>E. coli controls</td><td>E. coli is one of two wet weather limiting pollutants.</td><td>E. coli controls</td><td>E. coli is the dry weather limiting pollutant.</td></tr>
<tr><td rowspan="6">Metals</td><td>Copper</td><td rowspan="6">Zinc controls</td><td>A large portion of copper loading is being phased out through brake pad replacement (AB346). The reduction will cause zinc to become limiting the limiting metal.</td><td rowspan="6">Existing MCMs and BMPs</td><td rowspan="6">Exceedances of metals during dry weather are relatively rare. Existing MCMs and BMPs, including the additional MCMs incorporated under the 2012 Permit, have reasonable assurance of addressing dry weather metals exceedances (because they currently rarely occur).</td></tr>
<tr><td>Zinc</td><td rowspan="5">Zinc is one of two wet weather limiting pollutants.

The volumes of stormwater to be managed for zinc control are greater than volumes for control of these other metals.</td></tr>
<tr><td>Lead</td></tr>
<tr><td>Cadmium</td></tr>
<tr><td>Thallium</td></tr>
<tr><td>Mercury</td></tr>
<tr><td rowspan="7">Organics and Legacy Pollutants</td><td>Total DDTs</td><td rowspan="7" colspan="3">Annual load reduction will be achieved through zinc controls (and residual source controls, if necessary)</td><td rowspan="7">The volumes of stormwater to be managed for zinc control are greater than volumes for control of these organic / legacy pollutants.</td></tr>
<tr><td>Total PCBs</td></tr>
<tr><td>Total PAHs</td></tr>
<tr><td>Chlordane</td></tr>
<tr><td>Dieldrin</td></tr>
<tr><td>Dioxin</td></tr>
<tr><td>Diazinon</td></tr>
<tr><td rowspan="2">Nutrients</td><td>Total Phosphorous</td><td rowspan="2" colspan="3">Annual load reduction will be achieved through zinc controls (and residual source controls, if necessary)</td><td rowspan="2">The volumes of stormwater to be managed for zinc control are greater than volumes for control of these nutrients.</td></tr>
<tr><td>Total Nitrogen</td></tr>
<tr><td colspan="2">All Pollutants in Table 3-14</td><td colspan="4">Exceedances of the RWLs for these pollutants are rare, insufficient to meet 303(d) listing criteria. Existing MCMs and BMPs have reasonable assurance of addressing exceedances (because they currently rarely occur).</td></tr>
<tr><td colspan="2">All Pollutants in Table 3-15</td><td colspan="4">These pollutants are either not considered to originate from the MS4, or the WBPC is a condition rather than a “pollutant” with the potential to be discharged from the MS4.</td></tr>
</table>

6.2.7 Required Interim and Pollutant Reductions

The RAA Guidelines specify that required pollutant reductions should be determined by comparing baseline/current pollutant loading to the allowable pollutant loading (Regional Board, 2014). With a set of defined critical conditions and identified limiting pollutants for ULAR (as described in the previous two subsections), the required pollutant reductions for ULAR can be determined, as shown in **Table 6-6**. The control measures to be implemented by the EWMP are designed to achieve these reductions, and the RAA provides assurance the required reductions will be achieved by the selected control measures. Each EWMP Group member is held to achieving equitable reductions for the receiving waters / assessment areas to which they discharge. It is noted that the several of the assessment areas require greater than 75% reduction in zinc loading, which is rather high and leads to requirements for extensive structural control measures.

An important consideration for the RAA and scheduling of control measures is the difference between interim and requirements. While the critical condition (90th percentile) is used to define the required reductions for compliance, interim compliance is based on average conditions according to the RAA Guidelines (Regional Board, 2014):

> For interim WQBELs and/or receiving water limitations, the percent reduction based on annual average baseline loading may be used to set targets/goals for BMPs/watershed control measures. A gradual phasing of percent load reduction for interim WQBELs/RWLs to WQBELs/RWLs shall be applied over the course of the implementation schedule. [page 7]

For the ULAR RAA, the gradual phasing is achieved by determining the ratio of loading during average to 90th percentile conditions, as shown in Table 6-6. Zinc loading during the interim/average condition is between 26% and 41% of the loading that occurs during the /90th percentile condition. The approach for applying this ratio during scheduling of control measures for EWMP/TMDL milestones is described in **Appendix 6.G**. A regional example that shows validation of the RAA approach, driven by achievement of required reductions of loading during the /90th percentile condition, by demonstrating attainment of downstream RWLs after EWMP implementation is shown in Appendix 6.I.

Table 6-6. Limiting ULAR Pollutant Reductions for Interim and Compliance

Condition and Pollutant Addressed	Reduction Metric	RAA Assessment Area												
		Compton Creek	Rio Hondo	Los Angeles River Reach 2	Arroyo Seco	Verdugo Wash	Burbank Western Channel	Tujunga Wash	Bull Creek	Los Angeles River Reach 6	Aliso Wash	Browns Canyon Wash	McCoy-Dry Canyon Creek	Bell Creek
Compliance with Metals and Other Water Quality Priorities (except *E. coli*)	Loading during 90th percentile/ condition (pounds)[3]	1,359	1,123	4,323	298	401	532	720	335	1,712	284	298	136	104
	Allowable loading during 90th percentile/ condition (pounds)	312.6	460.4	2939.6	181.8	236.6	133.0	489.6	117.3	273.9	107.9	32.8	21.8	80.1
	Required Load Reduction[1]	77%	59%	32%	39%	41%	75%	32%	65%	84%	62%	89%	84%	23%
Interim Compliance with Metals and Other Water Quality Priorities (except *E. coli*)	Loading during average/interim condition (pounds)[2]	341	382	2,235	85	105	173	267	149	581	114	87	58	58
	Ratio used to gradually phase from interim to required reduction	0.25	0.34	0.52	0.29	0.26	0.33	0.37	0.44	0.34	0.40	0.29	0.43	0.56
Compliance with *E. coli*	Runoff volume to be retained	Runoff from critical bacteria storm is retained prior to discharge to receiving water (excluding open space subwatersheds)												

1 – Based on control of zinc during storm that generates the 90th percentile zinc Exceedance Volume

2 – Loading of zinc at mouth of watershed from storm that generates the average zinc Exceedance Volume

3 – Loading of zinc at mouth of watershed from storm that generates the 90th percentile zinc Exceedance Volume

6.3 Representation of EWMP Control Measures

Once the model is set up to accurately simulate baseline hydrology and water quality conditions, the targets have been calculated, and the required reductions estimated, the next stage of the RAA determines the optimal combination of BMP types to achieve applicable RWLs and WQBELs. This step requires a robust set of assumptions to define the watershed-wide extent and configuration of each of the types of control measures that make up the EWMP Implementation Strategy.

The representation of control measures in the model is an important element of the RAA, as it provides the link between future watershed activities, model-predicted water quality improvement, and, ultimately, compliance. Since the BMP modeling parameters will greatly influence the outcome of the RAA, it is imperative that the suite of BMP assumptions are based on the best available data and represent the opportunity and limitations that will be faced by designers, contractors, and maintenance crews in the field as these BMPs are implemented over time. Further, the technical rigor of the analysis must be appropriately balanced with the resolution of the modeling system and the accuracy of the key datasets.

This section presents and reviews the following three primary elements for representing BMPs in the RAA model:

- ***Opportunity* –** Where can these BMPs be located and how many can be accommodated?
- ***System Configuration* –** How is the runoff routed to and through the BMP and what is the maximum BMP size?
- ***Cost Functions* –** What is the relationship between BMP volume/footprint/design elements and costs?

The following sections provide an overview of methods, summarize key assumptions, and highlight potential data limitations. Appendices 6.C through 6.F, as summarized in the following subsections, contain additional information including details on how each type of control measure (LID, green streets, regional BMPs) was represented in the modeling system (SUSTAIN).

6.3.1 BMP Opportunities

BMPs can only feasibly be implemented at certain locations in the watershed. While physical constraints may limit implementation in some areas (e.g., high slopes, insufficient space), practical or preferential constraints are also an important consideration for each jurisdiction (e.g., parcel ownership, redevelopment rates). To ensure that the spatial and temporal extent of BMP opportunities were accurately accounted for in the model, a BMP opportunity assessment was customized for each individual BMP category and type. The best available data and GIS layers were specifically selected to screen out inappropriate opportunities and/or identify high priority project opportunities (e.g. regional projects on public parcels). A summary of these methods is provided in **Table 6-7** and detailed methods and screening results are provided in **Appendix 6.C**.

In addition to the spatial opportunity screening process, which highlighted on potential roadblocks to BMP implementation, the individual preferences of the EWMP Group members were incorporated into the RAA, in order to allow the EWMP Implementation Strategy to be customized to each jurisdiction. These preferences are summarized in **Table 6-8**.

Table 6-7. Summary of BMP Opportunities for Compliance RAA

BMP Category	Type	Opportunity Identified
Institutional	Institutional	Assumed to achieve 5% reduction for most jurisdiction. For those jurisdictions that elected to assume 10%, an enhanced set of institutional control measures is presented in the EWMP Implementation Strategy. The reductions were assumed to only be applicable to pollutants primarily associated with sediments (e.g., metals and historical organics), represented by total zinc. The 5% reduction was not directly applied to *E. coli*.
Low Impact Development	Ordinance	Acreage subject to redevelopment based on growth rates reported by City of Los Angeles.
	Planned	BMPs constructed after September 2011 were included based on list submitted in ULAR EWMP Work Plan.
	on Residential	1% of residential parcels enrolled per year, starting in 2017.
	on Public	Parcels flagged as opportunities based on screening for slopes, soil contamination, and ownership.
Green Streets	Green Streets	Available opportunity approximated for each subwatershed based upon street types and slopes.
Regional	Very High projects on Public	Top 20 ranked parcels from regional BMP selection process.
	High & Medium projects on Public	Parcels flagged as opportunities based on screening and prioritization conducted for regional project selection process.
	on Private	Control measures located on acquired private parcels to capture runoff near the subwatershed or jurisdiction outlet.

Table 6-8. Summary of BMP Preferences for ULAR EWMP Agencies

Jurisdiction	Institutional	LID Ordinance	Residential LID Incentive Program	LID Retofits on Municipal Parcels	Green Streets with Bioretention and Permeable Pavement	Very High/High Regional BMPs	Medium Regional BMPs on School Properties
Alhambra	5%	Yes	Yes	Yes	Yes	Yes	No
Burbank	10% [a]	Yes	Yes	Yes	Yes	Yes	Yes
Calabasas	5%	Yes	Yes	Yes	Yes	Yes	No
Glendale	10% [a]	Yes	Yes	Yes	Yes	Yes	No
Hidden Hills	5%	Yes	Yes	Yes	Yes	Yes	No
La Canada Flintridge	5%	Yes	Yes	Yes	Yes	No	No
Los Angeles	5%	Yes	Yes	Yes	Yes	Yes	No
Montebello	5%	Yes	Yes	Yes	Yes	Yes	Yes
Monterey Park	5%	Yes	No	Yes	Yes	Yes	No
Pasadena	5%	Yes	Yes	Yes	Yes	Yes	No

Table 6-8. Summary of BMP Preferences for ULAR EWMP Agencies

Jurisdiction	Institutional	LID Ordinance	Residential LID Incentive Program	LID Retofits on Municipal Parcels	Green Streets with Bioretention and Permeable Pavement	Very High/High Regional BMPs	Medium Regional BMPs on School Properties
Rosemead	5%	Yes	Yes	Yes	Yes	Yes	No
San Fernando	5%	Yes	Yes	Yes	Yes	Yes	No
San Gabriel	5%	Yes	Yes	Yes	Yes	Yes	No
San Marino	5%	Yes	Yes	Yes	Yes	Yes	No
South El Monte	5%	Yes	Yes	Yes	Yes	Yes	Yes
South Pasadena	10% [a]	Yes	Yes	Yes	Yes	Yes	No
Temple City	10% [a]	Yes	No	Yes	Yes	Yes	Yes
Unincorporated LA County	5%	Yes	Yes	Yes	Yes	Yes	Yes

a – See Table 7-4 in Section 7.5 for description of enhanced institutional control measures that will achieve the 10% reduction.

6.3.2 BMP Configuration

BMP configuration is determined by a combination of [1] physical watershed properties that are generally unchangeable (e.g., location of parcels or streets, soil types, drainage areas, space available for BMPs) and [2] BMP design assumptions which are at the discretion of the responsible agency (e.g., standard BMP profiles, underdrain configurations, soil media mixes). **Table 6-9** provides a brief overview of BMP configuration assumptions and **Appendix 6.D** provides details on how variables were defined for each BMP categories/types, including the following:

- **Drainage Area –** Determined by the physical setup of the watershed and the placement of the BMP, drainage area ultimately defines how much water and pollutant load could possibly arrive at the site. A typical (or specific, where possible) drainage area is estimated for each category of BMP in **Appendix 6.C** and **Appendix 6.D**.

- **Infiltration Rate –** Determined by the soil types in the area, infiltration rate defines the rate at which water exits the BMP into the soil. **Appendix 6.C** provides details for how infiltration rates were spatially estimated.

- **Routing –** Determined by the drainage network in the local area, the runoff conveyance method is critical to determining how much of the runoff and associated pollutants are accessible by the BMP. Conveyance systems that are underground or well below-grade often require pumping to lift the runoff to a BMP. **Table 6-9** provides details on when pumping is assumed.

- **BMP Design –** Determined by the physical space available at the site and the standard profile assumed, BMP design defines the spatial footprint, depth, and internal hydraulic routing of runoff through the BMP. **Appendix 6.D** provides BMP design details for each individual BMP category and type.

- **BMP Efficacy –** Determined by the BMP type selected, BMP efficacy defines the pollutant removal rates for overflow or underdrain effluent from the BMP. **Appendix 6.D** provides BMP efficacy details.

Careful analyses were performed to specifically tailor each of the above variables for each individual BMP category and type. The results of these analyses have yielded a robust and defensible suite of BMP configuration assumptions that reasonably represent future BMP implementation in the watershed.

6.3.3 Cost Functions

To support BMP optimization, cost functions were developed for each type of structural BMP to relate capital and operations and maintenance (O&M) costs to physical BMP characteristics such as depth, footprint, and configuration. The cost functions are primarily based on those presented in the WMMS developed for TMDL Implementation Strategy in Los Angeles County (County of Los Angeles, 2012; Tetra Tech, Inc., 2011). While maintenance costs from previous efforts were based on national literature review estimates, those costs were updated for the RAA to provide customized regional cost functions. Maintenance professionals from municipalities in Southern California were interviewed to determine actual costs for routine and intermittent maintenance practices such as mowing grass, pruning, spreading mulch, replacing soil media, sediment removal and street sweeping (Caltrans, City of La Mesa, City of Lemon Grove, City of San Diego, County of San Diego, and Unified Port of San Diego, 2013). The costs account for labor to perform the maintenance as well as costs for maintenance and upkeep of the equipment. A summary of the BMP cost functions, expressed as a function of BMP geometry is presented in **Table 6-10**.

It is important to note the cost functions are based on *20-year life cycle costs* including O&M.

Table 6-9. Summary of BMP Design Assumptions for Compliance RAA

BMP Category	Type	Key Design Parameters
Institutional	Institutional	Assumed 5% reduction based on increased requirements in 2012 MS4 Permit.
Low Impact Development	Ordinance	Bioretention/Biofiltration sized to capture 85th percentile runoff from parcel. Underdrains required if subsoil infiltration rate less than 0.3 in/hr.
	Planned	Bioretention/Biofiltration sized to capture 85th percentile runoff from parcel. Underdrains required if subsoil infiltration rate less than 0.3 in/hr.
	on Residential	Bioretention sized to approximately 4% of parcel area (typical sizing to capture 85th percentile runoff)
	on Public	Bioretention/Biofiltration sized to capture 85th percentile runoff from parcel. Underdrains required if subsoil infiltration rate less than 0.3 in/hr.
Green Streets	Green Streets	Bioretention/biofiltration is 4-ft wide. Permeable pavement/subsurface storage is 5-ft wide and used in tandem with bioretention/biofiltration. 50% of street length retrofittable. Underdrains required if subsoil infiltration rate less than 0.3 in/hr.
Regional	Very High Projects on Public	BMP footprint delineated and ponding depth specified based on site configuration, topography, depth to groundwater, and infrastructure. Pump specified if greater than 100 ft from major storm drain using optimum diversion rate (0.09 cfs/ac).
	High & Medium Projects on Public	Same as Very High except ponding depth was assumed to be 3 ft (rather than based on site-specific configuration). Also, drainage areas and footprints are coarser due to the large number of these projects.
	on Private	Assumed 3-ft-deep infiltration basin at subwatershed outlets. Pumping assumed with no diversion limitations. Maximum footprint = 5% of contributing area.

Table 6-10. Summary of BMP Cost Functions for Compliance RAA (20-year, including O&M)

BMP Category	BMP types	Functions for Estimating Total Costs [1]
LID and Green Streets	Bioretention with Underdrain	*Cost = 64.908 (A) + 2.165 (Vt) + 2.64 (Vm) + 3.3 (Vu)*
	Bioretention without Underdrain	*Cost = 56.658 (A) + 2.165 (Vt) + 2.64 (Vm)*
	Residential LID	*Cost = 4.000 (A)*
	Permeable Pavement with Underdrain	*Cost = 65.849 (A) + 3.3 (Vu)*
	Permeable Pavement without Underdrain	*Cost = 57.599 (A)*
Regional BMPs	Pump	*Cost = 56,227*(Pump Capacity$_{cfs}$) + $1,207,736*
	Regional Project on Public Parcel	*Cost = 45.42 (A) + 2.296 (Vt) + 2.8 (Vm)*
	Regional Project on Private Parcel	*Cost = 45.42 (A) + 2.296 (Vt) + 2.8 (Vm) + 129 (A)*

1 – Functions describe 20-year life cycle costs including O&M using the following variables: (*A)* is the area of the BMP footprint in square feet, (*Vt*) is the total volume of the BMP in cubic feet, (*Vm*) is the volume of the BMP soil media in cubic feet, and (*Vu*) is the volume of the BMP underdrain in cubic feet.

6.4 BMP Selection

The RAA process is an important tool for assisting EWMP agencies with selection of control measures for EWMP implementation (known as the EWMP Implementation Strategy). A major challenge associated with stormwater planning is the multitude of potential types and locations of control measures and the varying performance and cost of each scenario. This subsection describes the process for selecting the control measures for the EWMP Implementation Strategy by each jurisdiction.

6.4.1 Selection of Control Measures for Wet Weather Compliance

The SUSTAIN model within WMMS provides a powerful tool for considering millions of scenarios of control measures and recommending a solution based on cost-effectiveness. The cost functions described in the previous subsection are used to weigh the cost of different BMP scenarios with benefits in terms of pollutant load reduction. As shown in **Figure 6-7**, the RAA process for the ULAR EWMP first determines the control measures to achieve zinc RWLs under critical conditions and then determines the additional capacity (if any) to retain the critical bacteria storm. The optimization modeling is conducted stepwise to determine the control measures for compliance that are selected for the EWMP Implementation Strategy, as follows:

1. **Determine the cost-effective BMP solutions <u>for each subwatershed</u> in the EWMP area:** an example set of "BMP solutions" is shown in **Figure 6-8**, which shows thousands of scenarios considered for an individual subwatershed in the EWMP area. The scenarios are based on the available opportunity (e.g., the available footprints for regional BMPs and length of right-of-way for green streets) and predicted performance for controlling zinc if BMPs were implemented at those opportunities with varying sizes. The most cost-effective BMP solutions for each of the 1,129 subwatersheds in the EWMP area provide the basis for cost optimization.
2. **Determine the cost-effective scenarios <u>for each Group member</u>:** by rolling up the BMP solutions at the subwatershed level, the most cost-effective scenarios for each jurisdiction can be determined for a wide range of required zinc reductions. These "cost optimization curves" provide a potential EWMP Implementation Strategy for a range of required reductions. **Figure 6-9** shows example cost optimization curves for the jurisdictions that drain to Arroyo Seco. Each scenario is a "recipe for compliance" for all the subwatersheds in the jurisdictional area (for a given percent reduction). The complete set of cost optimization curves for the ULAR EWMP are presented in **Appendix 6.G**.

3. **Extract the cost-effective scenarios <u>for the required reduction</u>:** the required zinc reductions specified in **Table 6-7** determine the specific scenario that is selected from the cost optimization curves. All Group members within the assessment areas are held to the same percent reduction. The selected scenarios become the EWMP Implementation Strategy. **Figure 6-10** illustrates the process for extracting the control measures to achieve zinc RWLs from the cost optimization curve. The extracted control measures comprise a detailed recipe for compliance with RWLs for metals and other Water Quality Priorities for each subwatershed in the jurisdictional area.
4. **Route the critical bacteria storm through the control measures in the extracted scenario:** the effectiveness of the selected control measures for retaining the critical bacteria storm is evaluated. The additional capacity (if any) to retain the critical bacteria storm is determined for each subwatershed.

The resulting EWMP Implementation Strategy for compliance is presented in next section. A regional example that shows validation of the RAA approach and demonstrates attainment of downstream RWLs during critical conditions after EWMP implementation is shown in Appendix 6.I.

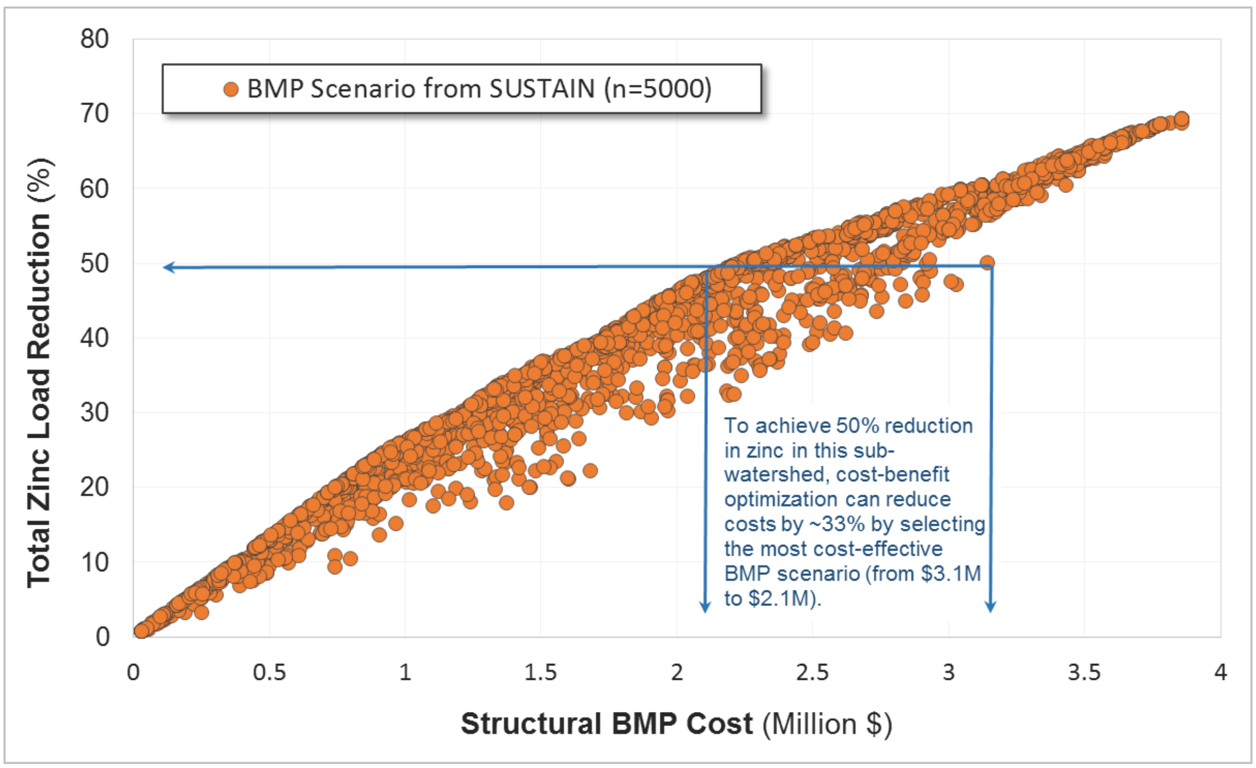


Figure 6-8. Example BMP Solutions for a Selected Subwatershed and Advantage of Cost-Benefit Optimization

This figure shows an optimization output for a single subwatershed. A similar curve was generated for each of the 1,129 subwatersheds in the ULAR EWMP area. The EWMP Implementation Strategy is based on an optimization routine that searches through those curves and selects the combination of solutions in each assessment area / watershed that provides the greatest cost-benefit for the required pollutant reduction.

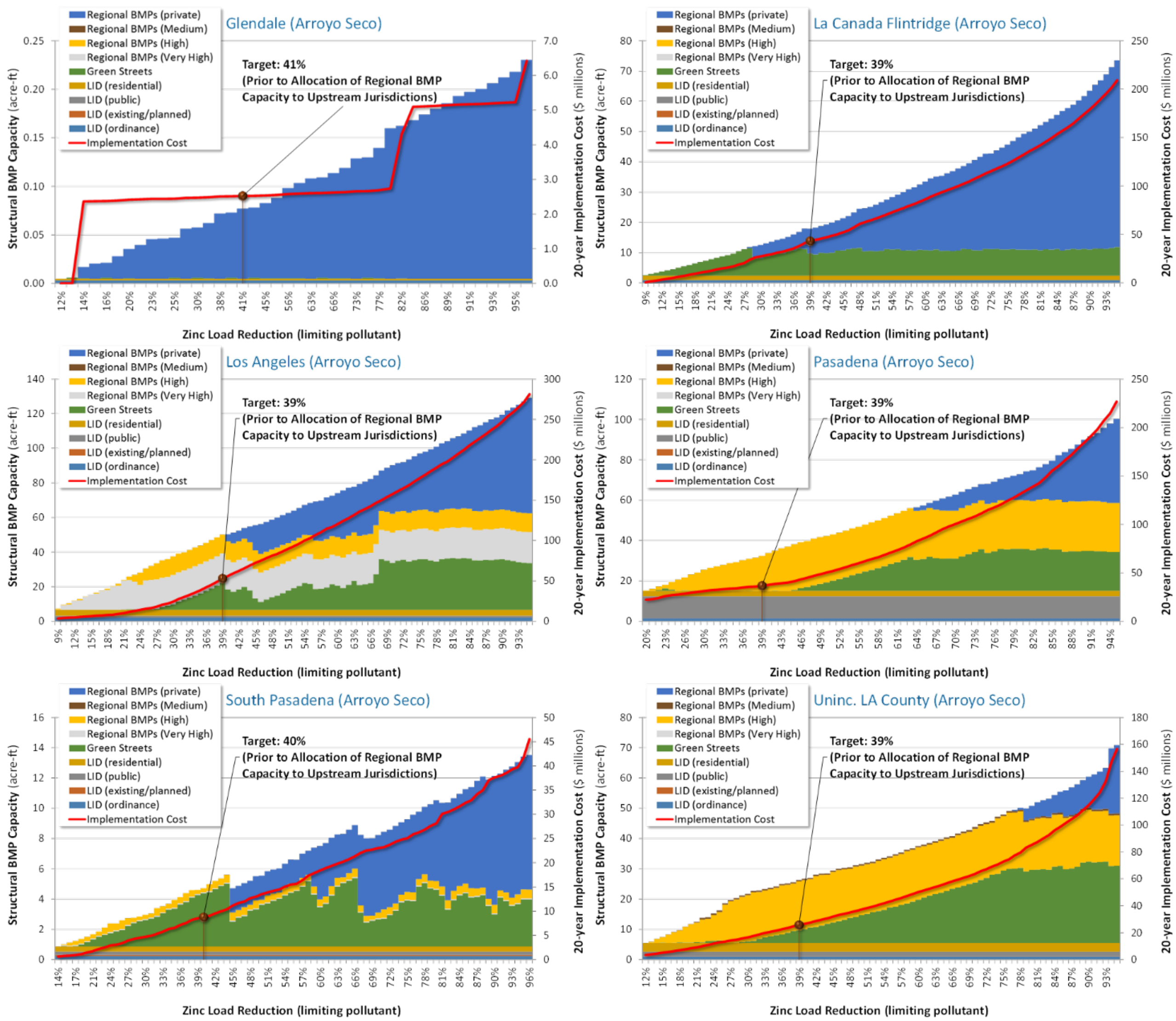
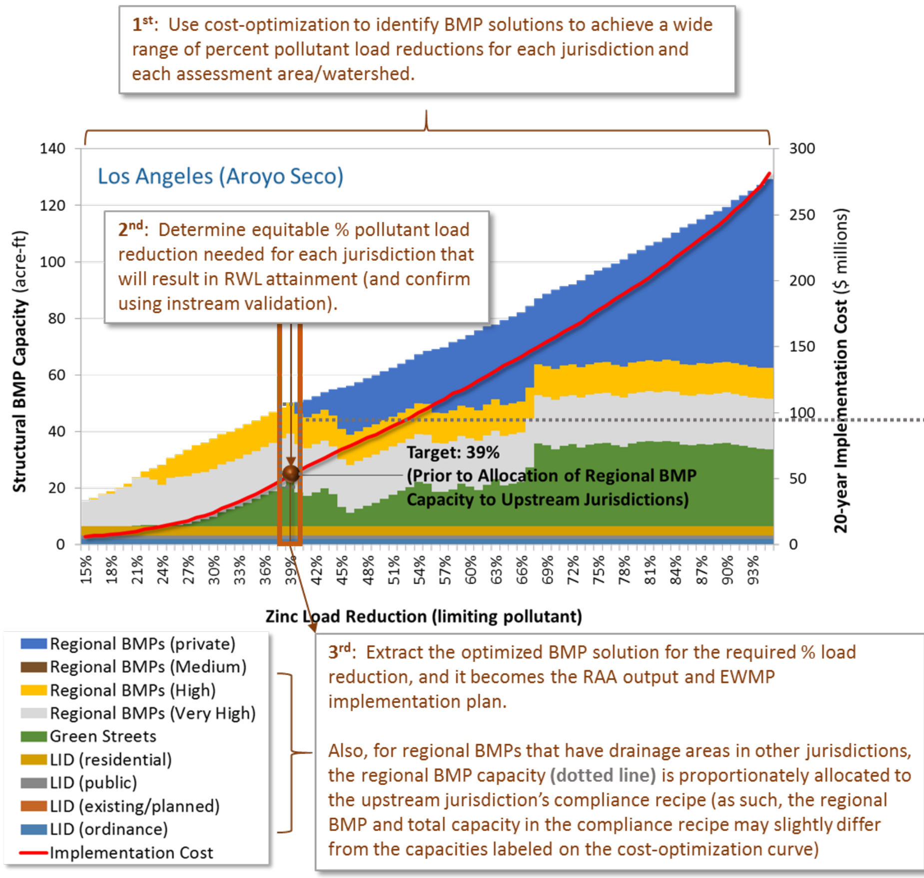


Figure 6-9. Example Cost Optimization Curves for a Watershed: Arroyo Seco

This example shows the set of optimized BMP solutions for ULAR EWMP jurisdictions that drain to Arroyo Seco. Each optimization curve represents over 1 million BMP scenarios that were evaluated for cost-effectiveness. All jurisdictions in Arroyo Seco are held to an equitable 39% reduction, but the curves differ among jurisdictions due to differing BMP opportunities. Different watersheds are subject to different percent reductions (see Section 6.5.4). See Appendix 6.G for the complete set of cost optimization curves.



Subwatershed ID	COMPLIANCE TARGETS: MEASURABLE AND ENFORCEABLE BMP GOAL		EWMP IMPLEMENTATION PLAN: APPROACH TO ACHIEVE COMPLIANCE TARGETS, SUBJECT TO ADAPTIVE MANAGEMENT (BMP capacity expressed in units of acre-feet)												
	For Metals by 2028	For Bacteria by 2037	For Metals Attainment by 2028											For Bacteria Attainment by 2037	
				Low-Impact Development				Streets	Regional BMPs						
	24-hour Volume Retained (acre-ft)	Additional 24-hour Volume to be Retained (acre-ft)	% Load Reduction Critical Condition	Ordinance	Planned LID	Public LID	Residential LID	Green Streets	Very High (public, owned)	High (public, owned)	Medium (public, non-owned)	Private	Total BMP Capacity (acre-ft)	Regional BMPs (private)	Total BMP Capacity (acre-ft)
640249	22.20	0.62	48%	0.50	---	0.15	0.78	3.36	2.99	0.00	0.00	0.00	**7.8**	0.62	**8.4**
640349	0.14	0.20	7%	0.14	---	---	0.00	0.00	0.00	0.00	0.00	0.00	**0.1**	0.20	**0.3**
640449	0.13	0.05	12%	0.03	---	0.08	0.01	0.00	0.00	0.00	0.00	0.00	**0.1**	0.05	**0.2**
640549	1.98	0.23	9%	0.54	0.02	---	1.37	0.00	13.22	0.04	0.00	0.00	**15.2**	0.23	**15.4**
640649	5.29	0.08	38%	0.20	---	---	0.15	4.45	0.00	0.00	0.00	0.00	**4.8**	0.08	**4.9**
640749	6.01	0.07	47%	0.22	0.00	0.24	0.22	2.89	0.00	3.21	0.00	0.00	**6.8**	0.07	**6.9**
640849	12.22	0.01	63%	0.23	---	0.35	0.54	2.98	0.00	4.82	0.00	0.00	**8.9**	0.01	**8.9**
640949	1.40	0.02	37%	0.06	---	0.22	0.01	0.43	0.00	0.10	0.00	0.00	**0.8**	0.02	**0.8**
641049	1.94	0.01	48%	0.05	---	---	0.08	1.63	0.01	0.42	0.00	0.00	**2.2**	0.01	**2.2**
641149	0.90	0.00	48%	0.02	---	0.02	0.04	0.69	0.06	0.00	0.00	0.00	**0.8**	0.00	**0.8**
641449	0.02	0.00	64%	0.00	---	0.02	0.00	0.00	0.00	0.02	0.00	0.00	**0.0**	0.00	**0.0**
641549	1.13	0.01	49%	0.03	---	0.11	0.11	0.00	0.65	0.00	0.00	0.00	**0.9**	0.01	**0.9**
641649	0.00	0.00	13%	0.00	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.0**	0.00	**0.0**
642049	0.00	0.00	6%	0.00	---	---	---	0.00	0.00	0.00	0.00	0.00	**0.0**	0.00	**0.0**
Total	**53.4**	**1.3**	**39%**	**2.0**	**0.0**	**1.2**	**3.3**	**16.4**	**16.9**	**8.6**	**0.0**	**0.0**	**48.6**	**1.3**	**49.9**

RED = Subwatersheds with highest required % load reductions
BLUE = Subwatersheds with highest BMP capacities within a BMP category

Figure 6-10. Illustration of how the EWMP Implementation Strategy is Extracted from a Cost Optimization Curve.

This illustration uses the City of Los Angeles jurisdiction in the Arroyo Seco watershed as an example. Three steps are shown for RAA development: cost-optimized BMP solutions are developed for a wide range of % load reductions (1st, uppermost text box), followed by determination of the equitable % load reduction needed to attain RWLs for the corresponding receiving water (2nd, middle text box), and then the corresponding BMP solution is extracted to complete the RAA and determine the EWMP Implementation Strategy for the jurisdictional area (3rd, bottom text box). The EWMP Implementation Strategy for all jurisdictions and assessment areas is presented in Section 7. Note that while all jurisdictions in an assessment area/watershed are held to an equivalent % reduction, subwatersheds *within* a jurisdiction may have variable reductions based on optimization (which is why some subwatersheds have high % reductions [red shaded rows in table] and others have low % reductions).

6.4.2 Selection of Control Measures for Interim Wet Weather Compliance

With the EWMP Implementation Strategy for compliance determined, the remaining step for the wet weather RAA is scheduling of control measures *over time* to achieve interim milestones. The following interim wet weather milestones were utilized for development of the ULAR EWMP, primarily based on the milestones of the LA River Metals and Bacteria TMDLs[29]:

- Achieve 31% of the reduction for zinc[30] and WBPCs identified in **Tables 3-13** and **3-14** (2017)
- Achieve 50% of the reduction for metals and WBPCs identified in **Tables 3-13** and **3-14** (2024)
- Achieve 100% of the reduction for metals and WBPCs identified in **Tables 3-13** and **3-14** (2028)
- Achieve 100% of the reduction for toxics (2032)
- Achieve 100% of the reduction for bacteria (2037)

The scenario of control measures that corresponds to each of the EWMP / TMDL milestones was extracted and used for scheduling of the EWMP Implementation Strategy, as presented in the next section.

As described in Section 6.5.4, the applicable critical condition gradually phases from average conditions for interim milestones to critical conditions (90th percentile) for compliance. The approach for determining the control measures that correspond to each milestone was as follows:

1. **Simulate the BMP performance of increasing levels of control measure implementation:** multiple increments of "percent completion" of the EWMP Implementation Strategy were simulated to determine the relative performance as control measures are implemented toward compliance. The result is a curve of Percent of Reduction versus Percent of Capacity (see **Figure 6-11**).
2. **Incorporate the gradual phasing from average the critical conditions:** the gradual phasing was accomplished by applying the average: ratios in **Table 6-6** to the BMP sequencing. An illustration of the phasing approach is shown in **Figure 6-11.** The orange "translator" from average to phases from relying entirely on average conditions at 0% completion and phases to relying entirely on conditions at 100% completion. The formulation of the orange translator line is based on the quadratic equation, as detailed in **Appendix 6.H**.

The scenario of control measures that corresponds to each of the EWMP / TMDL milestones was extracted and used for scheduling of the EWMP Implementation Strategy, as presented in the next section.

[29] Milestones for the San Gabriel River portion of South El Monte are described in **Appendix 1.B**.

[30] While these milestones are expressed as reduction in zinc, because zinc is a limiting pollutant (see Section 6.5.3), achievement of zinc RWLs by these dates assures even greater reduction in other Water Quality Priority pollutants.

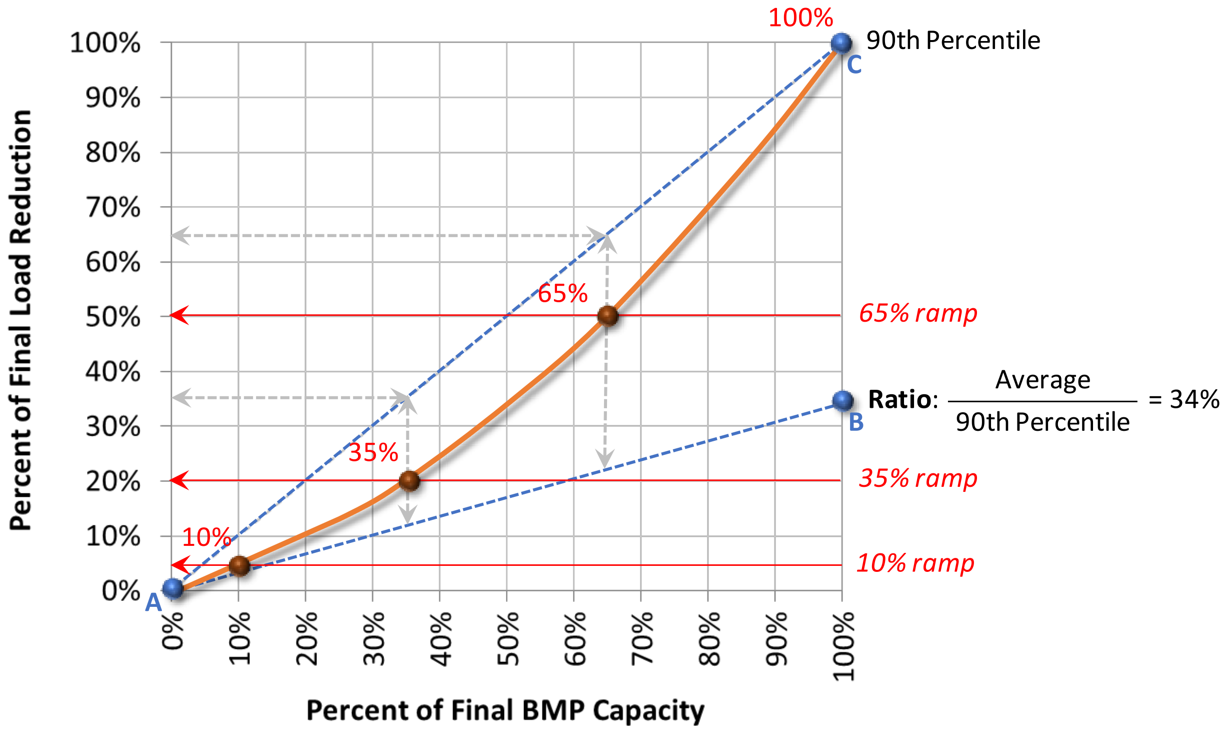


Figure 6-11. Illustration of Gradually Phasing from Average to Critical Conditions for Interim Milestones

The orange "translator" line phases from average to by relying entirely on average conditions at 0% BMP capacity and then phases to relying entirely on conditions at 100% BMP capacity. In the example, the average: ratio is 0.34 (see right hand side of figure). The percent BMP completion based on the compliance target (critical conditions) is represented by the top blue line [segment A→C], while percent BMP completion based on the interim target (average conditions) is represented by bottom blue line [segment A→B]. The orange curve represents the "translator" for phasing of the pollutant reduction target from average to critical conditions to match the approach recommended by the RAA Guidelines (and account for the average: ratio of 0.34). A reduction of 35% under average conditions represents a 20% reduction under conditions. A 65% reduction under average conditions represents a 50% reduction under conditions. The relative difference depends on the average: ratio, which is watershed-specific (see Table 6-6). As the ratio approaches 1.0, average and conditions become identical.

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Section 7
Detailed EWMP Implementation Strategy and Compliance Schedule

The EWMP Implementation Strategy is the "recipe for compliance" of each jurisdiction to address Water Quality Priorities and comply with the provisions of the MS4 Permit. Through the RAA, a series of quantitative analyses were used to identify the capacities of LID, green streets and regional BMPs that comprise the EWMP Implementation Strategy and assure those control measures will address the Water Quality Priorities. The EWMP Implementation Strategy includes individual recipes for each of the 17 jurisdictions and each watershed/assessment area – Los Angeles River above Sepulveda Basin, Los Angeles River below Sepulveda Basin, Compton Creek, Rio Hondo, Verdugo Wash, Arroyo Seco, Burbank Western Channel, Tujunga Wash, Bull Creek, Aliso Wash, Bell Creek, McCoy-Dry Canyon, and Browns Canyon Wash (see **Figure 6-1** for a map of these assessment areas). Implementation of the EWMP Implementation Strategy will provide a BMP-based compliance pathway for each jurisdiction under the MS4 Permit. This section describes the EWMP Implementation Strategy and the pace of its implementation to achieve applicable milestones, through the following subsections:

- Elements of the EWMP Implementation Strategy (7.1)
- Stormwater control measures to be implemented by 2037 for compliance (7.2)
- Scheduling of stormwater control measures to achieve TMDL and EWMP milestones (7.3)
- Non-stormwater control measures (7.4)
- Institutional control measures (7.5)

7.1 What are the Elements of the EWMP Implementation Strategy?

The EWMP Implementation Strategy is expressed in terms of [1] the volumes[31] of stormwater and non-stormwater to be managed by each jurisdiction to address Water Quality Priorities and [2] the control measures that will be implemented to achieve those volume reductions. The two primary elements of the Pollutant Reduction are as follows:

- **Compliance Targets**: for MS4 compliance determination purposes, the primary metric for EWMP implementation is the volume of stormwater managed by implemented control measures. The stormwater volume to be managed[32] is considered the BMP performance goal for the EWMP. To

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[31] Volume is used rather than pollutant loading because volume reduction is more readily tracked and reported by MS4 agencies. As described in Section 6.2.3, the volume reductions are actually a *water quality* improvement target based on required pollutant reductions.

[32] The reported volume is determined by tracking the amount of water that is be retained (infiltrated) by BMPs over the course of a 24-hour period under the critical 90th percentile storm condition. Additional volume would be *treated* by these BMPs, but that additional treatment is *implici*t to the reported Compliance Targets. For compliance purposes the volume in the Compliance Target can either be retained and/or treated to concentrations below RWLs. Both would result in compliance.

support future compliance determination and adaptive management, the volume of stormwater to be managed is reported along with the capacities of control measures to be implemented by each jurisdiction in the EWMP Implementation Strategy.

- **EWMP Implementation Strategy**: the network of LID, green streets and regional BMPs that has reasonable assurance of achieving the Compliance Targets is referred to as the EWMP Implementation Strategy. The identified BMPs (and BMP preferences) will likely evolve over the course of adaptive management in response to "lessons learned." As such, it is anticipated the BMP capacities within the various subcategories will be reported to the Regional Board but *not* tracked explicitly by the Regional Board for compliance determination. As BMPs are substituted over the course of EWMP implementation (e.g., replace green street capacity in a subwatershed with additional regional BMP capacity), the Group will show equivalency for achieving the corresponding Compliance Target.

Additionally, the EWMP Implementation Strategy includes the implementation of the MCMs, which are not only required by the Permit, but also address the Category 2 and 3 WBPCs identified in **Table 3-14**.

7.2 Which Stormwater Control Measures Correspond to Compliance by 2037?

The EWMP will guide stormwater management in the ULAR watershed for the coming decades, and the LID, green streets and regional BMPs to be implemented by the EWMP have the potential to transform communities. The EWMP Implementation Strategy identifies the location and type of control measures to be implemented by each jurisdiction for compliance by 2037, which includes addressing all Water Quality Priorities including the limiting pollutants zinc and *E. coli* (as described in Section 6.2.4). The EWMP Implementation Strategy for compliance is presented as follows:

- **Summary of total capacity of control measures for each jurisdiction across the entire EWMP area:** bar graphs are used to summarize the control measure capacities that comprise the EWMP Implementation Strategy. Shown in **Figure 7-1** are the various subcategories of LID, green streets and regional BMPs for each jurisdiction across the entire EWMP area by 2037.

- **Detailed recipe for compliance including volumes of stormwater to be managed and control measure capacities:** the EWMP Implementation Strategy is detailed for each subwatershed in the EWMP area (generally 1 to 2 square mile drainages). Shown in **Figure 7-2** is a map of the "density" of control measure capacities to address metals and other Water Quality Priorities (through controlling zinc) and **Figure 7-3** shows any additional capacity needed to address *E. coli*. The same results are shown as detailed tables in **Appendix 7.A** which present for each jurisdiction the volumes of stormwater to be managed in each subwatershed (Compliance Targets) and the control measures to achieve those volume reductions (EWMP Implementation

[2] While the EWMP Implementation Strategy reports the *total* BMP capacity to be implemented, that capacity is not a compliance target because some BMP capacities are sized to reflect a BMP program rather than sized to achieve the required reduction. For example, the BMPs implemented by the LID ordinance and the residential LID program were sized to retain the 85th percentile, 24-hour storm but that volume may be larger than is needed to achieve zinc RWLs. If those BMPs were replaced by a different type of BMP (e.g., regional BMP), the total BMP capacity may be smaller but just as effective.

Strategy). Note that separate Compliance Targets and EWMP Implementation Strategies are provided for Metals and Other Water Quality Priorities and *E. coli*.

Additionally, the EWMP Implementation Strategy includes the implementation of the MCMs, which are not only required by the Permit, but also address the Category 2 and 3 WBPCs identified in **Table 3-14**.

The network of LID, green streets and regional BMPs in the EWMP Implementation Strategy represents approximately **20 Rose Bowls of BMP capacity**. Implementation of such a large network of control would represent a sea change in how stormwater will be managed in the LA River, and will require orders of magnitude increases in stormwater funding. Note that non-stormwater and institutional control measures are separately described below in Section 7.4 and 7.5, respectively. The next subsection describes the timeline/sequencing for implementing the EWMP Implementation Strategy. The costs and financial strategy for the EWMP are presented in **Section 9**.

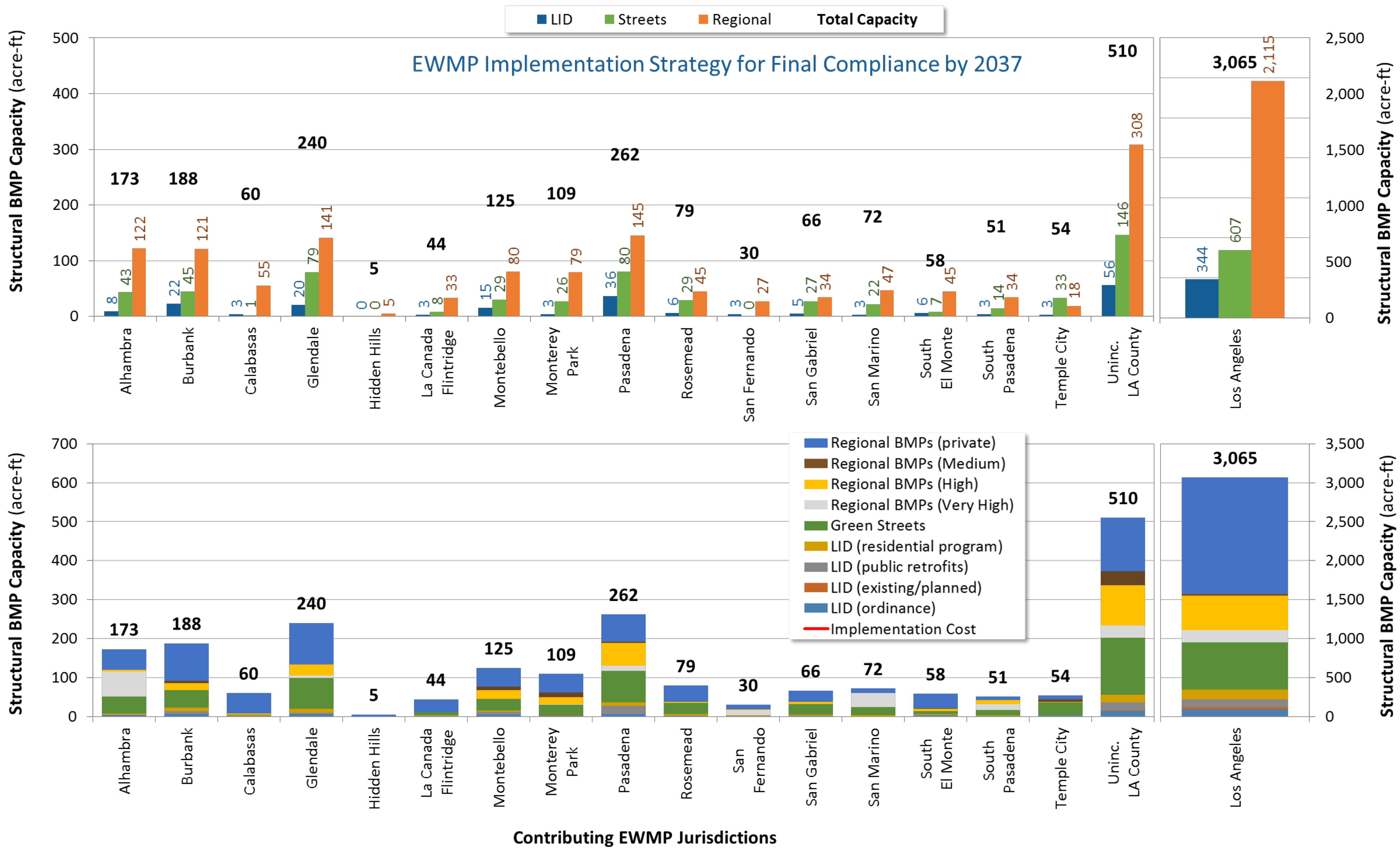

Figure 7-1. ULAR EWMP Implementation Strategy for Compliance by 2037

The two panels show the total structural BMP capacity required for each ULAR EWMP jurisdiction to attain RWLs. The top panel groups the BMP types into LID, green streets and regional BMPs, while the bottom panel provides more resolution for the BMP sub-categories. Detailed BMP capacities for each jurisdiction by subwatershed are presented in Appendix 7.A. BMP capacities for each jurisdiction by assessment area are also presented in **Appendix 7.C**. Note that a different y-axis scale is used for City of Los Angeles. The bars in the bottom panel are also presented for each jurisdiction in **Figure 7-5** through **Figure 7-21**.

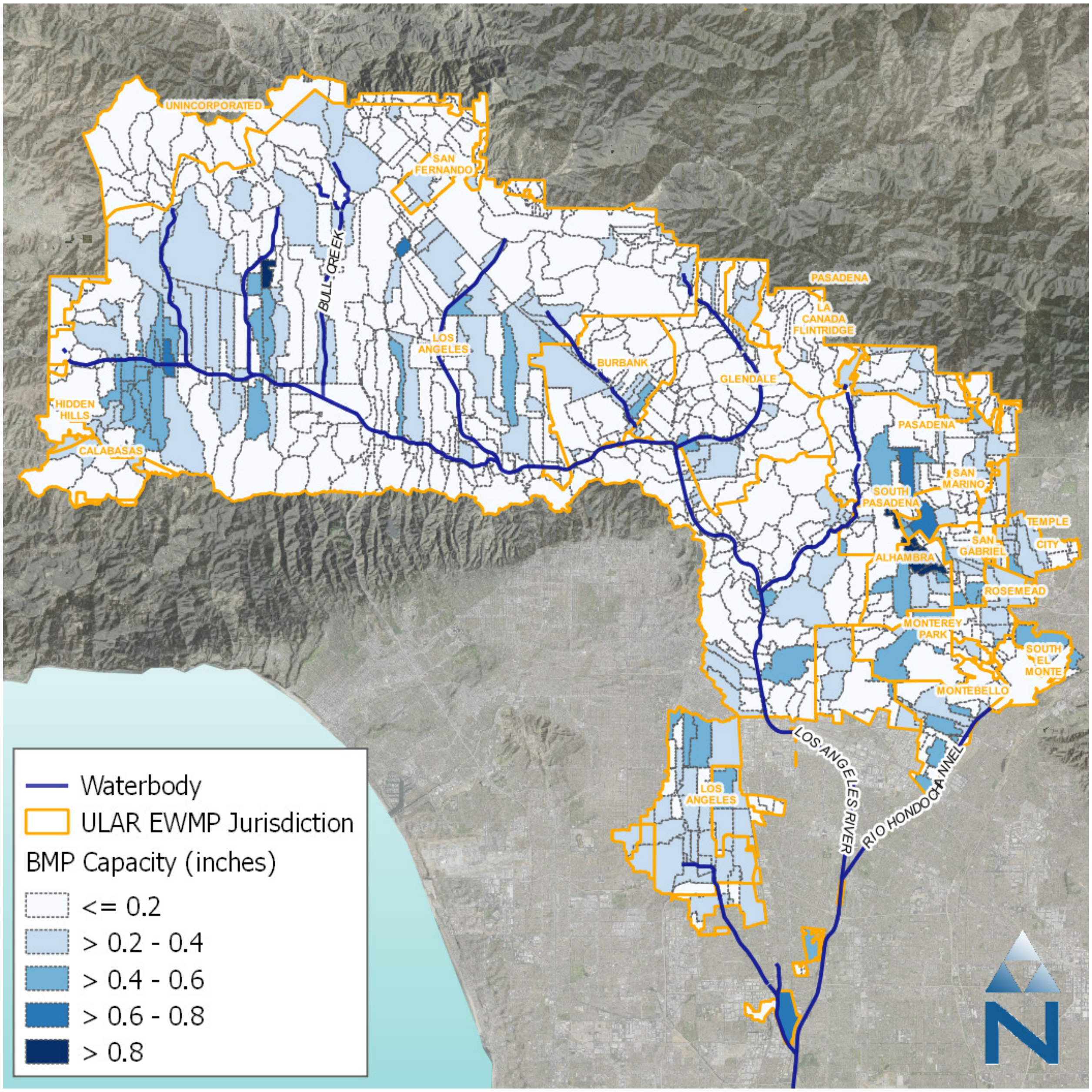

Figure 7-2. EWMP Implementation Strategy by Subwatershed for Metals and Other Water Quality Priorities (except *E. coli*)

This map presents the EWMP Implementation Strategy for Metals and Other Water Quality Priorities as control measure "density" by subwatershed. The BMP density is higher in some areas [dark blue] because either [1] relatively high load reductions are required or [2] BMPs in those areas were relatively cost-effective (e.g., due to high soil infiltration rates).The BMP capacities are normalized by area (i.e., the BMP capacity for each subwatershed [in units of acre-feet] was divided by the subwatershed area [in units of acres] to express the BMP capacity in units of depth [feet or inches]). Note that while all jurisdictions in an assessment area/watershed are held to an equivalent % reduction, subwatersheds *within* a jurisdiction may have variable reductions based on cost-benefit optimization (another reason why some subwatersheds within a jurisdiction are dark blue while others are light blue). The tabular version of this map is presented as a series of tables in in Appendix 7.A, and subwatershed index maps for each jurisdiction are presented in Appendix 7.B.

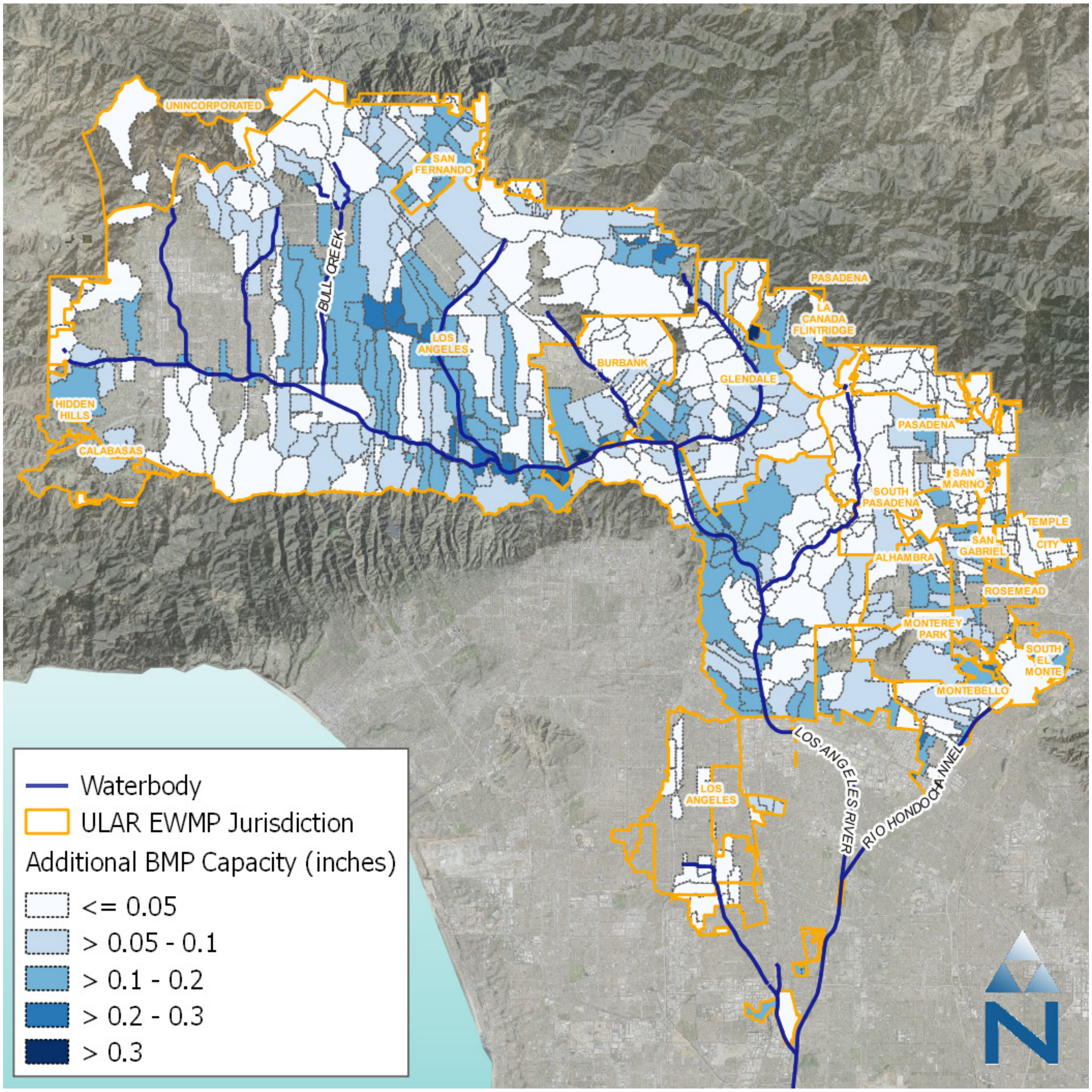

Figure 7-3. Additional Control Measures in EWMP Implementation Strategy to Address *E. coli*

This map uses the same approach as Figure 7-2 to presents the *additional* capacity in the EWMP Implementation Strategy to address *E. coli* (beyond the control measures to address Metals and Other Water Quality Priorities). Note the BMP capacities are much less than in Figure 7-2 because the control measures for Metals and Other Water Quality Priorities retain much of the critical bacteria storm. Some subwatersheds are not shaded because zero additional capacity is required. The tabular version of this map is presented as a series of tables in in Appendix 7.A, and subwatershed index maps for each jurisdiction are presented in Appendix 7.B.

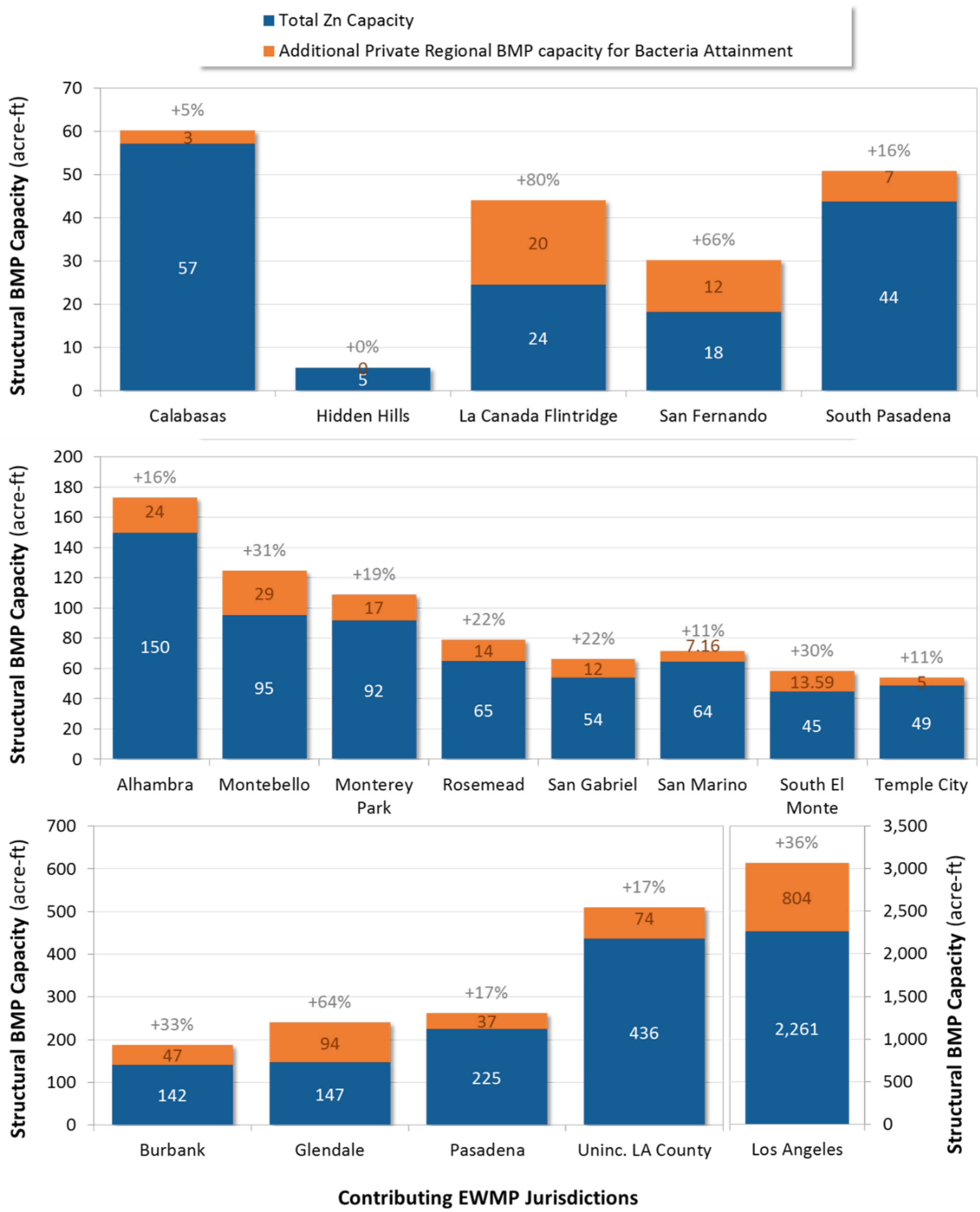

Figure 7-4. Additional Control Measures in EWMP Implementation Strategy to Address *E. coli*

The bars represent the total control measure capacity in the EWMP Implementation Strategy, and the percentages at the top of each bar report the percent increase in BMP capacity required by the RAA to control *E. coli* beyond the control measures for zinc. Note that the y-axis scale differ in each of the three panels and for the City of Los Angeles.

7.3 How are Stormwater Control Measures Scheduled to Achieve EWMP and TMDL Milestones?

As described in Section 3, the scheduling of LID, green streets and regional BMP implementation for the EWMP is based on the milestones of the applicable metals, toxics and bacteria TMDLs, as follows[33],[34]:

- By 2017, achieve a 31% milestone[35] for the Los Angeles River Metals TMDL and a 31% milestone for the WBPCs identified in **Tables 3-13** and **3-14**;
- By 2024, achieve a 50% milestone for the Los Angeles River Metals TMDL and a 50% milestone for the WBPCs identified in **Tables 3-13** and **3-14**;
- By 2028, achieve compliance (100% milestone) for the Los Angeles River Metals TMDL and a 100% milestone for WBPCs identified in **Tables 3-13** and **3-14**;
- By 2032, Achieve compliance for the Los Angeles / Long Beach Harbors Toxics TMDL; and
- By 2037, achieve compliance for the LA River Bacteria TMDL.

The scheduling of the EWMP Implementation Strategy is presented as the following components:

- **Summary of control measure capacities by each jurisdiction by assessment area/watershed:** the LID, green streets and regional BMP capacities that will be implemented over time to achieve milestones are shown in **Figure 7-5** thru **7-21**. Separate panels are shown for each jurisdiction, organized by LA River reaches and tributaries (recall that **Figure 6-1** shows a map of the assessment areas).
- **Detailed scheduling for each jurisdiction including volumes of stormwater to be managed and control measure capacities:** detailed tables that present the scheduling by assessment area for each jurisdiction including volumes of stormwater (Compliance Targets) to be managed are presented in **Appendix 7.C**. Each jurisdiction has a standalone Implementation Strategy for the LA River reaches and tributaries to which it contributes runoff.

Additionally, the EWMP Implementation Strategy includes the implementation of the MCMs, which are not only required by the Permit, but also address the Category 2 and 3 WBPCs identified in **Table 3-14.** The pace of implementation for the EWMP Implementation Strategy is rapid due to the compliance dates specified in the metals, toxics and bacteria TMDLs. Because the pace of implementation is directly proportional to required annual investments, the additional required resources to implement the EWMP will be significant. The costs and financial strategy are presented in **Section 9**.

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[33] For WBPCs that are not addressed in a Regional Board approved TMDL, attainment of the percentages may be demonstrated either as a reduction in exceedance frequency at time of EWMP approval or percent area meeting the RWL or in the case of the USEPA adopted TMDLs reduction from the baseline at the time of TMDL promulgation or percent area meeting the WQBEL or RWL.

[34] Milestones for the San Gabriel River portion of South El Monte are described in **Appendix 1.B**.

[35] The 31% milestone for 2017 was created as an EWMP milestone because the Permit requires milestones be developed if not specified in the Permit for the current Permit term. The Metals TMDL specifies a 25% milestone in 2012 and 50% milestone in 2024. The 31% milestone is the corresponding intermediate reduction, and is consistent with the 31% milestone specified by the Lower Los Angeles River WMP Group.

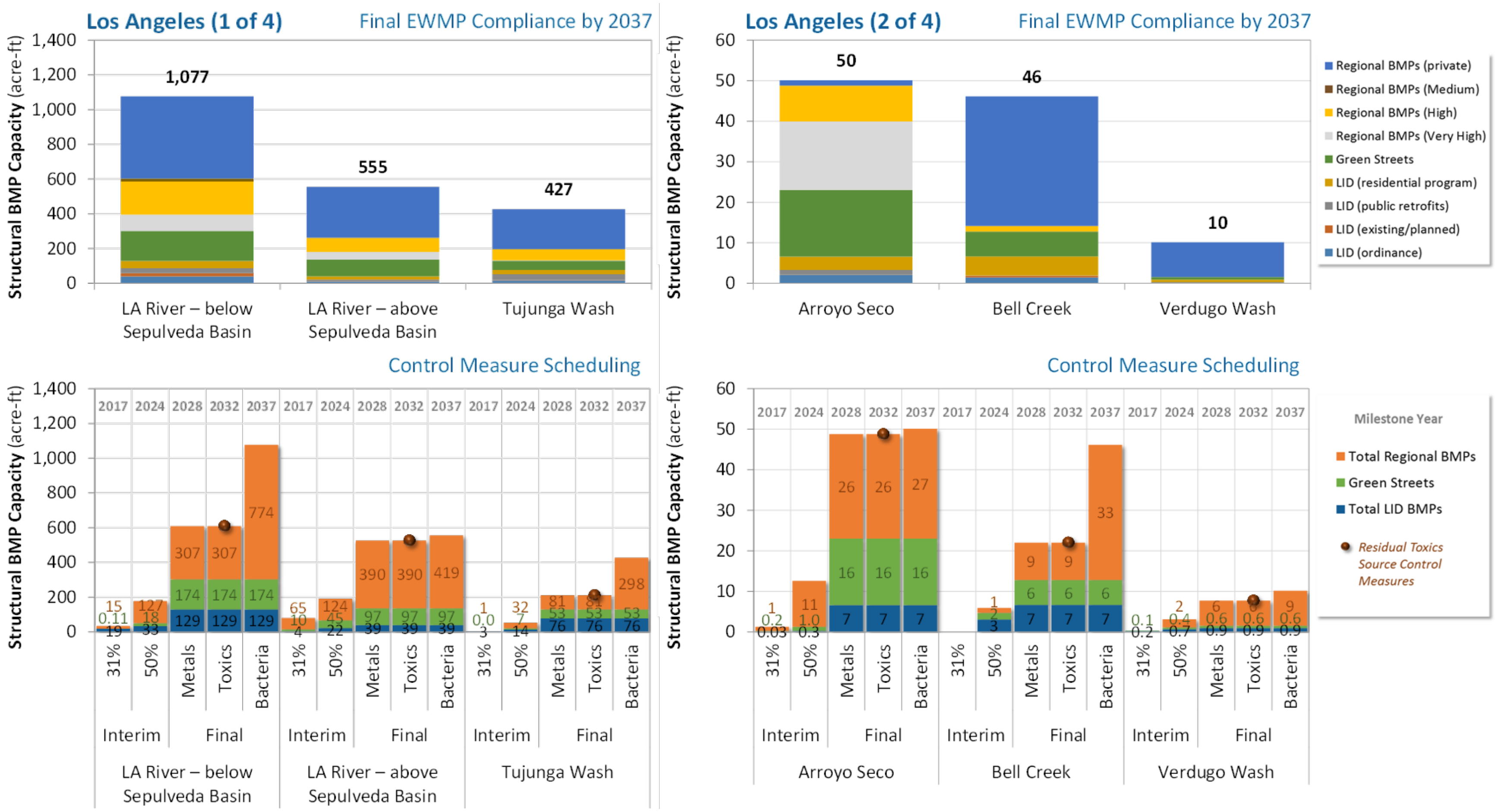

Figure 7-5. City of Los Angeles: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C.** For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary. Note the y-axis scale differs in each panel.

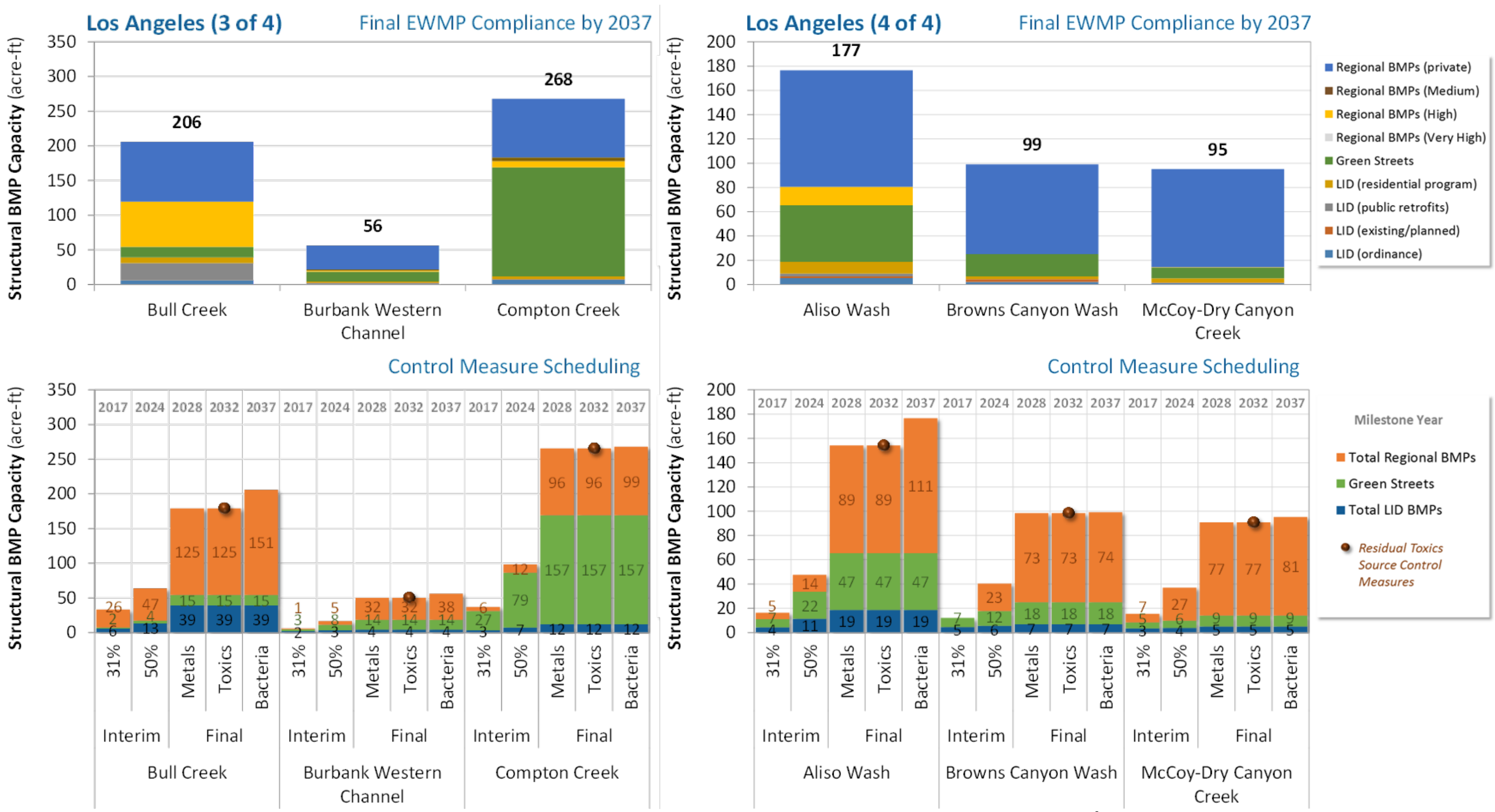

Figure 7-6. City of Los Angeles (continued): Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary. Note the y-axis scale differs in each panel.

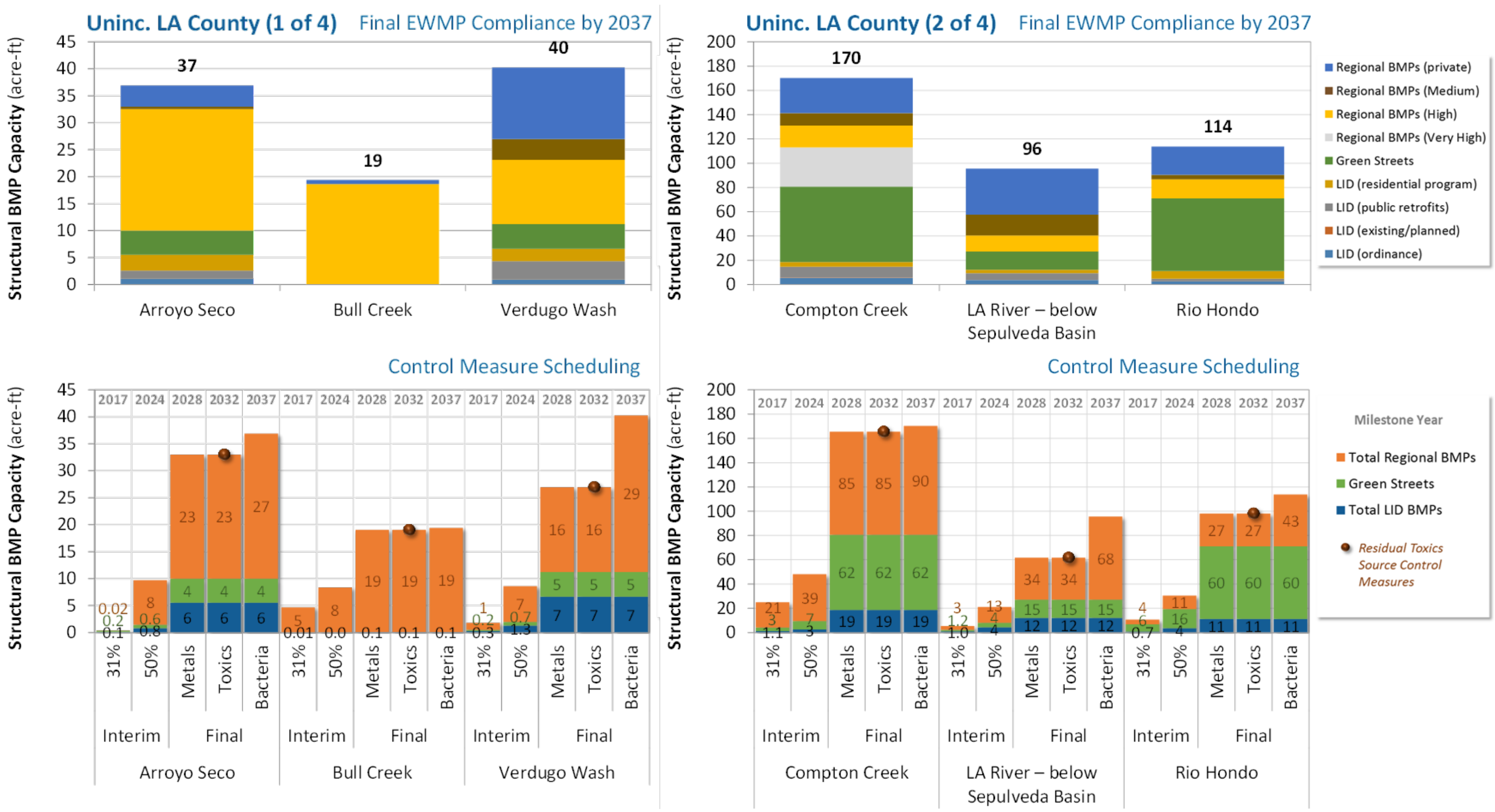

Figure 7-7. Uninc. LA County: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C.** For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary. Note the y-axis scale differs in each panel.

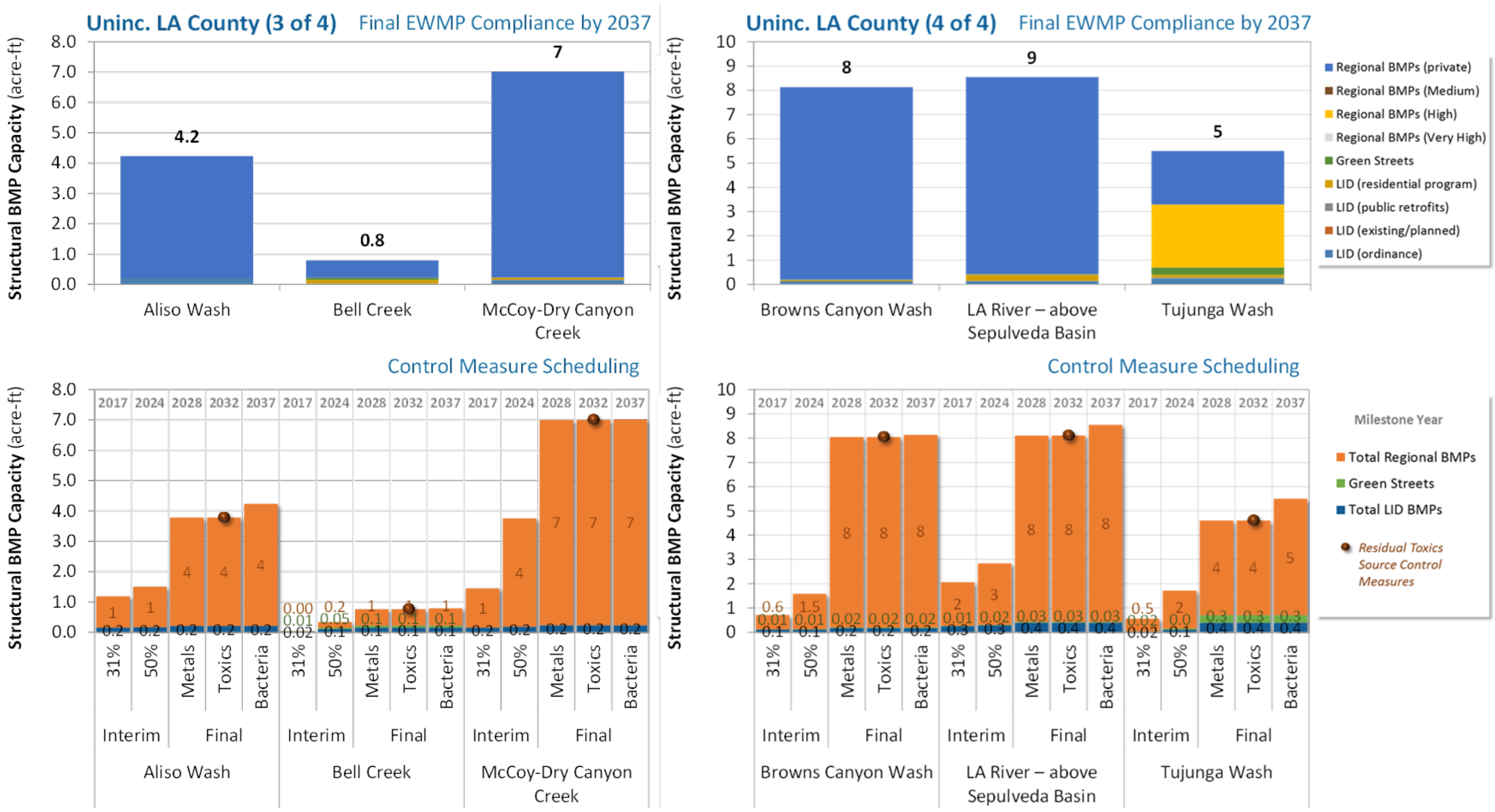

Figure 7-8. Uninc. LA County (continued): Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C.** For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary. Note the y-axis scale differs in each panel.

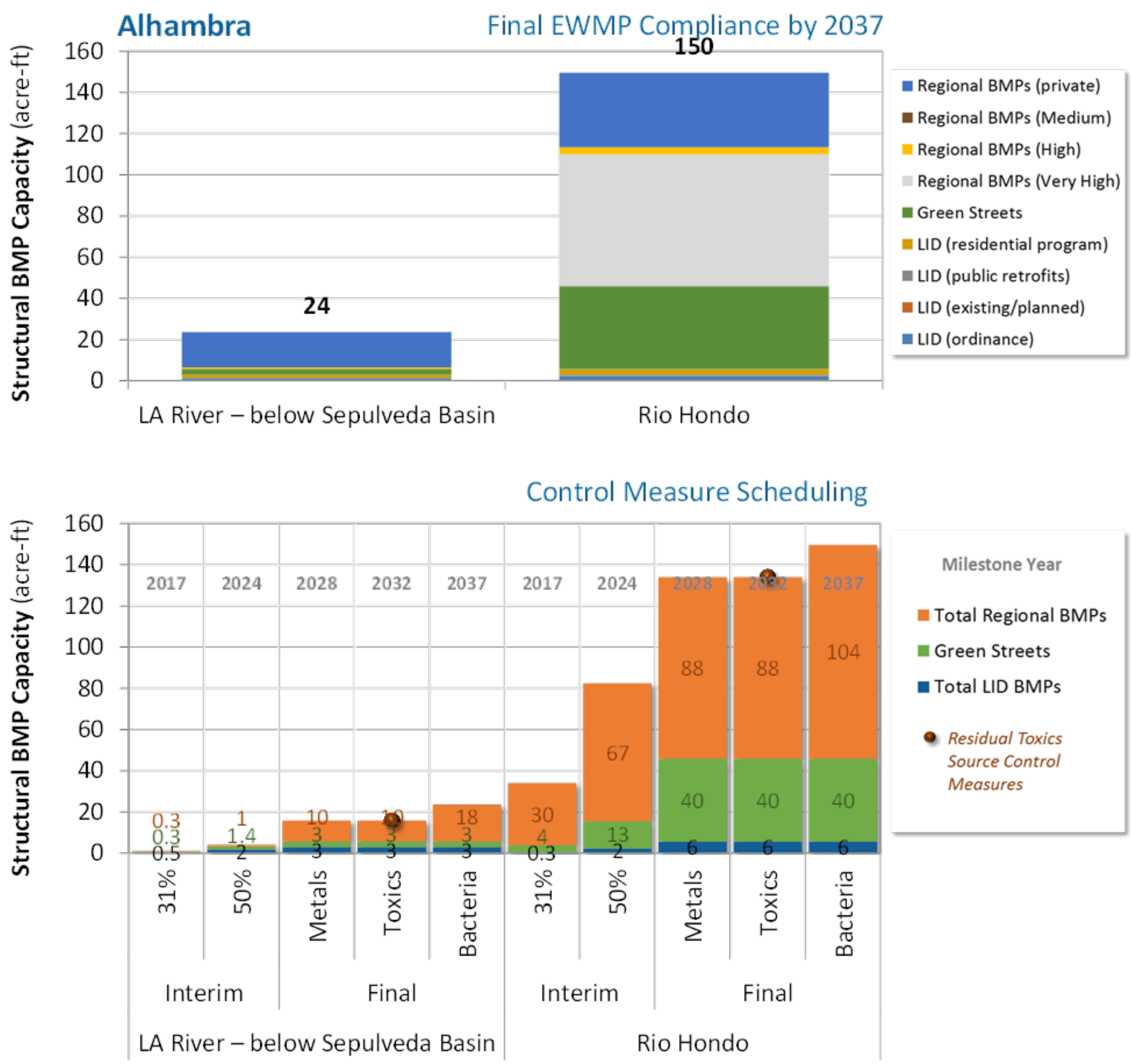

Figure 7-9. Alhambra: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

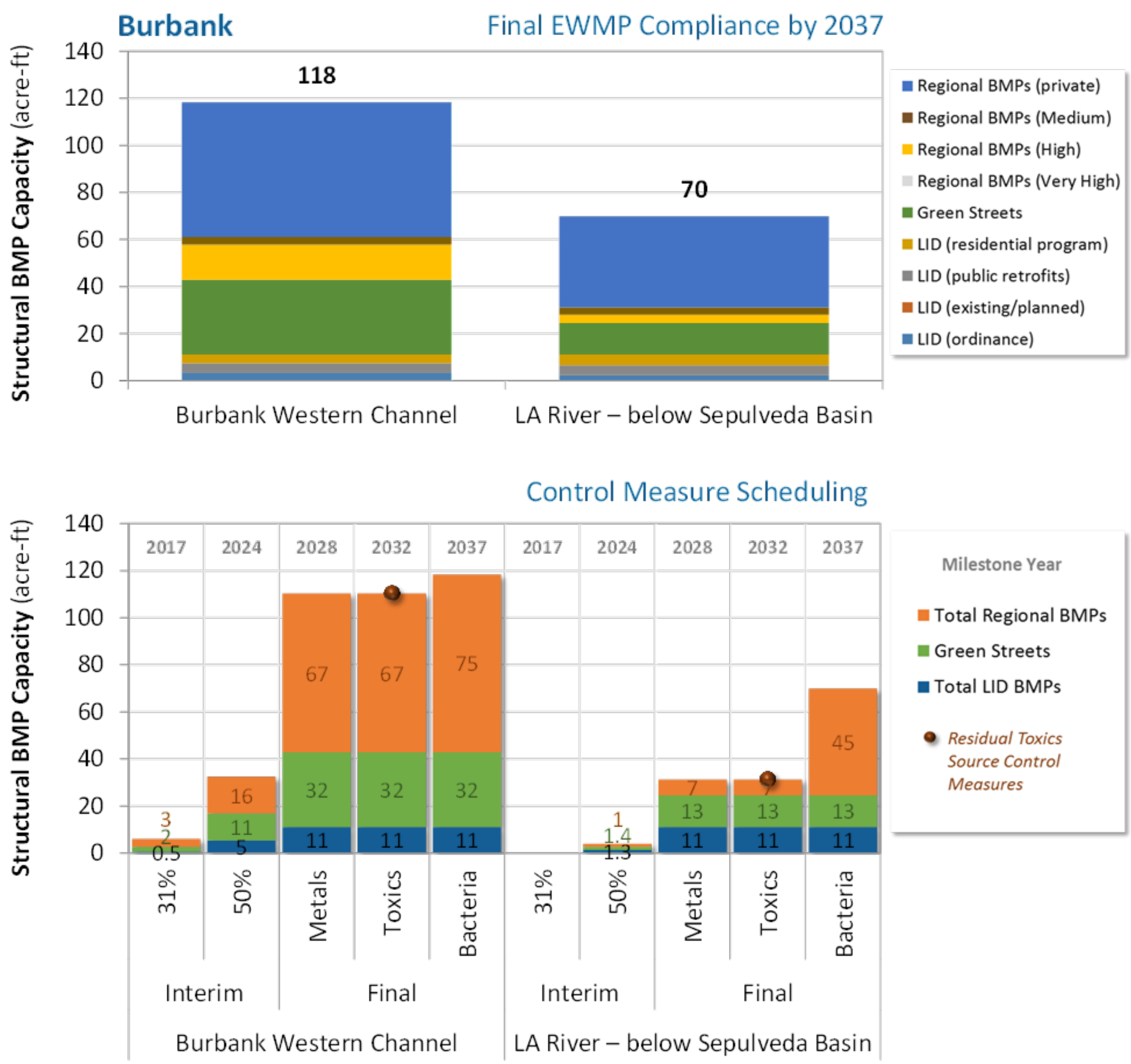

Figure 7-10. Burbank: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

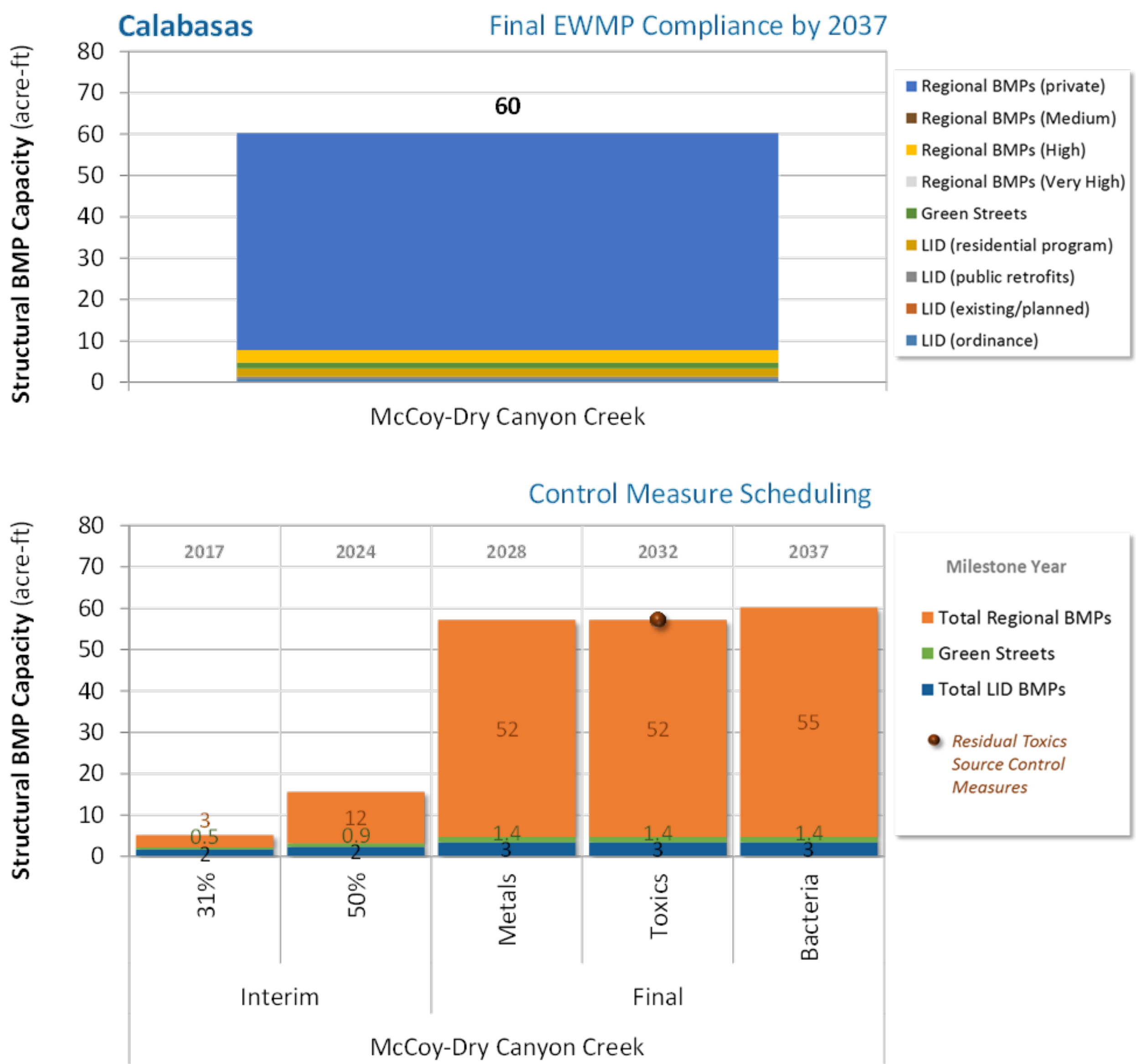

Figure 7-11. Calabasas: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

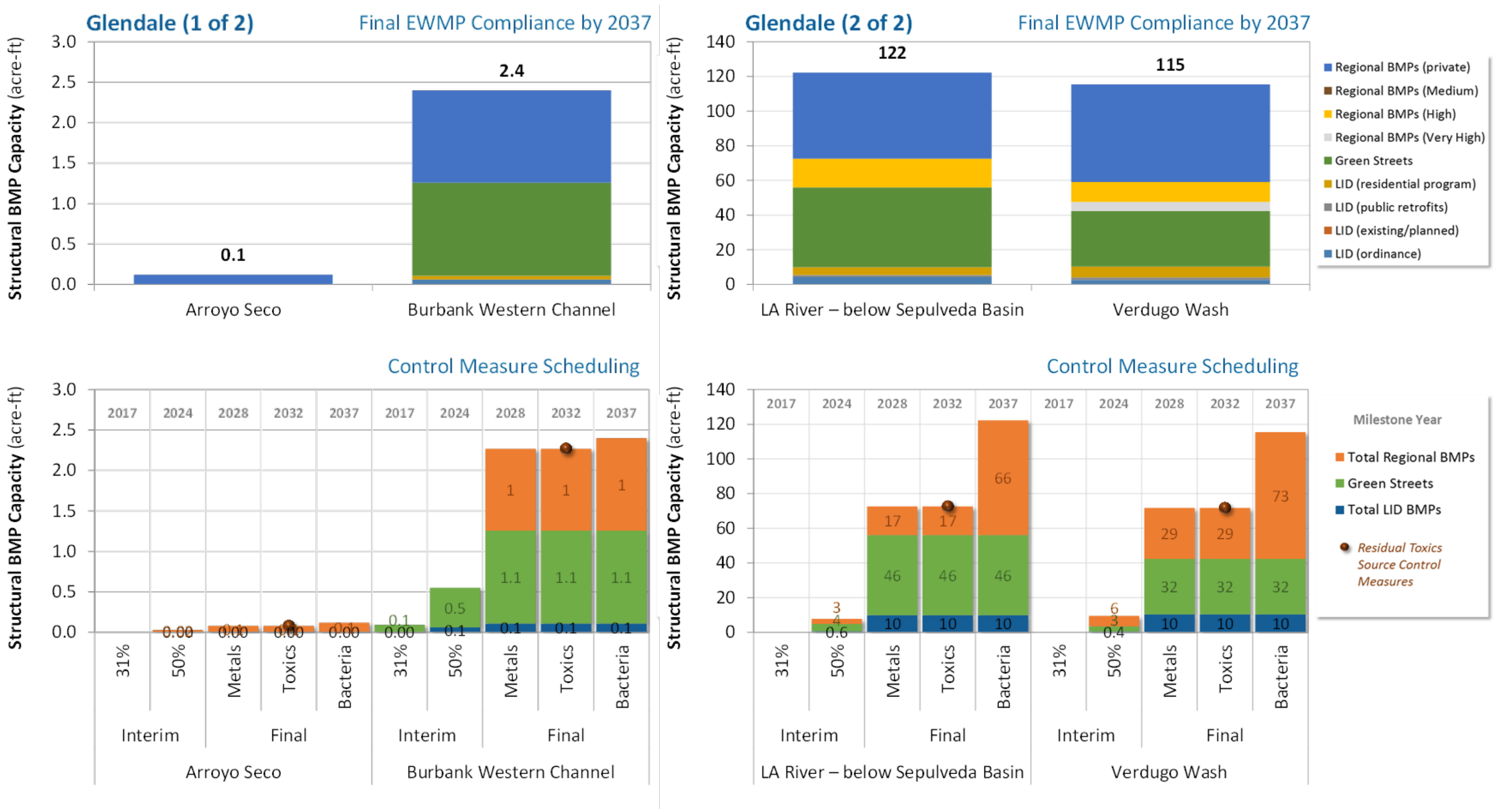

Figure 7-12. Glendale: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C.** For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary. Note the y-axis scale differs in each panel.

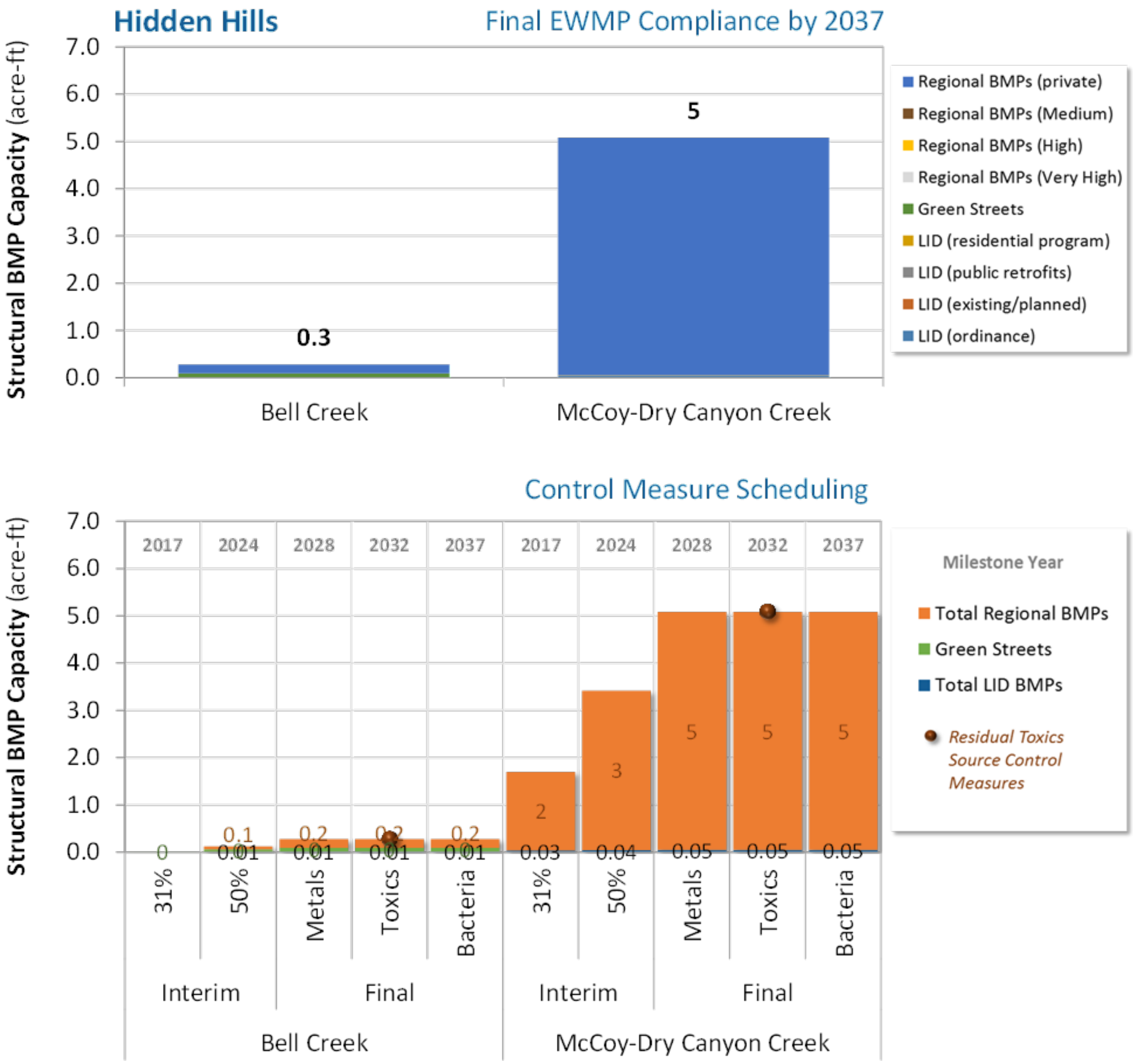

Figure 7-13. Hidden Hills: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

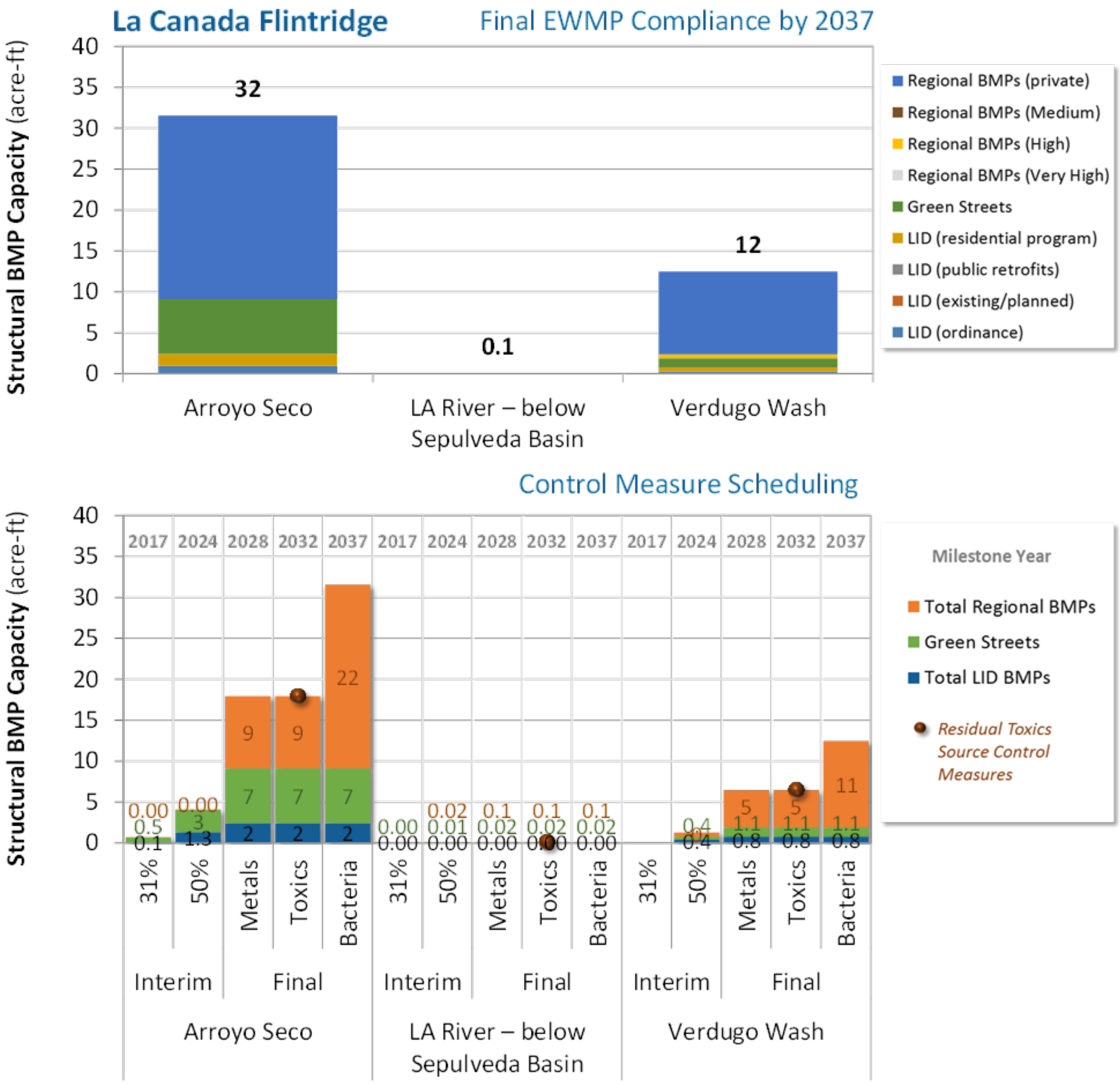

Figure 7-14. La Canada Flintridge: Scheduling of EWMP Implementation Strategy for Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

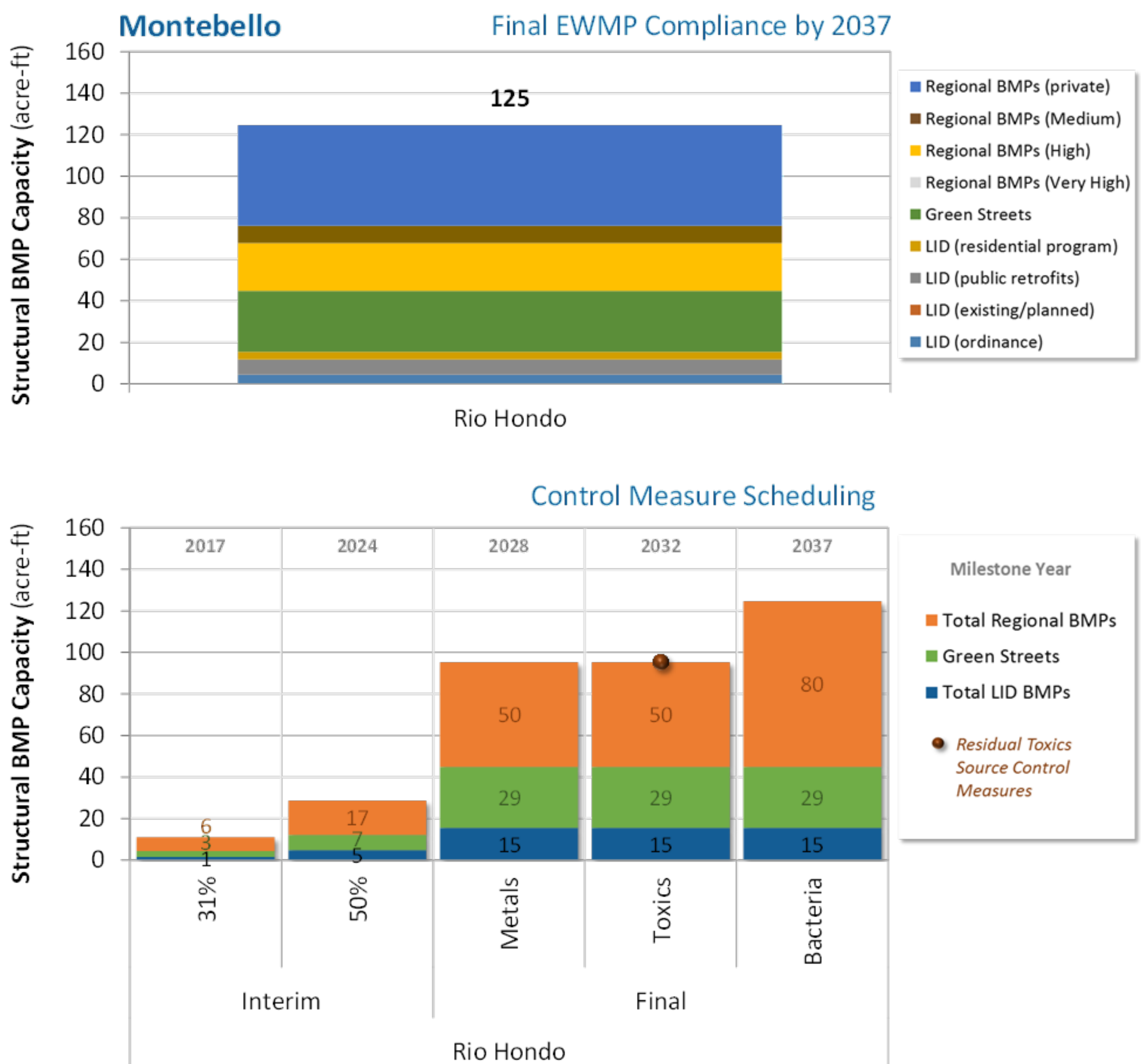

Figure 7-15. Montebello: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

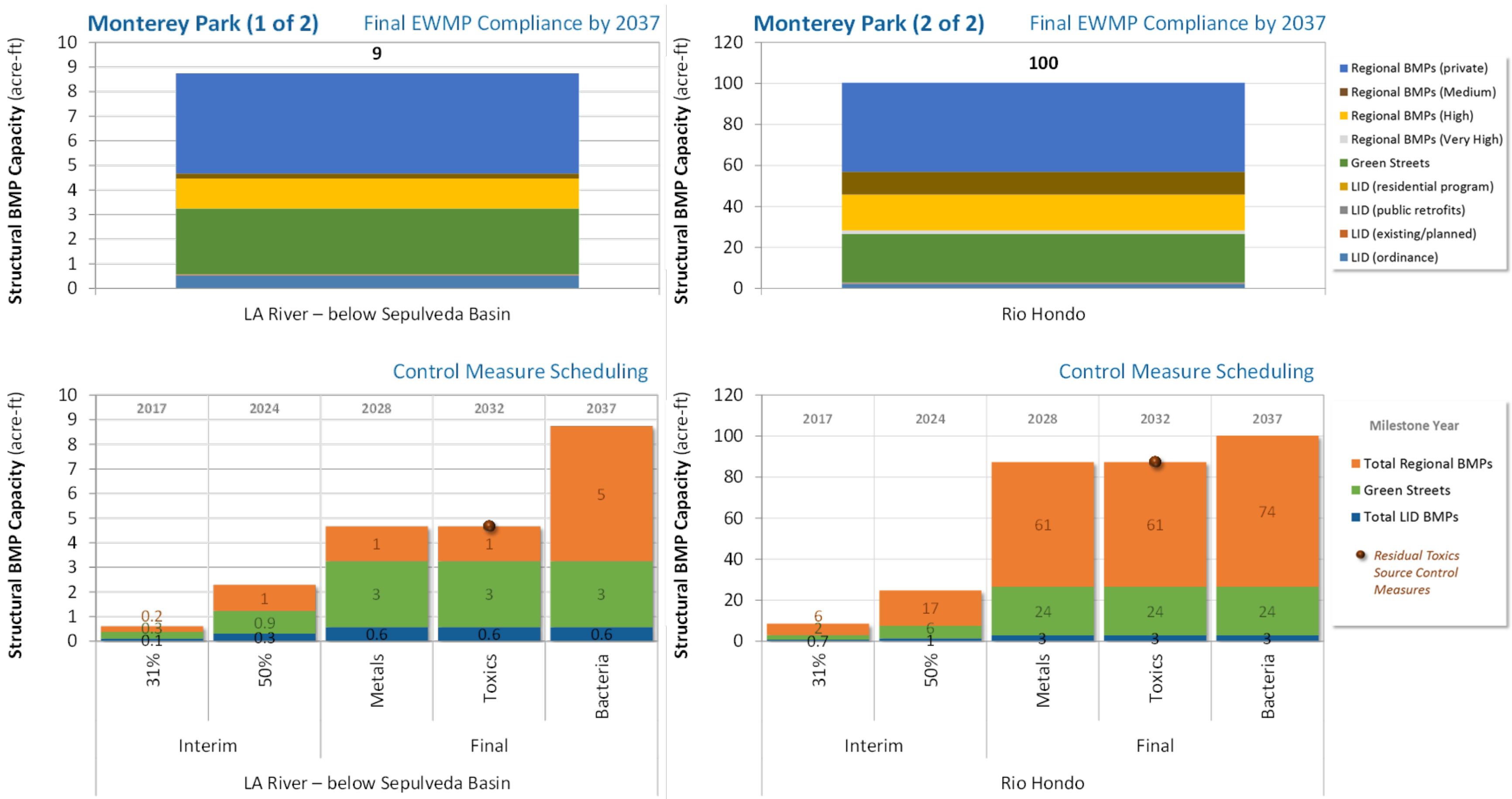

Figure 7-16. Monterey Park: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C.** For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary. Note the y-axis scale differs in each panel.

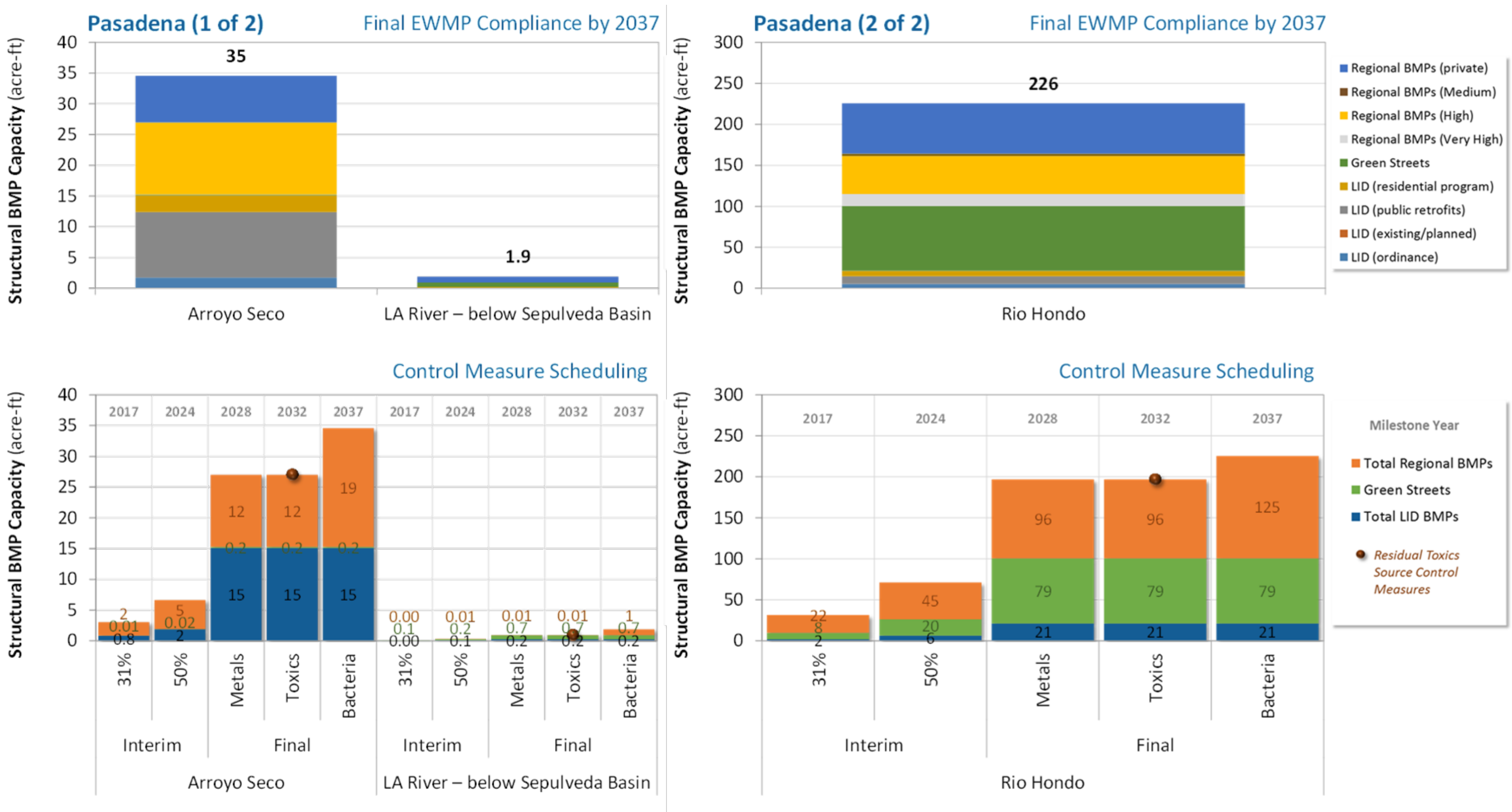

Figure 7-17. Pasadena: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C.** For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary. Note the y-axis scale differs in each panel.

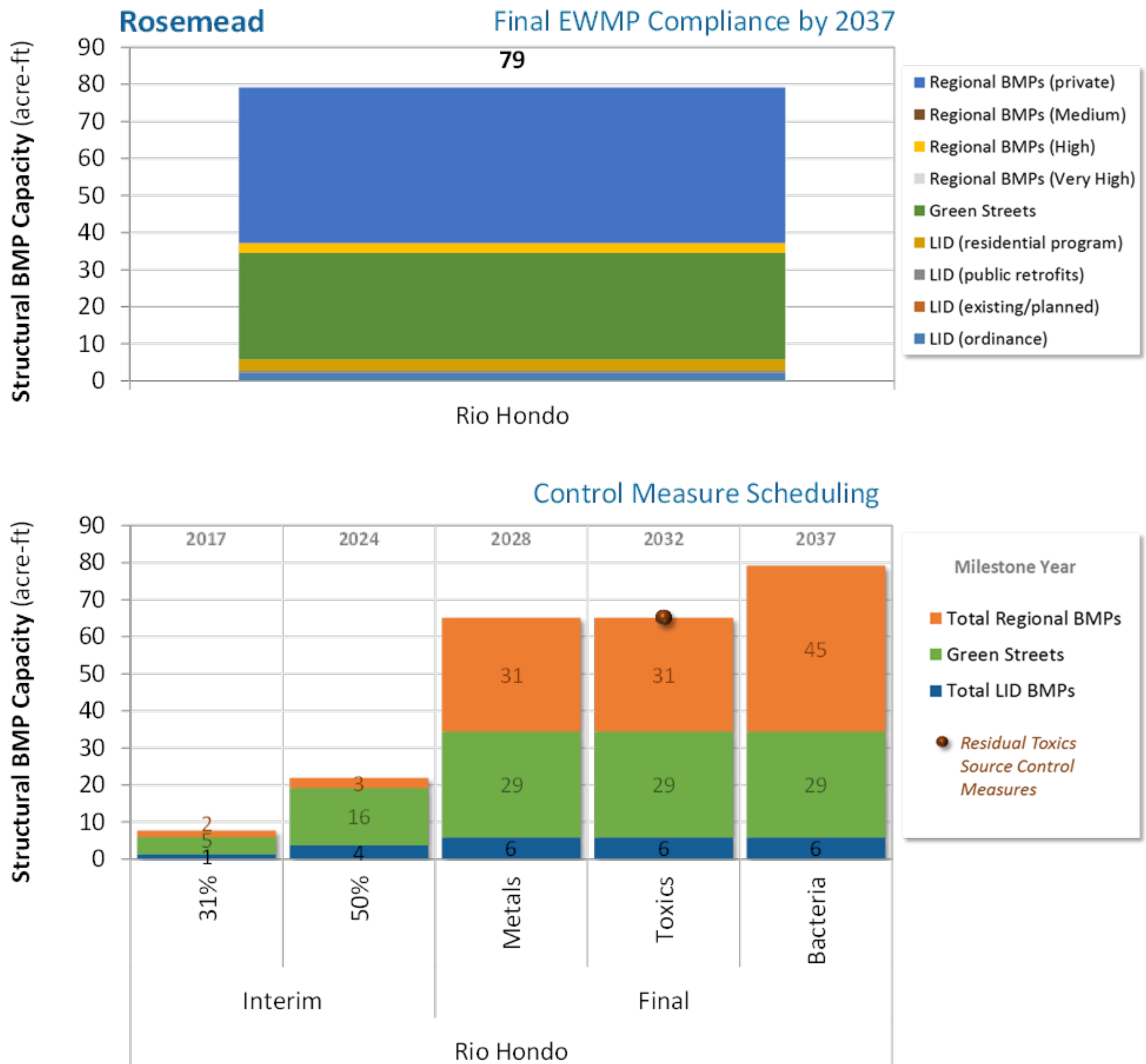

Figure 7-18. Rosemead: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

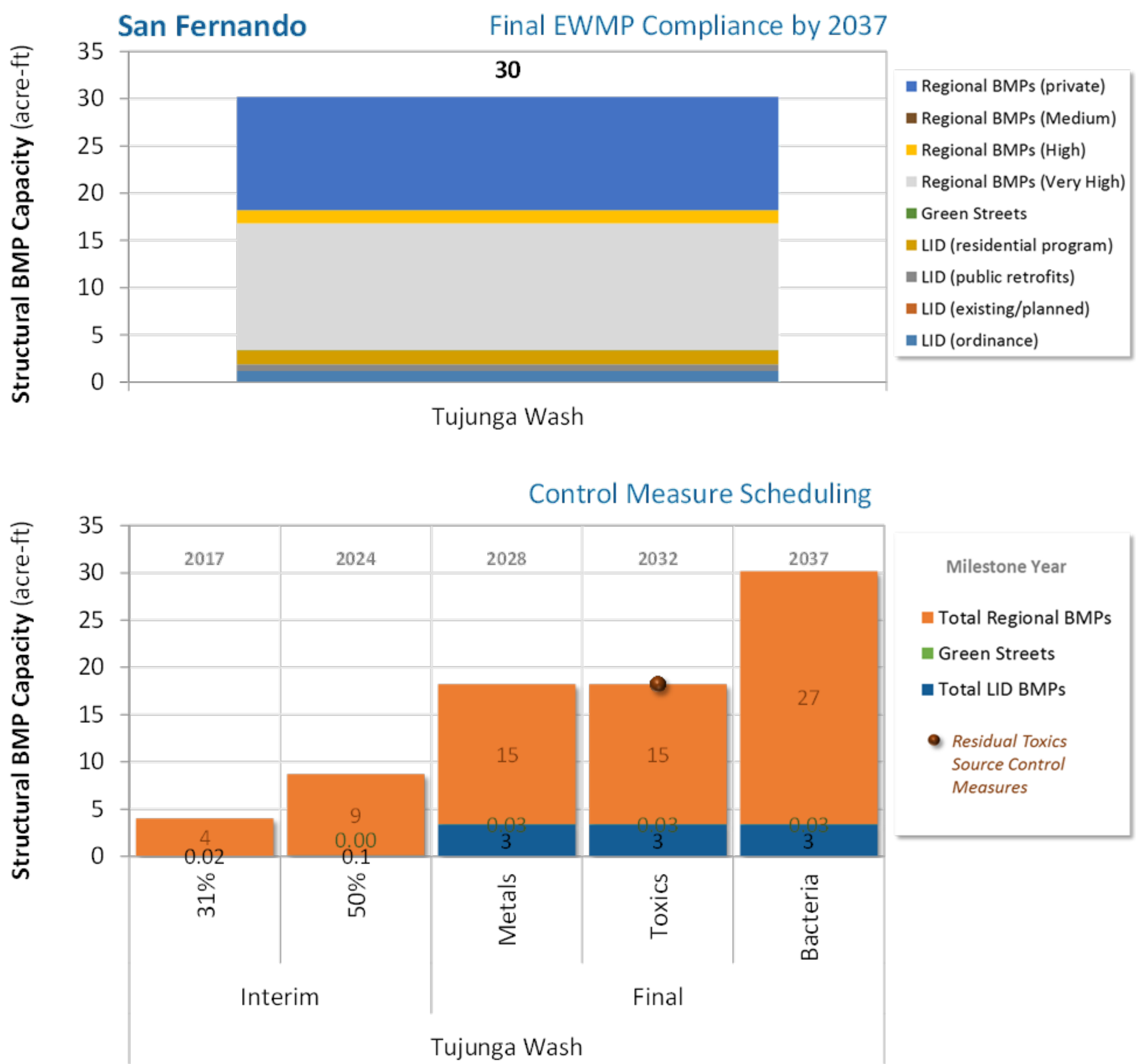

Figure 7-19. San Fernando: Scheduling of EWMP Implementation Strategy for EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

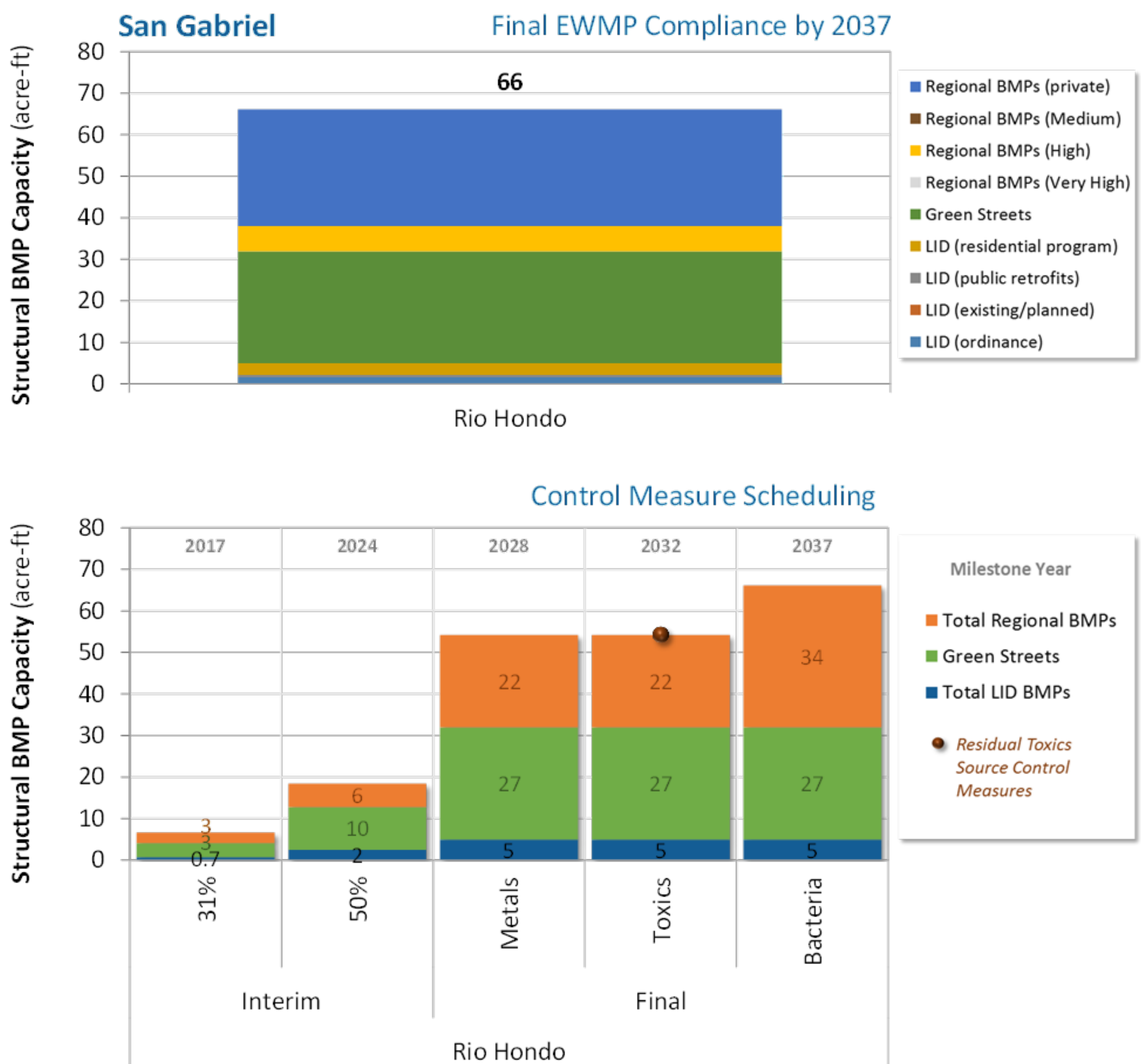

Figure 7-20. San Gabriel: Scheduling of EWMP Implementation Strategy for EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

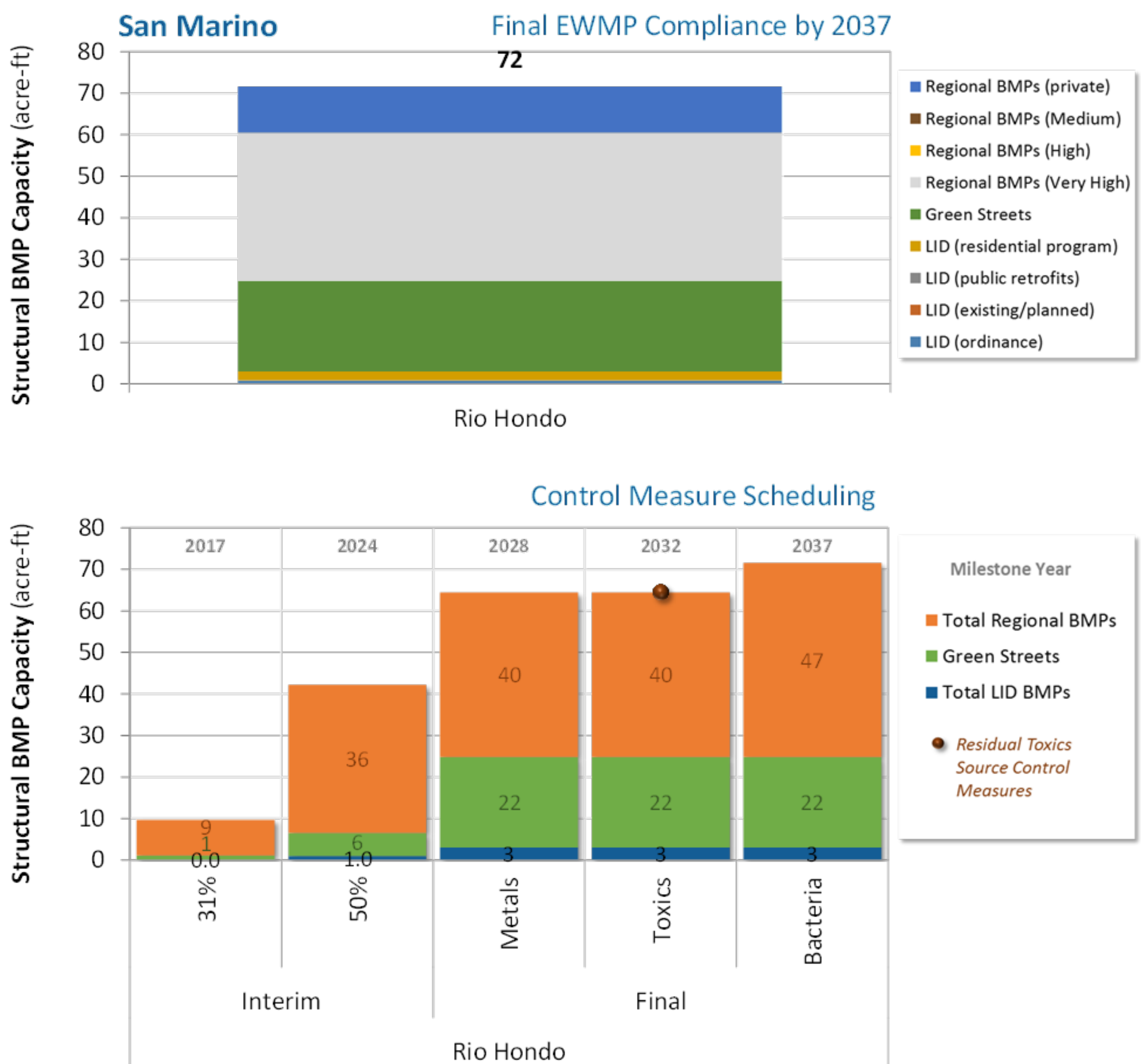

Figure 7-21. San Marino: Scheduling of EWMP Implementation Strategy for EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

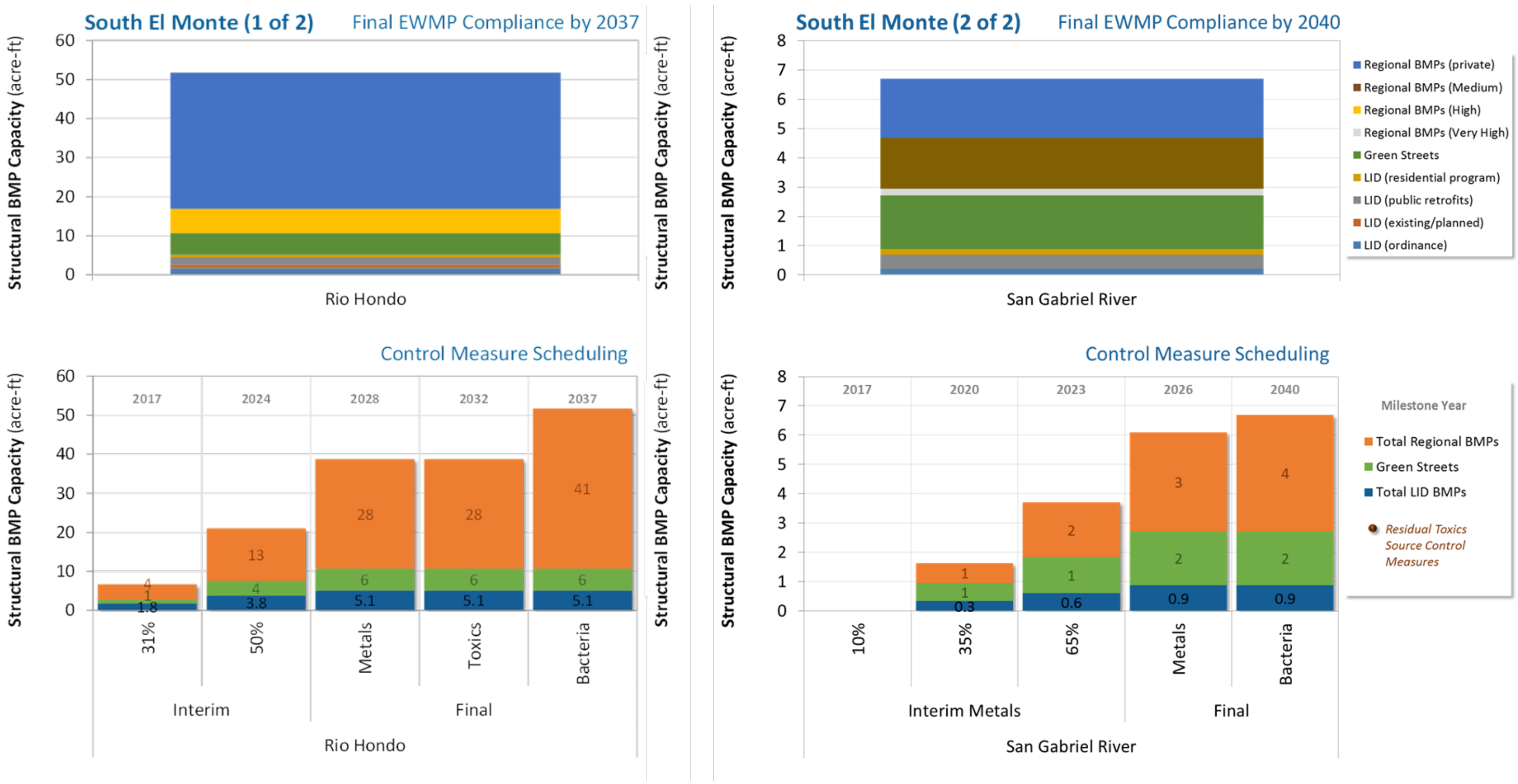

Figure 7-22. South El Monte: Scheduling of EWMP Implementation Strategy to Achieve EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panels represents the BMPs to achieve compliance in 2037 for Los Angeles River (left) and 2040 for San Gabriel River (right); the bottom panel shows the same control measured scheduled through 2037 (left) and 2040 (right). Note the y-axis scale differs in each panel. These capacities are also presented in detail in **Appendix 7.C**. For the LA River Metals TMDL (left), the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary. For San Gabriel River TMDLs (right), the milestones are described in Appendix 1.B.

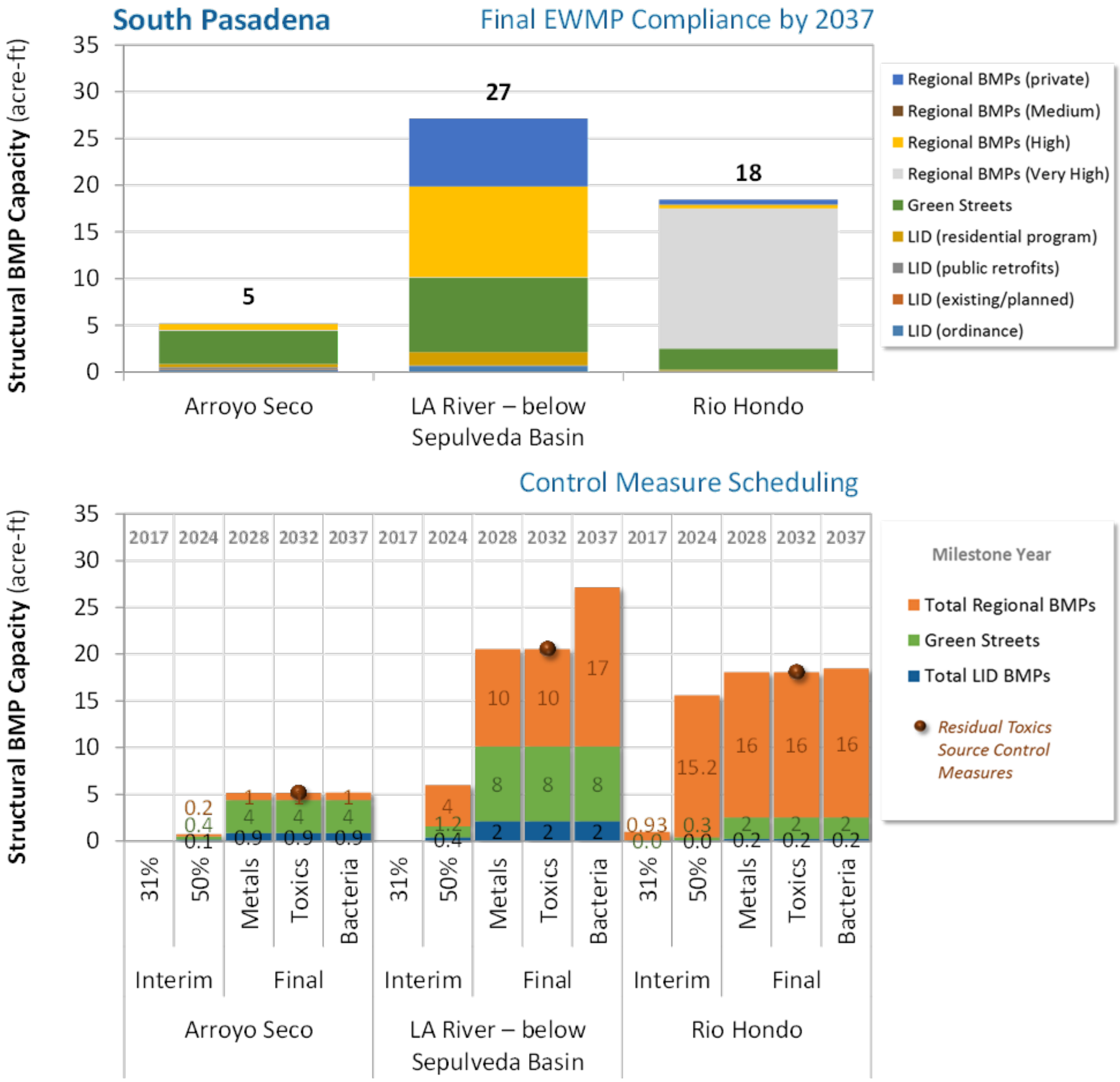

Figure 7-23. South Pasadena: Scheduling of EWMP Implementation Strategy for EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

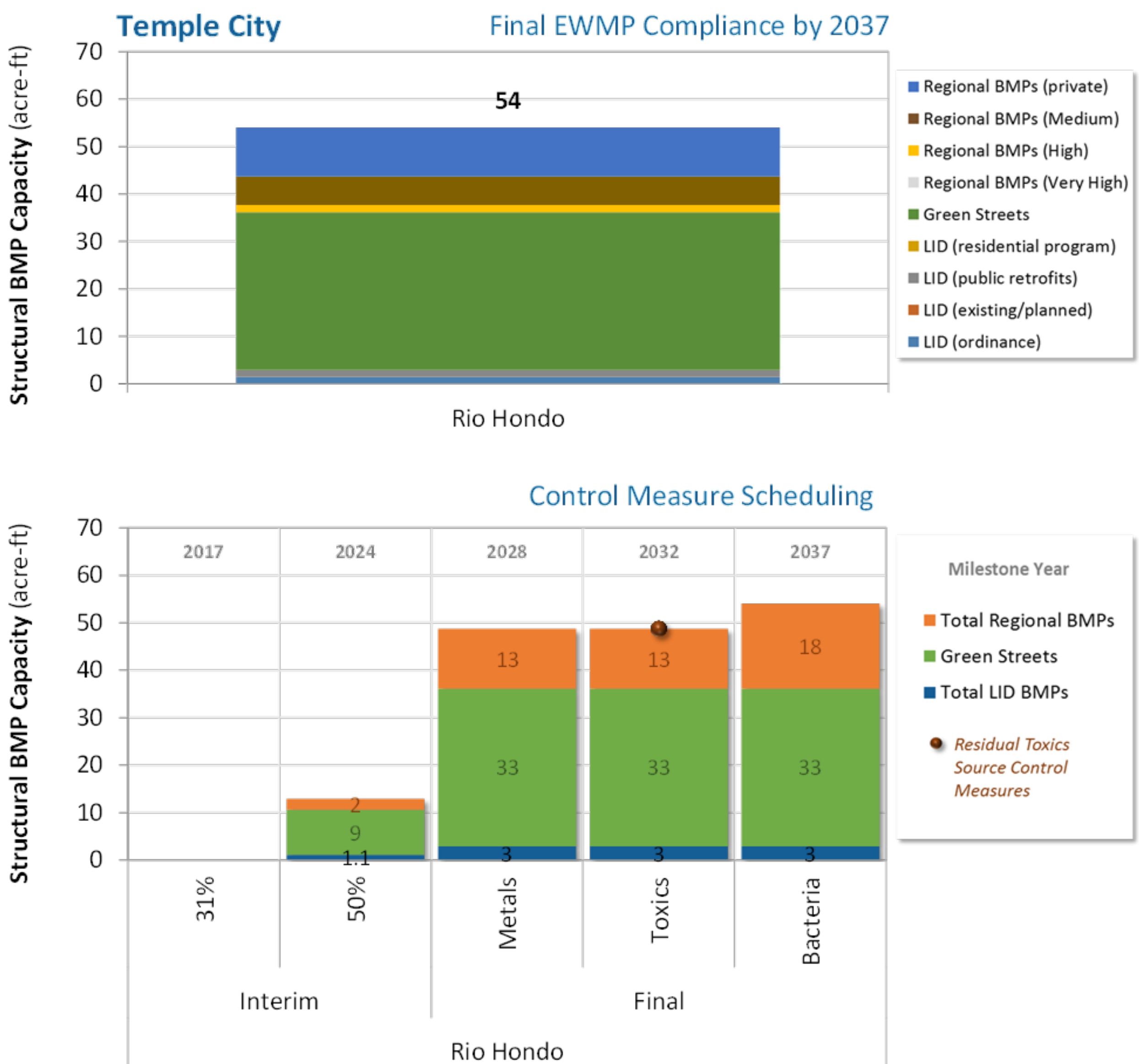

Figure 7-24. Temple City: Scheduling of EWMP Implementation Strategy for EWMP / TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone. The top panel represents the BMPs to achieve compliance in 2037; the bottom panel schedules them through 2037. These capacities are also presented in detail in **Appendix 7.C**. For the Metals TMDL, the 31% milestone was developed for the EWMP; the 50% milestone is specified by TMDL. Between 2026 and 2032, source control efforts to address toxics in sediments (indicated by red dot) will be implemented, if necessary.

7.4 How will Non-stormwater be Addressed by the EWMP?

The MS4 permit effectively prohibits non-stormwater discharges and the metals and bacteria TMDLs specify compliance dates for attainment of dry weather RWLs. The following subsections demonstrate[36] the EWMP will eliminate non-stormwater discharges and describe dry weather strategies to address the bacteria and metals TMDLs as well as the remaining dry weather WBPCs identified in **Tables 3-13** and **3-14**.

7.4.1 Elimination of Non-stormwater Discharges

The network of control measures in the EWMP Implementation Strategy will address both stormwater and non-stormwater discharges. As shown in **Figure 7-25** and **Figure 7-26**, the EWMP Implementation Strategy achieves 100% elimination of non-stormwater flows by 2037. By 2028, most jurisdictions will have achieved greater than 80% reduction of non-stormwater flows. These volume reductions will address *all pollutants* including metals and bacteria. In addition, there are several components of the EWMP that provide an additional "margin of safety" that non-stormwater reductions will occur more rapidly than shown in **Figures 7-22** and **7-23**, as follows:

1. The non-stormwater screening, investigation and abatement programs being conducted under the CIMP for the ULAR EWMP Group will target "significant" outfalls and eliminate additional non-stormwater discharges. For example, during outfall monitoring conducted along Reach 2 and 4 of the LA River, the outfalls with top 10% of flow rates represented a majority of flow (more than 50%) from all outfalls along the reach (CREST, 2008). The non-stormwater programs provide additional assurance of addressing dry weather Water Quality Priorities.

2. The non-stormwater volumes in the non-stormwater simulation were based on existing *median* outdoor water use rates. Most water supply agencies including the City of Los Angeles Department of Water and Power have initiatives to significantly reduce outdoor water use in the coming years. Regional reductions in outdoor water provide additional assurance of addressing dry weather Water Quality Priorities.

Specific strategies for the metals and bacteria TMDLs are described in the following subsections. Additionally, the EWMP Implementation Strategy includes the implementation of the MCMs, which are not only required by the Permit, but also address the Category 2 and 3 WBPCs identified in **Table 3-14**.

[36] Recall that Section 6.3.3 describes the methodology of the dry weather RAA.

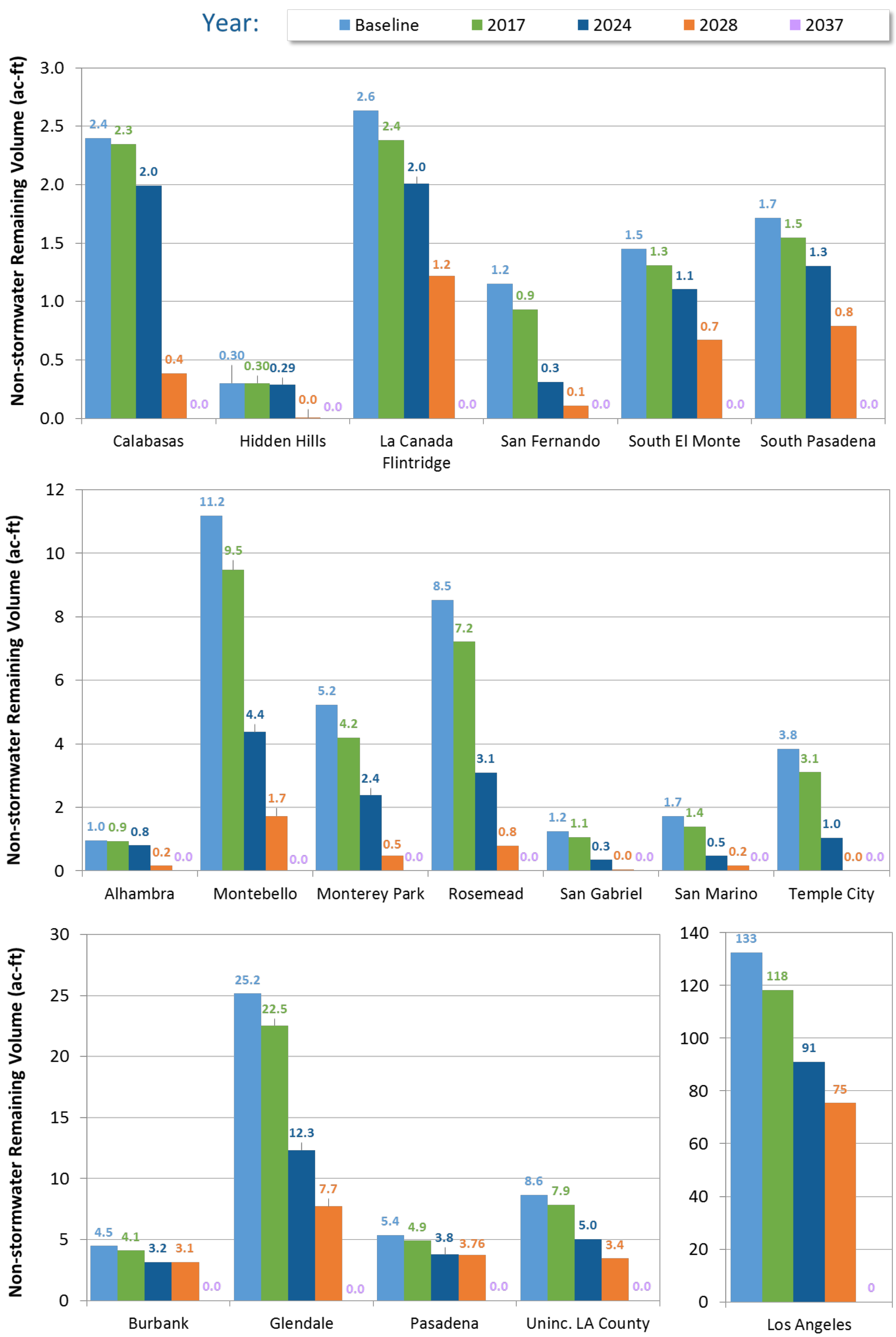

Figure 7-25. Schedule for Eliminating Non-Stormwater Discharges in ULAR.

The figure shows the effect of the wet weather control measures in the EWMP Implementation Strategy on non-stormwater discharges in the Upper Los Angeles River watershed. Over time, the wet weather control measures will eliminate non-stormwater discharges. Note the y-axis differs by panel.

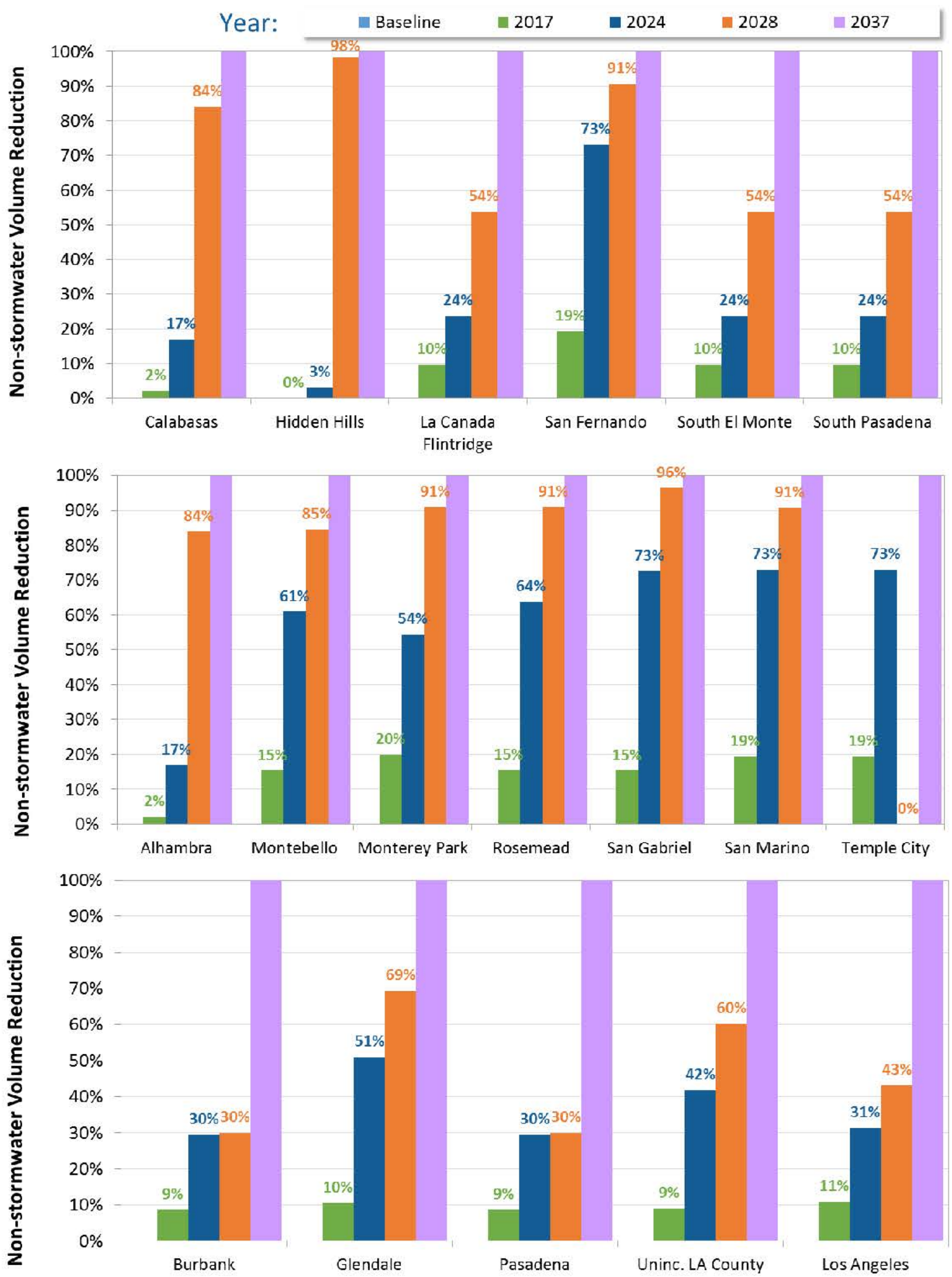

Figure 7-26. Non-Stormwater Reductions by Wet Weather Control Measures in ULAR.

The figure shows the same reductions as Figure 7-25, except expressed as percent reduction from baseline. Over time, the wet weather control measures will eliminate non-stormwater discharges. The reductions are sufficient to achieve the dry weather milestones for the LA River Metals TMDL (75% attainment by 2020 and   compliance by 2024).

7.4.2 Dry Weather Strategy for Bacteria TMDL

The LA River Bacteria TMDL includes an innovative dry weather implementation process called a LRS. The ULAR EWMP incorporates the LRS process as the dry weather strategy for addressing bacteria TMDL requirements. Because *E. coli* is the limiting dry weather pollutant, (Section 6.2.4), the LRS process will also address other dry weather Water Quality Priorities in the Upper LA River watershed.

As described in the Bacteria TMDL, each LA River segment and tributary is subject to a customized LRS that details the specific non-stormwater control measures to be implemented to achieve dry weather bacteria RWLs/WQBELs. Each LRS is based on outfall monitoring “snapshots”, Monte Carlo modeling and BMP design/feasibility considerations. The non-stormwater screening program under the CIMP for the ULAR EWMP Group is designed to collect the outfall monitoring data needed to develop Load Reduction Strategies. Through the LRS, two types of outfalls are identified for implementation actions, as follows:

- **Priority Outfalls** – the LRS process highlights the Priority Outfalls because they consistently have the highest loading rates of *E. coli*. As such, Priority Outfalls are the highest priority for source abatement and are subject to *specific implementation actions* in the LRS.
- **Outlier Outfalls** – the LRS process highlights Outlier Outfalls because they have episodic discharges that can lead to exceedances of the wasteload allocation. Outlier Outfalls are subject to *follow-up investigations* during LRS implementation.

The Bacteria TMDL includes phasing of LA River segments and tributaries, meaning that LRSs will be developed over the course of the TMDL compliance schedule, as shown in **Table 7-1**. To date, the LRS for Segment B of the LA River has been completed by the ULAR EWMP Group, and the LRSs for Arroyo Seco and Rio Hondo are underway, as described in the following subsections. As future LRSs are completed according to the TMDL schedule and the ULAR EWMP is updated through the adaptive management process required by the Permit, the EWMP will incorporate the non-stormwater control measures identified for each LA River segment and tributary.

Table 7-1. Bacteria TMDL Schedule for LRS Submittal to Regional Board by ULAR EWMP Group

LA River Segment	Mainstem or Tributary	TMDL Date for LRS Submittal
Segment B	Mainstem LA River	Attached to this EWMP, see Appendix 7.D.
	Arroyo Seco and Rio Hondo	March 2016
Segment A	Compton Creek	March 2018
Segment E	Mainstem LA River	September 2017
	Dry Canyon, McCoy Canyon, Bell Creek and Aliso Canyon Wash	September 2021
Segment C	Mainstem LA River	September 2023
	Tujunga Wash, Burbank Western Channel and Verdugo Wash	September 2023
Segment D	Mainstem LA River	September 2023
	Bull Creek	September 2023

7.4.2.1 LRS for Segment B of the LA River

The ULAR EWMP Group's LRS for Segment B of the LA River is attached to this EWMP as **Appendix 7.D**. The LRS identifies four Priority Outfalls and five Outlier Outfalls that will be subject to implementation actions and source investigations, respectively. The simulated effect of structural implementation actions at Priority Outfalls is shown in **Figure 7-27**. The drainage areas for these outfalls are shown in **Figure 7-28**. The LRS for the ULAR EWMP Group has identified specific structural control measures and has even developed specific conceptual designs for the Priority Outfalls, as summarized in **Table 7-2.** The LRS for Segment B provides a robust dry weather strategy for addressing bacteria TMDL requirements while simultaneously addressing other Water Quality Priorities.

Table 7-2. Control Measures identified by Load Reduction Strategy for Segment B of the LA River

Nonstormwater Control Measure	Outfall ID Addressed	Outfall Type	Completion Schedule	Lead Agency
Humboldt Stormwater Greenway Project	R2-A	Priority Outfalls	Already completed	City of LA [1]
Reuse and Removal Urban Flow Systems	R2-02		March 2019	City of LA [1]
Infiltration wetland	R2-04		March 2019	LA County [1]
7th Street Low Flow Diversion	R2-K		Already completed	City of LA [1]
Source Investigation and abatement	R2-G	Outlier Outfalls	March 2019	City of LA
	R2-E		March 2019	City of LA
	R2-NEW-14		March 2019	LA County
	R2-T		March 2019	LA County

1 – Other ULAR agencies are responsible for supporting operations and maintenance.

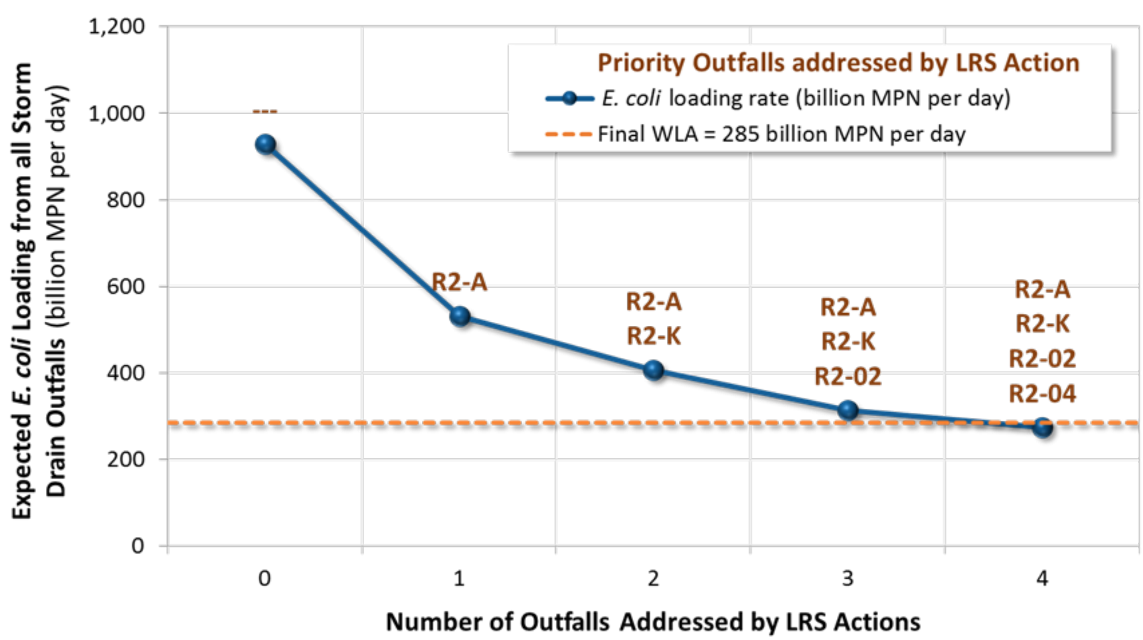

Figure 7-27. Effect of Priority Outfall Actions on *E. coli* Loading to Segment B from ULAR EWMP Group

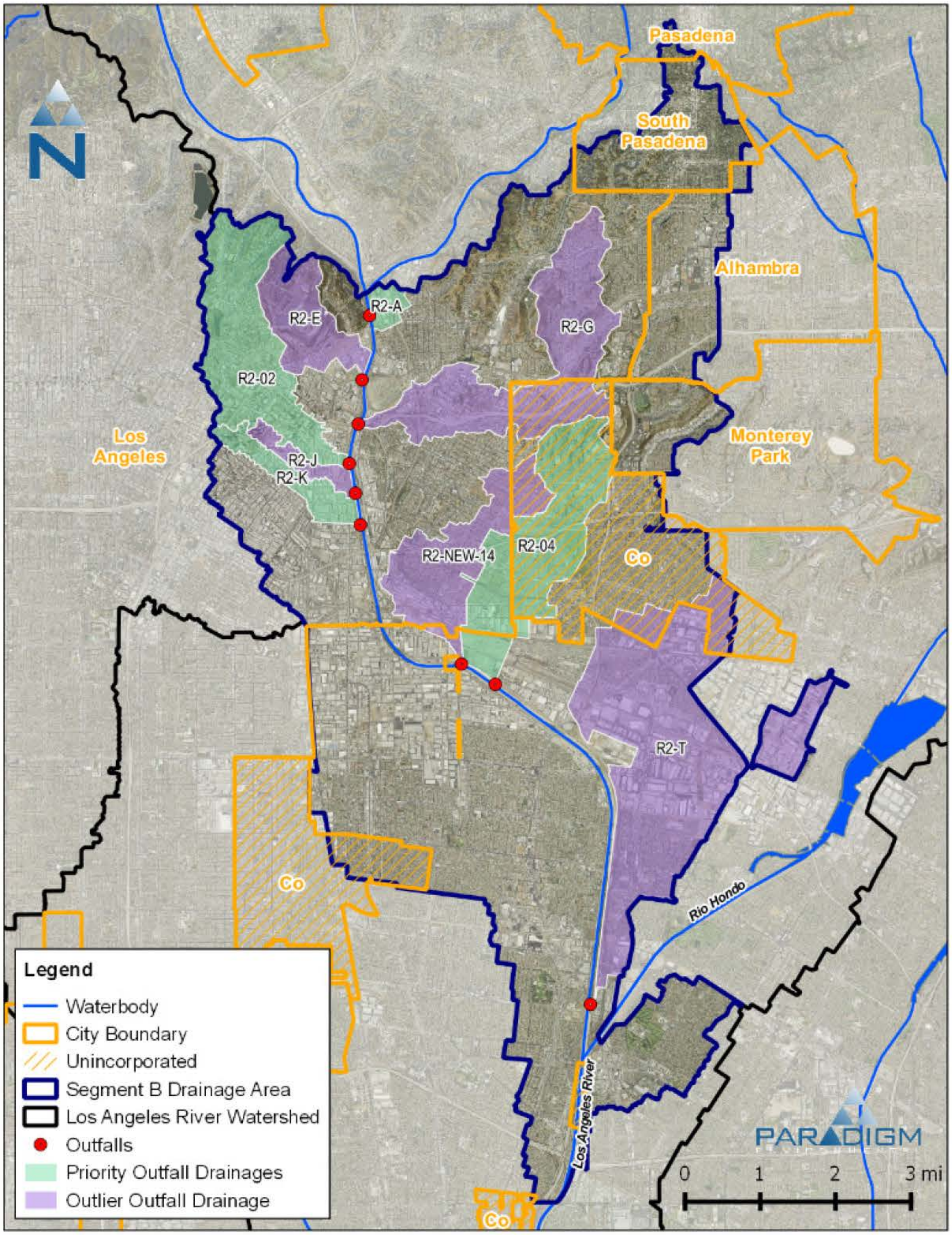

Figure 7-28. Drainage Areas for Priority and Outlier Outfalls in Segment B LRS by ULAR EWMP Group

7.4.2.2 LRS for Arroyo Seco and Rio Hondo

The ULAR EWMP Group has initiated the LRSs for Arroyo Seco and Rio Hondo, which are tributaries to Segment B. Both LRSs are due March 2016. For Rio Hondo, the Group is in process of collecting outfall monitoring snapshots. For Arroyo Seco, the City of Los Angeles has completed snapshots of outfalls within their jurisdictional area, and the Group has also begun collecting data from the jurisdictional areas upstream of the City of Los Angeles. The Arroyo Seco LRSs are not yet complete, and the ULAR EWMP Group may ultimately collaborate on a single LRS (rather than submitting two LRSs). The preliminary list of City of Los Angeles control measures for Arroyo Seco is shown in **Table 7-3** and the drainage areas for the targeted outfalls are shown in **Figure 7-29.**

Table 7-3. Preliminary List of Control Measures identified by City of LA for Arroyo Seco LRS

Nonstormwater Control Measure	Outfall ID Addressed	Outfall Type	Completion Schedule	Lead Agency
Arroyo Seco Urban Runoff Project No. 1	AS-15	Priority Outfalls	September 2020	City of LA
Arroyo Seco Urban Runoff Project No. 2	AS-21		September 2020	City of LA
Arroyo Seco Urban Runoff Project No. 3	AS-17	Outlier Outfall	September 2020	City of LA

Note: subject to change once LRS is completed and submitted.

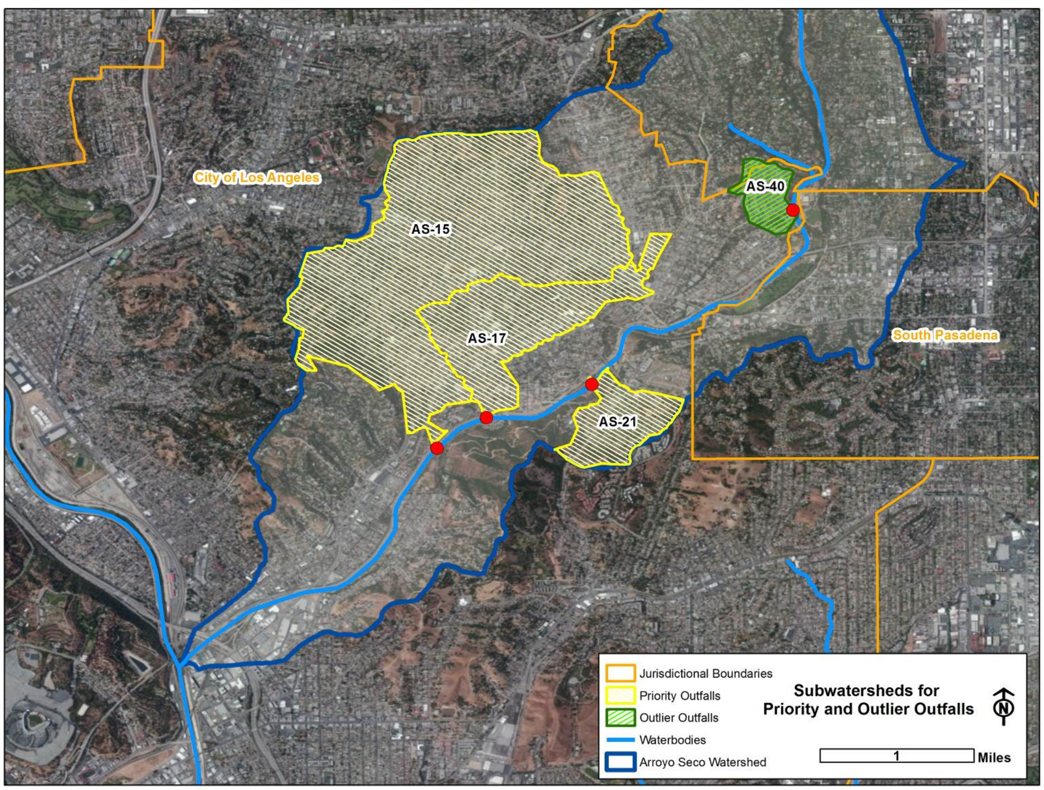

Figure 7-29. Drainage Areas for Preliminary Priority and Outlier Outfalls in City of LA Jurisdictional Area in Arroyo Seco Watershed

7.4.3 Dry Weather Strategy for Metals TMDL and Category 2/3 RWLs

The dry weather compliance date for the LA River Metals TMDL is January 11, 2024 (see Section 3). The EWMP Implementation Strategy clearly addresses the dry weather RWLs of the metals TMDL as well as all other dry weather Category 2 and 3 WBPCs identified in **Table 3-14** because during dry weather, exceedances of metals RWLs are relatively rare, as described in Section 6.5.4. As such, *existing* MCMs and control measures have reasonable assurance of attaining dry weather metals RWLs (see **Table 6-6**) and represent the implementation actions required under this EWMP to comply with the TMDL requirements and receiving water limitations provisions of the Permit.

Additionally, the following components of the EWMP Implementation Strategy will further support protecting water quality during dry weather conditions:

1. For most ULAR jurisdictions, the wet weather control measures in the EWMP Implementation Strategy will achieve greater than 50% reduction in non-stormwater flows by 2024 (see **Figure 7-24**). This will result in a relatively large reduction in dry weather loading of *all pollutants* including metals, providing an additional margin of safety for achieving dry weather metals RWLs.
2. The additional reductions in non-stormwater flows and dry weather metals loading provided by bacteria TMDL Load Reduction Strategies, non-stormwater abatement programs and outdoor water use reductions (as described in the previous subsection 7.4.1) provide an additional margin of safety for achieving dry weather metals RWLs.
3. The non-stormwater volumes in the non-stormwater simulation were based on existing *median* outdoor water use rates. Most water supply agencies including the City of Los Angeles Department of Water and Power have initiatives to significantly reduce outdoor water use in the coming years. Regional reductions in outdoor water provide additional assurance of addressing dry weather Water Quality Priorities.

Combined, these components demonstrate the EWMP includes a robust non-stormwater control strategy for achieving dry weather metals and Category 2 and 3 RWLs.

7.5 Which Institutional Control Measures are included in the EWMP?

The MS4 Permit requires extensive programs for institutional control measures, referred to as MCMs. The “default” MCMs in the Permit are an important element of the EWMP Implementation Strategy[37] for the ULAR EWMP Group. See Section 5.6 for a comparison of the 2001 and 2012 MCM requirements. The MCMs in the 2012 Permit represent a significant increase in effort compared to the 2001 Permit. These default MCMs provide the foundation for the EWMP. Additionally, Category 2 and 3 WBPCs, which have very low exceedance frequencies, will be addressed by MCMs and associated control measures. However, the MCMs may need to be modified to specifically target low exceeding pollutants if exceedances are seen subsequent to full implementation of the MCMs identified in the MS4 Permit.

[37] The RAA assumed a 5% reduction in pollutants due to implementation of default MCMs required in the Permit. The MCMs in the 2012 Permit are significantly enhanced from those in the 2001 Permit, and thus a 5% reduction is a reasonable (likely conservatively low) estimate of MCM performance.

In addition, several of the ULAR EWMP agencies have identified additional institutional control measures[38] as a component of their EWMP Implementation Strategy. The additional institutional control measures to be implemented are detailed in **Table 7-4** along with a schedule for completion. As the EWMP is implemented, Group members may identify additional institutional control measures (for additional jurisdictions) that may offset the need for some of the structural control measures identified in the EWMP Implementation Strategy; if so, the EWMP will be updated during the adaptive management process (described in Section 8).

Table 7-4. Additional Institutional Control Measures to be Implemented by Select ULAR Agencies

Agency	Additional Institutional Control Measures to be Implemented	Description	Schedule for Completion
Burbank	Enhanced street sweeping program	Burbank upgraded the fleet of street sweepers to more efficient sweepers as well as increased the number of street miles swept by including alleys as part of the sweeping routes. See Appendix 7D.	In Effect
Temple City	Small Site LID	The Temple City LID Ordinance requires for residential and industrial projects below the MS4 Permit threshold, requiring projects with 500 square feet or more of soil disturbance to incorporate LID BMPs into the project design. This ordinance will result in a significant reduction in stormwater pollution.	In Effect
• Temple City • South Pasadena • Glendale	Train staff to facilitate LID and Green Streets implementation	Conduct training for relevant staff in LID and Green Streets implementation prior to the onset of the programs. The elements of the training follow the provisions listed in MS4 Permit §VI.D.7. Additionally, the agency will educate governing bodies in LID and Green Streets implementation.	In Effect
• Temple City • South Pasadena • Glendale	Prepare guidance documents to aid implementation of MS4 Permit MCMs	Documents will be developed to address two issues: 1) the MS4 Permit introduces many new and enhanced MCM provisions that do not have preexisting guidance documentation and 2) the model Stormwater Quality Management Program (SQMP) – which was required in the prior LA MS4 Permit and served as a guide to permit implementation – is now obsolete. Unlike the SQMP, the	June 2015

[38] The RAA assumed a total 10% reduction in pollutants due to implementation of the default MCMs and the additional institutional control measures identified by the jurisdictions.

Table 7-4. Additional Institutional Control Measures to be Implemented by Select ULAR Agencies

Agency	Additional Institutional Control Measures to be Implemented	Description	Schedule for Completion
		Agencies are not bound to the guidance and forms provided. They are provided as a resource to improve the effectiveness of the Jurisdictional Stormwater Management Plans.	
South Pasadena	Incentives for irrigation reduction practices	• The City provides rebate incentives for rotating sprinkler heads to promote efficient irrigation and mitigate runoff. The City adds funds to Metropolitan Water District's rebate program. • The City teaches workshops on efficient irrigation to mitigate runoff. • The City teaches workshops on sustainable, water wise landscapes emphasizing the use of drip and no chemicals. • The City teaches workshops on rain water infiltration to educate residents on keeping rain water onsite where it can be cleaned by the soil and infiltrate into ground to replenish our groundwater aquifer. • The City offers a dozen different water wise workshops to residents and businesses. In each of the workshops, the concept of "nothing but rain down the drain" is emphasized using a variety of descriptive photos. The workshops also educate on not allowing any landscape chemicals into the storm drains. The workshops also educate attendees on keeping their sewer lines clean and only putting items that should go down the drain. • The City offers individual landscape assistance to residents to help them design sustainable, water wise landscapes emphasizing the use of drip and no chemicals. • The City tags and educates residents and businesses that have irrigation runoff. • Provide incentives such as rebates for irrigation reduction (i.e. runoff reduction) practices such as xeriscaping and turf conversion. • South Pasadena is currently involved in this effort through the Metropolitan Water District's water conservation rebate program.	In Effect
South Pasadena	Encourage retrofitting of downspouts (downspout disconnect)	Encourage owners/operators of existing developments to disconnect existing downspouts from the MS4.	In Effect
South Pasadena	Refocused outreach to target audiences and water quality priorities	Within the Public Information and Education Program, elements such as material use/development and advertisements will address WQPs. The development of this effort will be ongoing throughout the MS4 Permit term.	In Effect
Unincorporated Los Angeles County	Implementation of MCMs in the 2012 Permit	• Incorporation of regenerative sweepers in the street cleaning program • Expedited installation of full capture systems in catch basins in high trash generation areas: 40% by December 2016; 80% by December 2017; and 100% by December 2018. • Development of a Nutrients Reduction Outreach Program in areas draining to Puddingstone Reservoir	• Dec 2016 • Dec 2016-Dec 2018. • December 2018.

Section 8
Compliance Determination and Adaptive Management Framework

At its core, the EWMP is a regulatory document to support compliance determination with the MS4 Permit, and over time the EWMP will be adapted to become more effective as new program elements are implemented, regulations change and additional information and data are gathered. This section discusses the anticipated approach to compliance determination and discusses key elements of adaptive management. Adaptive management is a critical component of the EWMP implementation process, as the EWMP looks forward 22 years (to 2037) and watershed conditions, stormwater science and water quality regulations will certainly change over the coming decades. Over time, monitoring data collected by the CIMP will provide information on water quality conditions and the effectiveness of control measures, which can be compared to predictions by the RAA. In addition, EWMP members will update their EWMP Implementation Strategy based on new identified opportunities (e.g., identifying a newly available public parcel for a regional project) and/or lessons learned during control measure implementation (e.g., preferring one type of control measure over another).

8.1 Compliance Determination

As described in Section 1.2, the EWMP is a regulatory document that supports compliance determination through an optional compliance pathway for the MS4 Permit Without an EWMP, compliance determination would be based on comparison of monitoring data collected by the CIMP to RWLs and/or WQBELs. By developing and implementing an approved EWMP, the ULAR EWMP Group is provided another pathway for compliance determination. However, it is important to note the EWMP Implementation Strategy is *not* a standalone compliance requirement; determination of compliance always starts with review of receiving water monitoring data. If RWLs are not achieved, then compliance determination considers outfall monitoring data. Furthermore, areas that are addressed by a regional project that retains the 85th percentile, 24-hour storm are individually compliant with all RWLs and WQBELs of the Permit. ly, if RWLs and WQBELs are not achieved and runoff is not addressed through retention of the 85th percentile 24-hour storm, then compliance determination is based on whether the control Compliance Targets and/or control measures in the EWMP Implementation Strategy have been achieved/implemented per the compliance schedule. [39]

As outlined in **Table 8-1**, compliance should be determined separately for each constituent and condition (wet or dry). While the limiting pollutant analysis determined the control measures that will address all pollutants, it is not *necessary* to fully control zinc and *E. coli* to address the other Water Quality Priorities. For example, exceedances of metals during dry weather are rare and thus MCMs and associated control measures have reasonable assurance of attaining metals RWLs during dry weather. Similarly, for Category 2 and 3 WBPC, which also have very low exceedance frequencies

[39] See Section 7.1 for description of Compliance Targets, which are expressed in terms of the volume of stormwater runoff managed during a 24-hour period under the critical condition. Compliance Targets for each jurisdiction and assessment area / watershed are detailed in Appendix 7.A (compliance) and **Appendix 7.C** (scheduling for milestones). For compliance with dry weather RWLs, the non-stormwater control measures described in Section 7.4 are used for compliance determination.

(identified in **Table 3-14**), MCMs and associated control measures have reasonable assurance of attaining RWLs during dry weather. As such, if exceedances of metals during dry weather or exceedances of Category 3 WBPCs identified in **Table 3-14** occur during EWMP implementation, then compliance determination should *not* be based on the status of implementation of zinc and *E. coli* control measures. Instead, compliance determination should be based on evaluation of whether the existing level of implementation for MCMs and control measures (as of June 2015) has been maintained and adapted, if necessary, to meet limitations.

An important element of the current Permit provisions is that determination of compliance with limits of Regional Board adopted TMDLs (see **Table 3-1**) does not consider whether the EWMP Implementation Strategy has been completed; instead compliance determination is solely based on review of receiving water and outfall monitoring data. However, given rigor by which the EWMPs have been developed, there is optimism that future iterations of the Permit will add compliance with limits (not just interim) as a component of EWMP compliance determination (as discussed in the Permit Fact Sheet).

Table 8-1. EWMP Control Measures to be Assessed for Compliance Determination with ULAR EWMP if RWLs and WQBELs are not Attained per the Timelines Prescribed in the Permit and EWMP

Weather Condition	Pollutant	Control Measures to be Evaluated for BMP-based Compliance	Milestones and Implementation Schedule
Wet weather	Copper and Zinc	Control Measures detailed in Appendix 7A and 7C	Table 3-1 and Appendix 7C
	E. coli	Control Measures detailed in Appendix 7A and 7C	
	Toxics	Control Measures detailed in Appendix 7A and 7C	
	Category 2 pollutants	MCMs in 2012 MS4 Permit and modifications made during adaptive management, as needed.	See Table 3-13 and Table 3-14
	Category 3 pollutants		
Dry weather	Copper and Zinc	MCMs in 2012 MS4 Permit and modifications made during adaptive management, as needed. Also, Implementation of non-stormwater abatement program in CIMP	See Table 3-1
	E. coli	Load Reduction Strategy control measures	See Table 3-2
	Category 2 pollutants	MCMs in 2012 MS4 Permit and modifications made during adaptive management, as needed. Also, Implementation of non-stormwater abatement program in CIMP	See Table 3-13 and Table 3-14
	Category 3 pollutants		

8.2 Adaptive Management Framework

The Permit specifies the adaptive management process will be revisited every two years to evaluate the EWMP and update the program as necessary. Part VI.C.8 of the Permit identifies the adaptive management process as follows:

i. Permittees shall implement an adaptive management process, every two years, adapting the EWMP to become more effective, based on, but not limited to a consideration of the following:

1) Progress toward achieving interim and/or WQBELs and/or RWLs.

2) Achievement of interim milestones.

3) Re-evaluation of Water Quality Priorities and source assessment.

4) Availability of new information other than the Permittees' monitoring program

5) Regional Water Board recommendations; and

6) Recommendations through a public participation process

ii. Based on the results of the adaptive management process, Permittees shall report any modifications necessary to improve the effectiveness of the EWMP in the Annual Report.

iii. Permittees shall implement any modifications to the EWMP upon approval by the Regional Board or within 60 days of submittal if the Regional Board expresses no objections.

The EWMP adaptive management process will incorporate new monitoring data collected through implementation of the CIMP or other programs, experience gained from BMP implementation, and/or changes to the water quality standards (i.e., beneficial uses or WQBELs and/or RWLs). For example, the EWMP includes a robust adaptive management program that will continue to identify and prioritize the best locations, sizes, and types of BMPs for pollutant reduction. Over time, if additional parcels are identified that could provide cost-effective opportunities for implementing regional projects (e.g., school district properties), then regional projects would make up an even larger component of the EWMP. The adaptive management process will also define modifications necessary to improve the effectiveness of the EWMP in order to achieve compliance targets. Key factors to be considered during the adaptive management process are described below.

8.2.1 Updates to Water Quality Priorities

A key consideration of the adaptive management process of the Permit is part i.3, the re-evaluation of Water Quality Priorities. The ULAR EWMP Group envisions that the EWMP, CIMP, and special studies will lead to revisions to the Water Quality Priorities through Basin Planning in the coming years. Examples of these revisions include the following:

- **Updates to TMDL implementation schedules** – the pace of control measure implementation required by TMDLs in the LA River watershed is rapid, far above corresponding funding that is available for stormwater programs. The 31% milestone for the LA River Metals TMDL is especially problematic given its short timeframe (2017). The timelines for design, construction and permitting of BMPs are typically longer than two years. While the Group plans to implement projects in the near-term, the TMDL schedules for near-term milestones could be adjusted to reflect realistic construction schedules while still ensuring that commitments are made to achieving continuous incremental improvements in water quality.

- **Revisions to Water Quality Objectives** – through special studies and regulatory updates, RWLs (and water quality objectives) can be improved to incorporate the most recent scientific information and/or site-specific data. As an example, an updated RWL for copper in the LA River is in the process of being adopted by the Regional Board to reflect the findings of a site-specific objective study. Similar studies could be conducted for the limiting pollutants zinc and bacteria. For zinc, a water effects ratio could be considered for the LA River and its tributaries. For bacteria, federal regulations include a process for developing site-specific RWLs based on alternative indicators and/or risk assessment. The RWLs for other pollutants could also be updated as regulations are updated by the Regional Board and State Board to reflect the best available science and/or scientific studies are conducted to support Basin Plan Amendments.

- **Updates to beneficial uses**– for some Water Quality Priorities, the designated beneficial uses in the Basin Plan could be updated based on up-to-date use information. As an example, the

State Board is considering updates to statewide water quality objectives for bacteria, including an expanded application of the High Flow Suspension (HFS) to non-engineered channels. The Basin Plan currently only applies to the HFS to beneficial uses for engineered channels. Currently, Arroyo Seco and Compton Creek are excluded from the HFS because they were previously determined to be non-engineered (even though they are concrete channel for most of their length). Through the statewide update, the HFS could be expanded to these waterbodies, which would reduce the amount of regional projects on private land that are currently included in the EWMP Implementation Strategy.

- **Revisions to WQP categories** – for some Water Quality Priorities, the pollutants will benefit from additional monitoring data collected by the CIMP. New monitoring data may allow for the re-characterization of receiving water and discharge quality within the ULAR EWMP area. The monitoring data may show changes in constituents exceeding applicable water quality objectives, resulting in potential updates to the categories. For example, pollutants may be de-listed as control measures are implemented, or some pollutants may be demonstrated to be from non-MS4 sources.

The ULAR EWMP Group looks forward to closely working with the Regional Board and stakeholders on these and other revisions to the Water Quality Priorities.

8.2.2 Updates based on Review of Monitoring Data

Monitoring data gathered from the CIMP or other monitoring programs (e.g., specific studies) on receiving water conditions and stormwater/non-stormwater quality will support adaptive management at multiple levels. This information will be tied into the EWMP as feedback for the water quality changes resulting from control measures implemented by the ULAR EWMP Group. For example, the data could show the required reductions are less than anticipated which would could eventually lead to reduced capacities of control measures in the EWMP Implementation Strategy.

An Integrated Monitoring Compliance Report will be provided as part of the Annual Report that summarizes all identified exceedances of (1) outfall-based stormwater monitoring data, (2) wet weather receiving water monitoring data, (3) dry weather receiving water data, and (4) non-stormwater outfall monitoring data against all applicable WQBELs, RWLs, non-stormwater action levels, and aquatic toxicity thresholds. An effectiveness assessment of stormwater and non-stormwater control measures will be conducted as to whether the quality of discharges is improving, staying the same or declining.

8.2.3 Updates to RAA Model Parameters

Over time, the parameters in the watershed and BMP models used for the RAA may be updated based on newly available data. For example, as additional control measures are implemented in LA County, new data may become available regarding performance of control measures for reduction pollutants. In turn, the performance metrics in the RAA could be updated. Other types of data that could support RAA updates include soil infiltration data, revised catchment delineations, modified operations to impoundments / reservoirs, and major changes to the quality or volume of effluent discharges from publicly owned treatment works.

8.2.4 Updates to Preferences for Control Measure Implementation

Over the course of EWMP implementation, Group members have the flexibility to substitute different types of control measures based on lessons learned that affect preferences for implementing certain

BMPs. As long as the Compliance Targets are achieved (i.e., specified volumes of stormwater are managed), the type of control measure implemented does not affect compliance determination. As the EWMP is implemented over time, it is *expected* that refined strategies will identify a different suite of opportunities or different BMP designs from that which was assumed for the RAA. It will, therefore, be important to track BMP implementation so adjustments can be made when checking progress towards achieving Compliance Targets. To illustrate how control measure preferences could be modified during adaptive management, an example is described below and illustrated in **Figure 8-1**.

In **Figure 8-1**, the "recipe for compliance" is split to emphasize that the Compliance Targets (on the left-hand side) are the primary BMP performance goals, whereas the control measures (on the right-hand side) are subject to adaptive management. The objective is for each Group member to meet the Compliance Target (left-hand side) and management a certain amount of runoff in a 24-hour period with a suite of BMPs. The right-hand side represents the control measures identified by the RAA based on the assumptions described in Section 6. However, over time, the EWMP Implementation Strategy will be adjusted. In some cases, it may be possible to use alternative control measures or designs in such a way that the overall constructed size (and associated cost) of the suite of BMPs is reduced. A key consideration during adaptive management is identifying opportunities to offset / reduce the amount of private regional BMPs that are implemented, through expanded use of public land (e.g., identifying more parks and right-of-way), enhanced partnerships with other public agencies (e.g., placing BMPs on properties owned by schools and transportion agencies) and/or through partnerships with private agencies.

The capacities presented in Figure 8-1 are used for illustration purposes, the values in the tables are hypothetical, not actual calculations. The actual calculations to be performed will be based on the runoff volume managed by the control measures in the EWMP Implementation Strategy (under the RAA critical condition) in comparison to the proposed alternative BMPs. For most BMPs, the runoff volume managed will be the amount of runoff retained by the BMP (either through infiltration or irrigation use). The amount of runoff managed by a BMP is directly related to the amount of impervious area that drains to the BMP, and impervious area is a fundamental metric when predicting pollutant loading. The equivalency calculations will be derived critical condition being addressed by the EWMP – either the critical zinc storm, critical bacteria storm or design storm. The storm size will vary based on the subwatershed where the control measure will be located. The calculation methodology could be based in Excel®, use the RAA modeling system (LSPC and SUSTAIN) or employ tools similar to the MODRAT tool developed by Los Angeles County Department of Public Works. Over time, the WMG may elect to use web-based tools to streamline these calculations. The calculation methodology will be detailed in the annual report(s) where the equivalency calculations are used support substitution of alternative control measures.

Three scenarios to consider as examples are provided below:

- **Scenario 1:** the EWMP Implementation Strategy currently identifies 2.12 acre-feet of storage necessary for green streets. Consider a hypothetical example scenario where a street-scale analysis reveals that an additional 3 acre-feet of high-efficiency green street opportunities exist in the subwatershed, bringing the total green street implementation to 5.12 acre-feet. The Scenario 1 row in **Figure 8-1** demonstrates how this additional green street capacity can offset the need for other BMPs in the subwatershed; in this case, regional capacity on private parcels for bacteria compliance. It is important to realize, however, that a 1:1 exchange of BMP capacities between different types of control measures is not appropriate (e.g., in Scenario 1, the green street capacity increases by 3 acre-feet, but regional capacity on public land is reduced by only 2.5 acre-feet). Exchange of control measure capacity is not 1:1 because (1) green streets perform differently than regional BMPs, (2) the BMPs treat different land uses, and (3) the BMPs experience different infiltration rates. Adaptive management will therefore require some type of ”equivalency” demonstration to maintain reasonable assurance that the revised control measures will achieve the compliance goals on the left-hand side of the table.

- **Scenario 2:** this scenario demonstrates an example where residential LID programs progress at five times the pace assumed in the RAA. In this case, the Group member was able to achieve an adoption rate of 5% of residential parcels per year versus the 1% assumed by the RAA. The additional residential LID offsets the remaining 0.42 acre-feet of capacity for bacteria compliance in lieu of constructing regional BMPs on private parcels, and also offsets LID on public parcels. Note the substitution of regional LID requires more total control measure capacity (because regional projects located at the outfall are more efficient for removing pollutants), but the total cost would likely be far lower.

- **Scenario 3:** this scenario consider a situation where - instead of the previous two scenarios – a private parcel is acquired at the outlet of the subwatershed. Assuming redevelopment and residential LID will progress in the subwatershed regardless of other control measures, a regional project could be installed on the private parcel and optimized to satisfy the remaining compliance target runoff volume, eliminating the need for any other remaining BMPs in the subwatershed.

The above scenarios provide only a handful of examples where adaptive management would lead to adjustments of control measure capacities. It is anticipated that, over the course of implementation, agencies will continue to innovate, customize BMP configurations, and strategically locate BMP opportunities that will reduce the level of BMP implementation. It will be important to demonstrate equivalency as these adjustments are made to the EWMP Implementation Strategy.

(Current Fixed Goal)

COMPLIANCE TARGETS: BMP PERFORMANCE GOAL	
For Metals by 2028	For Bacteria by 2037
24-hour Volume Retained (acre-ft)	Additional 24-hour Volume to be Retained (acre-ft)
4.83	2.92

(Flexible)

EWMP IMPLEMENTATION PLAN:
APPROACH TO ACHIEVE COMPLIANCE TARGETS, SUBJECT TO ADAPTIVE MANAGEMENT
(BMP capacity expressed in units of acre-feet)

	For Metals Attainment by 2028											For Bacteria Attainment by 2037	
	% Load Reduction Critical Condition	Low-Impact Development				Streets	Regional BMPs						
		Ordinance	Planned LID	Public LID	Residential LID	Green Streets	Very High (public, owned)	High (public, owned)	Medium (public, non-owned)	Private	Total BMP Capacity (acre-ft)	Regional BMPs (private)	Total BMP Capacity (acre-ft)
	37%	0.16	0.04	0.13	0.23	2.12	0	0	0	0	**2.7**	2.92	**5.6**
Scenario 1:	37%	0.16	0.04	0.13	0.23	5.12	0	0	0	0	**5.7**	0.42	**6.1**
Scenario 2:	37%	0.16	0.04	--	1.15	5.12	0	0	0	0	**6.5**	--	**6.5**
Scenario 3:	37%	0.16	0.04	--	0.23	--	0	0	0	5	**5.4**	--	**5.4**

Scenario 1: **Adaptive Management: Burden Transferred from Regional Projects to Newly Identified High-Efficiency Green Street Opportunities**

Scenario 2: **Adaptive Management: Remaining Capacities for Bacteria and Public LID are offset by Residential LID**

Scenario 3: **Adaptive Management: Regional BMP Located at Subwatershed Outlet**

Figure 8-1. Hypothetical Alternative Control Measure Scenarios to Attain Compliance Targets

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Section 9
EWMP Implementation Costs and Financial Strategy

The purpose of this section is to present costs for constructing, operating and maintaining the control measures in the EWMP Implementation Strategy, along with the financial strategy for addressing those costs. For the purposes of the EWMP, the financial strategy is defined as the strategic options available to the Group members for financing the program costs associated with the MS4 Permit and the appropriate application and prioritization of these options. The section provides an overview of the following elements:

- Estimates of costs to construct, operate and maintain control measures (9.1);
- Assessment of existing stormwater program costs and funding sources (9.2); and
- Description of the financial strategy to secure for EWMP programs and projects (9.3).

9.1 EWMP Implementation Costs

The purpose of this section is to present the order-of-magnitude cost estimates for the EWMP Implementation Strategy. The estimated program costs were developed using the methodology described in Section 6.3.3. The general approach for cost estimate is based on "cost functions" that describe cost as a function of BMP size parameters (volume, depth, area, etc.). Details on the cost function methodology are provided in the documentation for the WMMS model (http://dpw.lacounty.gov/wmd/wmms/res.aspx). The cost functions used for this EWMP are presented in **Table 9-1**, which have been updated from those in the original WMMS[40]. The cost functions are based on generic, modular cost functions developed specifically for LA County. The cost functions[41] encompass planning, design, permits, construction, O&M, and post-construction inspection, where applicable. Cost estimates are applicable only for the modeled BMP configurations specified in Section 6 and **Appendix 6.D**. Note that costs do not account for inflation, interest, or time-value of money.

The costs for structural BMPs provided here are considered to be planning level only (order of magnitude), and can be refined as EWMP implementations progresses with the use of actual BMP implementation costs. Costs for enhanced MCMs and other institutional BMPs have not been included here and are in addition to the Capital and O&M costs.

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[40] The O&M cost estimates were further refined based on interviews with municipal maintenance staff in Southern California (City of San Diego and Tetra Tech, 2011; Caltrans, City of La Mesa, City of Lemon Grove, City of San Diego, County of San Diego, and Unified Port of San Diego, 2013). Routine maintenance was assumed to occur annually, while intermittent maintenance activities were assume to occur every four years. Replacement costs were not considered under the assumption that systems will be properly maintained and functional throughout and beyond the implementation schedule.

[41] While the cost functions in Section 6 were based on 20-year costs, this section separates the annual O&M costs from the capital costs to allow for cost estimates *over time*. For the RAA cost optimization, 20-year costs were used to ensure that O&M costs were considered when deeming a BMP scenario to be cost-effective.

Table 9-1. Summary of Annualized BMP Cost Estimation Formulas

BMP Category	BMP Types	Formulas For Estimating Total Costs [1]	
		Capital Costs	Annual O&M
LID and Green Streets	Bioretention with Underdrain	*Cost = 17.688 (A) + 2.165 (Vt) + 2.64 (Vm) + 3.3 (Vu)*	*Cost = 2.54 (A)*
	Bioretention without Underdrain	*Cost = 9.438 (A) + 2.165 (Vt) + 2.64 (Vm)*	*Cost = 2.54 (A)*
	Residential LID	*Cost = 4.000 (A)*	--
	Permeable Pavement with Underdrain	*Cost = 33.594 (A) + 3.3 (Vu)*	*Cost = 1.74 (A)*
	Permeable Pavement without Underdrain	*Cost = 25.344 (A)*	*Cost = 1.74 (A)*
Regional BMPs	Pump	*Cost = 56,227*(Pump Capacity$_{cfs}$) + \$1,207,736[2]*	
	Regional Project on Public Parcel	*Cost = 10.01 (A) + 2.296 (Vt) + 2.8 (Vm)*	*Cost = 1.918 (A)*
	Regional Project on Private Parcel	*Cost = 139.01 (A) + 2.296 (Vt) + 2.8 (Vm)*	*Cost = 1.918 (A)*

1 – Formulas describe annualized life cycle costs including routine and intermittent O&M using the following variables: (*A*) is the area of the BMP footprint in square feet, (*Vt*) is the total volume of the BMP in cubic feet, (*Vm*) is the volume of the BMP soil media in cubic feet, and (*Vu*) is the volume of the BMP underdrain in cubic feet.

2 – The resolution of WMMS output precludes the certain estimation of pump station quantity and capacity. Note that incidental costs associated with pump station operation will likely be incurred during implementation.

9.1.1 EWMP Implementation Costs by Control Measure Type and EWMP/TMDL Milestones

The total estimated costs for all control measures in the EWMP Implementation Strategy (LID, Green Streets, and Regional) are shown in **Table 9-2**. The capital and O&M costs are reported for the same milestones detailed in the EWMP Implementation Strategy. The implementation cost schedule relies on initial capital costs to achieve the control measure capacities at the milestone year, and then recurring annual O&M costs are accumulated over the compliance time frame.

Table 9-2. Total Costs by Milestone for each ULAR EWMP Group member ($ millions)1

Agency	Program	Present to 31% Metals TMDL Milestone (2017)		31% Metals TMDL Milestone (2017) to 50% Metals TMDL Milestone (2024)		50% Metals TMDL Milestone (2024) to Compliance with Metals TMDL (2028)		Metals TMDL Compliance (2028) to Compliance with Bacteria TMDL (2037)		Total at	
		Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Alhambra	LID	0.08		0.36		0.73		0.00		1.17	
	Streets	2.73		7.48		19.67		0.00		29.87	
	Regional on Public	7.45		9.14		0.17		0.00		16.77	
	Regional on Private	0.00		0.00		62.80		49.86		112.66	
	Subtotal	**10.26**	**1.19**	**16.97**	**3.17**	**83.37**	**6.52**	**49.86**	**7.18**	**160.47**	**7.18**
Burbank	LID	0.19		1.38		4.28		0.00		5.86	
	Streets	1.45		7.45		22.18		0.00		31.08	
	Regional on Public	0.83		3.26		2.02		0.00		6.11	
	Regional on Private	0.00	**0.30**	0.00	**1.74**	104.42	**6.55**	98.59	**7.84**	203.01	**7.84**

Table 9-2. Total Costs by Milestone for each ULAR EWMP Group member ($ millions)1

Agency	Program	Present to 31% Metals TMDL Milestone (2017)		31% Metals TMDL Milestone (2017) to 50% Metals TMDL Milestone (2024)		50% Metals TMDL Milestone (2024) to Compliance with Metals TMDL (2028)		Metals TMDL Compliance (2028) to Compliance with Bacteria TMDL (2037)		Total at	
		Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
	Subtotal	**2.47**		**12.09**		**132.90**		**98.59**		**246.06**	
Calabasas	LID	0.29		0.11		0.20		0.00		0.61	
	Streets	0.41		0.29		0.38		0.00		1.08	
	Regional on Public	0.72		0.02		0.00		0.00		0.74	
	Regional on Private	0.00		19.85		84.72		6.57		111.13	
	Subtotal	**1.43**	**0.14**	**20.28**	**0.44**	**85.29**	**1.60**	**6.57**	**1.69**	**113.57**	**1.69**
Glendale	LID	0.00		0.16		2.83		0.00		2.99	
	Streets	0.06		5.18		49.50		0.00		54.75	
	Regional on Public	0.00		2.25		5.94		0.00		8.19	
	Regional on Private	0.00		0.05		28.94		198.26		227.25	
	Subtotal	**0.06**	**0.01**	**7.64**	**0.93**	**87.21**	**8.36**	**198.26**	**10.97**	**293.17**	**10.97**
Hidden Hills	LID	0.00		0.00		0.00		0.00		0.00	
	Streets	0.00		0.03		0.02		0.00		0.06	
	Regional on Public	0.00		0.00		0.00		0.00		0.00	
	Regional on Private	3.52		3.76		3.78		0.00		11.06	
	Subtotal	**3.52**	**0.05**	**3.79**	**0.10**	**3.80**	**0.15**	**0.00**	**0.15**	**11.12**	**0.15**
La Canada Flintridge	LID	0.00		0.13		0.14		0.00		0.27	
	Streets	0.39		1.82		3.30		0.00		5.50	
	Regional on Public	0.00		0.12		0.00		0.00		0.12	
	Regional on Private	0.00		0.05		27.41		41.53		68.99	
	Subtotal	**0.39**	**0.05**	**2.13**	**0.29**	**30.84**	**1.06**	**41.53**	**1.61**	**74.89**	**1.61**
Los Angeles	LID	4.32		13.67		59.58		0.00		77.58	
	Streets	42.88		98.43		280.91		0.00		422.22	
	Regional on Public	29.45		61.55		60.99		0.00		151.99	
	Regional on Private	14.26		100.88		1,349.46		1,703.14		3,167.74	
	Subtotal	**90.91**	**9.25**	**274.54**	**30.91**	**1,750.94**	**95.68**	**1,703.14**	**118.07**	**3,819.52**	**118.07**
Montebello	LID	0.48		0.83		3.76		0.00		5.07	
	Streets	2.07		3.11		15.54		0.00		20.72	
	Regional on Public	1.59		2.48		3.60		0.00		7.67	
	Regional on Private	0.00		0.00		40.42		62.33		102.75	
	Subtotal	**4.14**	**0.49**	**6.42**	**1.22**	**63.32**	**4.44**	**62.33**	**5.26**	**136.21**	**5.26**
Monterey Park	LID	0.02		0.03		0.12		0.00		0.16	
	Streets	1.83		3.22		13.84		0.00		18.89	
	Regional on Public	1.42		3.08		3.30		0.00		7.80	
	Regional on Private	0.00		0.00		64.32		36.05		100.38	
	Subtotal	**3.26**	**0.37**	**6.33**	**1.09**	**81.57**	**3.94**	**36.05**	**4.41**	**127.22**	**4.41**
Pasadena	LID	1.04		1.44		11.03		0.00		13.51	
	Streets	5.61	**1.49**	8.25	**3.38**	41.64	**11.45**	0.00	**12.48**	55.49	**12.48**

Table 9-2. Total Costs by Milestone for each ULAR EWMP Group member ($ millions)1

Agency	Program	Present to 31% Metals TMDL Milestone (2017)		31% Metals TMDL Milestone (2017) to 50% Metals TMDL Milestone (2024)		50% Metals TMDL Milestone (2024) to Compliance with Metals TMDL (2028)		Metals TMDL Compliance (2028) to Compliance with Bacteria TMDL (2037)		Total at	
		Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
	Regional on Public	5.86		6.34		6.33		0.00		18.53	
	Regional on Private	0.00		0.00		69.00		78.84		147.84	
	Subtotal	**12.51**		**16.03**		**127.99**		**78.84**		**235.37**	
Rosemead	LID	0.13		0.28		0.31		0.00		0.72	
	Streets	3.24		7.46		9.04		0.00		19.74	
	Regional on Public	0.40		0.26		0.00		0.00		0.66	
	Regional on Private	0.00		0.00		59.20		29.80		88.99	
	Subtotal	**3.77**	**0.46**	**8.00**	**1.44**	**68.54**	**3.36**	**29.80**	**3.76**	**110.11**	**3.76**
San Fernando	LID	0.01		0.02		0.57		0.00		0.60	
	Streets	0.00		0.00		0.02		0.00		0.02	
	Regional on Public	0.98		1.13		1.52		0.00		3.63	
	Regional on Private	0.00		0.00		0.00		25.40		25.40	
	Subtotal	**0.99**	**0.11**	**1.15**	**0.24**	**2.11**	**0.47**	**25.40**	**0.80**	**29.65**	**0.80**
San Gabriel	LID	0.08		0.23		0.35		0.00		0.66	
	Streets	2.38		4.74		11.54		0.00		18.66	
	Regional on Public	0.61		0.77		0.10		0.00		1.49	
	Regional on Private	0.00		0.00		34.38		25.21		59.59	
	Subtotal	**3.07**	**0.37**	**5.75**	**1.06**	**46.37**	**2.99**	**25.21**	**3.32**	**80.40**	**3.32**
San Marino	LID	0.00		0.09		0.21		0.00		0.30	
	Streets	0.75		3.09		11.21		0.00		15.05	
	Regional on Public	2.10		6.65		0.00		0.00		8.75	
	Regional on Private	0.00		0.00		8.44		15.16		23.60	
	Subtotal	**2.85**	**0.33**	**9.82**	**1.47**	**19.87**	**2.99**	**15.16**	**3.19**	**47.70**	**3.19**
South El Monte[2]	LID	0.27		0.58		0.41		0.00		1.25	
	Streets	0.69		1.89		1.27		0.00		3.85	
	Regional on Public	0.95		0.58		0.00		0.00		1.53	
	Regional on Private	0.00		15.28		31.02		27.51		73.81	
	Subtotal	**1.91**	**0.22**	**18.32**	**0.79**	**32.70**	**1.41**	**27.51**	**1.77**	**80.44**	**1.77**
South Pasadena	LID	0.00		0.04		0.35		0.00		0.39	
	Streets	0.03		1.31		8.42		0.00		9.76	
	Regional on Public	0.23		4.65		1.49		0.00		6.37	
	Regional on Private	0.00		0.00		1.63		14.94		16.57	
	Subtotal	**0.25**	**0.03**	**6.00**	**0.71**	**11.90**	**1.91**	**14.94**	**2.10**	**33.09**	**2.10**
Temple City	LID	0.00		0.29		0.58		0.00		0.88	
	Streets	0.00		6.53		16.41		0.00		22.94	
	Regional on Public	0.00		0.57		1.29		0.00		1.85	
	Regional on Private	0.00		0.00		10.55		11.34		21.89	
	Subtotal	**0.00**	**0.00**	**7.39**	**0.92**	**28.83**	**3.33**	**11.34**	**3.47**	**47.56**	**3.47**

Table 9-2. Total Costs by Milestone for each ULAR EWMP Group member ($ millions)1

Agency	Program	Present to 31% Metals TMDL Milestone (2017)		31% Metals TMDL Milestone (2017) to 50% Metals TMDL Milestone (2024)		50% Metals TMDL Milestone (2024) to Compliance with Metals TMDL (2028)		Metals TMDL Compliance (2028) to Compliance with Bacteria TMDL (2037)		Total at	
		Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Uninc. LA County	LID	0.98		2.03		12.74		0.00		15.76	
	Streets	7.57		11.66		82.50		0.00		101.73	
	Regional on Public	8.46		13.05		20.25		0.00		41.76	
	Regional on Private	9.96		9.24		116.45		156.40		292.07	
	Subtotal	**26.98**	**2.14**	**35.98**	**5.36**	**231.95**	**20.72**	**156.40**	**22.77**	**451.31**	**22.77**
Total		**168.78**	**17.01**	**458.65**	**55.27**	**2,889.50**	**176.91**	**2,580.94**	**210.84**	**6,097.87**	**210.84**

[1] O&M costs for each milestone includes cost from previous milestone (i.e. the costs are cumulative)

[2] Cost estimates for the City of South El Monte include only those portions draining to Rio Hondo. Costs for the portions of the City of South El Monte that drain to the San Gabriel River are presented in Appendix 1B.

9.1.2 EWMP Costs by Tributary Area

The EWMP costs are presented for each tributary/assessment area in **Table 9-3**.

Table 9-3 Total Costs for each Subwatershed in the ULAR EWMP Area ($ millions) (Part 1)

Agency	Aliso Wash		Arroyo Seco		Bell Creek		Browns Canyon Wash		Bull Creek	
	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Alhambra	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Burbank	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calabasas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Glendale	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hidden Hills	0.00	0.00	0.00	0.00	0.45	0.01	0.00	0.00	0.00	0.00
La Canada Flintridge	0.00	0.00	52.41	1.21	0.00	0.00	0.00	0.00	0.00	0.00
Los Angeles	242.13	7.29	22.08	2.18	72.92	1.46	169.72	3.64	225.91	7.33
Montebello	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monterey Park	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pasadena	0.00	0.00	26.03	1.36	0.00	0.00	0.00	0.00	0.00	0.00
Rosemead	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Fernando	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Gabriel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Marino	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South El Monte	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South Pasadena	0.00	0.00	2.97	0.33	0.00	0.00	0.00	0.00	0.00	0.00
Temple City	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uninc. LA County	8.52	0.11	18.30	1.25	1.27	0.02	16.83	0.22	6.10	0.54
Total	**250.65**	**7.40**	**122.03**	**6.33**	**74.64**	**1.49**	**186.55**	**3.86**	**232.01**	**7.87**

Table 9-3 Total Costs for each Watershed in the ULAR EWMP Area ($ millions) (Part 2)

Agency	Burbank Western Channel		Compton Creek		Los Angeles River—Below Sepulveda Basin		Los Angeles River—Above Sepulveda Basin		McCoy-Dry Canyon Creek	
	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Alhambra	0.00	0.00	0.00	0.00	38.50	0.75	0.00	0.00	0.00	0.00
Burbank	150.35	5.12	0.00	0.00	95.71	2.73	0.00	0.00	0.00	0.00
Calabasas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	113.57	1.69
Glendale	3.22	0.13	0.00	0.00	142.49	5.92	0.00	0.00	0.00	0.00
Hidden Hills	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.67	0.14
La Canada Flintridge	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00
Los Angeles	83.69	2.27	291.60	16.32	1,222.66	38.34	727.71	20.55	177.79	3.03
Montebello	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Monterey Park	0.00	0.00	0.00	0.00	11.26	0.31	0.00	0.00	0.00	0.00
Pasadena	0.00	0.00	0.00	0.00	2.48	0.09	0.00	0.00	0.00	0.00
Rosemead	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Fernando	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Gabriel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
San Marino	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South El Monte	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South Pasadena	0.00	0.00	0.00	0.00	23.65	1.14	0.00	0.00	0.00	0.00
Temple City	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uninc. LA County	0.00	0.00	125.13	8.54	102.41	3.55	17.25	0.23	14.39	0.19
Total	**237.27**	**7.52**	**416.73**	**24.86**	**1,639.32**	**52.82**	**744.97**	**20.77**	**316.42**	**5.05**

Table 9-3 Total Costs for each Watershed in the ULAR EWMP Area ($ millions) (Part 3)

Agency	Rio Hondo		Tujunga Wash		Verdugo Wash		Total at	
	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Alhambra	121.97	6.42	0.00	0.00	0.00	0.00	160.47	7.18
Burbank	0.00	0.00	0.00	0.00	0.00	0.00	246.06	7.84
Calabasas	0.00	0.00	0.00	0.00	0.00	0.00	113.57	1.69
Glendale	0.00	0.00	0.00	0.00	147.21	4.91	293.17	10.97
Hidden Hills	0.00	0.00	0.00	0.00	0.00	0.00	11.12	0.15
La Canada Flintridge	0.00	0.00	0.00	0.00	22.32	0.39	74.89	1.61
Los Angeles	0.00	0.00	564.58	15.38	18.72	0.29	3,819.52	118.07
Montebello	136.21	5.26	0.00	0.00	0.00	0.00	136.21	5.26
Monterey Park	115.96	4.10	0.00	0.00	0.00	0.00	127.22	4.41
Pasadena	206.86	11.03	0.00	0.00	0.00	0.00	235.37	12.48
Rosemead	110.11	3.76	0.00	0.00	0.00	0.00	110.11	3.76
San Fernando	0.00	0.00	29.65	0.80	0.00	0.00	29.65	0.80
San Gabriel	80.40	3.32	0.00	0.00	0.00	0.00	80.40	3.32
San Marino	47.70	3.19	0.00	0.00	0.00	0.00	47.70	3.19
South El Monte	80.44	1.77	0.00	0.00	0.00	0.00	80.44	1.77
South Pasadena	6.47	0.64	0.00	0.00	0.00	0.00	33.09	2.10
Temple City	47.56	3.47	0.00	0.00	0.00	0.00	47.56	3.47
Uninc. LA County	97.90	6.52	5.64	0.15	37.57	1.46	451.31	22.77
Total	**1,051.58**	**49.48**	**599.87**	**16.33**	**225.83**	**7.06**	**6,097.87**	**210.84**

9.1.3 Unit Capital Costs by Parcel

The EWMP costs will have a significant impact on each jurisdiction. In determining the impact to each jurisdiction, it is possible to conduct a high-level calculation of dividing the capital costs by the number of parcels in the watershed. The estimate number of parcels in the ULAR EWMP area is 770,655. At a total capital cost of $6.1 billion (through 2037), the calculated unit capital cost is $7,913 per parcel. It should be noted that this is a very coarse metric. Parcels vary in size dramatically throughout the cities and the county, and ultimately costs will likely be developed relevant to parcel size, parcel imperviousness, and possibly other factors.

9.2 Existing Stormwater Program Costs and Funding Sources

Each jurisdiction in the ULAR EWMP area has existing recurring costs associated with stormwater activities. **Table 9-4** is a summary listing of existing costs and associated revenue source based on the results of a survey of Group members. It is assumed that the recurring costs will continue, and costs to implement the EWMP will be in addition to those costs. The Financial Strategy is focused on developing a set of funding sources to address the expected *additional* costs, and does not address funding requirements for *existing* stormwater programs.

Table 9-4. Existing Stormwater Program Costs for ULAR EWMP Group

Jurisdiction	Existing Utility (Yes/No)	Funding Source	Description of Costs	Total Costs ($)
Alhambra	No	General Fund	Management, O&M and Capital	~$980k/yr
Burbank	No	Various Funding Sources	Street Sweeping, Inspections, Connections, TMDLs, and O&M	~$3.8M/yr
Glendale	No	General and Enterprise Funds	Management, O&M and Capital	~$750k/yr
Los Angeles	Yes	Stormwater Fund	Management, Outreach, inspection, enforcement, monitoring	~$30M/yr (City Wide; not including Prop O)
Montebello	No	Water Fund	Management and Catch Basin	~$120k/yr
Monterey Park	No	General Fund/Grants	O&M, Street Sweeping and Trash Collection	~$5.3M/yr
South Pasadena	No	General Fund	Management, O&M and Capital	~$250k/yr
Temple City	No	General Fund	Management, O&M and Capital	~$90k/yr
Unincorporated LA County	No	Integrated Funding/Various Sources	Management, Outreach, inspection, enforcement, monitoring	~80M/yr (County wide)

1. The County has an ongoing collective budget of $10.1 million for 140 unincorporated areas. Additional funds for projects are allocated on an annual basis from the General Fund and other sources. In Fiscal Year 2015-16, the total allocation from the General Fund for stormwater management was $23 million. Additional funds from other sources, including the Gasoline Tax, Solid Waste Fund, Prop C, Prop A Local Return Funds, and Measure R, provide for ongoing MCM compliance activities.

9.3 Financial Strategy

The costs to implement the EWMP will require orders of magnitude increases in stormwater program funding. The capital and operating costs for EWMP control measures are large and will span decades. Expenditures for the EWMP Implementation Strategy will need to be coordinated with other regional efforts to improve habitat, promote greenways and increase access to the LA River and its tributaries. In order to garner community support for financing the costs, it will likely be necessary to quantify the multi-benefits of the LID, green streets and regional projects including improved aesthetics, increase recreational opportunity, water supply augmentation and climate change resiliency. The financial strategy to fund the LID, green streets, regional projects on public land, and regional projects on private land requires the utilization of multiple funding sources and may be supported by a coordinated, regional approach. Each jurisdiction will customize the suite of financial sources to the preferences of its community. As such, the financial strategy presented in this EWMP outlines multiple approaches to funding and allow each jurisdiction to consider and select the funding sources that best fit the specific preferences of the agency. These funding sources would be combined with existing funding sources such as general funds or fees to resource EWMP programs in the future. Additional activities to reduce the overall cost of EWMP implementation, including source control efforts (e.g., copper in brake pads and zinc in tires), are expected to be pursued at a regional level.

The financial strategy is a long term planning tool developed based on project needs identified for implementation over the next two decades. In consideration of the immediate needs and the potential for future adaptation of the EWMP, the financial strategy is focused on the identification and prioritization of funding sources that provide the best opportunities for project and program funding over the next five years. This planning horizon covers approaches to meet the first two TMDL milestones in 2017 and 2024. As with other aspects of the EWMP, the financial strategies will evolve and will be adaptively managed as funding needs and opportunities change.

9.3.1 Potential Funding Sources

The following are funding sources in addition to the general fund or existing program specific funds that can be examined for each jurisdiction or the entire EWMP Group. For each source, a brief description is included that describes the funding source, challenges, the potential or feasibility for securing funding under the source, and where possible, an estimate of the available funding from each source. Acknowledgement is given to *Stormwater Funding Options – Providing Sustainable Water Quality Funding in Los Angeles County,* a report authored by Ken Farfsing and Richard Watson dated May 21, 2014.

Clean Water State Revolving Fund

The Clean Water State Revolving Fund (CWSRF) is a potential funding source available to individual agencies that could be used to fund individual projects or groups of projects. The CWSRF can fund a variety of projects including stormwater measures to manage, reduce, treat, or recapture stormwater or subsurface drainage water; water conservation, efficiency, and reuse; and watershed pilot projects meeting criteria in CWA §122.

Financing terms include interest rates at ½ of the most recent General Obligation Bond Rate at the time of funding approval (1.6% in March 2015) with terms up to 30 years and there is no maximum funding limit. Typically, $200 - $300 million is available annually. However, the State Board estimates financing between $500 and $700 million in projects for FY 2015-16. Repayment begins one year after completion of construction.

One of the challenges in utilizing the CWSRF for project funding is the need to have existing funding streams to pay back the loans. However, if qualifying revenues are identified to cover the cost of the loans in the near term, longer term strategies (e.g., new fee programs) could be developed and implemented to provide the basis for the remainder of the loan.

Funds obtained under the CWSRF could be used for a variety of projects including LID, green streets, and regional projects. The legality of using CWSRF for property acquisition and funding of projects on private land needs further research. The CWSRF has high potential as a funding source in the near term (<5 years) as well as in longer term implementation.

The City of Los Angeles has begun discussions with CWSRF staff regarding the appropriate approach to submitting a request for funding. As part of preparing for the application for funding, the City of Los Angeles has developed a 5-year Capital Improvement Plan (CIP) that embodies the full range of projects required to comply with stormwater quality regulations and provide flood protection for the City's residents and rate payers. The projects address urban runoff that occurs in wet weather (stormwater) and dry weather (non-stormwater runoff). Overall, the projects in the CIP support a multi-benefit approach to improving stormwater quality while supporting the City's broader water resource initiatives to ensure that water supply benefits are being maximized while also providing flood protection.

Federal and State Grants

Federal and State Grant programs provide potential funding sources for individual agencies or groups of agencies and would typically be used to fund individual projects identified in the EWMP. Project eligibility is dependent on the grant program. For example, $200 million has been dedicated under the Proposition 1 Stormwater Grant Program that will be available for LID, greet streets, and regional projects. Additional grant funding available under Proposition 1 via other programs may also support EWMP projects such as urban creek restoration projects and IRWMP projects.

Challenges associated with grants include the matching requirements, which can be up to 50% of project costs under Proposition 1, and administration of the grants. Project readiness can be an issue, as many grant programs are focused on implementation of projects, with less money provided for planning needs. Grants are also competitive, with only $200 million available statewide under the Stormwater Grant Program. Given the intensive regulatory pressures on agencies across California, securing this type of funding could prove difficult. Lastly, grants are typically “one time” sources of funding for construction and would not include operations and maintenance costs.

Funds obtained through grant programs could be useful in design and construction of LID, green streets, and regional projects. Grants may contain restrictions on use for private property acquisition and it may not be possible to fund projects on private property. While grant programs may be an excellent source of funding for some key projects (rather than overall program implementation), due to the associated challenges, limited funding availability, and sustainability issues, the potential for grants to provide significant support to EWMP needs is minimal in comparison to the overall EWMP costs in the near and longer terms.

Traditional Fee Based Programs

Traditional fee based programs include modification of existing or establishment of new fee based programs that are familiar to government agencies, including service related fees, property based fees, and special assessment districts. These types of programs have typically been institutionalized in other capacities within local government. Examples of service related fees that could be used to fund portions of stormwater programs include establishment of, or increases to, fees associated with new and redevelopment, drainage or other environmental impacts, solid waste, water conservation, inspections, or storm drain/BMP maintenance. Property based fees include regular fees associated with land ownership (e.g., stormwater parcel tax) and may be calculated based on factors such as parcel size, impervious surface, land use, water use, or some combination. Special assessment districts would be focused on specific projects or program implementation areas (e.g., Watershed Management Areas) and could be implemented on tax rolls as a secure funding stream for a discrete area (e.g., the land area draining to a retention basin). An example could be the use of Enhanced Infrastructure Finance Districts tailored to the Watershed Management Group, as outlined in recently adopted (2014) California legislation SB628. Another example, could be the formation of a Joint Powers Authority (JPA). The City of Los Angeles has conducted a preliminary scoping to assess the efforts that may be needed to evaluate the feasibility of creating new regional funding sources cooperatively implemented via a JPA as a potential approach to focus revenue generation and utilization on a more targeted basis.

These types of funding sources would typically be pursued within individual agencies, potentially streamlining approval processes and governance. Funding from these types of programs would typically cover project and program costs within individual agencies and revenues would be commensurate with program responsibilities and agency size. Additional funding could be in the tens of millions of dollars annually, depending on the program and the size of the agency.

There are clear challenges to implementation of these programs and individual agencies will have to work with legal counsel to determine the most feasible, appropriate, and beneficial to their respective programs. The most challenging hurdle may be Proposition 218, which requires public approval through a formal ballot initiative for the establishment of new or increases to existing fees associated with stormwater. However, new legislation such as AB2403 may successfully modify the legislative definition of water to include stormwater which could reduce or eliminate the need for a ballot measure to implement stormwater fees. This and other efforts to reform Proposition 218 to include stormwater as a utility may reduce these challenges in the future.

Considering the current Proposition 218 challenges, these funding sources appear to be viable in the longer term, with each source having a high long term potential. However, even in the near term, many agencies may be able to successfully navigate legal constraints, with greater potential for success lying within internal fee based programs. Although perhaps more challenging, property based fees and special assessment districts would have a moderate potential for success in the near term.

Innovative Regional Funding Sources

Several potential funding sources could be considered through regional or watershed based collaboration between agencies. These funding sources include water quality trading programs, public private partnerships, monetizing rain water, sales tax measures, and environmental impact fees. The sources could generate longer term revenue streams for programs and projects.

Water Quality Trading **-** Water quality trading (WQT) has the potential to provide benefits to the public and private sectors by creating opportunities to fund costly structural projects more efficiently and at lower costs. The program could fund regional BMPs on public and private property, depending on the design of the program. The concept is founded upon the difference in feasibility and costs to construct BMPs depending on site constraints, with some projects being more challenging (i.e., technically infeasible, cost prohibitive) than others.

The availability of funds is subject to market conditions related to supply and demand. As development/redevelopment rebounds, particularly infill development in dense areas of the watershed, the demand for offsite options, in lieu fee programs, and/or water quality credits could increase. In order for the program to be feasible, the need would be balanced by an availability of local projects that would serve as offsite compliance measures, either from private developers or from municipal agencies (e.g., EWMP projects).

While the concept of water quality trading is not new and several successful programs have been established across the United States, there are relatively few water quality trading programs that are actively trading water quality credits. Lessons learned and considerations from other programs include substantial up front program development costs related to technical support and stakeholder outreach; significant transaction costs associated with connecting buyer and seller are mostly driven by uncertainty; and ongoing internal administrative and resource demands can be burdensome. However, if the program were developed regionally, some of these challenges may be reduced through economies of scale.

Due to the significant technical, administrative, and legal undertakings to establish a WQT program, it could be a viable source for funding regional projects, but would likely not be able to contribute significantly to funding needs in the near term. Such a program appears to be more feasible in the long term.

Public Private Partnerships – Public-private partnerships (P3s) are contractual agreements between the public and private sectors that could allow for greater private sector participation in the financing, construction, and operation of watershed projects. While the concept is relatively new to the watershed management sector, P3s are active in other disciplines, supporting transportation, water, and wastewater infrastructure projects, health care, building construction, power, parks and recreation, and technology. P3s may be a potential funding source for green streets projects, regional projects, and projects on private property.

P3 projects can provide the agency the ability to combine existing sources of revenue with new financing resources such as private commercial debt, increasing the ability of the agency to fund much needed projects, while reducing the burden on local resources. Benefits of P3s can include expedited completion of projects, cost savings, improved quality and system performance, use of private resources and personnel, and access to new sources of private capital. P3s also allow an agency to better manage risk associated with the project(s) by placing more responsibility onto the private sector partner. In this context, there may be the potential for the private sector to somewhat offset regulatory risk.

P3s represent a largely unexplored resource within the stormwater sector and have the potential to provide financing for projects and programs. Anticipated challenges include initial development of programs, identification and mitigation of institutional constraints, availability of investors with the expertise in the field, identification of opportunities, and understanding legal implications. Additionally, where projects do not produce revenue (i.e., those without long term funding sources such as fee programs), investors will likely be less interested. Considering the challenges and relative infancy of P3 funding within California, P3s may have more potential as a funding mechanism in the long term rather than in the near future.

Monetizing Rain Water – The concept of monetizing rain water as a funding source is relatively new and would consist of capturing rain water and selling it at or below water wholesale prices. The rain water could be captured, stored, and conveyed to augment local water use or captured and infiltrated to augment water supply. Revenues could potentially be realized through the sale of the water to end users or to local water agencies. If viable, this source of revenue would most likely be linked to larger, regional projects with significant capacity to capture large volumes of water. For example, agencies could work with the Metropolitan Water Metropolitan Water District (MWD) of Southern California to reevaluate their approach for managing the Local Resource Program (LRP) to fund stormwater capture and use projects that offset the use of imported water supplies.

The availability of funding would be dependent on infrastructure to capture rainwater, the amount of rain in a given time period, and the ability to ensure the availability and usability of the resource (e.g., conveyance systems, infiltration feasibility, aquifer availability), each of which presents challenges. Given the current drought conditions in California, water rights issues would also be a likely hurdle.

With the relatively recent introduction of the concept, potential revenue projections are not available. However, under the right conditions, there may be opportunities in the future for project costs to be buffered after construction, lending this source to a potential way to sustain operation and maintenance costs for EWMP projects. Considering the challenges and potential legal issues with monetizing rain water, its utility as a funding source in the near term is limited, but may be moderately feasible in the long term.

Regional Sales Tax Measures, Environmental Impact Fees **–** Increases in sales tax or the imposition of environmental impact fees have the potential to provide significant levels of funding to local programs. Sales tax measures could fund LID, greens streets, and regional BMPs, whereas environmental impact fees may be more limited to larger projects (e.g., green streets, regional BMPs).

Sales tax measures could be implemented by jurisdiction or regionally, but would likely need extensive outreach to gain voter approval. Environmental impact fees associated with products that contribute to water quality issues would likely originate at the state level. Examples of products include residential pesticides contributing to aquatic toxicity or automobile tires contributing to heavy metals. Either funding source would potentially take years to move forward through the legislative processes. While these sources are viable solutions and have the potential to provide funding in the millions of dollars annually, the legislative process makes them more feasible as long term solutions.

9.3.2 Applicability and Prioritization

Based on available funds, the near and long term potential or feasibility of the funding sources, and on the applicability of the funding sources to the types of BMPs identified in the EWMP, the preferred funding sources can generally be prioritized for each BMP type. The funding sources for each BMP type are ranked in general order of preference in Tables 9-5 through Table 9-9. The funding sources, associated BMPs, near/long term feasibility (less or greater than five years, respectively, to establish the funding source), and ranges of potential funding available are summarized in Table 9-9. The ranges of potential funding available are broad estimates for the watershed on an annual basis once a funding source is fully implemented and will vary depending on the approach and methods of implementation, scale/service area, legal constraints, and public/political acceptance.

Table 9-5 Low Impact Development Projects Funding Sources Prioritization

Funding Source	Estimate of Potential Annual Available Funding in the Watershed	Scope/ Scale		Potential/ Feasibility	
		Project	Program	Near Term (<5 years)	Long Term (>5 years)
Clean Water State Revolving Fund[1]	$$$$	●	●	High	High
Service Related Fees[1]	$-$$		●	High	High
Federal/ State Grants[1]	$	●		Moderate	Moderate
Sales Tax Measure[1]	$-$$		●	Low	Moderate

1. Subject to local, state, and federal restrictions on use of funds. May not be eligible for property acquisition.

Available Funding Key:
$ = $1-5M
$$ = $5-25M
$$$ = $25-100M
$$$$ = >$100M

Table 9-6 Green Streets Projects Funding Sources Prioritization

Funding Source	Estimate of Potential Annual Available Funding in the Watershed	Scope/ Scale		Potential/ Feasibility	
		Project	Program	Near Term (<5 years)	Long Term (>5 years)
Clean Water State Revolving Fund[1]	$$$$	●	●	High	High
Service Related Fees[1]	$-$$		●	High	High
Federal/ State Grants[1]	$	●		Moderate	Moderate
Property Based Fees[1]	$$-$$$		●	Moderate	High
Special Assessment Districts[1]	$$-$$$	●	●	Moderate	High
Public Private Partnerships	$	●	●	Low	Moderate
Sales Tax Measure[1]	$-$$		●	Low	Moderate
Environmental Impact Fees[1]	$-$$		●	Low	Moderate

1. Subject to local, state, and federal restrictions on use of funds. May not be eligible for property acquisition.

Available Funding Key:
$ = $1-5M
$$ = $5-25M
$$$ = $25-100M
$$$$ = >$100M

Table 9-7 Regional Projects Funding Sources Prioritization

Funding Source	Estimate of Potential Annual Available Funding in the Watershed	Scope/ Scale		Potential/ Feasibility	
		Project	Program	Near Term (<5 years)	Long Term (>5 years)
Clean Water State Revolving Fund[1]	$$$$	●	●	High	High
Federal/ State Grants[1]	$	●		Moderate	Moderate
Property Based Fees[1]	$$-$$$		●	Moderate	High
Special Assessment Districts[1]	$$-$$$	●	●	Moderate	High
Water Quality Trading	$-$$	●	●	Low	Moderate
Public Private Partnerships	$	●	●	Low	Moderate
Monetizing Rain Water	$$		●	Low	Moderate
Sales Tax Measure[1]	$-$$		●	Low	Moderate
Environmental Impact Fees[1]	$-$$		●	Low	Moderate

1. Subject to local, state, and federal restrictions on use of funds. May not be eligible for property acquisition.

Available Funding Key:
$ = $1-5M
$$ = $5-25M
$$$ = $25-100M
$$$$ = >$100M

Table 9-8 Projects on Private Property Funding Sources Prioritization

Funding Source	Estimate of Potential Annual Available Funding in the Watershed	Scope/ Scale		Potential/ Feasibility	
		Project	Program	Near Term (<5 years)	Long Term (>5 years)
Clean Water State Revolving Fund[1]	$$$$	●	●	High	High
Service Related Fees[1]	$-$$		●	High	High
Federal/ State Grants[1]	$	●		Moderate	Moderate
Property Based Fees[1]	$$-$$$		●	Moderate	High
Special Assessment Districts[1]	$$-$$$	●	●	Moderate	High
Water Quality Trading	$-$$	●	●	Low	Moderate
Public Private Partnerships	$	●	●	Low	Moderate
Sales Tax Measure[1]	$-$$		●	Low	Moderate
Environmental Impact Fees[1]	$-$$		●	Low	Moderate

1. Subject to local, state, and federal restrictions on use of funds. May not be eligible for property acquisition.

Available Funding Key:
$ = $1-5M
$$ = $5-25M
$$$ = $25-100M
$$$$ = >$100M

Table 9-9 Funding Sources Summary

Funding Source	Estimate of Potential Annual Available Funding in the Watershed	Scope/ Scale		Potential/ Feasibility	
		Project	Program	Near Term (<5 years)	Long Term (>5 years)
Clean Water State Revolving Fund[1]	$$$$	●	●	High	High
Federal/ State Grants[1]	$	●		Moderate	Moderate
Service Related Fees[1]	$-$$		●	High	High
Property Based Fees[1]	$$-$$$		●	Moderate	High
Special Assessment Districts[1]	$$-$$$	●	●	Moderate	High
Water Quality Trading	$-$$	●	●	Low	Moderate
Public Private Partnerships	$	●	●	Low	Moderate
Monetizing Rain Water	$$		●	Low	Moderate
Sales Tax Measure[1]	$-$$		●	Low	Moderate
Environmental Impact Fees[1]	$-$$		●	Low	Moderate

1. Subject to local, state, and federal restrictions on use of funds. May not be eligible for property acquisition.

Available Funding Key:
$ = $1-5M
$$ = $5-25M
$$$ = $25-100M
$$$$ = >$100M

The above tables represent a general prioritization of the identified funding sources available to the Permittees and will be used as a general guide for individual agencies to support their needs with respect to the EWMP projects. The agencies will consider the types of projects and programs they need to develop, the amount of funding needed, and the various factors presented above to develop their individual selection and prioritization of funding sources specific to their agency.

9.3.3 Signature Projects

Eight signature projects are identified in Section 4.5. All signature projects are regional BMPs with subsurface retention and infiltration as the primary retention and treatment mechanism. Treatment areas for these projects range from approximately 50 acres to 5,100 acres. All projects are "very high" priorities for implementation, indicating that they are sited on publicly owned parcels and are the highest priority for implementation. Signature projects identified in the ULAR watershed, preliminary cost estimates, and responsible agencies are described in Section 4.5. Although funding for design and construction has not been identified for all signature projects, agencies are pursuing various funding sources. The process for securing the funding includes several steps:

- An evaluation of the agency specific funding need for each project;
- A prioritization of funding sources depending on the needs; and
- Pursuing the selected funding source(s).

Consistent with prioritized funding sources for regional projects, (Table 9-7), preferred funding sources for these projects include the loans through the CWSRF, Federal and/or State Grants, property based fees, and/or special assessment districts. The process for obtaining funds through the CWSRF is:

1. Agency submits an application for financial assistance to the State Water Board using the Financial Assistance Application Submittal Tool (FAAST) system. The initial application consists of general, financial, technical, and environmental components.

2. Upon receipt of a complete application, the State Division of Financial Assistance (DFA) reviews the application for project scope, budget, and timeline, and if acceptable, adds the project to the project list.

3. Once the application review is complete, DFA prepares an initial Financial Assistance Agreement based on estimated construction costs. At this stage, soft costs, including those incurred prior to the agreement are eligible for re-imbursement.

4. The Agency submits the Budget Approval package once the project has been bid and construction costs ized.

5. The initial Financial Assistance Agreement is then updated with the construction costs and executed. Upon execution, construction costs are eligible for re-imbursement.

6. Based on the Budget Approval package, a construction completion date is established, which sets the initial date for repayment, one year from the construction completion date. Upon project completion, the agency would submit a project report.

The process to obtain Federal and State Grant Funds is similar. Projects that have completed preliminary design are more likely to receive funding for construction. In the near term, agencies are anticipating Round 1 solicitation for Proposition 1 stormwater grant funds in the spring of 2016 and are currently preparing preliminary project designs. In order to be eligible, the approved EWMP will have to meet the Stormwater Resource Plan guidelines adopted by the State Board (anticipated in December 2015) and will have to be incorporated into the IRWMP. Where this integration has occurred, projects may be eligible for funding under the Proposition 1 Stormwater Grant Program. Upon solicitation, project applications detailing project design, environmental needs, multiple benefits, and agency matching funds will be completed through the FAAST system. Upon award, applicants will enter into funding agreements with the State Board and typically have three years to construct the projects.

Property based fees and special assessment districts will take considerably more effort to implement. Agencies are currently investigating the potential for property based fees and special assessment districts on a regional scale, but are currently subject to Proposition 218 restrictions. As legislation progresses to ease the Proposition 218 restrictions, agencies may be able to implement these types of funding sources through internal process such as ordinance modifications and approval by their governing body. Until then, these types of funding sources will require explicit public concurrence.

9.3.4 Potential Future Steps

The financial strategy discussed herein outlines an approach to utilize multiple options for funding individual projects and the overall EWMP program. Potential future steps to support execution of the financial strategy include:

- Development of public support for executing the financial strategy through outreach efforts. The outreach efforts would build on the recommendations in the Stormwater Funding Options Report (Farfsing, Watson, 2014) which include:
    - Improvement of existing public education and outreach programs to make a more direct connection with residents, the business community, and others regarding stormwater program requirements and funding issues.
    - Outreach to the public, school districts, state, and federal officials.
    - Communication with the governor and legislature on the need for additional funding opportunities to address stormwater issues.
    - Outreach to the area's Congressional delegation to provide education on stormwater and urban runoff issues; consistent and coordinated action in requesting federal funding assistance.
    - Encourage the incorporation of the best science into the Basin Plan.
    - Active participation in the design of future bond programs to ensure additional funding is provided for stormwater and urban runoff programs.
- Creation of inter-jurisdiction EWMP financial working group. Local agencies will reconvene the City Managers Work Group in early 2016 to continue to develop viable funding alternatives for stormwater programs and projects. The group serves at the direction of the City Managers Committees of the California Contract Cities Association and the League of California Cities, Los Angeles County division. Future efforts will be an outgrowth of the recommendations in the Stormwater Funding Options Report (Farfsing, Watson, 2014).

- Development of a financial plan which could include the following components: implementation of a new fee or charge, establishment of a new enterprise fund, cash and debt financing, operating and capital reserves, and cash flow modeling. As described above, the City Managers Work Group will reconvene in 2016 and will be further developing funding options and outlining steps to support implementation. The group will be working to address recommendations related to legislation (e.g., the use of state facilities, capture and use, source control, establishment of special assessment districts), developing a regional stormwater quality fee, and implementing local funding options. Next steps at each level – legislation, reginal stormwater quality, and local funding – will explore the necessary actions to implement new fees or charges, establish new enterprise funds, and options for cash and debt financing.

Section 10
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