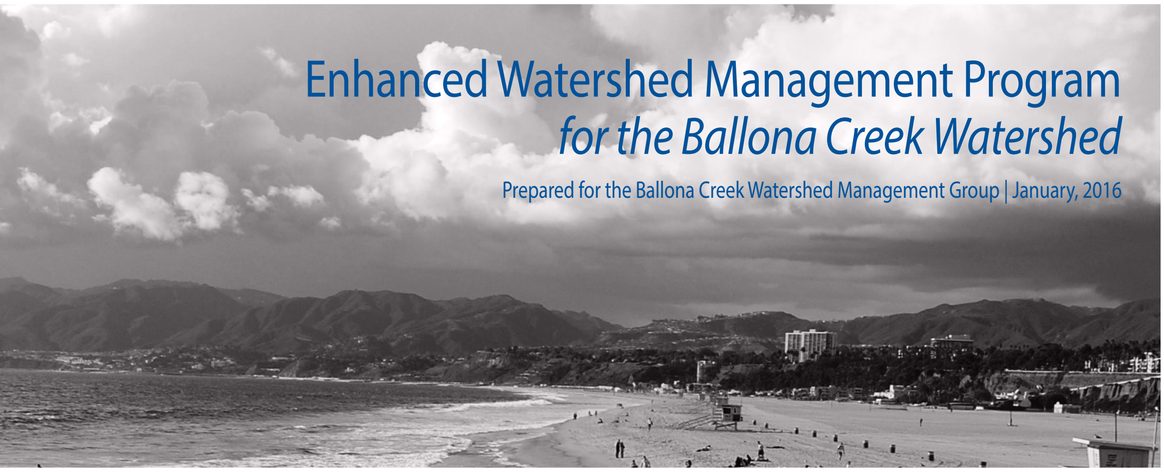
Enhanced Watershed Management Program
for the Ballona Creek Watershed

Prepared for the Ballona Creek Watershed Management Group | January, 2016



ACKNOWLEDGMENT

The Ballona Creek Enhanced Watershed Management Program (BC EWMP) was developed under the leadership and guidance of the agencies that form the Ballona Creek Watershed Management Group (BCWMG). The management and staff at each of the BCWMG members worked in close collaboration with the consultant team in developing this EWMP Plan. Additionally, three stakeholder workshops were held, as well as a series of one-on-one meetings with stakeholders. The BCWMG would like to thank everyone that participated in the process and provided their input and suggestions. It informed and shaped this EWMP plan. This EWMP plan provides a blueprint for how to best manage urban runoff to provide for cleaner watersheds through regional collaboration. Not only will implementation of the EWMP reduce pollutants in the watershed, it will improve our communities, enhance aesthetics and property values, increase recreational opportunities, augment water supplies, and provide for climate change resiliency.

Ballona Creek Watershed Management Group

PROJECT TEAM

City of Los Angeles | County of Los Angeles and Los Angeles County Flood Control District | City of Beverly Hills | City of Culver City | City of Inglewood City of West Hollywood | City of Santa Monica

CONSULTANT TEAM

Black & Veatch | CDM Smith | CH2M HILL
Larry Walker Associates | Paradigm Environmental
Tetra Tech, Inc.

Photo Credits: Credits are listed from left to right, top to bottom.

- Cover: Andrew Basmajian, City of Santa Monica, Office of Sustainability & the Environment; City of West Hollywood; Jose Lozano, LA Sanitation, City of Los Angeles; City of Los Angeles; County of Los Angeles; City of West Hollywood; Susie Santilena; City of Beverly Hills; Jose Lozano, LA Sanitation, City of Los Angeles; Friends of Ballona Wetlands; CDM Smith; City of Los Angeles; Jose Lozano, LA Sanitation, City of Los Angeles; CDM Smith
- Acknowledgement page: Jose Lozano, LA Sanitation, City of LA
- This page: CDM Smith

Table of Contents

List of Figures

List of Tables

Appendices

This page intentionally left blank.

Acronyms and Abbreviations

µg/L	micrograms per liter
ASCE	American Society of Civil Engineers
BCWMA	Ballona Creek Watershed Management Area
BC EWMP Group	Ballona Creek Watershed Management Group
BMPs	Best Management Practices
CASQA	California Stormwater Quality Association
CDFW	California Department of Fish and Wildlife
CIMP	Coordinated Integrated Monitoring Program
CPT	Cone penetrometer testing
CTR	California Toxics Rule
CWA	Clean Water Act
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
E. coli	*Escherichia coli*
EWMP	Enhanced Watershed Management Program
GIS	geographic information system
HFS	High Flow Suspension
IC/ID	Illicit Connection and Illicit Discharges
in/hr	inches per hour
IRWMP	Integrated Regional Watershed Management Plan
LACDPW	Los Angeles County Department of Publics Works
LACFCD	Los Angeles County Flood Control District
LID	Low Impact Development
LSPC	Loading Simulation Program C++
MCMs	minimum control measures
mL	milliliter
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
NA	not applicable
NGO	non-governmental organization
NOI	Notice of Intent
NOTF	North Outfall Treatment Facility
NPDES	National Pollutant Discharge Elimination System
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls

Acronyms and Abbreviations

RAA	Reasonable Assurance Analysis
Regional Board	Regional Water Quality Control Board, Los Angeles
RWLs	Receiving Water Limitations
SMB	Santa Monica Bay
SUSMP	Standard Urban Stormwater Mitigation Plan
SUSTAIN	System for Urban Stormwater Treatment and Analysis Integration
TBD	To be determined
TMDL	Total Maximum Daily Load
TMDLIP	Total Maximum Daily Load Implementation Plan
USEPA	US Environmental Protection Agency
WERF	Water Environment Research Federation
WLA	Wasteload Allocation
WMA	Watershed Management Area
WMMS	Watershed Management Modeling System
WQO	Water Quality Objectives
WQBELs	Water-Quality Based Effluent Limits

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 the development of Enhanced Watershed Management Program (EWMP) Plans. Through a collaborative approach, an EWMP for the Ballona Creek (BC) Watershed Management Area (WMA) was developed by the Ballona Creek Watershed Management Group (BC EWMP Group). The BC EWMP Group is comprised of the cities of Los Angeles (lead coordinating agency), Beverly Hills, Culver City, Inglewood, Santa Monica, West Hollywood, and the Unincorporated County of Los Angeles and the Los Angeles County Flood Control District (LACFCD). By electing to comply with the optional compliance pathway in the MS4 Permit, the BC EWMP Group has leveraged this EWMP to facilitate a robust, comprehensive stormwater management approach for the Ballona Creek watershed and to address the priority water quality conditions in the WMA.

The Ballona Creek Watershed is an important watershed in southern California. The land use is dense and heavily urbanized. The Ballona Creek 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.

Controlling pollutants in stormwater is a major challenge for the Group Members, but state and federal regulations applicable to the watershed establish clear compliance timelines to address water quality issues. For example, the Ballona Creek Watershed is subject to a Total Maximum Daily Load (TMDL) for metals that requires compliance by 2021 and a bacteria TMDL that also requires compliance by 2021. These TMDLs also include milestones that require water quality improvements in the near-term. High levels of metals can negatively impact aquatic life (e.g., fish) in the rivers, creek and estuary; elevated bacterial concentrations can pose a potential health risk to people that recreate in the watershed. To comply with the Permit and to address the water quality issues in a comprehensive quantitative manner, this EWMP plan has been prepared.

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 (Figure ES-1):

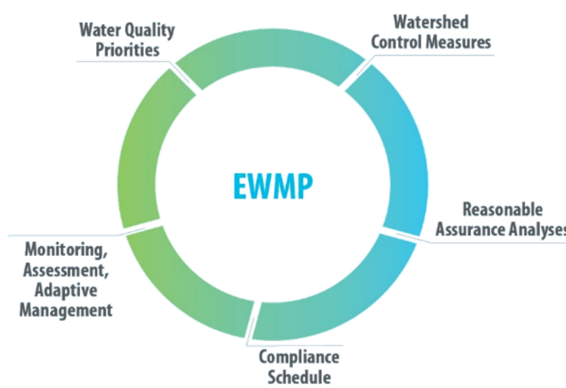


Figure ES-1 EWMP Elements

ES.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 55,000 data records of water quality monitoring 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 ten 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** are 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 (e.g., interim and final numeric limits) and other representative Los Angeles Regional Water Quality Control Board (Regional Board) adopted TMDLs. The scheduling of low impact development (LID), green streets and regional BMP implementation for the EWMP is based on the milestones of the applicable metals and bacteria TMDLs, as follows:

- Achieve a 50 percent milestone for the Ballona Creek Metals TMDL by 2016;
- Achieve final compliance (100 percent milestone) for the Ballona Creek Metals TMDL by 2021; and
- Achieve final compliance for the Ballona Creek Bacteria TMDL by 2021.

During EWMP implementation, special studies could be completed to revise the water quality objectives to be more reflective of conditions in Ballona Creek watershed (e.g., a water effects ratio could be used to develop site-specific objectives for zinc, which could reduce the required reductions and have a major effect of the EWMP control measures).

ES.2 Watershed Control Measures

The Permit requires identification of Watershed Control Measures, which are BMPs that will be implemented through the EWMP, individually or collectively, at watershed-scale to address the Water Quality Priorities. Section 4 of the EWMP describes the regional (Signature) projects and Section 5 of the EWMP describes the distributed BMPs. The total network of LID, green streets and regional BMPs in the EWMP Implementation Strategy represents over eight Rose Bowls of BMP capacity. For EWMP development it was important to establish nomenclature/definitions of the various control measures. The following categories of distributed and regional approaches control measures make up the EWMP Implementation Strategy.

The three main categories of structural BMPs can be further categorized as LID, green streets, and regional projects:

Low-Impact Development: these are distributed structural practices that capture, infiltrate, store and use, and/or treat runoff at the parcel (normally less than 10 tributary acres (Figure ES-2). 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 non-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.

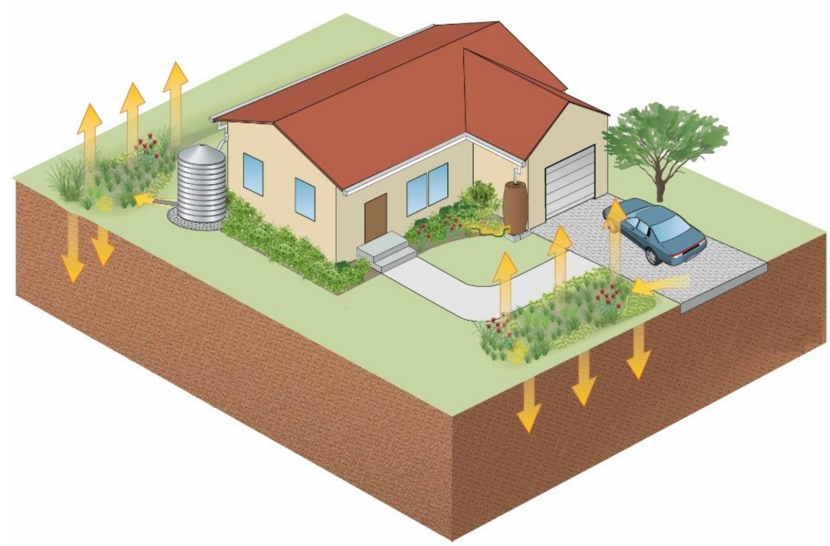


Figure ES-2 Conceptual Schematic of LID Implemented on a Parcel (arrows indicate water pathways)

Green Streets: these are distributed structural practices that are typically implemented as linear bioretention/biofiltration practices installed parallel to roadways (discussed in Section 5). 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 (Figure ES-3). Permeable pavement can also be implemented in tandem, or as a standalone practice, in parking lanes of roads. As shown in Figure ES-4, a high percentage of streets are planned for green street retrofits for the EWMP Implementation Strategy. Green

Figure ES-3 Conceptual Schematic of a Green Street (arrows indicate water pathways) 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.

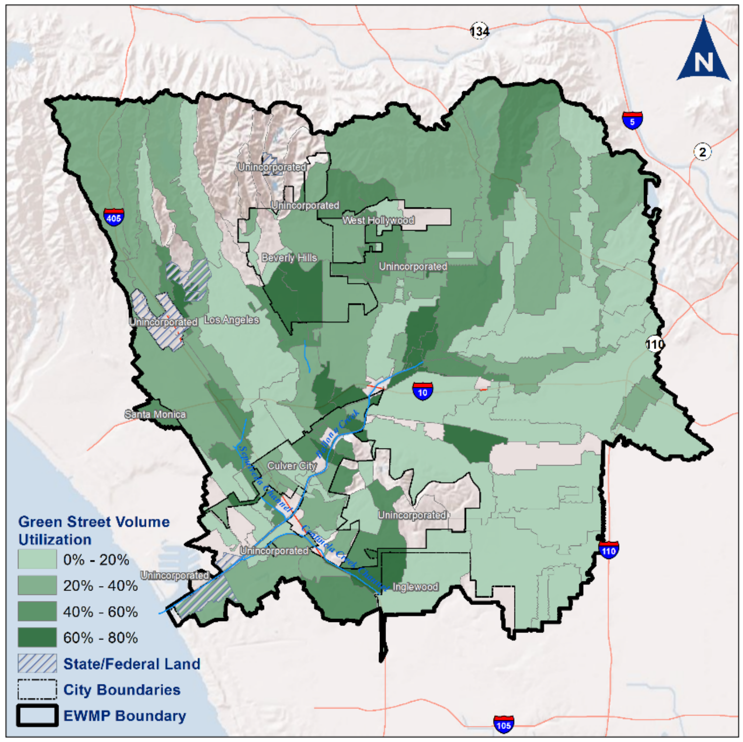


Figure ES-4 Planned Percent of Streets for Green Street Retrofit in Ballona Creek Watershed

Regional Projects: Regional projects are centralized facilities located near the downstream ends of large drainage areas, typically treating tens to hundreds of acres. Regional projects are designed to receive large volumes of runoff from extensive upstream areas and can provide a cost-effective mechanism for infiltration and pollutant reduction (Figure ES-5). 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 BC EWMP includes over 68 regional BMPs, including 10 signature, multi-benefit regional projects (Figure ES-6). Of these 10, 4 regional projects will retain the stormwater volume from the 85th percentile, 24-hour storm. The EWMP also includes regional projects on private land to assure pollutant reductions are achieved.

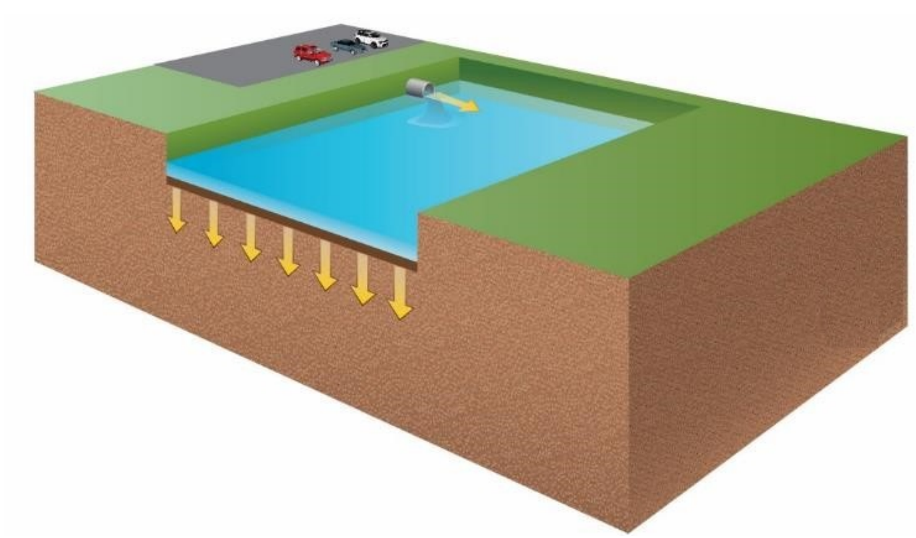


Figure ES-5 Conceptual Schematic of a Regional Project (arrows indicate water pathways)

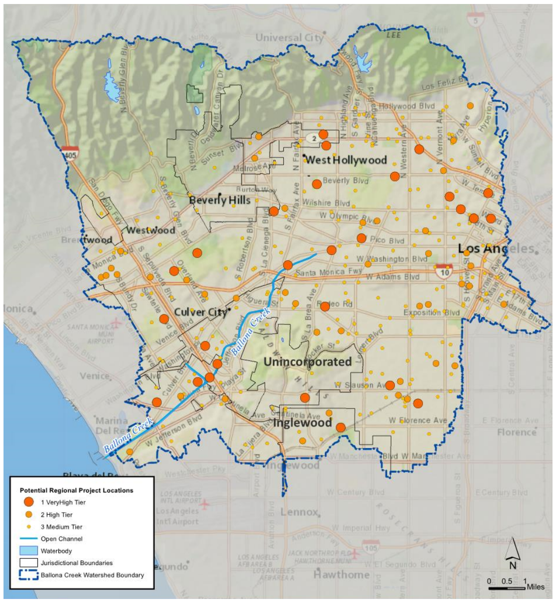


Figure ES-6 Potential Locations for Regional Projects in Ballona Creek Watershed

ES.3 Reasonable Assurance Analysis

A key element of the 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 BC EWMP. WMMS is specified in the 2012 MS4 Permit as an approved tool to conduct the RAA. The Los Angeles County Flood Control District, through a joint effort with U.S. Environmental Protection Agency (USEPA), developed WMMS specifically to support informed decisions for managing stormwater. The RAA modeling system incorporates three primary tools:

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 several potential scenarios and optimizing/selecting control measures based on cost-effectiveness (also within SUSTAIN).

The EWMP includes demonstrations that the RAA modeling system is able to accurately predict flows and pollutant concentration in the Ballona Creek Watershed. The RAA was developed based on complying with the applicable criteria for “limiting pollutants” during 90th percentile conditions. Limiting pollutants are the pollutants that drive BMP capacity (e.g., control measures that address the limiting pollutant will also address other pollutants). The limiting pollutants for the Ballona Creek Watershed are as follows:

- Wet weather – zinc and *Escherichia coli* (*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 pollutants, and thus control of zinc and *E. coli* has assurance of addressing the other BC wet weather Water Quality Priorities. The RAA for BC 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 limits (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 in the Bacterial Source Identification Study along the Los Angeles River (CREST, 2008). Among the Water Quality Priority 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 was used to consider millions of BMP scenarios and the EWMP Implementation Strategy was selected based on the most cost-effective scenarios, while also incorporating preferences of the EWMP Group.

ES.4 Detailed EWMP Implementation Strategy and Compliance Schedule

The EWMP Implementation Strategy (presented in Section 7 of the EWMP) 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 eight jurisdictions and each watershed/assessment area – Ballona Creek, Centinela Creek, and Sepulveda Channel – a total of 180 subwatersheds (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.

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 EWMP Implementation Strategy identifies the location and type of control measures for each jurisdiction for final compliance by 2021, which includes addressing all Water Quality Priorities including the limiting pollutants zinc and *E. coli*. Implementation of the LID, green streets and regional projects to address the Water Quality Priorities will result in a network of control measures that has the equivalent capacity of over eight Rose Bowl stadiums. As shown in Figure ES-7, for the set of BMP to be implemented across the entire BC EWMP area by 2021, regional projects on public land make up 18 percent of the total control measure capacity. LID and green streets each make up 13 percent and 17 percent, respectively. Regional BMPs on private land make up over half the capacity, due to limited public space for constructing control measures. Over time, if additional public opportunities are identified, the portion of the Implementation Strategy that is the regional BMPs on private land could be reduced.

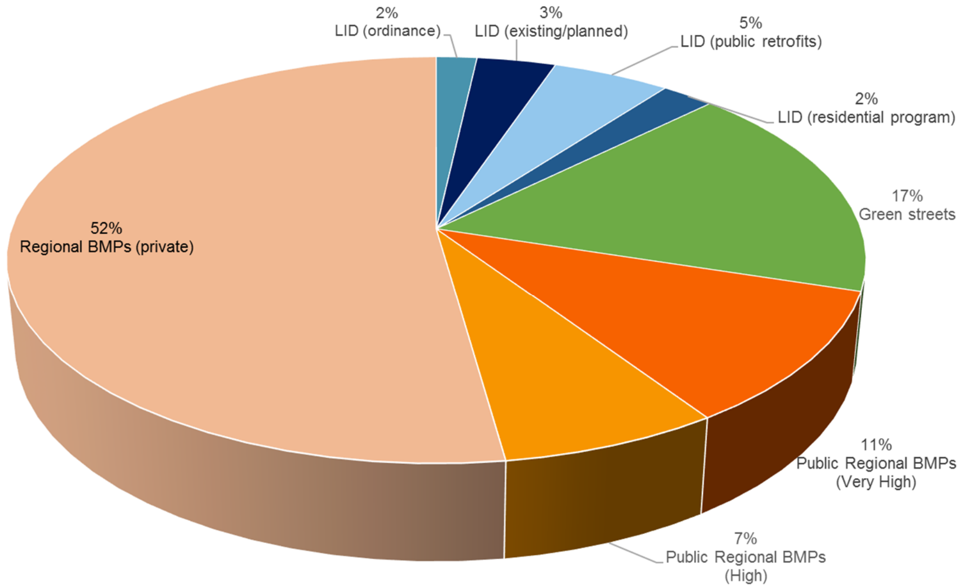


Figure ES-7 BMPs Planned for Ballona Creek Watershed[1]

The EWMP Implementation Strategy is ultimately a recipe for compliance for each jurisdiction and subwatershed in the EWMP area. A total of 180 subwatersheds (Figure ES-8) are provided a specific set of LID, green streets 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 EWMP 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 2021 (the final compliance date for addressing metals and bacteria) is shown in Figure ES-9. The strategy varies by jurisdiction depending on the pollutant reduction requirements and BMP

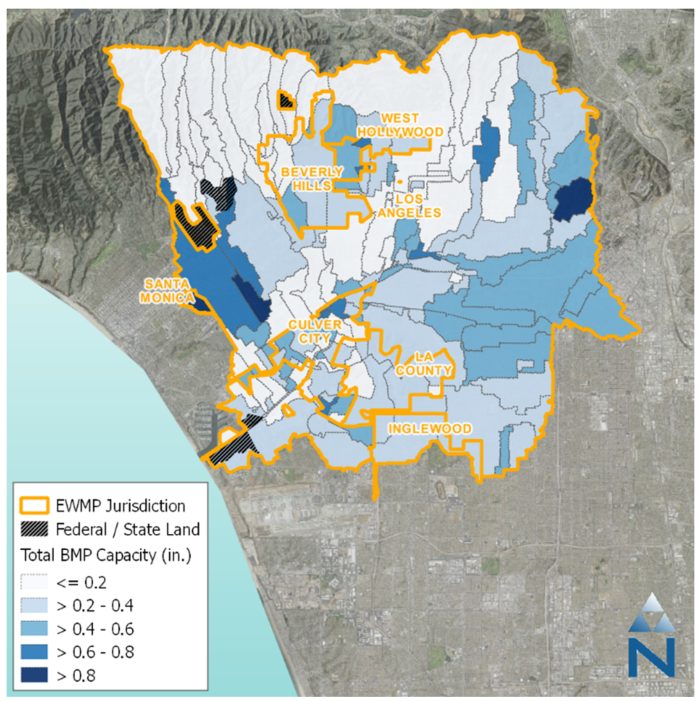


Figure ES-8 BMP Density in Ballona Creek Watershed by Subwatersheds

[1] Medium projects are not depicted separately but may be included during adaptive management and implemented as an alternative to Regional Private Projects with potential for cost savings.

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

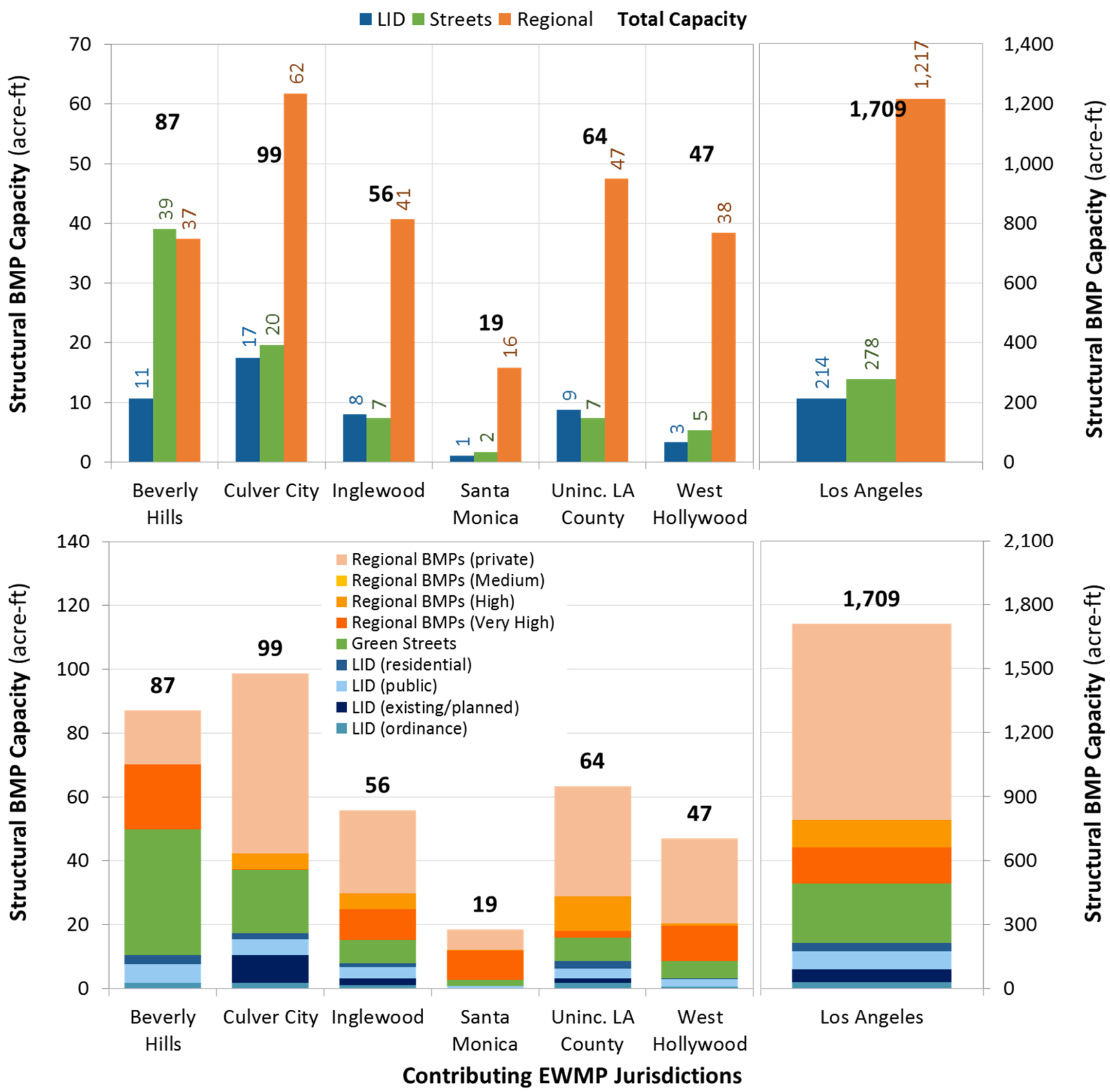


Figure ES-9 BMP Capacity in Ballona Creek Watershed by EWMP Jurisdictions[2]

The network of LID, green streets and regional BMPs in the EWMP Implementation Strategy is extensive and its implementation would represent a change in how stormwater will be managed in the Ballona Creek Watershed.

The pace of implementation for the EWMP Implementation Strategy is rapid due to the compliance dates specified in the metals and bacteria TMDLs. Because the pace of implementation is directly

[2] Medium projects are not depicted separately but may be included during adaptive management and implemented as an alternative to Regional Private Projects with potential for cost savings.

proportional to required internal and financial resources, the additional required resources to implement the EWMP will be significant, as presented in Figure ES-10.

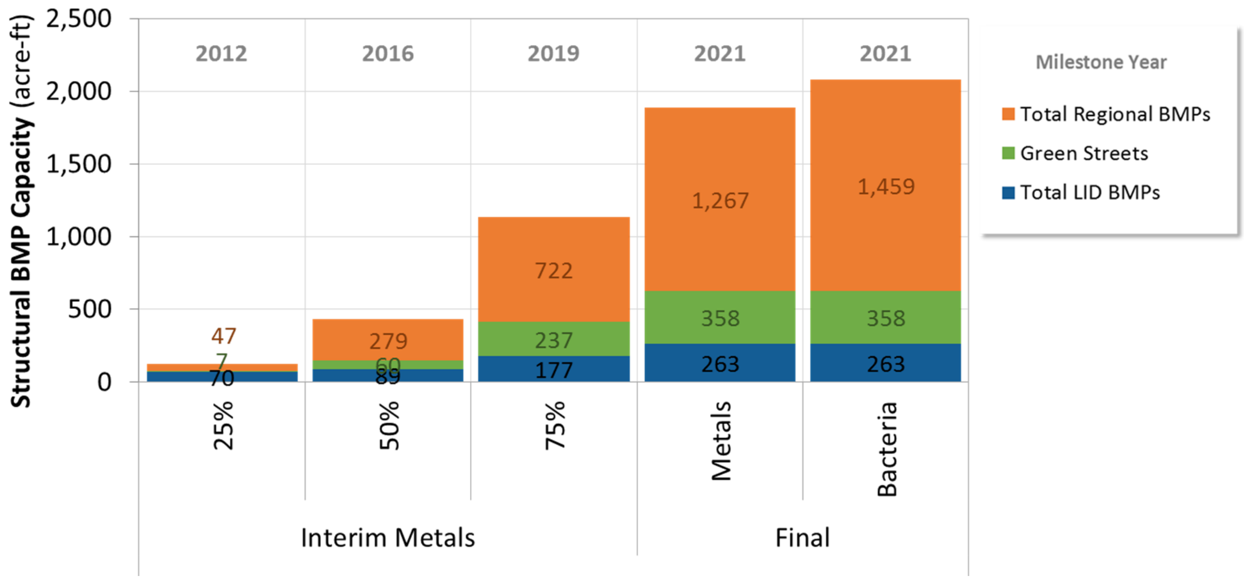


Figure ES-10 EWMP Implementation Strategy Schedule

ES.5 EWMP Implementation Costs and Financial Strategy

The total estimated capital cost is approximately $2.7B, over the course of six years. The costs 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. Funds have not been identified in the EWMP Implementation Plan but will be pursued. Potential funding sources and alternatives that could be evaluated by each Group Member include grants, fees and charges, legislative and policy remedies.

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 2021 are approximately $2.7B, which is approximately $9,422 per parcel, with total operations and maintenance costs exceeding $77M per year (Table ES-1). Expenditures for the EWMP Implementation Strategy will need to be coordinated with other regional efforts to improve habitat, promote greenways and increase access to Ballona Creek. 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 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.

Table ES-1 Estimated Capital, Operation and Maintenance Cost to Achieve TMDL Compliance

Agency	Present to 50% Metals TMDL Milestone (2016)		50% Metals TMDL Milestone (2016) to Final Compliance with Metals TMDL (2021)		50% Metals TMDL Milestone (2016) to Final Compliance with Bacteria TMDL (2021)		Total at Final (2021)	
	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Beverly Hills	5.4	µ.64	45	4.6	21	4.9	72	4.9
Culver City	21	1.1	96	3.5	21	3.8	14µ	3.8
Inglewood	7.8	µ.4µ	59	2.µ	µ.µ7µ	2.µ	67	2.µ
Los Angeles	1µµ	9.9	1,8µµ	58	35µ	63	2,3µµ	63
Santa Monica	2.7	µ.31	15	µ.64	µ	µ.64	17	µ.64
Uninc. LA County	14	µ.79	63	2.1	6.2	2.2	84	2.2
West Hollywood	2.9	µ.34	5µ	1.6	11	1.7	64	1.7
Total	**150**	**14**	**2,200**	**72**	**410**	**78**	**2,700**	**78**

Section 1
Introduction

The Ballona Creek Enhanced Watershed Management Program (EWMP) Plan describes a customized compliance pathway that Los Angeles County Municipal Separate Storm Sewer System (MS4) Permittees in the watershed will utilize to fulfill the Watershed Management Program requirements contained in the 2012 MS4 Permit (Order No. R4-2012-0175; National Pollutant Discharge Elimination System [NPDES] Permit No. CAS004001).

The MS4 Permittees in the Ballona Creek Watershed completed a Notice of Intent (NOI) for the development of the EWMP and Coordinated Integrated Monitoring Program (CIMP) for the Ballona Creek Watershed. The NOI was approved by the Los Angeles Regional Water Quality Control Board (Regional Board) on February 26, 2014. All MS4 Permittees in the Ballona Creek Watershed have agreed to a collaborative approach in meeting the requirements of the new MS4 Permit. The Ballona Creek Watershed Management Group (BC EWMP Group) has leveraged this EWMP to facilitate a robust, comprehensive approach to stormwater planning for the Ballona Creek Watershed. This EWMP builds upon multiple previously-developed planning efforts[3] 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.

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 water reuse, irrigation, and indoor use, while also creating additional benefits for the communities in the BC watershed. This EWMP presents a toolbox of distributed and regional watershed control measures to address applicable stormwater quality regulations including the following:

- **Low impact development (LID):** 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 investigate LID retrofits on public parcels.
- **Green streets:** the right-of-way along streets offer a significant opportunity to implement control measures on public land. The EWMP includes extensive green streets to retain runoff from roads and alleys, and indirectly from roofs and parking surfaces. Green streets will potentially offer many other benefits to communities in terms of aesthetics, safety and increased property values.

---

[3] A Work Plan for the BC EWMP, as required by the Permit, was submitted in June 2014. The Work Plan described the work efforts and analyses that were planned to support EWMP development.

- **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 BC EWMP includes 68 regional BMPs, including 4 multi-benefit regional projects that retain the stormwater 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” or “recipe for compliance,” for the Group members. The EWMP Implementation Strategy is quantitatively robust, as modeling was used to demonstrate that receiving water limitations (RWLs) and/or water-quality based effluent limits (WQBELs) will be achieved by the identified control measures, called 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. In order to construct and maintain the large network of control measures in the EWMP Implementation Strategy, stormwater funding levels will need to increase by orders of magnitude and the EWMP includes cost estimates and a financial strategy for increasing stormwater funding.

1.1 Applicability of the EWMP Plan

The Ballona Creek EWMP applies to areas covered by the MS4 Permit within the Ballona Creek Watershed Management Area (BCWMA) (Figure 1-1). The EWMP applies to the following MS4 Permittees, which comprise the BC EWMP Group: Cities of Los Angeles (lead coordinating agency), Beverly Hills, Culver City, Inglewood, Santa Monica, and West Hollywood, Unincorporated County of Los Angeles, and the Los Angeles County Flood Control District (LACFCD).

The Plan identifies and outlines a path to developing control measures to address Water Body-Pollutant Combinations (WBPCs) that have been observed to exceed water quality objectives (WQO) within the receiving waterbodies. Prioritization of water quality issues is an important element of the EWMP; thus the basis for the EWMP will be most influenced by high priority WBPCs and urban sources for these pollutants. The EWMP Plan supports the program elements that are applicable to MS4 Permit requirements for RWLs (Section V.A) and Total Maximum Daily Load (TMDL) provisions (Section VI.E) by setting a path for compliance. Also, the EWMP is applicable to MCMs (Section VI.D), which may be modified to more effectively address the highest priority water quality conditions.

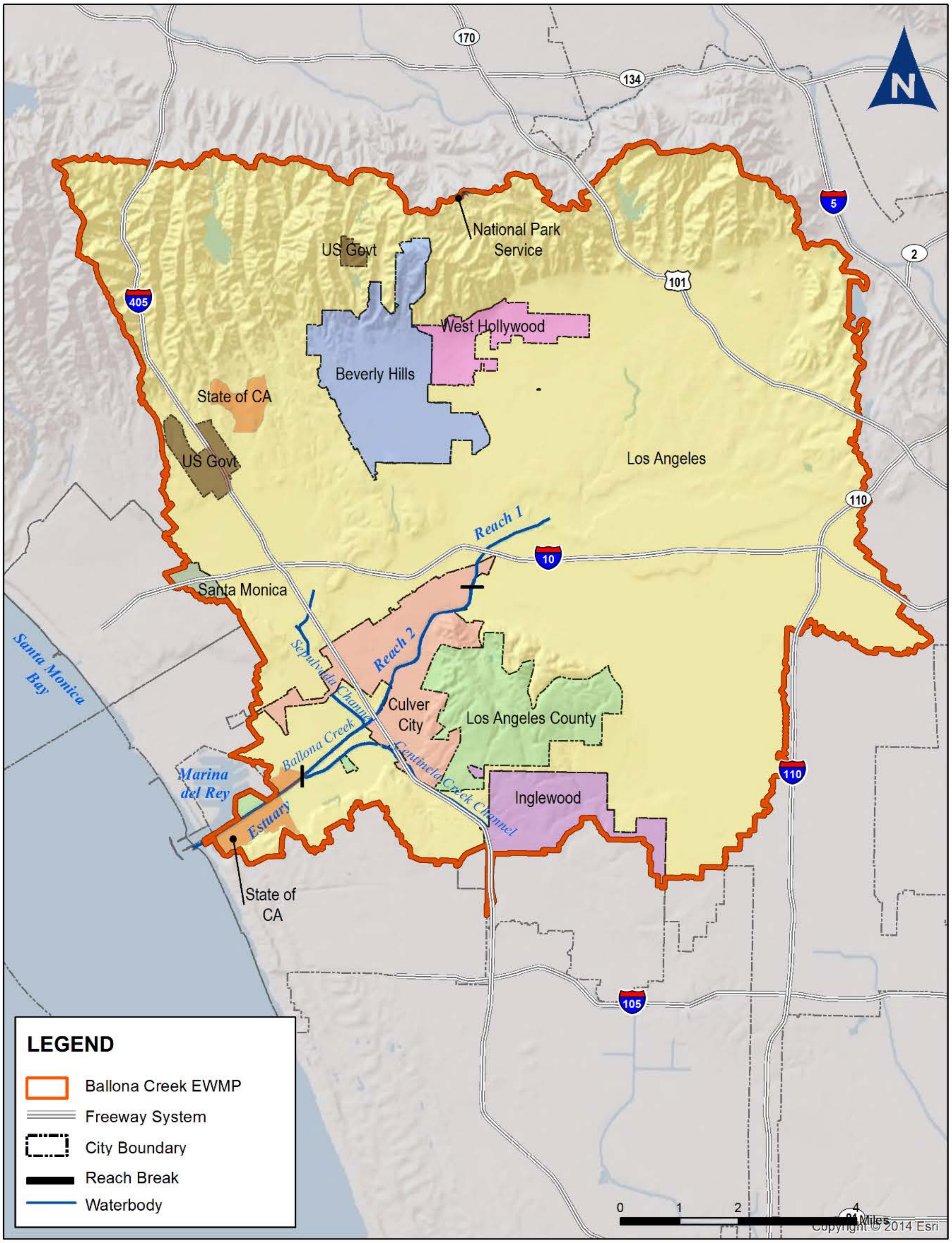


Figure 1-1 Ballona Creek Watershed Management Area

1.2 What Areas are Covered by this EWMP?

The Ballona Creek Watershed is approximately 128 square miles in area and comprises the Cities of Beverly Hills and West Hollywood, and portions of the Cities of Los Angeles, Inglewood, Culver City, and Santa Monica as well as unincorporated areas of the County of Los Angeles. Additionally, LACFCD owns and operates drainage infrastructure within incorporated and unincorporated areas in the watershed. Figure 1-1 provides a map of the watershed boundaries and the delineations of the jurisdictions of the MS4 Permittees and other entities within the watershed.

Ballona Creek and Estuary are collectively approximately 9.5 miles long and divided in three hydrological units:

- Ballona Creek Reach 1 is approximately two miles long from Cochran Avenue to National Boulevard. This portion of the creek is channelized with vertical concrete walls.
- Ballona Creek Reach 2 is approximately four miles long between National Boulevard and Centinela Avenue where Ballona Estuary starts. Reach 2 is also channelized for the most part, with trapezoidal walls.
- Ballona Estuary starts at Centinela Creek and continues to the Pacific Ocean. This portion of the creek is approximately 3.5 miles of soft bottom channel and experiences tidal inundation.

Major tributaries to Ballona Creek include Sepulveda Canyon Channel (tributary to Reach 2) and Centinela Creek (tributary to Ballona Estuary). Other water bodies in the watershed include the Del Rey Lagoon and the Ballona Wetlands, which are both connected to the Ballona Estuary through tide gates. Note that although Benedict Canyon Channel is identified in TMDLs as a tributary to Ballona Creek, it is a closed channel that daylights where the channel meets Ballona Creek and is not identified in the Basin Plan as a waterbody in the watershed. As such, it is not considered a tributary for the purposes other than addressing the bacteria TMDL for the watershed. The City of Los Angeles is the responsible agency for the Del Rey Lagoon whose tributary area is approximately 25 acres. The Ballona Wetlands encompass approximately 626 acres (541 acres of natural wetlands area and 85 acres of roads, parking lots, levees and other structures). Approximately 460 acres of the Ballona Wetlands are located within the Ballona Creek Watershed and the remaining portion is located in the Marina Del Rey watershed. The Ballona Wetlands are owned and/or managed by the California Department of Fish and Wildlife (CDFW) and the State Land Commission. The relevant water bodies named in the Basin Plan are summarized in Table 1-1.

Table 1-1 Waterbodies Associated with the BCWMA EWMP

Mainstem	Associated Waterbodies
Ballona Creek Reach 1	
Ballona Creek Reach 2	Sepulveda Channel
Ballona Creek Estuary	Centinela Creek Channel
Lagoons and Wetlands	
Del Rey Lagoon	Ballona Creek Wetlands
Downstream Waters	
Santa Monica Bay	

The BC EWMP Group members have agreed to collectively develop the EWMP. Therefore, the EWMP covers all of the areas owned by the MS4 Permittees within the watershed. A breakdown of areas by MS4 Permittee and other agencies is provided in Table 1-2. Collectively, the MS4 Permittees in the Ballona Creek Watershed have jurisdiction over about 123 square miles or 96 percent of the total watershed area. The EWMP agencies have no jurisdiction over the land that is owned by the State of California (e.g., CDFW, the State Lands Commission, and the California Department of Transportation [Caltrans]) or the US Government. All of the drainage infrastructure operated and maintained by the LACFCD within the BCWMA is covered under this EWMP.

Table 1-2 Ballona Creek Watershed Land Area Distribution and EWMP Participation

Agency	EWMP Agency	Land Area (Acres)	Percentage of EWMP Area
City of Los Angeles	Yes	65,272.89	83.21
County of Los Angeles	Yes	3,164.76	4.µ3
Los Angeles County Flood Control District	Yes	NA	
City of Beverly Hills	Yes	3,618.95	4.61
City of Culver City	Yes	3,125.µµ	3.98
City of Inglewood	Yes	1,9µ7.72	2.43
City of West Hollywood	Yes	1,135.µµ	1.45
City of Santa Monica	Yes	217.31	µ.28
Area of EWMP Agencies in the BCWMA		**78,441.63**	**100**
Caltrans	No	1,651.33	
State of California	No	9µ9.34	
US Government	No	674.49	
Total Area of the BCWMA		**81,676.79**	

1.3 Which Regulations are Driving the EWMP?

While the EWMP comprises a multi-faceted document/program that is far broader than stormwater compliance, it is fundamentally a regulatory document. Elements of the regulatory framework, including applicable schedules for TMDLs, are described in the following subsections.

1.3.1 Major Elements of the 2012 MS4 Permit

On November 8, 2012, the Regional Board adopted Waste Discharge Requirements (WDRs) for MS4 discharges within the Coastal Watersheds of Los Angeles County, except those discharges originating from the City of Long Beach which are covered under a different MS4 permit (Order No. R4-2012-0175; NPDES Permit No. CAS004001). 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 the cities within the BC watershed. The 2012 MS4 Permit supersedes the 2001 MS4 Permit.

The 2012 MS4 Permit contains effluent limitations, RWLs, TMDL provisions, and outlines the process for developing watershed management programs, including this EWMP. The MS4 Permit incorporates the TMDL Wasteload Allocations (WLAs) applicable to dry- and wet-weather conditions as WQBELs and/or RWLs. Section V.A of the Permit requires compliance with the WQBELs as outlined by the respective TMDLs.

1.3.2 Role of EWMP for Permit Implementation

The BC EWMP Group has elected to collaborate on preparing the EWMP Plan that achieves the water quality objectives of the receiving waters. The BC EWMP Group members intend to use the EWMP process to formulate a strategy that will remove or reduce pollutants from dry- and wet-weather urban runoff in a cost-effective manner, while providing multi-purpose projects that provide not only water quality improvement but other benefits to the region and the local communities.

Implementation Plans have been developed that include strategies for demonstrating compliance with the Ballona Creek and Ballona Estuary TMDLs. The Implementation Plans and strategies for compliance are based on a multi-pollutant approach that maximizes the retention and use of urban runoff as a resource for groundwater recharge and irrigation. The Implementation Plans are:

- Multi-Pollutant TMDL Implementation Plan for the Unincorporated County Area of Ballona Creek (County of Los Angeles, 2010),
- Ballona Creek Bacteria TMDL Implementation Plan (City of Beverly Hills *et al.*, Nov 2009);
- Ballona Creek Metals TMDL Implementation Plan (City of Beverly Hills *et al.*, Jan, 2010); and
- Ballona Creek Estuary Toxic Pollutants TMDL Implementation Plan (City of Beverly Hills *et al.*, June, 2012).

The EWMP offers an opportunity to develop a comprehensive stormwater management plan that optimizes the stormwater and financial resources under the stewardship of the BC EWMP Group members. By leveraging past regional planning efforts and investments, including TMDL Implementation Plans, while exploring additional project opportunities to satisfy the predicted load reductions to meet the BCWMA's numeric goals, the EWMP includes projects that provide not only water quality improvement but also environmental, aesthetic, recreational, water supply and/or other community enhancements.

The EWMP comprehensively evaluates opportunities, within the participating Permittees' collective jurisdictional area in the BCWMA, for multi-benefit regional projects that, wherever feasible, retain (i) all non-stormwater runoff and (ii) all stormwater 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 BCWMA where retention of the 85th percentile, 24-hour storm event is not feasible, the EWMP includes a RAA to demonstrate that applicable WQBELs and RWLs will be achieved through implementation of other watershed control measures. Specific requirements of an EWMP are defined in the Permit (Section VI.C.1.g.) as follows:

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 Clean Water Act (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 final 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 stormwater 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 stormwater 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 final 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-stormwater discharges of pollutants through the MS4, and controls to reduce the discharge of pollutants in stormwater to the maximum extent practicable) are not delayed; and*

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

1.3.3 Applicable TMDLs and Implementation Schedules

A TMDL represents an amount of pollution that can be released by anthropogenic and natural sources in a watershed into a specific water body without causing a decline in water quality and a concomitant impairment of beneficial uses. The CWA requires the development of water quality standards that identify beneficial uses and criteria to protect beneficial uses for each water body found within its region. Beneficial uses include swimming, fishing, drinking water, navigability, and wildlife habitats and reproduction. Table 1-3 presents the designated beneficial uses in the Ballona Creek Watershed as described in the Water Quality Control Plan, Los Angeles Region (Basin Plan).

Section 303(d) of the 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 a TMDL which will ensure attainment of water quality standards.

The TMDL is assigned to non-point (e.g., areal deposition or releases) and point sources (e.g., MS4 Permittees) as load allocations and WLAs, respectively. TMDLs are determined based on the need to meet a narrative or numerical target, which is required to protect the beneficial uses of the receiving water body. A narrative target is used in the existing trash TMDL, which states that no trash can enter the Santa Monica Bay. Conversely, a numerical target is set for concentrations of specific water quality constituents including toxics, bacteria, and metals TMDLs.

Table 1-3 Ballona Creek Watershed Designated Beneficial Uses as Presented in the Los Angeles Region Basin Plan

Water Body	REC1	LREC-1	REC2	HFS	MUN	NAV	COMM	WARM	EST	MAR	WILD	RARE	MIGR	SPWN	SHELL	WET [b]
Ballona Creek Estuary (Centinela Ave. to Pacific Ocean) [c,w]	E					E	E		E	E	E	E[e]	E[f]	E[f]	E	
Centinela Creek	E															
Ballona Lagoon [c]	E					E	E		E	E	E	E[e]	E[f]	E[f]	E	E
Ballona Wetlands [c]	E								E		E	E[e]	E[f]	E[f]		E
Del Rey Lagoon [c]	E					E	E		E		E	E[e]	E[f]	E[f]		E
Ballona Creek Reach 2 (Estuary to National Blvd.)	P[s,au]	E		Y[av]	P*			P			P					
Sepulveda Channel	E[g]															
Ballona Creek Reach 1 (Above National Blvd.)	P[s,au]		E	Y[av]	P*			P			E					

E: Existing beneficial use P: Potential beneficial use

b: Waterbodies designated as WET may have wetlands habitat associated with only a portion of the waterbody. Any regulatory action would require a detailed analysis of the area.

c: Coastal waterbodies which are also listed in Coastal Features Table (2-3) or in Wetlands Table (2-4) of the Basin Plan. Ballona Lagoon, while listed in the Basin Plan as part of the Ballona Creek Watershed, is actually in the Marina del Rey watershed. In order to be consistent with the Basin Plan, Ballona Lagoon is shown in this table, but recognize that it will be addressed in the Marina del Rey EWMP.

e: One or more rare species utilizes all ocean, bays, estuaries, and coastal wetlands for foraging and/or nesting.

f: Aquatic organisms utilize all bays, estuaries, lagoons, and coastal wetlands, to a certain extent, for spawning and early development. This may include migration into areas which are heavily influenced by freshwater inputs.

g: The Ballona Creek Bacteria TMDL designates Sepulveda Channel as Fresh Waters Designated for Water Contact Recreation (REC-1).

s: Access prohibited by Los Angeles County Department of Public Works.

w: These areas are engineered channels. All references to Tidal Prisms in Regional Board documents are functionally equivalent to estuaries

* Asterisked MUN designations are designated under SB 88-63 and RB 89-µ3. Some designations may be considered for exemption at a later date (See pages 2-3, 4 for more details).

au: The REC-1 use designation does not apply to recreational activities associated with the swimmable goal as expressed in the Federal Clean Water Act section 1µ1(a)(2) and regulated under the REC-1 use in the Basin Plan, or the associated bacteriological objectives set to protect those activities. However, water quality objectives set to protect other REC-1uses associated with the fishable goal as expressed in the Federal Clean Water Act section 1µ1µ(a)(2) shall remain in effect for waters where the (au) footnote appears.

av: The High Flow Suspension only applies to water contact recreational activities associated with the swimmable goal as expressed in the federal Clean Water Act section 1µ1(a)(2) and regulated under the REC-1 use, noncontact water recreation involving incidental water contact regulated under the REC-2 use, and the associated bacteriological objectives set to protect those activities. Water quality objectives set to protect [1] other recreational uses associated with the fishable goal as expressed in the federal Clean Water Act section 1µ1(a)(2) and regulated under the REC-1 use and [2] other REC-2 uses (e.g., uses involving the aesthetic aspects of water) shall remain in effect at all times for waters where the (av) footnote appears.

Table 1-4 presents TMDLs developed specifically for the Ballona Creek Watershed and TMDLs that apply to the Ballona Creek Watershed as a subwatershed of the Santa Monica Bay Watershed Management Area. Table 1-4 includes recent amendments to bacteria, toxics, and metals TMDLs in the Watershed. Table 1-5 presents interim and final compliance deadlines for the relevant TMDLs. Table 1-6 notes where the Permit assigns WQBELs, RWLs, or in the case of U.S. Environmental Protection Agency (USEPA) TMDLs and WLAs, to Permittees within the Ballona Creek Watershed Management Area (BCWMA). Table 1-4 and Table 1-5 do not include the Santa Monica Bay Beaches Bacteria TMDLs because the WLAs for the receiving waters in the Ballona Creek Watershed are established in the Ballona Creek, Ballona Estuary, and Sepulveda Channel Bacteria TMDL.

Table 1-4 TMDLs Applicable to the Ballona Creek Watershed

TMDL	Regional Board Resolution Number(s)	Effective Date and/or EPA Approval Date
Ballona Creek Trash (BC Trash)[1]	2µµ4-µ23	µ8/11/2µµ5
	2µ15-µµ6	µ6/11/2µ15
Ballona Creek Estuary Toxic Pollutants (BC Toxics TMDL)	2µµ5-µµ8	µ1/11/2µµ6
	2µ13-µ1µ	1µ/26/2µ15
Ballona Creek, Ballona Estuary, and Sepulveda Channel Bacteria (BC Bacteria TMDL)	2µµ6-µ11	µ4/27/2µµ7
	2µ12-µµ8	µ7/µ2/2µ14
Ballona Creek Metals (BC Metals TMDL)	2µµ7-µ15	1µ/29/2µµ8
	2µ13-µ1µ	1µ/26/2µ15
Santa Monica Bay Nearshore and Offshore Debris (Santa Monica Bay [SMB] Trash TMDL)	2µ1µ-µ1µ	µ3/2µ/2µ12
Santa Monica Bay DDTs and PCBs (SMB Toxics)	NA (USEPA TMDL)	µ3/26/2µ12
Ballona Creek Wetlands TMDL for Sediment and Invasive Exotic Vegetation (Wetlands TMDL)		µ3/26/2µ12
Santa Monica Bay Beaches Bacteria TMDL	2µµ2-µµ4	µ7/15/2µµ3
	2µµ6-µµ6	µ4/µ6/2µµ6

[1]Per Resolution No. 2µ15-µµ6, the LACFCD is identified as a responsible agency despite not having a WLA because compliance strategies rely upon implementation of BMPs within LACFCD facilities for certain actions related to TMDL implementation.
[2]The Santa Monica Bay Beaches Bacteria TMDL includes site BC-1 in Jurisdictional Group 2, located at the jetty off the shore near the Ballona Creek mouth.

The numeric WQBELs and RWLs and the WLAs for the USEPA TMDLs listed in Table 1-5 and can be found in Attachment M of the Permit. The BC Toxics TMDL and BC Metals TMDL were amended on December 5, 2013 by the Regional Board. Revised WQBELs must be incorporated into the Permit by the Regional Board at some point after the effective date of the TMDL amendment. However, for the purposes of developing the EWMP, the EWMP Plan will consider WQBELs based on both the current and amended TMDLs.

The Regional Board adopted TMDLs presented above required responsible parties to submit a Total Maximum Daily Load Implementation Plan (TMDLIP) to describe how they would achieve compliance with the WLAs. The cities of Los Angeles, Culver City, Beverly Hills, Inglewood, West Hollywood, Santa Monica, and Caltrans submitted TMDLIPs to address each of the impairments contained within these TMDLs. Additionally, the County of Los Angeles and LACFCD submitted an integrated TMDLIP to address the impairments. Once approved, the EWMP for the BCWMA will replace the individual TMDLIPs.

Table 1-5 Applicability of WQBELs, RWLs, and/or WLAs Associated with TMDLs as Identified in the Permit[1]

TMDL	Constituent	BC Estuary	BC Lagoon	BC Wetlands	BC Reach 1	BC Reach 2	Centinela Creek	Sepulveda Canyon Channel	Benedict Canyon[2]	Santa Monica Bay
BC Trash TMDL and SMB Trash TMDL	Trash	E		--	E	E	E	E	--	E
BC Estuary Toxics TMDL	Cadmium (sediment)	E		--	--	--	--	--	--	--
	Copper (sediment)	E		--	--	--	--	--	--	--
	Lead (sediment)	E		--	--	--	--	--	--	--
	Zinc (sediment)	E		--	--	--	--	--	--	--
	Silver (sediment)	E		--	--	--	--	--	--	--
	Polycyclic aromatic hydrocarbons (PAHs) (sediment)[3]	E		--	--	--	--	--	--	--
	Chlordane (sediment)	E		--	--	--	--	--	--	--
	DDT (sediment)	E		--	--	--	--	--	--	--
	PCBs (sediment)	E		--	--	--	--	--	--	--
Santa Monica Bay DDTs and PCBs TMDL	DDT (sediment)	--		--	--	--	--	--	--	WLA
	PCBs (sediment)	--		--	--	--	--	--	--	WLA
BC, Estuary, and Sepulveda Channel Bacteria TMDL	Total Coliform	E/R	E/R	--	--	--	E/R	--	--	--
	Fecal Coliform	E/R	E/R	--	E/R	--	E/R	--	--	--
	Enterococcus	E/R	E/R	--	--	--	E/R	--	--	--
	Escherichia coli (E. coli)	--		--		E/R		E/R	E/R	--
BC Metals TMDL	Copper	--		--	E	E	--	E	--	--
	Lead	--		--	E	E	--	E	--	--
	Zinc	--		--	E	E	--	E	--	--
	Selenium[2]	--		--	E	E	--	E	--	--
BC Wetlands Sediment and Invasive Exotic Vegetation TMDL	Sediment	--		WLA	--	--	--	--	--	--

[1]Unless explicitly stated as sediment, constituents are associated with the water column.
[2]Note that although Benedict Canyon Channel is identified in TMDLs as a tributary to Ballona Creek, it is a closed channel that daylights where the channel meets Ballona Creek and is not identified in the Basin Plan as a waterbody in the watershed. As such, it is not considered a tributary for the purposes other than addressing the bacteria TMDL for the watershed.
[3]The BC Toxics and Metals TMDLs were amended on December 5, 2µ13 and WLAs associated with these constituents were removed. Associated WQBELs would be expected to be removed when the Permit is updated to incorporate these two TMDLs once they become effective.
E: Effluent limit established based on a TMDL.
R: RWL established based on a TMDL.
WLA: Wasteload Allocation assigned in a USEPA TMDL, but not included as effluent or RWLs.

1.4 EWMP Development

The goal of the BC EWMP Group is to develop a watershed-wide EWMP that will, once implemented, remove or reduce pollutants from dry- and wet-weather urban runoff in a cost-effective manner and comply with MS4 Permit requirements. The RAA demonstrations show that the projects identified in the EWMP will meet the requirements of the MS4 Permit.

1.4.1 EWMP Development Process

Figure 1-2 presents a flowchart of the EWMP development process. The first step was to develop water quality priorities. To achieve the watershed water quality goals, the EWMP is based on a comprehensive assessment of water quality priorities in order to develop a strategy that systematically addresses pollutant reduction in accordance with established TMDL compliance schedules while also addressing additional WBPCs identified during the Plan development as described in Section 3.

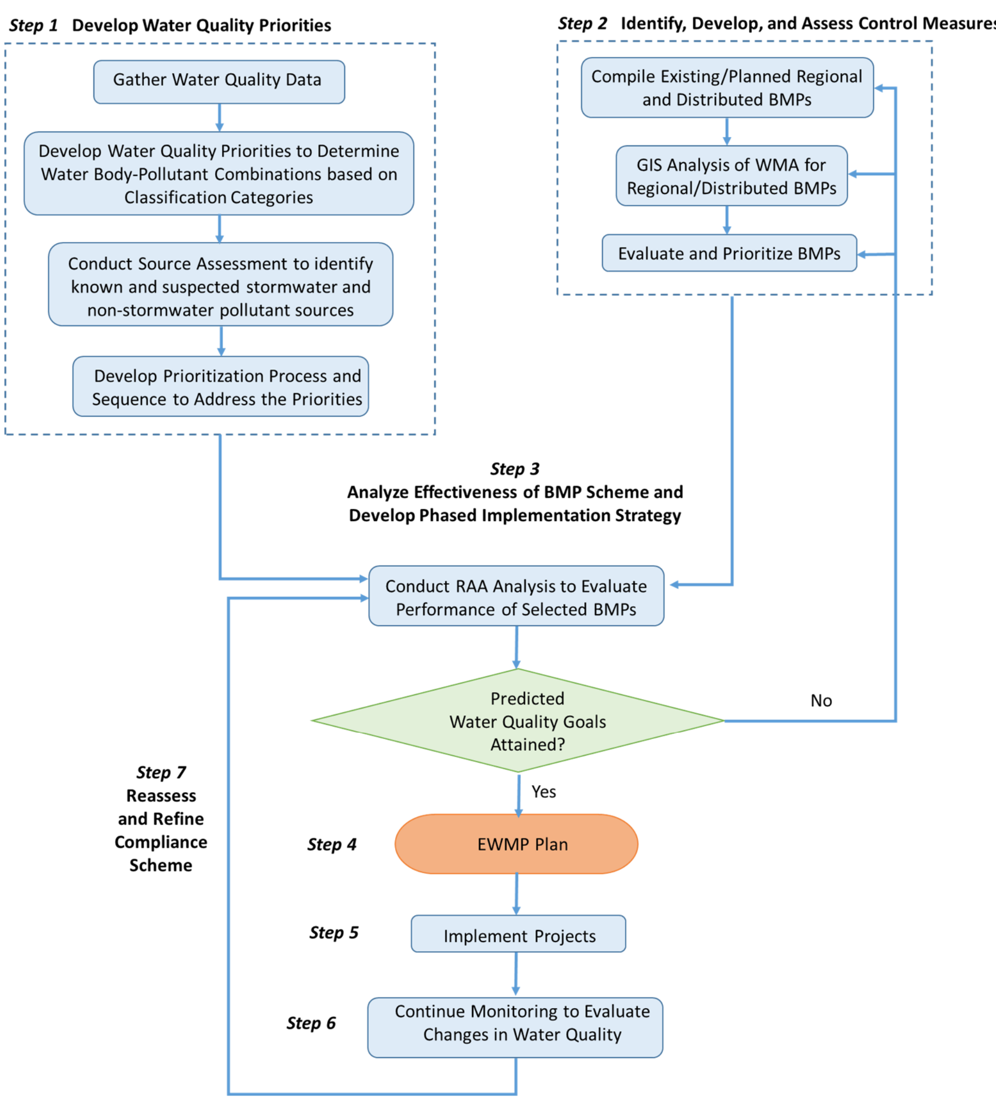


Figure 1-2 EWMP Development Process

Improvements to water quality will be achieved through implementation of control measures, which consist of structural and non-structural (institutional) Best Management Practices (BMPs). Step 2 identified the existing BMPs to establish an understanding of the current status of stormwater programs implemented by the various BC EWMP Group members. Planned BMPs, as well as additional potential BMPs or BMP improvements were also identified in this step and serve as the "tool kit" for achieving the water quality goals. Input from stakeholders was solicited, as outlined in Section 5.1.

Combinations of existing, planned, and selected potential BMPs were evaluated by an RAA using a watershed model to provide an assessment of the ability of selected BMP scenarios to meet the water quality goals in the watershed (Step 3). A recipe for compliance for each jurisdiction is the basis for the EWMP Plan (Step 4).

As the BC EWMP projects are implemented over time (Step 5), monitoring data will be collected (Step 6) and used in a feedback loop to reassess and refine the compliance scenario established in the EWMP (Step 7). As part of an adaptive management process, modifications to the EWMP Plan will be reflected in updates over two-year cycles. The adaptive management framework is discussed in Section 8.

1.4.2 Watershed Management Group and Stakeholder Process

The BC EWMP Group, comprised of the jurisdictions identified in Section 1.1, has jointly and cooperatively agreed to execute the EWMP Plan contained herein (i) in accordance with the Permit requirements and (ii) with stakeholder support and input. To achieve this objective, monthly meetings of the BC EWMP Group have been held since the project's inception. The BC EWMP Group has been meeting and working together to develop regional solutions since well before the 2012 permit. In addition, a series of three workshops were held in which other interested parties and stakeholders within the watershed were given the opportunity to provide input and insight into the approach and findings of the Plan, particularly with respect to identifying potential multi-benefit regional projects.

1.5 EWMP Plan Overview

The remainder of this EWMP Plan 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 – Water Quality Priorities: Presents the process to identify and prioritize water quality impairments in the watershed based on review of available monitoring data. Note the BC EWMP Group has also developed a CIMP to collect water quality data and measure the effectiveness of the EWMP. 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.

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 BC watershed. In addition, this section highlights signature regional projects that have been evaluated through detailed conceptual level designs by each of the BC EWMP Group members. Finally, the discussion includes an acknowledgement of previous planning documents incorporated into the EWMP.

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 Ballona Creek Watershed. This section provides a summary of the green infrastructure programs within the EWMP and highlights several signature projects as examples 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 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.

This page intentionally left blank.

Section 2
Legal Authority

The 2012 MS4 Permit requires each agency participating in the Ballona Creek EWMP to demonstrate legal authority to employ Watershed Control Measures (WCMs), as specified in Permit Section VI.C.5.b.iv.(6):

> "Permittees shall provide documentation that they have the necessary legal authority to implement the Watershed Control Measures identified in the plan, or that other legal authority exists to compel implementation of the Watershed Control Measures."

Participating agencies will utilize these WCMs as part of the EWMP to help achieve Permit compliance by reducing MS4 pollutant discharges to receiving waters. This includes any variety or combination of MCMs, non-stormwater discharge measures, and TMDL control measures.

Section VI.A.2.a of the Permit specifies that "Each Permittee must establish and maintain adequate legal authority, within its respective jurisdictions, to control pollutant discharges into and from its MS4 through ordinance, statute, permit, contract, or similar means. This legal contract must, at a minimum, authorize or enable the Permittee to "have legal authority to enact parts i through xii of this Permit section, which include implementing, operating, maintaining, inspecting, and enforcing control measures to reduce pollutant loads.

Section VI.A.2.b of the Permit specifies that "Each Permittee must submit a statement certified by its legal counsel that the Permittee has the legal authority within its jurisdiction to implement and enforce each of the requirements contained in 40 CFR § 122.26(d)(2)(i)(A-F) and this Order. Each Permittee shall submit this certification annually as part of its Annual Report beginning with the first Annual Report required under this Order."

Ordinances cited by each agency's chief legal counsel pertaining to Legal Authority Provisions Permit Sections VI.A.2.a and VI.A.2.b are summarized in Appendix 2.A and the letters from each jurisdiction are included in their entirety in Appendix 2.B.

This page intentionally left blank.

Section 3
Priorities for Water Quality Compliance

The requirement to identify water quality priorities is an important first step in the EWMP process. The following section briefly presents 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. The water quality priorities provide the basis for prioritizing implementation and monitoring activities within the EWMP and the selection and scheduling of BMPs in the RAA.

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 Ballona Creek 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 (e.g., interim and final numeric limits).

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 WBPCs to support the development of priorities (Table 3-1). The Permit establishes a four-step process that leads to prioritization and sequencing of the water quality issues within each watershed, as follows:

- **Step 1:** Water quality characterization (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 (VI.C.5.a.ii, pg. 59), to identify water body-pollutant combinations that fall into three Permit defined categories;
- **Step 3:** Source assessment (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 (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.

Table 3-1 Water Body-Pollutant Classification Categories (Permit Section IV.C.5.a.ii)

Category	Water Body-Pollutant Combinations (WBPCs)
1 Highest Priority	WBPCs for which TMDL WQBELs and/or RWLs are established in Part VI.E and Attachment M of the MS4 Permit.
2 High Priority	WBPCs for which data indicate water quality impairment exists in the receiving water according to the State's Listing Policy, regardless of whether the pollutant is currently on the 3µ3(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 MS4 Permit RWLs and for which MS4 discharges may be causing or contributing to the exceedance.

3.1 Water Quality Characterization (Step 1)

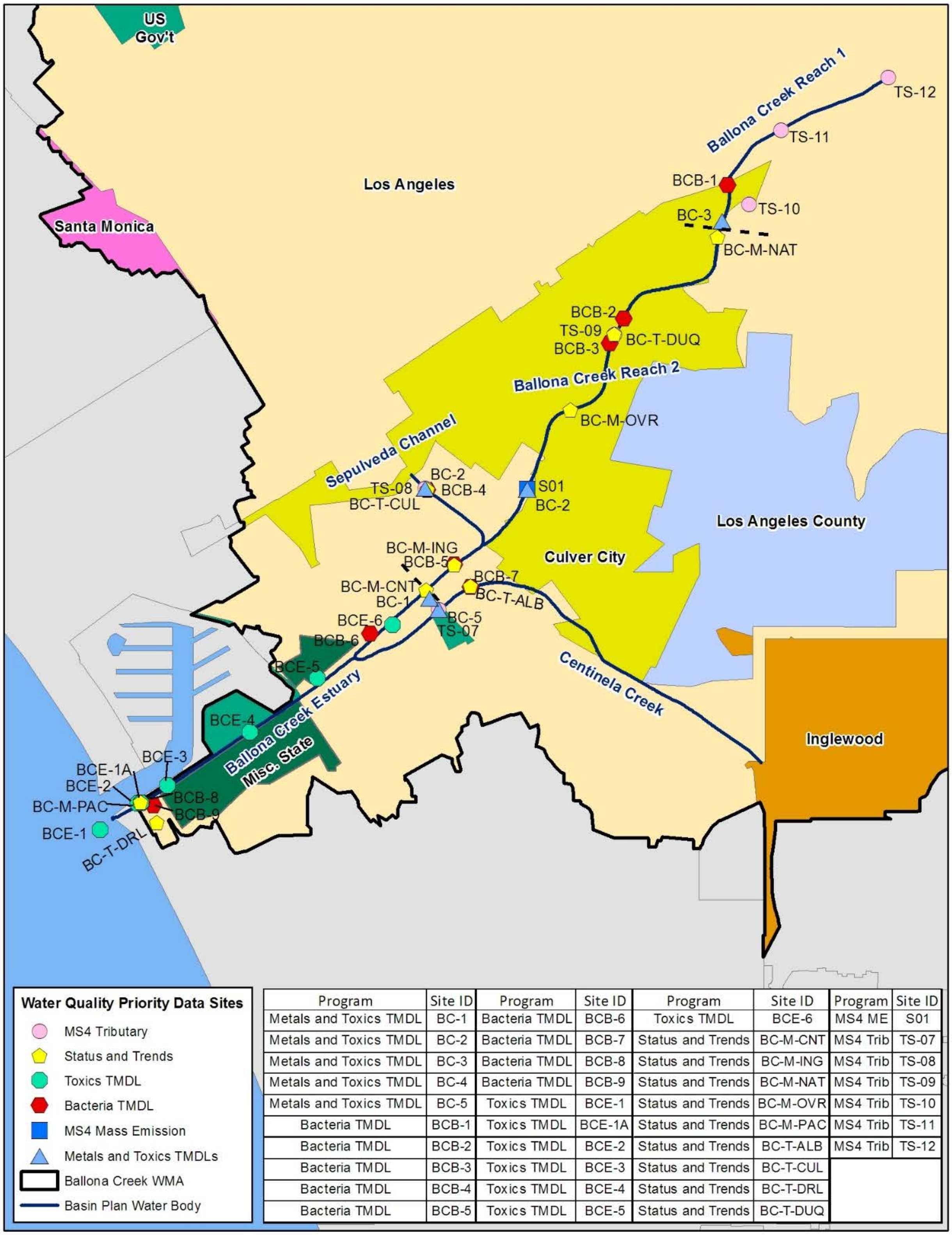
Data were compiled to identify constituents exceeding applicable water quality objectives. Over 55,000 data records were compiled and reviewed as part of the data analysis. Figure 3-1 presents the site locations for the data used for the water quality characterization process. Applicable water quality 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.

3.2 Water Body Pollutant Classification (Step 2)

Based on available information and data analysis, WBPCs were classified into one of the three Permit categories described in Table 3-1. To further support development of the EWMP, the three Permit categories were further subdivided into subcategories (described in Table 3-2) and each WBPC was assigned to an appropriate subcategory. Table 3-3 presents the BCWMG WBPCs by subcategory. Table 3-4 lists the applicable interim and final WQBELs and RWLs for each identified Category 1, 2, and 3 pollutant. Summary tables presenting the data analysis to support the placement of WBPCs into the various subcategories are presented in Attachment 3 of Appendix 3.B.

3.3 Source Assessment (Step 3)

Following the water body-pollutant classification, 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 intent of the source assessment is to identify potential sources within the watershed for the WBPCs in Categories 1 through 3 and to support prioritization and sequencing of management actions. Pollutant exceedances may come from point or non-point sources, as described below. Often, however, non-point source discharges may flow to the MS4 and thus become associated with the MS4 and subject to the MS4 Permit requirements. Appendix 3.D contains detailed descriptions of WBPCs and their common sources.



Program	Site ID	Program	Site ID	Program	Site ID	Program	Site ID
Metals and Toxics TMDL	BC-1	Bacteria TMDL	BCB-6	Toxics TMDL	BCE-6	MS4 ME	S01
Metals and Toxics TMDL	BC-2	Bacteria TMDL	BCB-7	Status and Trends	BC-M-CNT	MS4 Trib	TS-07
Metals and Toxics TMDL	BC-3	Bacteria TMDL	BCB-8	Status and Trends	BC-M-ING	MS4 Trib	TS-08
Metals and Toxics TMDL	BC-4	Bacteria TMDL	BCB-9	Status and Trends	BC-M-NAT	MS4 Trib	TS-09
Metals and Toxics TMDL	BC-5	Toxics TMDL	BCE-1	Status and Trends	BC-M-OVR	MS4 Trib	TS-10
Bacteria TMDL	BCB-1	Toxics TMDL	BCE-1A	Status and Trends	BC-M-PAC	MS4 Trib	TS-11
Bacteria TMDL	BCB-2	Toxics TMDL	BCE-2	Status and Trends	BC-T-ALB	MS4 Trib	TS-12
Bacteria TMDL	BCB-3	Toxics TMDL	BCE-3	Status and Trends	BC-T-CUL		
Bacteria TMDL	BCB-4	Toxics TMDL	BCE-4	Status and Trends	BC-T-DRL		
Bacteria TMDL	BCB-5	Toxics TMDL	BCE-5	Status and Trends	BC-T-DUQ		

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

Table 3-2 Details for Water Body-Pollutant Classification Subcategories

Category	Water Body-Pollutant Combinations (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 final 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 final 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 there have been 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: 3µ3(d) Listed WBPCs or WBPCs that meet 3µ3(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 3µ3(d) List are differentiated from those that are not to support utilization of EWMP compliance mechanisms.
	Category 2B: 3µ3(d) Listed WBPCs or WBPCs that meet 3µ3(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: 3µ3(d) Listed WBPCs or WBPCs that meet 3µ3(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.
	Category 3C: All other WBPCs that have exceeded in the past 1µ 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 3-3 Summary of Ballona Creek Water Body-Pollutant Categories

Constituents	Ballona Creek				Centinela Creek	Sepulveda Channel	Benedict Channel[1]	Santa Monica Bay
	Estuary	Wetlands	Reach 1	Reach 2				
Category 1A: WBPCs with past due or current Permit term TMDL deadlines with exceedances in the past 5 years. (I = Interim and F = Final Limits)								
Trash	I/F	I/F	I/F	I/F	I/F	I/F	--	I
Total Coliform, Fecal Coliform, Enterococcus	F (Dry)	--	--	--	--	--	--	F (Dry)
E. coli	--	--	F (Dry)	F (Dry)	F (Dry)	F (Dry)	F (Dry)	--
Copper, Lead, Zinc, Selenium[2]	--	--	I (Wet & Dry)/F (Dry)				--	--
Sediment: Cadmium, Copper, Lead, Zinc, Silver	I	--	--	--	--	--	--	--
Sediment: PAHs[2], Chlordane, DDT, PCBs	I	--	--	--	--	--	--	--
Category 1B: WBPCs with TMDL deadlines beyond the Permit term with exceedances in the past 5 years. (F = Final Limits)								
Trash	--	--	--	--	--	--	--	F
Copper, Lead, Zinc, Selenium[2]	--		F (Wet)				--	--
Sediment: Cadmium, Copper, Lead, Zinc, Silver	F	--	--	--	--	--	--	--
Sediment: PAHs[2], Chlordane, DDT, PCBs	F	--	--	--	--	--	--	--
Total Coliform, Fecal Coliform, Enterococcus	F (Wet)	--	--	--	--	--	--	F (Wet)
E. coli	--	--	F (Wet)	F (Wet)	F (Wet)	F (Wet)	F (Wet)	--
Category 1C: WBPCs addressed in USEPA TMDL without a Regional Board adopted Implementation Plan. (WLA = Wasteload Allocation in USEPA TMDL)								
DDT (sediment)	--	--	--	--	--	--	--	WLA
PCBs (sediment)	--	--	--	--	--	--	--	WLA
Sediment	--	WLA	--	--	--	--	--	--
Category 1D: WBPCs with past due or current Permit term TMDL deadlines but have not exceeded in past 5 years.								
None	--	--	--	--	--	--	--	--
Category 2A: 3µ3(d) Listed WBPCs or WBPCs that meet 3µ3(d) Listing requirements with exceedances in the past 5 years.								
Shellfish Harvesting Advisory	3µ3(d)	--	--	--	--	--		--
Cyanide	--	--	--	Delist	--	--	--	--
Copper (dissolved and total)	Dry	--	--	--	--	--	--	--
Mercury (total)	--	--	--	Dry	--	--	--	--
4,4'- Dichlorodiphenyldichloroethylene (4,4'-DDE)	--	--	--	--	Wet	--	--	--
Benzo(a)anthracene	--	--	--	Wet	--	--	--	--

Table 3-3 Summary of Ballona Creek Water Body-Pollutant Categories

Constituents	Ballona Creek				Centinela Creek	Sepulveda Channel	Benedict Channel[1]	Santa Monica Bay
	Estuary	Wetlands	Reach 1	Reach 2				
Dibenzo(a,h)anthracene	Dry	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	Dry	--	--	--	--	--	--	--
Category 2B: 3µ3(d) Listed WBPCs or WBPCs that meet 3µ3(d) Listing requirements that are not a "pollutant"[3] (*i.e.*, toxicity).								
pH	--	--	--	Dry	--	Dry	--	--
Category 2C: 3µ3(d) Listed WBPCs or WBPCs that meet 3µ3(d) Listing requirements but have not exceeded in past 5 years.								
Ammonia	--	--	--	--	--	Dry (Delist)	--	--
Copper (dissolved and total)	Wet (NS)	--	--	--	--	--	--	--
Lead (dissolved and total)	Dry	--	--	--	--	--	--	--
Mercury Total	Wet (NS)/Dry (NS)	--	Wet (NS)/Dry (NS)	Wet	--	--	--	--
Nickel (dissolved and total)	Dry (NS)	--	--	--	--	--	--	--
Silver (dissolved and total)	--	--	Wet	--	--	--	--	--
Zinc (dissolved and total)	Wet (NS)	--	--	--	--	--	--	--
Category 3A: All other WBPCs with exceedances in the past 5 years.								
Ammonia-N	--	--	--	Dry	--	--	--	--
Silver (total)	--	--	--	--	Wet	--	--	--
4,4'-DDE	--	--	--	Wet	--	--	--	--
4,4'-DDT	--	--	--	--	Wet	--	--	--
3,4 Benzofluoranthene	--	--	--	Wet	--	--	--	--
alpha-chlordane	--	--	--	Wet	--	--	--	--
gamma-chlordane	--	--	--	Wet	--	--	--	--
Benzo(a)anthracene	--	--	--	--	Wet	--	--	--
Benzo(a)pyrene	--	--	--	Wet	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	Wet	--	--	--
Bis(2-Ethylhexyl) phthalate	--	--	--	Wet	--	--	--	--
Chrysene	--	--	--	Wet	Wet	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	Wet	Wet	--	--	--

Table 3-3 Summary of Ballona Creek Water Body-Pollutant Categories

Constituents	Ballona Creek				Centinela Creek	Sepulveda Channel	Benedict Channel[1]	Santa Monica Bay
	Estuary	Wetlands	Reach 1	Reach 2				
Category 3B: All other WBPCs that are not a "pollutant"[3] (*i.e.*, toxicity).								
Dissolved Oxygen	--	--	--	Wet	--	--	--	--
pH	--	--	--	Wet	Wet/Dry	--	--	--
Category 3C: All other WBPCs that have exceeded in the past ten years, but not in past five years.								
Bis(2-Ethylhexyl) phthalate	--	--	--	Dry	Wet (NS)	Wet (NS)	--	--
Diazinon	--	--	--	Wet	--	Wet (NS)	--	--
Cadmium (total)	--	--	Wet	Wet	Wet	--	--	--
Cyanide (total)	--	--	--	--	--	Wet (NS)	--	--
Silver (dissolved and total)	Wet (NS)	--	--	Wet	--	--	--	--
Zinc (total)	Dry (NS)	--	--	--	--	--	--	--

[1] Note that although Benedict Canyon Channel is identified in TMDLs as a tributary to Ballona Creek, it is a closed channel that daylights where the channel meets Ballona Creek and is not identified in the Basin Plan as a waterbody in the watershed. As such, it is not considered a tributary for the purposes other than addressing the bacteria TMDL for the watershed.

[2] The BC Toxics and Metals TMDLs were amended on December 5, 2µ13 and WLAs associated with these constituents were removed. Associated WQBELs would be expected to be removed when the Permit is updated to incorporate these two TMDLs.

[3] 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 final (F) effluent and/or RWLs.

NS = Not sampled

3µ3(d) = WBPC on the 2µ1µ 3µ3(d) List where the listing was confirmed during data analysis.

Delist = WBPC on the 2µ1µ 3µ3(d) List that could now be delisted.

Table 3-4 Applicable Interim and Final WQBELs and RWLs for Each Identified Category 1, 2, and 3 Pollutant

Constituents	Interim WQBEL	Final WQBEL	RWL	RWL Source
Category 1A: WBPCs with past due or current Permit term TMDL deadlines with exceedances in the past 5 years.				
Trash	[1]	[1]	--	--
Total Coliform, Fecal Coliform, Enterococcus	--	[1]	[1]	TMDL
E. coli	--	[1]	[1]	TMDL
Copper, Lead, Zinc, Selenium[2]	[1]	[1]	--	--
Sediment: Cadmium, Copper, Lead, Zinc, Silver	[1]	--	--	--
Sediment: PAHs[2], Chlordane, DDT, PCBs	[1]	--	--	--
Category 1B: WBPCs with TMDL deadlines beyond the Permit term with exceedances in the past 5 years.				
Trash	--	[1]	--	--
Copper, Lead, Zinc, Selenium[2]	--	[1]	--	--
Sediment: Cadmium, Copper, Lead, Zinc, Silver	--	[1]	--	--
Sediment: PAHs[2], Chlordane, DDT, PCBs	--	[1]	--	--
Total Coliform, Fecal Coliform, Enterococcus	--	[1]	[1]	TMDL
E. coli	--	[1]	[1]	TMDL
Category 1C: WBPCs addressed in USEPA TMDL without a Regional Board adopted Implementation Plan.				
DDT (sediment)	[3]			--
PCBs (sediment)	[3]			--
Sediment	[3]			--
Category 1D: WBPCs with past due or current Permit term TMDL deadlines but have not exceeded in past 5 years.				
None	--	--	--	--
Category 2A: 3μ3(d) Listed WBPCs or WBPCs that meet 3μ3(d) Listing requirements with exceedances in the past 5 years.				
Shellfish Harvesting Advisory	--	--	[4]	BP
Cyanide	--	--	5.2 – 22 mg/L	CTR Freshwater Chronic and Acute
Copper (dissolved)	--	--	3.1 μg/L	CTR Saltwater Chronic
Copper (total)	--	--	3.7 μg/L	CTR Saltwater Chronic
Mercury (total)	--	--	μ.μ5μ - μ.μ51 μg/L	CTR HH Organism
4,4’- Dichlorodiphenyldichloroethylene (4,4'-DDE)	--	--	μ.μμμ59 μg/L	CTR HH Organism
Benzo(a)anthracene	--	--	μ.μ49 μg/L	CTR HH Organism
Dibenzo(a,h)anthracene	--	--	μ.μ5 μg/L	CTR HH Organism
Indeno(1,2,3-cd)pyrene	--	--	μ.μ5 μg/L	CTR HH Organism
Category 2B: 3μ3(d) Listed WBPCs or WBPCs that meet 3μ3(d) Listing requirements that are not a “pollutant” [5] (*i.e.*, toxicity).				
pH	--	--	6.5-8.5	BP Minimum/Maximum
Category 2C: 3μ3(d) Listed WBPCs or WBPCs that meet 3μ3(d) Listing requirements but have not exceeded in past 5 years.				
Ammonia	--	--	[6]	BP 3μ-day Chronic early life stage fish present
Copper (dissolved)	--	--	4.8 μg/L	CTR Saltwater Acute
Copper (total)	--	--	5.8 μg/L	CTR Saltwater Acute

Table 3-4 Applicable Interim and Final WQBELs and RWLs for Each Identified Category 1, 2, and 3 Pollutant

Constituents	Interim WQBEL	Final WQBEL	RWL	RWL Source
Lead (dissolved)	--	--	8.1 µg/L	CTR Saltwater Chronic
Lead (total)	--	--	8.5 µg/L	CTR Saltwater Chronic
Mercury Total	--	--	µ.µ5µ - µ.µ51 µg/L	CTR HH Organism
Nickel (dissolved)	--	--	8.2 µg/L	CTR Saltwater Chronic
Nickel (total)	--	--	8.3 µg/L	CTR Saltwater Chronic
Silver (dissolved and total)	--	--	HBC	CTR Freshwater Acute
Zinc (dissolved)	--	--	9µ µg/L	CTR Saltwater Acute
Zinc (total)	--	--	95.1 µg/L	CTR Saltwater Acute
Category 3A: All other WBPCs with exceedances in the past 5 years.				
Ammonia-N	--	--	[6]	BP 3µ-day Chronic early life stage fish present
Silver (total)	--	--	HBC	CTR Freshwater Acute
4,4'-DDE	--	--	µ.µµµ59 µg/L	CTR HH Organism
4,4'-DDT	--	--	µ.µµµ59 µg/L	CTR HH Organism
3,4 Benzofluoranthene	--	--	µ.µ49 µg/L	CTR HH Organism
alpha-chlordane	--	--	µ.µµµ59 µg/L	CTR HH Organism
gamma-chlordane	--	--	µ.µµµ59 µg/L	CTR HH Organism
Benzo(a)anthracene	--	--	µ.µ49 µg/L	CTR HH Organism
Benzo(a)pyrene	--	--	µ.µ49 µg/L	CTR HH Organism
Benzo(k)fluoranthene	--	--	µ.µ49 µg/L	CTR HH Organism
Bis(2-Ethylhexyl) phthalate	--	--	5.9 µg/L	CTR HH Organism
Chrysene	--	--	µ.µ49 µg/L	CTR HH Organism
Indeno(1,2,3-cd)pyrene	--	--	µ.µ49 µg/L	CTR HH Organism
Category 3B: All other WBPCs that are not a "pollutant"[5] (*i.e.*, toxicity).				
Dissolved Oxygen	--	--	5 mg/L	BP Single sample
pH	--	--	6.5-8.5	BP Minimum/Maximum
Category 3C: All other WBPCs that have exceeded in the past ten years, but not in past five years.				
Bis(2-Ethylhexyl) phthalate	--	--	5.9 µg/L	CTR HH Organism
Diazinon	--	--	µ.17 µg/L	USEPA Freshwater Acute
Cadmium (total)	--	--	HBC	CTR Freshwater Acute
Cyanide (total)	--	--	22 mg/L	CTR Freshwater Acute
Silver (dissolved)	--	--	1.9 µg/L	CTR Saltwater Acute
	--	--	HBC	CTR Freshwater Acute
Silver (total)	--	--	2.24 µg/L	CTR Saltwater Acute
	--	--	HBC	CTR Freshwater Acute
Zinc (total)	--	--	85.6 µg/L	CTR Saltwater Chronic

[1] Interim and final WQBELs and RWLs for TMDLs in the Ballona Creek Watershed are listed in Part E of Attachment M of the MS4 Permit.
[2] The BC Toxics and Metals TMDLs were amended on December 5, 2µ13 and WLAs associated with these constituents were removed. Associated WQBELs would be expected to be removed when the Permit is updated to incorporate these two TMDLs.
[3] Constituent assigned Wasteload Allocation in USEPA TMDL.

[4] The Ballona Creek Estuary is listed as impaired based on an existing shellfish harvesting advisory.
[5] While pollutants may be contributing to the impairment, it currently is not possible to identify the specific pollutant/stressor.
[6] The 3µ-day chronic-criterion objective is pH and temperature dependent.
Note that unless explicitly stated as sediment, constituents are associated with the water column.
BP = Basin Plan
HBC = Hardness Based Criteria, as defined by CTR
HH = Criteria for the protection of human health

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 pathways outlined in the Permit:

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

USEPA TMDLs, 303(d) listings without an adopted TMDL, 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 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 (e.g.., 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[4] 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.

As such, the process for setting numeric milestones and compliance schedules for the remaining water quality priorities is dependent upon whether or not the water body is identified as impaired on the

[4] 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." Due to the need to define the control measures and timelines for addressing the various pollutants per the permit requirements, "classes" are preliminary in nature and may be refined as part of EWMP development.

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 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 EWMP implementation schedule was developed based on TMDL milestones (e.g., interim and final numeric limits). Interim and final compliance dates in the Regional Board adopted TMDLs are the primary drivers for the BC EWMP Group RAA and EWMP implementation schedule. Table 3-6 presents the compliance schedule for USEPA TMDLs, 303(d) listings, and other RWL exceedances which fall under Category 1, 2 and 3. For simplicity, only the year of each milestone is shown; however, the exact date remains consistent with the milestone dates included in the relevant Regional Board-adopted TMDL (Table 3-5). The EWMP, including its implementation schedule will be reviewed and updated periodically as part of the adaptive management process; therefore, the schedule identified in Table 3-6 may be revised in the future Regional BMPs on private land make up over half the capacity, due to limited public space for constructing control measures. Over time, if additional public opportunities are identified, the portion of the Implementation Strategy that is the regional BMPs on private land could be reduced.

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 final schedule milestones are based on the schedule for the BC Toxics TMDL. The final dry and wet weather milestone for Category 2 WBPCs that meet the requirements to be removed from the 303(d) List and Category 3 WBPCs presented in Table 3-7 is January 11, 2021. Table 3-8 presents the list of the remaining Category 2 and 3 WBPCs where the WBPC is a condition rather than a “pollutant” with the potential to be discharged from the MS4. Data collected under the CIMP will be assessed and if the MS4 discharges are identified as causing or contributing to exceedances for WBPCs identified in Table 3-8, 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 BC watershed is provided in Appendix 3.

Table 3-5 Summary of Compliance Dates and Milestones for TMDLs in the BC EWMP Area

TMDL	Water-bodies	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	2017	2018	2019	2020	2021	2025
BC Trash	All Water-bodies	Trash	% Reduction	All	**9/30**	**9/30**	**9/30**	**9/30**							
					80%	**90%**	**96.7%**	**100%**							
Santa Monica Bay Trash	Santa Monica Bay	Trash	% Reduction	All					**3/20**	**3/20**	3/2µ	3/2µ	3/2µ		
									20%	**40%**	6µ%	8µ%	1µµ%		
BC Toxics	Estuary	Sediment: Copper, Lead, Zinc, Silver,	% of MS4 Area Meets WQBELs	All		**1/11**		**1/11**		**1/11**				1/11	
		DDT, Chlordane, PCBs				**25%**		**50%**		**75%**				1µµ%	
Amended BC Toxics	Estuary	Sediment: Copper, Lead, Zinc, Silver, DDT, Chlordane	% of MS4 Area Meets WQBELs or Reduction in Loading	All		**1/11**			**1/11**	**1/11**				1/11	1/11
						25%			**50%**	**75%**				1µµ%	
		Sediment: PCBs				**25%**			**25%**					5µ%	1µµ%
BC Metals	Reach 1, 2, Sepulveda Channel	Copper, Lead, Zinc, Selenium	% of MS4 Area Meets WQBELs	Dry	**1/11**		**1/11**		**1/11**					1/11	
					50%		**75%**		**100%**						
				Wet	**25%**				**50%**					1µµ%	
Amended BC Metals	Reach 1, 2, Sepulveda Channel	Copper, Lead, Zinc	% of MS4 Area Meets WQBELs or Reduction in Loading	Dry	**1/11**		**1/11**		**1/11**					1/11	
					50%		**75%**		**100%**						
				Wet	**25%**				**50%**					1µµ%	

Table 3-5 Summary of Compliance Dates and Milestones for TMDLs in the BC EWMP Area

TMDL	Water-bodies	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	2017	2018	2019	2020	2021	2025
BC Bacteria	Estuary Centinela Creek, Del Rey Lagoon	Total Coliform, Fecal Coliform, Enterococcus	Meet RWLs/WLAs	Dry		**4/27**								7/15	
						100%									
	Reach 2, Sepulveda Channel, Benedict Canyon[2]	*E. coli*		Wet										1µµ%	
Santa Monica Bay DDTs and PCBs	Santa Monica Bay	PCBs and DDT	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.										
BC Wetlands Sediment and Invasive Exotic Vegetation	Wetlands	Sediment and Invasive Species	Meet WLAs	All											

[1] The Permit term is assumed to be five years from the Permit effective date or December 27, 2µ17.

[2] Note that although Benedict Canyon Channel is identified in TMDLs as a tributary to Ballona Creek, it is a closed channel that daylights where the channel meets Ballona Creek and is not identified in the Basin Plan as a waterbody in the watershed. As such, it is not considered a tributary for the purposes other than addressing the bacteria TMDL for the watershed

Table 3-6 Compliance Schedule for Category 1, 2, and 3 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]										
				2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2025
Mercury (total)	C2: Estuary C2: Reach 2 C2: Reach 1	Amended BC Metals	Dry	**50%**		**75%**		**100%**						
			Wet	**25%**				**50%**					1µµ%	
Nickel[2]	C2: Estuary	Amended BC Metals	Dry	**50%**		**75%**		**100%**						
Silver	C3: Reach 2 C2: Reach 1 C3: Centinela	Amended BC Metals	Wet	**25%**				**50%**					1µµ%	
DDT (sediment)	C1 (EPA TMDL): Santa Monica Bay	Amended BC Toxics	All		**25%**			**50%**	**75%**				1µµ%	
PCBs (sediment)	C1 (EPA TMDL): Santa Monica Bay	Amended BC Toxics	All		**25%**			**25%**					5µ%	1µµ%
Sediment	C1 (EPA TMDL): Wetlands	Amended BC Toxics	All		**25%**			**50%**	**75%**				1µµ%	
4,4'-DDE	C3: Reach 2 C2: Centinela	Amended BC Toxics	Wet		**25%**			**50%**	**75%**				1µµ%	
Benzo(a)anthracene	C2: Reach 2 C3: Centinela	Amended BC Toxics	Wet		**25%**			**50%**	**75%**				1µµ%	
Dibenzo(a,h)anthracene	C2: Estuary	Amended BC Toxics	Dry		**25%**			**50%**	**75%**				1µµ%	
Indeno(1,2,3-cd)pyrene	C2: Estuary C3: Reach 2 C3: Centinela	Amended BC Toxics	All		**25%**			**50%**	**75%**				1µµ%	
Shellfish Harvesting Advisory	C2: Estuary	BC Bacteria	Dry										1µµ%	
			Wet										1µµ%	

[1] The Permit term is assumed to be five years from the Permit effective date or December 27, 2µ17.

[2] Note that if additional control measures will need to be implemented to provide reasonable assurance that RWLs will be met in the Ballona Creek Estuary, the schedule will extend beyond the Amended BC Metals TMDL schedule and will be developed based on the RAA analysis to reflect the additional reductions necessary to meet the RWL.

Table 3-7 Compliance Schedule based on the BC Toxics TMDL for Category 2 and 3 Water Quality Priorities that Do Not Meet the 303(d) Listing[1] Requirements

Constituent	WQP Category and Water Body	Weather Condition	Schedule	Notes
Cadmium (total)	C3: Reach 2 C3: Reach 1 C3: Centinela	Wet	January 11, 2µ21	Only 2 of 1µ3 exceedances in last 1µ years in Reach 2, 1 of 2µ exceedances in last 1µ years in Reach 1, and 2 of 38 exceedances in last 1µ years in Centinela Creek
4,4'-DDT	C3: Centinela	Wet		Only 1 of 27 exceedances in last 1µ years in Centinela Creek
3,4 Benzofluoranthene	C3: Reach 2	Wet		Only 1 of 59 exceedances in last 1µ years in Reach 2
alpha-chlordane	C3: Reach 2	Wet		Only 1 of 57 exceedances in last 1µ years in Reach 2
gamma-chlordane	C3: Reach 2	Wet		Only 1 of 57 exceedances in last 1µ years in Reach 2
Benzo(a)pyrene	C3: Reach 2	Wet		Only 1 of 66 exceedances in last 1µ years in Reach 2
Benzo(k)fluoranthene	C3: Centinela	Wet		Only 1 of 27 exceedances in last 1µ years in Centinela Creek
Bis(2-Ethylhexyl) phthalate	C3: Reach 2 C3: Centinela C3: Sepulveda	All		Only 5 of 72 exceedances in last 1µ years in Reach 2, 1 of 14 exceedances in last 1µ years in Centinela Creek, and 1 of 14 exceedances in last 1µ years in Sepulveda Channel
Chrysene	C3: Reach 2 C3: Centinela	Wet		Only 1 of 66 exceedances in last 1µ years in Reach 2 and 1 of 27 exceedances in last 1µ years in Centinela Creek
Diazinon	C3: Reach 2 C3: Sepulveda	Wet		Only 2 of 61 exceedances in last 1µ years in Reach 2 and 1 of 11 exceedances in last 1µ years in Sepulveda Channel
Cyanide	C2: Reach 2 C3: Sepulveda	All		Meets criteria to de-list for waterbodies on 3µ3(d) list and does not meet criteria to be placed on 3µ3(d) list for waterbodies not on 3µ3(d) list
Ammonia	C3: Reach 2 C2: Sepulveda	Dry		Meets criteria to de-list for waterbodies on 3µ3(d) list and does not meet criteria to be placed on 3µ3(d) list for waterbodies not on 3µ3(d) list

[1] 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.

Table 3-8 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

Constituent	WQP Category and Water Body	Weather Condition	Notes
Dissolved Oxygen	C3: Reach 2	All	Reflective of a condition of pollution, not necessarily a result of MS4 discharge
pH	C2: Reach 2 C2: Sepulveda	All	Reflective of a condition of pollution, not necessarily a result of MS4 discharge

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[5]. 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 Ballona Creek 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 includes an acknowledgement of other regional planning efforts underway by many other agencies and organizations, and highlights specific elements of the EWMP regional project opportunities that will be integrated with those regional efforts. 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 high-level overview of green infrastructure, which includes LID and green streets, 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 tens to hundreds of acres). Regional projects have access to large volumes of runoff from extensive upstream areas, and thus can provide a cost-effective mechanism for pollutant load reduction through infiltration or capture and use. 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 the cost-effective locations with the best available BMP opportunity.

Regional BMP 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 water quality improvement including water supply augmentation, community enhancement, and habitat restoration. The ability to meet many needs with a single project makes regional projects not only attractive from a water quality efficiency standpoint, but 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 the EWMP effort, generate funding interest, and make significant progress toward multi-agency objectives (e.g., park improvements, flood control facility rehabilitation, *etc.*).

[5] 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 final TMDL RWLs and WQBELs for upstream areas.

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 non-potable water supplies for activities like toilet flushing and irrigation.
- Naturalized systems like infiltration basins and stormwater wetlands can also enhance plant and bird, and allow educational opportunities through the creation of "outdoor classroom."

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. Shown in Appendix 4.A are a series of example "BMP fact sheets" that present the different types of regional projects, including the following illustrated in Figure 4-1:

- Infiltration facilities (surface basins or subsurface galleries),
- Retention facilities (surface basins or subsurface galleries),[6]
- Constructed wetland, and flow-through/linear wetland.

Through detailed screening processes, water quality modeling and feasibility analyses (described in subsequent subsections), regional projects[7] were selected and placed into the three 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 would nonetheless be evaluated for EWMP implementation. Not all EWMP Group members included Medium projects in their EWMP Implementation Strategy. However, Medium projects could be included during adaptive management and implemented as partnership-driven alternatives to Regional Private Projects for potential cost savings.

---

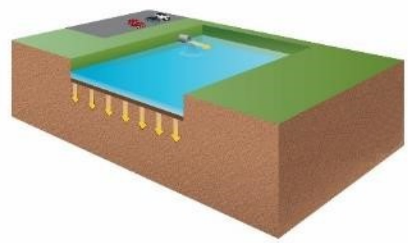
[6] Retention facilities also include structural BMPs designed to capture and use runoff to offset non-potable water supply

[7] While the Permit emphasizes regional projects that can retain the 85th percentile, 24-hour storm from its upstream drainage area, EWMP Group 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.

- **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 streets 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 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. EWMP Group Members that did not elect to include Medium regional opportunities in the RAA could potentially use these other public opportunities to offset the need for private land acquisition. 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.

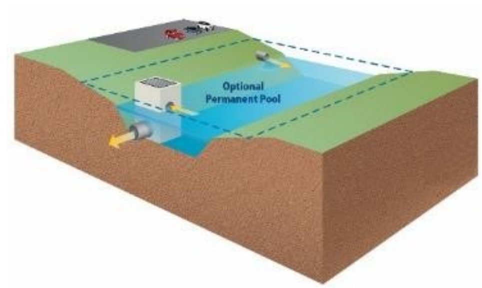
Infiltration Facilities

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.



Retention Facilities

Retention facilities are designed to retain runoff and improve water quality primarily through pollutant settling. Stored water can also be used to augment local water supply (e.g. via irrigation of parks and open spaces). Retention 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.

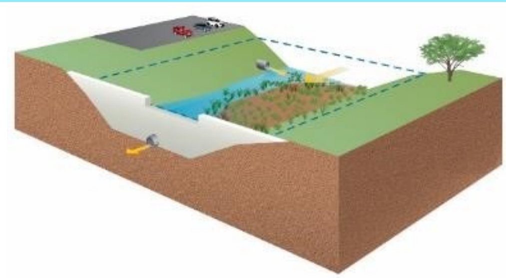


Figure 4-1 Examples of Types of Regional Projects to be used for EWMP Implementation (more details provided in Appendix 4.A)

4.3 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. A total of 26 Very High and 42 High projects are included in the EWMP Implementation Strategy[8]. Combined, as shown in Figure 4-2, regional projects on public land make up 18 percent of the total control measure capacity[9] in the EWMP.

Regional projects on private land make up an additional 52 percent of the EWMP capacity[10]. Combined, regional projects represent 70 percent of the EWMP control measures.

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, then regional projects on public land would make up an even larger component of the EWMP or reduce the need for regional projects on private land.

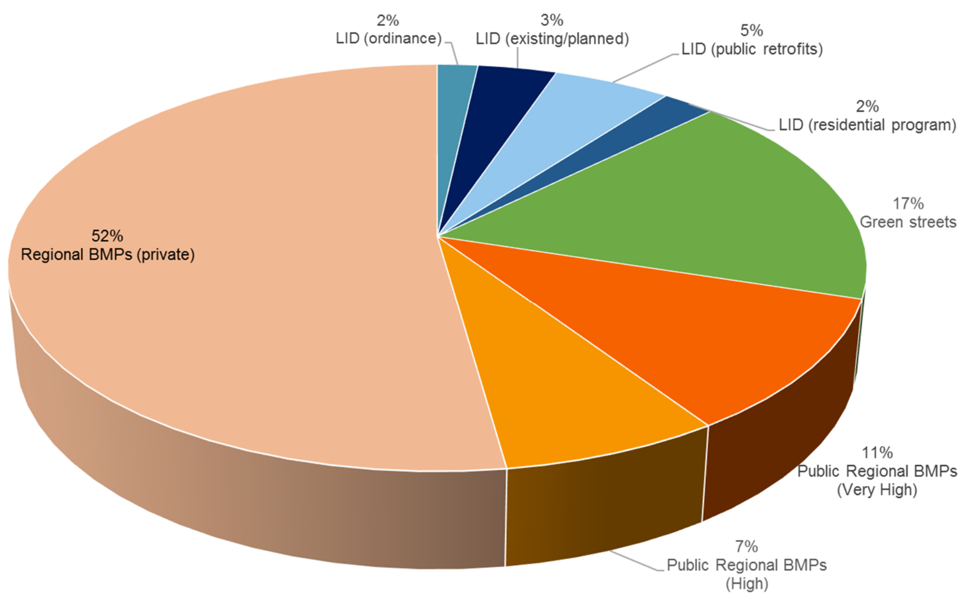


Figure 4-2 Relative Capacities of Different Control Measure Categories for the BC EWMP by 2021[11]

[8] 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.

[9] In other words, regional projects on public land make up 18 percent of the "void space" of all control measures in the EWMP Implementation Strategy.

[10] The capacities shown in Figure 4-3 are for implementation through 2021.

[11] All of the additional control measure capacity between metals and bacteria TMDL attainment 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 300 acres of regional BMP footprint for metals and an additional 64 acres for bacteria.

4.4 How were Regional BMPs Selected for the EWMP?

The EWMP Group developed and implemented a process for identifying opportunities for regional projects. 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 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 inches storm drain or open channels, tributary drainage area and other criteria described in more detail in the Appendix 4.B.

The outcome of this process was identification of over 400 *opportunities* throughout the watershed and ranked into three categories: Very High (26), High (42) and Medium (341), based on criteria summarized in Appendix 4.B. These regional project opportunities are depicted in Figure 4-3. During the RAA process (Section 6), the list of projects was refined and the RAA evaluated and selected for inclusion in the EWMP, based on cost-benefit optimization, 28 Very High and 15 High opportunities. 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).

4.5 Which Signature Regional Projects are included in the EWMP?

A key outcome of the regional project selection process was identification of ten signature regional projects, as listed in Table 4-1. In addition to the projects shown below, there are several additional projects that are Very High priority, including the North Outfall Treatment Facility ([NOTF], also known as the Low Flow Treatment Facility #1). These signature projects were subject to more detailed environmental, geotechnical and engineering feasibility analysis. The evaluation methodology and a more detailed description of these analyses and results are 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 (for subsequent use) and infiltration as primary functionality. On the following pages (Figure 4-5 through Figure 4-39), example “project fact sheets” are presented for the signature projects. The following items are included for each project fact sheet:

- A fact sheet with a summary description of the recommended BMP project; BMP parameters; and a description of potential benefits;
- A figure showing a plan view of the project site, showing the identified BMP opportunity area(s) and surrounding storm drain infrastructure;
- A figure showing a plan view of the maximum and alternative drainage areas delineated for the project site;
- A figure presenting preliminary design concepts; and
- 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 which 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 flow from an 85th percentile, 24-hour 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 than simply capturing the 85th percentile, 24-hour storm event defined in the MS4 Permit. The process of optimizing the size of each potential BMP site location is described in more detail in Appendix 4.C. Additional geotechnical data (cone penetrometer testing [CPT]) was collected for the projects and are included as Appendix 4.D.

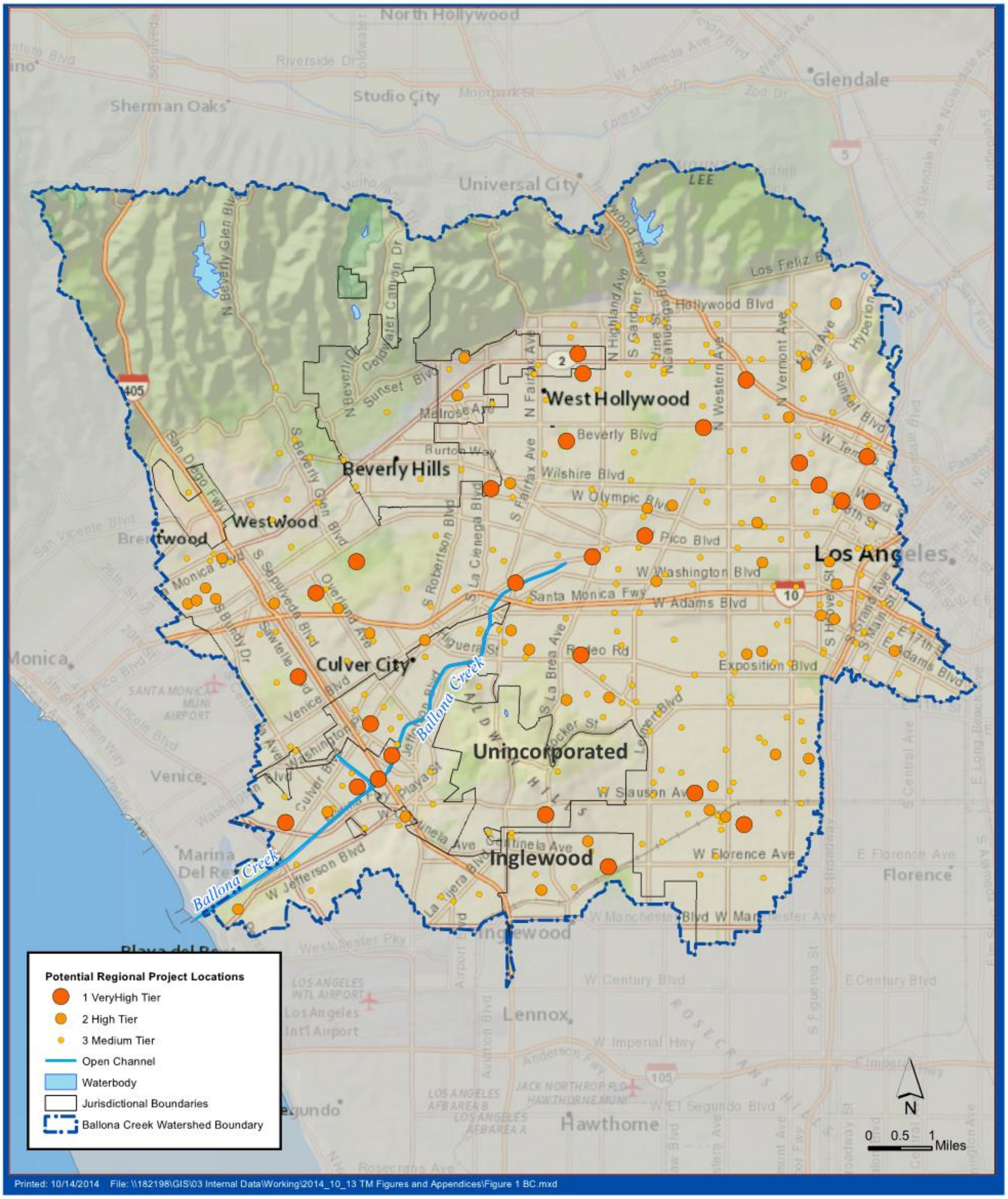


Figure 4-3 Regional Project Opportunities in the Ballona Creek Watershed

Table 4-1 Summary of Signature Projects

Regional Project	Responsible EWMP Group Members in Design Drainage Area[1]	BMP Type	Design Drainage Area[3]	Available BMP Volume	Recom-mended BMP Volume	Approximate Rainfall Event Depth Captured Based on Recommended Volume[2]	Retains the 85th Percentile, 24-Hour Storm Event?	Total Capital Cost Estimate
			(acres)	(AF)	(AF)	(inch)		
Rancho Park Golf Course and Cheviot Hills Recreation Center	Los Angeles, (Beverly Hills, County of Los Angeles)	Surface and Subsurface Retention & Infiltration	359	4µ3	11.6	1.2	Yes	$4,374,µµµ
La Cienega Park	Beverly Hills, Los Angeles, (West Hollywood)	Subsurface Retention & Infiltration	578	51.3	24	1.µ	Yes	$32,176,µµµ
Culver Boulevard Median	Culver City, Los Angeles	Subsurface Retention & Infiltration	829	33.7	29.2	µ.6	No[4]	$16,55µ,µµµ
Edward Vincent Junior Park	Inglewood, Los Angeles, County of Los Angeles	Biofiltration and Wetlands	983	63	45.7	1.µ	Yes	$44,891,µµµ
Lafayette Park	Los Angeles	Subsurface Retention & Infiltration	637	25	18	µ.5	No	$27,681,µµµ
Poinsettia Park	Los Angeles, West Hollywood	Subsurface Retention & Infiltration	1,379	15.5	1µ.1	µ.2	No	$13,523,µµµ
Queen Anne Recreation Center	Los Angeles	Subsurface Retention & Infiltration	3,µ67	42	11.6	µ.1	No	$33,165,µµµ
Plummer Park	Los Angeles, West Hollywood	Subsurface Retention & Infiltration	283	7.2	7.2	µ.7	No	$12,5µ8,µµµ
Ladera Park	County of Los Angeles	Subsurface Retention & Infiltration	11µ	7.µ	5.3	1.µ	Yes	$7,µµ8,µµµ
Westside Water Quality Improvement Project, Phase 2	Santa Monica, Los Angeles	Subsurface Retention & Harvest for Irrigation and Indoor Flushing	2,736	TBD	TBD	µ.8+ (Anticipated)	TBD	TBD

[1] EWMP Group Members listed in parentheses are included in the maximum potential drainage area to site, but are not tributary to the specific storm drain diversion point for the alternative design drainage area.
[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).
[3] Design drainage area reflects the area considered during the design for retaining the design storm or maximizing pollutant load reduction and is either the maximum or alternative drainage area (defined in Table 4-2).
[4] An optimization routine was run, which resulted in maximizing pollutant load reduction from the maximum drainage area versus capturing the BMP volume from the alternative design area.

Table 4-1 Summary of Signature Projects (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)	
Rancho Park Golf Course and Cheviot Hills Recreation Center	December 2µ17	n/a	December 2µ17	1	µ.5	µ.75	Groundwater recharge (Santa Monica Basin), potential enhancement of park features and facilities, flood control benefits, trash capture, public outreach and education
La Cienega Park	December 2µ17	December 2µ17	December 2µ17	2	µ.5	4.5	Groundwater recharge (Central Basin), enhancement of park features and facilities, flood control benefits, trash capture, public outreach and education
Culver Boulevard Median	September 2µ16	May 2µ16	n/a	2	µ.1	4.5	Groundwater recharge (Santa Monica Basin), flood control benefits, heat island alleviation from new street trees, trash capture, public outreach and education
Edward Vincent Junior Park	December 2µ17	December 2µ17	December 2µ17	2	µ.5	6.25	Groundwater recharge (Boundary of Central and West Coast Basins), flood control benefits, wildlife habitat and passive recreation, enhancement of existing park facilities, trash capture, public outreach and education
Lafayette Park	December 2µ17	n/a	December 2µ17	2	µ.5	4	Groundwater recharge (Central Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Poinsettia Park	December 2µ17	December 2µ17	December 2µ17	1	µ.5	2	Groundwater recharge (Hollywood Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Queen Anne Recreation Center	December 2µ17	n/a	December 2µ17	2	µ.5	4.75	Groundwater recharge (Central Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Plummer Park	December 2µ17	December 2µ17	December 2µ17	1	µ.5	1.75	Groundwater recharge (Hollywood Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Ladera Park	December 2µ17	n/a	December 2µ17	1	µ.5	1	Groundwater recharge (West Coast Basin), flood control benefits, enhancement of existing park facilities, trash capture, public outreach and education
Westside Water Quality Improvement Project, Phase 2	Completed	December 2µ17	December 2µ17	1	µ.5	2	Potable water offset via onsite use (irrigation and toilet flushing), flood control benefits, enhancement of existing park facilities, public outreach and education

Table 4-2 Key Design Parameters

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 Appendix 4.C.
	Alternative (Minimum) Drainage Area	The area in acres of the alternative drainage area delineated for each project site. The alternative drainage area was developed for those sites where it was acknowledged a BMP for the maximum drainage area may not be achievable. The alternative drainage area delineation is described in Section 2 of Appendix 4.C.
	Maximum Required BMP Volume	The BMP volume in acre-feet (AF) that is required to retain the flow from the 85th percentile, 24-hour design storm generated from the maximum drainage area.
	Alternative Required BMP Volume	The BMP volume in AF that is required to retain the flow from the 85th percentile design storm generated from the alternative drainage area.
	Groundwater Depth	The depth to groundwater in feet from the ground surface. Groundwater depths were determined using groundwater contours and ground elevation GIS data provided by the City. The depth to groundwater measurements are from previous studies. Current depth to groundwater will be evaluated prior to the next design stage.
BMP Design Parameters	**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.
	Recommended Maximum BMP Depth	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 AF 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 amount of stormwater volume to be captured in the BMP in AF. This volume is recommended based on the hydrologic modeling and optimization results as discussed in Section 2 of Appendix 4.C.

4.5.1 Rancho Park Golf Course and Cheviot Hills Recreation Center

Rancho Park Golf Course and Cheviot Hills Recreation Center is located within the City of Los Angeles in an area that drains to Sepulveda Channel. The site consists of an 18-hole golf course, a driving range, a club house, and several active recreational fields. The potential BMP type is proposed as a belowground retention/infiltration basin situated beneath sports fields on the east side of the facility. The City is supportive of another potential BMP type that is proposed for the west side of the park which is a surface retention/infiltration basin in an area currently utilized for some staging and storage.

The maximum drainage area for this project site is 7,273 acres. This maximum drainage area includes the watershed draining to Benedict Canyon, located less than two miles to the east of the identified BMP opportunity area. After review of available site information and surrounding infrastructure data, a smaller (alternative) drainage area was delineated, encompassing approximately 359 acres.

After reviewing the hydrologic model results and estimated runoff volumes for the various diversion scenarios, it was determined that this site is best suited for a proposed retention/infiltration BMP, sized to accommodate the 85th percentile, 24-hour design storm volume contributed from the alternative drainage area. As a result, the recommended active volume of the BMP is 11.6 acre feet. It should be noted that the City is considering a project to divert dry weather flows from nearby

Benedict Canyon to be treated at this project site. The recommended active volume presented below does not include the potential diversion of dry weather flows from Benedict Canyon.

Table 4-3 below summarizes some key conceptual design parameters for this project site. Figures 4-4 through 4-7 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 Rancho Park Golf Course and Cheviot Hills Recreation Center Design Parameters

Rancho Park Golf Course and Cheviot Hills Recreation Center Design Parameters (LA10)		
Project Site Parameters	Total (Maximum) Drainage Area	7,273 acres
	Alternative (Minimum) Drainage Area	359 acres
	Maximum Required BMP Volume	181.4 AF
	Alternative Required BMP Volume	7.7 AF
	Groundwater Depth	5µ feet
BMP Design Parameters	BMP Opportunity Area	15.5 acres
	Recommended Maximum BMP Depth	26 feet
	Available BMP Volume	4µ3 AF
	Recommended Active BMP Volume	**11.6** AF

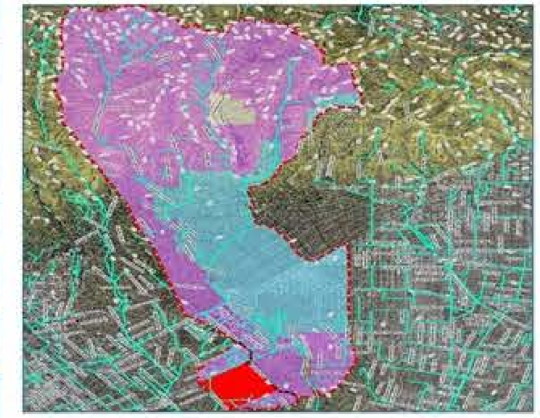
Ballona Creek Enhanced Watershed Management Program
Signature Project
Rancho Park Golf Course / Cheviot Hills Recreation Center
FACT SHEET
PN 182198

Site Location			
Site Location, City	Los Angeles	Site Name	Rancho Park Golf Course/Cheviot Hills Recreation Center
Latitude	34° 2' 43.548" N	Longitude	118° 25' 14.49" W
Landuse	Open Space	Street Address	10000 W Pico Blvd
Major Watershed	Ballona Creek	Land Owner	City of Los Angeles
Existing Land Use of Site: Park			

Watershed Characteristics	
Drainage Area Max/Alternative, ac	7,273/359
Hydrologic Soil Group	Ramona Sandy Loam, Tujunga Fine Sandy Loam
Soil Infiltration Rate, in/hr	0.29
Design Storm Event, in	85th Percentile, 24 hr
Recommended Active BMP Volume, ac-ft = 11.8	

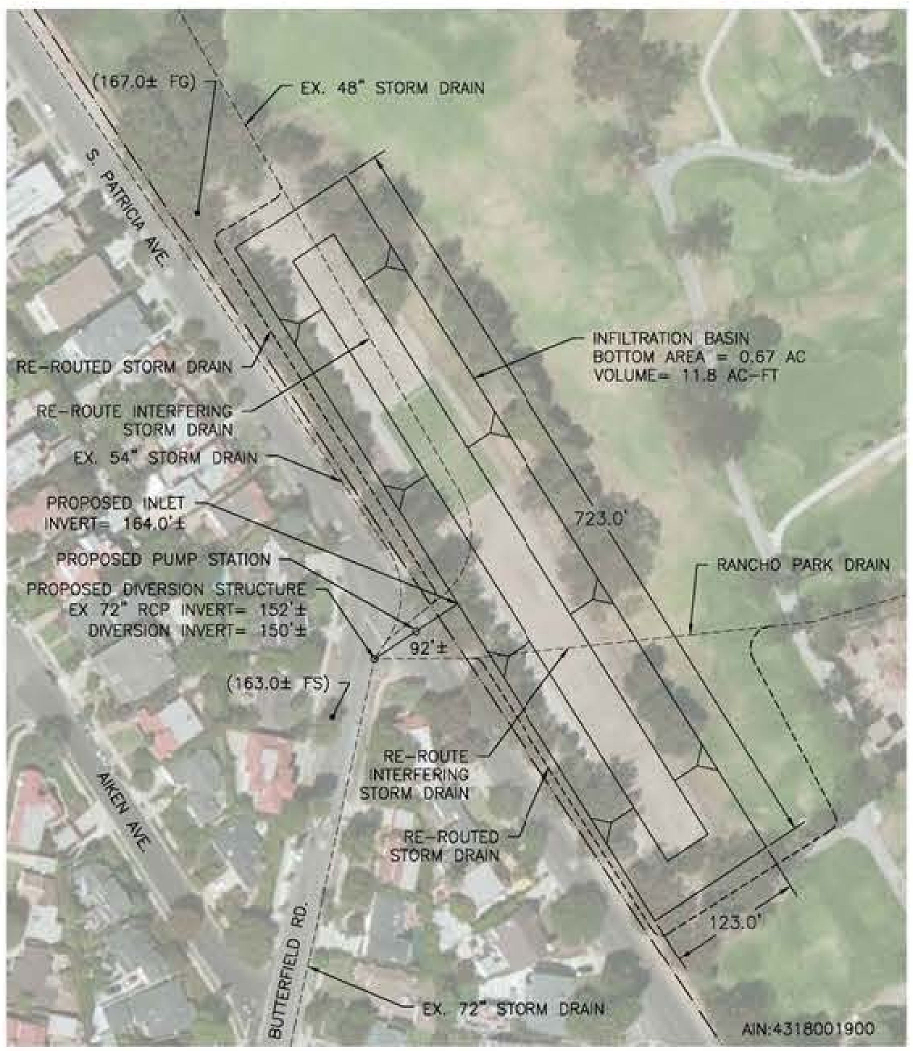
Retrofit Characteristics	
Proposed Retrofit	Surface and Subsurface Infiltration
Recommended BMP Footprint, ft²	88,929
Available BMP Volume, ac-ft	403
BMP Water Storage Depth, ft	10
Gravel Depth, ft	0

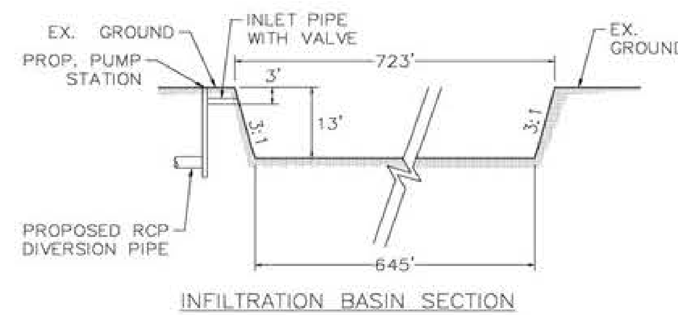
Budget-Level estimates for both soft and hard costs	$4,374,000	**Schedule**	1 year design, 6 months bid, 9 months construction (2 ¼ years total)

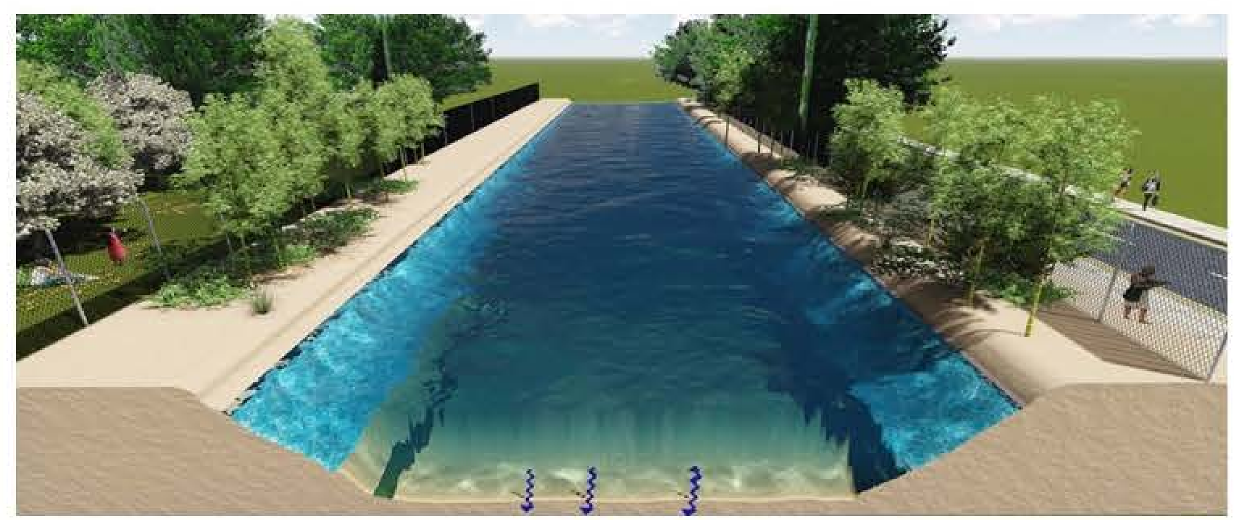


Drainage Map

Watershed and Vicinity







Rendered Improvements

Note: Figures are not to scale

Figure 4-4 Rancho Park Golf Course and Cheviot Hills Recreation Center Super Fact Sheet

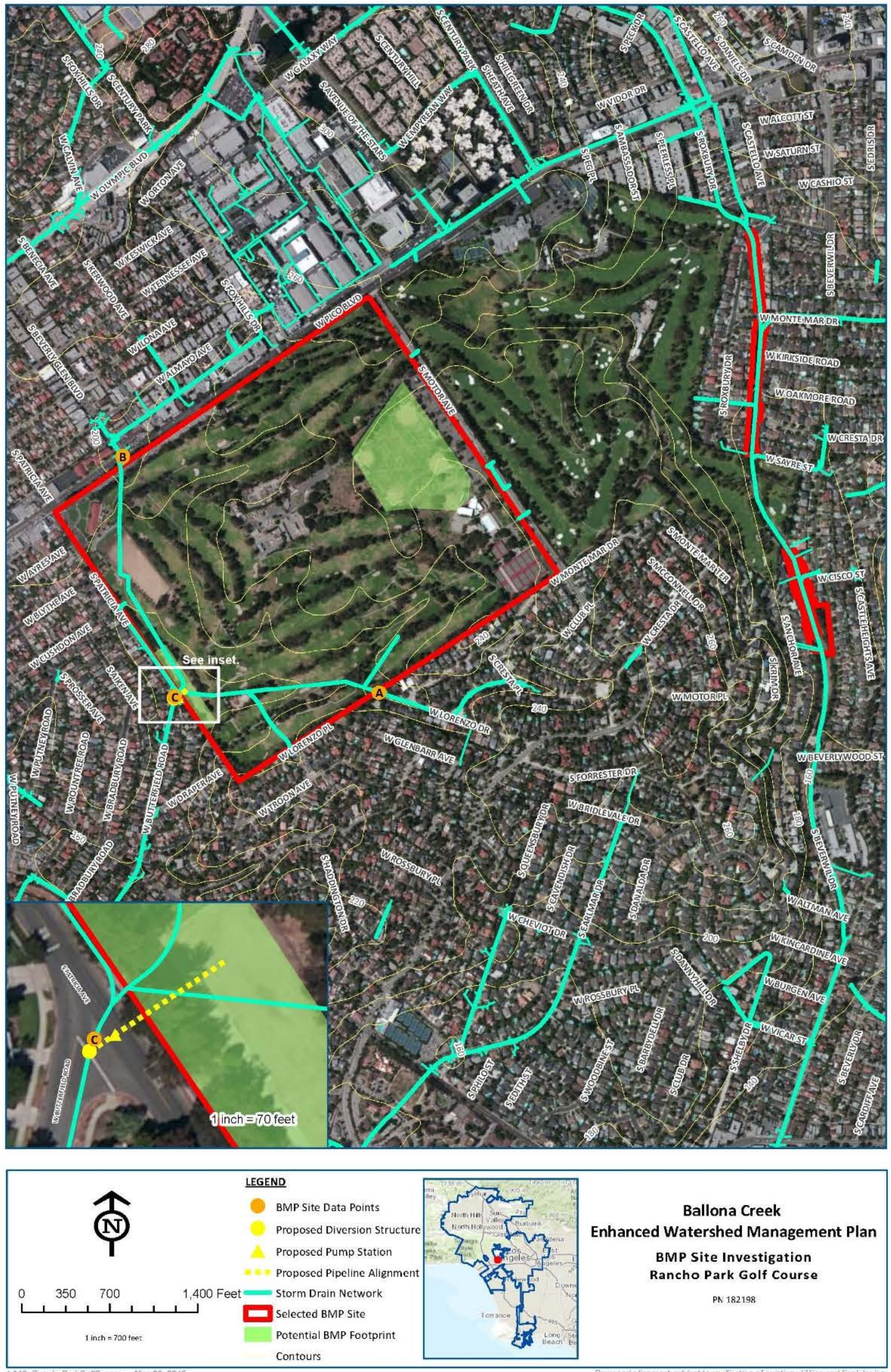


Figure 4-5 Rancho Park Golf Course and Cheviot Hills Recreation Center Surface and Subsurface Infiltration Basin – Preliminary Design Concepts

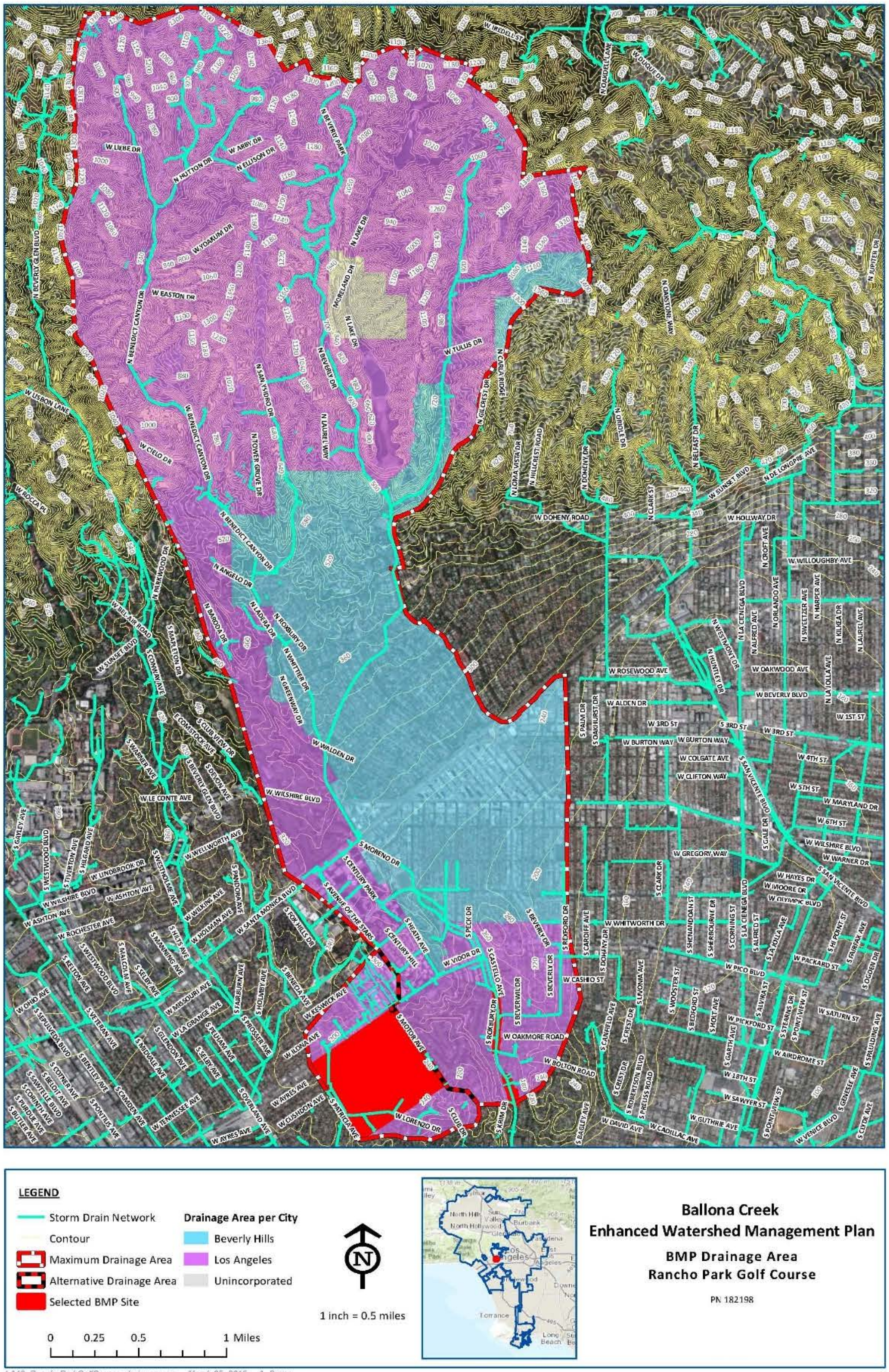


Figure 4-6 Rancho Park Golf Course and Cheviot Hills Recreation Center Surface and Subsurface Infiltration Basin – Drainage Map

Figure 4-7 Rancho Park Golf Course and Cheviot Hills Recreation Center Surface and Subsurface Infiltration Basin – Preliminary Design Concepts

4.5.2 La Cienega Park / Frank Fenton Field

La Cienega Park and Frank Fenton Field are both located within the City of Beverly Hills in an area that drains to Ballona Creek. The park is owned and operated by the City of Beverly Hills. The parks consist of a community center, tennis courts, a playground, a running track and several active recreational fields. The potential BMP is proposed as a belowground retention/infiltration basin situated beneath sports fields on the south and east portions of the park.

The maximum drainage area for this project site is approximately 7,776 acres. After review of available site opportunities and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 578 acres.

After reviewing the hydrologic model results and estimated runoff volumes for the various diversion scenarios, it was determined that a belowground retention/infiltration BMP sized to accommodate the 85th percentile, 24-hour storm event runoff contributed from the alternative drainage area is best suited for this project site. As a result, the recommended active volume of the BMP is 24.0 acre-feet.

Table 4-4 summarizes some key conceptual design parameters for this project site. Figure 4-8 through 4-11 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 La Cienega Park/Frank Fenton Field Design Parameters

La Cienega Park/Frank Fenton Field Design Parameters (BH01)		
Project Site Parameters	Total (Maximum) Drainage Area	7,776 acres
	Alternative (Minimum) Drainage Area	578 acres
	Maximum Required BMP Volume	352 AF
	Alternative Required BMP Volume	24 AF
	Groundwater Depth	25 feet
BMP Design Parameters	BMP Opportunity Area	6.4 acres
	Recommended Maximum BMP Depth	8 feet
	Available BMP Volume	51.3 AF
	Recommended Active BMP Volume	**24** AF

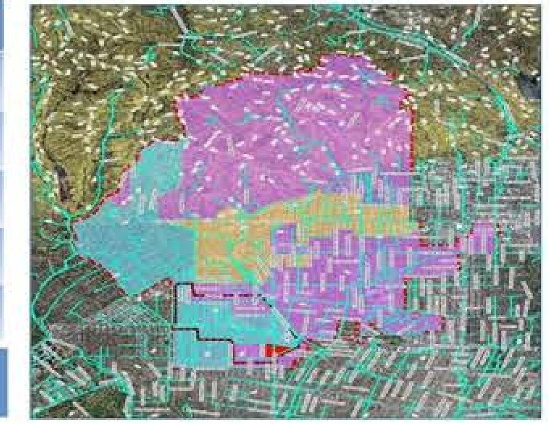
Ballona Creek Enhanced Management Program
Signature Project: La Cienega Park
FACT SHEET
PN 182198

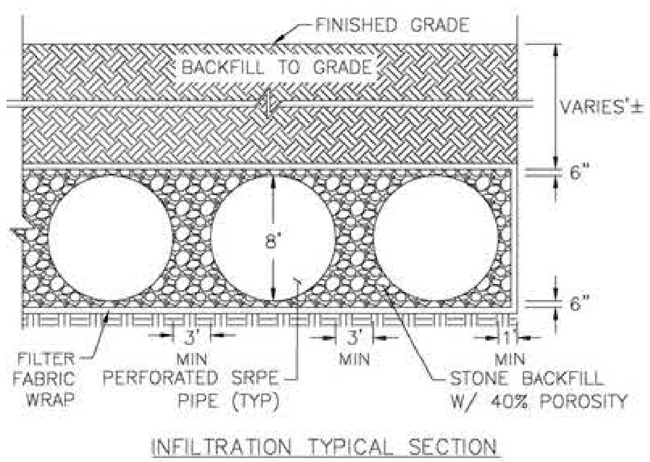
Note: Figures are not to scale

Site Location			
Site Location, City	Beverly Hills	Site Name	La Cienega Park
Latitude	33° 59' 38.23" N	Longitude	118° 22' 7.7448" W
Landuse	Open Space	Street Address	8400 Gregory Way
Major Watershed	Ballona Creek	Land Owner	City of Beverly Hills
Existing Land Use of Site: Park			

Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Alternative, ac	7,776/578	Proposed Retrofit	Subsurface Infiltration
Hydrologic Soil Group	Hanford Fine Sandy Loam	Recommended BMP Footprint, ft^2	167,923
Soil Infiltration Rate, in/hr	0.06	Available BMP Volume, ac-ft	51.3
Design Storm Event, in	85th Percentile, 24 hr	BMP Water Storage Depth, ft	9
Recommended Active BMP Volume, ac-ft = 24.6		Gravel Depth, ft	1

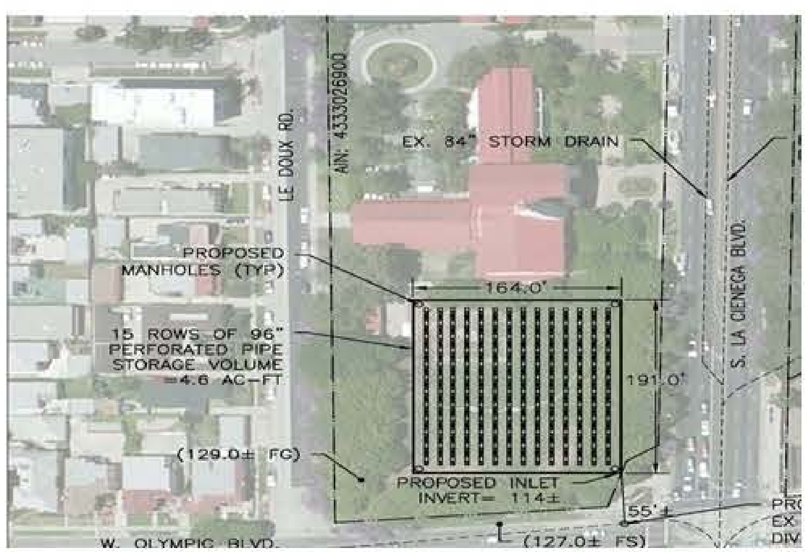
Budget-Level estimates for both soft and hard costs	$32,176,000	**Schedule**	2 years design, 6 months bid, 4 years 6 months construction (7.00 years total)


Drainage Map




Rendered Improvements


Watershed and Vicinity



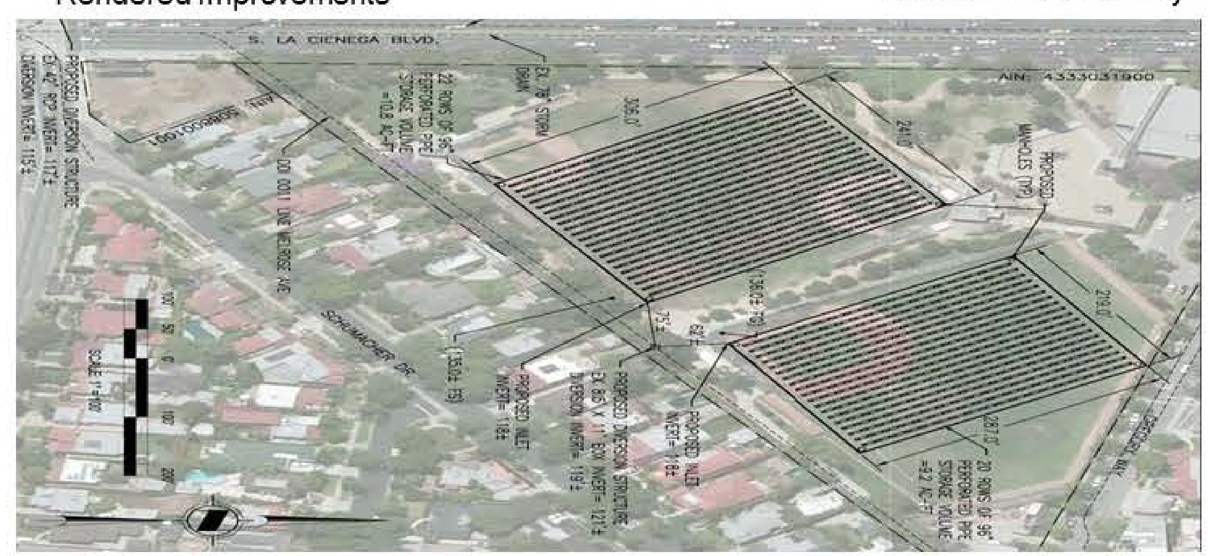


Figure 4-8 La Cienega Park/Frank Fenton Field Super Fact Sheet

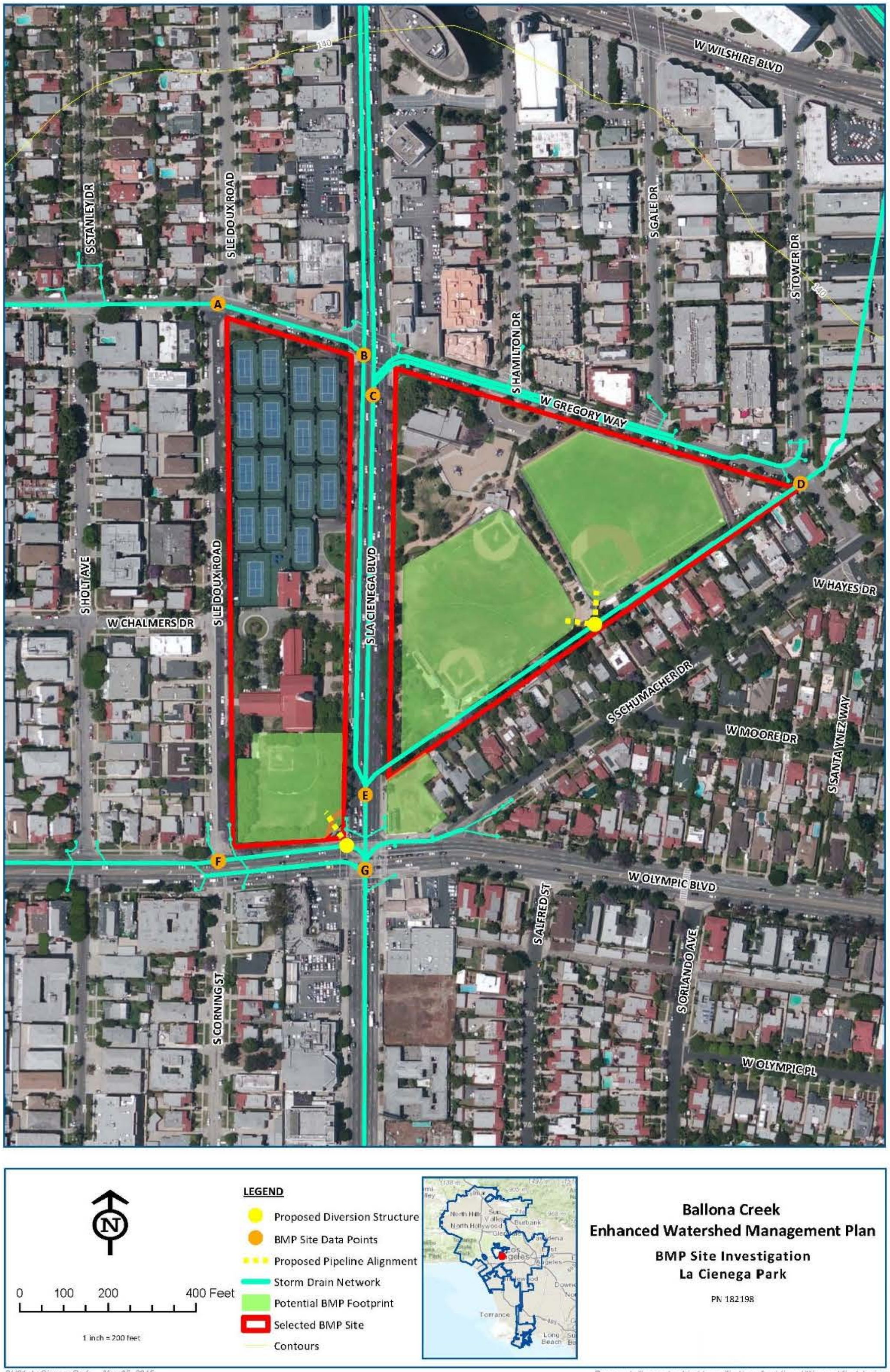


Figure 4-9 La Cienega Park/Frank Fenton Field Subsurface Infiltration Site – Site Map

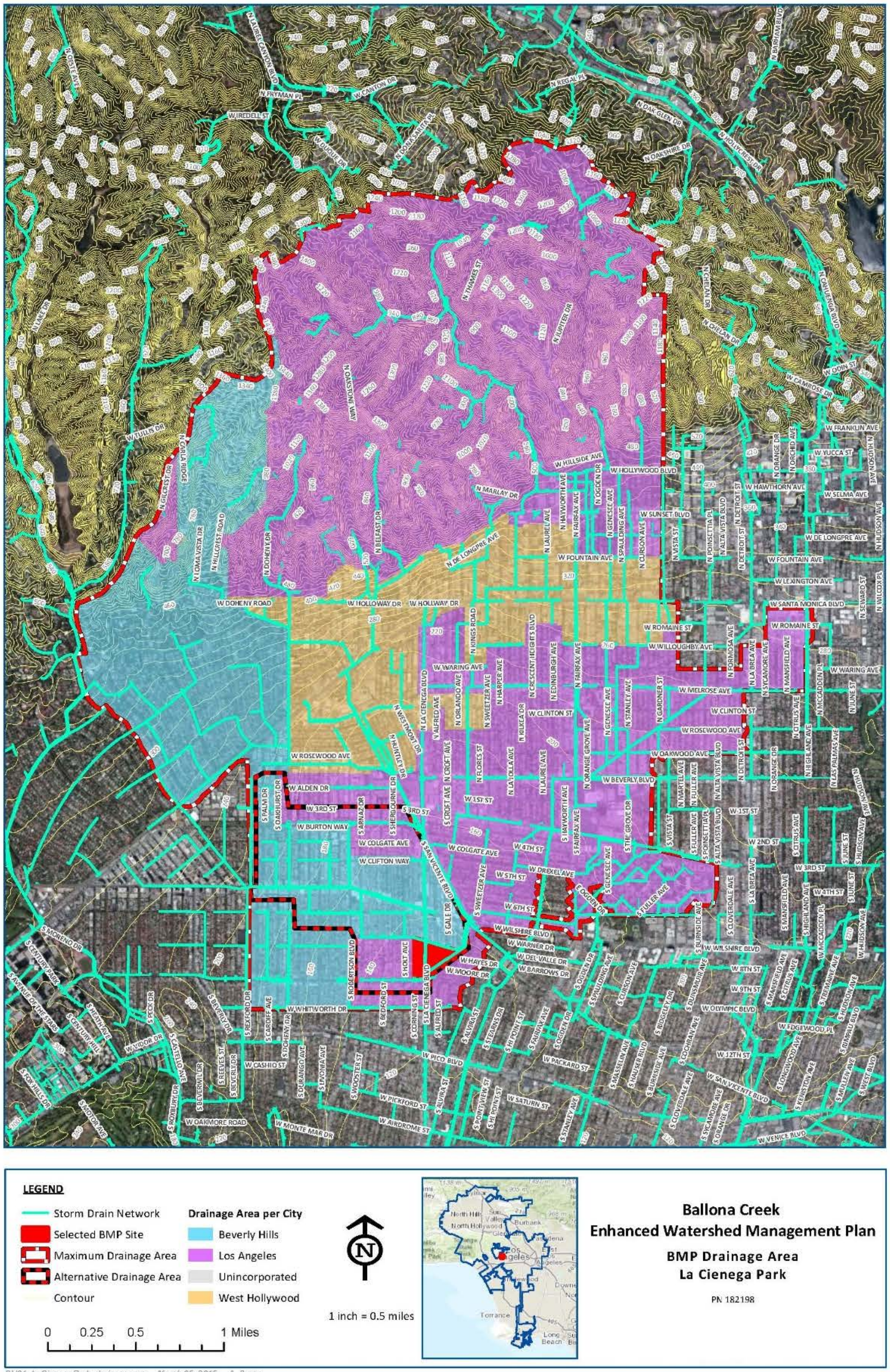


Figure 4-10 La Cienega Park/Frank Fenton Field Subsurface Infiltration Drainage Area – Drainage Map

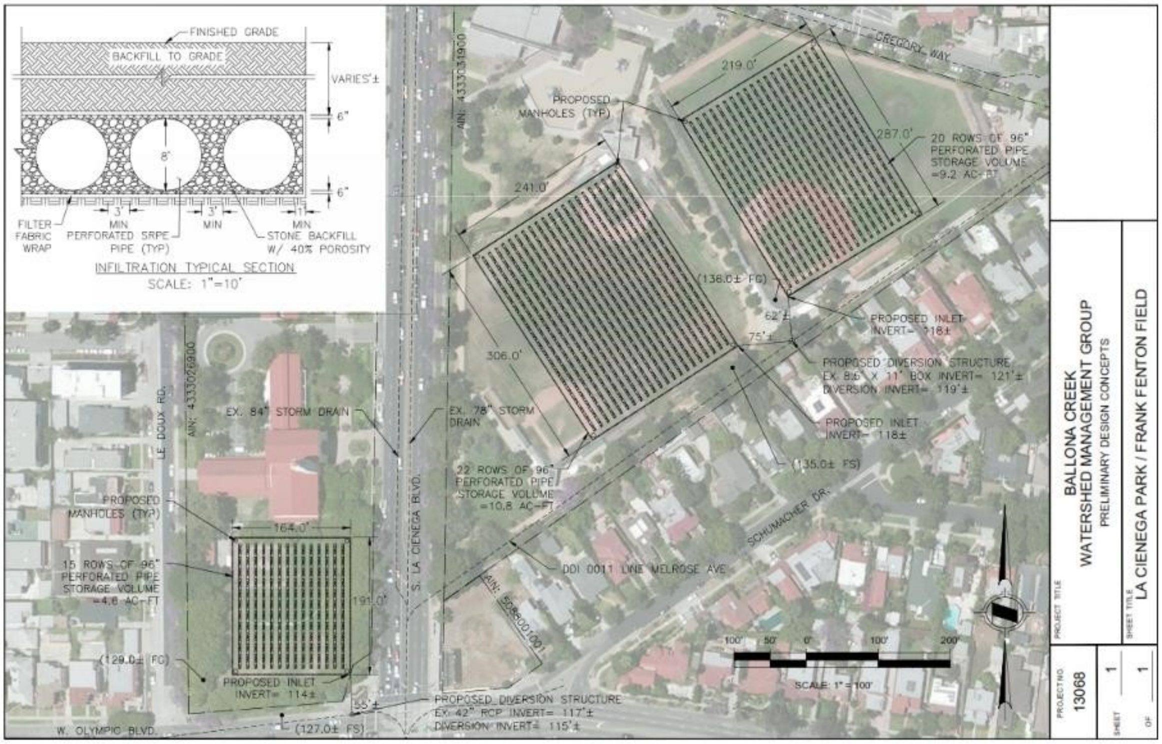


Figure 4-11 La Cienega Park/Frank Fenton Field Subsurface Infiltration Drainage Area – Preliminary Design Concepts

4.5.3 Culver Boulevard Median

The Culver Boulevard Median site is located within Culver City in an area that drains to Ballona Creek. The site is located within public right-of-way along Culver Boulevard between Elenda Street and Sepulveda Boulevard. The site will primarily make use of an abandoned rail corridor from a former light rail system within the median of Culver Boulevard. The potential BMP is proposed as a belowground retention/infiltration basin situated beneath the median.

The maximum drainage area for this project site is approximately 829 acres. After review of available site opportunities and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 139 acres.

After reviewing the hydrologic model results and estimated runoff volumes for the various diversion scenarios, it was determined that a retention/infiltration BMP at this site can accommodate the 85th percentile, 24-hour design storm runoff contributed from the maximum drainage area. However, to maximize pollutant load reduction, design was based on the alternative drainage area. As a result, the recommended active volume of the BMP is 29.2 acre-feet. This optimized project size allows for maximizing the treatment volume while staying below the point of diminishing returns.

Table 4-5 summarizes some key conceptual design parameters for this project site. Figures 4-12 through 4-15 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 Culver Boulevard Median Design Parameters

Culver Boulevard Median Design Parameters (CC01)		
Project Site Parameters	Total (Maximum) Drainage Area	829 acres
	Alternative (Minimum) Drainage Area	139 acres
	Maximum Required BMP Volume	41 AF
	Alternative Required BMP Volume	5.6 AF
	Groundwater Depth	53 feet
BMP Design Parameters	BMP Opportunity Area	2.2 acres
	Recommended Maximum BMP Depth	15 feet
	Available BMP Volume	33.7 AF
	Recommended Active BMP Volume	**29.2** AF

Ballona Creek Enhanced Management Program
Signature Project: Culver Boulevard Median
FACT SHEET
PN 18298

Note: Figures are not to scale

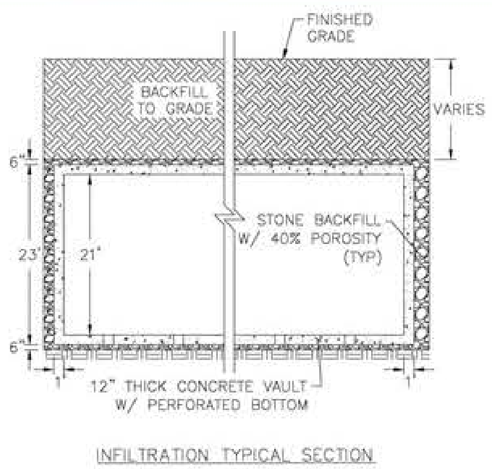
Site Location			
Site Location, City	Culver City	Site Name	Culver Boulevard Median
Latitude	34° 0' 27.18" N	Longitude	118° 24' 26.93" W
Landuse	Roadway	Street Address	Culver Boulevard between Harter Ave and Huron Ave
Major Watershed	Ballona Creek	Land Owner	Culver City
Existing Land Use of Site: Culver Boulevard Median			

Watershed Characteristics	
Drainage Area Max/Alternative, ac	829/139
Hydrologic Soil Group	Chino Silt Loam, Hanford Fine Sandy Loam
Soil Infiltration Rate, in/hr	0.30
Design Storm Event, in	
Recommended Active BMP Volume, ac-ft = 29.2	

Retrofit Characteristics	
Proposed Retrofit	Subsurface Infiltration
Recommended BMP Footprint, ft²	62,948
Available BMP Volume, ac-ft	33.7
BMP Water Storage Depth, ft	21
Gravel Depth, ft	0

Budget-Level estimates for both soft and hard costs	$16,550,000	**Schedule**	2 years design, 2 months bid, 2.25 years construction (4 ½ years total)

Drainage Map



Rendered Improvements

Watershed and Vicinity

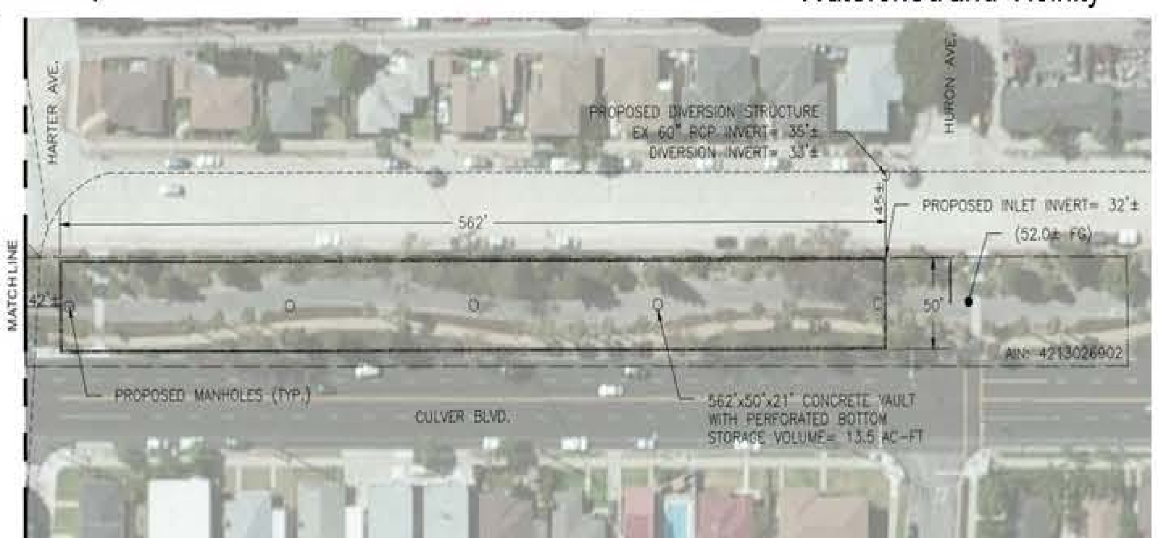


Figure 4-12 Culver Boulevard Median Super Fact Sheet

Figure 4-13 Culver Boulevard Median Subsurface Infiltration Site – Site Map

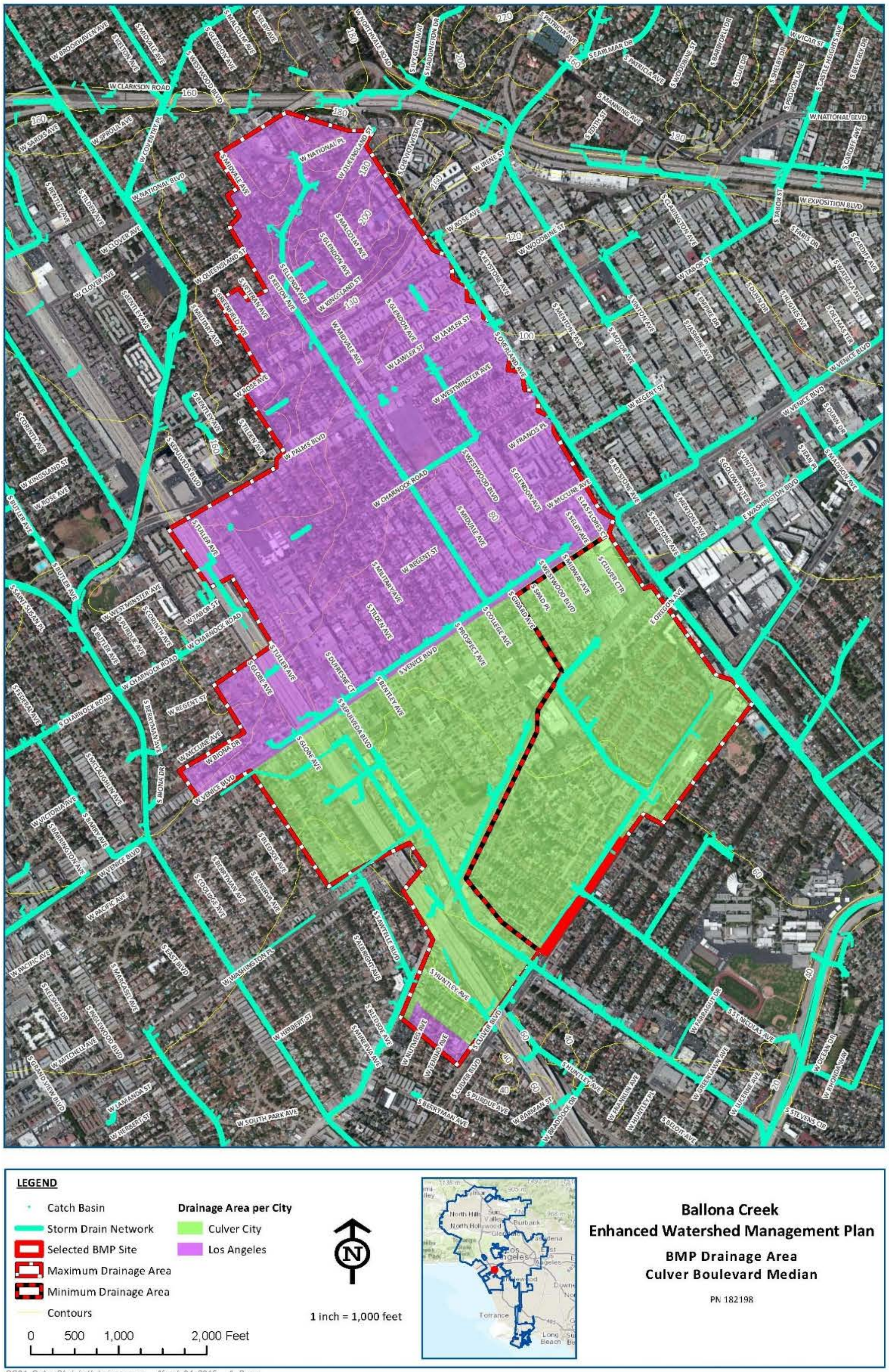


Figure 4-14 Culver Boulevard Median Subsurface Infiltration Drainage Area – Drainage Map

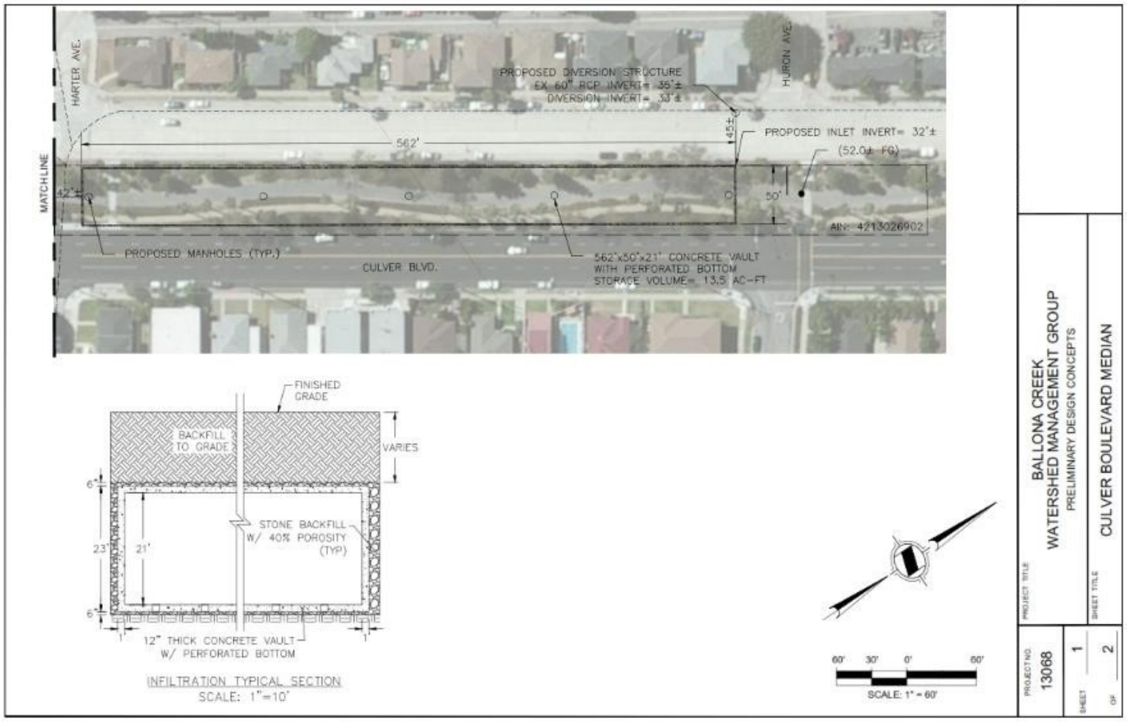


Figure 4-15a Culver Boulevard Median Subsurface Infiltration Drainage Area – Preliminary Design Concepts (1 of 2)

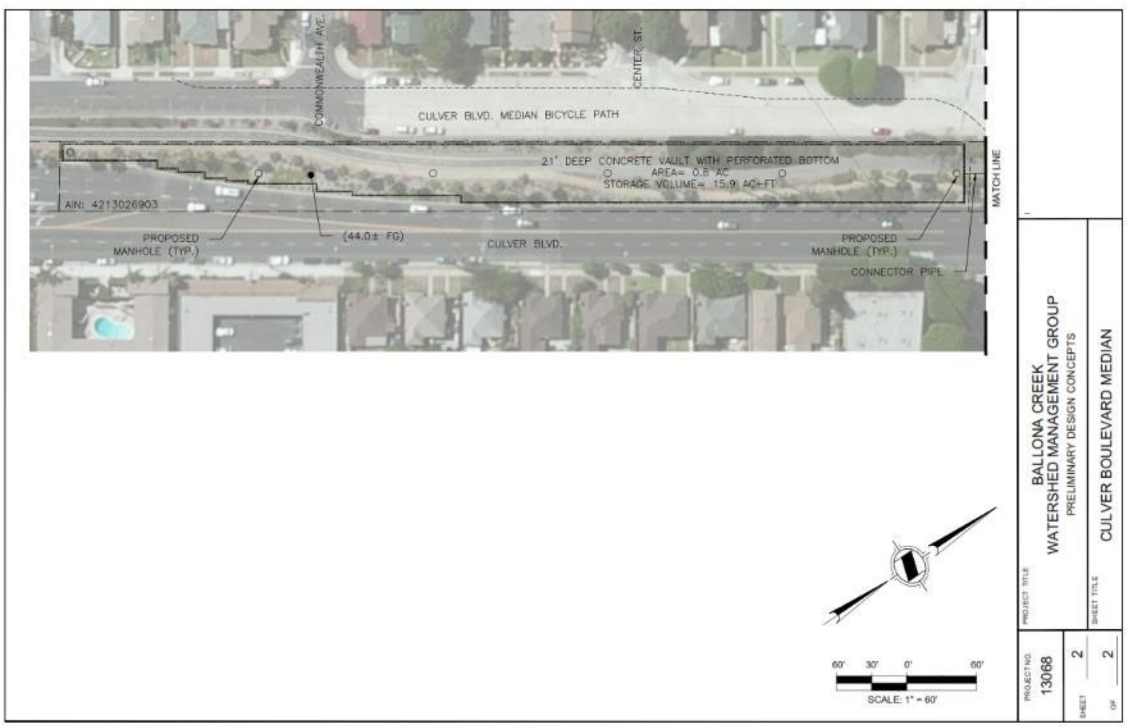


Figure 4-15b Culver Boulevard Median Subsurface Infiltration Drainage Area – Preliminary Design Concepts (2 of 2)

4.5.4 Edward Vincent Junior Park

Edward Vincent Jr. Park is located within the City of Inglewood in an area that drains to Centinela Creek. The park is owned and maintained by the City of Inglewood. The park consists of a recreation center, community pool, sports courts, active recreational fields and a large amount of open turf areas with some trees. The potential BMP type that is being considered is a surface retention/infiltration basin at the west side of the park. It had been discussed that the low point of the park could possibly be utilized as a biofiltration/wetlands area.

The maximum drainage area for this project site is approximately 983 acres. After review of the available site information and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 453 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 surface retention/infiltration 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 is 45.7 acre feet.

Table 4-6 below summarizes some key conceptual design parameters for this project site. Figures 4-16 through 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 Edward Vincent Junior Park Design Parameters

Edward Vincent Junior Park Design Parameters (IG01)		
Project Site Parameters	Total (Maximum) Drainage Area	983 acres
	Alternative (Minimum) Drainage Area	453 acres
	Maximum Required BMP Volume	31.5 AF
	Alternative Required BMP Volume	11 AF
	Groundwater Depth	18µ feet
BMP Design Parameters	BMP Opportunity Area	6.3 acres
	Recommended Maximum BMP Depth	1µ feet
	Available BMP Volume	63 AF
	Recommended Active BMP Volume	**45.7** AF

Ballona Creek Enhanced Management Program
Signature Project: Edward Vincent Junior
FACT SHEET
PN 182198

Note: Figures are not to scale

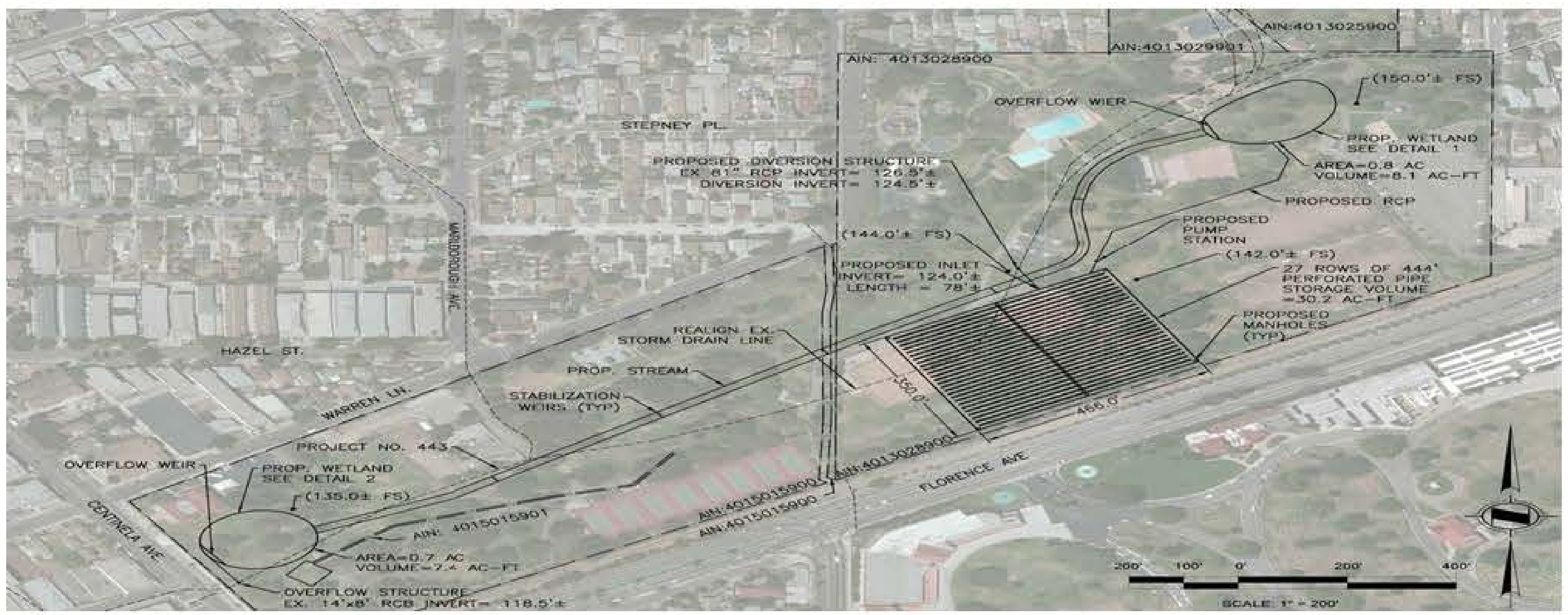
Site Location			
Site Location, City	Inglewood	Site Name	Edward Vincent Junior
Latitude	33° 58' 20.582'' N	Longitude	118° 20' 39.14'' W
Landuse	Open Space	Street Address	700 Warren Lane
Major Watershed	Ballona Creek	Land Owner	City of Inglewood
Existing Land Use of Site: Park			

Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Alternative, ac	983/453	Proposed Retrofit	Biofiltration and Wetlands
Hydrologic Soil Group	Ramona Loam, Yolo Loam	Recommended BMP Footprint, ft²	228,440
Soil Infiltration Rate, in/hr	0.30	Available BMP Volume, ac-ft	63
Design Storm Event, in	85th Percentile, 24 hr	BMP Water Storage Depth, ft	10 or 11
Recommended Active BMP Volume, ac-ft = 45.7		Gravel Depth, ft	1

Budget-Level estimates for both soft and hard costs	$44,891,000	**Schedule**	2 years design, 6 months bid, 6 years 3 months construction (8 ¾ years total)

Drainage Map

Watershed and Vicinity



Rendered Figure 1: Cross Section at the creek

Rendered Figure 1: Cross Section at the baseball field

Rendered Improvements

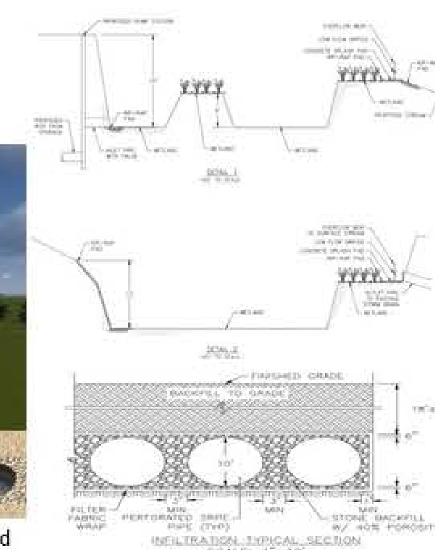


Figure 4-16 Edward Vincent Junior Park Super Fact Sheet

Figure 4-17 Edward Vincent Junior Surface Infiltration Site – Site Map

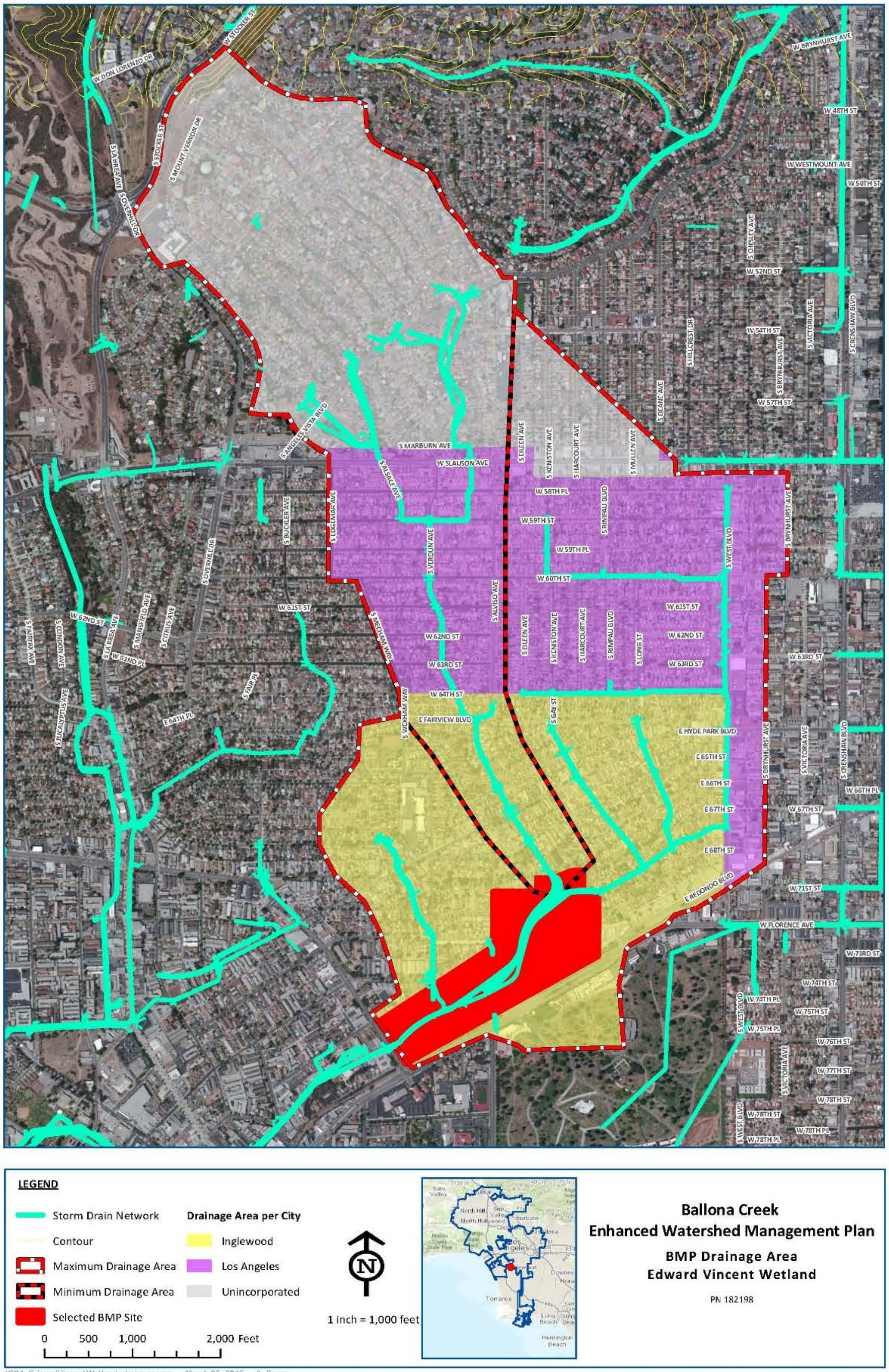


Figure 4-18 Edward Vincent Junior Surface Infiltration Site – Drainage Map

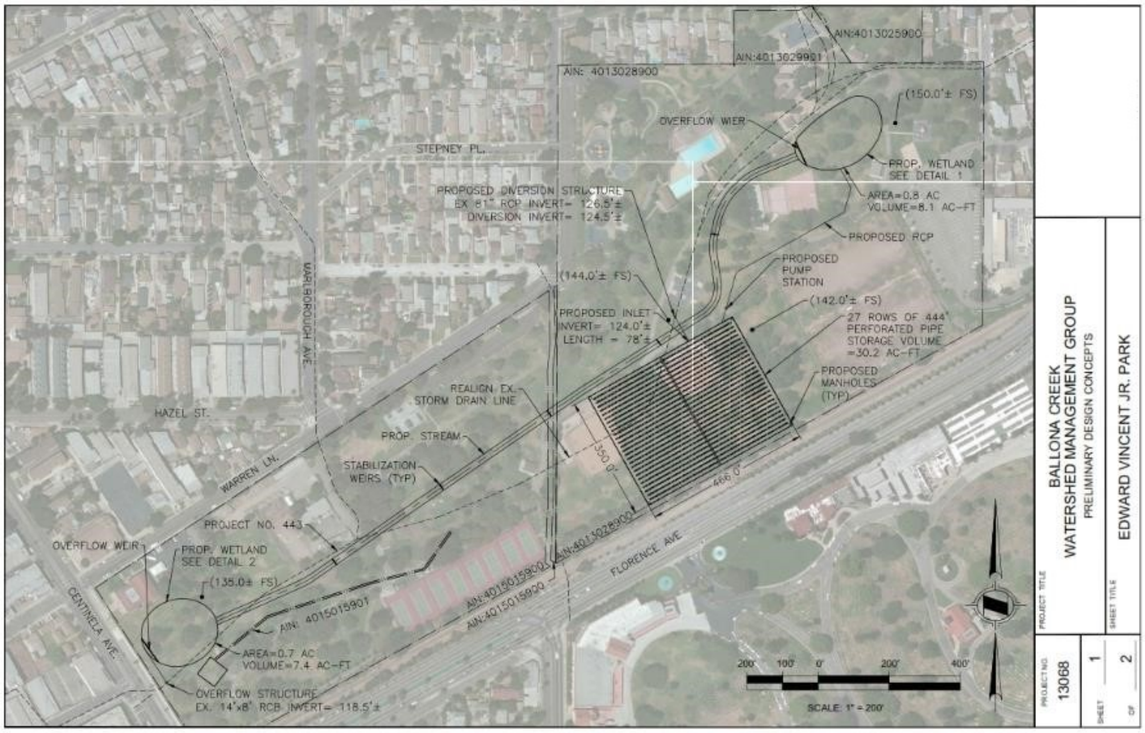


Figure 4-19a Edward Vincent Junior Surface Infiltration Site – Preliminary Design Concepts (1 of 2)

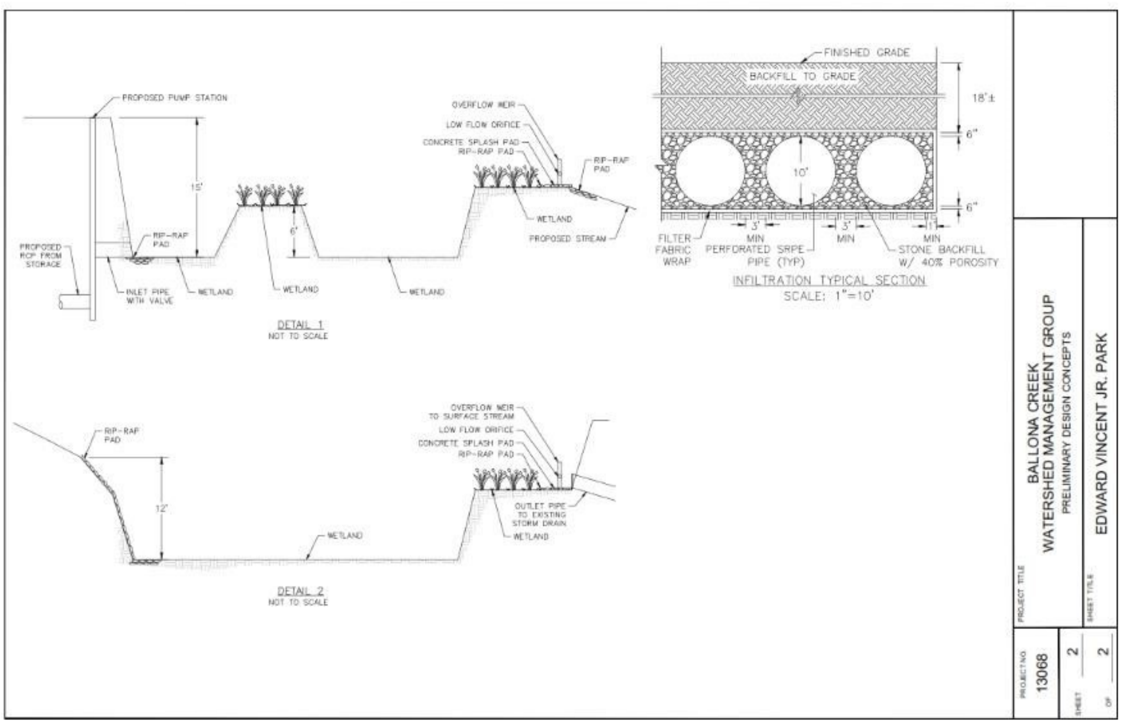


Figure 4-19b Edward Vincent Junior Surface Infiltration Site – Preliminary Design Concepts (2 of 2)

4.5.5 Plummer Park

Plummer Park is located within the City of West Hollywood and consists of a community center, tennis courts, a war memorial, and several lawn and playground areas with trees. The potential BMP type is proposed as a belowground retention/infiltration basin situated beneath a parking lot on the north side of the park. The potential location of the BMP could change depending on future plans for the site.

The maximum drainage area for this project site is approximately 389 acres. After review of available site information and surrounding infrastructure data, a smaller (alternative) drainage area was delineated, encompassing approximately 283 acres.

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 alternative drainage area. As a result, the recommended active volume of the BMP is 7.2 acre-feet. This optimized project size allows for maximizing the treatment volume while staying below the point of diminishing returns.

Table 4-7 below summarizes some key conceptual design parameters for this project site. Figures 4-20 through 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 Plummer Park Design Parameters

Plummer Park Design Parameters (WH01)		
Project Site Parameters	Total (Maximum) Drainage Area	389 acres
	Alternative (Minimum) Drainage Area	283 acres
	Maximum Required BMP Volume	13 AF
	Alternative Required BMP Volume	9.3 AF
	Groundwater Depth	Approximately 8µ feet
BMP Design Parameters	BMP Opportunity Area	µ.9 acres
	Recommended Maximum BMP Depth	8 feet
	Available BMP Volume	7.2 AF
	Recommended Active BMP Volume	**7.2** AF

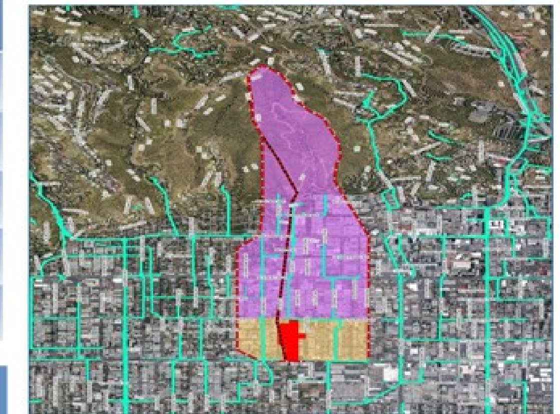
Ballona Creek Enhanced Management Program
Signature Project: Plummer Park
FACT SHEET
PN 182198

Site Location			
Site Location, City	West Hollywood	Site Name	Plummer Park
Latitude	34° 5' 29.2704" N	Longitude	118° 21' 3.002" W
Landuse	Open Space	Street Address	7377 Santa Monica Blvd
Major Watershed	Ballona Creek	Land Owner	City of West Hollywood
Existing Land Use of Site: Park			

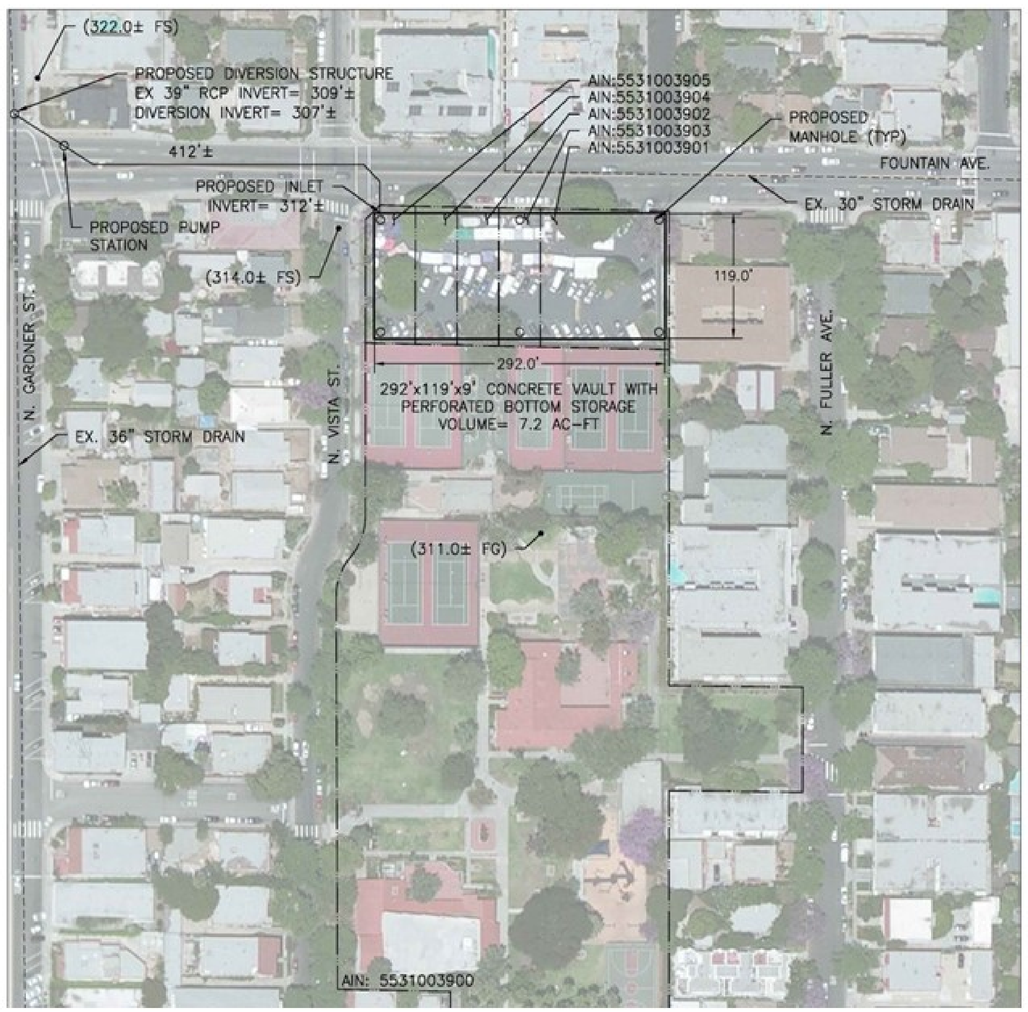
Watershed Characteristics	
Drainage Area Max/Alternative, ac	389/283
Hydrologic Soil Group	Tujunga Fine Sandy Loam
Soil Infiltration Rate, in/hr	0.51
Design Storm Event, in	
Recommended Active BMP Volume, ac-ft = 7.2	

Retrofit Characteristics	
Proposed Retrofit	Subsurface Infiltration
Recommended BMP Footprint, ft^2	34,748
Available BMP Volume, ac-ft	7.2
BMP Water Storage Depth, ft	9
Gravel Depth, ft	1

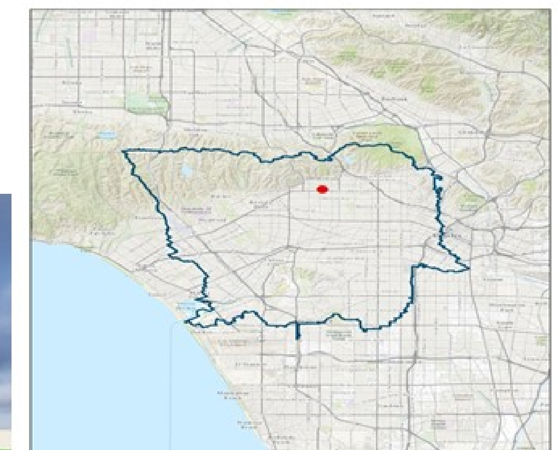
Budget-Level estimates for both soft and hard costs	$12,508,000	**Schedule**	1 year design, 6 months bid, 1 year 9 months construction (3 ¼ years total)



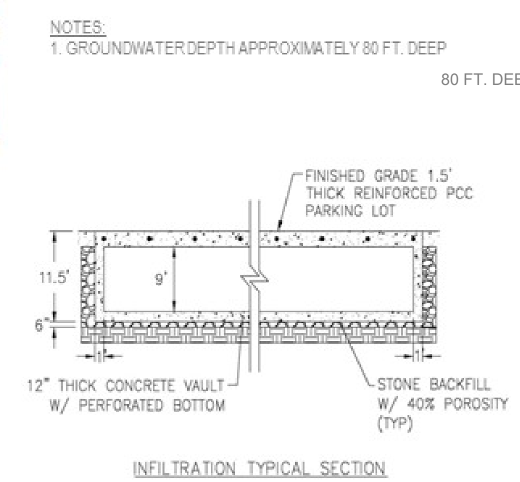
Drainage Map



Rendered Improvements



Watershed and Vicinity



Note: Figures are not to scale

Figure 4-20 Plummer Park Super Fact Sheet

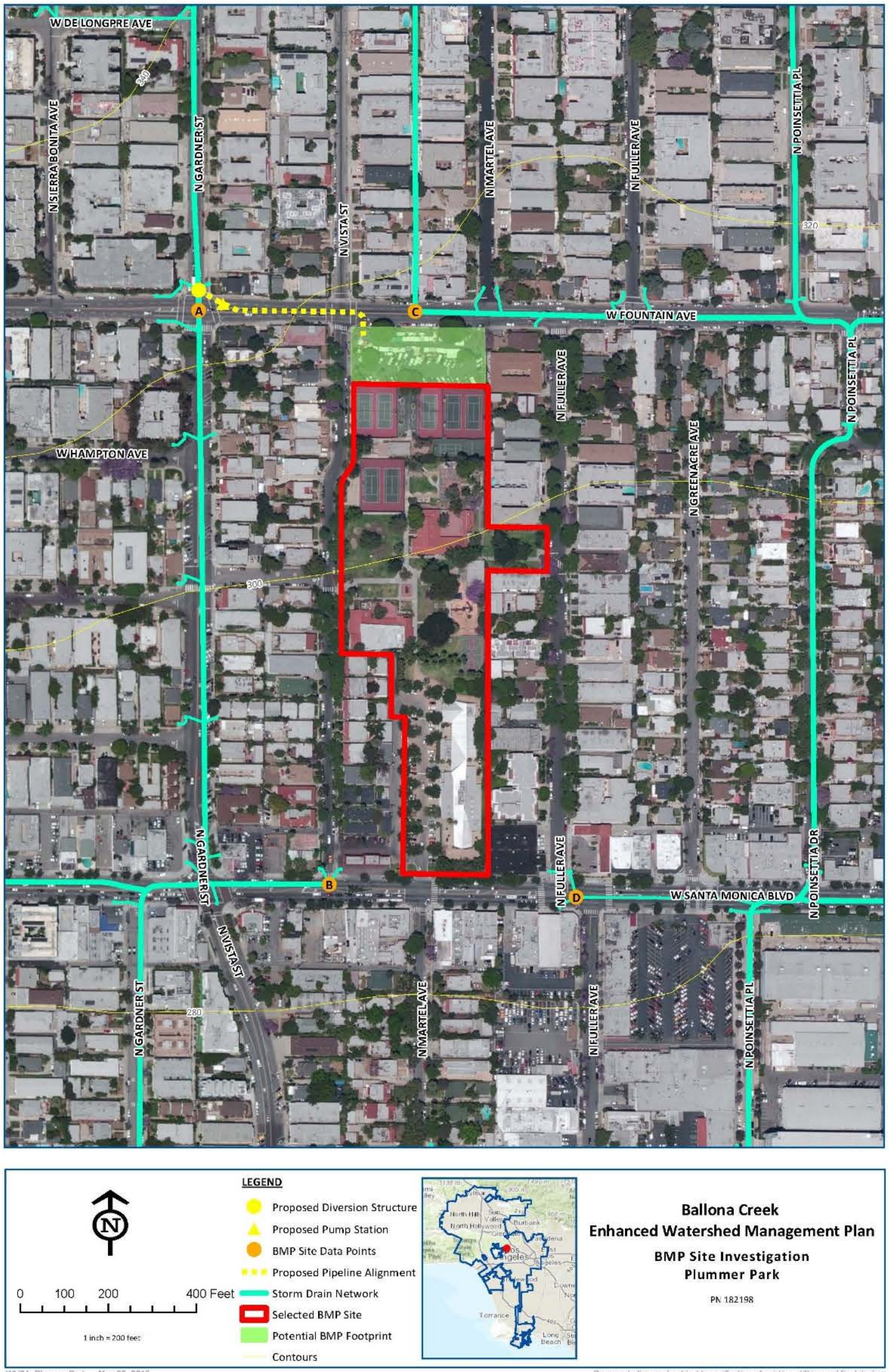


Figure 4-21 Plummer Park Subsurface Infiltration Site – Site Map

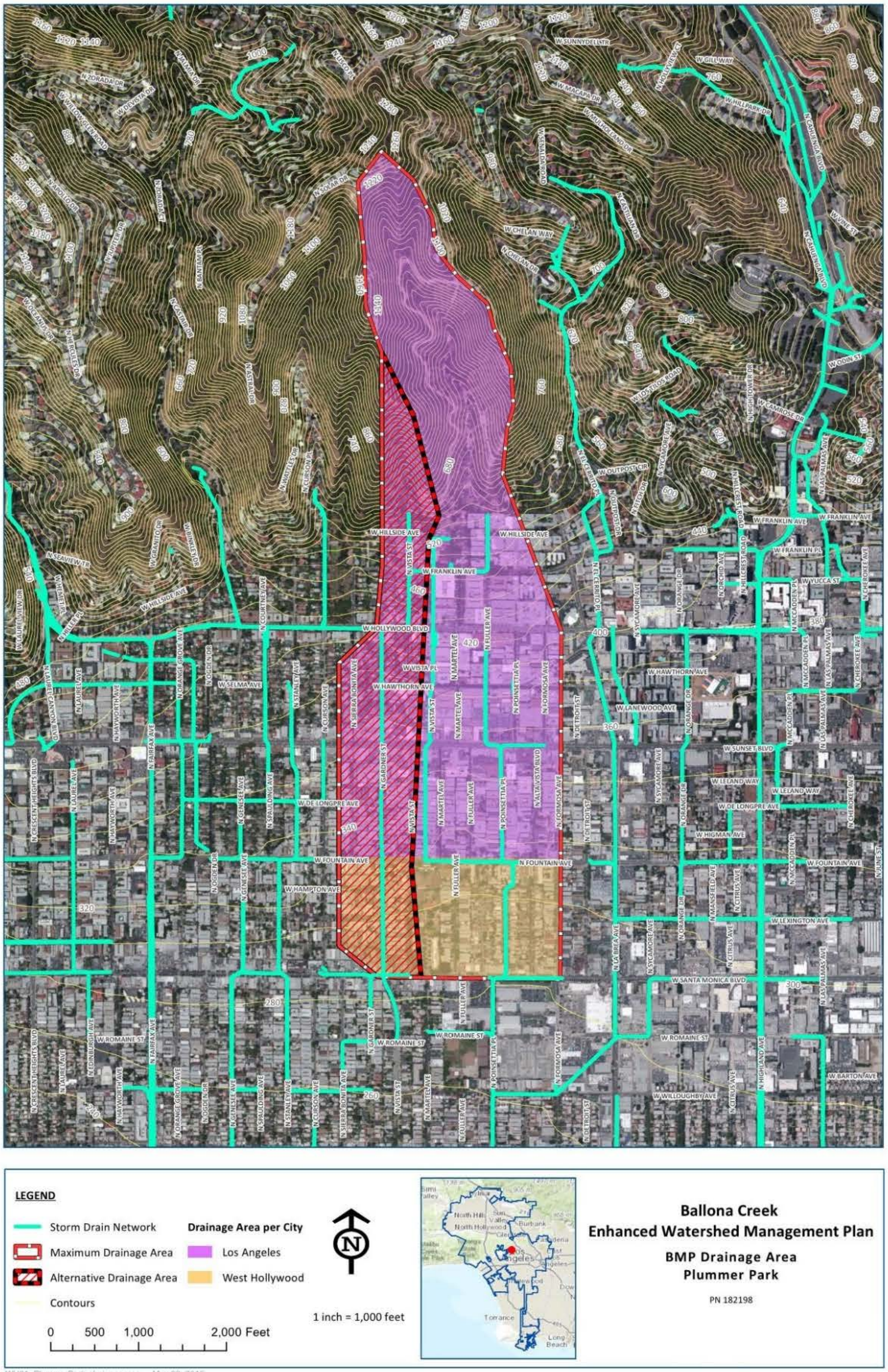


Figure 4-22 Plummer Park Subsurface Infiltration Site - Drainage Map

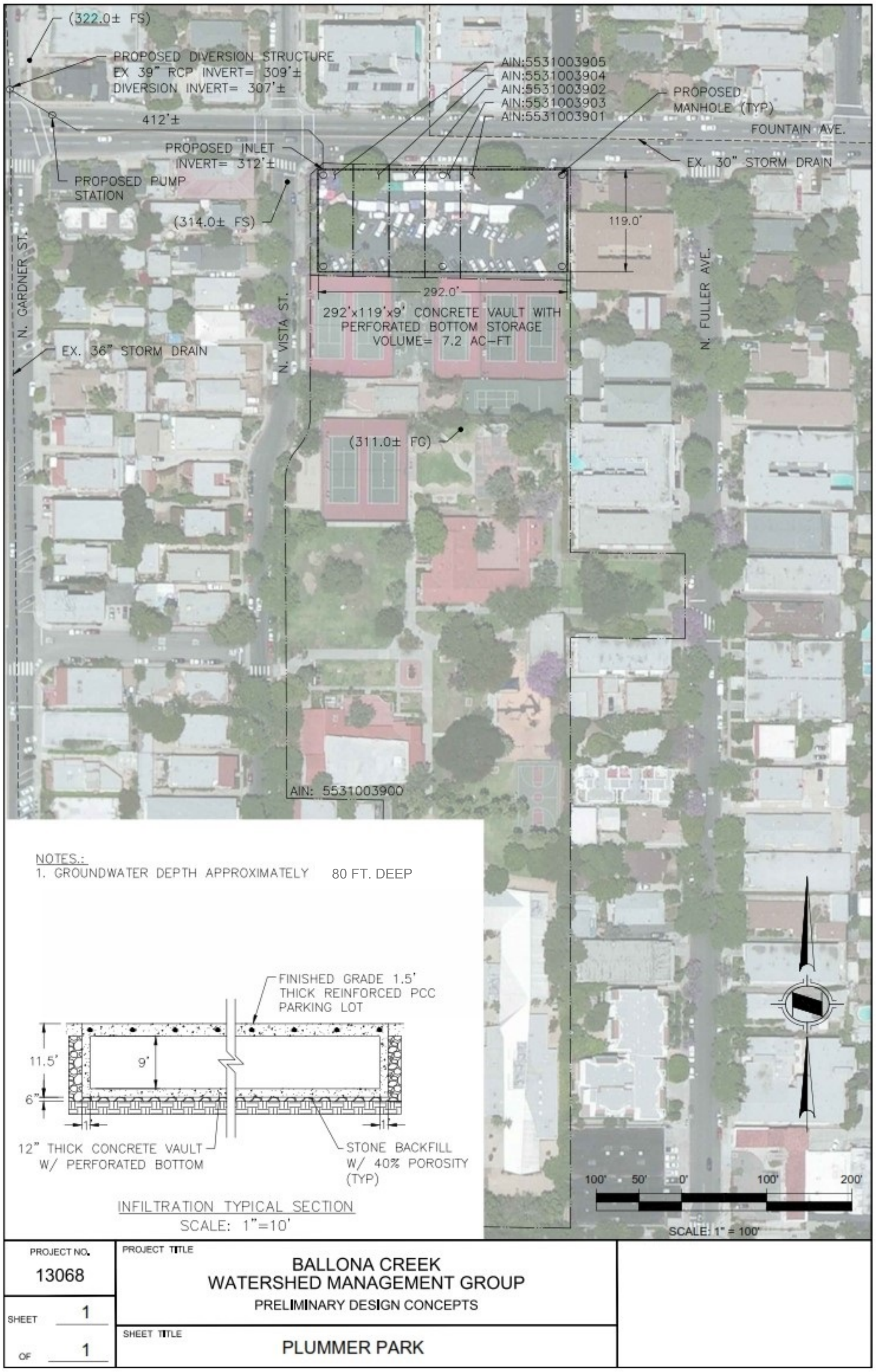


Figure 4-23 Plummer Park Subsurface Infiltration Site – Preliminary Design Concepts

4.5.6 Queen Anne Recreation Center

The Queen Anne Recreation Center is located in the City of Los Angeles in an area that drains to Ballona Creek. Park facilities include an auditorium, barbecue pits, two softball diamonds, basketball courts, a playground, picnic area, restrooms, and tennis courts. The potential BMP type proposed is a belowground retention/infiltration basin situated beneath the softball diamonds and open field space in the central portion of the parcel.

The maximum drainage area for this project site is approximately 8,537 acres. After review of available site information and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 3,067 acres.

After reviewing the hydrologic model results and estimated runoff resulting from the various diversion scenarios, it was determined that this location cannot accommodate the 85th percentile, 24-hour design storm flows from the alternative drainage area. Thus, it is recommended that the BMP be sized for retention/infiltration of approximately 11.6 AF 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, as discussed in Appendix 4.C.

Table 4-8 below summarizes some key conceptual design parameters for this project site. Figures 4-24 through 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 Queen Anne Recreation Center Design Parameters

Queen Anne Recreation Center Design Parameters (LA05)		
Project Site Parameters	Total (Maximum) Drainage Area	8,537 acres
	Alternative (Minimum) Drainage Area	3,µ67 acres
	Maximum Required BMP Volume	397.3 AF
	Alternative Required BMP Volume	141.7 AF
	Groundwater Depth	45 feet
BMP Design Parameters	BMP Opportunity Area	2.1 acres
	Recommended Maximum BMP Depth	2µ feet
	Available BMP Volume	42 AF
	Recommended Active BMP Volume	**11.6** AF

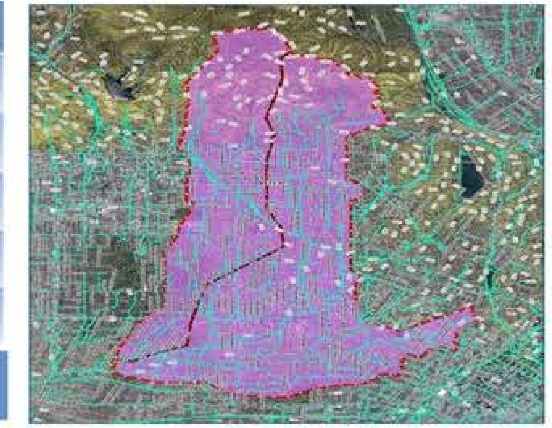
Ballona Creek Enhanced Management Program
Signature Project: Queen Ann Recreation Center
FACT SHEET
PN

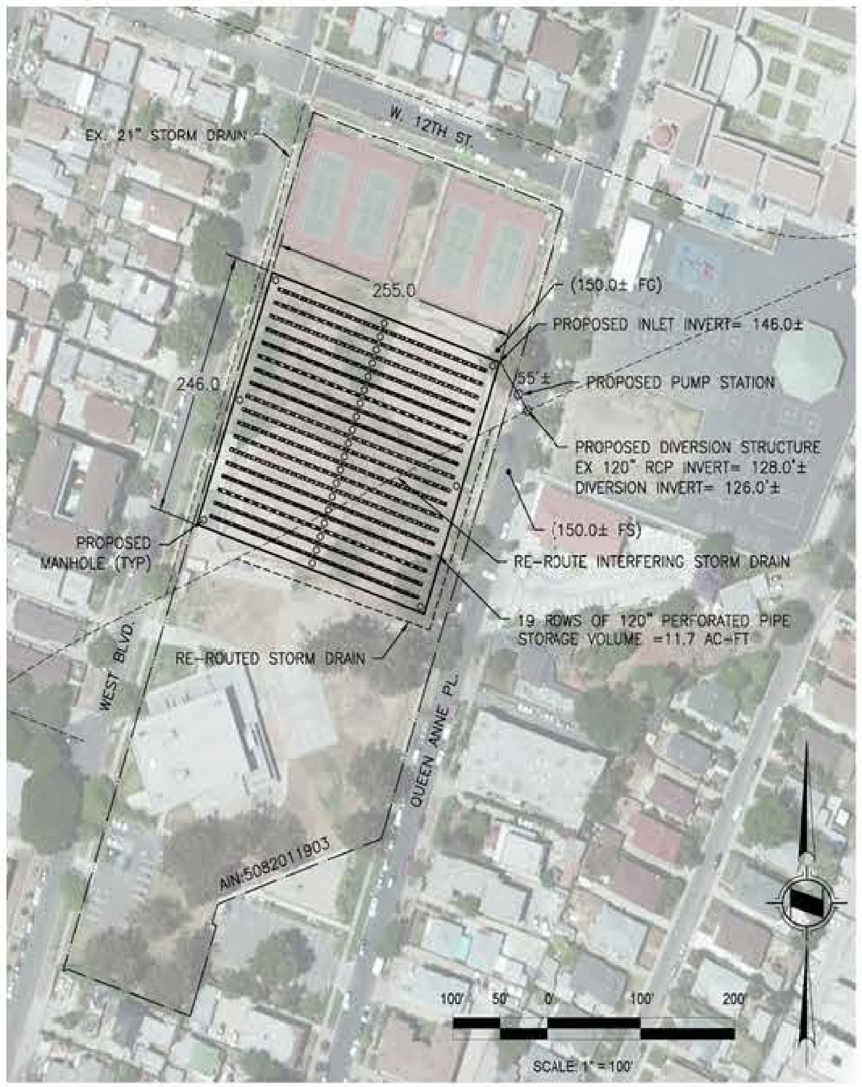
Site Location			
Site Location, City	Los Angeles	Latitude	34° 3' 2.8944'' N
Site Name	Queen Ann Recreation Center	Longitude	118° 19' 57.26'' W
Landuse	Open Space	Street Address	1240 West Blvd
Major Watershed	Ballona Creek	Land Owner	City of Los Angeles
Existing Land Use of Site: Park			

Watershed Characteristics	
Drainage Area Max/Alternative, ac	8,537/3,067
Hydrologic Soil Group	Hanford Gravelly Sandy Loam
Soil Infiltration Rate, in/hr	0.23
Design Storm Event, in	
Recommended Active BMP Volume, ac-ft = 11.6	

Retrofit Characteristics	
Proposed Retrofit	Subsurface Infiltration
Recommended BMP Footprint, ft^2	37,230
Available BMP Volume, ac-ft	42
BMP Water Storage Depth, ft	11
Gravel Depth, ft	1

Budget-Level estimates for both soft and hard costs	$33,165,000	**Schedule**	2 years design, 6 months bid, 4 years 9 months construction (7 ¾ years total)





Rendered Improvements

Watershed and Vicinity

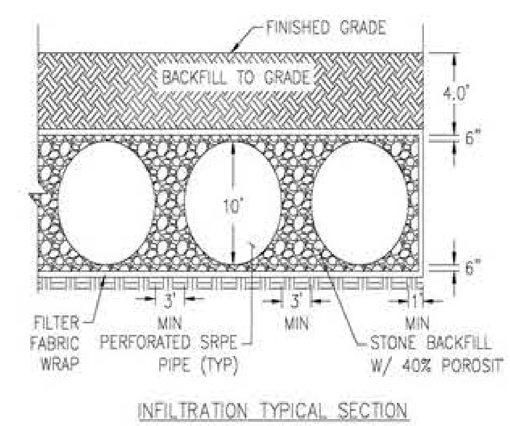


Figure 4-24 Queen Anne Recreation Center Super Fact Sheet

Figure 4-25 Queen Anne Recreation Center Subsurface Infiltration Site – Site Map

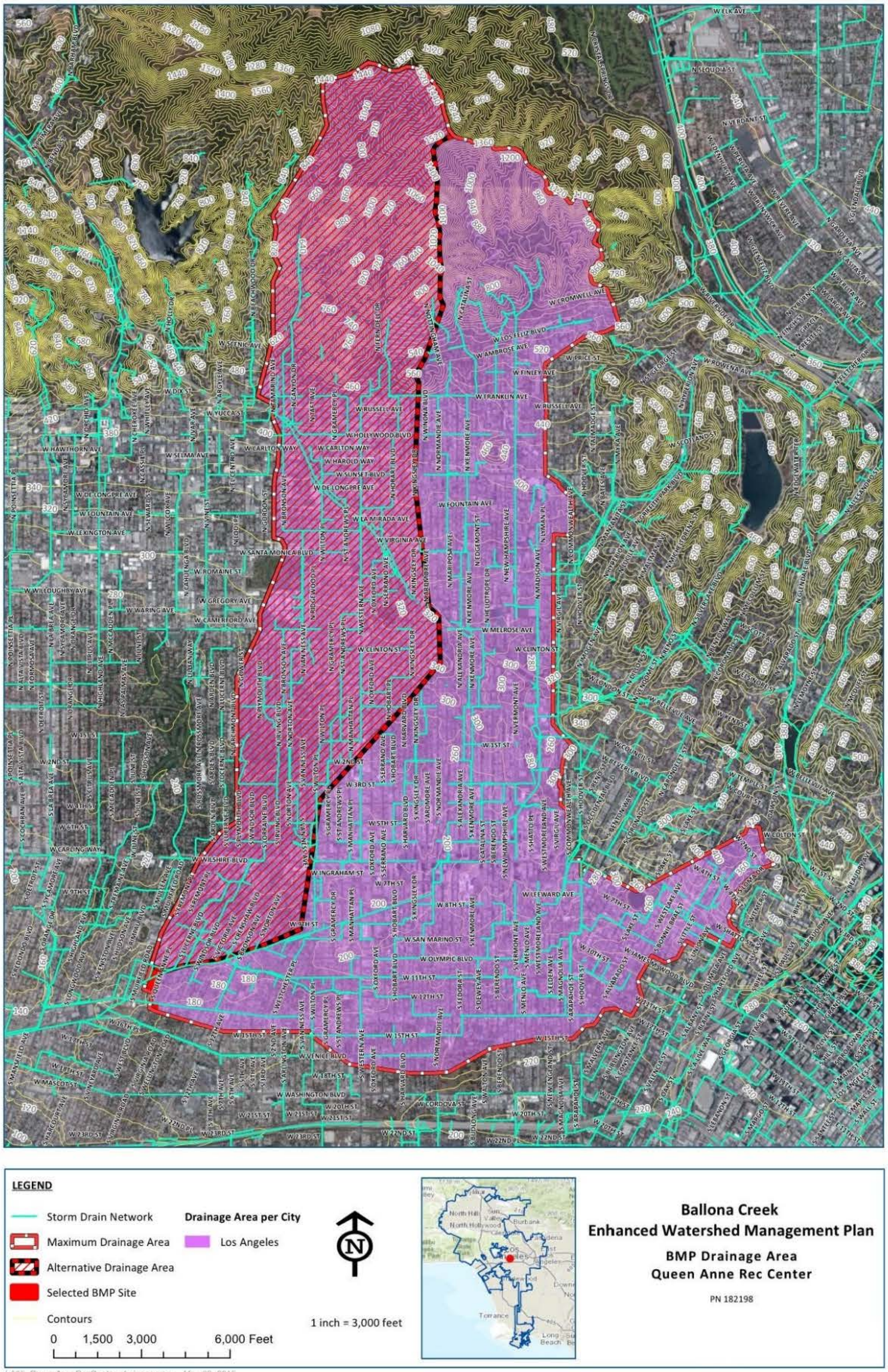


Figure 4-26 Queen Anne Recreation Center Subsurface Infiltration Site - Drainage Map

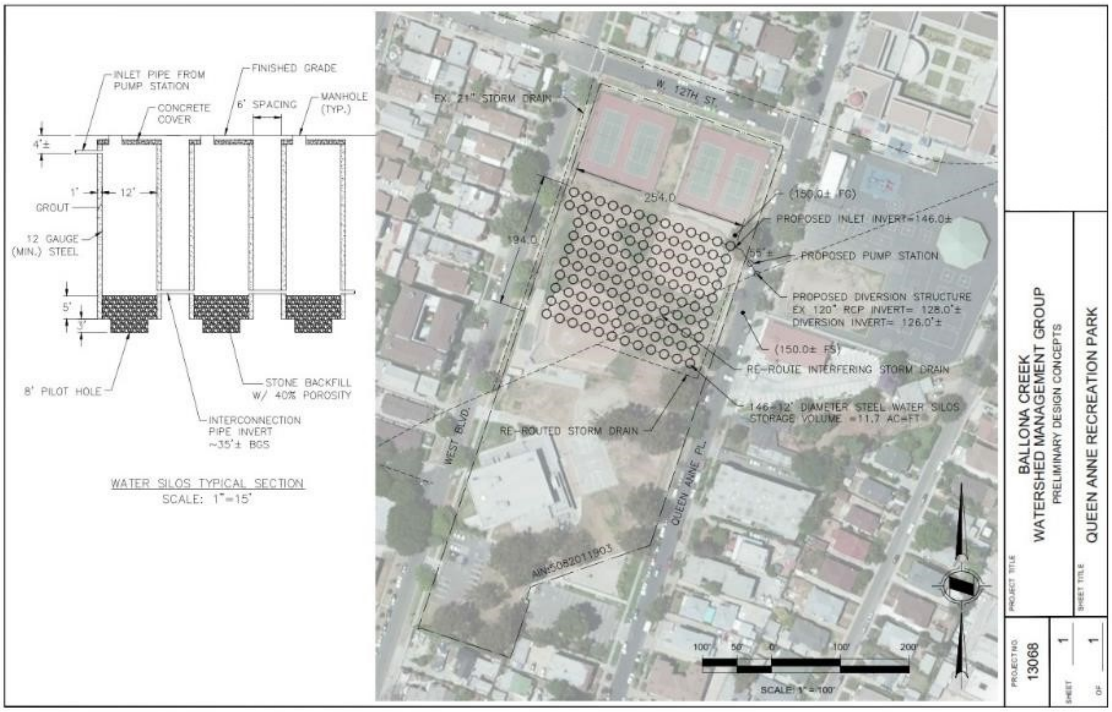


Figure 4-27a Queen Anne Recreation Center Subsurface Infiltration Site – Preliminary Design Concepts

Figure 4-27b Queen Anne Recreation Center Subsurface Infiltration Site – Additional Preliminary Design Concepts

4.5.7 Poinsettia Park

Poinsettia Park is located in the City of Los Angeles in an area that drains to Ballona Creek. Park facilities include two softball diamonds, basketball courts, a children's play area, handball courts, and tennis courts. The potential BMP type is proposed as a belowground retention/infiltration basin situated beneath the softball diamonds and the open field in the northwest corner of the park.

The maximum drainage area for this project site is approximately 1,379 acres. After review of the upstream storm drainage system for this site, it was determined that a smaller alternative drainage area could not be isolated.

After reviewing the hydrologic model results and given the area and depth available for BMP opportunities at this site, it was determined that this location cannot accommodate the 85th percentile flows from the maximum drainage area. Thus, it is recommended that the BMP be sized for retention/infiltration of approximately 10.1 AF of runoff, which will be conveyed to the BMP via a 20 cfs pumped diversion.

Table 4-9 summarizes some key conceptual design parameters for this project site. Figures 4-28 through 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 Poinsettia Park Design Parameters

Poinsettia Park Design Parameters (LA18)		
Project Site Parameters	Total (Maximum) Drainage Area	1,379 acres
	Alternative (Minimum) Drainage Area	Not Applicable (N/A)
	Maximum Required BMP Volume	56 AF
	Alternative Required BMP Volume	N/A
	Groundwater Depth[1]	1µ feet
BMP Design Parameters	BMP Opportunity Area	3.1 acres
	Recommended Maximum BMP Depth	5 feet
	Available BMP Volume	15.5 AF
	Recommended Active BMP Volume	**10.1 AF**

[1] Depth appears to be shallow but this will be further reviewed during concept design phase.

Ballona Creek Enhanced Management Program
Signature Project: Poinsettia Park
FACT SHEET
PN 182198

Note: Figures are not to scale

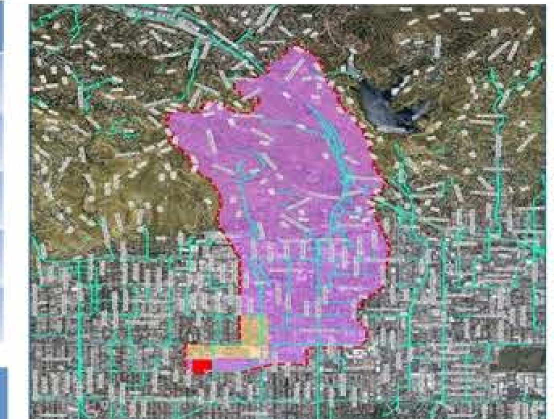
Site Location			
Site Location, City	Los Angeles	Site Name	Poinsettia Park
Latitude	34° 5' 16.911' N	Longitude	118° 20' 58.794'' W
Landuse	Open Space	Street Address	7341 Willoughby Ave
Major Watershed	Ballona Creek	Land Owner	City of Los Angeles
Existing Land Use of Site: Park			

Watershed Characteristics	
Drainage Area Max/Alternative, ac	1,379/NA
Hydrologic Soil Group	Ramona Loam, Ramona Sandy Loam
Soil Infiltration Rate, in/hr	0.06
Design Storm Event, in	
Recommended Active BMP Volume, ac-ft = 10.1	

Retrofit Characteristics	
Proposed Retrofit	Subsurface Infiltration
Recommended BMP Footprint, ft^2	112,700
Available BMP Volume, ac-ft	15.5
BMP Water Storage Depth, ft	4
Gravel Depth, ft	0

Budget-Level estimates for both soft and hard costs	$13,523,000	**Schedule**	1 year design, 6 months bid, 2.00 years construction (3 ½ years total)

Rendered Improvements



Drainage Map

Watershed and Vicinity

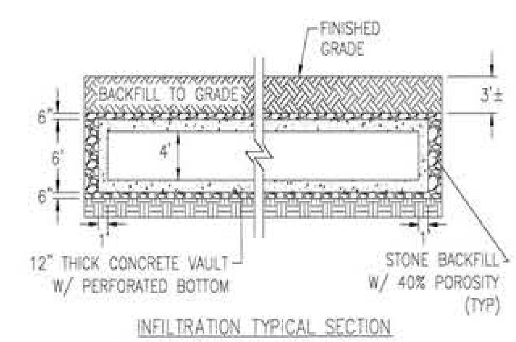


Figure 4-28 Poinsettia Park Super Fact Sheet

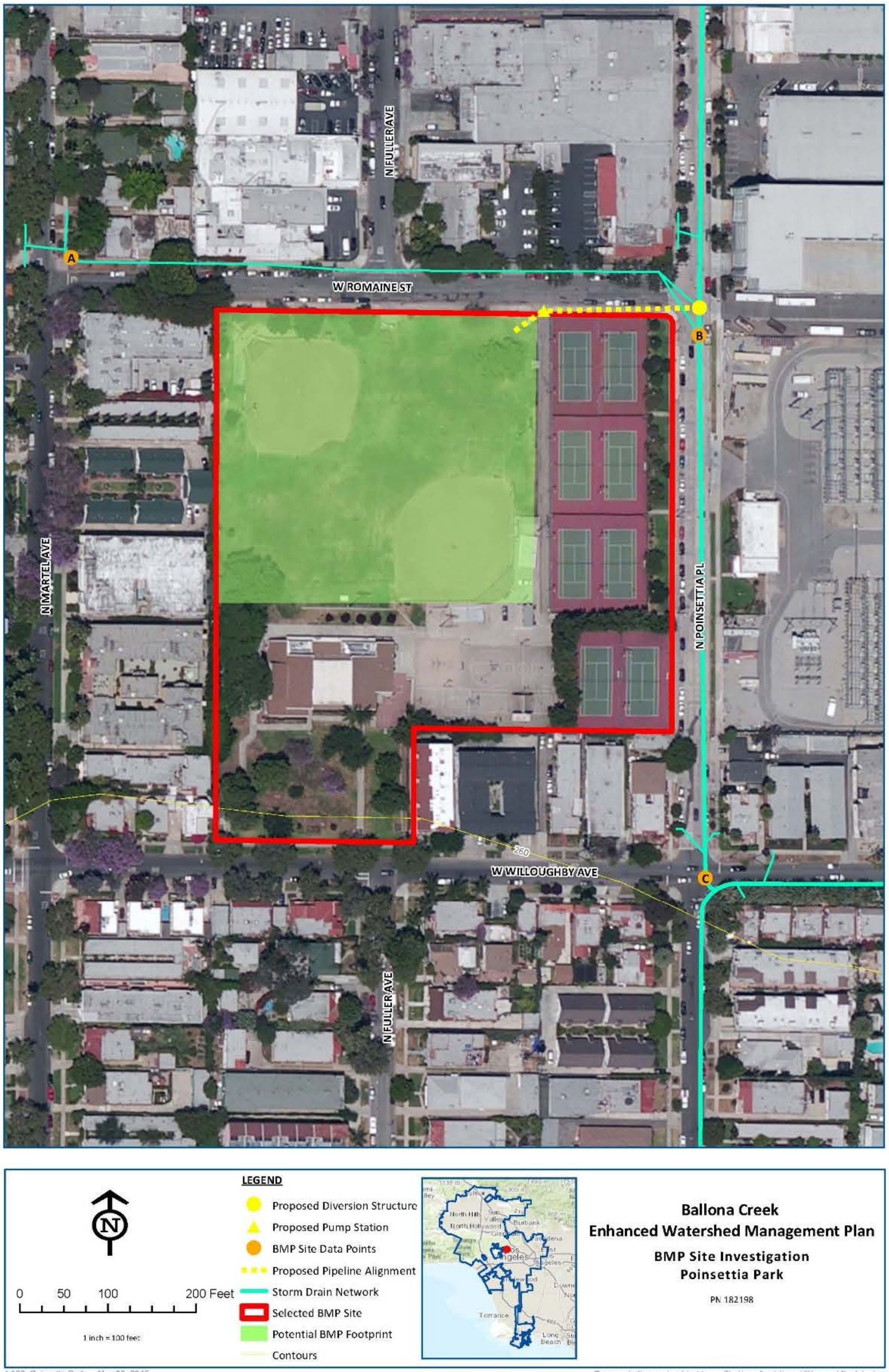


Figure 4-29 Poinsettia Park Subsurface Infiltration Site – Site Map

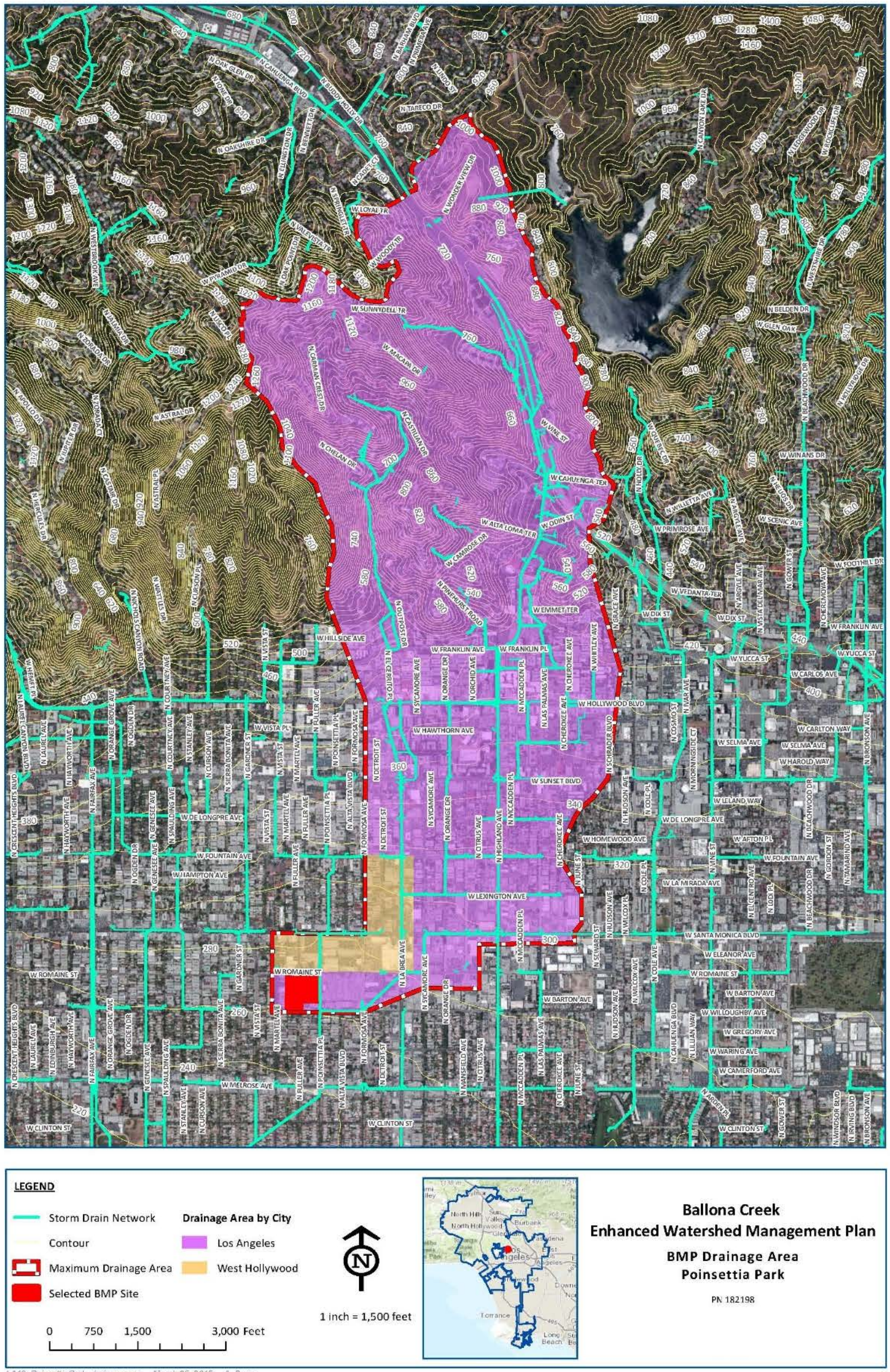


Figure 4-30 Poinsettia Park Subsurface Infiltration Site - Drainage Map

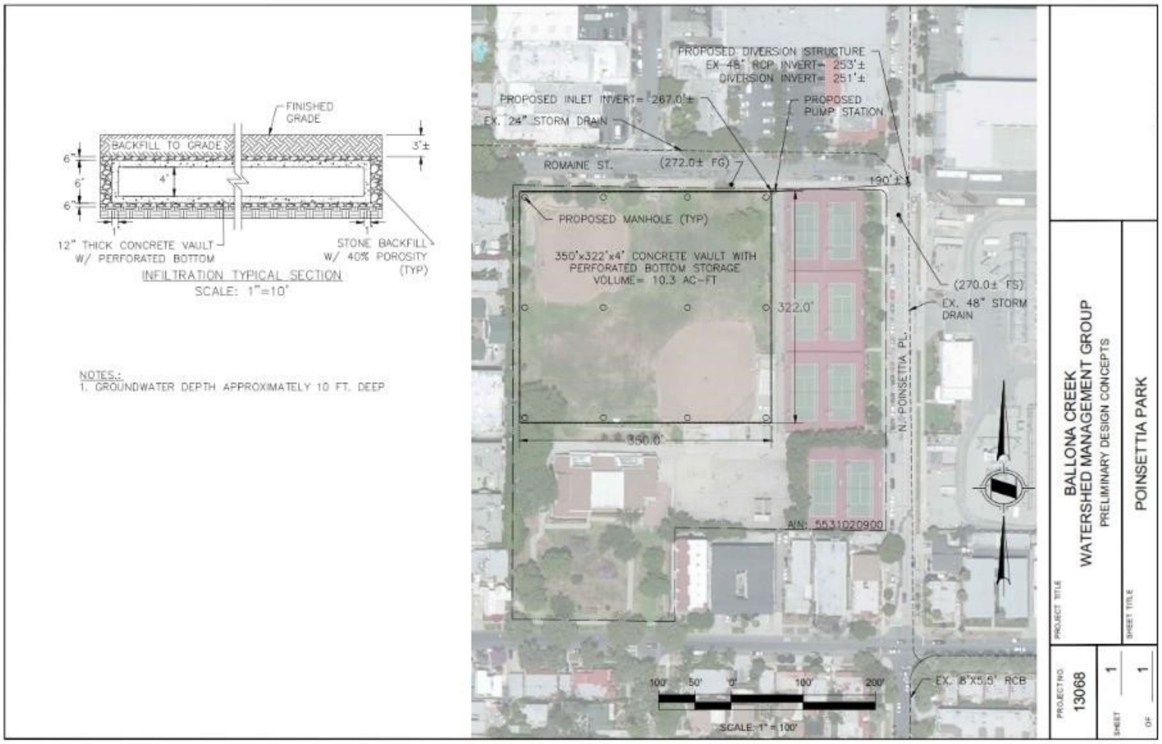


Figure 4-31 Poinsettia Park Subsurface Infiltration Site – Preliminary Design Concepts

4.5.8 Ladera Park

Ladera Park is located in unincorporated Los Angeles County in an area that drains to Ballona Creek. Park facilities include a baseball/softball diamond, basketball court, a children's play area, community recreation center, senior center, outdoor amphitheater, picnic facilities with barbecue grills, and tennis courts. The potential BMP type is proposed as a belowground retention/infiltration basin situated beneath the open field space along the park's eastern boundary and the baseball diamond in the southeast corner of the park.

Details on this project site were provided by the County of Los Angeles (County). Prior to the preparation of this EWMP Plan, the County had completed site investigations and begun developing potential BMP project concepts including selecting the project type and identifying the drainage area and potential BMP footprint. It was decided that this BMP should be sized to accommodate the flows from the 85th percentile, 24-hour storm event from the identified drainage area.

The County's previously identified a 110-acre drainage area. Open fields along the east boundary of the park were selected as the preferred BMP project location. Given the available area, depth, soil infiltration rate and storm volume, it was determined that this location could accommodate the flows from the 85th percentile, 24-hour storm from the maximum drainage area. Thus, it is recommended that the BMP be sized for retention/infiltration of approximately 5.3 AF of runoff.

Table 4-10 below summarizes some key conceptual design parameters for this project site. Figures 4-32 through 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 Ladera Park Field Design Parameters

Ladera Park Field Design Parameters (LC01)		
Project Site Parameters	Total (Maximum) Drainage Area	11µ acres
	Alternative (Minimum) Drainage Area	N/A
	Maximum Required BMP Volume	5.1 AF
	Alternative Required BMP Volume	N/A
	Groundwater Depth	13µ feet
BMP Design Parameters	BMP Opportunity Area	µ.35 acres
	Recommended Maximum BMP Depth	2µ feet
	Available BMP Volume	7.µ AF
	Recommended Active BMP Volume	**5.3 AF**

Ballona Creek Enhanced Management Program
Signature Project: Ladera Park
FACT SHEET
PN 182198

Note: Figures are not to scale

Site Location			
Site Location, City	Los Angeles	Site Name	Ladera Park
Latitude	33° 59' 9.819" N	Longitude	118° 21' 34.47" W
Landuse	Open Space	Street Address	6027 Ladera Park Ave
Major Watershed	Ballona Creek	Land Owner	City of Los Angeles
Existing Land Use of Site: Park			

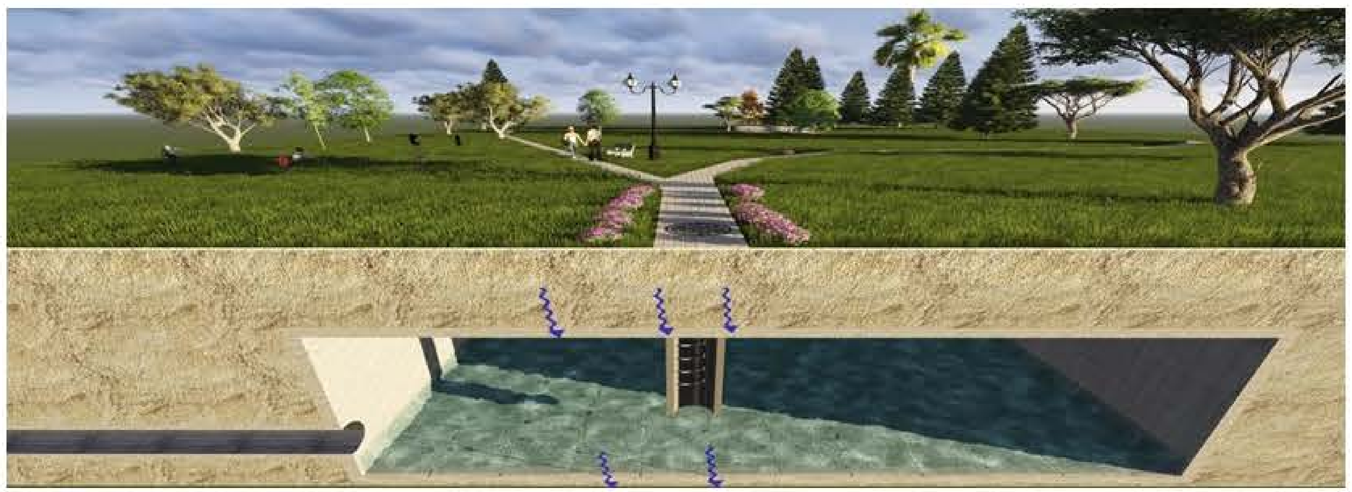
Watershed Characteristics	
Drainage Area Max/Alternative, ac	110/NA
Hydrologic Soil Group	
Soil Infiltration Rate, in/hr	0.06
Design Storm Event, in	85th Percentile, 24 hr
Recommended Active BMP Volume, ac-ft = 5.3	

Retrofit Characteristics	
Proposed Retrofit	Subsurface Infiltration
Recommended BMP Footprint, ac	0.6
Available BMP Volume, ac-ft	6.2
BMP Water Storage Depth, ft	20
Gravel Depth, ft	0

Budget-Level estimates for both soft and hard costs	$7,008,000	Schedule	1 year design, 6 months bid, 1.00 year construction (2 ½ years total)


Drainage Map


Watershed and Vicinity


Rendered Improvements

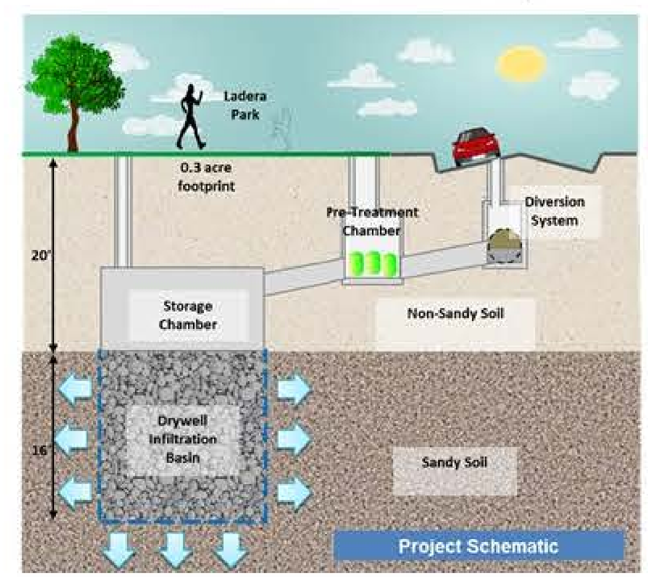


Figure 4-32 Ladera Park Field Super Fact Sheet

Figure 4-33 Ladera Park Field Subsurface Infiltration Site – Site Map

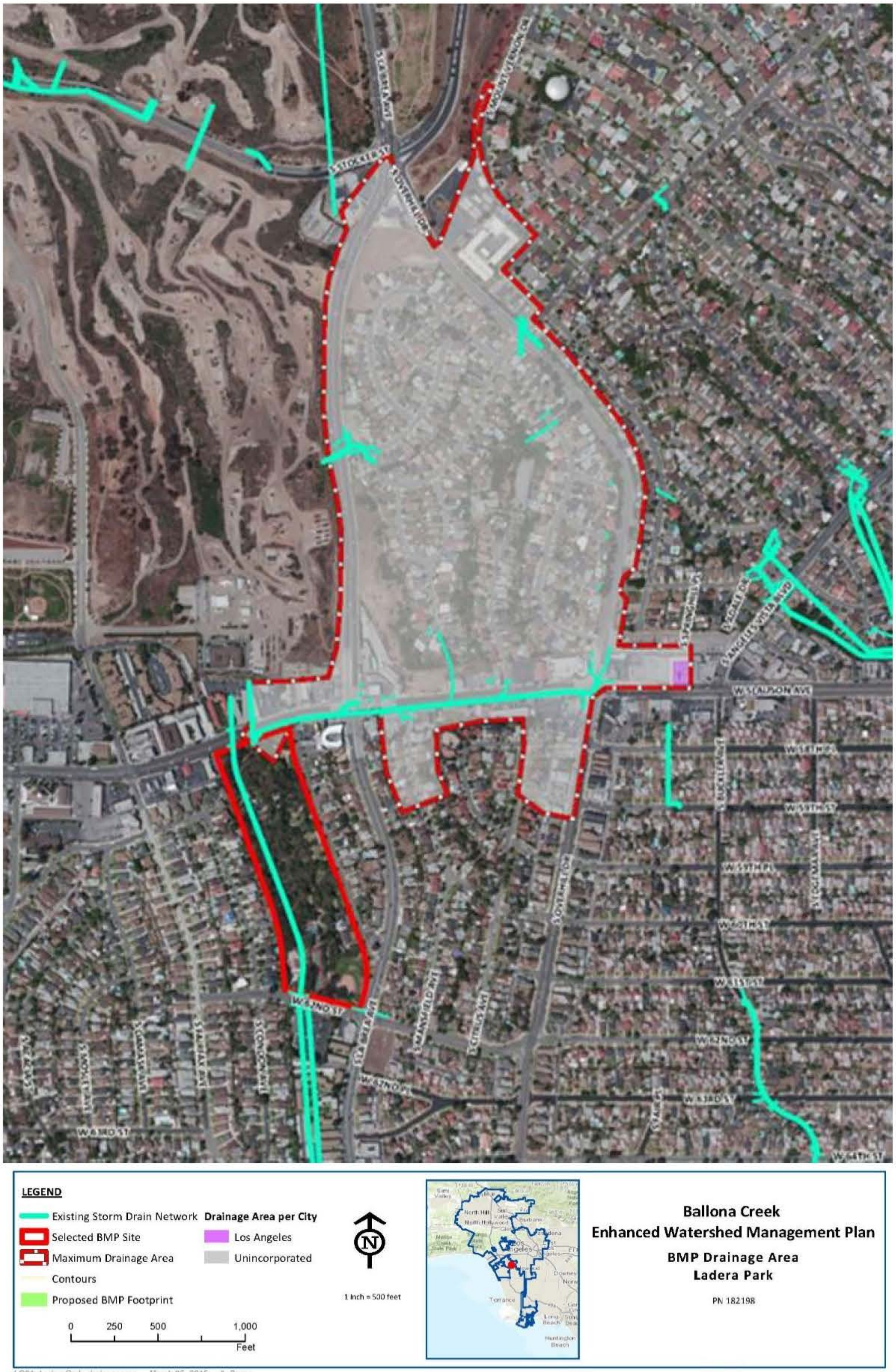


Figure 4-34 Ladera Park Field Subsurface Infiltration Site - Drainage Map

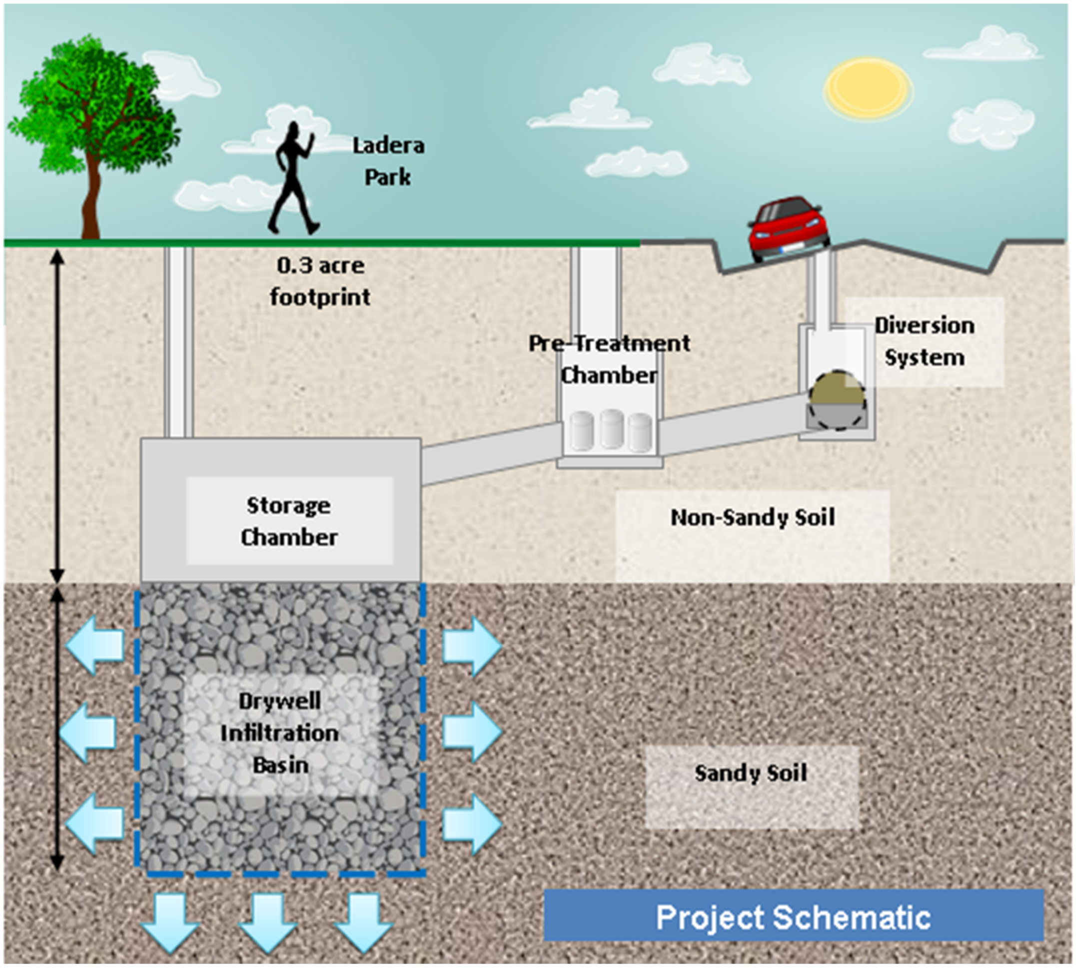


Figure 4-35 Ladera Park Field Subsurface Infiltration Site – Preliminary Concept Design

4.5.9 Lafayette Park

Lafayette Park is located in the City of Los Angeles in an area that drains to Ballona Creek. Park facilities include an auditorium, basketball courts, a playground, community room, picnic tables, an indoor-style soccer field, tennis courts, and a skate park. The potential BMP type is proposed as a below-ground retention/infiltration basin situated beneath the basketball court and picnic area in the north/center portion of the parcel and the wooded walkway area in the southwestern portion of the parcel.

The maximum drainage area for this project site is approximately 2,864 acres. After review of available site information and surrounding infrastructure, a smaller (alternative) drainage area was delineated, encompassing approximately 637 acres.

After reviewing the hydrologic model results and estimated runoff volume for the various diversion scenarios, it was determined that this project site cannot accommodate the retention/infiltration of the 85th percentile design storm flows contributed from the smaller alternative drainage area. As a result, the recommended active volume of the BMP is 18.0 acre feet. The recommended size has been optimized to allow for maximizing the project volume while staying below the point of diminishing returns. Optimization curves are provided in Appendix 4.C.

The table below summarizes key conceptual design parameters of the BMP proposed at Lafayette Park. Figures 4-36 through 4-39 provided on the following pages show proposed site features and the tributary drainage area(s) considered during the engineering and environmental feasibility analysis.

Table 4-11 Lafayette Park Field Design Parameters

Lafayette Park Field Design Parameters (LA04)		
Project Site Parameters	Total (Maximum) Drainage Area	2,864 acres
	Alternative (Minimum) Drainage Area	637 acres
	Maximum Required BMP Volume	143.5 AF
	Alternative Required BMP Volume	3µ.4 AF
	Groundwater Depth[1]	2µ feet
BMP Design Parameters	BMP Opportunity Area	2.5 acres
	Recommended Maximum BMP Depth	1µ feet
	Available BMP Volume	25 AF
	Recommended Active BMP Volume	**18.0 AF**

[1] Depth appears to be shallow but this will be further reviewed during concept design phase.

Ballona Creek Enhanced Management Program
Signature Project: Lafayette Park
FACT SHEET
PN 182198

Note: Figures are not to scale

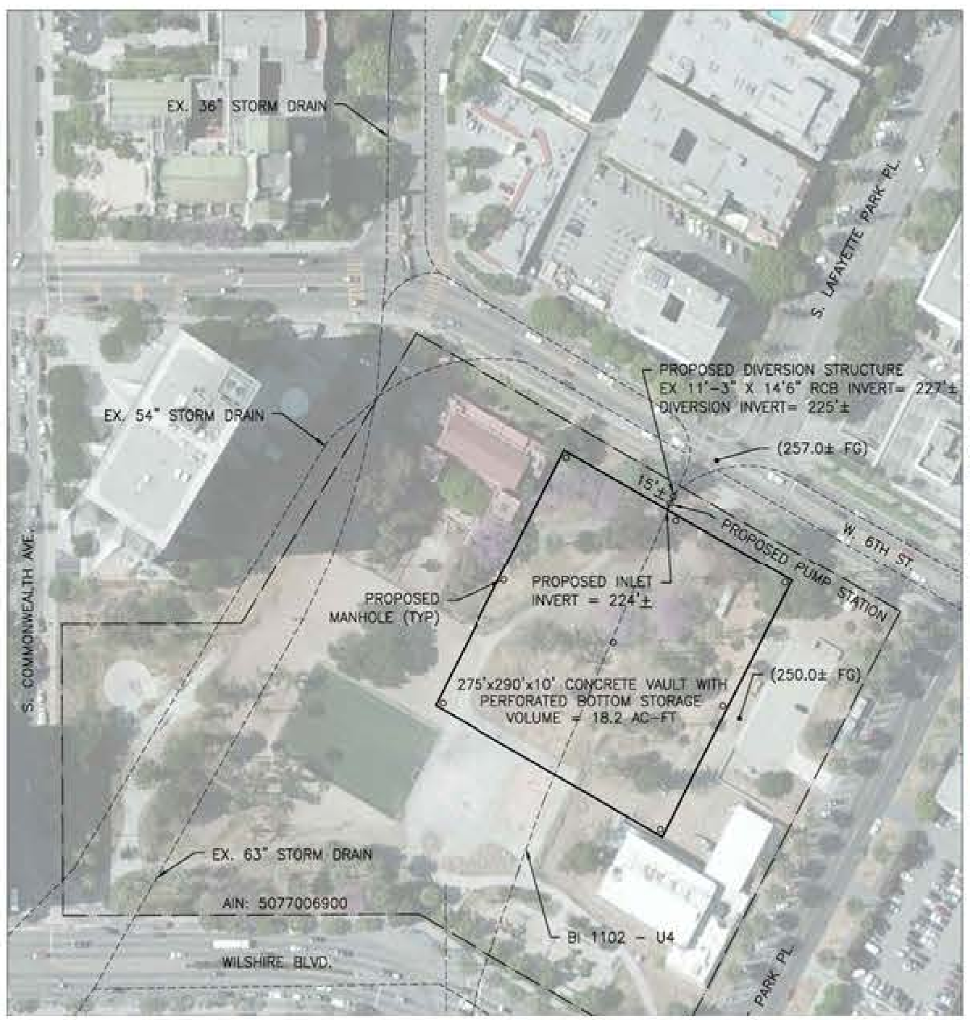
Site Location			
Site Location, City	Los Angeles	Site Name	Lafayette Park
Latitude	34° 3' 48.21" N	Longitude	118° 16' 59.613' W
Landuse	Open Space	Street Address	2820 W 6th Street
Major Watershed	Ballona Creek	Land Owner	City of Los Angeles
Existing Land Use of Site: Park			

Watershed Characteristics		Retrofit Characteristics	
Drainage Area Max/Alternative, ac	2,864/637	Proposed Retrofit	Subsurface Infiltration
Hydrologic Soil Group	Tujunga Fine Sandy Loam	Recommended BMP Footprint, ft^2	79,750
Soil Infiltration Rate, in/hr	0.30	Available BMP Volume, ac-ft	25
Design Storm Event, in		BMP Water Storage Depth, ft	10
Recommended Active BMP Volume, ac-ft = 18.0		Gravel Depth, ft	0

Budget-Level estimates for both soft and hard costs	$27,681,000	**Schedule**	2 years design, 6 months bid, 4.00 years construction (6 ½ years total)

Drainage Map

Watershed and Vicinity



Rendered Improvements

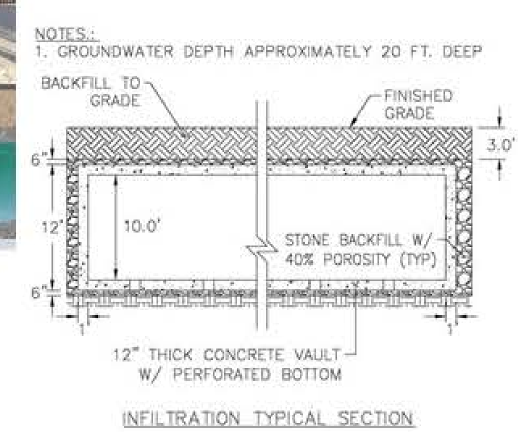


Figure 4-36 Lafayette Park Field Super Fact Sheet

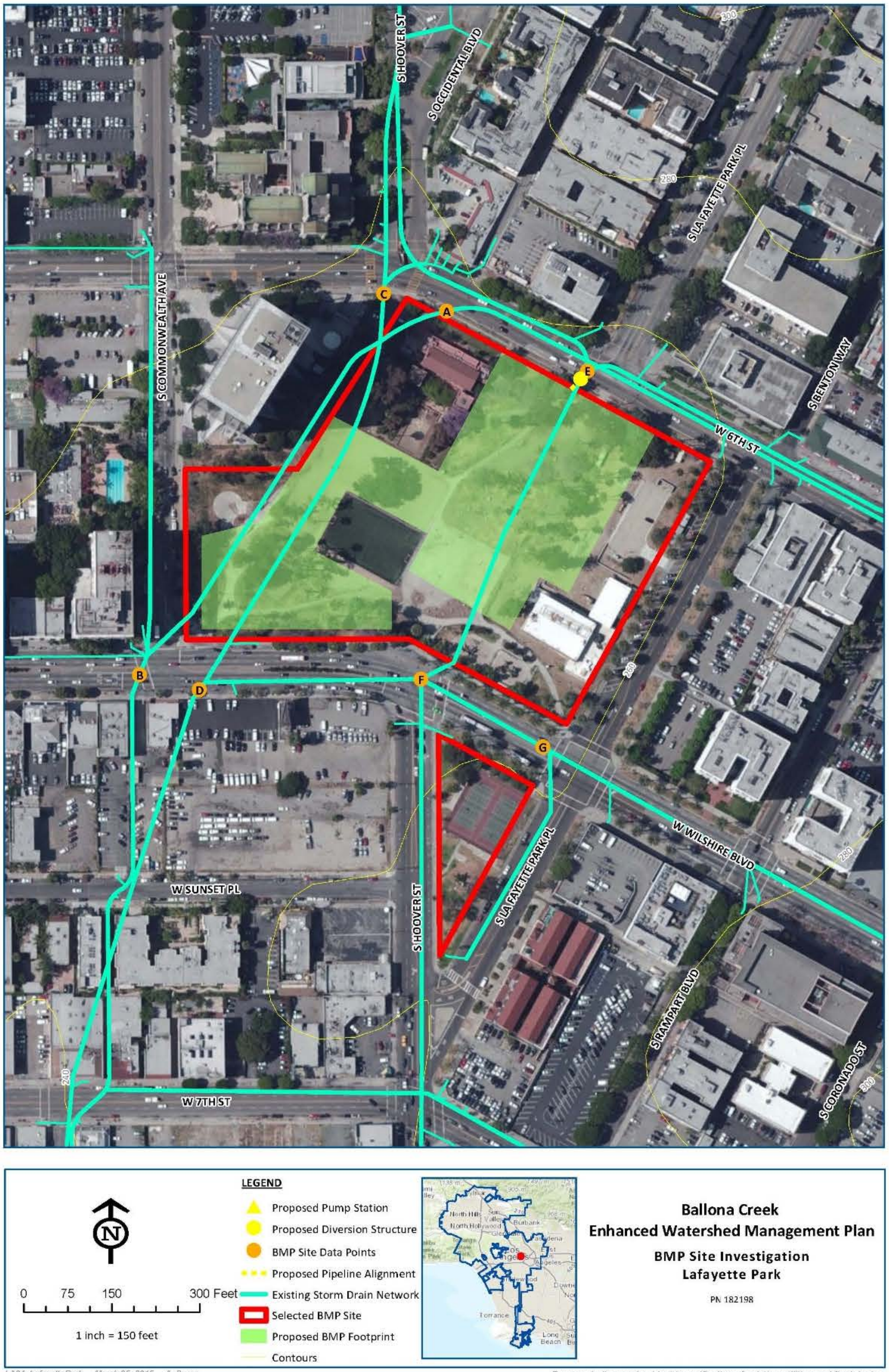


Figure 4-37 Lafayette Park Field Subsurface Infiltration Site – Site Map

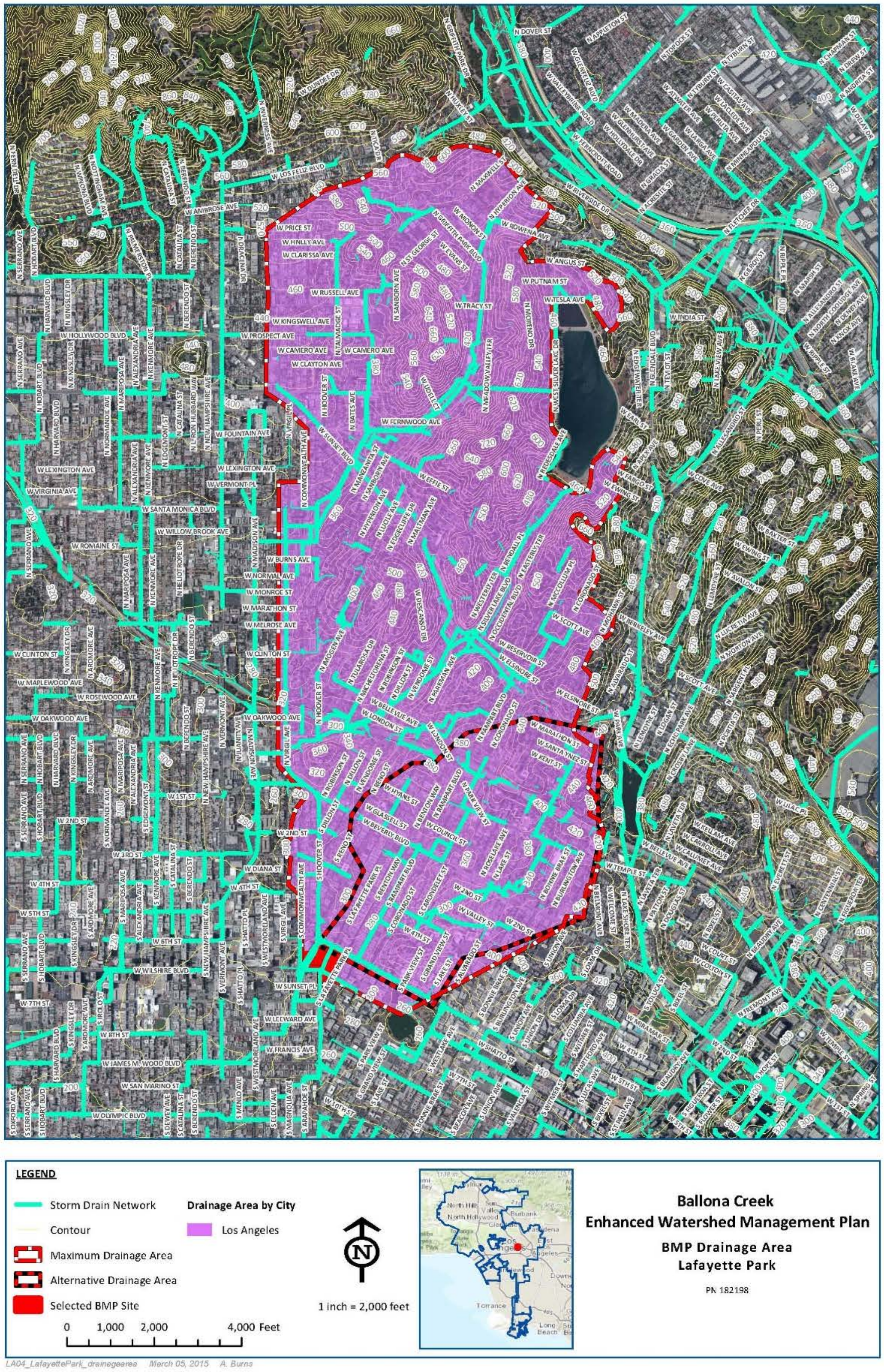


Figure 4-38 Lafayette Park Field Subsurface Infiltration Site – Drainage Map

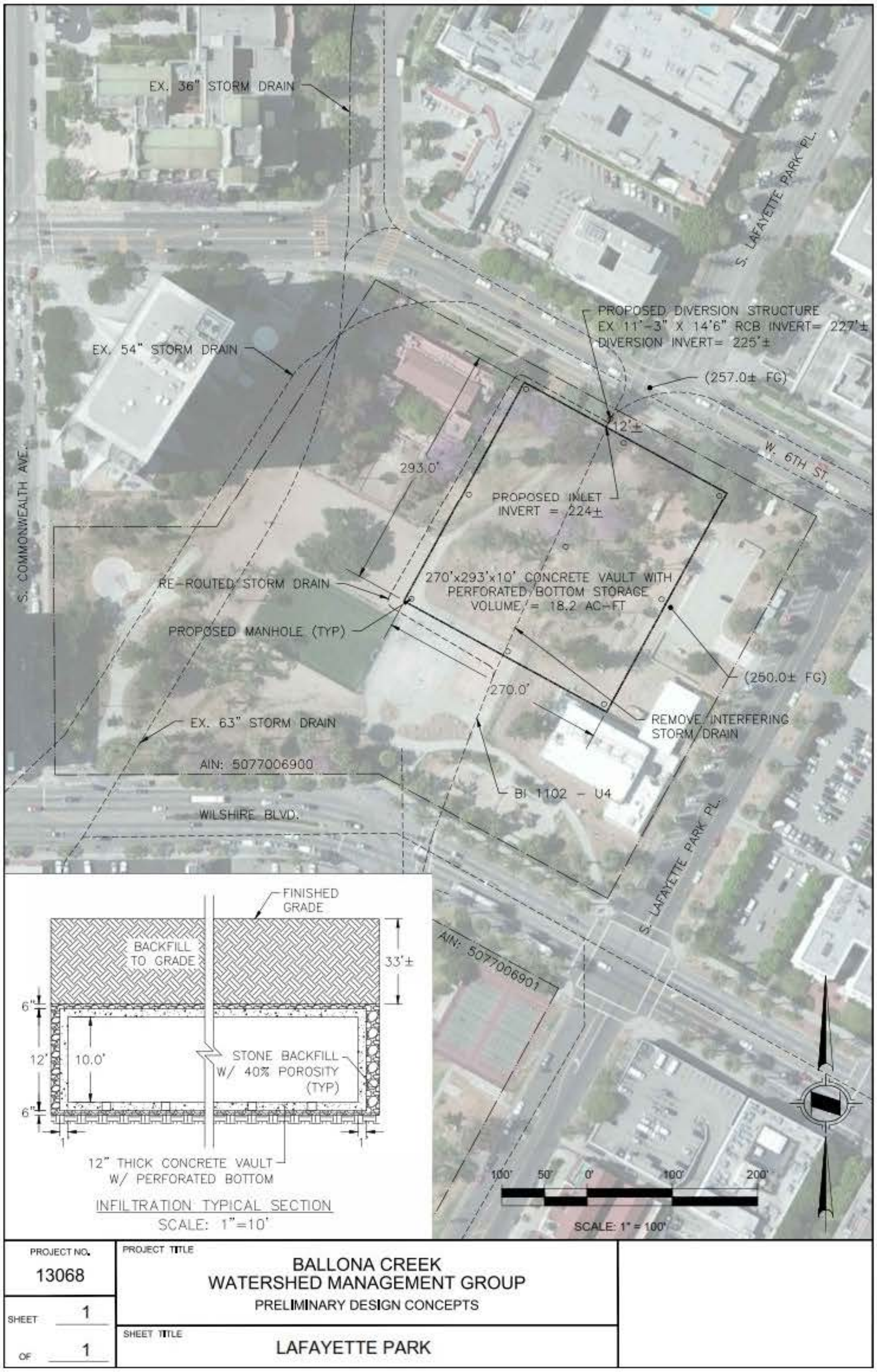


Figure 4-39 Lafayette Park Field Subsurface Infiltration Site – Preliminary Design Concepts

4.5.10 Westside Water Quality Improvement Project Phase 2

The Westside Water Quality Improvement Project (Phase 1) became operational in the fall of 2006 and treats urban runoff from the eastern portion of the City of Santa Monica and parts of west Los Angeles in BMPs sited at Mar Vista Park. Phase 1 diverts dry and wet weather runoff from the Sawtelle Channel for extensive treatment through two BMPs (Storm Filter filtration unit and a Bio Clean Baffle Box). After treatment for trace metals, organic chemicals, trash, debris, oil and grease, and some pathogens, the urban runoff is returned to the Sawtelle Channel. The runoff treated in Phase 1 comes from approximately 220 acres within Santa Monica's Centinela sub-watershed area and 2,280 acres from parts of west Los Angeles. This drainage area may increase to a total of 2,736 acres as a result of the proposed project (Phase 2). Phase 2 would be an expansion of Phase 1 in order to fully capture the 85th percentile, 24-hour storm from the upstream area draining to the Sawtelle Drain. Currently, urban runoff is diverted from the box culvert in Sawtelle Channel, and flows under the athletic field to the western parking lot where it is treated before released back into the culvert. The Phase 1 system already harvests most, if not all, dry weather runoff. Phase 2 will modify the existing stormwater harvesting and treatment (and release) systems at the western end of the park, installed by the City of Santa Monica, to retain treated stormwater onsite in storage tanks under the athletic field, and use harvested runoff for irrigation and indoor flushing. As with all other Signature Regional Projects, this project is considered a Very High Priority project in the RAA performed for this EWMP.

Table 4-12 Westside Water Quality Improvement Project Phase 2 Design Parameters

Westside Water Quality Improvement Project Phase 2 Design Parameters		
Project Site Parameters	Total (Maximum) Drainage Area	2,736 acres
	Alternative (Minimum) Drainage Area	N/A
	Maximum Required BMP Volume	TBD
	Alternative Required BMP Volume	N/A
	Groundwater Depth	TBD
BMP Design Parameters	BMP Opportunity Area	TBD
	Recommended Maximum BMP Depth	TBD
	Available BMP Volume	TBD
	Recommended Active BMP Volume	TBD

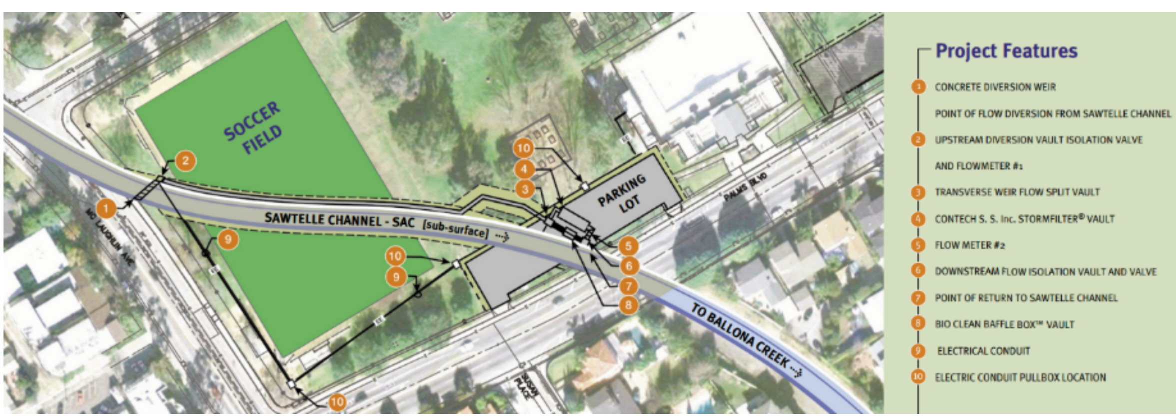


Figure 4-40 Westside Water Quality Improvement Project Components

Sources: http://expogreenway.org/Conservation_files/CentinelaBrochure.pdf

4.6 How is the EWMP Integrated with Previous, Ongoing and Future 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. Following is a list of the plans reviewed as a part of this process:

- *Ballona Creek Watershed Management Plan (2004);*
- *Ballona Creek Greenway Plan (2011);*
- *Santa Monica Bay Restoration Plan (2008);*
- *Multi-Pollutant TMDL Implementation Plan for the Unincorporated County Area of Ballona Creek (2012);*
- *Request for Time Schedule Order (TSO) Ballona Creek, Ballona Estuary, and Sepulveda Channel Bacterial TMDL (2013);*
- *TMDLs for Bacterial Indicator Densities in Ballona Creek, Ballona Estuary, & Sepulveda Channel (2006, 2012) and its implementation plan (2009);*
- *Reconsideration of Certain Technical Matters of the TMDL for Bacteria Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel (2012);*
- *TMDLs for Metals in Ballona Creek (2005,2007) and its implementation plan (2010);*
- *TMDLs for Toxics in Ballona Creek Estuary (2005) and its implementation plan (2011);*
- *Trash TMDLs in Ballona Creek and Wetland (2001, 2004);*
- *Ballona Creek Wetland TMDL for Sediment and Invasive Exotic Vegetation (2012);*
- *Draft TMDLs for [dichloro diphenyl trichloroethane] DDTs and [polychlorinated biphenyls] PCBs in Santa Monica Bay (2011);*
- *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); and*
- *Water Quality Compliance Master Plan for Urban Runoff (May 2009).*

The set of regional project opportunities includes many of these opportunities, but in many cases, these project opportunities are outside of the ownership or jurisdiction of the BC EWMP Group members. While these project opportunities are not included in this EWMP, a database has been developed and is available as a reference document for future use by BC EWMP Group members and is included in Appendix 4-2. As progress is made with those project opportunities by others, they can be evaluated for inclusion during future EWMP updates through an adaptive management process.

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

Complimentary to the regional BMP program introduced in Section 4, robust green infrastructure programs will be critical to achieving water quality compliance in the Ballona Creek 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, small control measures in available rights-of-way, on private and public parcels (where regional BMPs are not feasible/desirable). This section provides a high-level summary of the green infrastructure programs 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 Ballona Creek EWMP includes two primary types of green infrastructure, Low Impact Development (LID) and green streets, as illustrated below. Appendix 4.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 level (normally less than ten 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 non-potable water demands. The types of LID incorporated into the EWMP are the LID ordinance, residential LID, and LID retrofits of public parcels.

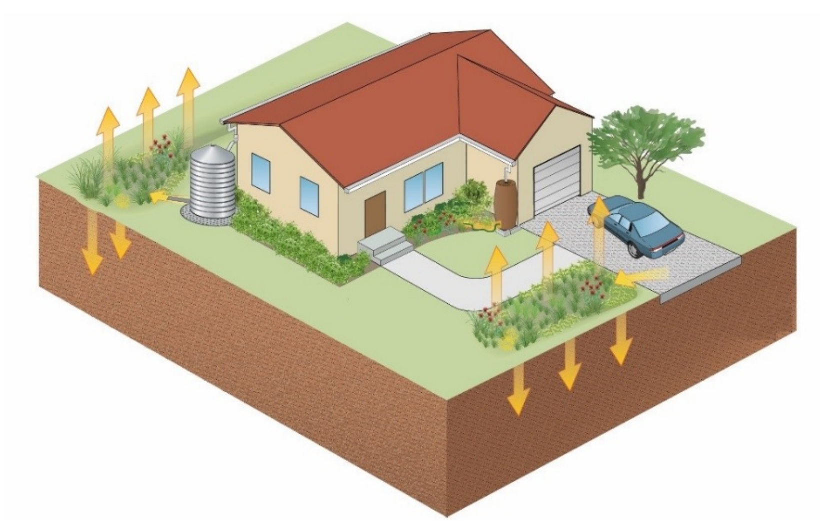


Figure 5-1 Conceptual Schematic of LID Implemented at the Site Scale
(arrows indicate water pathways)

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[12] (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).

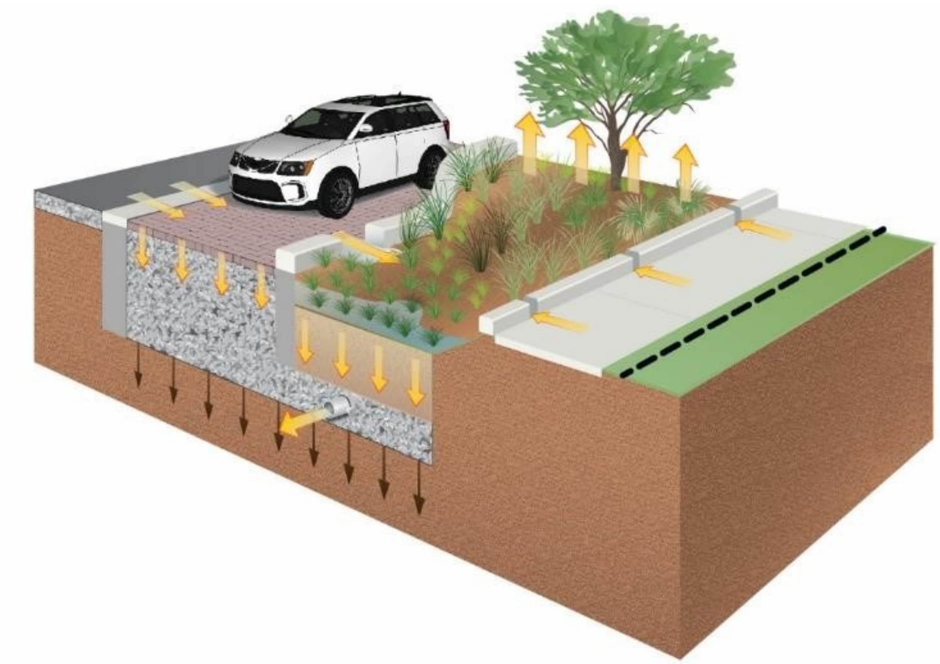


Figure 5-2 Conceptual Schematic of Green Street
(arrows indicate water pathways)

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 30 percent of the control measure capacity in the EWMP to be implemented by 2021, as shown in Figure 5-3 (LID and green streets each make up 13 percent and 17 percent respectively). 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 though "programs", namely watershed-scale LID and green street programs. The following objectives should be considered:

- **Identify and prioritize opportunities –** Individual green infrastructure projects and programs can vary widely in cost efficiency and site applicability. Assessing and comparing specific 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.

[12] 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 Ballona Creek Watershed.

- **Evaluate existing projects –** Demonstration projects that have been implemented to date can serve several key purposes: (1) facilitate public interest, education, and support in the programs; (2) provide BMP performance data to inform implementation; and (3) 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 or 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.*, 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, all BC EWMP Group members adopted green infrastructure guidelines 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 2µ35	X			X	X
Green Alleys Program	Sister to Green Streets Program. Effort began as a study led by USC and non-governmental organizations (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

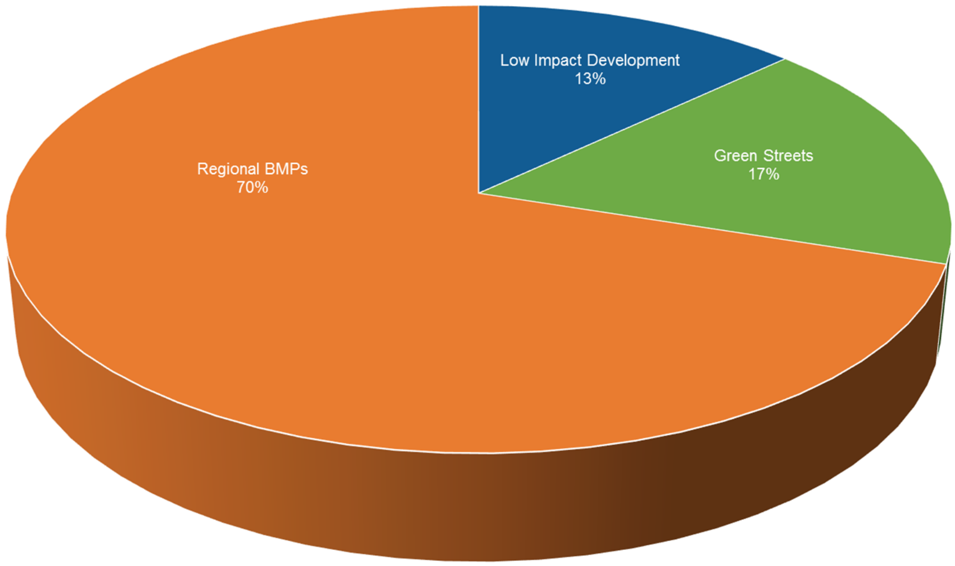


Figure 5-3 Relative Capacity of LID, Green Streets and Regional Control Measures for the Ballona Creek EWMP by 2021

5.3 How are Green Streets integrated into the EWMP?

The right-of-way along streets may be the most extensive opportunity for the Ballona Creek 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 can retain ownership
- Design/construction standards can yield efficiency
- Strategic selection of streets can yield cost savings
- Opportunity for integration with capital improvement projects (CIP)
- 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 streets opportunities to be retrofitted with green infrastructure to meet EWMP objectives, as shown in Figures 5-5 and 5-6. 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.

Figure 5-4 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 and regional BMP programs. 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.

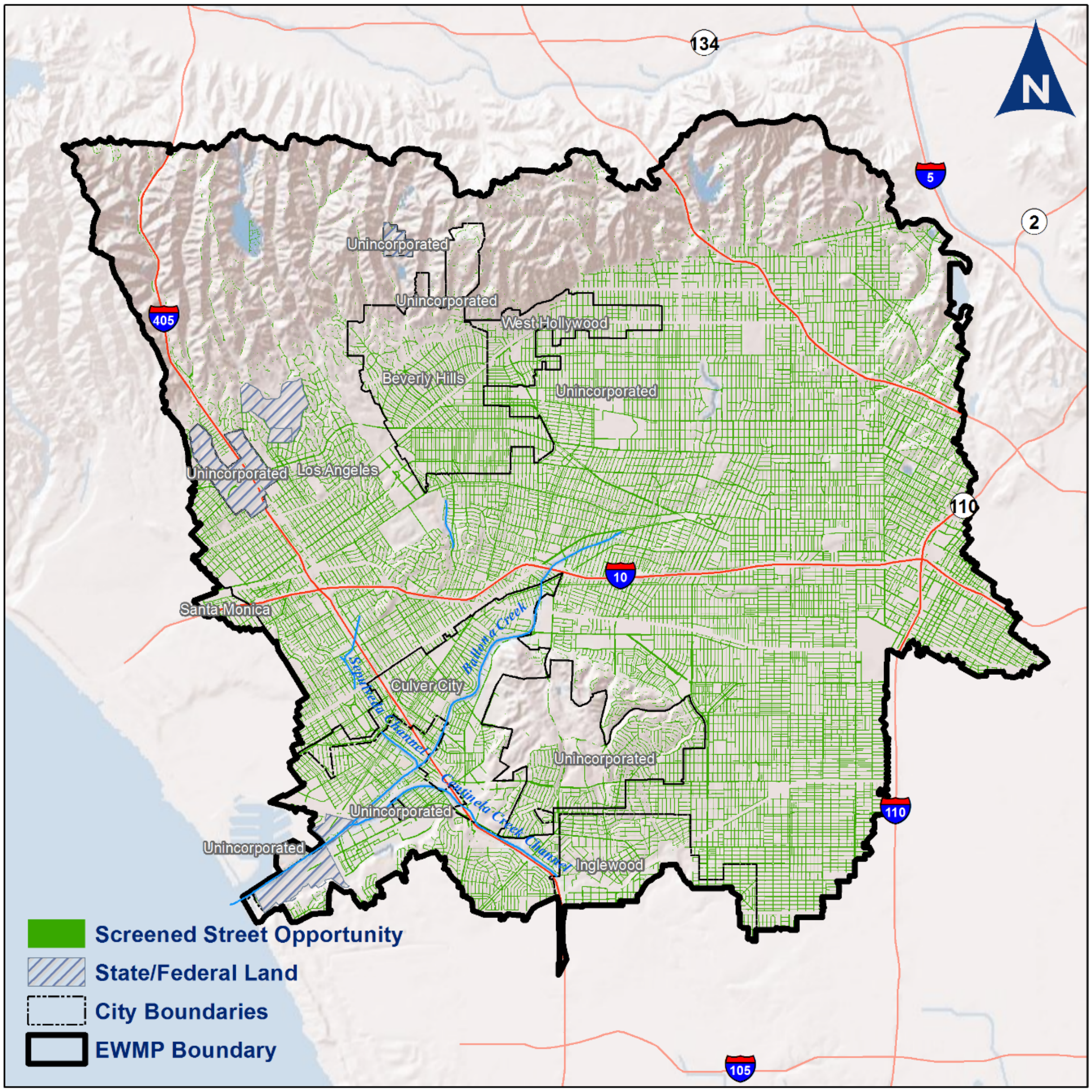


Figure 5-5 Green Street Screened Opportunities in the Ballona Creek EWMP Area

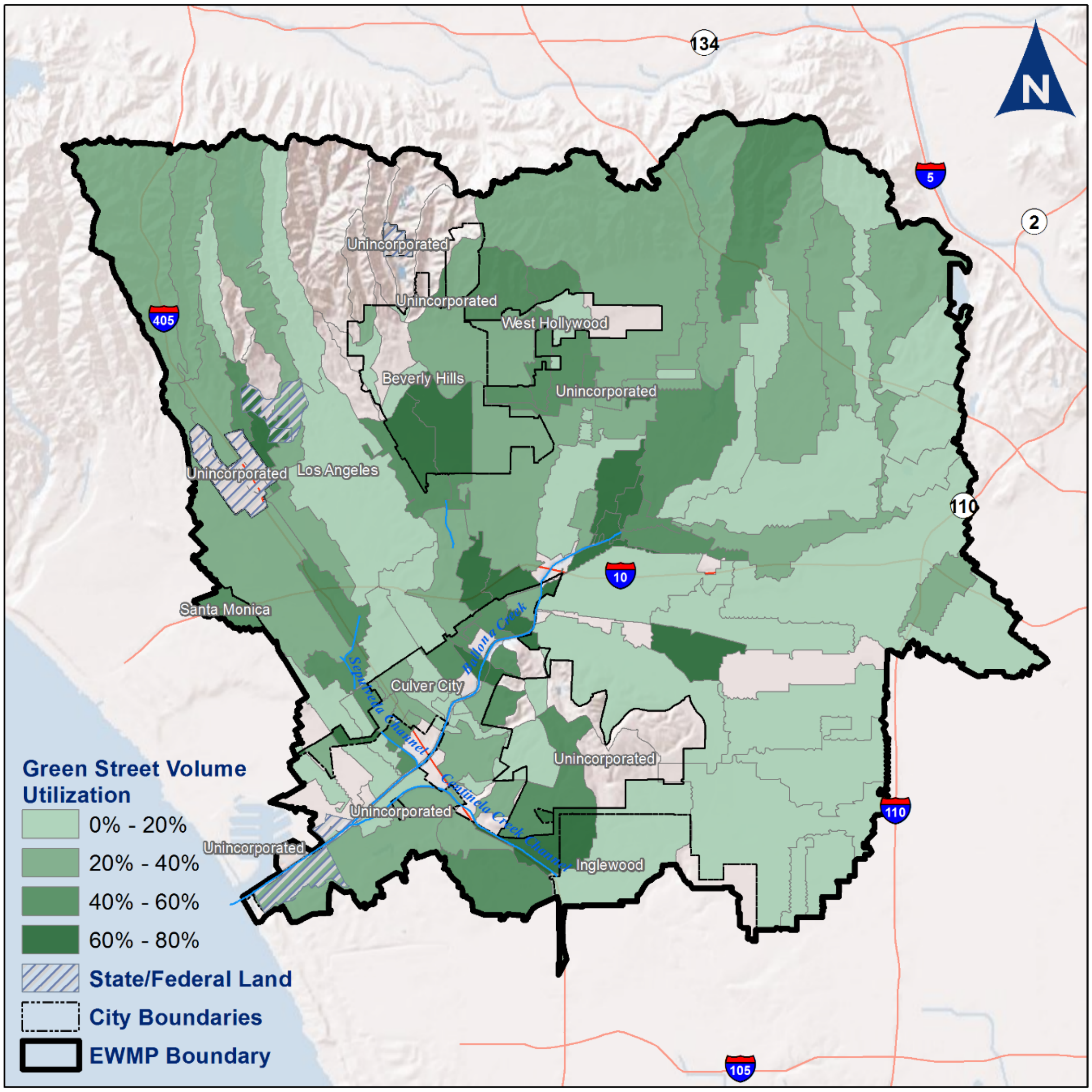


Figure 5-6 Percent of Required Green Street Implementation in the Ballona Creek EWMP Area Relative to Total Available Capacity (e.g., percent utilization was calculated as the EWMP-prescribed BMP volume divided by the total available BMP volume)

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 90 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 (Figure 5-7). For development and redevelopment 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. Note that *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). The key advantage to the BC 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 is redeveloped over the course of the compliance period based on projected growth rates.

Figure 5-7 Biofiltration in a Redeveloped Shopping Center Parking Lot

Under the LID ordinance, the BC EWMP Group members retain 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 occurs throughout the watershed, it will be important for the BC 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 BC EWMP Group members minimal
- Requires strong standards and oversight
- Benefit is proportional to growth / number of redeveloped parcels

5.4.2 Residential LID

Accounting for approximately 20 percent of all developed impervious area in the watershed, residential parcels represent an important opportunity for LID implementation (Figure 5-8). 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 street BMPs and could reduce the overall operations and maintenance burden on the BC 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 (Section 6.3). The goal is to annually enroll one percent of residential parcels in the residential LID program.

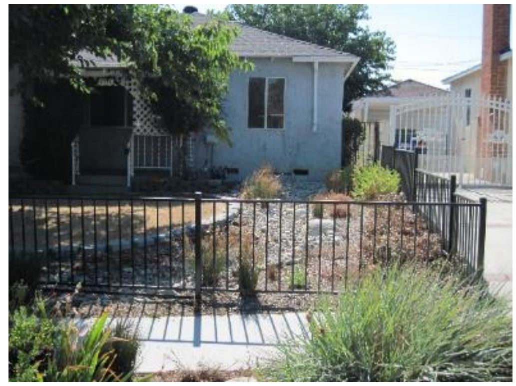


Figure 5-8 Residential LID Retrofit in the Form of a Xeriscaped Infiltration Swale

<u>**Residential LID Program Highlights:**</u>

- 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 (Figure 5-9) 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.

Figure 5-9 Community Members Engaged in "Urban Acupuncture" (Residential LID) Demonstration Projects

(source: The River Project)

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.

Figure 5-10 Bioretention and Permeable Pavement at the Los Angeles Zoological Park

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

Sites that attract significant public traffic, such as libraries, City Hall, and parks can also provide excellent forums to demonstrate LID practices (Figure 5-10 and Figure 5-11). Not only will these demonstrations help the BC EWMP 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).

Figure 5-11 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 taking 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 BC EWMP Group members and a literature review to identify BMPs within the Ballona Creek EWMP area (as presented in the Work Plan and 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 example 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 Residential Neighborhood "Pilot-to-Scale" Landscape Transformation Project

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 BMP 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 percent of all residential properties in the Ballona Creek Watershed could yield 3,665 to 7,872 acre-feet per year.

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
- ***Approximate Cost:*** TBD

Building upon this analysis and the collaborative work already completed, TreePeople proposes the following Upper LA Watershed candidate neighborhoods: Pacoima, Sylmar, and Sun Valley; and/or in the following Ballona Creek/Dominguez 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 rain tanks for capture and use), entirely on private residential properties (Figure 5-12). 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

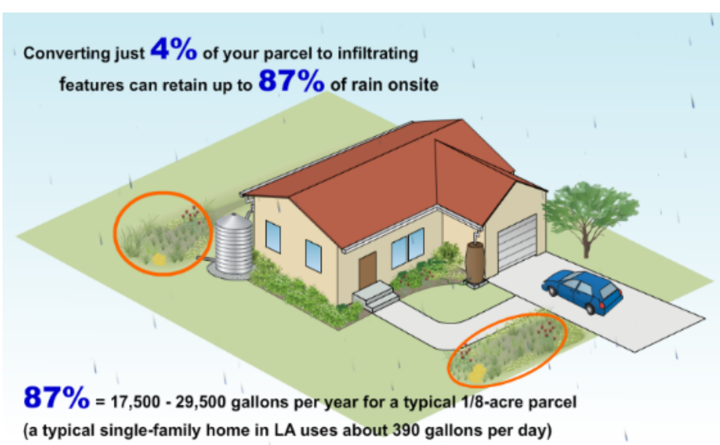


Figure 5-12 Landscape Transformation

(source: TreePeople)

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.

5.5.2 Vermont Avenue Stormwater Capture and Green Street Project

At a Glance:

- ***Location***: Vermont Avenue from Gage Avenue to Florence Avenue, South Los Angeles
- ***Control Measures: 1/2 mile of Green Streets***
- ***Expected Completion:*** December 2016
- ***Approx. Cost:*** $5 million

Figure 5-13 Proposed bio-Filtration Island

The Vermont Avenue Stormwater Capture and Green Street Project will implement a series of BMPs along a half-mile segment of Vermont Avenue from Gage Avenue to Florence Avenue of an area known as the Vermont Corridor in South Los Angeles. BMPs that filter and/or infiltrate runoff will also be installed in three prioritized sub-watersheds that terminate at storm drains near the eastern flow line of Vermont Avenue (Figure 5-13).

Figure 5-14 Existing Wet-Weather Flooding and Ponding Along the Proposed Vermont Avenue Project Site

These subwatershed areas were prioritized based on criteria that will contribute to project success, including acreage of tributary, pollutants to be captured, available space in the public right-of-way, land use, and community visibility (proximity to busy intersection and presence of schools and other community hubs). Figure 5-14 depicts typical flooding and ponding conditions in the project area. The project's total drainage area is 85.6 acres.

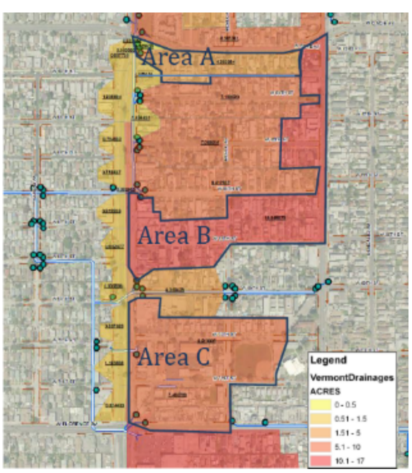


Figure 5-15 Project Subareas

The capture goal for these areas is to detain and to filter or infiltrate the 3/4" inch design storm for Area A, and the 3/4" design storm runoff from the public right-of-way, including sidewalks, parkways, and streets in Areas B and C (Figure 5-15). To the extent feasible within the constraints of the existing utility and roadway infrastructure, green street features will be placed along both the east and west sides of a half-mile stretch of Vermont from Gage Avenue to Florence Avenue, but will be prioritized in areas on the eastern side as these receive the greatest flow volume. A bio-filtration island at the intersection of Gage Avenue and Vermont Avenue has also been identified for additional treatment and beautification in Area A. Public outreach and education will be key components of the project, and the results and recommendations will benefit other implementation efforts throughout the region. Varying levels of public outreach will be performed in the prioritized areas, focusing on residents, schools, and businesses. Results of these public outreach efforts will be measured through public surveys.

5.5.3 Westwood Neighborhood Greenway

Although the Greenway will be constructed as a separate project, elements of the Greenway are designed to complement the objectives of the Expo Light Rail. Located at the Westwood Station, The multi-benefit project is a "Highest" priority project and will provide urban runoff treatment, green space, access to public transit, educational and recreational opportunities. Project components include simulated streams, walkways, bike paths, and aesthetic and educational amenities resulting in year-round treatment of urban runoff, water conservation and beneficial use, enhancement of educational opportunities for local K-12 schools, additional green recreational space, and mitigation of heat-island effect.

At a Glance:

- ***Location:*** Exposition Light Rail Transit Station (Westwood Station) between Westwood Blvd and Overland Avenue
- ***Control Measures:*** Simulated streams along rail tracks, lift stations, and bioswales.
- ***Expected Completion:*** In planning stage; from Pre-Design to Completion ~ 3.5 years
- ***Approx. Cost***: Preliminary Cost ~$3.5M

Figure 5-16 Artist Rendering of Project Components

Dry-weather flow will be diverted from Overland drain to capture runoff from 2,400 acres of drainage area. Diverted water will be lifted to the stream on the north side of the Station (North Stream) for physical and biological treatment by flowing through various plant communities, soil media, and through exposure to sunlight (Figure 5-16). During the dry-weather approximately 23 to 135 gallons per minute of dry-weather flow is expected to be continuously captured and treated by the swales.

During the wet season, the alley on the north side of Westwood station experiences flooding and water ponding. This project proposes catch basins and underground culvert on the north side to capture stormwater runoff from 3 to 5 acres of residential and street areas. Captured storm flow will be designed to go through physical and biological treatment in the south swale (Figure 5-17). Excess treated water will flow back into Overland drain through the return flow structure.

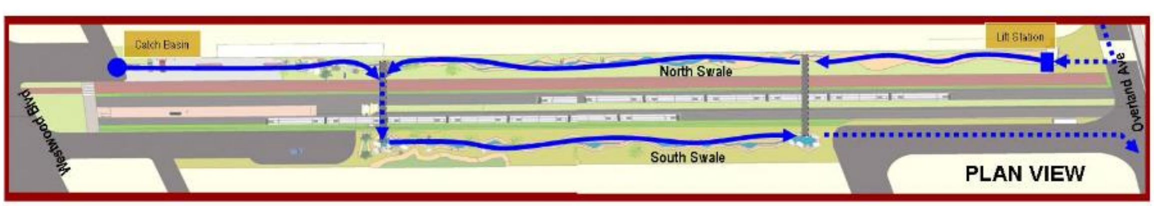


Figure 5-17 Flow Diagram of the Streams (Dotted Lines Represent Underground Flow)

5.5.4 Centinela Avenue Hybrid Green Street Regional Project

The Centinela Avenue Hybrid Green Street Regional Project is proposed along a 0.4-mile stretch of South Centinela Avenue from West Pico Boulevard southward to Ocean Park Boulevard (Figure 5-18). The goal of the project will be to harvest surface runoff and runoff pumped from the storm drain running under the roadway. Two storm drain pipes run beneath South Centinela Avenue – one 63-inch City of Los Angeles pipe transporting runoff from a 180-acre area of Los Angeles and a 93-inch LACFCD storm drain draining a 245-acre area in Santa Monica. This stretch of South Centinela Avenue is in a highly urbanized residential area. South Centinela Avenue runs in a general northwest to southeast direction. From Montana Avenue to just south of Airport Avenue, South Centinela Avenue acts as a dividing line between two cities – the City of Santa Monica to the west and the City of Los Angeles to the east. South Centinela Ave is 60 feet wide from curb to curb with two driving lanes in each direction. Parking lanes exist on each side of the street. The parkways are 4 feet wide, as are the sidewalks.

Surface runoff would be harvested and directed into surface green infrastructure systems in the public right of way, such as curb extensions, depressed landscapes, and tree wells. Underground runoff would be diverted from the storm drain, pre-treated and retained in storage tanks for passive infiltration or use. The location of project elements would preferably be both sides of the street from just south of Pico Boulevard, south of the I-10 freeway to Ocean Park. However, if utility conflicts make it infeasible to place features on both sides of the street, project proponents may consider placing features on one side of the street. Infiltration would be in locations with minimal utilities and some open space at the south end near Ocean Park Boulevard.

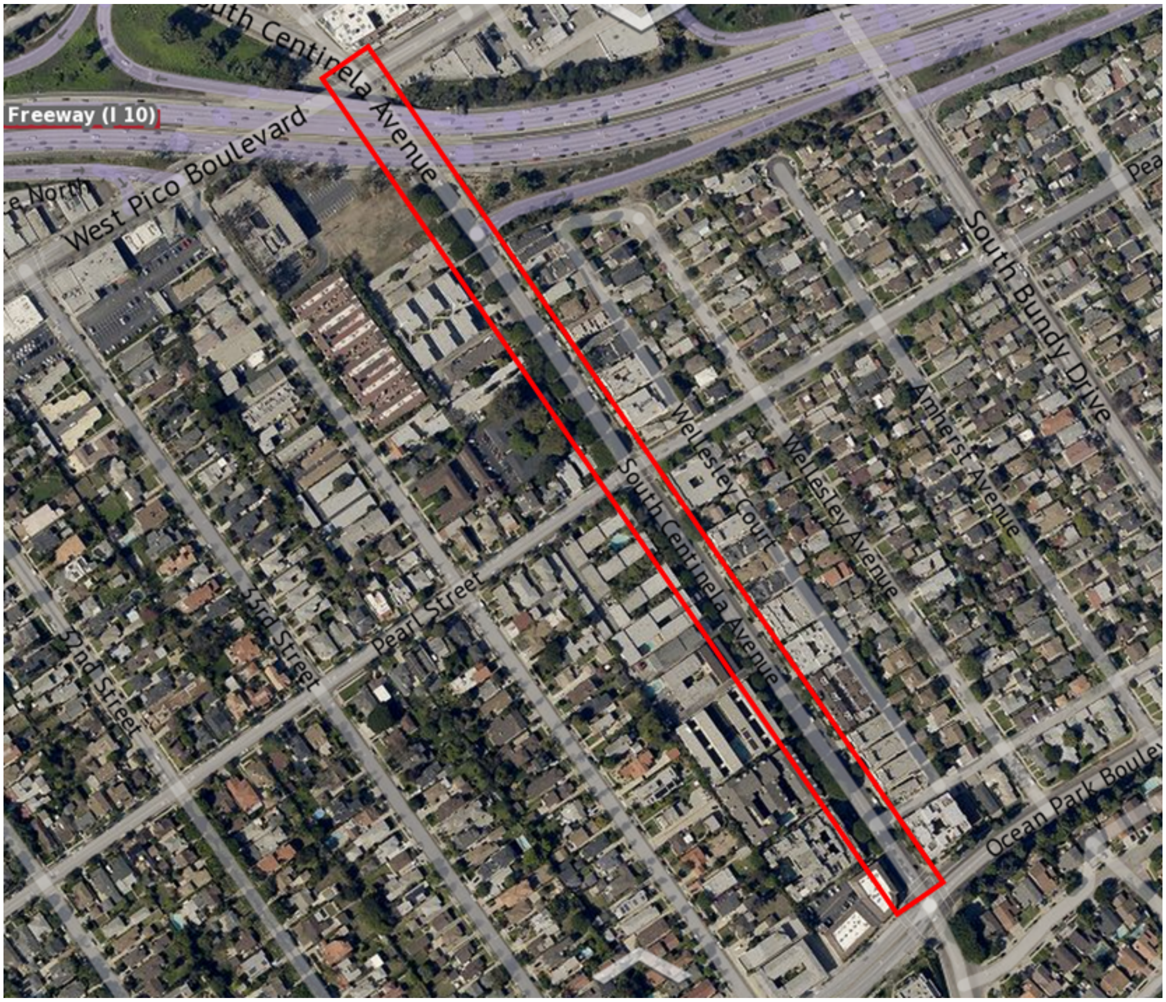


Figure 5-18 Location of Proposed Centinela Avenue Hybrid Green Street Regional Project

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 (IC/ID) Detection and Elimination Program;
- Public Agency Activities Program;

- Public Information and Participation Program; and
- Planning and Land Development Program.

Specific institutional BMPs currently implemented by the BC EWMP Group members' jurisdictions as part of these stormwater program categories are reported in the Los Angeles County MS4 Permit Unified Annual Report[13].

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 percent reduction in pollutants. A summary of these changes in Permit requirements is provided in Appendix 4.B., 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 ▪ Provision for alternative compliance measures due to technical infeasibility of onsite retention, or opportunity for groundwater replenishment at offsite location
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 3 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.

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

Although some BC EWMP Group members have elected to implement additional or enhanced institutional control measures to achieve additional reductions, institutional control measures above and beyond the 2012 Permit are not currently represented in the RAA. Over time, it is anticipated that BC EWMP Group members will consider and implement enhanced institutional control measures to reduce the level of structural control measures. Enhanced institutional control measures that are already being implemented include additional street sweeping and increased catch basin and storm drain cleaning. The BC EWMP Group members are routinely reviewing new or enhanced non-structural BMPs that target the pollutants of concern in the Ballona Creek Watershed. As new or modified institutional control measures are identified, they will be evaluated and incorporated as part of each jurisdiction's control programs.

This page intentionally left blank.

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). While the RAA is a critical element of the EWMP, the content can be rather technical and some readers may wish to proceed to Section 7 which describes the EWMP Implementation Strategy (*e.g.*, the outcome of the RAA).

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 final pollutant reduction (6.2.5).
- Representation of control measures in RAA (6.3); and
- 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.H). 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 BC 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[14] is available for public download from Los Angeles County Department of Public Works website (http://dpw.lacounty.gov/wmd/wmms/res.aspx).

The entire WMMS domain encompasses Los Angeles County's coastal watersheds of approximately 3,100 square miles, representing 2,655 subwatersheds. Of those, the BC EWMP area encompasses 180 subwatersheds[15] (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 a GIS, comprehensive data storage and management capabilities, and a 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 (HSPF) 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.

[14] 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.

[15] To support evaluation of regional BMPs, some of these subwatersheds were further grouped by "pour point" to receiving waters.

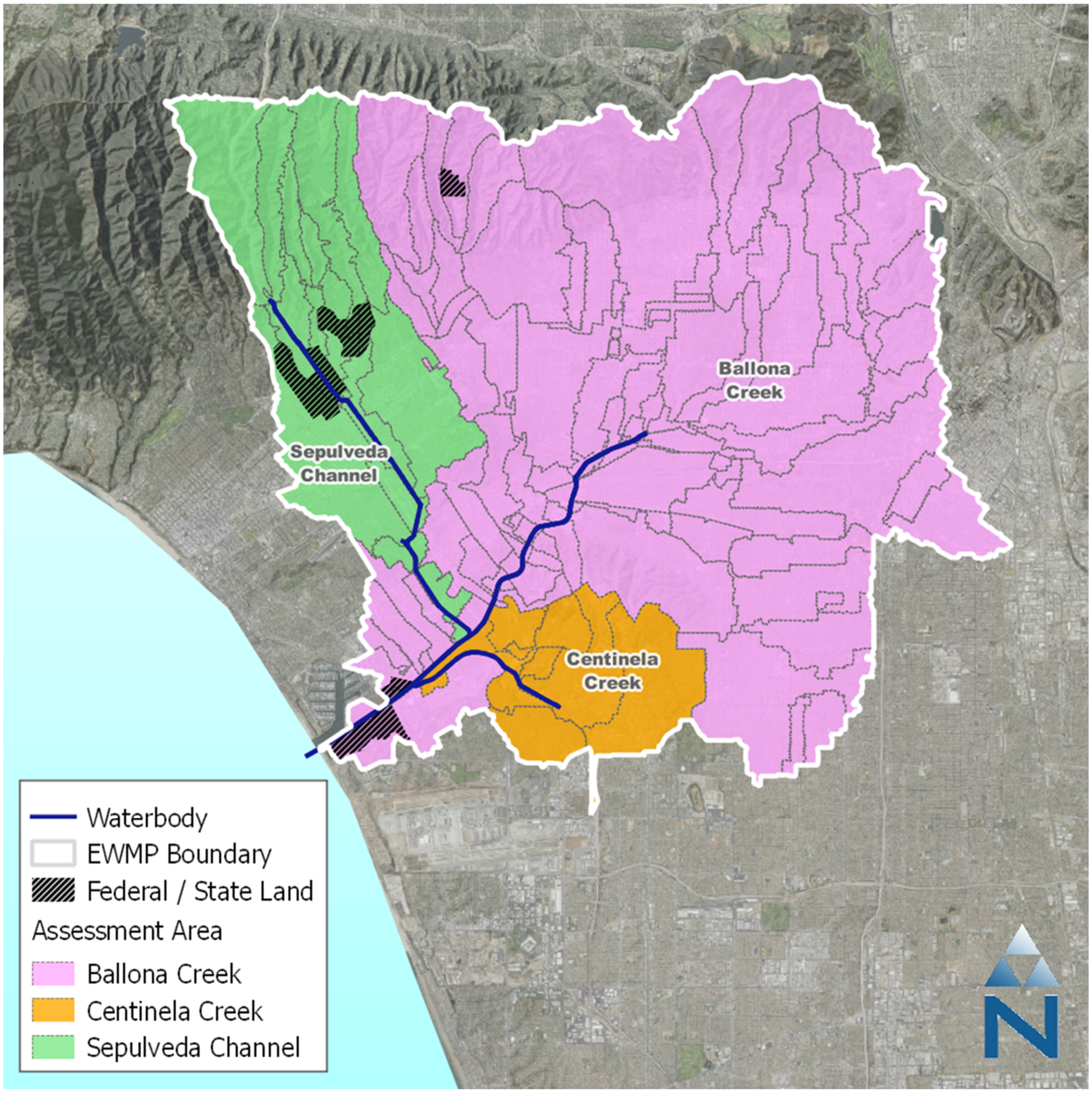


Figure 6-1 BCWMA and 180 Subwatersheds Represented by WMMS

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.

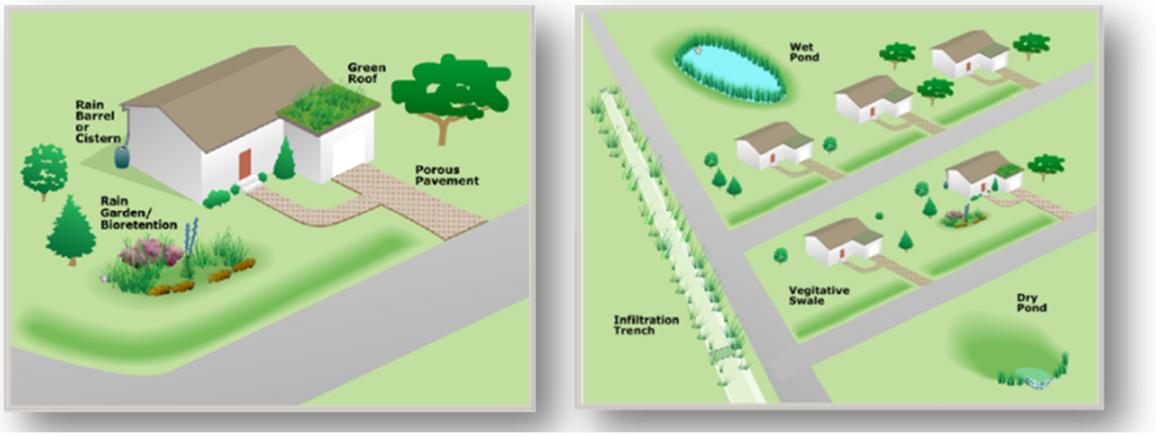


Figure 6-2 SUSTAIN Model Interface Illustrating BMP Opportunities in Watershed Settings
(source: USEPA, 2µµ9)

The *secondary application* of SUSTAIN is BMP selection, which is based on a cost-benefit analysis of different BMP alternatives. The SUSTAIN model in WMMS includes a cost database[16] 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)[17].

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 for 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 BC 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:

---

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

[17] 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[18];
- Simulated pollutants include total suspended solids, *E. coli*, total copper, total zinc, and total lead; and
- An hourly time step was used to simulate the flow rate and pollutant concentration at each of the 180 subwatershed outlets (see Figure 6-1) and the resultant downstream receiving water conditions.

In order 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 BC 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 BC 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 Programs for the metals and bacteria TMDLs and mass emission monitoring by Los Angeles County Department of Public Works (LACDPW) at Sawtelle Avenue (S01).
- Hydrology calibration: One LACDPW streamflow gage, Ballona Creek above Sawtelle Boulevard, located on the Ballona Creek mainstem was used for the hydrology calibration.

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. The baseline (LSPC) model performs quite well for representing existing hydrologic and water quality conditions. Details of the baseline model development and calibration are presented in Appendix 6.A. 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 BC watershed, and
- Operations data (outflows) for impoundments in the BC watershed.

---

[18] All stormwater control measures implemented prior to October 2011 are assumed to be implicitly represented within the baseline conditions.

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

Location	Model Period	Hydrology Parameter	Modeled vs. Observed	RAA Guidelines Performance Assessment
Ballona Creek above Sawtelle Blvd (LACFCD F38C)	1µ/1/2µµ1 – 9/3µ/2µµ7	Total Annual Volume	-1.5%	Very Good
		Highest 1µ% of Flows	-1.5%	Very Good

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	78	-33.5	Fair
Total Copper	76	-13.5	Very Good
Total Zinc	76	-21.7	Good
Total Lead	76	-12.5	Very Good
E.coli *	54	-31.6	Fair

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

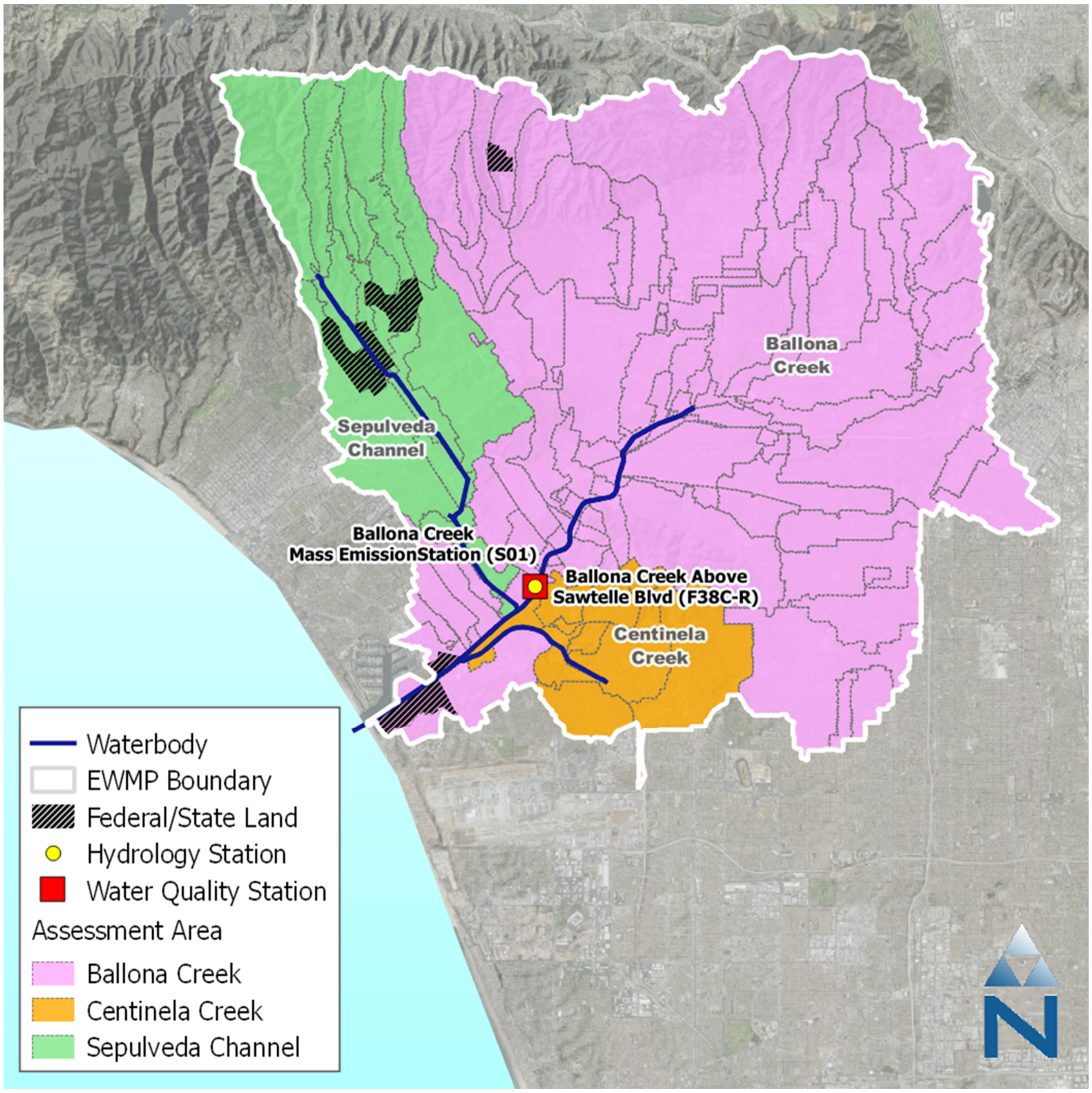


Figure 6-3 Hydrology and Water Quality Calibration Stations for BC RAA

6.2.3 Non-Stormwater (Dry Weather) Simulation

A separate RAA was performed for dry weather conditions to assure that control measures in the EWMP attain dry weather WQBELs/RWLs and address non-stormwater discharges that are effectively prohibited. This subsection summarizes the development of the non-stormwater model developed for the dry weather RAA. Two separate modeling analyses were performed for dry weather:

- Simulation of *E. coli* concentrations in Ballona Creek mainstem and predicted reductions due to implementation of low flow treatment facilities (LFTF). Details are presented in Appendix 6.B1; and
- Simulation of non-stormwater flows and predicted reductions due to implementation of wet weather control measures. Details are presented in Appendix 6.B2.

Each of these analyses are summarized in the following subsections.

6.2.3.1 Simulated Effectiveness of Low Flow Treatment Facilities

To provide assurance that RWLs for the Bacteria TMDL will be achieved by the EWMP Implementation Strategy, a dry weather simulation was performed using QUAL2K. Details of the simulation are presented in Appendix 6.B1.The model simulates dry weather flow rates in Ballona Creek from its headwaters (daylight at Cochran Avenue) to the freshwater confluence with the Ballona Estuary (at Centinela Boulevard). The model was used to demonstrate that two proposed LFTFs, one at the North Outfall Treatment Facility (LFTF-1) and one along Sepulveda Channel (LFTF-2). These two facilities, along with a facility to divert Centinela Channel, are an element of the Time Schedule Order (TSO) for the Ballona Creek Bacteria TMDL. The simulated baseline concentrations in Ballona Creek mainstem are shown in Figure 6-4. The potential effect of the LFTFs (subject to change, based on final design selection) is presented in the EWMP Implementation Strategy section.

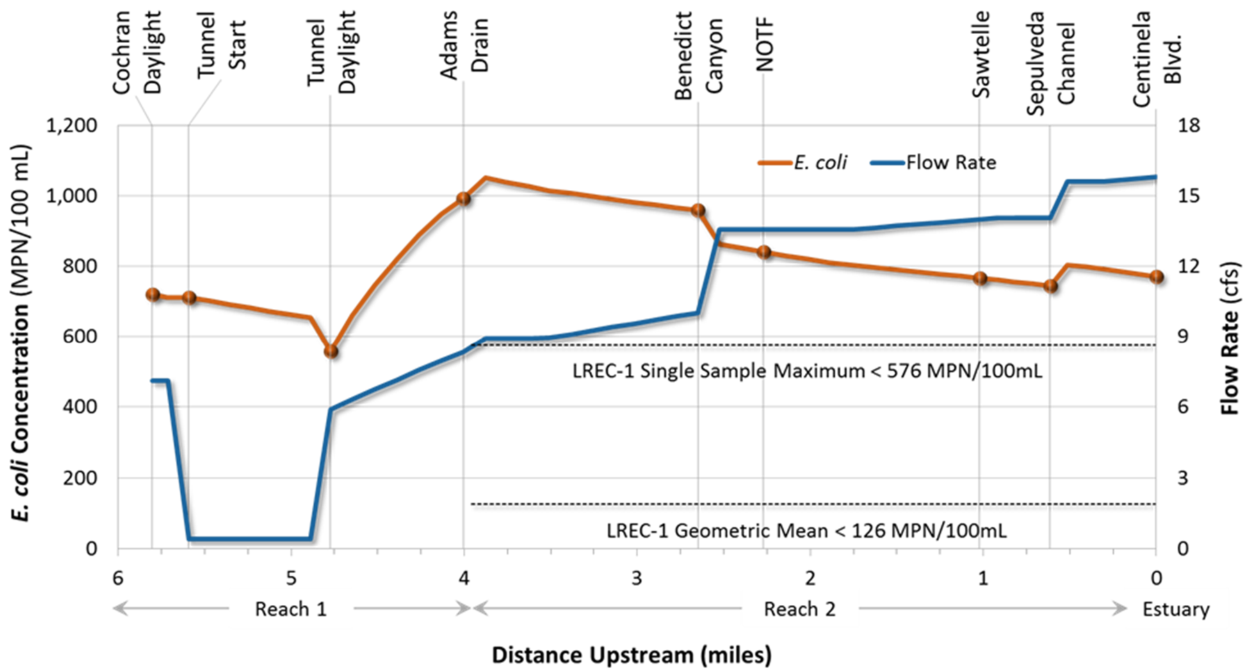


Figure 6-4 Simulated Baseline *E. coli* Concentrations in Ballona Creek

6.2.3.2 Simulated Reduction in Non-stormwater Flows due to Wet Weather Control Measures

The MS4 Permit effectively prohibits discharges of non-stormwater[19] (dry weather runoff) and states that EWMPs shall "ensure that discharges…do not include non-stormwater discharges that are effectively prohibited." A baseline non-stormwater model was developed for the BC 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[20] in each of the

[19] 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.

[20] 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. By focusing on the non-stormwater portion

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 BC 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 period and specifically because of California's 20x2020 Water Conservation Plan. (DWR *et al.*, 2010).

- **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. Details of the simulation are presented in Appendix 6.B2

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.

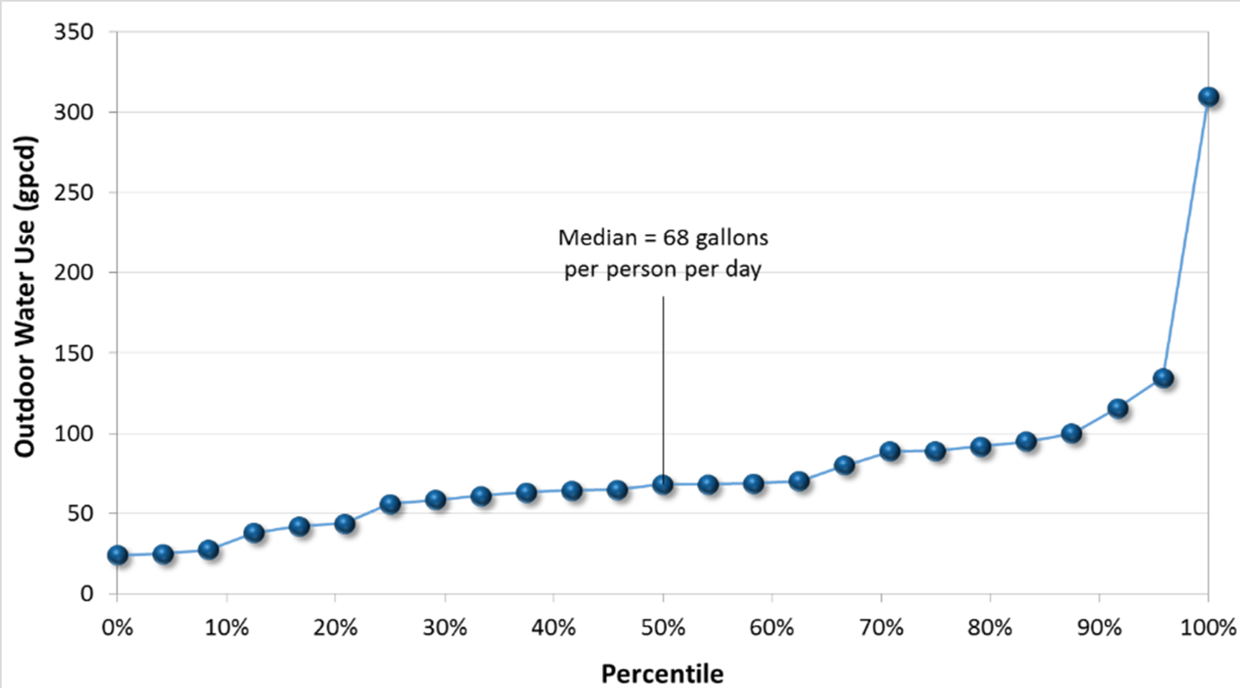


Figure 6-5 Outdoor Water Use Estimates from Literature Review

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:" 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 suspended solids, zinc, copper, lead, 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).

Note the Ballona Creek Wetlands TMDL for Sediment and Invasive Exotic Vegetation does not require pollutant reductions by the MS4. According to the TMDL (pg. 74), "since the current existing discharge of sediment load is not contributing to the listed impairments or otherwise causing a negative impact to Ballona Creek Wetlands, this TMDL establishes WLAs based on existing conditions." Because the MS4 WLA is based on existing conditions, no demonstration of reduction is required by the RAA. The reductions to be achieved by control measures in the EWMP (for other TMDLs) will clearly maintain existing conditions and will even reduce sediment loading from existing conditions.

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 E.4.ii of Attachment M of Permit	Permit / Metals TMDL	See Part E.4.iii of Attachment M of Permit	Permit / Metals TMDL	All Assessment Areas
Bacteria	*E. coli*	126 MPN per 1µµ mL [1]	Bacteria TMDL	235 MPN per 1µµ mL [1,2]	Bacteria TMDL	All Assessment Areas
Toxics and Legacy Pollutants	Total DDTs	1µ.56 grams per year [3]			Estuary Toxics TMDL	Average Annual Loading from EWMP Area (assessed at mouth of Ballona Creek)
	Total PCBs	152 grams per year [3]				
	Total PAHs	26,9µµ grams per year [3]				
	Chlordane	3.34 grams per year [3]				
	Cadmium	8,µµµ grams per year [3]				
	Silver	6,69µ grams per year [3]				

1 – The bacteria TMDL applies the *E. coli* target to freshwater and fecal coliform to marine water. For the RAA, the *E. coli* target was used because it is limiting when compared to fecal coliform. Also, as described in Section 6.2.5.1, the RAA approach for wet weather is to retain the runoff from the 9µth percentile, 16th wettest day (critical bacteria storm) which is highly conservative and reduces the sensitivity of the RAA to the concentration-based targets of the bacteria TMDL.

2 – Per the Bacteria TMDL, the wet weather target incorporates 15 Allowable Exceedance Days including days subject to the High Flow Suspension.

3 – The loading of these pollutants was modeled by simulating TSS loading and estimating 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 3. For chlordane, the assumed baseline concentration is µ.µ26 ug/g based on the average concentration of stormborne sediments collected in Ballona Creek. For DDTs, the assumed baseline concentration is µ.µ36 ug/g based on the average concentration reported. For PCBs, the assumed baseline concentration is µ.µ17 ug/g based on the maximum concentration reported (there were too few detections to report an average). For silver, the assumed baseline concentration is µ.63 ug/g based on the maximum concentration reported (there were too few detections to report an average). For cadmium, the assumed baseline concentration is 1.97 ug/g based on the average concentration reported.

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, management of a 90th percentile storm requires larger BMPs than management of a median (50th percentile) storm. The RAA Guidelines specify the RAA for final 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 BC RAA, three primary *wet weather* critical conditions were considered as follows:

1. **90th Percentile Metals Exceedance Volume:** The BC Metals TMDL uses the 90th percentile daily flow rate to define the wet weather critical condition. In turn, the BC RAA analyzes the volume of runoff during each rolling 24-hour period[21] 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[22] is the critical condition for metals and the overall primary critical condition for management[23] of stormwater by BC 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 BC. The table shows the 90th percentile volume is indeed a critical condition, with volumes being approximately five times larger than the median storm. The EWMP manages (retains and treats) the Exceedance Volume from each of the 180 subwatersheds in the BC area to achieve metals RWLs.

2. **Critical Bacteria Storm:** For addressing *E. coli* impairments, the "critical bacteria storm" is the 90th percentile wet day when bacteria RWLs apply. Bacteria RWLs do *not* apply on Allowable Exceedance Days, for which there are 15 per year. To identify the critical bacteria storm, within each water year between 2002 and 2012, the 16th- wettest day was determined (the first day with RWLs apply). For the ten-year simulation, there are ten of those days (one per year) and the 2nd wettest is the critical bacteria storm (the 2nd highest of ten values is the 90th percentile). The simulated critical bacteria storm

[21] A duration of 24-hours was selected for several reasons. First, the BC 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. Finally, 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.

[22] 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.

[23] The term "manage" incorporates both retention and treatment approaches. Retention of the Exceedance Volume ensures 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.

is a 24-hour storm. The EWMP retains[24] the runoff from the critical bacteria storm (from each subwatershed outlet, prior to discharge to receiving waters) to achieve *E. coli* WQBELs. By managing bacteria discharges from watersheds that drain to Ballona Creek (and achieving RWLs in Ballona Creek), assurance is provided that RWLs at BC-1 will be achieved too.

3. **Annual Average <u>Toxics</u> Loading**: The Ballona Creek Estuary Toxics TMDL (toxics/legacy pollutants) use annual average loading as the critical condition. For the RAA, the average year was defined as the 2007/2008 Water Year. The pollutant loading that occurs over the course of 2007/2008 is considered the average annual pollutant loading for the RAA. The EWMP manages (retains and treats) the annual runoff from in the Ballona Creek area to achieve WQBELs for toxics/legacy pollutants.

Additional information regarding the RAA critical conditions including comparison of Exceedance Volume approach to other 90th percentile metrics is provided in Appendix 6.I.

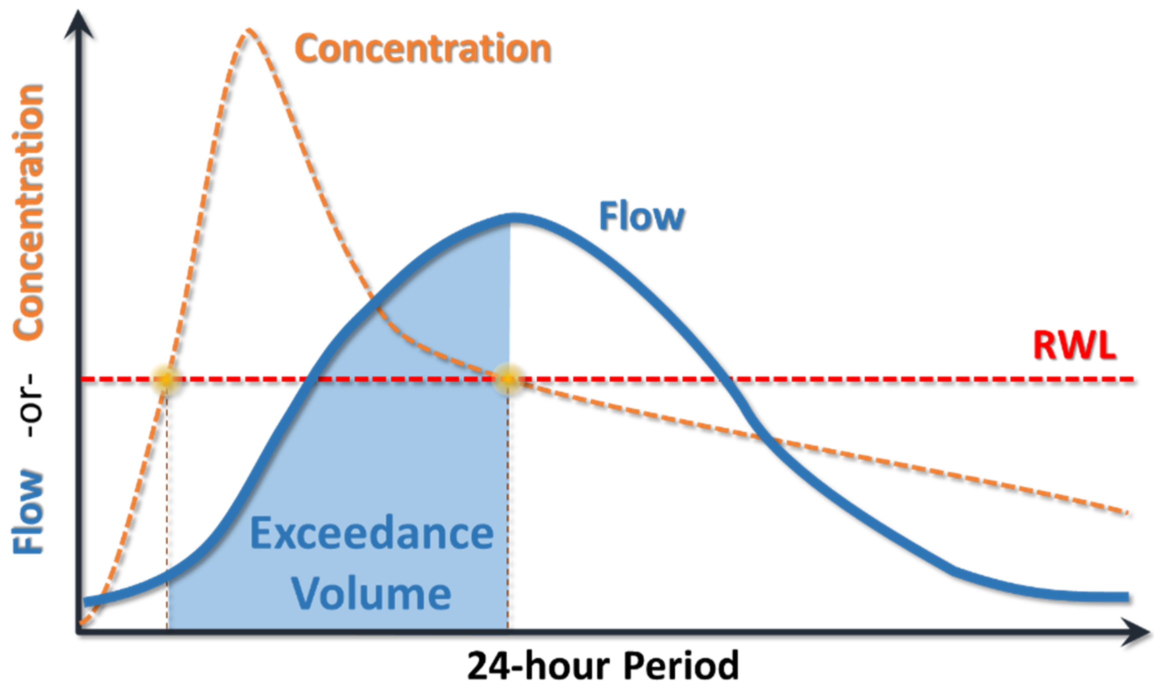


Figure 6-6 Illustration of How Metals Exceedance Volume is Calculated for Critical Condition Determination

---

[24] 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 historical rainfall at rain gages in the EWMP area (e.g., generally larger storms at higher elevations and smaller storms at lower elevations).

Table 6-4 Zinc Exceedance Volume Summary Statistics for Ballona Creek

Total Zinc Exceedance Volume (EV) Statistics (units of acre-feet)	RAA Assessment Area (at watershed mouth)		
	Ballona Creek Mainstem	Sepulveda Channel	Centinela Creek
Number of rolling, 24-hour periods with an EV in 1µ-year simulation (out of a total of 87,66µ periods)	7,27µ	6,723	5,465
Average EV	755	123	63
1µth percentile EV	135	21	6
25th percentile EV	2µ1	35	15
Median EV	392	73	36
75th percentile EV	915	161	92
9µth percentile EV	1,929	3µ7	163

Note: The storm that generates the 9µth percentile zinc EV is the critical condition for metals. The storm that generates the average zinc EV is the interim condition for metals.

6.2.5.2 Dry Weather Critical Conditions

The dry weather critical condition was based on two factors (see Section 6.3.3):

- Median outdoor water use, which is conservatively high considering recent water conservation efforts due to drought conditions, and
- A critical dry period identified in late August to September.

6.2.5.3 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 Water Quality Priority 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 Water Quality Priority pollutants, and thus control of zinc and *E. coli* has assurance of addressing the other BC wet weather Water Quality Priorities. The BC RAA 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 6-6.
- **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. For example, during monitoring "snapshots" of over 100 outfalls during the Bacteria Source Identification Study, over 85 percent of samples exceeded WQBELs for *E. coli* during dry weather, according to the Bacteria Source Identification Study along the Los Angeles River (CREST, 2008). As presented in Appendix 6.B1, of all the constituents analyzed, *E. coli* has the highest dry weather exceedance

rate with 79 percent of samples (699 of 889) exceeding. The average concentration of 1131 MPN per 100 mL is ten times higher than the RWL.

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. As such, if exceedances of metals during dry weather 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. More importantly, compliance with EWMP implementation should be determined separately for each constituent and condition (wet or dry).

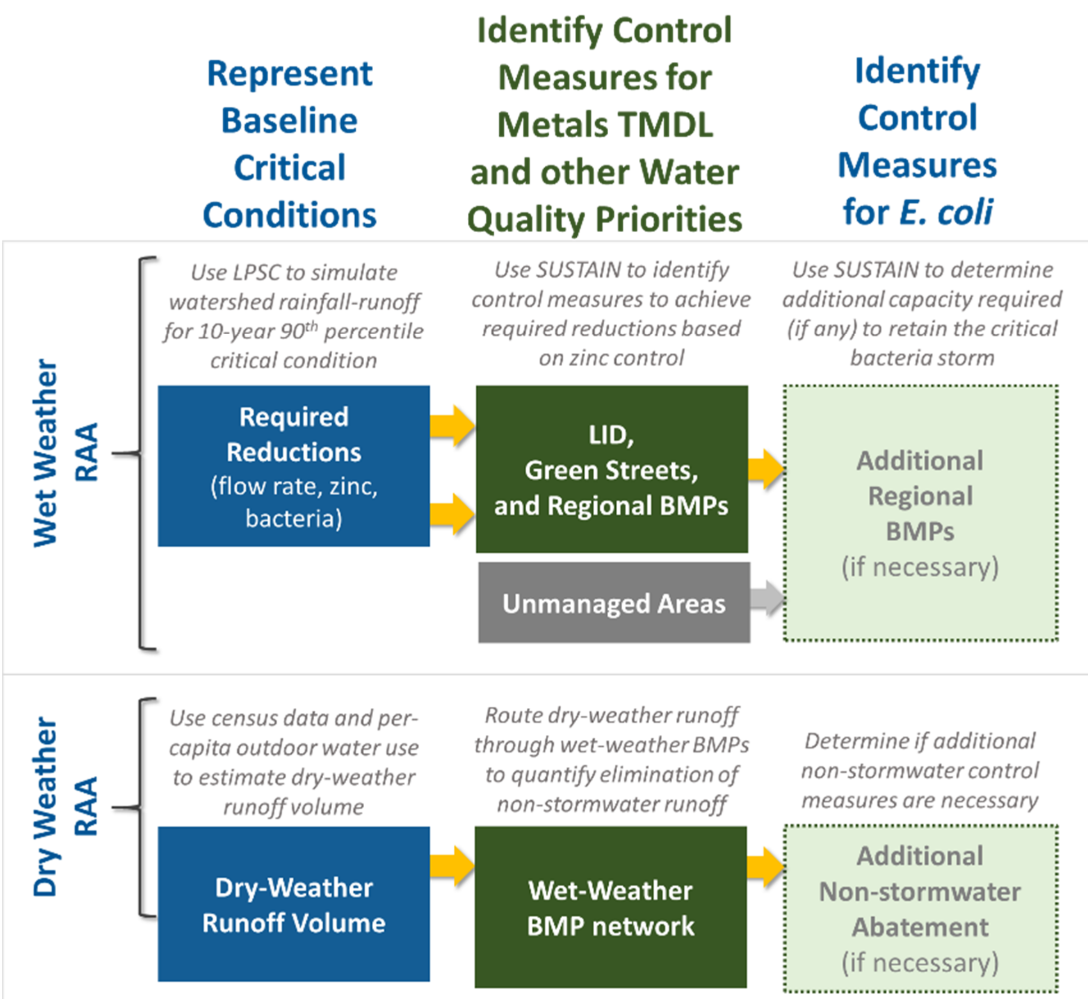


Figure 6-7 RAA Process for Establishing Critical Conditions and Addressing Water Quality Priorities

Table 6-5 Limiting Pollutant Selection and Justification for RAA

Pollutant Class	Pollutant	RAA approach to Addressing Pollutant			
		Wet Weather RWLs: Addressed by	Justification for control approach	Dry Weather RWLs: Addressed by	Justification for control approach
Bacteria	*E. coli*	*E. coli* controls	*E. coli* is one of two wet weather limiting pollutants.	*E. coli* controls	*E. coli* is the dry weather limiting pollutant.
Metals	Copper	Zinc controls	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.	Existing MCMs and BMPs	Exceedances of metals during dry weather are relatively rare. Existing MCMs and BMPs, including the additional MCMs incorporated under the 2µ12 Permit, have reasonable assurance of addressing dry weather metals exceedances (because they currently rarely occur).
	Zinc		Zinc is one of two wet weather limiting pollutants.		
	Lead		The volumes of stormwater to be managed for zinc control are greater than volumes for control of these other metals.		
	Nickel				
	Mercury				
Toxics and Legacy Pollutants	DDTs	Annual load reduction will be achieved through zinc controls (and residual source controls, if necessary)			The volumes of stormwater to be managed for zinc control are greater than volumes for control of these toxics / legacy pollutants.
	PCBs				
	PAHs				
	Silver				
	Cadmium				
All Pollutants in Table 3-7		Exceedances of the RWLs for these pollutants are rare, insufficient to meet 3µ3(d) listing criteria. Existing MCMs and BMPs have reasonable assurance of addressing exceedances (because they currently rarely occur).			
All Pollutants in Table 3-8		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.			

6.2.5.4 Required Interim and Final 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 BC (as described in the previous two subsections), the required pollutant reductions for BC can be determined, as shown in Table 6-6. The control measures for the EWMP are designed to achieve these reductions, and the RAA provides assurance that the required reductions will be achieved by the selected control measures. Each jurisdiction in the BC EWMP Group is held to achieving equitable reductions for the receiving waters/assessment areas to which they discharge. It is noted that the required percent reductions for zinc in Ballona Creek are among the highest of all the EWMPs in the LA County area.

An important consideration for the RAA and scheduling of control measures is the difference between interim and final requirements. While the critical condition (90th percentile) is used to define the required reductions for final 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 final WQBELs/RWLs shall be applied over the course of the implementation schedule. (page 7).

For the BC 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 percent and 41 percent of the loading that occurs during the final/90th percentile condition. The approach for applying this ratio during scheduling of control measures for EWMP/TMDL milestones is described in Appendix 6.H. A regional example that shows validation of the RAA approach and demonstrates attainment of downstream RWLs after EWMP implementation is shown in Appendix 6.I.

Table 6-6 Limiting BC Pollutant Reductions for Interim and Final Compliance

Condition and Pollutant Addressed	Reduction Metric	RAA Assessment Area		
		Ballona Creek	Sepulveda Channel	Centinela Creek
Final Compliance with Metals and Other Water Quality Priorities (except E. coli)	Loading during 9µth percentile/final condition (pounds)[3]	1,983	416	211
	Allowable loading during the 9µth percentile/final condition (pounds)	543.3	78.6	31.µ
	Required Load Reduction[1]	72.6%	81.1%	85.3%
Interim Compliance with Metals and Other Water Quality Priorities (except E. coli)	Loading during average/interim condition (pounds)[2]	795	172	55
	Ratio used to gradually phase from interim to final required reduction	µ.4µ	µ.41	µ.26
Final Compliance with E. coli	Runoff volume to be retained	Runoff from critical bacteria storm is retained prior to discharge to receiving water		

[1]Based on control of zinc during storm that generates the 9µth 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 9µth 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.

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

BMP Category	Type	Opportunity Identified
Institutional	Institutional	Assumed to achieve 5 percent reduction for most jurisdictions. The 5% reduction was assumed to be reflective of the expanded MCM requirements in the 2µ12 MS4 Permit.
Low Impact Development	Ordinance	Acreage subject to redevelopment based on growth rates reported by City of Los Angeles.
	Planned	BMPs constructed after September 2µ11 were included based on list submitted in Ballona Creek EWMP Work Plan (see Appendix 6.F).
	on Residential	One percent of residential parcels enrolled per year, starting in 2µ17.
	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 2µ 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.

1 During the RAA process, the list of projects was refined and 28 Very High and 15 High opportunities were evaluated and selected for inclusion in the RAA.

In addition to the spatial opportunity screening process, which highlighted potential roadblocks to BMP implementation, the preferences of the BC 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 6-8 Summary of BMP Preferences for Ballona Creek EWMP

Jurisdiction	Institu-tional	LID Ordinance	Residential LID Incentive Program	LID Retrofits on Municipal Parcels	Green Streets with Bioretention and Permeable Pavement	Very High/ High Regional BMPs	Medium Regional BMPs on School Properties
Beverly Hills	5%	Yes	Yes	Yes	Yes	Yes	No
City of Los Angeles	5%	Yes	Yes	Yes	Yes	Yes	No
Culver City	5%	Yes	Yes	Yes	Yes	Yes	No
Inglewood	5%	Yes	Yes	Yes	Yes	Yes	No
Santa Monica	5%	Yes	Yes	Yes	Yes	Yes	Yes
Unincorporated LA County	5%	Yes	Yes	Yes	Yes	Yes	N/A
West Hollywood	5%	Yes	Yes	Yes	Yes	Yes	Yes[25]

[25] Also prefer to include non-BC EWMP Group members-owned parcels, such as Metro Transit Authority parcels.

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 every 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.

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

BMP Category	Type	Key Design Parameters
Institutional	Institutional	Not modeled explicitly.
Low Impact Development	Ordinance	Bioretention/Biofiltration sized to capture 85th percentile runoff from parcel. Underdrains required if subsoil infiltration rate less than µ.3 inches per hour (in/hr).
	Planned	Bioretention/Biofiltration sized to capture 85th percentile runoff from parcel. Underdrains required if subsoil infiltration rate less than µ.3 in/hr.
	on Residential	Bioretention sized to approximately 4 percent 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 µ.3 in/hr.
Green Streets	Green Streets	Bioretention/biofiltration is 4 feet wide. Permeable pavement/subsurface storage is 5 feet wide and used in tandem with bioretention/biofiltration. 5µ percent of the street length retrofittable. Underdrains required if subsoil infiltration rate less than µ.3 in/hr.
Regional	Very High Projects on Public	BMP footprint delineated and maximum storage depth specified based on site configuration, topography, depth to groundwater, and infrastructure. Pump specified if greater than 1µµ feet from major storm drain using an optimum diversion rate (µ.µ9 cfs/acre).
	High & Medium Projects on Public	Same as Very High except maximum storage depth was assumed to be 3 feet (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 a foot deep infiltration basin at subwatershed outlets. Pumping assumed with no diversion limitations. Maximum footprint is equal to 5 percent of contributing area.

6.3.3 Cost Functions

To support BMP optimization, cost functions were developed for each type of structural BMP to relate capital and O&M costs to physical BMP characteristics such as depth, footprint, and configuration. The cost functions are primarily based on those presented in WMMS. 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 costs.

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

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 2μ-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 BC EWMP Group members 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 Final 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 Ballona Creek first determines the control measures to achieve zinc RWLs under critical conditions and then determines the additional capacity (if any) needed to retain the critical bacteria storm. The optimization modeling is conducted stepwise to determine the control measures for final compliance in 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 180 subwatersheds in the BCWMA provide the basis for cost optimization.

2. **Determine the cost-effective scenarios <u>for each jurisdiction</u> in the EWMP Group:** by rolling up the BMP solutions from the subwatershed level to a jurisdictional 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 the mainstem of the Ballona Creek. 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 Ballona Creek 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 6-6 determine the specific scenario that is selected from the cost optimization curves. All jurisdictions 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 final compliance is presented in Section 7.

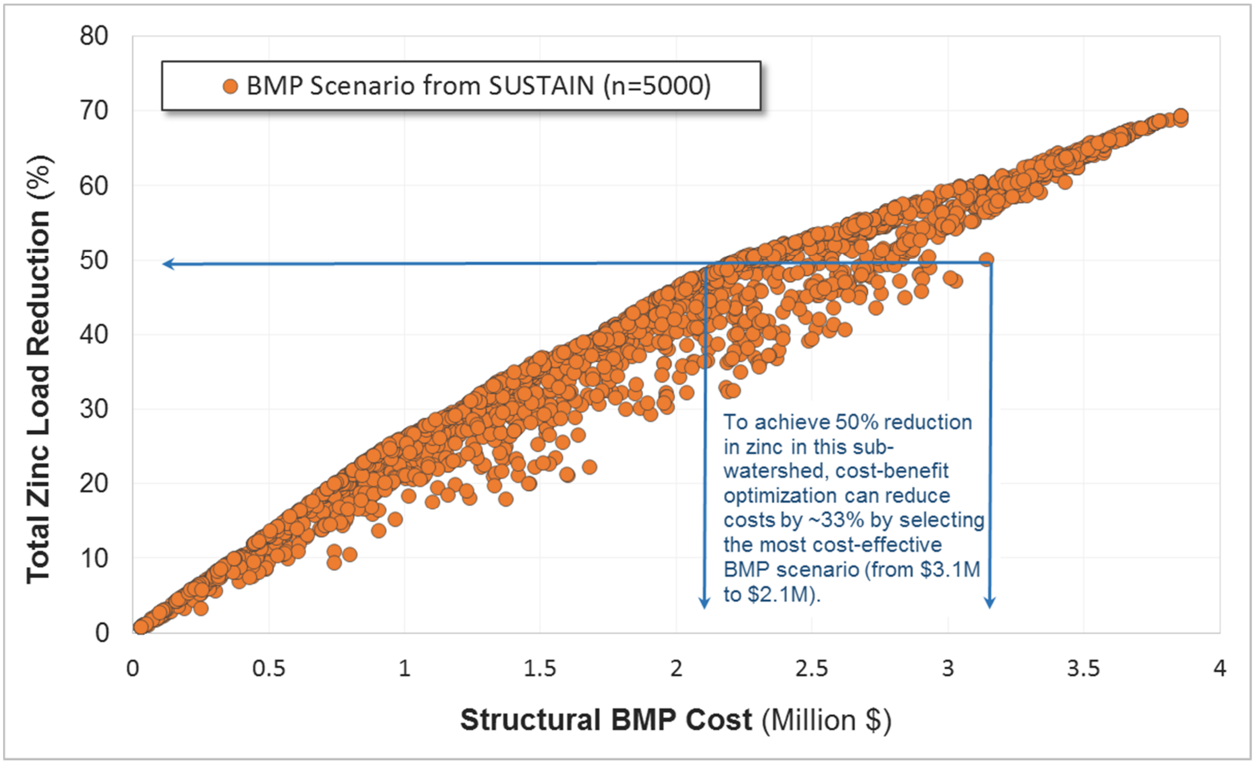


Figure 6-8 Example BMP Solutions for a Selected Subwatershed and Advantage of Cost-Benefit Optimization[1]

1 - This figure shows an optimization output for a single subwatershed. A similar curve was generated for each of the 18µ subwatersheds in the 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.

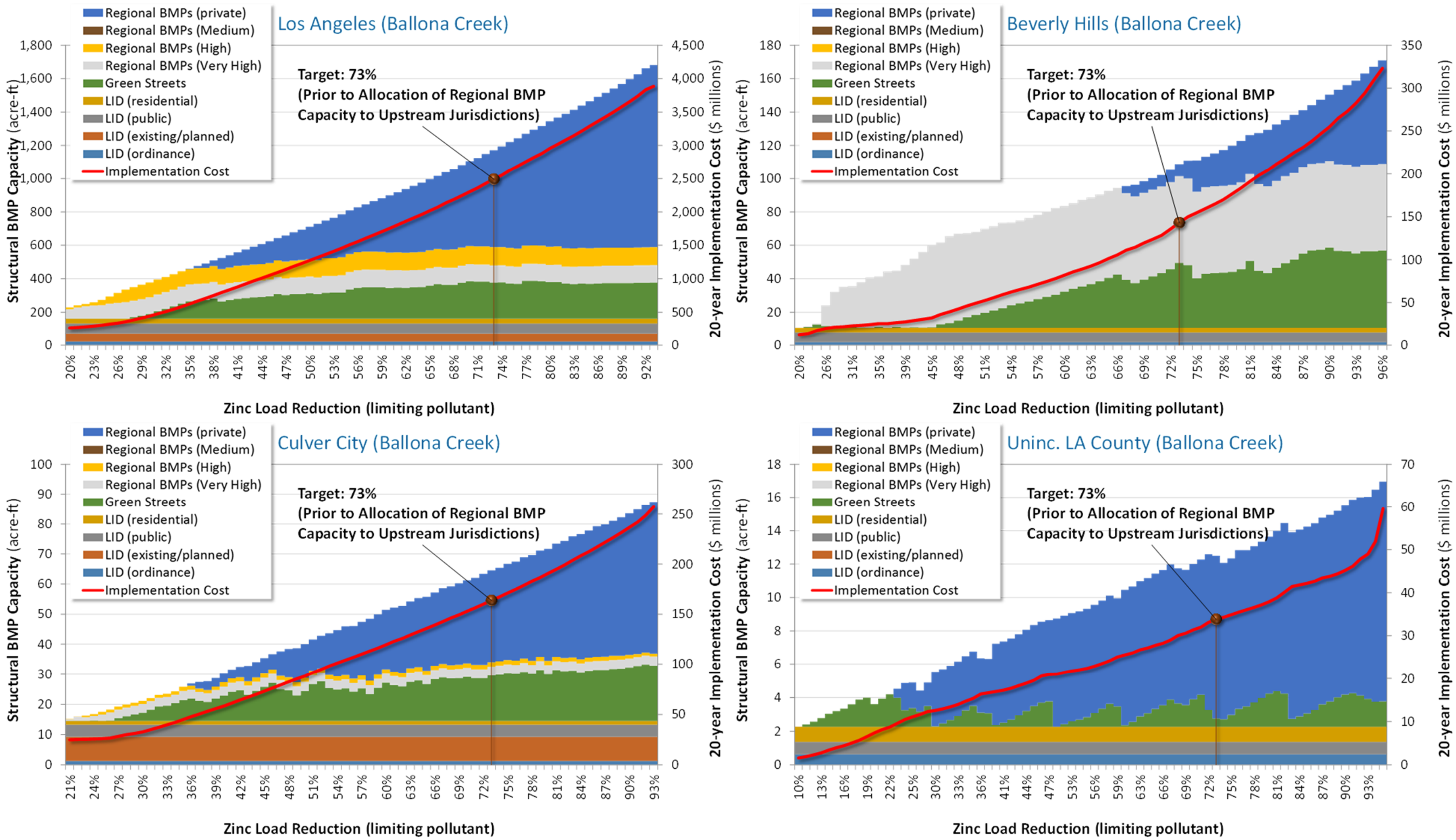
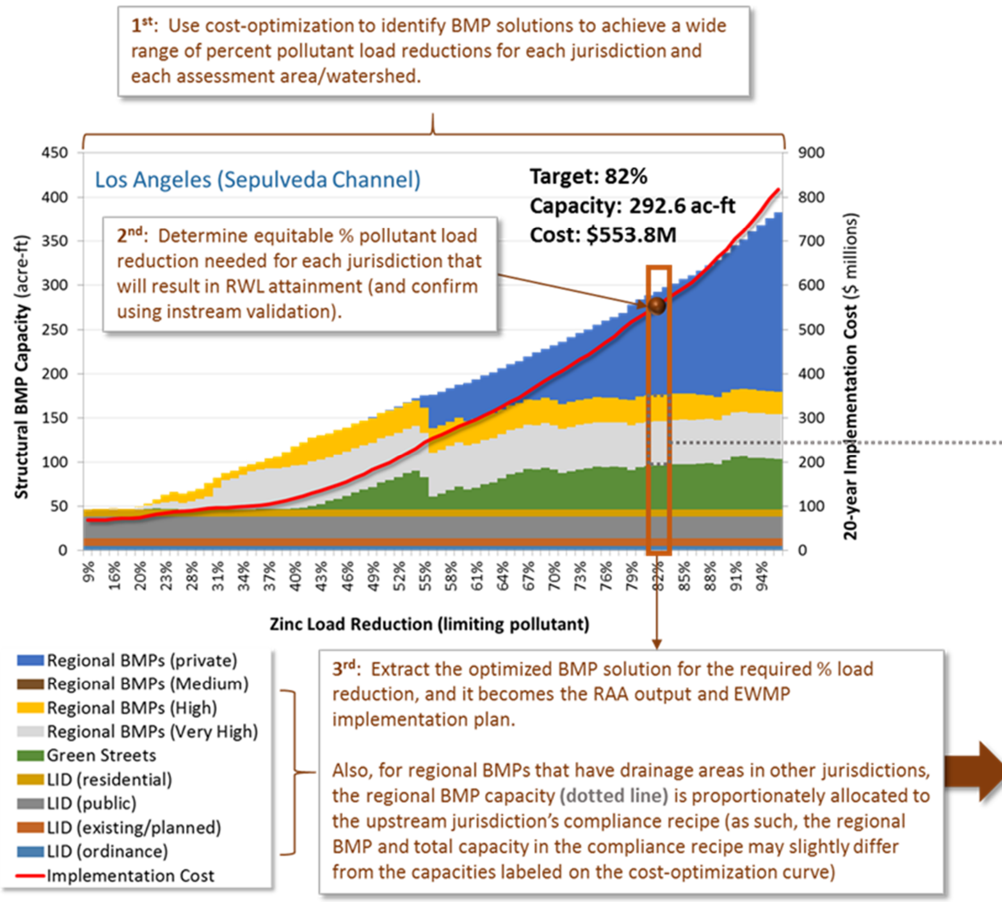


Figure 6-9 Example Cost Optimization Curves for a Watershed: Ballona Creek (mainstem)[1]

1 - This example shows the set of optimized BMP solutions for BC EWMP jurisdictions that drain to mainstem Ballona Creek. Each optimization curve represents over 1 million BMP scenarios that were evaluated for cost-effectiveness. All jurisdictions that drain to Ballona Creek mainstem are held to an equitable 73 percent 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.



	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 2021	For Bacteria by 2021	For Metals Attainment by 2021												For Bacteria Attainment by 2021	
				Low-Impact Development				Streets	Regional BMPs							
Subwatershed ID	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)
103149	25.97	0.00	95%	0.24	1.15	2.33	0.62	7.48	0.04	0.01	0.00	6.14	**18.0**	0.00	**18.0**
103249	356.70	0.00	86%	1.11	0.85	4.61	1.19	23.94	24.37	21.99	0.00	36.02	**114.1**	0.00	**114.1**
103349	36.03	0.00	95%	0.15	0.18	0.21	0.19	1.83	9.99	3.29	0.00	2.53	**18.4**	0.00	**18.4**
103449	145.01	0.00	87%	1.21	3.63	1.10	2.32	0.03	5.46	2.92	0.00	45.06	**61.7**	0.00	**61.7**
103549	21.73	0.56	60%	0.34	0.35	0.11	0.58	0.01	0.00	1.19	0.00	0.00	**2.6**	0.56	**3.1**
103649	41.40	0.00	84%	0.35	0.10	0.57	0.43	8.56	0.00	0.01	0.00	23.76	**33.8**	0.00	**33.8**
103749	56.80	3.70	67%	0.29	1.50	2.56	0.77	2.66	0.00	0.01	0.00	0.00	**7.8**	3.70	**11.5**
103849	16.49	0.19	58%	0.41	0.04	--	0.52	0.98	0.00	0.07	0.00	0.00	**2.0**	0.19	**2.2**
103949	7.47	0.14	47%	0.17	0.26	--	0.51	0.62	0.00	0.03	0.00	0.00	**1.6**	0.14	**1.7**
104049	2.57	1.51	37%	0.10	0.09	0.74	0.12	1.59	0.00	0.00	0.00	0.00	**2.6**	1.51	**4.2**
104149	0.64	0.43	26%	0.10	0.05	--	0.31	0.24	0.00	0.00	0.00	0.00	**0.7**	0.43	**1.1**
104249	0.05	0.44	6%	0.09	0.14	--	0.25	0.00	0.00	0.00	0.00	0.00	**0.5**	0.44	**0.9**
104349	2.77	1.92	32%	0.15	0.07	0.02	--	1.86	0.00	0.00	0.00	0.00	**2.1**	1.92	**4.0**
104449	1.25	1.01	32%	0.25	0.28	11.96	0.34	0.37	0.00	0.00	0.00	0.00	**13.2**	1.01	**14.2**
104549	0.08	0.56	7%	0.16	0.22	--	--	0.00	0.00	0.00	0.00	0.00	**0.4**	0.56	**0.9**
Total	**715.0**	**10.5**	**82%**	**5.1**	**8.9**	**24.2**	**8.1**	**50.2**	**39.9**	**29.5**	**0.0**	**113.**	**279.4**	**10.5**	**289.9**

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[1]

1 - This illustration uses the City of Los Angeles jurisdiction in the Sepulveda Channel watershed as an example. Three steps are shown for RAA development: cost-optimized BMP solutions are developed for a wide range of percent load reductions (1st, uppermost text box), followed by determination of the equitable percent 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 percent reduction, subwatersheds *within* a jurisdiction may have variable reductions based on optimization (which is why some subwatersheds have high percent reductions [red shaded rows in table] and others have low percent reductions).

6.4.2 Selection of Control Measures for Interim Wet Weather Compliance

With the EWMP Implementation Strategy for final 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 BC EWMP primarily based on the milestones of the BC Metals TMDL:

- Achieve 25 percent of the reduction for zinc[26] (2012)[27]
- Achieve 50 percent of the reduction for metals (2016)
- Achieve 25 percent of the reduction for WBPCs identified in Tables 3-5 (2017)
- Achieve 100 percent of the reduction for metals and WBPCs identified in Tables 3-5 (2021)

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 final 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 final EWMP Implementation Strategy were simulated to determine the relative performance as control measures are implemented toward final compliance. The result is a curve of Percent of Final Reduction versus Percent of Final Capacity (see Figure 6-11).
2. **Incorporate the gradual phasing from average the critical conditions:** the gradual phasing was accomplished by applying the average: final 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 final phases from relying entirely on average conditions at 0 percent completion and phases to relying entirely on final conditions at 100 percent 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. A regional example that shows validation of the RAA approach and demonstrates attainment of downstream RWLs after EWMP implementation is shown in Appendix 6.I.

---

[26] 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.

[27] While the 25 percent reduction milestone for 2012 has passed, the control measures are still evaluated by the RAA for planning purposes.

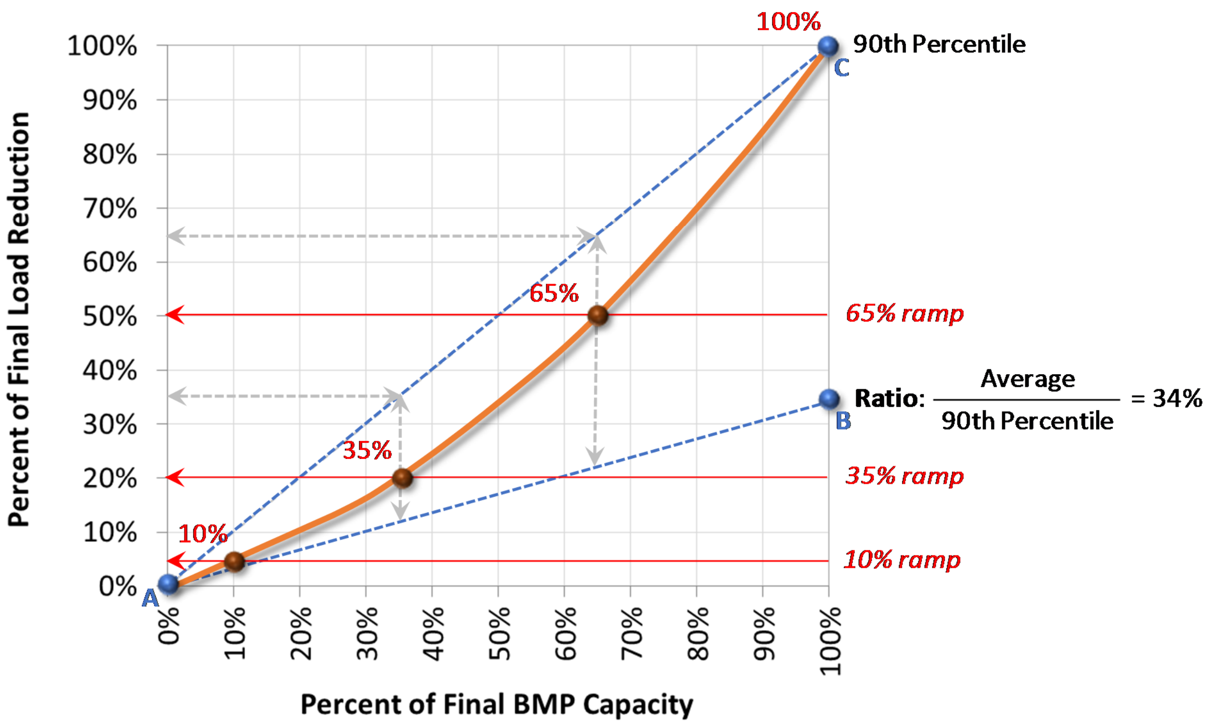


Figure 6-11 Illustration of Gradually Phasing from Average to Critical Conditions for Interim Milestones[1]

1 - The orange "translator" line in this figure phases from average to final by relying entirely on average conditions at µ percent final BMP capacity and then phases to relying entirely on final conditions at 1µµ percent BMP capacity. In the example, the average:final ratio is µ.34 (see right hand side of figure). The percent BMP completion based on the final 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:final ratio of µ.34). A reduction of 35 percent under average conditions represents a 2µ percent reduction under final conditions. A 65 percent reduction under average conditions represents a 5µ percent reduction under final conditions. The relative difference depends on the average:final ratio, which is watershed-specific (see Table 6-6). As the ratio approaches 1.µ, average and final conditions become identical.

Section 7
Detailed EWMP Implementation Strategy and Compliance Schedule

The EWMP Implementation Strategy is 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 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 compliance for each jurisdiction and each watershed/assessment area – Ballona Creek (mainstem), Sepulveda Channel, and Centinela Creek, (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 program milestones. Subsections include:

- Elements of the EWMP Implementation Strategy (7.1);
- Stormwater control measures to be implemented by 2021 for final compliance (7.2);
- Scheduling of stormwater control measures to achieve TMDL and EWMP milestones (7.3); and
- Non-stormwater control measures (7.4).

7.1 What are the Elements of the EWMP Implementation Strategy?

The EWMP Implementation Strategy is expressed in terms of [1] the volumes[28] 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[29] is considered the BMP performance goal for the EWMP. To support future compliance determinations 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.

---

[28] 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.

[29] The reported volume is determined by tracking the amount of water that is be retained (and/or 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.

- **EWMP Implementation Strategy**: the network of control measures that provides 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 the EWMP implementation through an adaptive management paradigm and in response to "lessons learned." As such, it is anticipated the BMP capacities[30] 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 3-7.

7.2 Which Stormwater Control Measures Correspond to Final Compliance by 2µ21?

The EWMP will guide stormwater management in the Ballona Creek Watershed for the coming decades, and the LID, green streets and regional BMPs to be implemented have the potential to transform communities. The EWMP Implementation Strategy identifies the location and type of control measures for each jurisdiction for final compliance by 2021, 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 final compliance is presented as follows:

- **Summary of total capacity of control measures for each jurisdiction across the entire BCWMA area.** Figure 7-1 summarizes control measure sub-categories that will be for each jurisdiction across the entire BCWMA. This figure provides both a summary by major categories (LID, green streets and regional BMPs) and subcategories within these major categories.
- **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 BCWMA (generally 1 to 2 square mile drainages). Figure 7-2 and Figure 7-3 are maps of the "density" of control measure capacities to address metals and other Water Quality Priorities (through controlling zinc) and Figure 7-4 shows the additional control measure capacity required to address *E. coli*. The maps are shown in 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 Strategy). Note that separate Compliance Targets and EWMP Implementation Strategies are provided for Metals and Other Water Quality Priorities and *E. coli.* Index maps that correspond to the subwatershed IDs are provided in Appendix 7.B.

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 3-7.

---

[30] 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.

The network of LID, green streets and regional BMPs in the EWMP Implementation Strategy represents approximately **eight 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 Ballona Creek Watershed. 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.

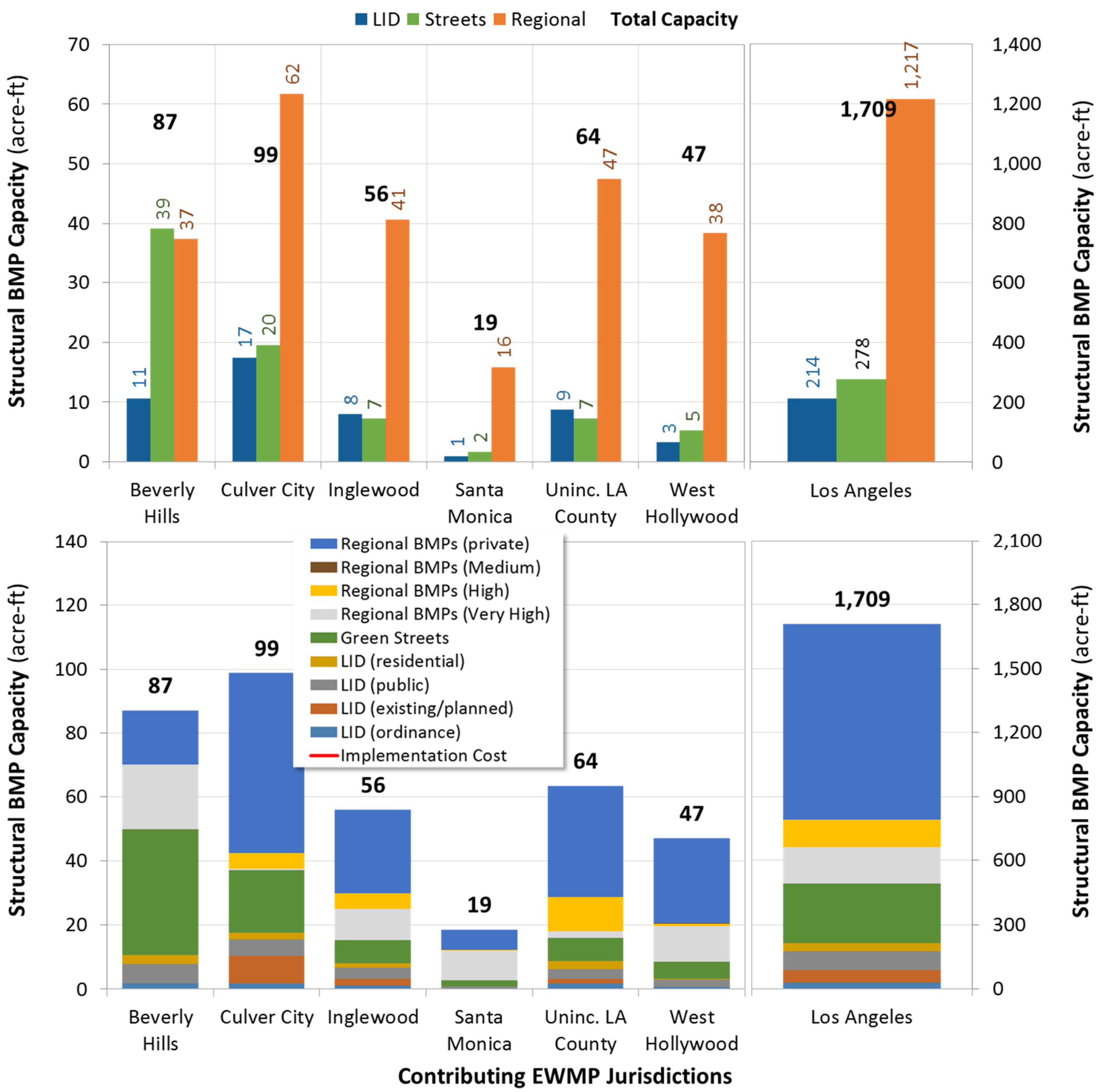


Figure 7-1 BC EWMP Implementation Strategy for Final Compliance by 2021[1]

1 - The two panels in Figure 7-1 show the total structural BMP capacity required for each BC 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 subcategories. 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 City of LA has a different scale.

The LACFCD will work with the Watershed group on their efforts to address source controls; assess, develop, and pursue funding for structural BMPs, and promote the use of water reuse and infiltration. As regional project scopes are further refined, the LACFCD will determine on a case-by-case basis our contribution to the projects.

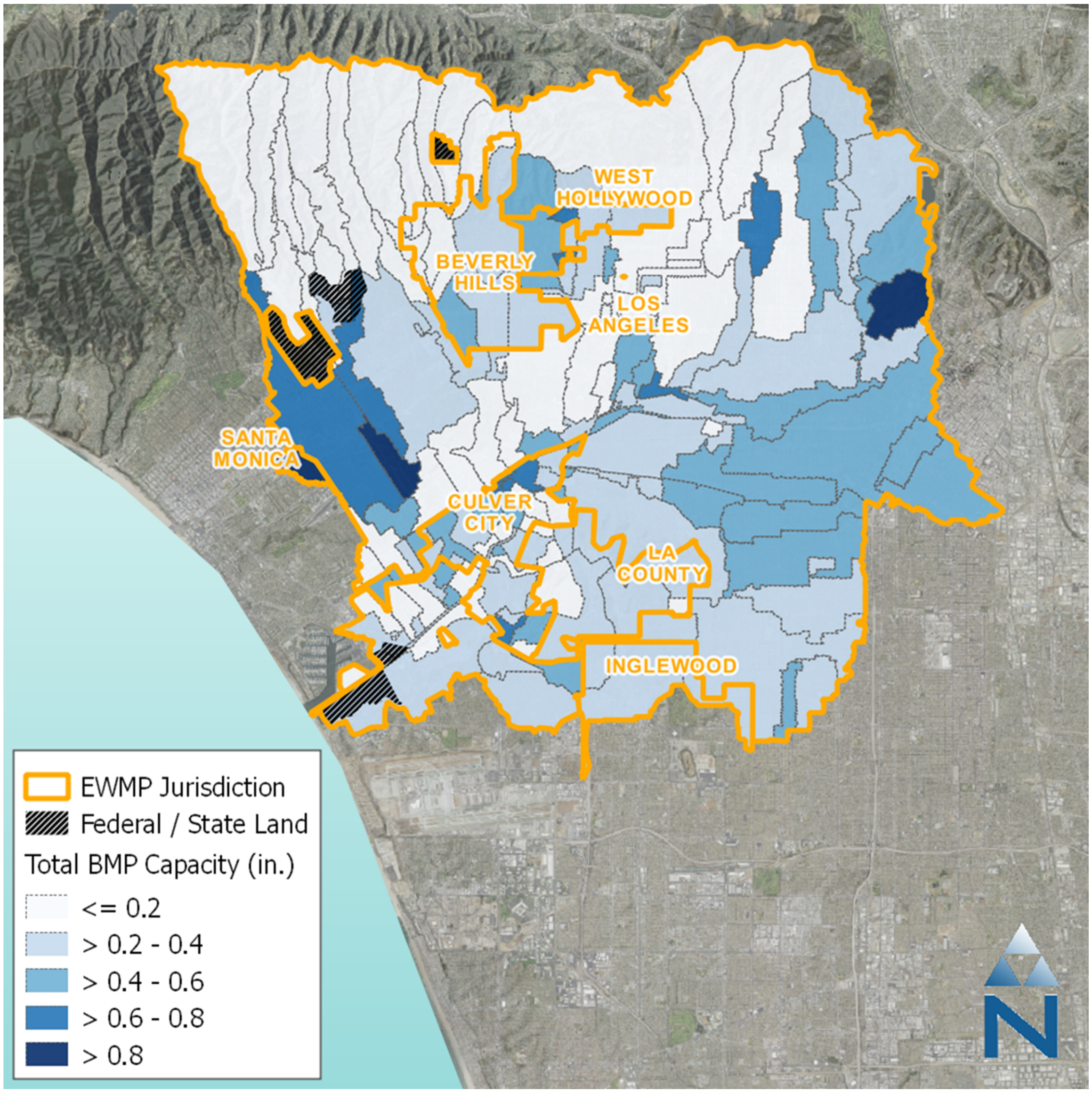


Figure 7-2 EWMP Implementation Strategy by Subwatershed for Metals and Other Water Quality Priorities (except *E. coli*)[1]

1 - Figure 7-2 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 (*e.g.*, the BMP capacity for each subwatershed [in units of AF] 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 percentage reduction, subwatersheds within a jurisdiction may have variable reductions based on 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.

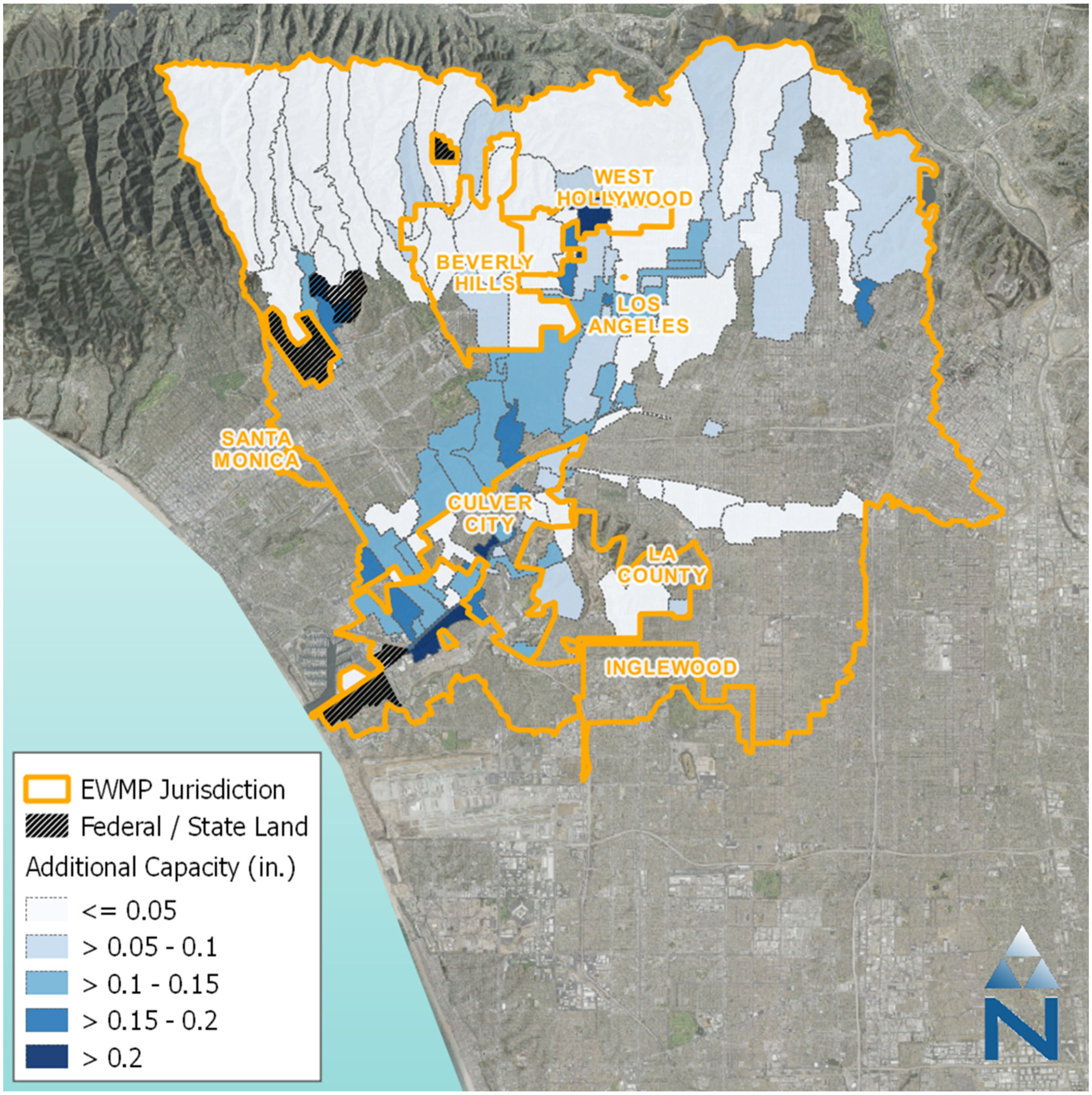


Figure 7-3 Additional Control Measures in EWMP Implementation Strategy to Address *E. coli*[1]

1 - Figure 7-3 uses the same approach as Figure 7-2 to present the additional capacity in the EWMP Implementation Strategy to address *E. coli* (beyond the control measures to be implemented to address zinc. Note the BMP capacities are much less than in Figure 7-2 because the control measures for zinc retain much of the critical bacteria storm. Some subwatersheds are not shaded because zero additional capacity is required to meet bacteria compliance targets. The tabular version of this map is presented as a series of tables in Appendix 7.A, and subwatershed index maps for each jurisdiction are presented in Appendix 7.B.

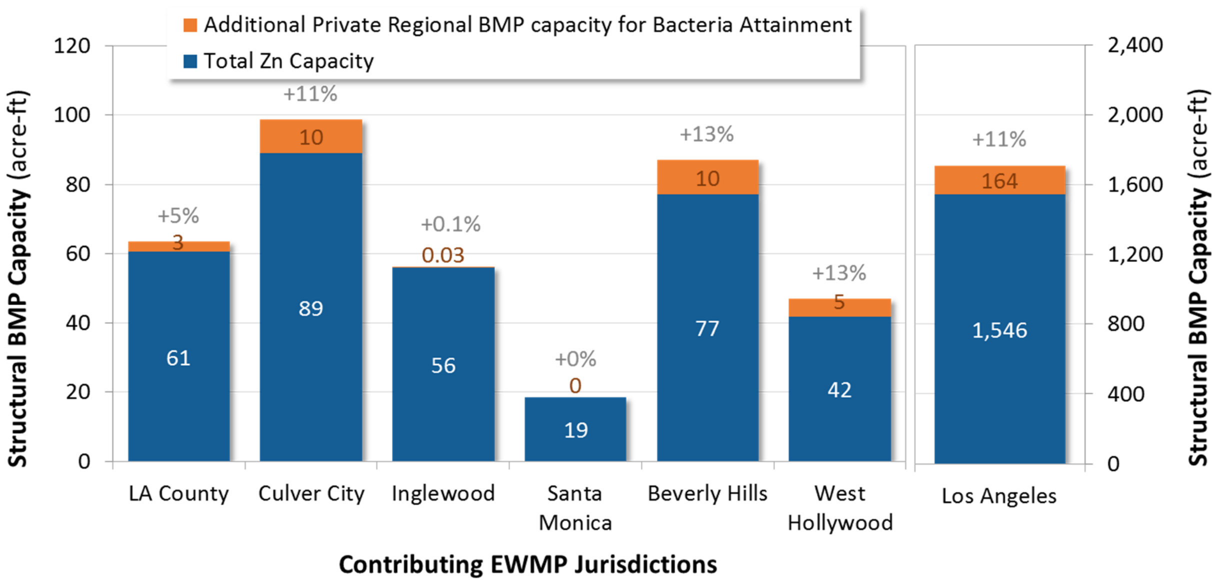


Figure 7-4 Additional Control Measures in EWMP Implementation Strategy to Address *E. coli*[1]

1 - The bars in Figure 7-4 represent the total control measure capacity in the EWMP Implementation Strategy, and the percentages at the top of the bars report the percent increase in capacity required by the RAA to control *E. coli* beyond the control measures for zinc. Note that City of LA uses a different scale

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 applicable milestones of the BC TMDLs and other applicable WBPCs identified in Table 3-5 and Table 3-6[31].

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

- **Summary of control measure capacities for jurisdictions in each assessment area/watershed**: Figure 7-5 through Figure 7-7 show the LID, green streets and regional BMP capacities that will be implemented over time to achieve TMDL milestones compliance targets. Separate panels are shown for each assessment area/watershed – Ballona Creek mainstem (Figure 7-5), Sepulveda Channel (Figure 7-6), and Centinela Creek (Figure 7-7). These capacities are also presented in detail in Appendix 7.C, organized by jurisdiction. For the metals TMDL, only the 50 percent milestone applies as a Permit limitation; the 25 percent and 75 percent milestones are shown for reference.
- **Summary of control measure capacities for each jurisdictions**: Shown in Figure 7-8 through Figure 7-14 are panels that summarize the EWMP Implementation Strategy for each individual jurisdiction including control measure scheduling.

[31] 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.

- **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 recipe for each assessment area/watershed.

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 3-7. The pace of implementation for the EWMP Implementation Strategy is rapid due to the compliance dates for the Ballona Creek Metals TMDL and Bacteria TMDL. The pacing of BMP implementation in Ballona Creek is among the fastest of all the EWMPs in LA County. Because the pace of implementation is directly proportional to required internal and financial resources, the additional required resources to implement the EWMP will be significant. The costs and financial strategy are presented in Section 9.

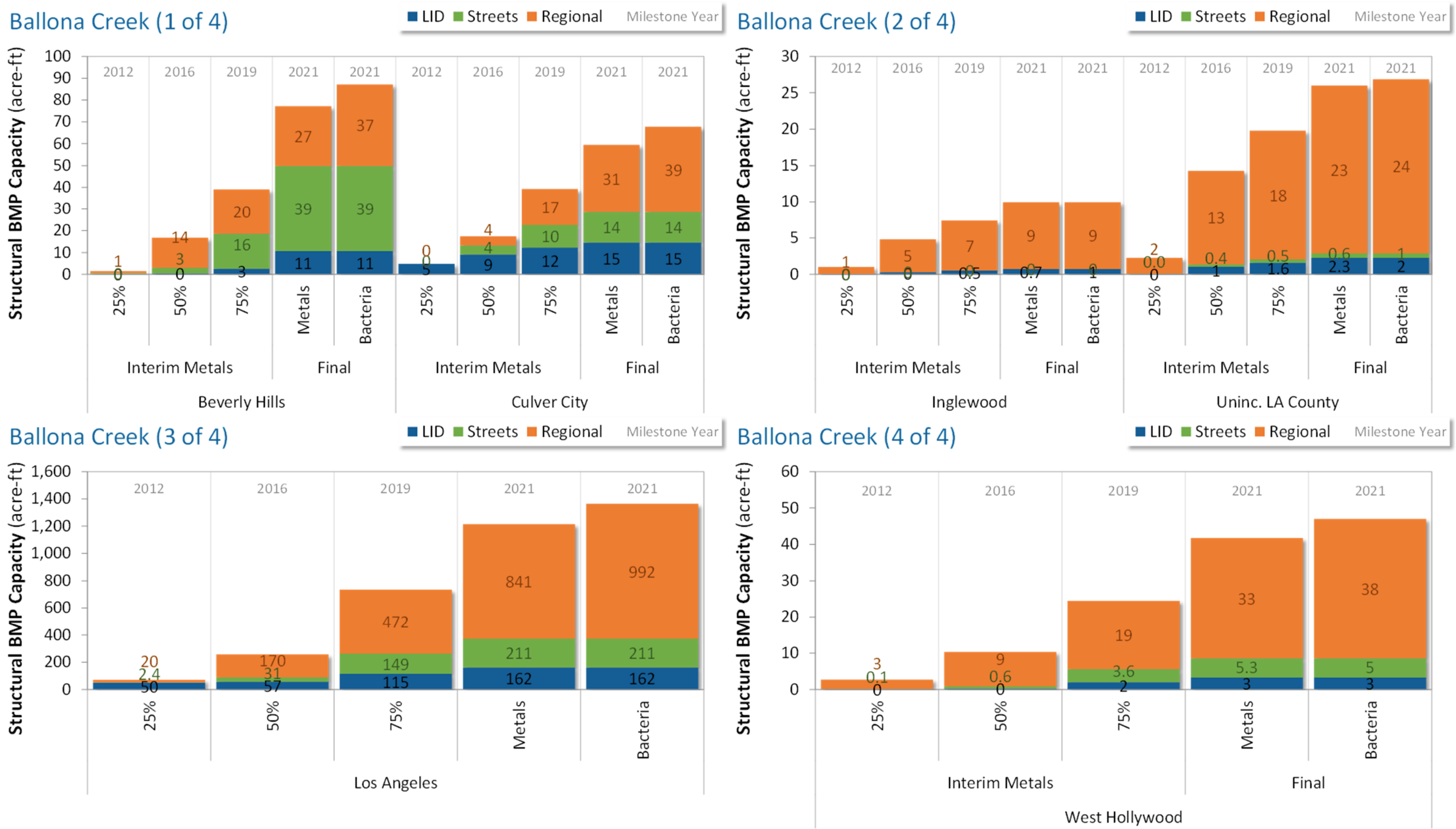


Figure 7-5 Ballona Creek: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

The bars represent the LID, green street and regional BMP capacity to achieve each EWMP/TMDL milestone or compliance target. These capacities are also presented in detail in Appendix 7.C, organized by jurisdiction. For the metals TMDL, only the 50 percent milestone applies as a Permit limitation; the 25 percent and 75 percent milestones are shown for reference. Note that y-axis scales differ among panels.

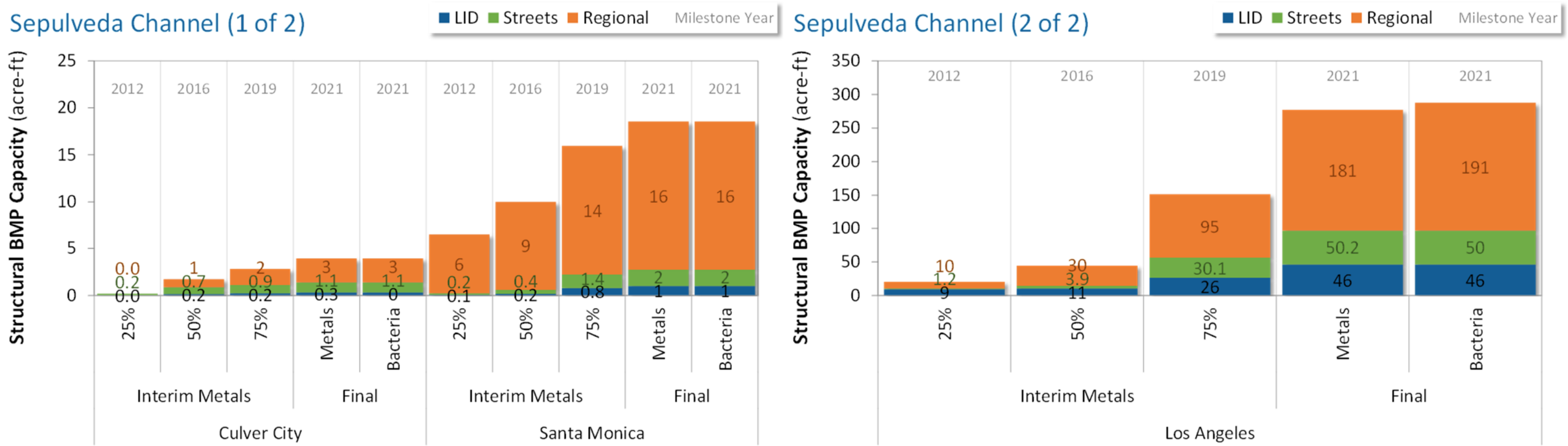


Figure 7-6 Sepulveda Channel: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

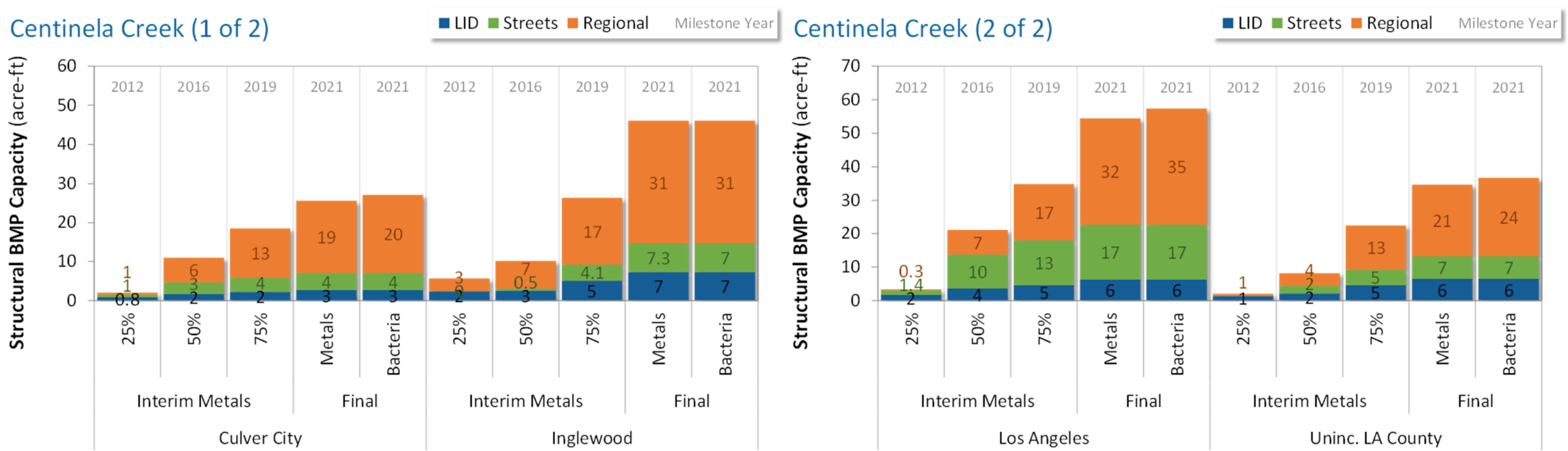


Figure 7-7 Channel: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

The bars represent the LID, green streets, and regional BMP capacity to achieve each EWMP/TMDL milestone. The capacities are also presented in detail in Appendix 7.C, organized by jurisdiction. For the metals TMDL, only the 50 percent milestone applies as a Permit limitation; the 25 percent and 75 percent milestones are shown for reference. Note that y-axis scales differ among panels.

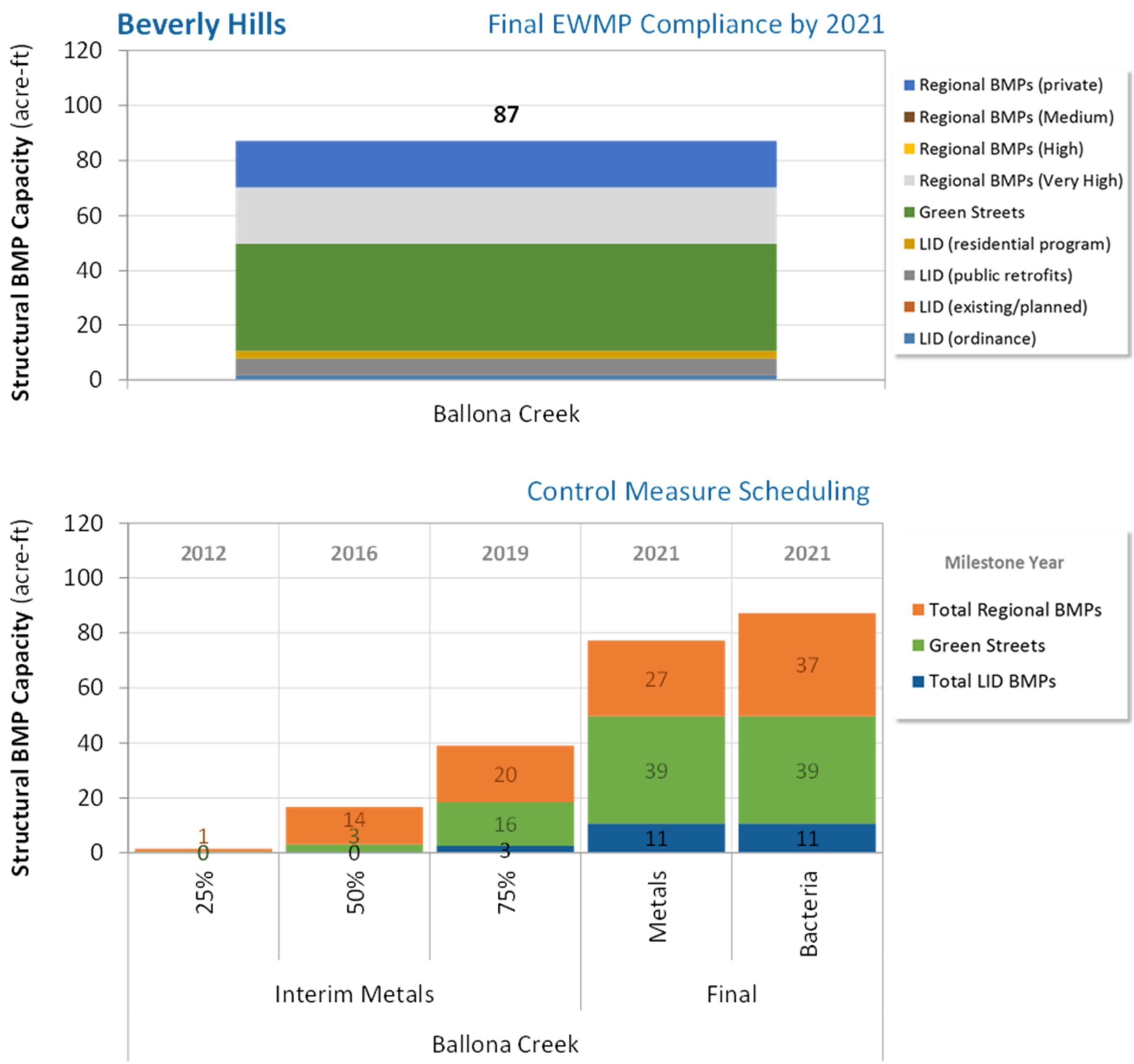


Figure 7-8 Beverly Hills: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

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 final compliance in 2021; the bottom panel schedules them through 2021.The capacities are also presented in detail in Appendix 7C.

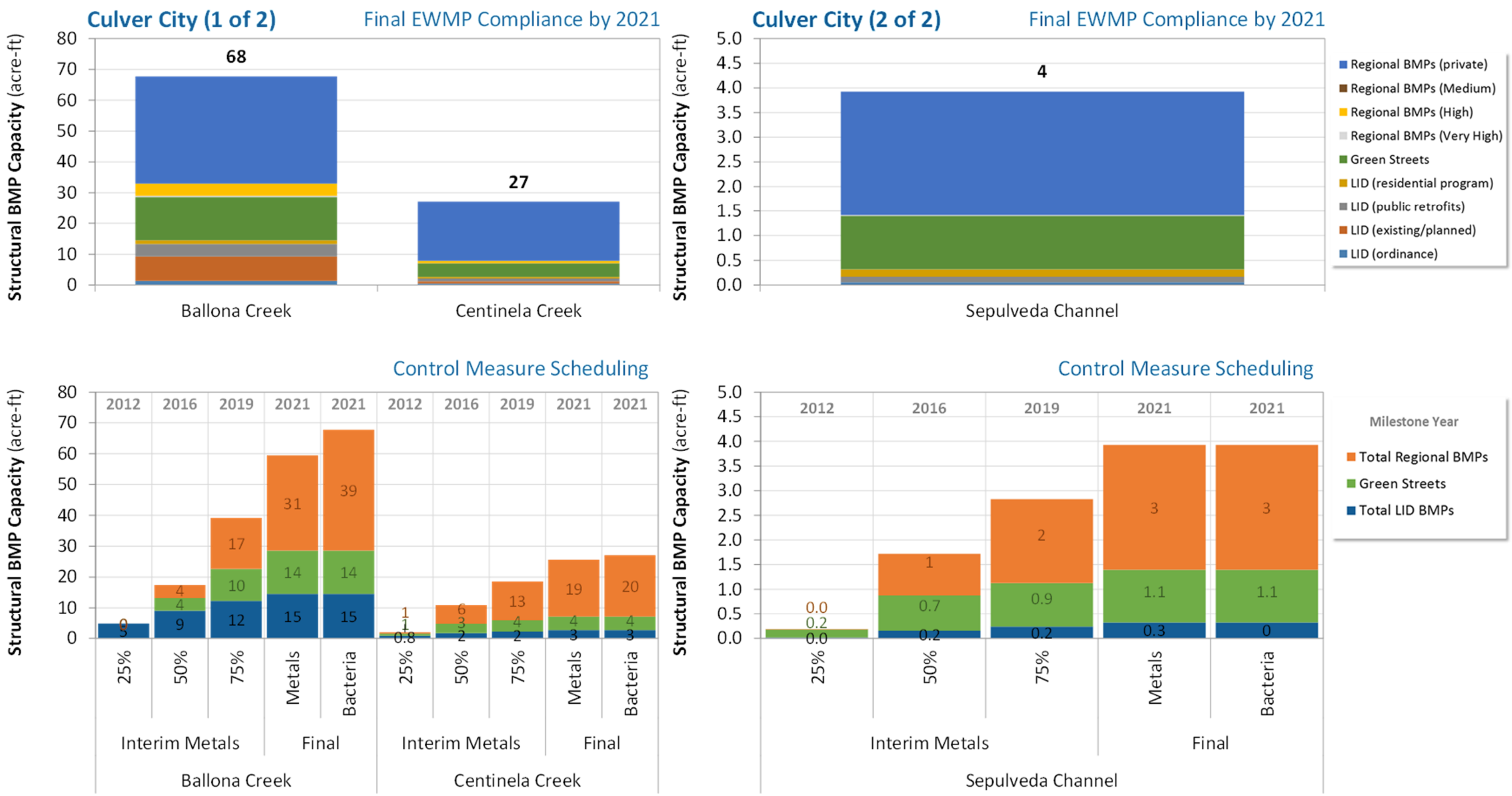


Figure 7-9 Culver City: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

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 final compliance in 2021; the bottom panel schedules them through 2021. The capacities are also presented in detail in Appendix 7C. Note that y-axis scales differ among panels.

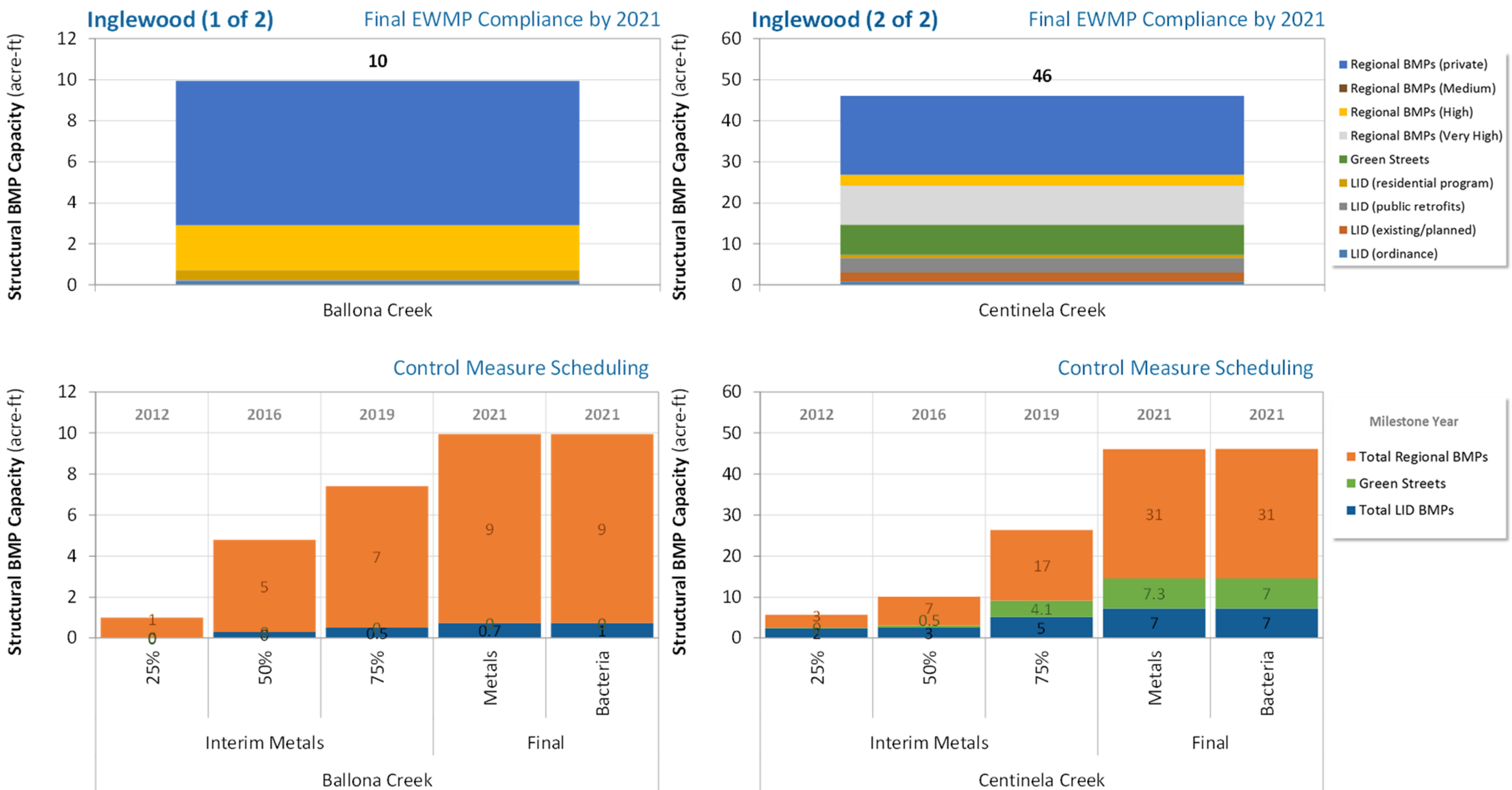


Figure 7-10 Inglewood: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

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 final compliance in 2021; the bottom panel schedules them through 2021. The capacities are also presented in detail in Appendix 7C. Note that y-axis scales differ among panels.

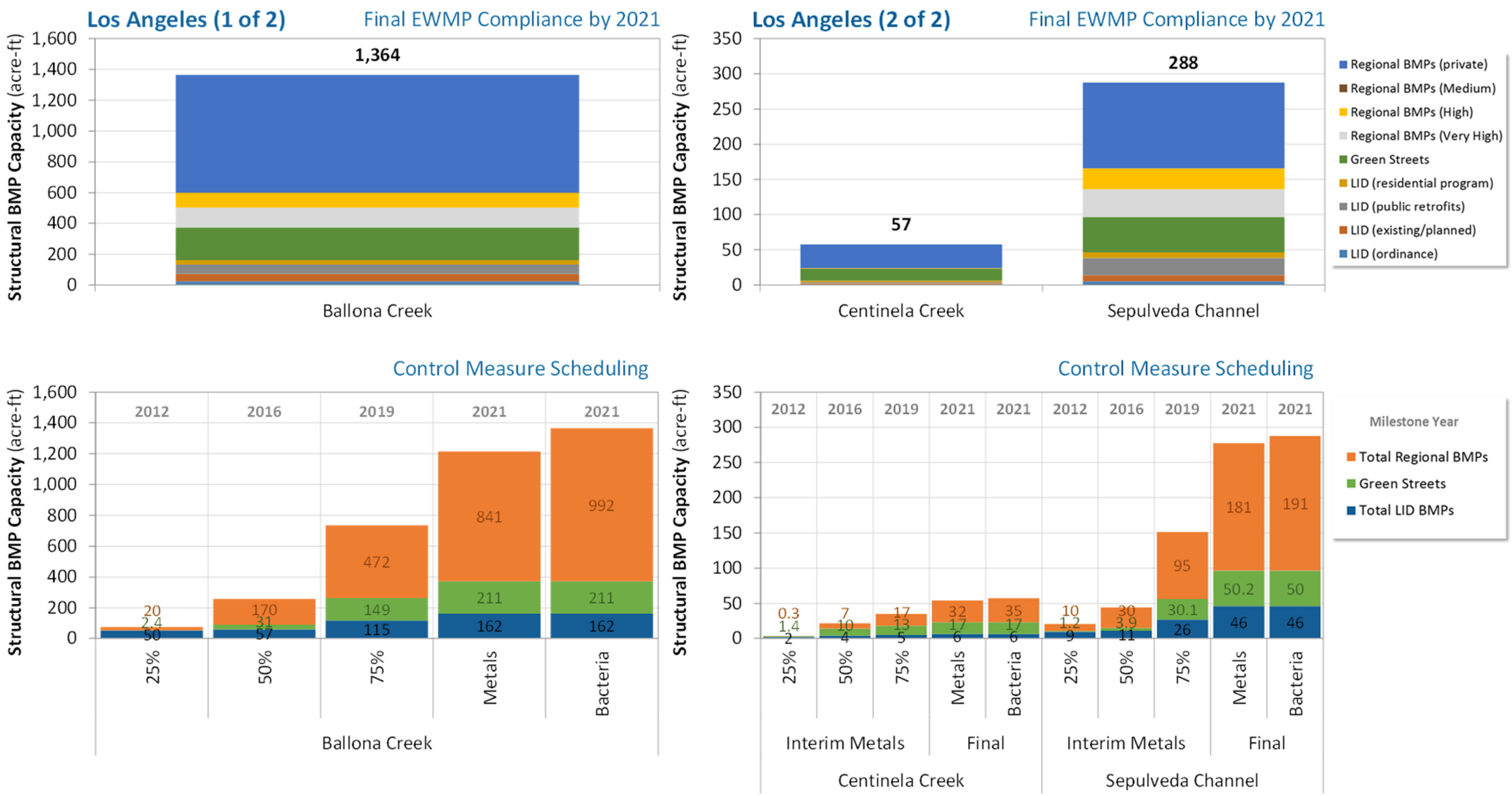


Figure 7-11 Los Angeles: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

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 final compliance in 2021; the bottom panel schedules them through 2021. The capacities are also presented in detail in Appendix 7C. Note that y-axis scales differ among panels.

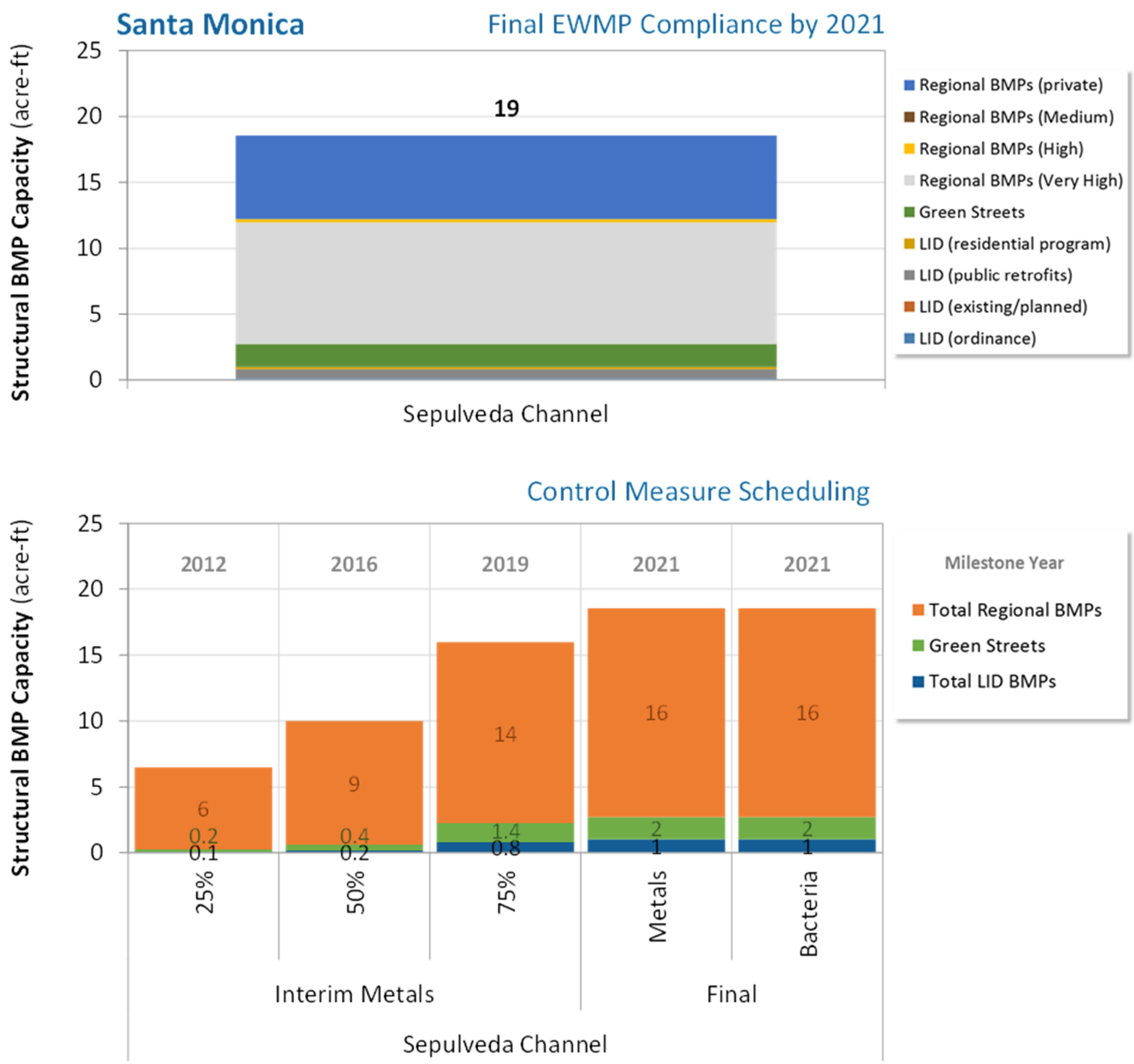


Figure 7-12 Santa Monica: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

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 final compliance in 2021; the bottom panel schedules them through 2021. The capacities are also presented in detail in Appendix 7C.

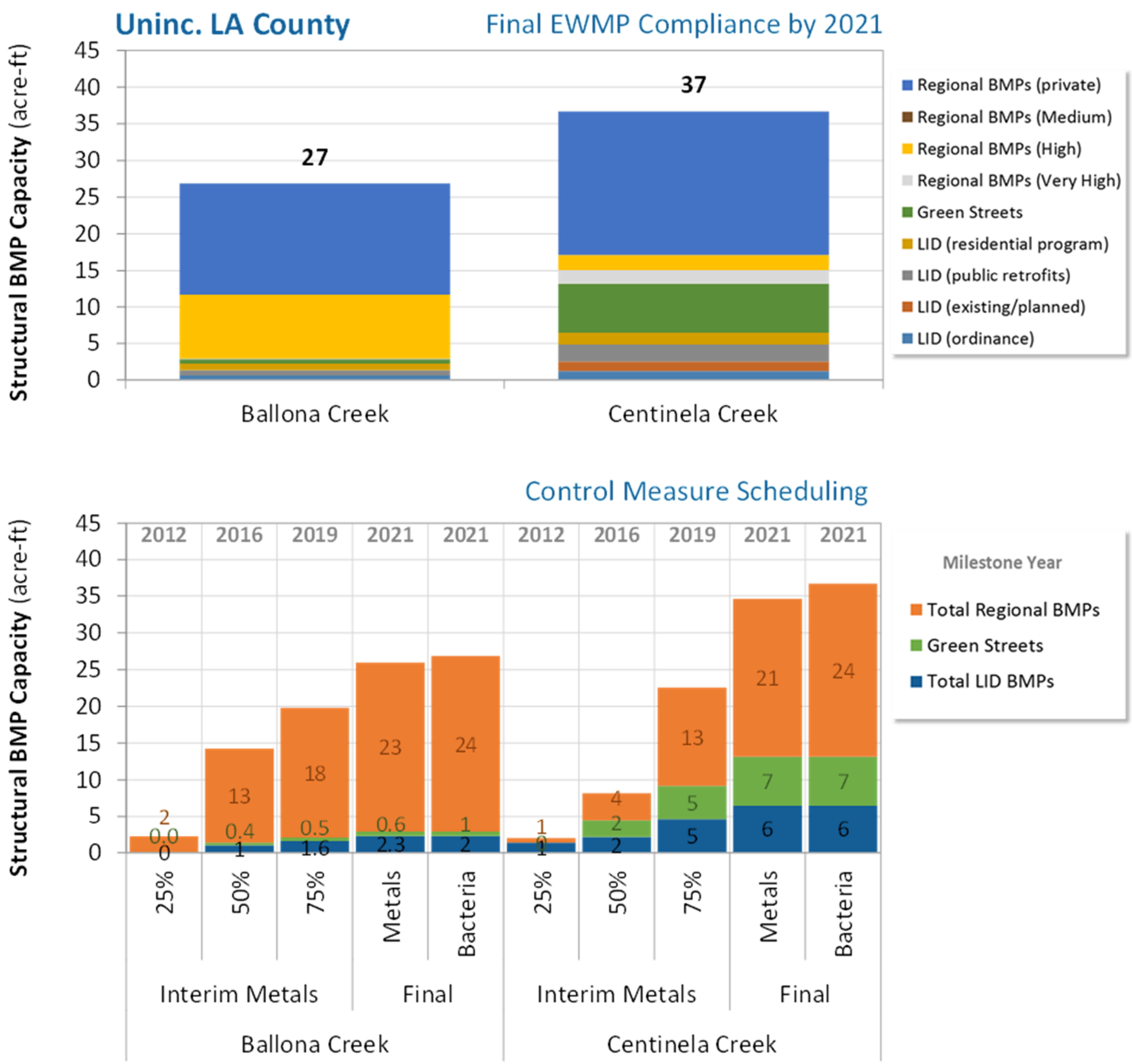


Figure 7-13 Uninc. LA County: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

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 final compliance in 2021; the bottom panel schedules them through 2021. The capacities are also presented in detail in Appendix 7C.

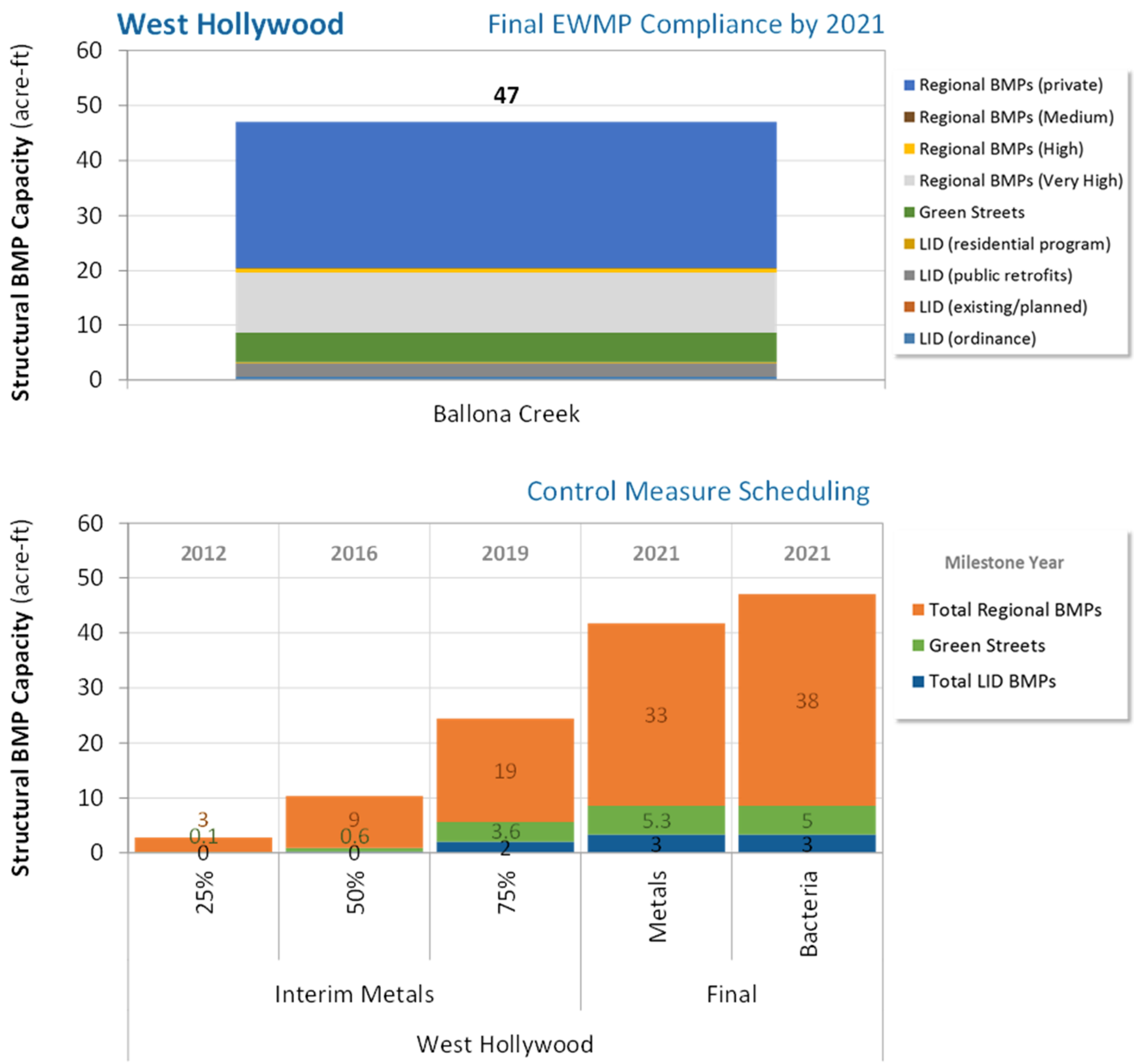


Figure 7-14 West Hollywood: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

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 final compliance in 2021; the bottom panel schedules them through 2021. The capacities are also presented in detail in Appendix 7C.

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 include milestones for attainment of dry-weather compliance targets. The EWMP Implementation Strategy provides assurance of eliminating non-stormwater discharges through implementation of the network of wet weather control measures. As shown in Figure 7-15, the EWMP Implementation Strategy achieves 100 percent elimination of non-stormwater flows by 2021. The following subsections consider attainment of RWLs for metals and bacteria (Section 6.B describes the dry weather RAA). The dry weather flow reductions shown in Figure 7-15 are based wholly on wet weather control measure implementation. Wet weather control measures are expected to eliminate both authorized and exempt non-stormwater flows, and will address all dry weather pollutants. For bacteria only, additional dry weather control measures will be implemented as described in Section 7.4.2.

7.4.1 Dry-Weather Strategy for Metals

The final dry-weather compliance date for the Ballona Creek Metals TMDL is January 11, 2016 (see Section 2). The EWMP Implementation Strategy clearly addresses the dry weather RWLs of the metals TMDL as well as all other dry weather Category 1, 2 and 3 WBPCs identified in Table 3-6 and Table 3-7, as 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 EWMP Implementation Plan RAA provides assurance of addressing metals RWLs for the following reasons:

1. The non-stormwater screening, investigation and abatement programs being conducted under the CIMP for the BC EWMP Group will increase the rate of eliminating non-stormwater flows beyond the reductions provided by the control measures of the EWMP Implementation Strategy. In other words, the non-stormwater abatement programs provide a "margin of safety" for attainment of metals RWLs.

2. An additional margin of safety is provided by the assumed outdoor water use in the dry weather RAA (Section 6.2.3). The non-stormwater volumes in the non-stormwater analysis were based on existing median outdoor water use rates. Most water supply agencies have initiatives to significantly reduce outdoor water use in the coming years and thus the rate of elimination of non-stormwater flows should be more rapid than shown in Figure 7-15.

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 of dry-weather strategy provide assurance that metals RWLs as well as the Category 1, 2, and 3 WPBCs will be attained.

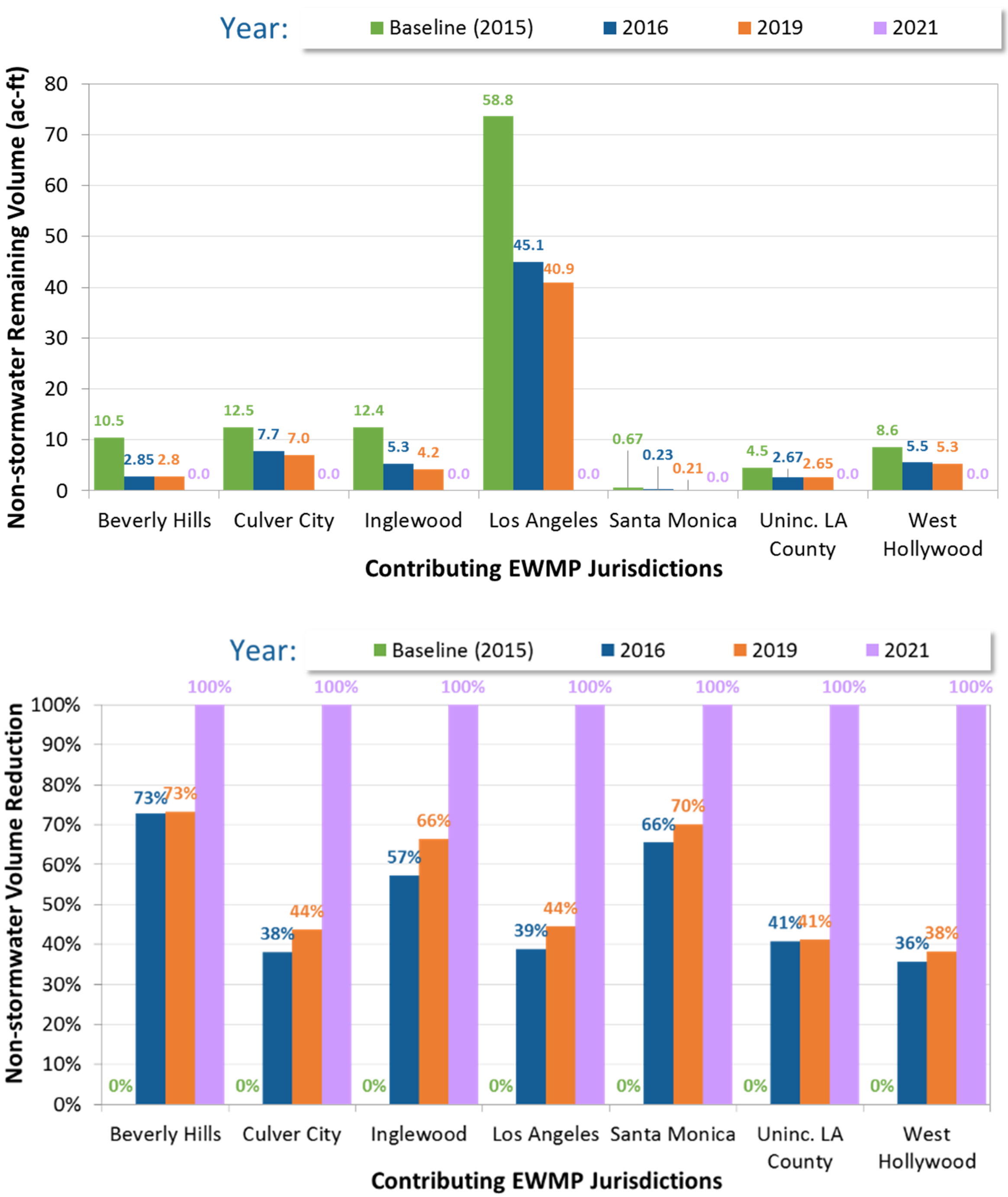


Figure 7-15 Schedule for Eliminating Non-Stormwater Discharges in Ballona Creek

7.4.2 Dry-Weather Strategy for Bacteria

The dry weather strategy for bacteria is based on control measures identified in the Time Schedule Order for the watershed. In particular, the following control measures are a component of the EWMP Implementation Strategy:

1. **North Outfall Treatment Facility**. The NOTF is in the process of being retrofitted to capture, disinfect and return[32] Ballona Creek flows along Reach 2. The disinfected effluent discharged from NOTF (sometimes referred to as Low Flow Treatment Facility #1) coupled with implementation of the Sepulveda Channel LFTF will lead to the attainment of RWLs in Ballona Creek.

2. **Sepulveda Channel LFTF.** A concept design has been developed for a facility that diverts non-stormwater flows prior to where Sepulveda Channel becomes an open channel. The Sepulveda LFTF will result in the attainment of RWLs in Sepulveda Channel and prevent discharges from the channel causing exceedances of RWLs in Ballona Creek.

The RAA simulation demonstrates that these two facilities will result in attainment of RWLs in Ballona Creek (Figure 7-16). Concentrations of *E. coli* have reasonable assurance of being less than single sample and geometric mean RWLs downstream of the NOTF. In Reach 1, where the REC-2 RWLs apply, current concentrations of bacteria are typically less and RWL exceedances are uncommon.

In addition to the two projects described above, the following projects or activities are important components of the dry weather strategy for bacteria:

1. **Centinela Creek Diversion Project**. A feasibility study and pre-design have been completed for a project that will intercept flows from Centinela Channel and prevent flows from the channel from causing exceedances of bacterial indicators in Ballona Creek Estuary.

2. **Non-stormwater screening, investigation and abatement programs**. As described for metals, non-stormwater abatement programs provide an additional "margin of safety" that *E. coli* RWLS will be attained. Note the non-stormwater program for Ballona Creek is integrated with outfall monitoring requirements of the bacteria TMDL, and thus the non-stormwater program will include measurement of *E. coli* in non-stormwater discharges.

3. **Region-wide reductions in outdoor water use**. With heightened awareness of drought conditions, it is anticipated that outdoor water use reductions will lead to reduced flows of non-stormwater.

Taken as a whole, the dry weather EWMP Implementation Strategy for addressing bacteria is robust because it includes an array of control measures, ranging from a large structural control measures (NOTF) to targeted outfall monitoring and abatement.

Wet-weather control measures in the EWMP Implementation Strategy are also able to mitigate non-stormwater discharges in the Ballona Creek Watershed (Figure 7-15). The top panel shows the estimated volume of non-stormwater being discharged as the EWMP schedule progresses, while the bottom panel shows the corresponding non-stormwater volumes reductions. Over time, the wet-weather control measures will help ensure elimination of remaining non-stormwater discharges along with other diversion and water use reduction strategies. The reductions to be achieved by the dry

[32] It is important to note that scenario shown is preliminary and subject to change – for example, the design of NOTF may be modified to divert of portion of flows to Hyperion Treatment Plan (rather than treat and release all intercepted flows).

weather compliance dates from the Ballona Creek Metals TMDL are sufficient to achieve the milestones.

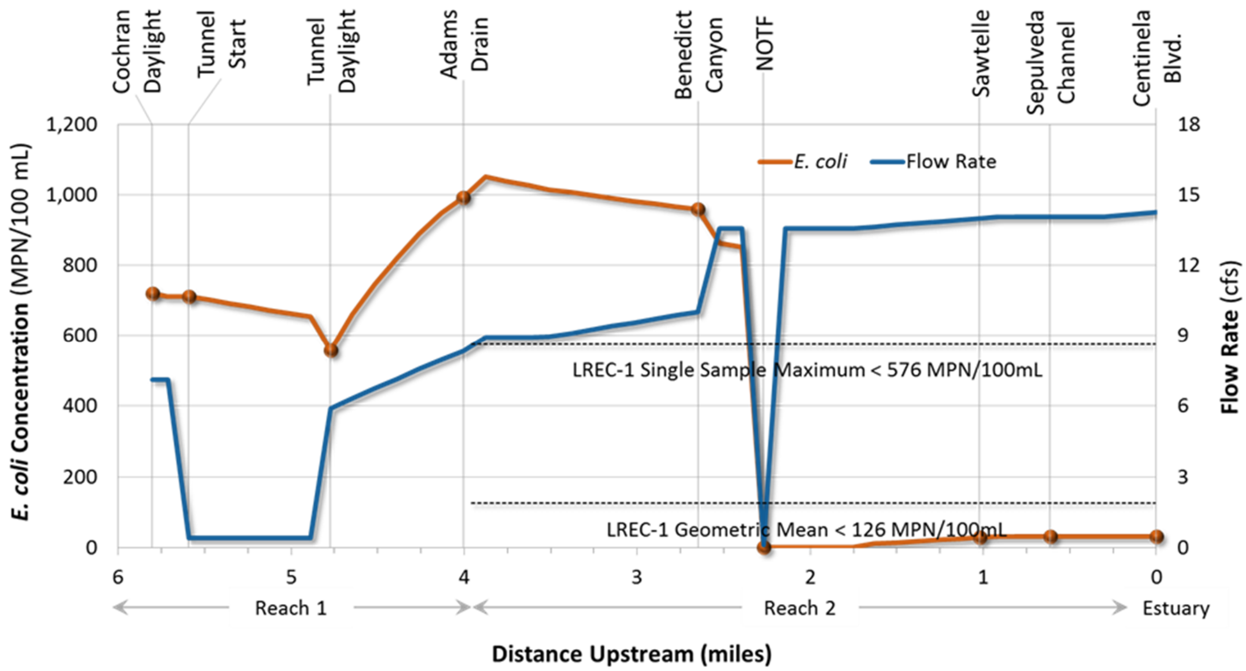


Figure 7-16 Concentration of E.coli in Ballona Creek with NOTF and Sepulveda Channel LFTF Operational

Figure 7-16 shows the result of QUAL2K modeling as described in Appendix 6.B. The NOTF and Sepulveda Channel LFTF provide reasonable assurance of attaining *E. coli* RWLs in Ballona Creek. Note the geometric mean WQO of 126 MPN per 100 mL does not apply to Reach 1. It is important to note that scenario shown is preliminary and subject to change (the resulting water quality conditions would change under a diversion scenario) – for example, the design of NOTF may be modified to divert of portion of flows to Hyperion Treatment Plan (rather than treat and release all intercepted flows).

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[33] for the BC 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 (June 2015).

[33] 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.

This page intentionally left blank.

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 evolve 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 first EWMP looks to 2021 and dynamic 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 siting 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. Figure 8-1 provides an illustration of the process for compliance determination, based on the "Compliance with Receiving Water Limitations Not Otherwise Addressed by a TMDL through a WMP or EWMP section of the Permit (page 49) and the TMDL Compliance Determination" section of the Permit (starts on page 141). 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 BC 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. Finally, 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. [34]

[34] 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 (final 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.

As outlined in Table 8-1, compliance should be determined separately for each constituent and condition (wet or dry).[35] 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 (identified in Table 3-8), 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 3-8 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 final limitations.

Table 8-1 WMP Control Measures to be Assessed for Compliance Determination with BCWMG 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 2µ12 MS4 Permit and modifications made during adaptive management, as needed.	See Table 3-7 and Table 3-8
	Category 3 pollutants		
Dry weather	Copper and Zinc	MCMs in 2µ12 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	Control measures in Time Schedule Order	See TSO
	Category 2 pollutants	MCMs in 2µ12 MS4 Permit and modifications made during adaptive management, as needed. Also, Implementation of non-stormwater abatement program in CIMP	See Table 3-7 and Table 3-8

An important element of the current Permit provisions is that determination of compliance with final 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 final limits (not just interim) as a component of EWMP compliance determination (as discussed in the Permit Fact Sheet).

[35] An exception would be areas that drain to regional projects that manage the 85th percentile, 24-hour storm.

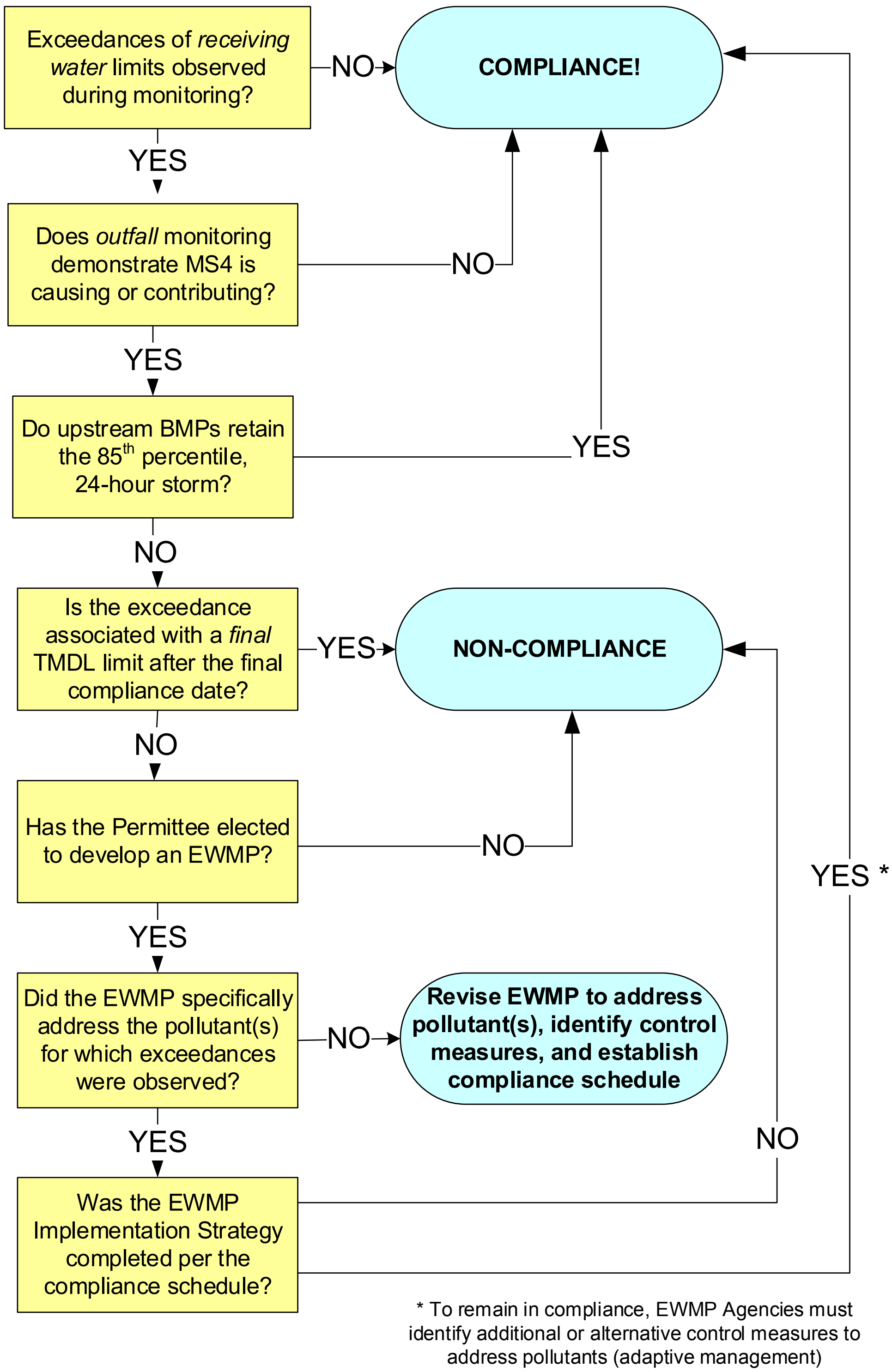


Figure 8-1 MS4 Permit Compliance Determination Process

8.2 Adaptive Management Framework

The Permit specifies the adaptive management process will be revisited every two years to re-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 final 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.
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 (*e.g.*, beneficial uses or WQBELs and/or RWLs). The process will 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 BC 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 BC watershed is rapid, far above corresponding funding that is available for stormwater programs. The milestones for the BC Metals TMDL are especially problematic given their short timeframe (2016). The EWMPs provide some of the first comprehensive cost estimates for implementation of the RWLs and WQBELs in the MS4 Permit (presented in next section), and they could be used to support revisions to TMDL implementation schedules during upcoming TMDL reopeners. While the BC EWMP Group anticipates stormwater funding to increase in the coming years (as described in the next section), the TMDL schedules for near-term milestones could be adjusted to reflect currently available funding 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. Studies for site-specific objectives could be conducted for the limiting pollutants zinc and bacteria in the BC watershed. For zinc, a water effects ratio (WER) should considered for the Ballona Creek and its associated waterbodies. 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. Through the statewide update, the HFS could be expanded to BC waterbodies, which would reduce the amount of regional projects on private land that are currently included in the EWMP Implementation Strategy.

- **Revisions to Water Quality Priority categories** – for some Water Quality Priorities, the pollutants will benefit from additional monitoring data collected by the CIMP. New monitoring data may result in the re-characterization of receiving water and discharge quality within the BC 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 BC 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 Reviews of the 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 BC 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 the 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, changes in rainfall patterns, water conservation efforts, and major changes to the quality or volume of effluent discharges from POTWs.

8.2.4 Updates to Preferences for Control Measure Implementation

Over the course of EWMP implementation, BC EWMP 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 (*e.g.*, 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 provided below and in Figure 8-2.

In Figure 8-2, the "recipe for compliance" is split to emphasize that the Compliance Targets (on the left-hand side) are fixed, enforceable goals, whereas the plan (on the right-hand side) is subject to adaptive management. The objective is for each BC EWMP Group member to meet the Compliance Target (left-hand side) and manage 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. Three scenarios to consider as examples are provided below.

The capacities presented in Figure 8-2 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.

	(Current Fixed Goal) COMPLIANCE TARGETS: MEASURABLE AND ENFORCEABLE BMP GOAL		(Flexible) EWMP IMPLEMENTATION PLAN: APPROACH TO ACHIEVE COMPLIANCE TARGETS, SUBJECT TO ADAPTIVE MANAGEMENT (BMP capacity expressed in units of acre-feet)												
	For Metals by 2026	For Bacteria by 2040	For Metals Attainment by 2021											For Bacteria Attainment by 2021	
				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)
	13.81	3.81	41%	0.49	0.30	0.40	0.87	5.92	0.00	0.29	0.00	0.00	**8.3**	3.81	**12.1**
Scenario 1:			41%	0.49	0.30	0.40	0.87	8.92	0.00	0.29	0.00	0.00	**11.3**	1.00	**12.3**
Scenario 2:			41%	0.49	0.30	--	4.35	8.92	0.00	0.29	0.00	0.00	**14.4**	--	**14.4**
Scenario 3:			41%	0.49	0.30	--	0.87	--	--	--	--	8.0	**9.7**	--	**9.7**

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 8-2 EWMP Implementation Plan Scenarios

- **Scenario 1**: The EWMP Implementation Strategy currently identifies 5.92 AF of storage necessary for green streets for this subwatershed. Consider a hypothetical example scenario where a street-scale analysis reveals that an additional 3 AF of high-efficiency green street opportunities exist in the subwatershed, bringing the total green street implementation to 8.92 AF. The Scenario 1 row 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 AF, but regional capacity on public land is reduced by 2.81 AF). 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 percent of residential parcels per year versus the 1 percent assumed by the RAA. The additional residential LID offsets the remaining 1 AF 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 considers 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 overall level of BMP implementation. It will be important to demonstrate equivalency as these adjustments are made to the EWMP Implementation Strategy.

Section 9
EWMP Implementation Costs and Financial Strategy

The purpose of this section is to present costs for constructing, operating and maintaining all 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 Permittees 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:

- Estimates of costs to construct, operate and maintain required control measures (9.1);
- Assessment of existing stormwater program cost and funding sources (9.2);
- Description of the financial strategy to secure funding 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[36]. The cost functions are based on generic, modular cost functions developed specifically for Los Angeles County. The cost functions[37] encompass planning, design, permits, construction, operations and maintenance (O&M), and post-construction inspection, where applicable. Cost estimates are applicable only for the modeled BMP configurations specified in Section 6 and Appendix 6D. Note that costs do not account for inflation, interest, or time-value of money.

The costs for structural BMPs are considered to be planning level only (order of magnitude), and can be refined as EWMP implementation progresses with the use of actual BMP implementation costs. Costs for enhanced minimum control measures and other institutional BMPs have not been included because they will vary by jurisdiction and are estimated to be a small percentage of the overall program costs. Monitoring and stormwater program costs are not included.

---

[36] 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.

[37] 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.

Table 9-1 Summary of Annualized Cost Estimation Formulas

BMP Category	BMP Types	Functions 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	Pumps[2]	*Cost = 56,227*(Pump Capacity$_{cfs}$) + \$1,207,736*	
	Regional Project on Public Parcel	*Cost = 10.01 (A) + 2.296 (Vt) + 2.8 (Vm)*	*Cost = 1.918 (A)*
	Regional Project on Private Parcel[3]	*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.
[3] Includes land acquisition cost estimate.

9.1.1 EWMP Costs by BMP and TMDL Milestones

The total estimated costs for all control measures in the EWMP Implementation Strategy (LID, GreenStreets, 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 BC EWMP Group member ($ millions) [1]

Agency	Program	Present to 50% Metals TMDL Milestone (2016)		50% Metals TMDL Milestone (2016) to Final Compliance with Metals TMDL (2021)		50% Metals TMDL Milestone (2016) to Final Compliance with Bacteria TMDL (2021)		Total at Final (2021)	
		Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Beverly Hills	LID	µ.24		3.83		µ.µµ		4.µ7	
	Streets	1.82		25.17		µ.µµ		26.99	
	Public Regional	3.36		1.66		µ.µµ		5.µ2	
	Private Regional	µ.µµ		14.71		21.15		35.86	
	Subtotal	**5.43**	**0.64**	**45.37**	**4.59**	**21.15**	**4.87**	**71.95**	**4.87**
Culver City	LID	1.18		2.21		µ.µµ		3.39	
	Streets	5.34		8.14		µ.µµ		13.48	
	Public Regional	1.24		µ.µ5		µ.µµ		1.29	
	Private Regional	13.22		85.63		2µ.79		119.64	
	Subtotal	**20.98**	**1.12**	**96.02**	**3.52**	**20.79**	**3.79**	**137.80**	**3.79**
Inglewood	LID	µ.26		2.11		µ.µµ		2.38	
	Streets	µ.34		4.69		µ.µµ		5.µ3	
	Public Regional	2.28		1.27		µ.µµ		3.55	
	Private Regional	4.93		5µ.55		µ.µ7		55.55	
	Subtotal	**7.81**	**0.40**	**58.63**	**2.04**	**0.07**	**2.04**	**66.51**	**2.04**
Los Angeles	LID	7.27		53.4µ		µ.µµ		6µ.67	
	Streets	32.23		168.79		µ.µµ		2µ1.µ2	
	Public Regional	46.76		26.44		µ.µµ		73.19	
	Private Regional	13.27		1,586.83		346.85		1,946.95	
	Subtotal	**99.53**	**9.90**	**1,835.46**	**57.94**	**346.85**	**62.50**	**2,281.84**	**62.50**
Santa Monica	LID	µ.1µ		µ.34		µ.µµ		µ.44	
	Streets	µ.3µ		µ.9µ		µ.µµ		1.2µ	
	Public Regional	2.31		µ.µ2		µ.µµ		2.33	
	Private Regional	µ.µµ		13.39		µ.µµ		13.39	
	Subtotal	**2.71**	**0.31**	**14.65**	**0.64**	**0.00**	**0.64**	**17.36**	**0.64**
Uninc. LA County	LID	µ.8µ		1.38		µ.µµ		2.18	
	Streets	1.86		3.2µ		µ.µµ		5.µ6	
	Public Regional	3.µ5		µ.µ8		µ.µµ		3.13	
	Private Regional	8.74		58.6µ		6.23		73.57	
	Subtotal	**14.45**	**0.79**	**63.25**	**2.10**	**6.23**	**2.18**	**83.93**	**2.18**

Table 9-2 Total Costs by Milestone for each BC EWMP Group member ($ millions) [1]

Agency	Program	Present to 50% Metals TMDL Milestone (2016)		50% Metals TMDL Milestone (2016) to Final Compliance with Metals TMDL (2021)		50% Metals TMDL Milestone (2016) to Final Compliance with Bacteria TMDL (2021)		Total at Final (2021)	
		Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
West Hollywood	LID	µ.16		1.39		µ.µµ		1.55	
	Streets	µ.42		3.26		µ.µµ		3.68	
	Public Regional	2.33		µ.59		µ.µµ		2.92	
	Private Regional	µ.µµ		44.92		11.18		56.11	
	Subtotal	**2.91**	**0.34**	**50.17**	**1.57**	**11.18**	**1.72**	**64.26**	**1.72**
Total		**153.82**	**13.50**	**2,163.55**	**72.40**	**406.28**	**77.74**	**2,723.65**	**77.74**

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

9.1.2 EWMP Costs by Watershed

The EWMP costs are presented for each watershed in Table 9-3.

Table 9-3 Total Costs for each Assessment Area / Watershed in the BC EWMP Area ($ millions)

Agency	Ballona at the Mouth		Centinela Creek		Sepulveda Channel		Total	
	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Beverly Hills	71.95	4.87	µ.µµ	µ.µµ	µ.µµ	µ.µµ	71.95	4.87
Culver City	87.µ2	2.61	44.63	1.µ1	6.15	µ.17	137.8µ	3.79
Inglewood	15.55	µ.26	5µ.96	1.78	µ.µµ	µ.µµ	66.51	2.µ4
Los Angeles	1,872.4µ	48.48	83.86	2.51	325.58	11.5µ	2,281.84	62.5µ
Santa Monica	µ.µµ	µ.µµ	µ.µµ	µ.µµ	17.36	µ.64	17.36	µ.64
Uninc. LA County	35.37	µ.78	48.56	1.41	µ.µµ	µ.µµ	83.93	2.18
West Hollywood	64.26	1.72	µ.µµ	µ.µµ	µ.µµ	µ.µµ	64.26	1.72
Total	**2,146.55**	**58.72**	**228.01**	**6.70**	**349.08**	**12.32**	**2,723.65**	**77.74**

9.1.3 Unit Costs by Parcel

The EWMP costs will have a significant impact on each jurisdiction. In determining the impact to each permittee, it is possible to conduct a high-level calculation of dividing the capital costs by the number of parcels in the watershed. The calculated total is $9,422 per parcel for the approximately 289,000 parcels in the Ballona Creek EWMP area. It should be noted that this a very preliminary estimate for planning purposes only. 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 Programs

Each jurisdiction in the BC 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 EWMP 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 City-Wide Stormwater Costs

Jurisdiction	Existing Utility?	Funding Source	Description of Costs	Total Costs
Beverly Hills	Yes	Stormwater Fund/General Fund	Management, Outreach, Inspections, O&M, Street Sweeping, Plan Check Review, Enforcement, TMDLs and Capital	~$14.4M/yr
Culver City	No	General Fund	Management, MCMs, TMDLs	~$5µµ,µµµ/yr
Inglewood	Yes	Sewer Fund	O&M and Capital, Runoff Investigation	$2.2M/yr
Los Angeles	Yes	Stormwater Fund	Management, Outreach, inspection, enforcement, monitoring	~$3µM/yr (City Wide; not including Prop O)
Santa Monica	Yes	Stormwater Fund/General Fund	O&M and Capital, Outreach, Inspections, Management	~$13.7M/yr
Unincorporated LA County[1]	No	Integrated Funding/Various Sources	Management, Outreach, inspection, enforcement, monitoring	~8µM/yr (County wide)
West Hollywood	No	General Fund	Management, Outreach, Inspections	~$1M/yr

[1] The County has an ongoing collective budget of $1µ.1 million for 14µ unincorporated areas. Additional funds for projects are allocated on an annual basis from the General Fund and other sources. In Fiscal Year 2µ15-16, 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 those control measures are large and will span decades. 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 their agency. These funding sources would be combined with existing funding sources such as general funds or fees to resource EWMP programs in the future in order to improve cost-effectiveness and leverage existing resources. 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 2016 and 2021. 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.

Multiple agencies in the watershed are pursuing grant funding for various projects. For example:

- Culver City has recently applied for grant funds under Proposition 84 and under Proposition 1.
- The City of Los Angeles is pursuing grant funding for high priority projects in the near term while they seek to identify sustainable sources of funding in the long term for future projects and operation and maintenance related to EWMP implementation.
- Unincorporated LA County is planning to apply for the Proposition 84 Santa Monica Bay Restoration Commission Grant.
- The City of West Hollywood is submitting a grant application under Proposition 84 to implement a green streets project to pave alleys with permeable asphalt.

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 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.

With the exception of JPAs, 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.

Despite the challenges, some agencies are moving forward with new fee based programs. For example, Culver City is currently developing their fee program and is working towards a potential public vote in November 2016.

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) is an innovative market based approach that involves a party facing relatively high pollutant reduction costs compensating another party to achieve less costly pollutant reduction with the same or greater water quality benefit. 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.

In some cases, agencies are interested in these types of programs to fund EWMP projects. For example, Culver City is currently developing an in-lieu fee option for the Land and Planning Development Program within its jurisdiction.

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.

The relationship that Culver City has developed with Costco in the Marina del Rey Watershed is a good example of recent advances in P3 funding. Although not in Ballona Creek, this project may be used as a model for the development of future partnerships in this watershed.

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 9-8. 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

$$$ = $25-1µµM
$$$$ = >$1µµM

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
$$ = $5-25M
$$$ = $25-1µµM

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
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
$$ = $5-25M
$$$ = $25-1µµM

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
$$ = $5-25M
$$$ = $25-1µµM

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	$-$$	●	●	Low	Moderate
Public Private Partnerships	$	●	●	Low	Moderate
Sales Tax Measure[1]	$-$$		●	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
$$ = $5-25M
$$$ = $25-1µµM

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

Ten signature projects are identified in Section 4.5. All signature projects are regional BMPs. Eight of the signature projects utilize surface and/or subsurface retention and infiltration as the primary retention and treatment mechanism. Two utilize treatment technologies (biofiltration and wetlands or filtration) to remove pollutants before utilizing runoff or returning it to the storm drain system. Treatment areas for these projects range from approximately 100 acres to 8,500 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 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 Final Budget Approval package once the project has been bid and construction costs finalized.

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 Final 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 final 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 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, regional stormwater quality fee,, 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.

This page intentionally left blank.

Section 1μ
References

Bay Area Stormwater Management Agencies Association (BASMAA). 2011. 2010-11 Annual Reports for the Municipal Regional Stormwater NPDES Permit, Pollutants of Concern and Monitoring, A7-A12 Brake Pad Copper Reduction.

Breault, R.F., Smith, K.P., Sorenson, J.R. 2005. Residential Street-Dirt Accumulation Rates and Chemical Composition, and Removal Efficiencies by Mechanical-and Vacuum-Type Sweepers, New Bedford, Massachusetts, 2003–04. USGS Scientific Investigations Report 2005-5184.

California Department of Transportation (Caltrans). 2000. District 7 Litter Management Pilot Study, URSGWC Project No. 58-977001NJ.01-FR400, June 26, 2000.

California Stormwater Quality Association (CASQA). 2010. Fact Sheet on SB 346 and Copper Compliance for Stormwater Permittees.

CASQA. 2007. Municipal Stormwater Program Effectiveness Assessment Guidance. May 2007.

County of Los Angeles. 2010. Multi-Pollutant TMDL Implementation Plan for the Unincorporated County Area of Ballona Creek. Submitted to California Regional Water Quality Control Board – Los Angeles Region. 7 October 2010.

Clean Rivers Through Stakeholder-led TMDLs Consulting Team. 2010. Los Angeles River Watershed Bacteria TMDL – Technical Report Section 3: Numeric Targets. Prepared for CREST (Cleaner Rivers through Effective Stakeholder-Led TMDLs

CREST (2008). Cleaner Rivers through Effective Stakeholder-led TMDLs. Los Angeles River Bacteria Source Identification Study: Final Report. Report can be found at http://www.crestmdl.org/reports/index.html., November 2008.

Donigian, A.S., and J.T. Love, 2003. Sediment Calibration Procedures and Guidelines for Watershed Modeling. Aqua Terra Consultants, Mountain View, California.

Donigian, A.S., Jr. 2000. HSPF Training Workshop Handbook and CD. Lecture #19: Calibration and Verification Issues. Prepared for and presented to the U.S. Environmental Protection Agency, Office of Water, Office of Science and Technology, Washington, DC.

Donigian, A.S., Jr., J.C. Imhoff, B.R. Bicknell, and J.L. Kittle, Jr. 1984. Application Guide for Hydrological Simulation Program – FORTRAN (HSPF). EPA-600 / 3-84-965. U.S. Environmental Protection Agency, Environmental Research Laboratory, Athens, GA.

California Department of Water Resources, State Water Resources Control Board, California Bay-Delta Authority, California Energy Commission, California Department of Public Health, California Public Utilities Commission, California Air Resources Board. 20x2020 Water Conservation Plan. February 2010.

City of Beverly Hills, CalTrans, City of Culver City, City of Los Angeles, City of Inglewood, City of Santa Monica, and City of West Hollywood. Total Maximum Daily Load for Toxic Pollutants in Ballona Creek Estuary Implementation Plan. June 2012.

City of Beverly Hills, CalTrans, City of Culver City, City of Los Angeles, City of Inglewood, City of Santa Monica, and City of West Hollywood. Total Maximum Daily Load for Metals in Ballona Creek, Implementation Plan (Draft). January 2010.

City of Beverly Hills, CalTrans, City of Culver City, City of Los Angeles, City of Inglewood, City of Santa Monica, and City of West Hollywood. Total Maximum Daily Load for Bacterial Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel Implementation Plan (Draft). November 2009.

Lumb, A.M., R.B. McCammon, and J.L. Kittle, Jr. 1994. User's Manual for an Expert System (HSPEXP) for Calibration of the Hydrological Simulation Program – FORTRAN. Water-Resources Investigation Report 94-4168. U.S. Geological Survey, Reston, VA.

Mayer, P., W. DeOreo, M. Mayden, R. Davis, E. Caldwell, T. Miller, P.J. Bickel. 2009. Evaluation of California Weather-Based "SMART" Irrigation Controller Programs.

Pitt, R.E., Williamson, D., Voorhees, J., and Clark, S., 2004, Review of historical street dust and dirt accumulation and washoff data in James, W., Irvine, K.N., McBean, E.A., and Pitt, R.E., eds., Effective modeling of urban water systems: Niagara Falls, NY, Computational Hydraulics Institute, p43.

Regional Board. 2002. Amendment to the Water Quality Control Plan for the Los Angeles Region to Incorporate Implementation Provisions for the Region's Bacteria Objectives and to Incorporate a Wet-Weather Total Maximum Daily Load for Bacteria at Santa Monica Bay Beaches. Resolution No. 2003-10. December 12, 2002.

Sartor, J.D., and Gaboury, D.R. 1984. Street sweeping as a pollution control measure—Lessons learned over the past ten years: Science of the Total Environment, v. 33, p. 171–183.

Shen, J., A. Parker, and J. Riverson. 2004. A New Approach for a Windows-based Watershed Modeling System Based on a Database-supporting Architecture. Environmental Modeling and Software, July 2004.

Storm Water Managers Resource Center (SMRC). Pollution Prevention Fact Sheet: Parking Lot and Street Cleaning. (No Date, found here: http://www.stormwatercenter.net/).

Tetra Tech. 2010a. Los Angeles County Watershed Model Configuration and Calibration—Part I: Hydrology. Prepared for County of Los Angeles Department of Public Works, Watershed Management Division, Los Angeles County, CA, by Tetra Tech, Pasadena, CA.

Tetra Tech. 2010b. Los Angeles County Watershed Model Configuration and Calibration—Part II: Water Quality. Prepared for County of Los Angeles Department of Public Works, Watershed Management Division, Los Angeles County, California, by Tetra Tech, Pasadena, California.

Tetra Tech. 2011. Evaluation of Water Quality Design Storms. Prepared for County of Los Angeles Department of Public Works, Watershed Management Division, Los Angeles County, CA, by Tetra Tech, Pasadena, California.

Tetra Tech and USEPA (U.S. Environmental Protection Agency). 2002. The Loading Simulation Program in C++ (LSPC) Watershed Modeling System – User's Manual. Tetra Tech, Fairfax, Virginia, and U.S. Environmental Protection Agency, Washington, DC.

University of Florida. (2012). Mercury Spills. Available at: http://www.ehs.ufl.edu/programs/ih/mercury/

USEPA (U.S. Environmental Protection Agency). 2009. SUSTAIN—A Framework for Placement of Best Management Practices in Urban Watersheds to Protect Water Quality. EPA/600/R-09/095. U.S. Environmental Protection Agency, Office of Research and Development, Edison, NJ.

USEPA (U.S. Environmental Protection Agency). 2003. Fact Sheet: Loading Simulation Program in C++. USEPA, Watershed and Water Quality Modeling Technical Support Center, Athens, Georgia. Available at: http://www.epa.gov/athens/wwqtsc/LSPC.pdf.

USEPA. 2000. Stormwater Phase II Final Rule, Construction Site Runoff Control Minimum Control Measure Fact Sheet. EPA 833-F-00-008. January 2000 (revised December 2005).

USEPA. 1999. Preliminary Data Summary of Urban Storm Water Best Management Practices, EPA-821-R-99-012, August 1999 (Chapter 5).

Water Environment Research Federation and American Society of Civil Engineers (WERF and ASCE). 2012. International Stormwater Best Management Practices (BMP) Database, Narrative Overview of BMP Database Study Characteristics. Prepared by Wright Water Engineers, Inc. and Geosyntec Consultants.

Wisconsin Department of Natural Resources (DNR). (2002). Problems Associated with bis(2-ethylhexyl)phthalate Detections in Groundwater Monitoring Wells. Publication WA 1011. Rev. 2002. Available at: http://dnr.wi.gov/files/pdf/pubs/wa/wa1011.pdf

Zou, R., Liu, Y., Riverson, J., Parker, A. and S. Carter. 2010. A nonlinearity interval mapping scheme for efficient waste load allocation simulation-optimization analysis. Water Resources Research, August 2010.

This page intentionally left blank.