

COVER TBD

Preliminary Draft Ballona Creek

Enhanced Watershed Management
Program (EWMP) Plan

DRAFT

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Acronyms and Abbreviations	
µg/L	micrograms per liter
APLs	anticipated participation levels
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
BSAMAA	Bay Area Stormwater Management Agencies Association
BCWMA	Ballona Creek Watershed Management Area
BCWMG	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
CO	Current Organics
CTR	California Toxics Rule
CWA	Clean Water Act
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DWFs	dry-weather flows
DTSC	California Department of Toxic Substances Control
<i>e. coli</i>	<i>Escherichia coli</i>
EMCs	event mean concentrations
ESCP	Erosion and Sediment Control Plans
EWMP	Enhanced Watershed Management Program
GIS	geographic information system
GPCD	gross per capita water demand
gpd	gallons per day
HFS	High Flow Suspension
HO	Historical Organics
I&I	infiltration and inflow
I/F	interim and/or final
IBD	International BMP Database
IC/ID	Illicit Connection and Illicit Discharges
in/hr	inches per hour
IPM	Integrated Pest Management
IPs	Implementation Plans

Acronyms and Abbreviations

IRWMP	Integrated Regional Watershed Management Plan
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LADWP	Los Angeles Department of Water and Power
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
MWDOC	Municipal Water District of Orange County
NA	not applicable
NGO	non-governmental organization
NOI	Notice of Intent
NOTF	North Outfall Treatment Facility
NPDES	National Pollutant Discharge Elimination System
NS	not sampled
NURP	National Urban Runoff Program
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
RAA	Reasonable Assurance Analysis
Regional Board	Regional Water Quality Control Board, Los Angeles
RWLs	Receiving Water Limitations
SCCWRP	Southern California Coastal Water Research Project
SCSC	Southern California Stormwater Committee
SMB	Santa Monica Bay
SUSMP	Standard Urban Stormwater Mitigation Plan
SUSTAIN	System for Urban Stormwater Treatment and Analysis Integration
TAC	Technical Advisory Committee
TBD	To be determined
TMDL	Total Maximum Daily Load
TMDLIP	Total Maximum Daily Load Implementation Plan
USEPA	US Environmental Protection Agency
WBICs	Weather-Based Irrigation Controllers
WERF	Water Environment Research Federation

Acronyms and Abbreviations

WLA	Wasteload Allocation
WMA	Watershed Management Area
WMG	Watershed Management Groups
WMMS	Watershed Management Modeling System
WQ	Water Quality
WQBELs	Water-Quality Based Effluent Limits

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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 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 County of Los Angeles (Unincorporated County) and the Los Angeles County Flood Control District (LACFCD). By electing to comply with the optional compliance pathway in the MS4 Permit, the BC EWMP Group has leveraged this EWMP to facilitate a robust, comprehensive approach to stormwater management for the Ballona Creek watershed 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 and is tributary to Ballona Creek Estuary, which is an important habitat and the largest wetlands in Los Angeles County. 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.

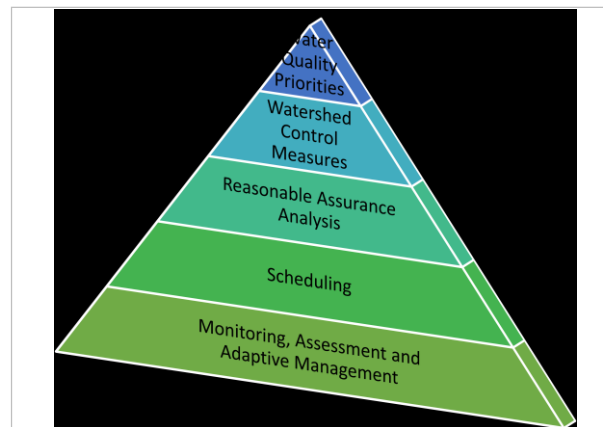
Controlling pollutants in stormwater is a major challenge for the Group Members, but state and federal regulations applicable to the watershed establish clear compliance timelines to address water quality issues. For example, the Ballona Creek watershed is subject to a Total Maximum Daily Load (TMDL) 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 bacteria 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.

ES.1 Elements of the EWMP

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

ES.1.1 Water Quality Priorities

The identification of Water Quality Priorities (Section 3 of the EWMP) was an important first step in the EWMP Plan development process. The Water Quality Priorities highlight the pollutants and waterbodies that are potentially not attaining water quality standards. The Water Quality Priorities are a driver of the control measures in the EWMP. For example, if a water quality objective is not being attained, additional pollutant reduction is required and thus more or larger control measures are needed to achieve those reductions. Over 55,000 data records of water quality monitoring data were compiled and analyzed to determine three



categories of Water Quality Priorities based on whether TMDLs have been developed for waterbody-pollutants, whether water quality exceedances have occurred in the last 10 years and whether the stormwater system is a likely source of these pollutants. The water quality prioritization process of the Permit determines the water body-pollutant combinations (WBPCs) that will be addressed by the EWMP. The Permit defines three categories of Water Quality Priorities:

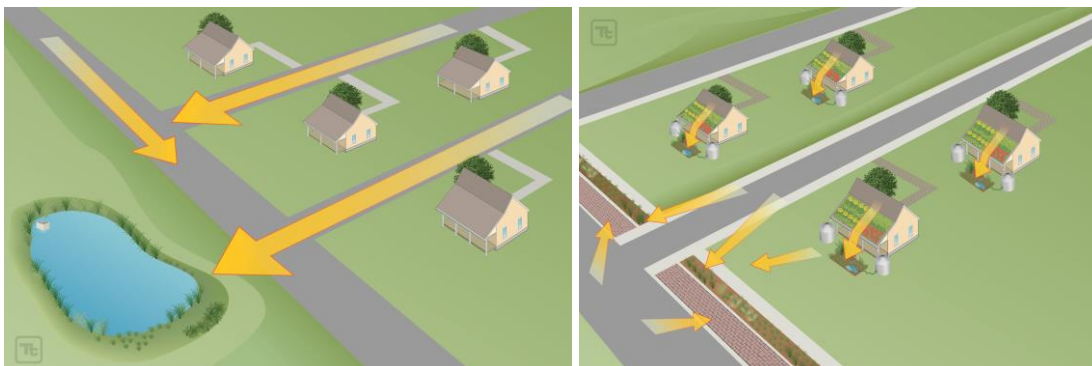
- **Category 1** are pollutants subject to an established TMDL.
- **Category 2** are pollutants on the State Water Resources Control Board 2010 Clean Water Act Section 303(d) List of Impaired Water Bodies or those constituents that have sufficient exceedances to be listed.
- **Category 3** are pollutants 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 (*i.e.*, interim and final numeric limits) and other representative Regional Board adopted TMDLs. The scheduling of 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;
- Achieve final compliance for the Ballona Creek Bacteria TMDL by 2021.

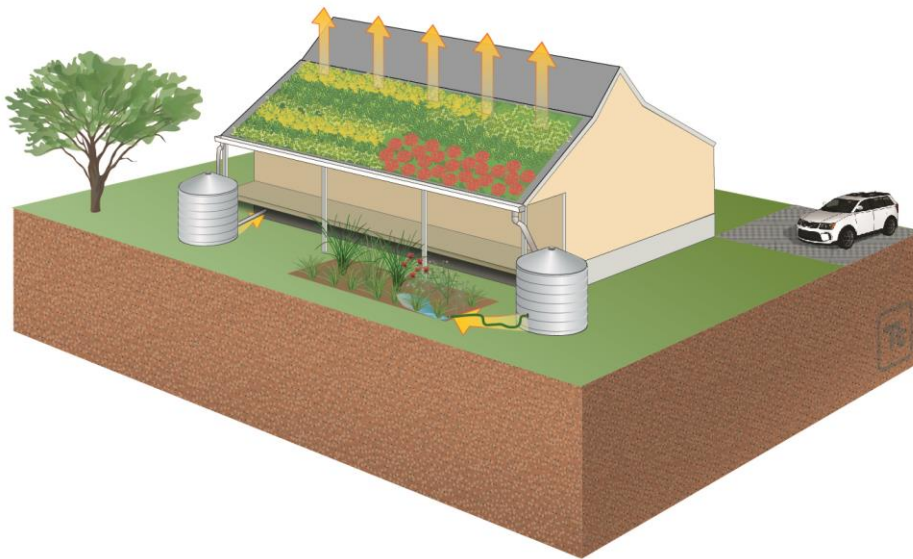
ES1.2 Watershed Control Measures

The Permit requires the identification of Watershed Control Measures, which are strategies and 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 six 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 (see the illustration below of distributed versus regional approaches):



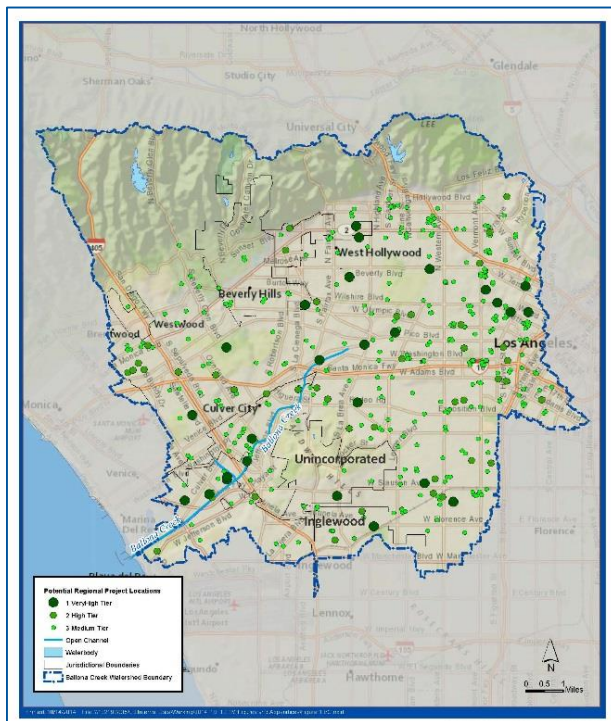
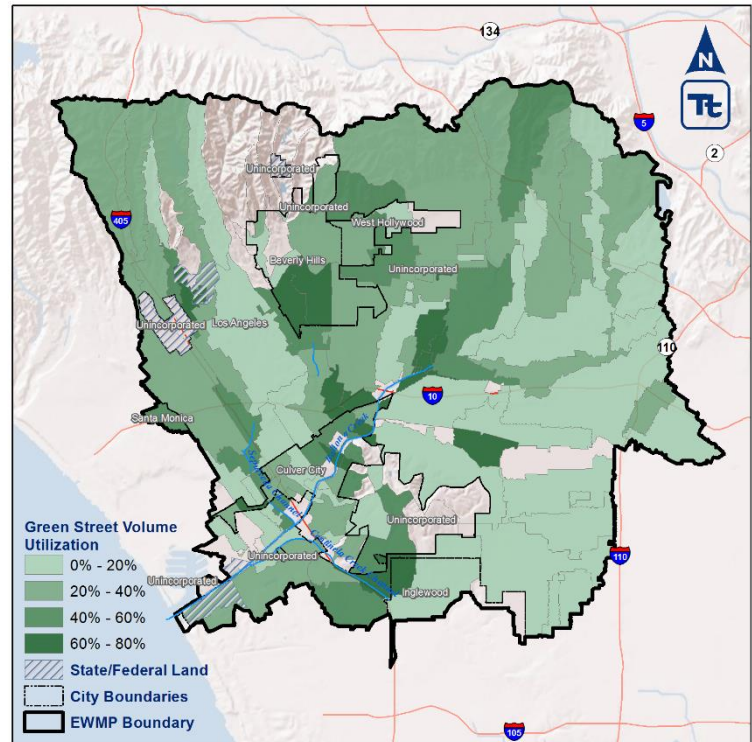
Furthermore, the three main categories of structural BMPs can be further categorized as low-impact development (LID), green streets, and regional projects:

- **Low-Impact Development:** these are distributed structural practices that capture, infiltrate, 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 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.

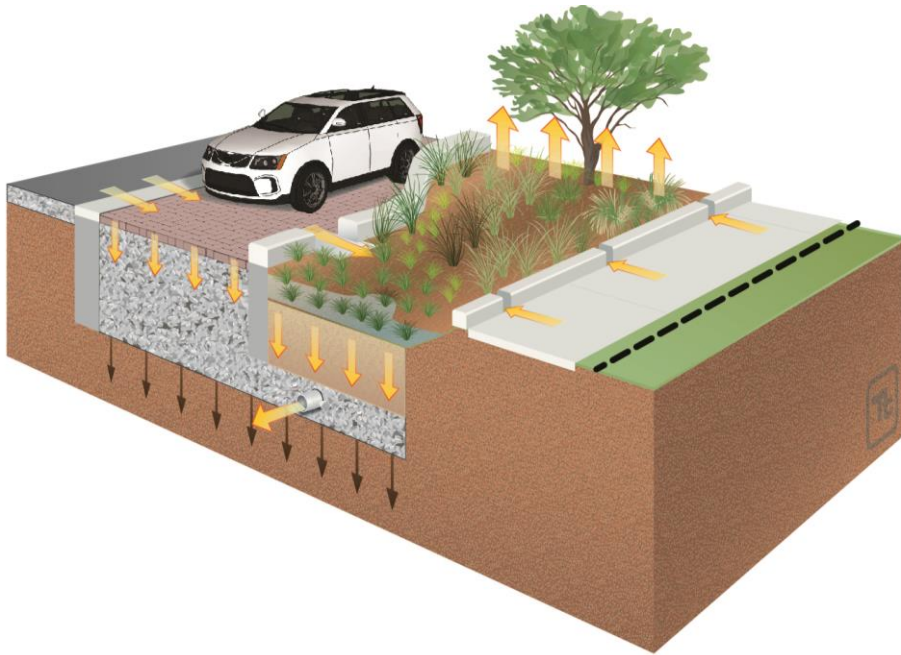


Conceptual schematic of LID implemented on a parcel (arrows indicate water pathways)

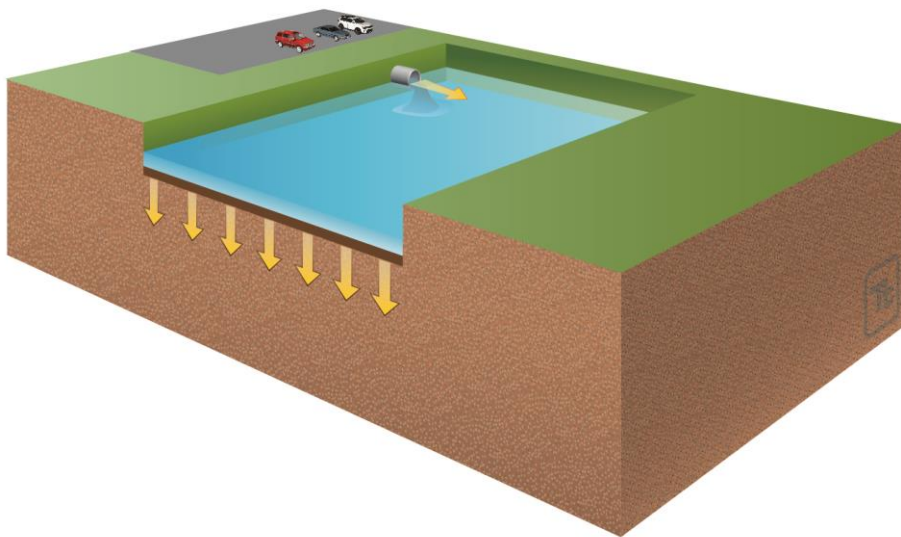
Green Streets: these are distributed structural practices that are typically implemented as linear bioretention/biofiltration practices installed parallel to roadways (discussed in Section 5). These systems receive runoff from the gutter via curb cuts or curb extensions (sometimes called bump outs) and infiltrate it through native or engineered soil media. Permeable pavement can also be implemented in tandem, or as a standalone practice, in parking lanes of roads. As shown in the figure to the right, a high percentage of streets are planned for green street retrofits for the EMWP Implementation Strategy. Green streets have been demonstrated to provide “complete streets” benefits in addition to stormwater management, including pedestrian safety and traffic calming, street tree canopy and heat island effect mitigation, increased property values, and even reduced crime rates.



Regional projects: Regional projects are centralized facilities located near the downstream ends of large drainage areas, typically treating 10s to 100s of acres, (see figure to left). Regional projects receive large volumes of runoff from extensive upstream areas and can provide a cost-effective mechanism for infiltration and pollutant reduction. Runoff is typically diverted to regional projects after it has already entered storm drains and engineered channels. Routing offsite runoff to public parcels (versus treating surface runoff near its source, as with green streets and LID) often allows regional BMPs to be placed in cost-effective locations with the best available BMP opportunity. The BC EWMP includes over 68 regional BMPs, including 10 signature, multi-benefit regional projects. Of these 10, 4 regional projects will retain the storm water volume from the 85th percentile, 24-hour storm. The EWMP also includes regional projects on private land to assure pollutant reductions are achieved.



Conceptual schematic of a green street (arrows indicate water pathways)



Conceptual schematic of a regional project (arrows indicate water pathways)

ES.1.3 Reasonable Assurance Analysis

A key element of each EWMP is the 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 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 (*i.e.*, 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 *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 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 the Bacteria 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.

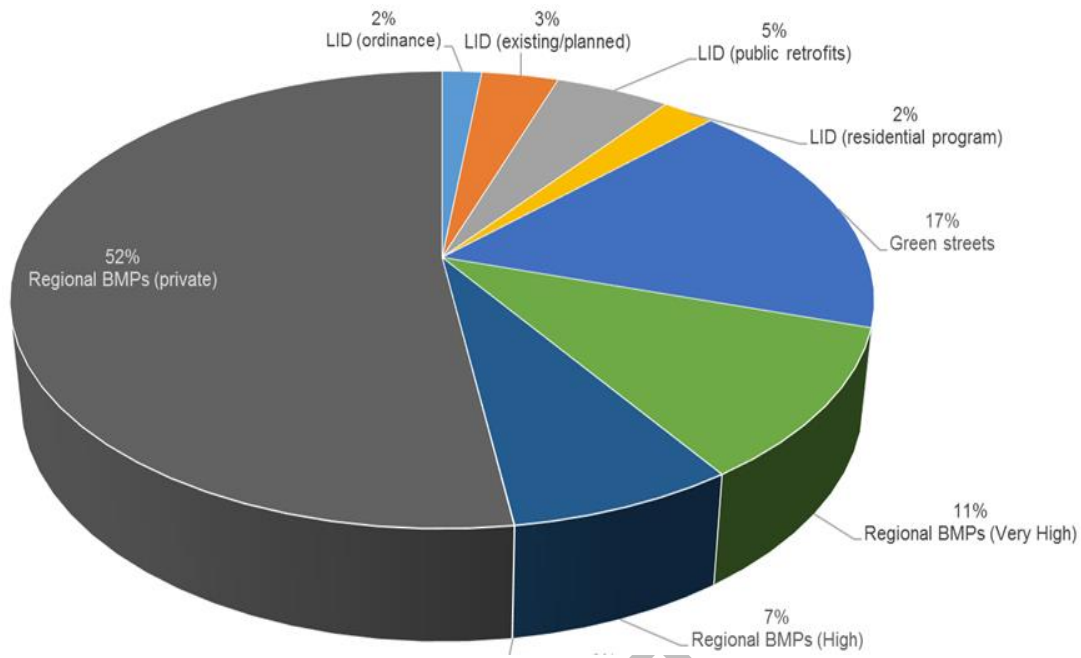
ES.1.4 Detailed EWMP Implementation Strategy and Compliance Schedule

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.

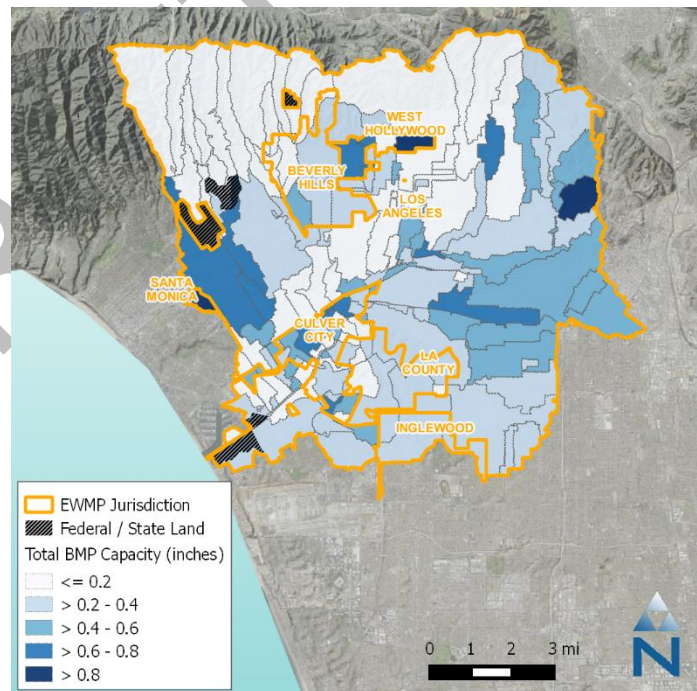
The EWMP Implementation Strategy is expressed in terms of [1] the volumes of stormwater and non-stormwater to be managed by each jurisdiction to address Water Quality Priorities and [2] the control measures that will be implemented to achieve those volume reductions, as follows:

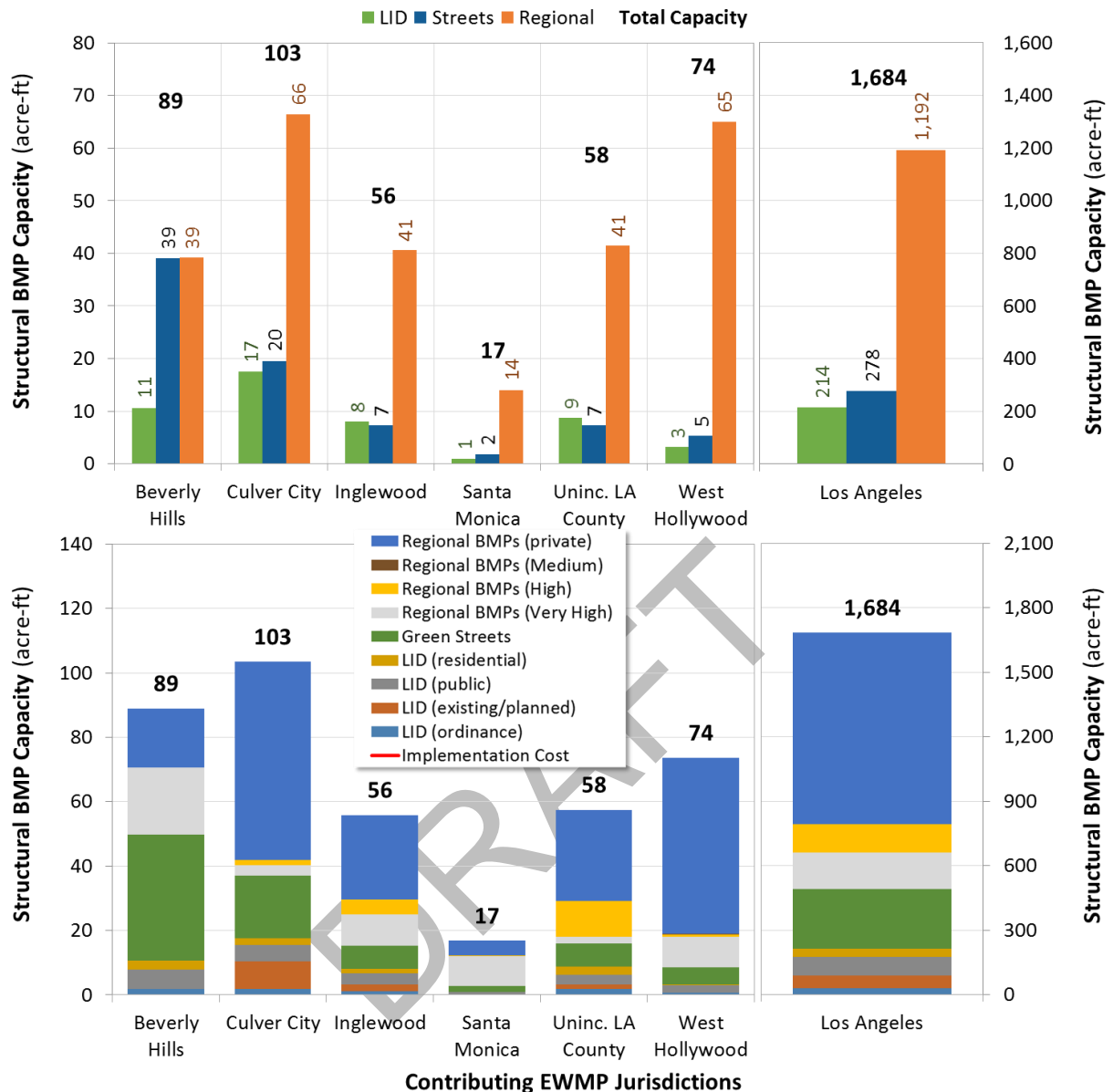
Compliance Targets: for MS4 compliance determination purposes, the ultimate metric for EWMP implementation is the volume of stormwater managed by implemented control measures. The stormwater volume to be managed is considered the measurable and enforceable goal that will be used by the Regional Board to assess BMP-based compliance.

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 to be implemented by 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 street and regional projects to address the Water Quality Priorities will result in the capture of a volume of water (along with its pollutants) that has the equivalent capacity of over 6 Rose Bowl stadiums filled with water. As shown in the figure below, 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.



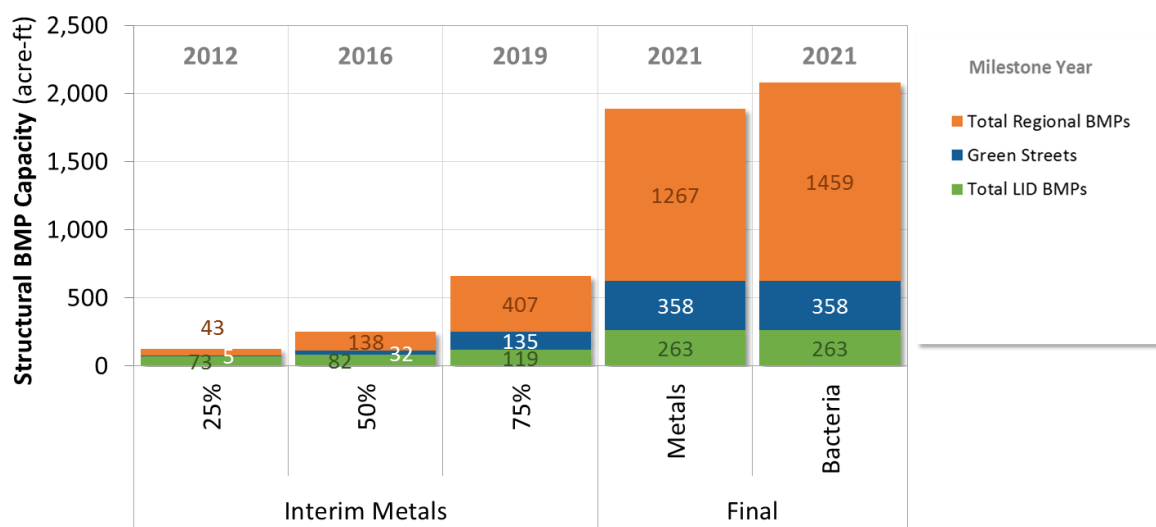
The EWMP Implementation Strategy is ultimately a recipe for compliance for each jurisdiction and subwatershed in the EWMP area. A total of 1,119 subwatersheds (see figure to right) are provided a specific set of LID, green street and regional control measures. The BMP density is higher in some areas [dark blue] because either [1] relatively high load reductions are required or [2] BMPs in those areas were relatively cost-effective (e.g., due to high soil infiltration rates). The EMWP 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 the figure below. The strategy varies by jurisdiction depending on the pollutant reduction requirements and BMP preferences. The top panel groups the BMP types into LID, green streets and regional BMPs, while the bottom panel provides more resolution for the BMP sub-categories





The network of LID, green streets and regional BMPs in the EWMP Implementation Strategy is extensive and its implementation would represent a sea 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 proportional to required internal and financial resources, the additional required resources to implement the EWMP will be significant, as presented below.



ES.1.5 EWMP Implementation Costs and Financial Strategy

The total estimated capital cost is approximately \$2.7 billion, over the course of 6 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 are not currently available nor have they been identified for the EWMP Implementation Plan. 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 is approximately \$2.7B, which is approximately \$9,422 per parcel, with total operations and maintenance costs exceeding \$77M per year (see table below). 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.

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	Capital	O&M	Capital	O&M	Capital	O&M
Beverly Hills	\$5.52	\$0.65	\$45.40	\$4.60	\$24.30	\$4.92	\$75.20	\$4.92
Culver City	\$21.40	\$1.20	\$107	\$3.65	\$20.50	\$3.92	\$148	\$3.92
Inglewood	\$2.80	\$0.32	\$63.80	\$2.03	\$0.07	\$2.03	\$66.70	\$2.03
Los Angeles	\$132	\$14.10	\$1,750	\$57.30	\$346	\$61.80	\$2,230	\$61.80
Santa Monica	\$1.69	\$0.19	\$12.00	\$0.59	\$0	\$0.59	\$13.70	\$0.59
Uninc. LA County	\$3.38	\$0.40	\$61.10	\$1.93	\$6.21	\$2.02	\$70.70	\$2.02
West Hollywood	\$5.16	\$0.62	\$109	\$2.34	\$9.32	\$2.46	\$124	\$2.46
Totals	\$171	\$17.50	\$2,150	\$72.40	\$406	\$77.70	\$2,720	\$77.70

DRAFT

Section 1

Introduction

The Ballona Creek Enhanced Watershed Management Program (EWMP) Plan describes a customized compliance pathway that 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 EWMP Plan describes the work efforts and analysis that will be conducted to develop an EWMP that addresses the Permit requirements.

The MS4 Permittees completed a Notice of Intent (NOI) for the development of an 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 efforts¹ 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 groundwater recharge and irrigation, 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:** control measures implemented on parcels to retain stormwater runoff during rain events. For the EWMP, the Group members' LID ordinances are also incorporated. In addition, residential LID programs are incorporated to incentivize adoption of rain cisterns and other methods to reduce runoff from residential properties, while also facilitating community engagement and awareness. Group members will also implement LID retrofits on public parcels.
- **Green streets:** the rights-of-way along streets offers a significant opportunity to implement control measures on public land. The EWMP includes extensive green streets to retain runoff from roads and alleys. Green streets will potentially offer many other benefits to communities in terms of aesthetics, safety and increased property values.
- **Regional projects:** these control measures are an emphasis of the Permit because they are able to capture runoff from large upstream areas. The EWMP emphasizes implementation of regional projects, particularly those that are able to retain the 85th percentile, 24-hour storm event. The BC EWMP includes 68 regional BMPs, including 10 multi-benefit regional projects that retain the storm water volume from the 85th percentile, 24-hour storm for the drainage

¹ 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.

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 RWLs and/or WBELs 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 apply 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 Ballona Creek Watershed Management Group (BCWVG): Cities of Los Angeles (lead coordinating agency), Beverly Hills, Culver City, Inglewood, Santa Monica, and West Hollywood, Los Angeles County, 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 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 receiving water limitations (RWLs) (Section V.A) and TMDL provisions (Section VI.E) by setting a path for compliance. Also, the EWMP is applicable to Minimum Control Measures (MCMs) (Section VI.D), which may be modified to more effectively address the highest priority water quality conditions.

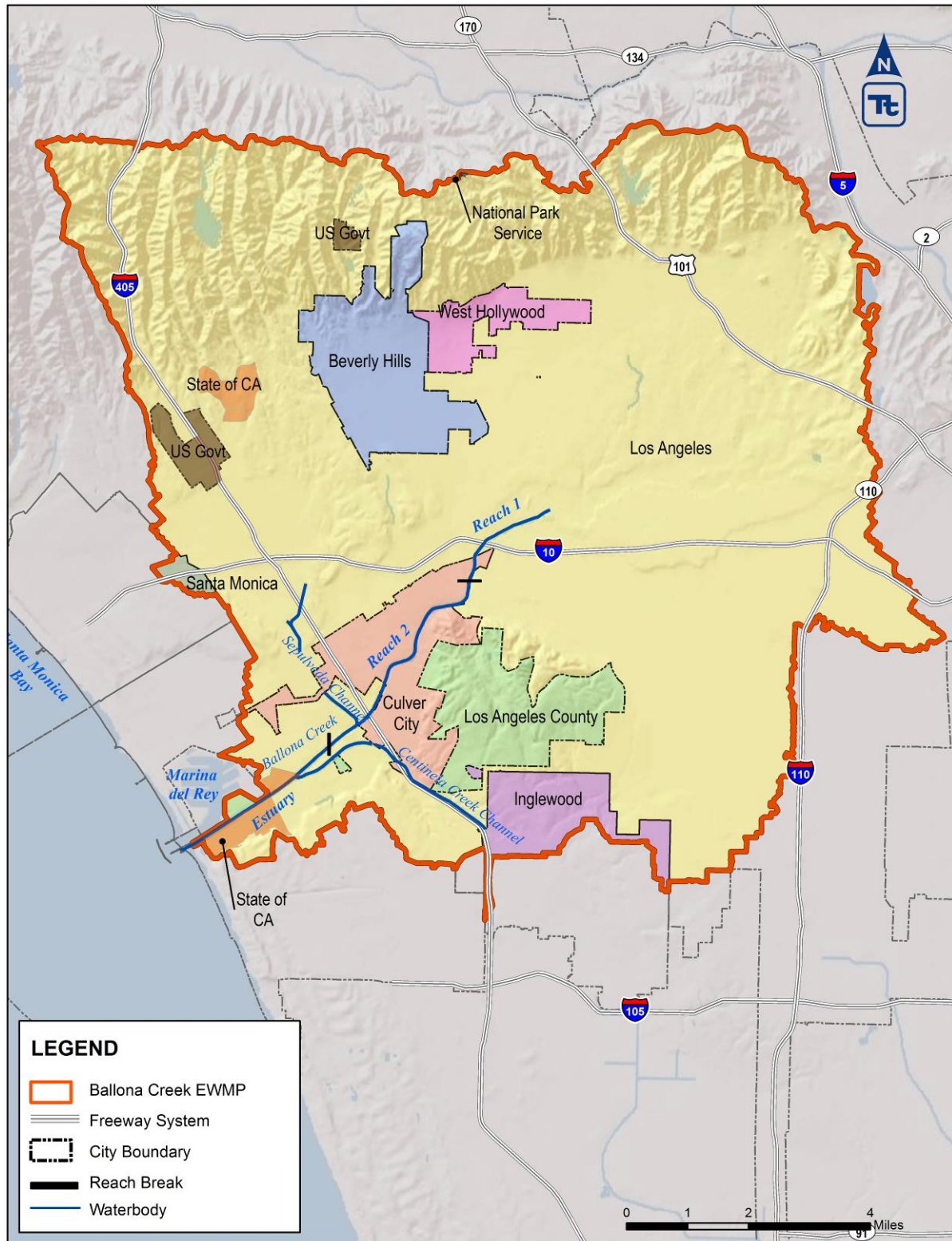


Figure 1-1 Ballona Creek Watershed Management Area

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, the Los Angeles County Flood Control District (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 BCWMA agencies 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 (*i.e.*, 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	4.03
Los Angeles County Flood Control District	Yes	NA	
City of Beverly Hills	Yes	3,618.95	4.61
City of Culver City	Yes	3,125.00	3.98
City of Inglewood	Yes	1,907.72	2.43
City of West Hollywood	Yes	1,135.00	1.45
City of Santa Monica	Yes	217.31	0.28
Area of EWMP Agencies in the BCWMA		78,441.63	100
Caltrans	No	1,651.33	
State of California	No	909.34	
US Government	No	674.49	
Total Area of the BCWMA		81,676.79	

1.3 Which Regulations are Motivating 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, Los Angeles County and 84 incorporated cities within Los Angeles County, including the cities within the BCWMA. The 2012 MS4 Permit supersedes the 2001 MS4 Permit.

The 2012 MS4 Permit contains effluent limitations, RWLs, MCMs, 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 water quality-based effluent limits (WQBELs) and/or RWLs. Section V.A of the Permit requires compliance with the WQBELs as outlined by the respective TMDLs.

1.3.2 Role of EWMP for Permit Implementation

The BCWVG has elected to collaborate on preparing an EWMP Plan that achieves the water quality objectives of the receiving waters. The BCWVG 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:

- 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 BCWVG 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 Reasonable Assurance Analysis (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 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;*
- 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 Federal Clean Water Act (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). The Regional Board carries out its CWA responsibilities through the state's Porter-Cologne Water Quality Control Act and establishes water quality objectives designed to protect beneficial uses contained in the 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 protect a narrative or numerical target, which is needed required to protect the beneficial use 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 (ends at Centinela Creek) ^{c,w}	E		E			E	E		E	E	E	E ^e	E ^f	E ^f	E	
Ballona Lagoon ^c	E		E			E	E		E	E	E	E ^e	E ^f	E ^f	E	E
Ballona Wetlands ^c	E		E						E		E	E ^e	E ^f	E ^f		E
Del Rey Lagoon ^c	E		E			E	E		E		E	E ^e	E ^f	E ^f		E
Ballona Creek Reach 2 (Estuary to National Blvd.)	p ^{s,au}	E	E	Y ^{av}	P [*]			P			P					
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.

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 89-03. 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 101(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-1 uses associated with the fishable goal as expressed in the Federal Clean Water Act section 101(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 101(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 101(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 BCWMA. Table 1-4 through Table 1-6 do not include the Santa Monica Bay Beaches Bacteria TMDLs because the WLAs for these TMDLs 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)	2004-023	08/11/2005
Ballona Creek Estuary Toxic Pollutants (BC Toxics TMDL)	2005-008	01/11/2006
	2013-010	Not Yet Effective
Ballona Creek, Ballona Estuary, and Sepulveda Channel Bacteria (BC Bacteria TMDL)	2006-011	04/27/2007
	2012-008	Not Yet Effective
Ballona Creek Metals (BC Metals TMDL)	2007-015	10/29/2008
	2013-010	Not Yet Effective
Santa Monica Bay Nearshore and Offshore Debris (Santa Monica Bay [SMB] Trash TMDL)	2010-010	03/20/2012
Santa Monica Bay DDTs and PCBs (SMB Toxics)	NA (USEPA TMDL)	03/26/2012
Ballona Creek Wetlands TMDL for Sediment and Invasive Exotic Vegetation (Wetlands TMDL)		03/26/2012

The numeric WQBELs and RWLs and the WLAs for the USEPA TMDLs listed in Table 1-5 and Table 1-6 can be found in Attachment M of the Permit. The Permit presents alternative WQBELs and RWLs for the BC Bacteria TMDL, which will become effective upon the effective date of the TMDL amendment (*i.e.*, after USEPA approval of the amendment). 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 supersede individual TMDLIPs.

Table 1-5 Interim and Final TMDL Compliance Milestones Applicable to the Ballona Creek Watershed

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	3/20	3/20	3/20		
									20%	40%	60%	80%	100%		
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%				100%	
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%				100%	
		Sediment: PCBs				25%			25%					50%	100%
BC Metals	Reach 1, 2, Sepulveda Canyon	Copper, Lead, Zinc, Selenium	% of MS4 Area Meets WQBELs	Dry	1/11		1/11		1/11					1/11	
				Wet	50%		75%		100%						
Amended BC Metals	Reach 1, 2, Sepulveda Canyon	Copper, Lead, Zinc	% of MS4 Area Meets WQBELs or Reduction in Loading		25%				50%					100%	
				Dry	1/11		1/11		1/11					1/11	
				Wet	50%		75%		100%						
BC Bacteria	Estuary	Total Coliform, Fecal Coliform, Enterococcus	Meet RWLs/WLAS	Dry		4/27								7/15	
						100 %									

Table 1-5 Interim and Final TMDL Compliance Milestones Applicable to the Ballona Creek Watershed

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
	Reach 1, 2, Sepulveda Canyon, Centinela Creek, Benedict Canyon ²	<i>Escherichia coli</i> (<i>e. coli</i>)		Wet										100%	
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											

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

²Note 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 1-6 Applicability of WQBELs, RWLs, and/or WLAs Associated with TMDLs as Identified in the Permit¹

TMDL	Constituent	BC Estuary	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	--	--	--	--	--	--	--
	Fecal Coliform	E/R	--	--	--	--	--	--	--
	Enterococcus	E/R	--	--	--	--	--	--	--
	<i>E. coli</i>	--	--	E/R	E/R	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	--	--	--	--	--	--

¹Unless explicitly stated as sediment, constituents are associated with the water column.

²Note 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.

³The BC Toxics and Metals TMDLs were amended on December 5, 2013 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.

1.5 EWMP Overview

The remainder of this EWMP Plan includes the following sections:

Section 2 – Legal Authority: Section 2 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 EWMP Group has also developed a Coordinated Integrated Monitoring Program (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 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: Section 7 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: Section 8 is 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: Section 9 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: Section 10 contains a list of references cited in the EWMP.

DRAFT

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. Agencies cited city-specific municipal codes, Los Angeles County Code (LACC), and LACFCD Code to verify legal authority to implement this section of the Permit (Appendix 2).

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.” Similar to Section VI.A.2.a, the agencies cite the municipal codes, county code, and LACFCD code as evidence of authority.

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.

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 outcome of each step. 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. 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, including:

- **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).

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 303(d) List and for which the MS4 discharges may be causing or contributing to the impairment.
3 Medium Priority	WBPCs for which there are insufficient data to indicate impairment in the receiving water according to the State's Listing Policy, but which exceed applicable 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.

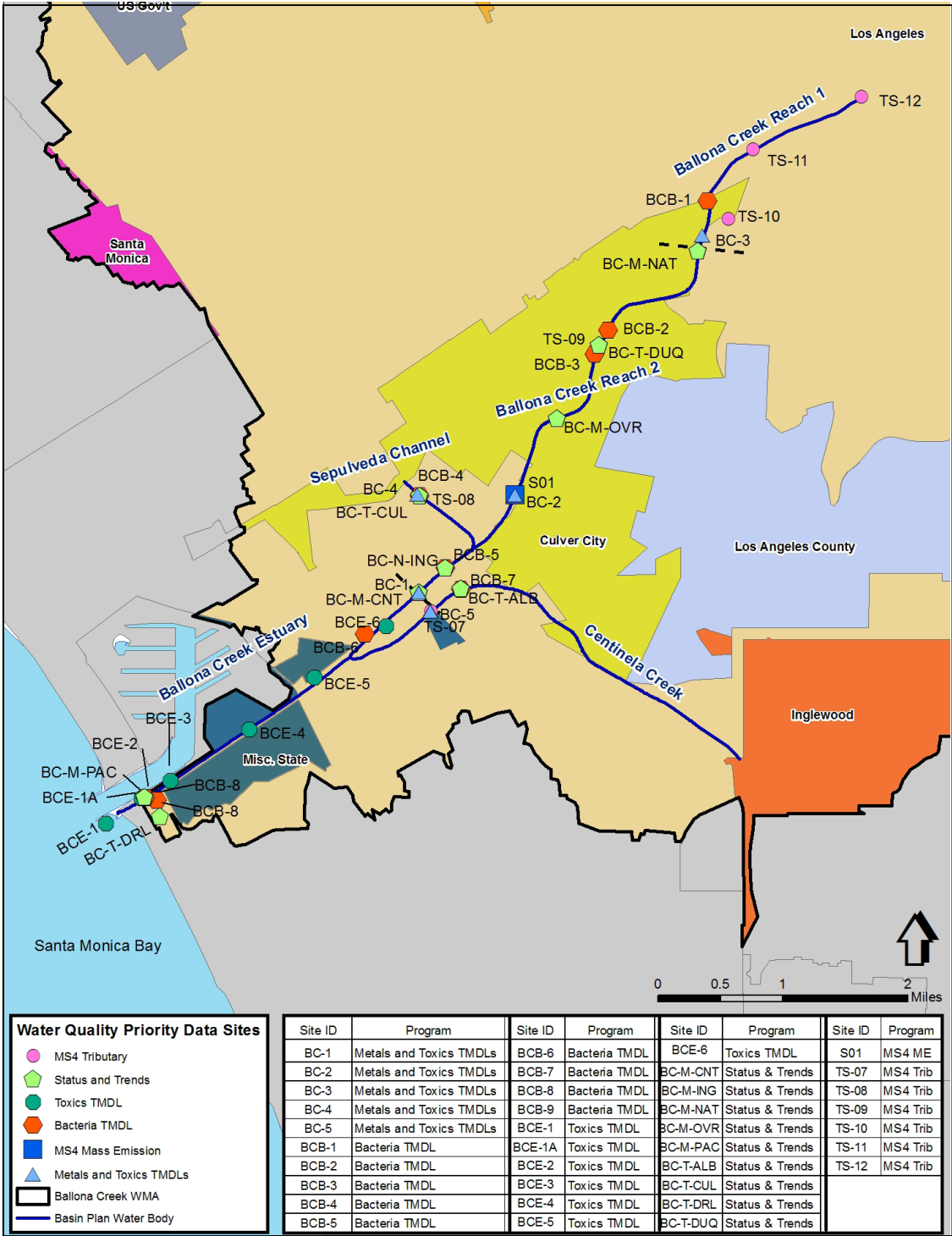


Figure 3-1 Monitoring Site Locations for Data Utilized in the Water Quality Characterization Process

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. 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.

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 (*i.e.*, 303(d) listings and other exceedances of RWLs), Part VI.C.2.a of the Permit (page 49) specifies how interim numeric milestones and compliance schedules must be set for each WBPC based on its placement in one of the following groups:

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 have 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: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements with exceedances in the past 5 years.	WBPCs with confirmed impairment or exceedances of RWLs. WBPCs in a similar class ¹ as those with TMDLs are identified. WBPCs currently on the 303(d) List are differentiated from those that are not to support utilization of EWMP compliance mechanisms.
	Category 2B: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements that are not a “pollutant” ² (e.g., toxicity).	WBPCs where specific actions may not be identifiable because the cause of the impairment or exceedances is not resolved. Either routine monitoring or special studies identified in the CIMP should support identification of a “pollutant” linked to the impairment and re-prioritization in the future.
	Category 2C: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements but there have been no exceedances in the past 5 years.	WBPCs where specific actions for implementation may end up not being identified because recent exceedances have not been observed (and thus specific BMPs may not be necessary.) Pollutants that are in a similar class ¹ as those with TMDLs are identified. Either routine monitoring or special studies identified in the CIMP should ensure these WBPCs are addressed to support re-prioritization in the future.
3	Category 3A: All other WBPCs that have exceeded in the past 5 years.	Pollutants that are in a similar class ¹ as those with TMDLs are identified.
	Category 3B: All other WBPCs that are not a “pollutant” ² (e.g., toxicity).	WBPCs where specific actions may not be identifiable because the cause of the impairment or exceedances is not resolved. Either routine monitoring or special studies identified in the CIMP should support identification of a “pollutant” linked to the impairment and re-prioritization in the future.
	Category 3C: All other WBPCs that have exceeded in the past 10 years, but not in past 5 years.	Pollutants that are in a similar class ¹ as those with TMDLs are identified.

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

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

- **Group 1:** Pollutants that are in the same class² 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; or
- **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.
- **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 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 Proposed Interim 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 (*i.e.*, interim and final numeric limits). Interim and final compliance dates in the Amended BC Metals TMDL, the Amended BC Toxics TMDL, and the BC Bacteria TMDL are the primary drivers for the BCWMA RAA and EWMP implementation schedule and are presented in Table 3-3. Table 3-4 presents the compliance schedule for USEPA TMDLs, 303(d) listings, and other RWL exceedances. 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. 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 3-4 may be revised in the future.

For pollutants which have exceeded RWLs at a very low exceedance frequency over the past ten years throughout the BCWMA, a schedule was not created because specific implementation actions (beyond those already being implemented to achieve compliance with RWLs) are not required to address such low exceedance frequencies. Exceedance frequencies were determined to be very low if per available data, the exceedance frequency was less than what is necessary to make an impairment finding in the receiving water according to the State's Listing Policy (*i.e.*, Category 3 WBPCs). Table 3-5 presents the justification for why a compliance schedule is not warranted for the remaining 303(d) listings and other RWL exceedances for which no compliance schedule was included.

² 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.

Table 3-3 Summary of Compliance Dates and Milestones for TMDLs in the BCWMG 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	3/20	3/20	3/20		
									20%	40%	60%	80%	100%		
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%				100%	
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%				100%	
		Sediment: PCBs				25%			25%					50%	100%
BC Metals	Reach 1, 2, Sepulveda Canyon	Copper, Lead, Zinc, Selenium	% of MS4 Area Meets WQBELs	Dry	1/11		1/11		1/11					1/11	
				Wet	50%		75%		100%						
Amended BC Metals	Reach 1, 2, Sepulveda Canyon	Copper, Lead, Zinc	% of MS4 Area Meets WQBELs or Reduction in Loading		25%				50%					100%	
				Dry	1/11		1/11		1/11					1/11	
				Wet	50%		75%		100%						

Table 3-3 Summary of Compliance Dates and Milestones for TMDLs in the BCWMG 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	Total Coliform, Fecal Coliform, Enterococcus	Meet RWLs/WLAs	Dry		4/27								7/15	
						100%									
	Reach 1, 2, Sepulveda Canyon, Centinela Creek, Benedict Canyon ¹	<i>Escherichia coli (e. coli)</i>		Wet										100%	
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, 2017.

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 3-4 Compliance Schedule for Water Quality Priority WBPCs in the EWMP Which Warrant a Compliance Schedule

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%					100%	
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%					100%	
DDT (sediment)	C1 (EPA TMDL): Santa Monica Bay	Amended BC Toxics	All		25%			50%	75%				100%	
PCBs (sediment)	C1 (EPA TMDL): Santa Monica Bay	Amended BC Toxics	All		25%			25%					50%	100%
Sediment	C1 (EPA TMDL): Wetlands	Amended BC Toxics	All		25%			50%	75%				100%	
4,4'-DDE	C3: Reach 2 C2: Centinela	Amended BC Toxics	Wet		25%			50%	75%				100%	
Benzo(a)anthracene	C2: Reach 2 C3: Centinela	Amended BC Toxics	Wet		25%			50%	75%				100%	
Dibenzo(a,h)anthracene	C2: Estuary	Amended BC Toxics	Dry		25%			50%	75%				100%	
Indeno(1,2,3-cd)pyrene	C2: Estuary C3: Reach 2 C3: Centinela	Amended BC Toxics	All		25%			50%	75%				100%	
Shellfish Harvesting Advisory	C2: Estuary	BC Bacteria	Dry										100%	
			Wet										100%	

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

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 3-5 Water Quality Priority WBPCs Which Do Not Warrant a Compliance Schedule

Constituent	WQP Category and Water Body	Compliance Schedule Source	Weather Condition	Justification for Why WBPC Does Not Warrant a Compliance Schedule
Cadmium (total)	C3: Reach 2 C3: Reach 1 C3: Centinela	None	Wet	Only 2 of 103 exceedances in last 10 years in Reach 2, 1 of 20 exceedances in last 10 years in Reach 1, and 2 of 38 exceedances in last 10 years in Centinela Creek ¹
4,4'-DDT	C3: Centinela	None	Wet	Only 1 of 27 exceedances in last 10 years in Centinela Creek ¹
3,4 Benzofluoranthene	C3: Reach 2	None	Wet	Only 1 of 59 exceedances in last 10 years in Reach 2 ¹
alpha-chlordane	C3: Reach 2	None	Wet	Only 1 of 57 exceedances in last 10 years in Reach 2 ¹
gamma-chlordane	C3: Reach 2	None	Wet	Only 1 of 57 exceedances in last 10 years in Reach 2 ¹
Benzo(a)pyrene	C3: Reach 2	None	Wet	Only 1 of 66 exceedances in last 10 years in Reach 2 ¹
Benzo(k)fluoranthene	C3: Centinela	None	Wet	Only 1 of 27 exceedances in last 10 years in Centinela Creek ¹
Bis(2-Ethylhexyl) phthalate	C3: Reach 2 C3: Centinela C3: Sepulveda	None	All	Only 5 of 72 exceedances in last 10 years in Reach 2, 1 of 14 exceedances in last 10 years in Centinela Creek, and 1 of 14 exceedances in last 10 years in Sepulveda Channel ¹
Chrysene	C3: Reach 2 C3: Centinela	None	Wet	Only 1 of 66 exceedances in last 10 years in Reach 2 and 1 of 27 exceedances in last 10 years in Centinela Creek ¹
Diazinon	C3: Reach 2 C3: Sepulveda	None	Wet	Only 2 of 61 exceedances in last 10 years in Reach 2 and 1 of 11 exceedances in last 10 years in Sepulveda Channel ¹
Cyanide	C2: Reach 2 C3: Sepulveda	None	All	Meets criteria to de-list for waterbodies on 303(d) list and does not meet criteria to be placed on 303(d) list for waterbodies not on 303(d) list
Ammonia	C3: Reach 2 C2: Sepulveda	None	Dry	Meets criteria to de-list for waterbodies on 303(d) list and does not meet criteria to be placed on 303(d) list for waterbodies not on 303(d) list
Dissolved Oxygen	C3: Reach 2	None	All	Reflective of a condition of pollution, not necessarily a result of MS4 discharge
pH	C2: Reach 2 C2: Sepulveda	None	All	Reflective of a condition of pollution, not necessarily a result of MS4 discharge

¹ As a result, pollutant does not necessitate implementation actions. If exceedances are observed in greater than 10 percent of samples in the future, a schedule and milestones will be developed.

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.A.

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 EWMP³. 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 and institutional control measures is provided in Section 5.

4.1 What are the Benefits of Regional Projects?

Regional projects are centralized facilities located near the downstream ends of large drainage areas (typically treating 10s to 100s of acres). Regional projects have access to large volumes of runoff from extensive upstream areas, and thus can provide a cost-effective mechanism for infiltration and pollutant reduction. Runoff is typically diverted to regional projects after it has already entered storm drains and engineered channels. Routing offsite runoff to public parcels (versus treating surface runoff near its source, as with green streets and LID) often allows regional BMPs to be placed in the cost-effective locations with the best available BMP opportunity. The regional project program will consider not only the interactions between BMPs and their environmental factors, but to also consider synergies and integration with concurrent drinking water, wastewater, and other engineering programs.

It is important to emphasize that regional projects offer a variety of benefits beyond simply water quality improvement including water supply augmentation, community enhancement, and habitat restoration. This 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

Regional BMP Program Highlights:

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

³ 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.

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

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

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

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

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

A wide array of region 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 show the different types of regional projects, including the following illustrated in Figure 4-1:

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

Through detailed screening processes, water quality modeling and feasibility analyses (described in subsequent subsections), regional projects⁴ 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

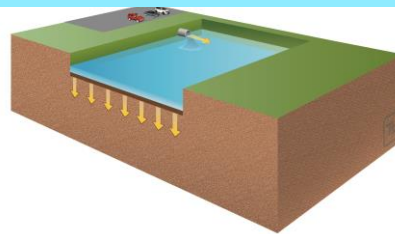
⁴ While the Permit emphasizes Regional EWMP Projects that can retain the 85th percentile, 24-hour storm from its upstream drainage area, EWMP Group members determined that it would be useful to identify and include the broadest group of all potential regional BMP projects and locations, and not simply the subset of projects that could capture the 85th percentile storm

- **“Medium”**: projects located on parcels owned by other agencies (*i.e.*, school districts) but with nonetheless be evaluated for EWMP implementation. Not all EWMP Group members included Medium projects in their EWMP Implementation Strategy.

In addition, a fourth category of regional project was utilized by the RAA – “regional BMPs on private land” – in cases where the water quality modeling required more pollutant reduction than could be achieved with the identified BMP opportunities for LID, green infrastructure and regional BMPs on public land. Regional projects on private land were generally given the lowest priority for implementation, although there are some significant opportunities to integrate 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.

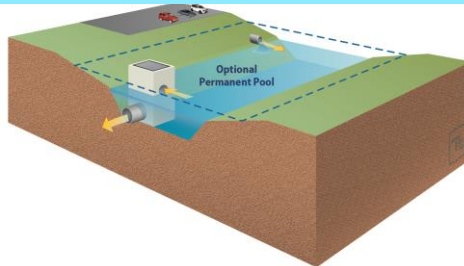
Infiltration Basins

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



Detention Basins

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



Constructed Wetlands

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

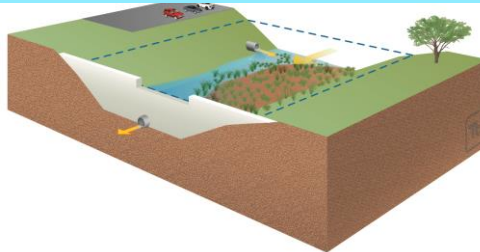


Figure 4-1 Examples of Types of Regional Projects to be used for EWMP Implementation (more details provided in Appendix 4.A)

4.3 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 15 Very High and 28 High projects are included in the EWMP Implementation Strategy⁵. Combined, as shown in Figure 4-2, regional projects on public land make up 18 percent of the total control measure capacity⁶ in the EWMP.

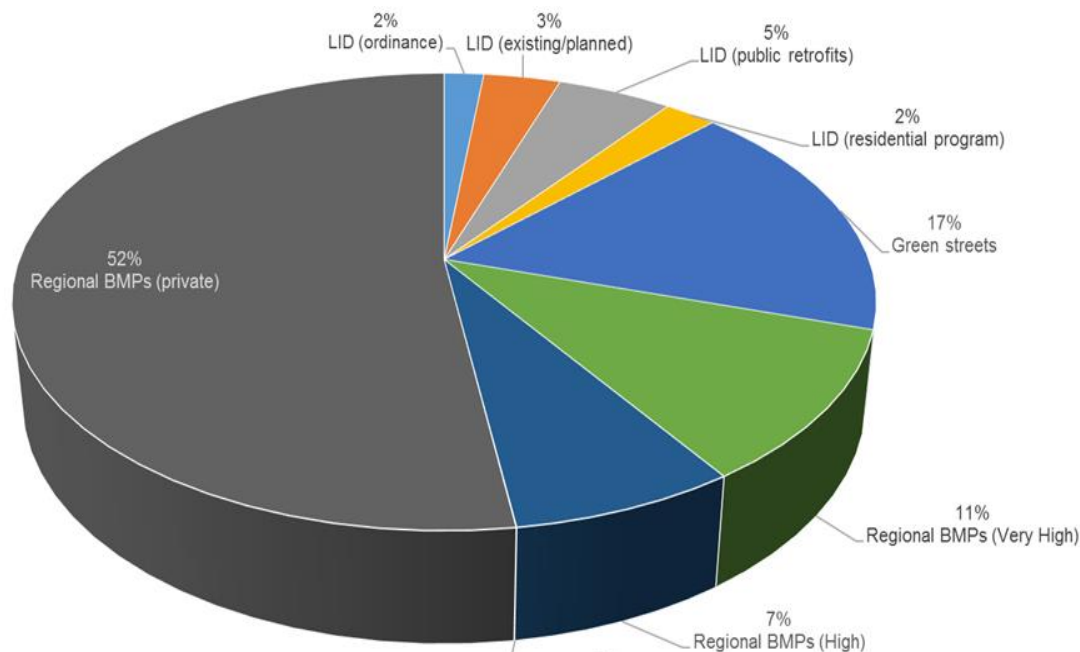


Figure 4-2 Relative Capacities of Different Control Measure Categories to be implemented by the BC EWMP by 2021

Regional projects on private land make up an additional 52 percent of the EWMP capacity⁷. 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 (*e.g.*, school district properties), then regional project would make up an even larger component of the EWMP.

⁵ 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). The signature regional projects were subject to conceptual level designs as described below.

⁶ 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.

⁷ The capacities shown in Figure 4-3 are for implementation through 2021.

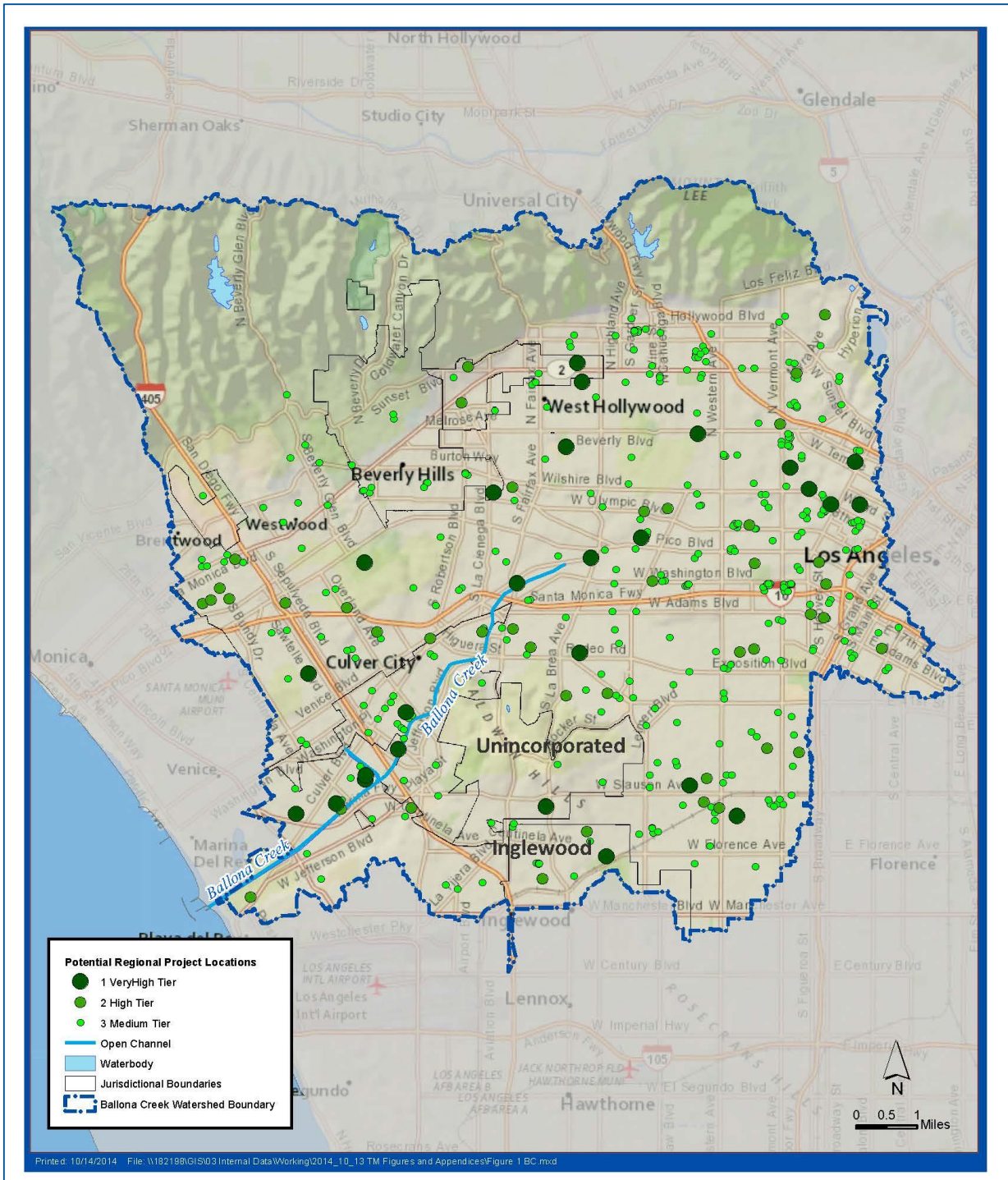


Figure 4-3 Regional Project Opportunities in the Ballona Creek Watershed

4.4 How were Regional BMPs Selected for the EWMP?

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



Emphasis was placed on developing and implementing a process for Step 2, Identify New/Additional Regional Projects. All parcels within the watershed were evaluated according to GIS criteria such as: parcel ownership, land use, parcel size, slope, proximity to 36-inch storm drain or open channel, 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 4-4. Of these more than half of the Very High and High opportunities were evaluated by the RAA and selected for inclusion in the EWMP based on cost-benefit optimization. Most agencies determined that Medium opportunities, because they would include siting regional projects located on other agencies land, should be evaluated for inclusion in the EWMP over the course of adaptive management (rather than including them in the 2015 draft).

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 addition 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 is presented in Appendix 4.C: Engineering and Environmental Feasibility for Selected Regional Project Sites, February 2015. Key design parameters considered for each signature project are presented in Table 4-2. Each of the signature regional projects will achieve multiple benefits including water supply, groundwater recharge, flood control, recreation and/or habitat.

The signature regional projects emphasize subsurface retention and infiltration as primary functionality. On the following pages (Figure 4-5 through 4-28), 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.
- 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.

Table 4-1 Summary of Signature Projects

Regional Project	BMP Type	Maximum Drainage Area		Alternative Drainage Area		Available BMP Volume	Recommended BMP Volume	Retain the 85 th Percentile, 24-Hour Storm Event	Cost
		(acres)	BMP Volume (AF)	(acres)	BMP Volume (AF)	(AF)	(AF)		
Rancho Park Golf Course	Surface and Subsurface Retention & Infiltration	7,273	181.4	359	7.7	403	11.6	Yes	
La Cienega Park	Subsurface Retention & Infiltration	7,776	352	578	24	51.3	24	Yes	
Culver Boulevard Median	Subsurface Retention & Infiltration	829	41	139	5.6	33.7	29.2	No	
Edward Vincent Junior Park	Biofiltration and Wetlands	983	31.5	453	11	63	45.7	Yes	
Lafayette Park	Subsurface Retention & Infiltration	2,864	143.5	637	30.4	25	18	No	
Poinsettia Park	Subsurface Retention & Infiltration	1,379	56	N/A	N/A	15.5	10.1	No	
Queen Anne Recreation Center	Subsurface Retention & Infiltration	8,537	397.3	3,067	141.7	42	11.6	No	
Plummer Park	Subsurface Retention & Infiltration	389	13	283	9.3	7.2	7.2	No	
Ladera Park	Subsurface Retention & Infiltration	155	5.1	N/A	N/A	7.0	5.3	Yes	

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 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 85 th 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 85 th percentile design storm generated from the alternative drainage area.
	Groundwater Depth	The groundwater depth in feet from the ground surface. Groundwater depths were determined using groundwater contours and ground elevation geographic information system (GIS) data provided by the City.
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 BMP volume 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

Rancho Park Golf Course 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. The figures 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 Design Parameters

Summary of Rancho Park Golf Course (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	50 feet
BMP Design Parameters	BMP Opportunity Area	15.5 acres
	Recommended Maximum BMP Depth	26 feet
	Available BMP Volume	403 AF
	Recommended Active BMP Volume	11.6 AF

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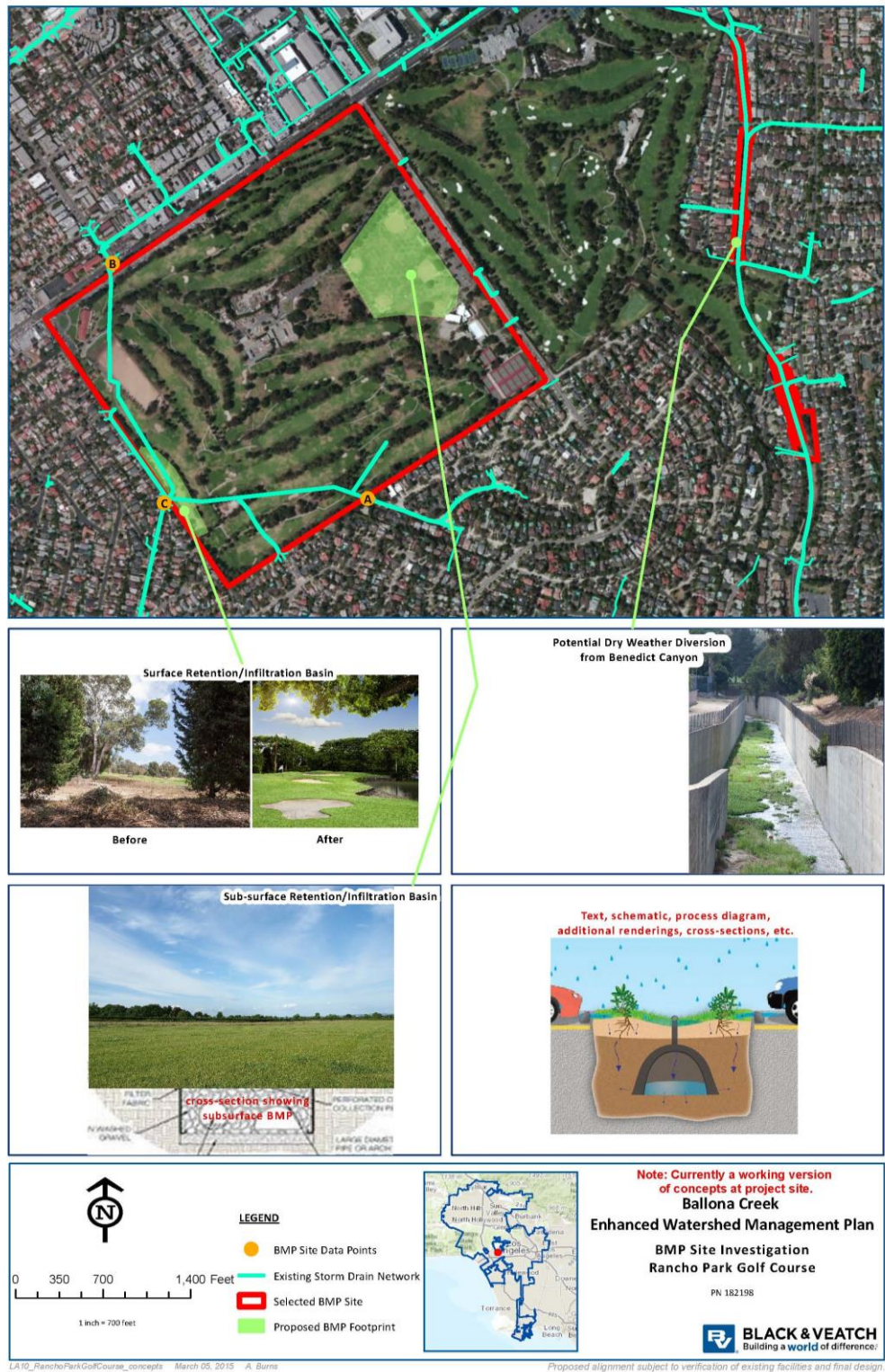


Figure 4-2 Rancho Park Golf Course Surface and Subsurface Infiltration Site – Site Map

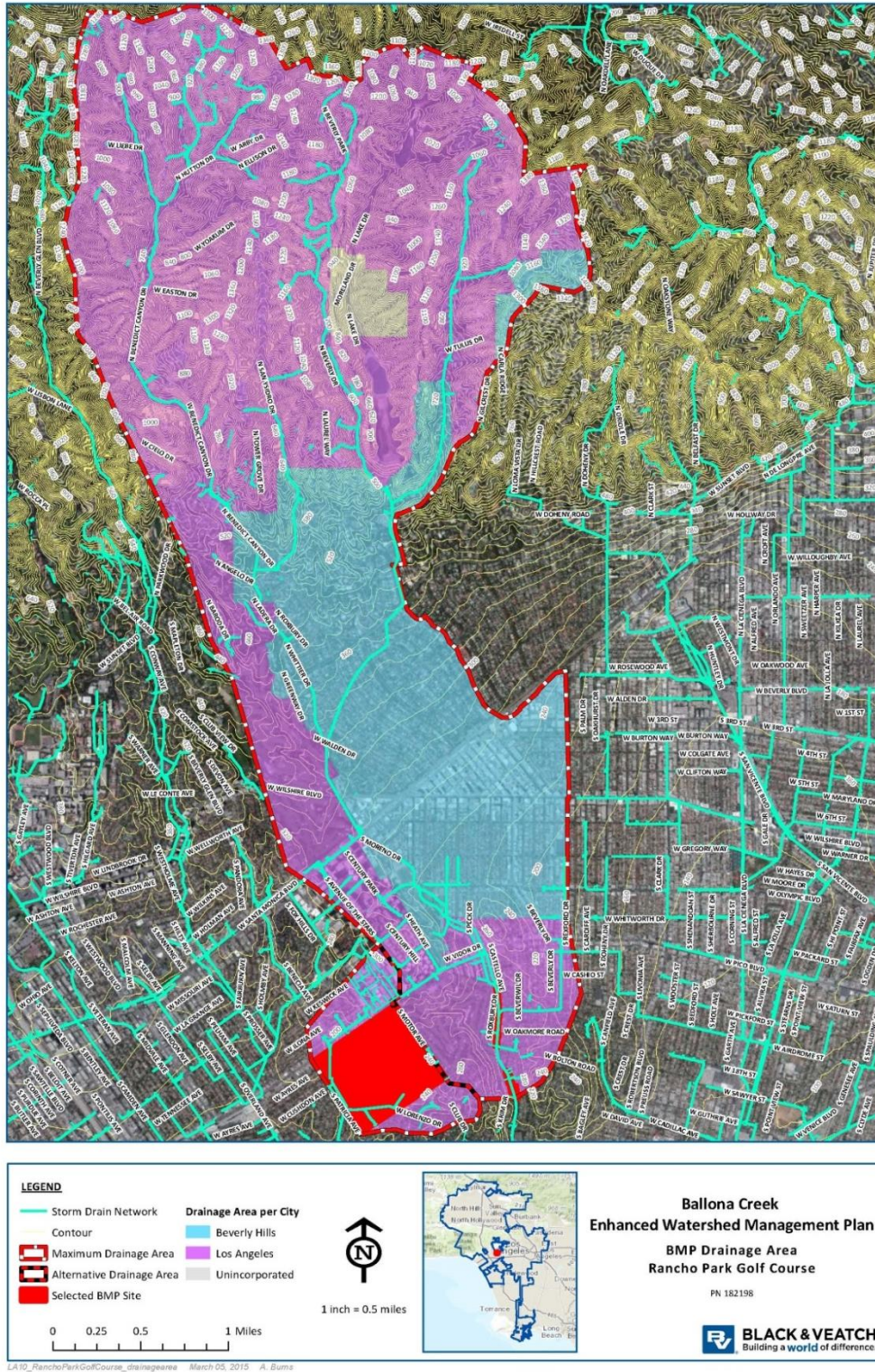


Figure 4-3 Rancho Park Golf Course Surface and Subsurface Infiltration Basin – Drainage Map



Figure 4-4 Rancho Park Golf Course 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. The figures 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

Summary of La Cienega Park / Frank Fenton Field (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

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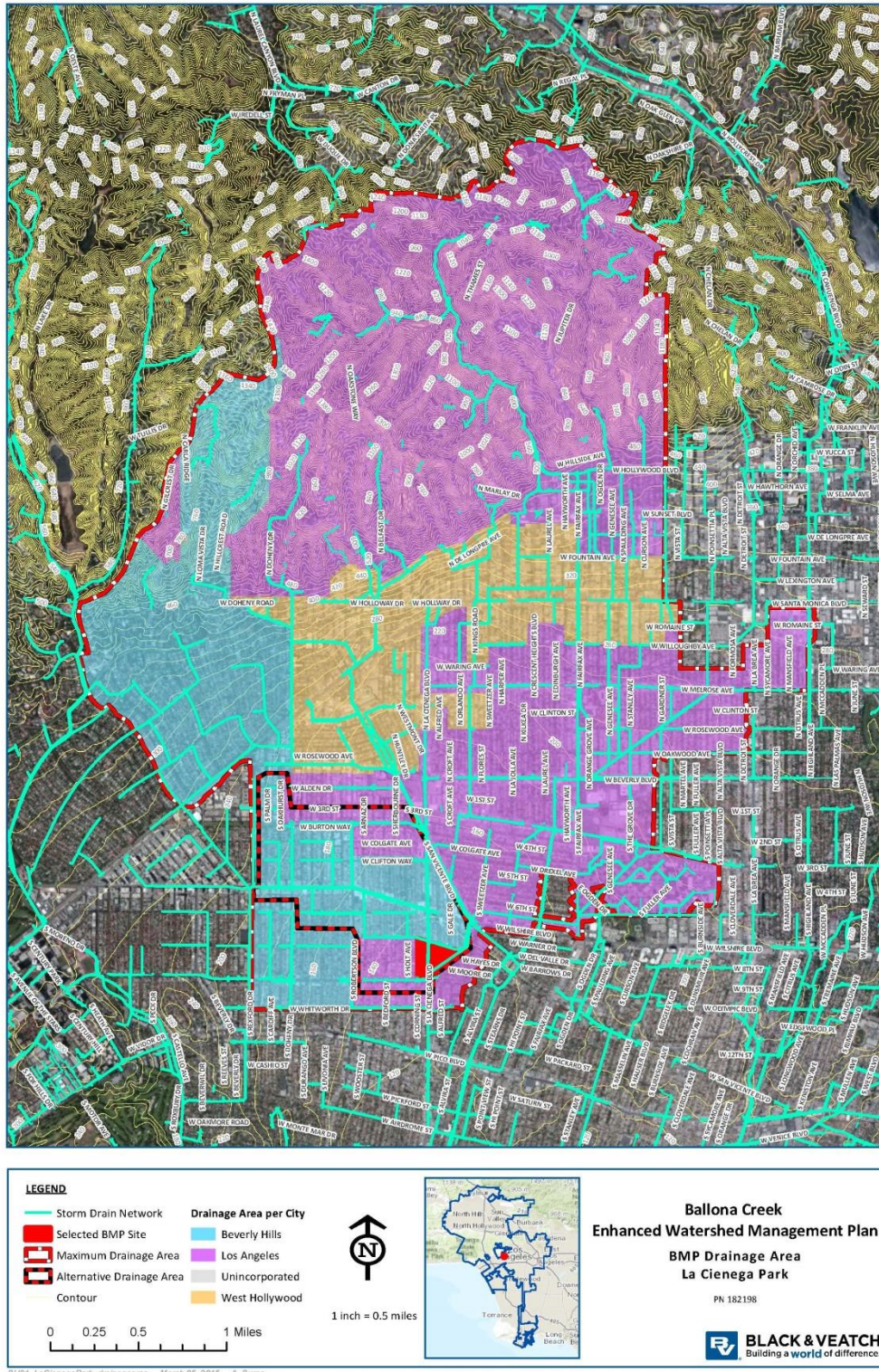
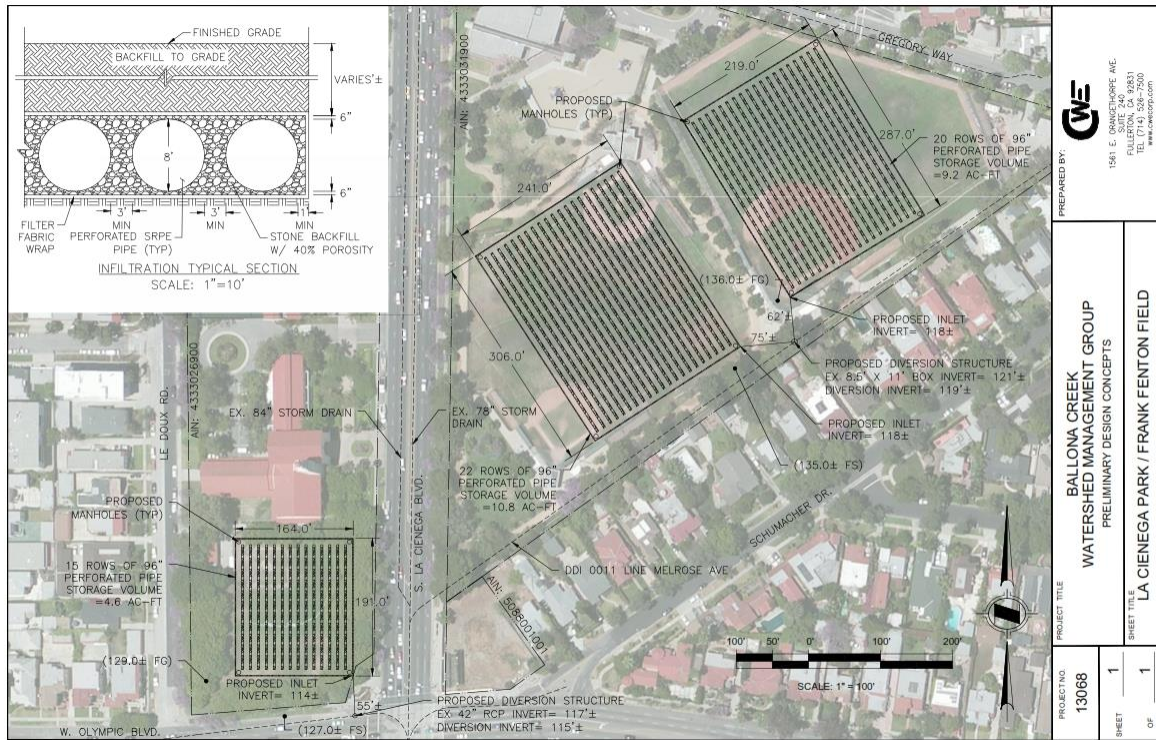


Figure 4-6 La Cienega Park Subsurface Infiltration Drainage Area – Drainage Map



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 Huron Avenue 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 cannot accommodate the 85th percentile, 24-hour design storm runoff contributed from the maximum 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. The figures 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

Summary of Culver Boulevard Median (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

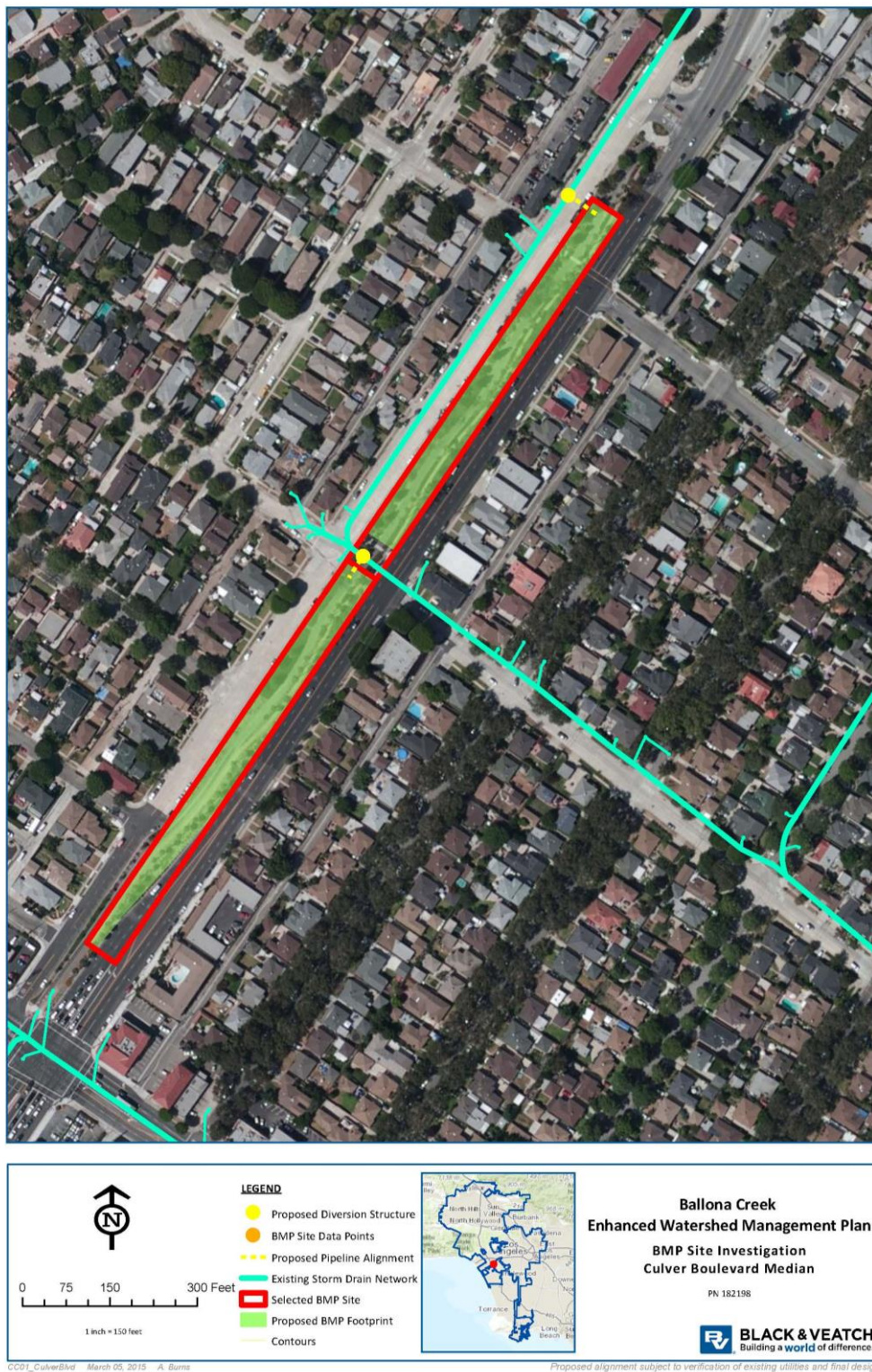


Figure 4-8 Culver Boulevard Median Subsurface Infiltration Site – Site Map

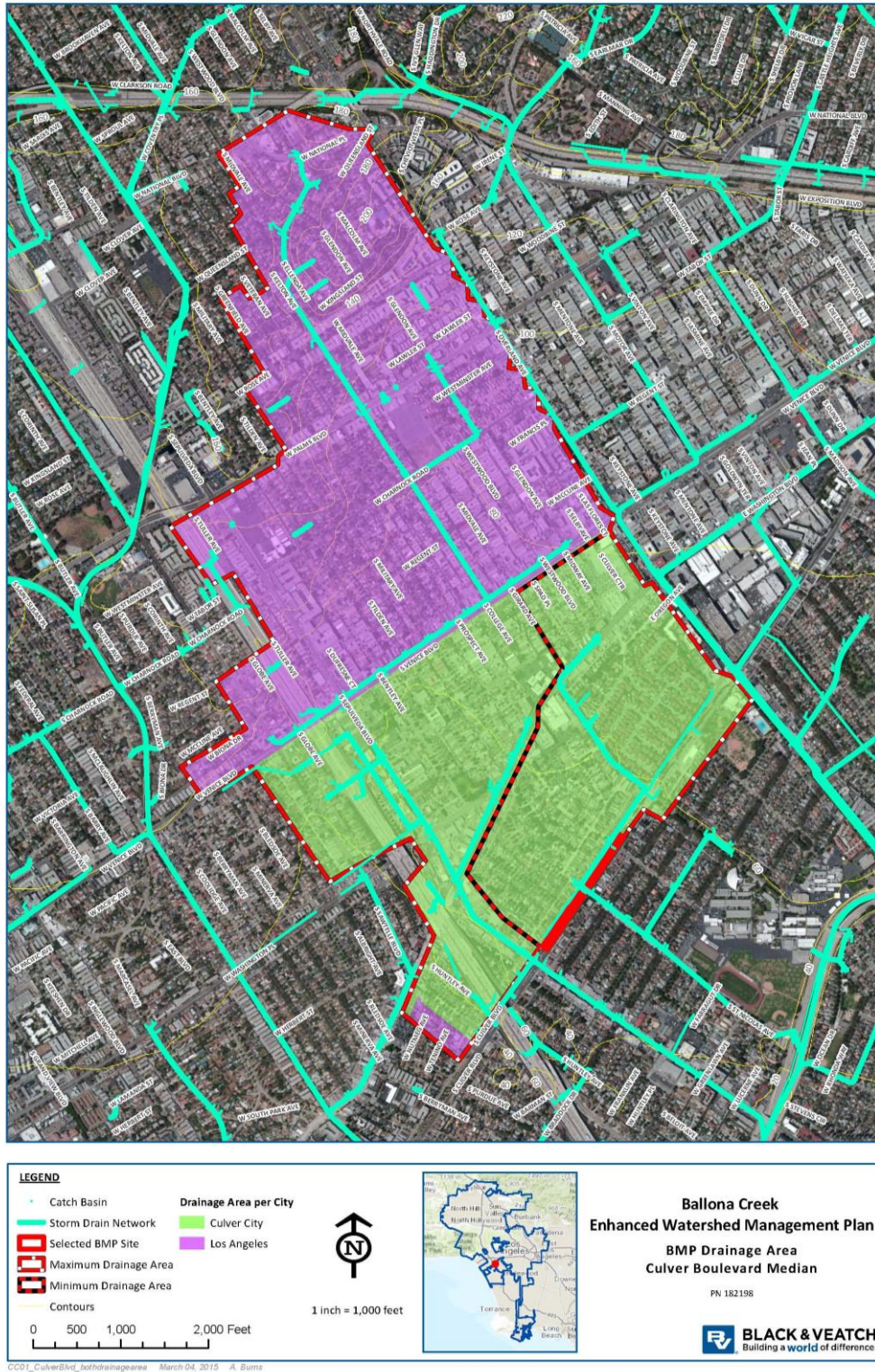


Figure 4-9 Culver Boulevard Median Subsurface Infiltration Drainage Area – Drainage Map

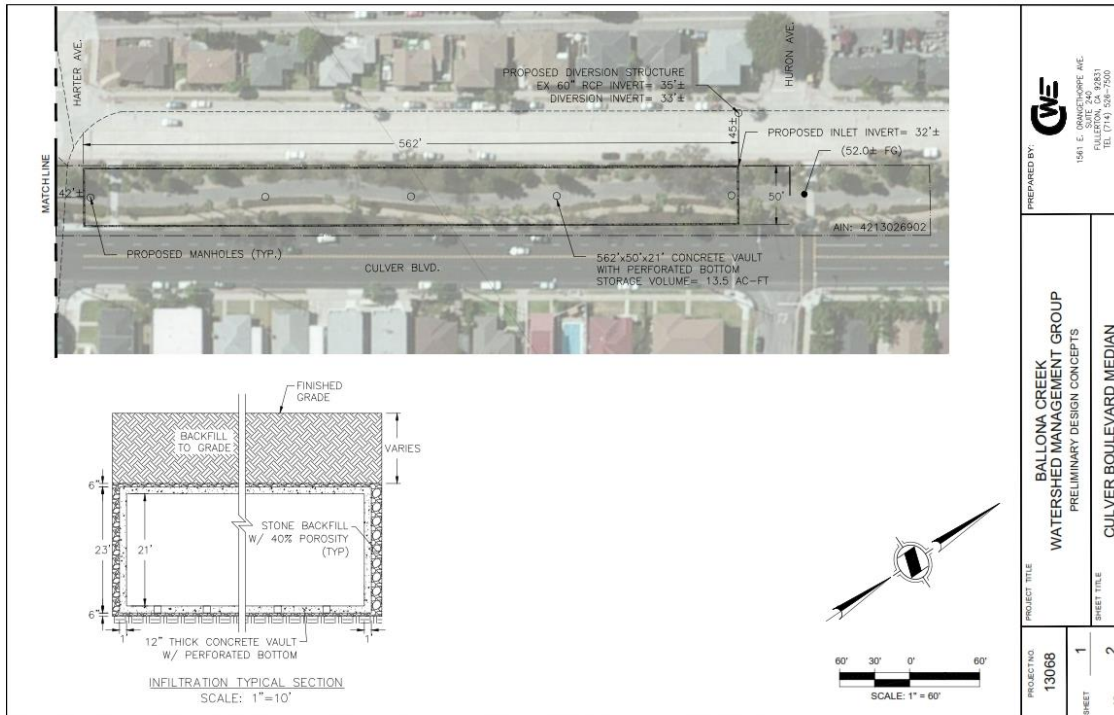


Figure 4-10 Culver Boulevard Median Subsurface Infiltration Drainage Area – Preliminary Design Concepts (1 of 2)

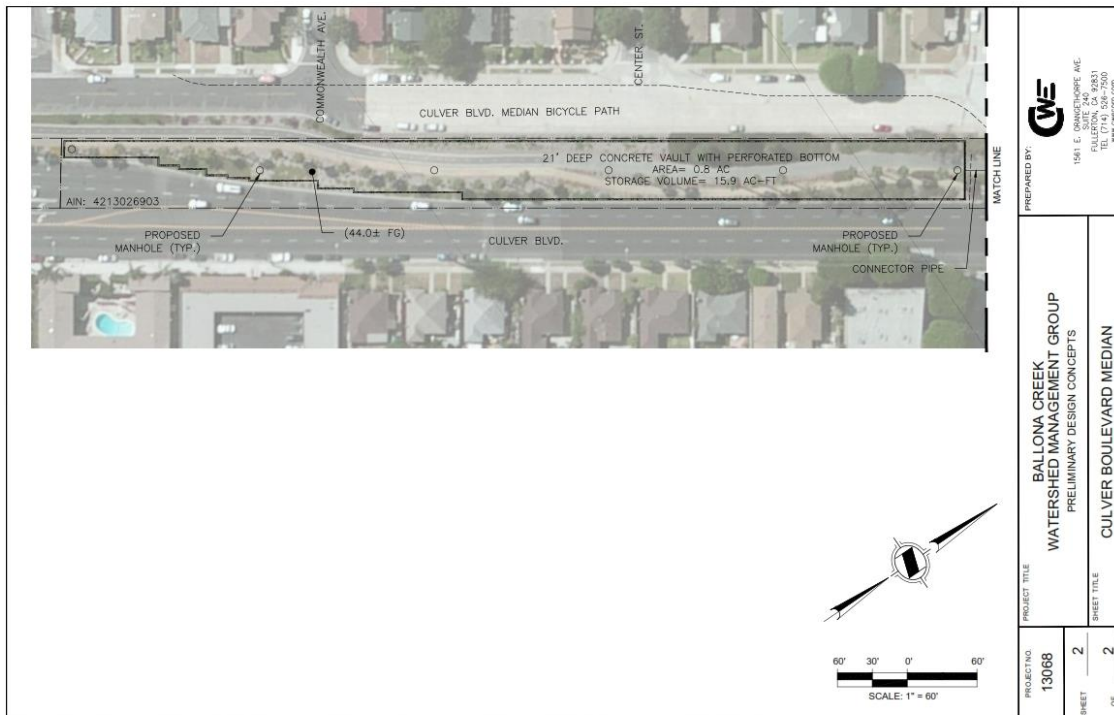


Figure 4-11 Culver Boulevard Median Subsurface Infiltration Drainage Area – Preliminary Design Concepts (2 of 2)

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. The figures 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

Summary of Edward Vincent Jr. Park (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	180 feet
BMP Design Parameters	BMP Opportunity Area	6.3 acres
	Recommended Maximum BMP Depth	10 feet
	Available BMP Volume	63 AF
	Recommended Active BMP Volume	45.7 AF



Figure 4-12 Edward Vincent Junior Surface Infiltration Site – Site Map

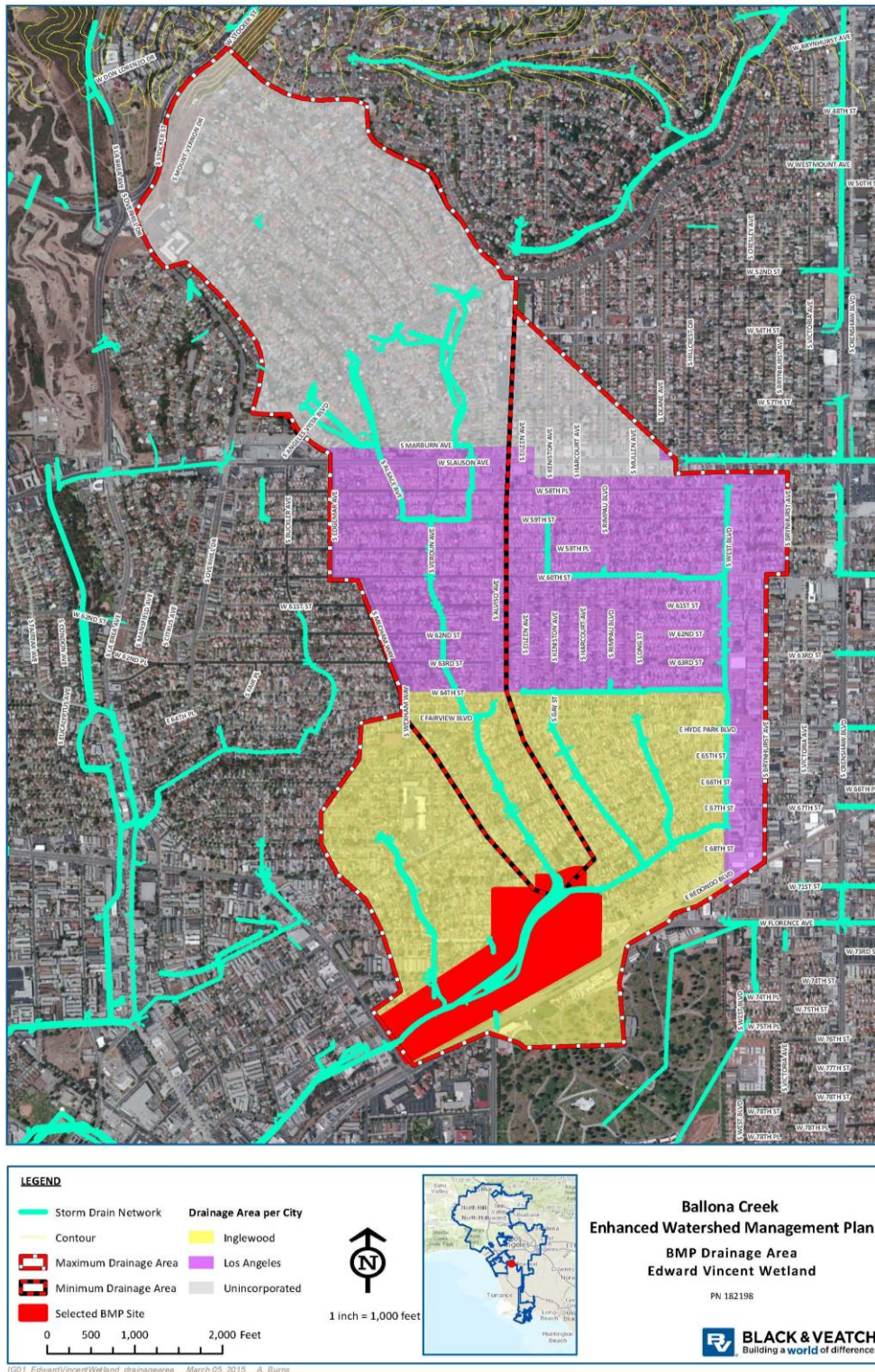


Figure 4-13 Edward Vincent Junior Surface Infiltration Site – Drainage Map

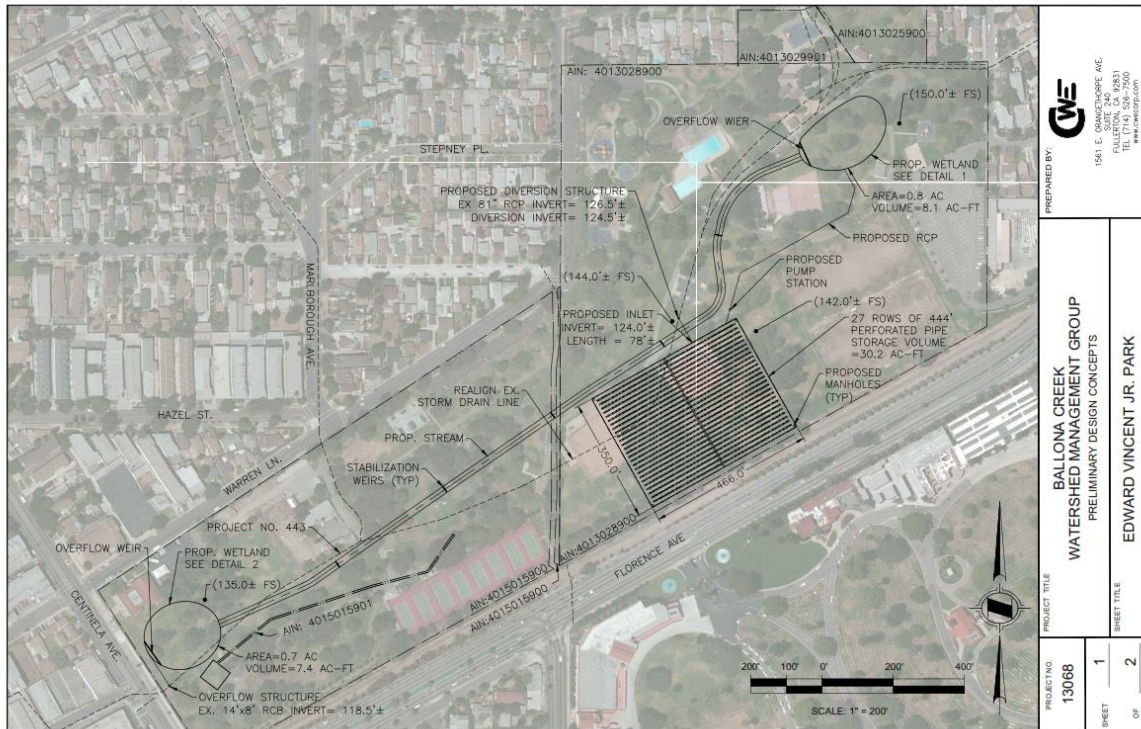


Figure 4-14 Edward Vincent Junior Surface Infiltration Site – Preliminary Design Concepts (1 of 2)

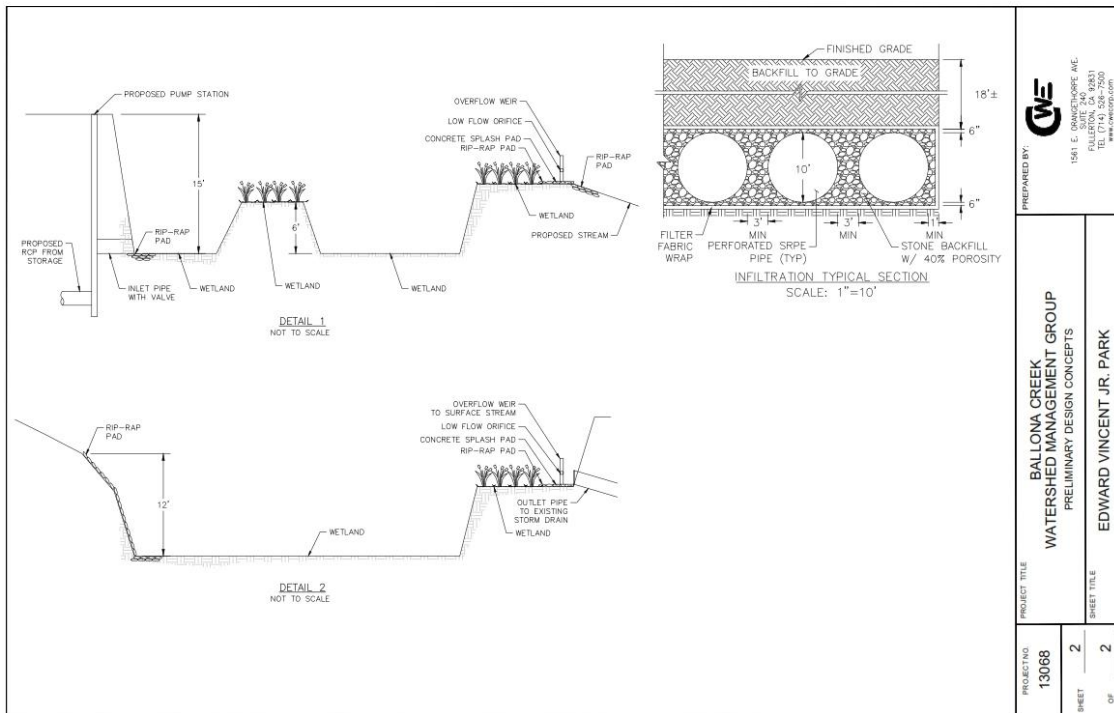


Figure 4-15 Edward Vincent Junior Surface Infiltration Site – Preliminary Design Concepts (2 of 2)

4.5.5 Plummer Park

Plummer Park is located within the City of West Hollywood in an area that drains to Benedict Canyon. The park consists of a community center, tennis courts, a war memorial, and several wooded areas with mature 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 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, a BMP implemented at this site will provide important water quality benefits; however, it will not qualify as a regional project site.

Table 4.7 below summarizes some key conceptual design parameters for this project site. The figures 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

Table 3.5-1 Summary of Plummer Park (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	13 feet
BMP Design Parameters	BMP Opportunity Area	0.9 acres
	Recommended Maximum BMP Depth	8 feet
	Available BMP Volume	7.2 AF
	Recommended Active BMP Volume	7.2 AF

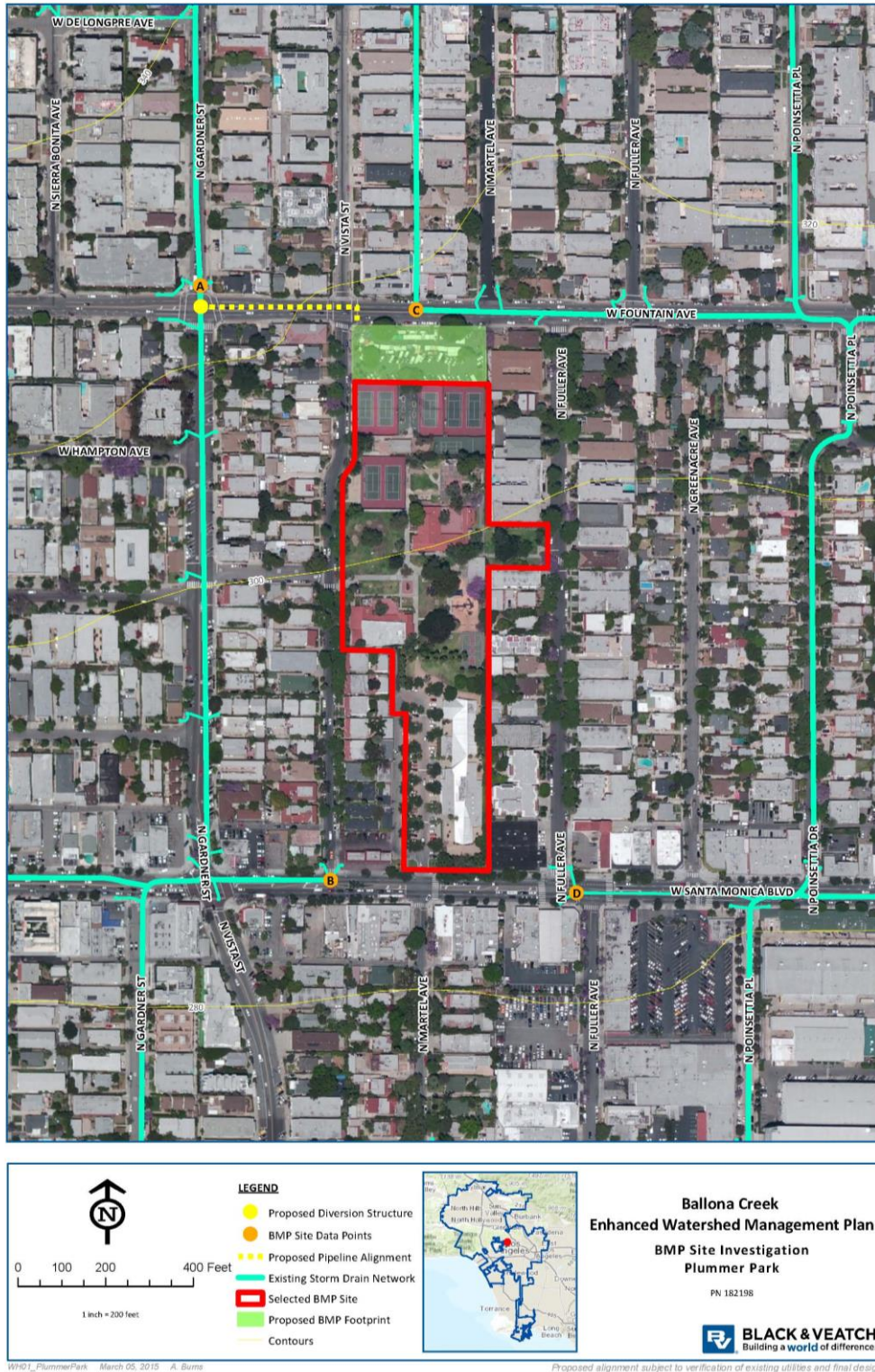


Figure 4-16 Plummer Park Subsurface Infiltration Site – Site Map

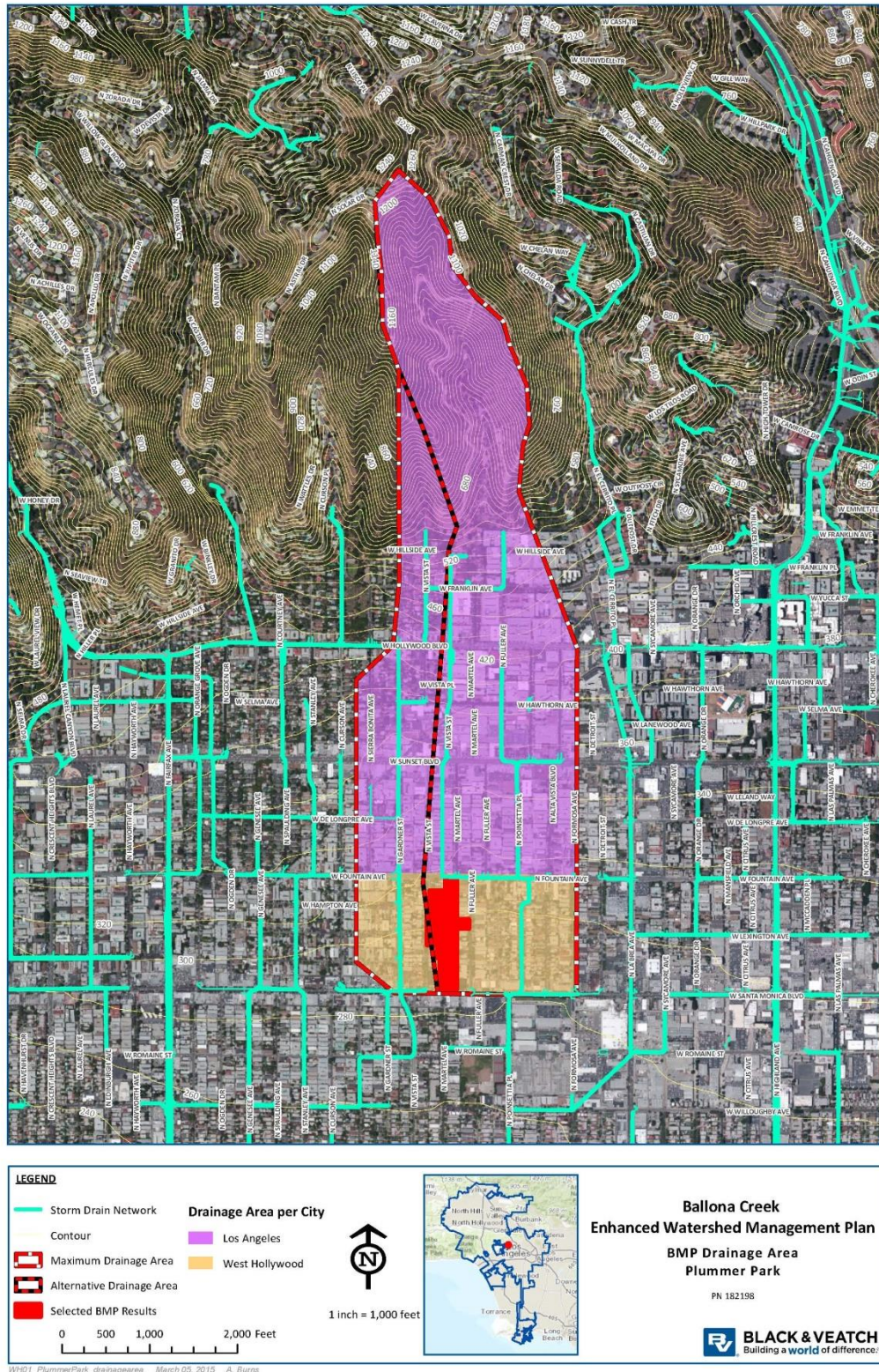


Figure 4-17 Plummer Park Subsurface Infiltration Site - Drainage Map



Figure 4-18 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. The figures 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

Summary of Queen Anne Recreation Center (LA05)		
Project Site Parameters	Total (Maximum) Drainage Area	8,537 acres
	Alternative (Minimum) Drainage Area	3,067 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	20 feet
	Available BMP Volume	42 AF
	Recommended Active BMP Volume	11.6 AF



Figure 4-19 Queen Anne Recreation Center Subsurface Infiltration Site – Site Map



Figure 4-20 Queen Anne Recreation Center Subsurface Infiltration Site - Drainage Map

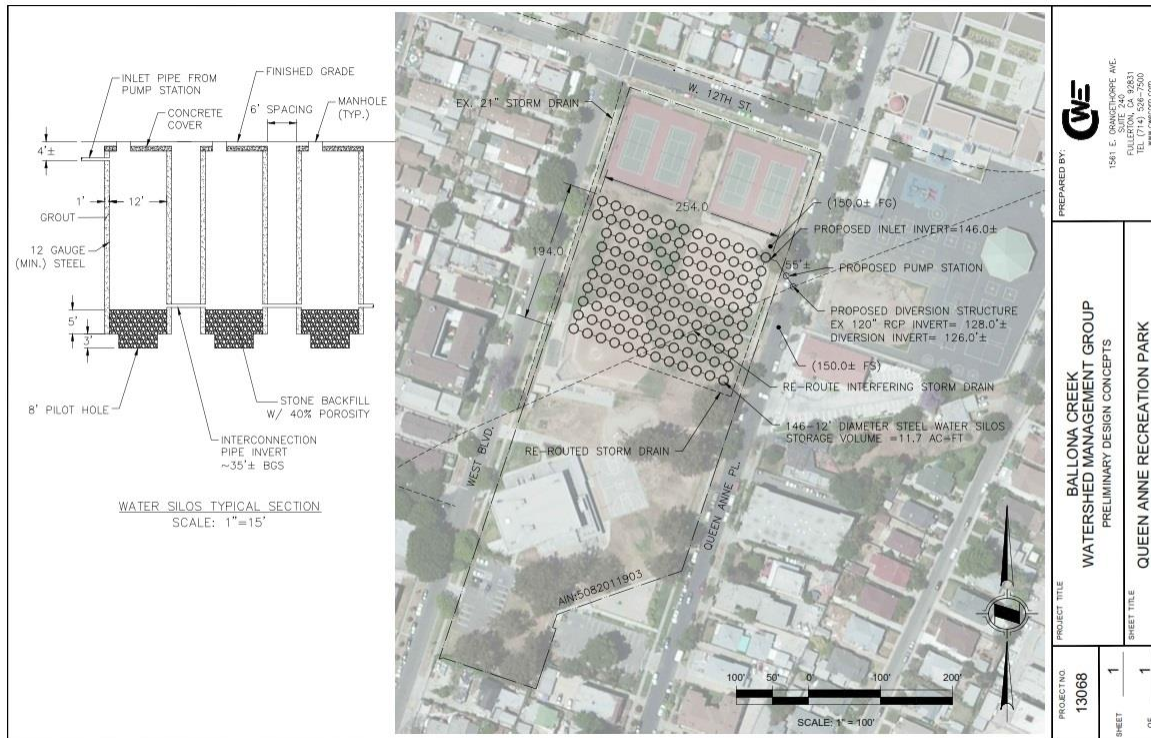


Figure 4-21 Need Name

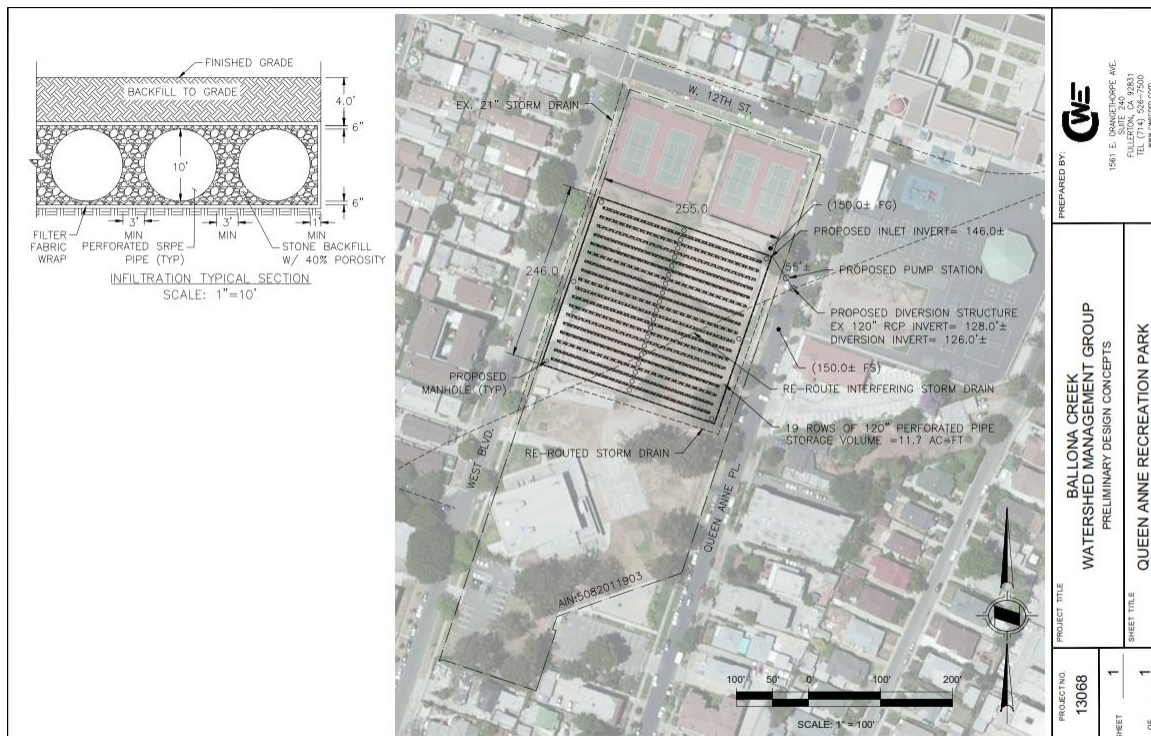


Figure 4-22 Queen Anne Recreation Center Subsurface Infiltration Site – Preliminary Design Concepts

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. The figures 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

Table 3.8-1 Summary of Poinsettia Park (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	10 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

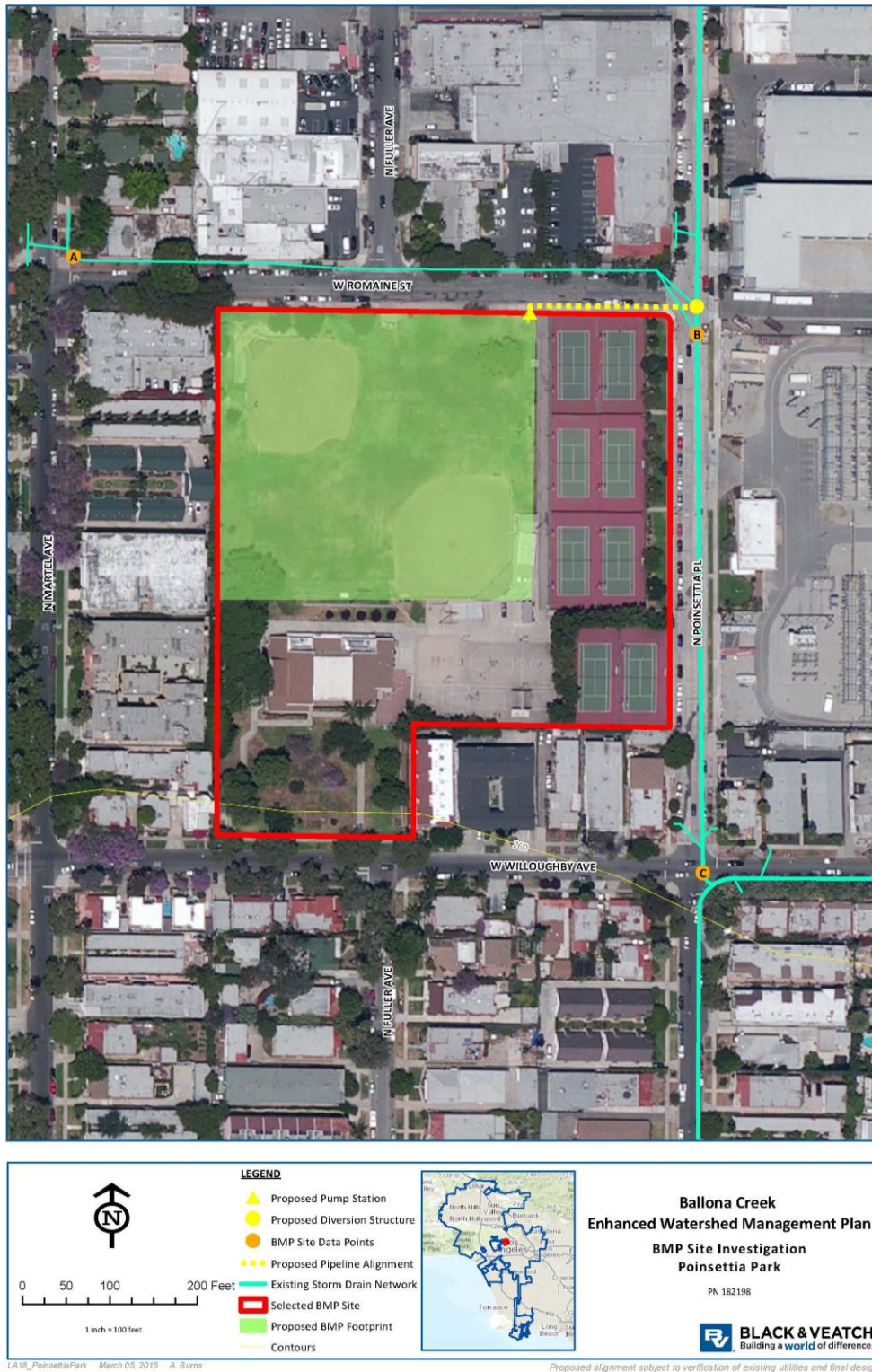


Figure 4-23 Poinsettia Park Subsurface Infiltration Site – Site Map

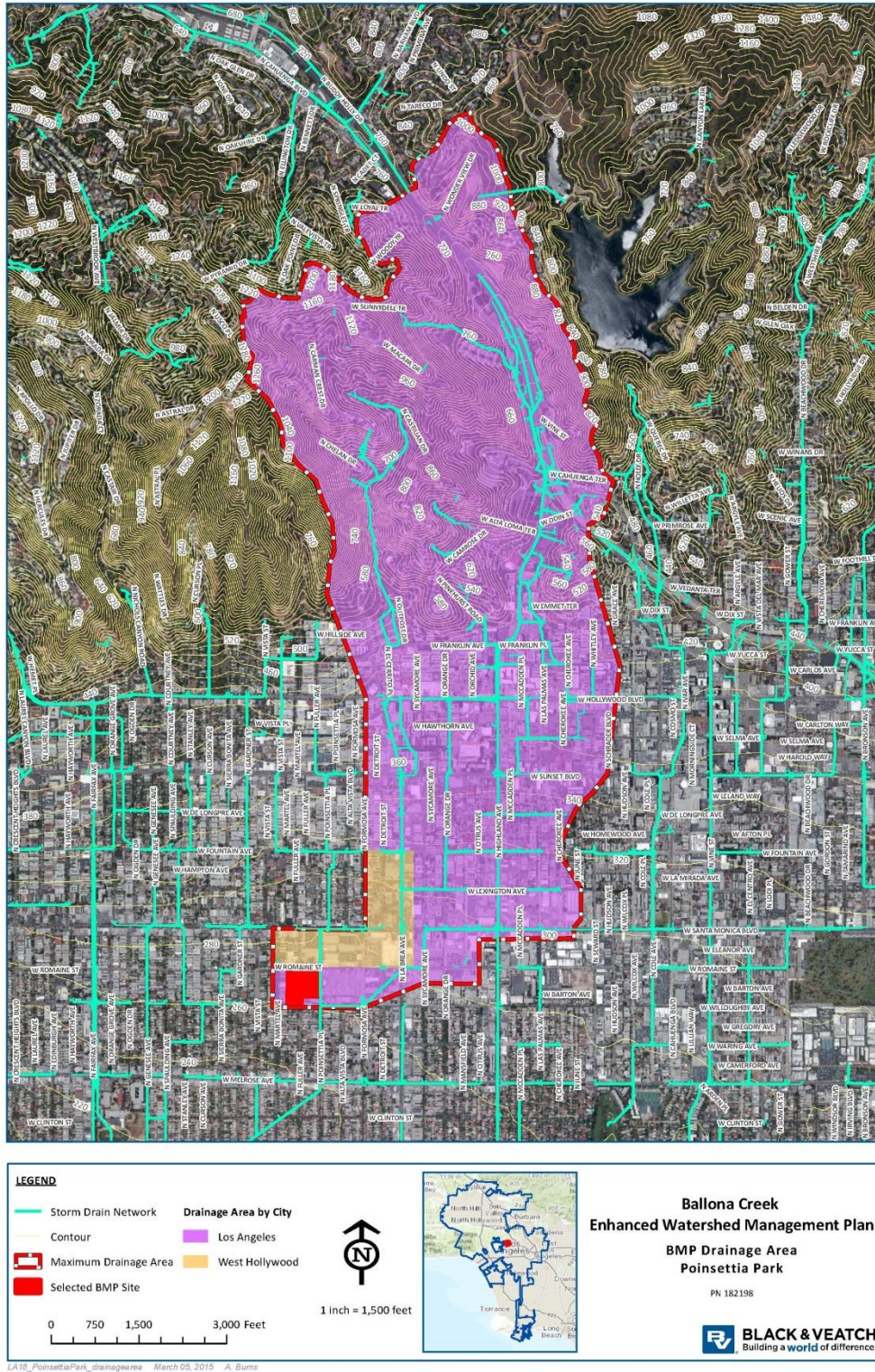


Figure 4-24 Poinsettia Park Subsurface Infiltration Site - Drainage Map

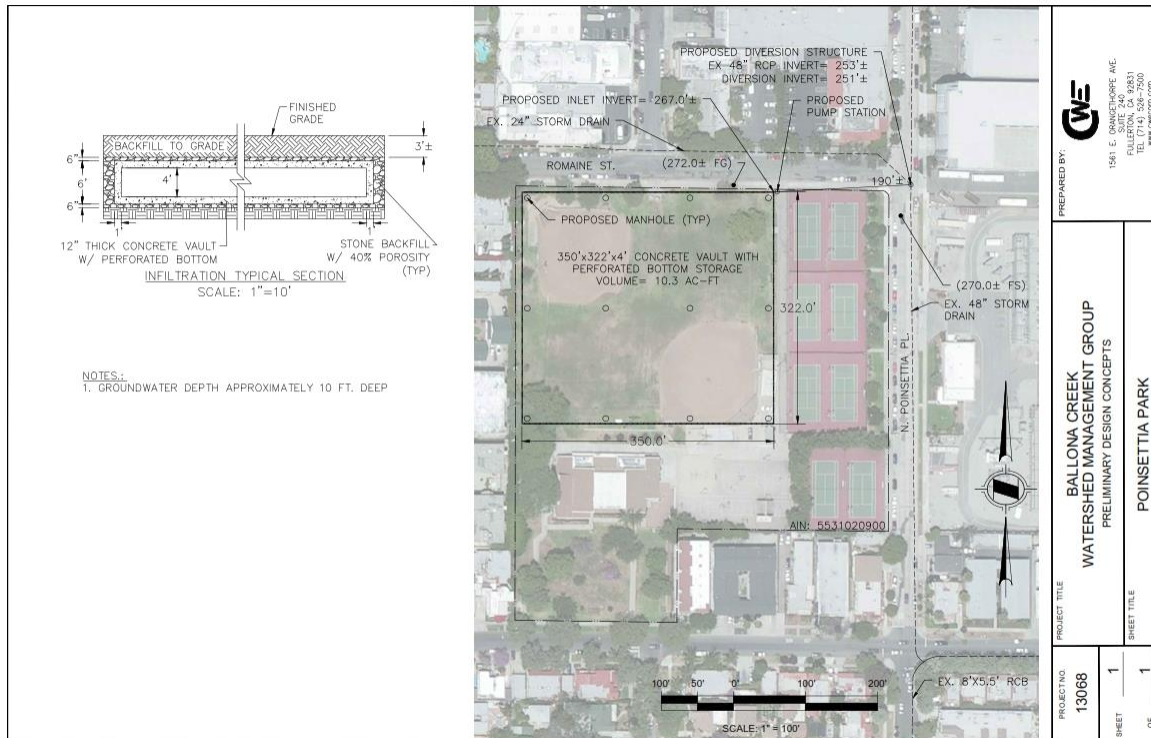


Figure 4-25 Poinsettia Park Subsurface Infiltration Site – Preliminary Design Concepts

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. The figures 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

Summary of Ladera Park (LC01)		
Project Site Parameters	Total (Maximum) Drainage Area	155 acres
	Alternative (Minimum) Drainage Area	N/A
	Maximum Required BMP Volume	5.1 AF
	Alternative Required BMP Volume	N/A
	Groundwater Depth	130 feet
BMP Design Parameters	BMP Opportunity Area	0.35 acres
	Recommended Maximum BMP Depth	20 feet
	Available BMP Volume	7.0 AF
	Recommended Active BMP Volume	5.3 AF



Figure 4-26 Ladera Park Subsurface Infiltration Site – Site Map

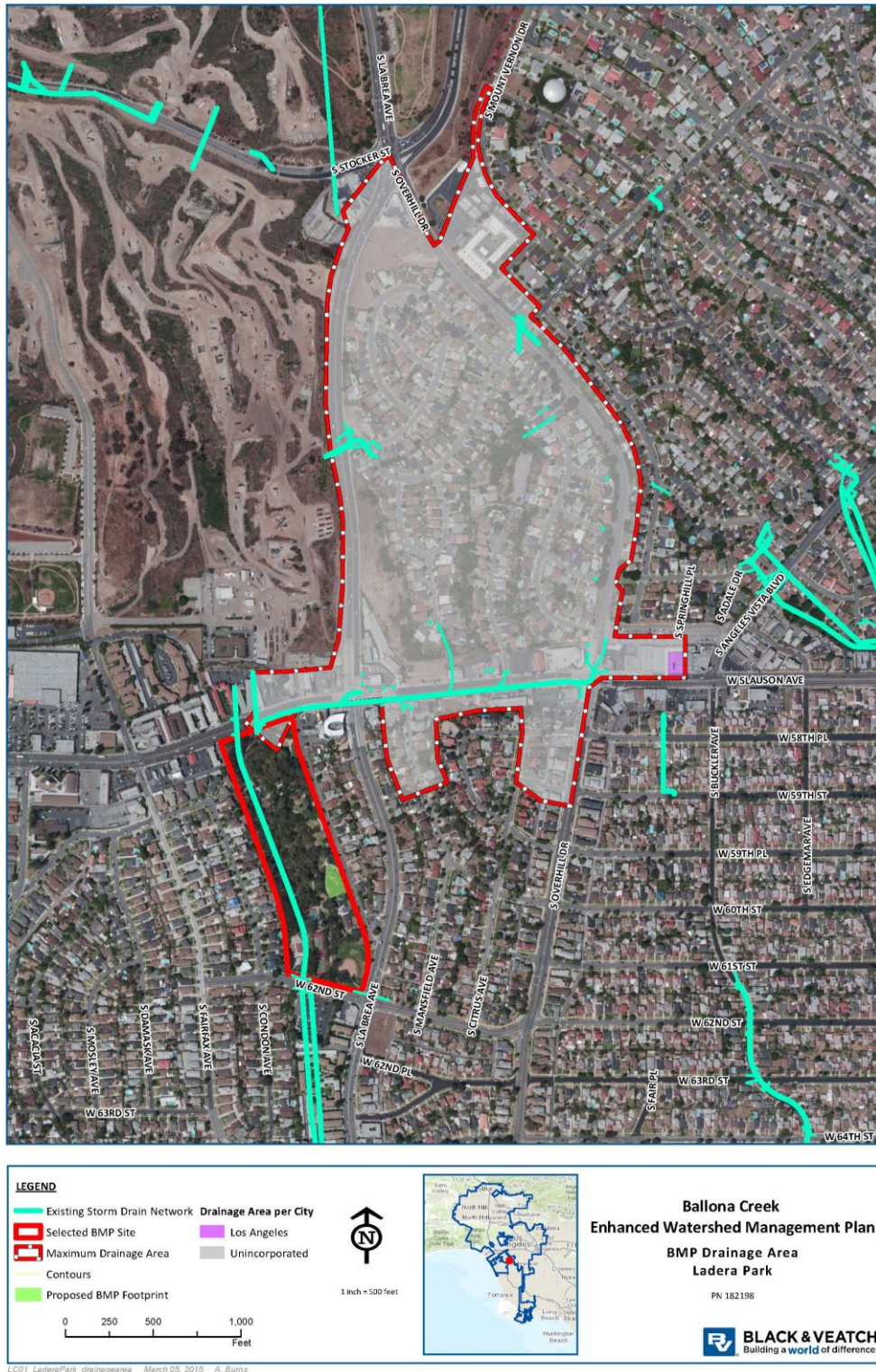


Figure 4-27 Ladera Park Subsurface Infiltration Site - Drainage Map



Figure 4-28 Ladera Park Subsurface Infiltration Site – Preliminary Design Concepts

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.

The figures 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

Summary of Lafayette Park (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	30.4 AF
	Groundwater Depth	20 feet
BMP Design Parameters	BMP Opportunity Area	2.5 acres
	Recommended Maximum BMP Depth	10 feet
	Available BMP Volume	25 AF
	Recommended Active BMP Volume	18.0 AF

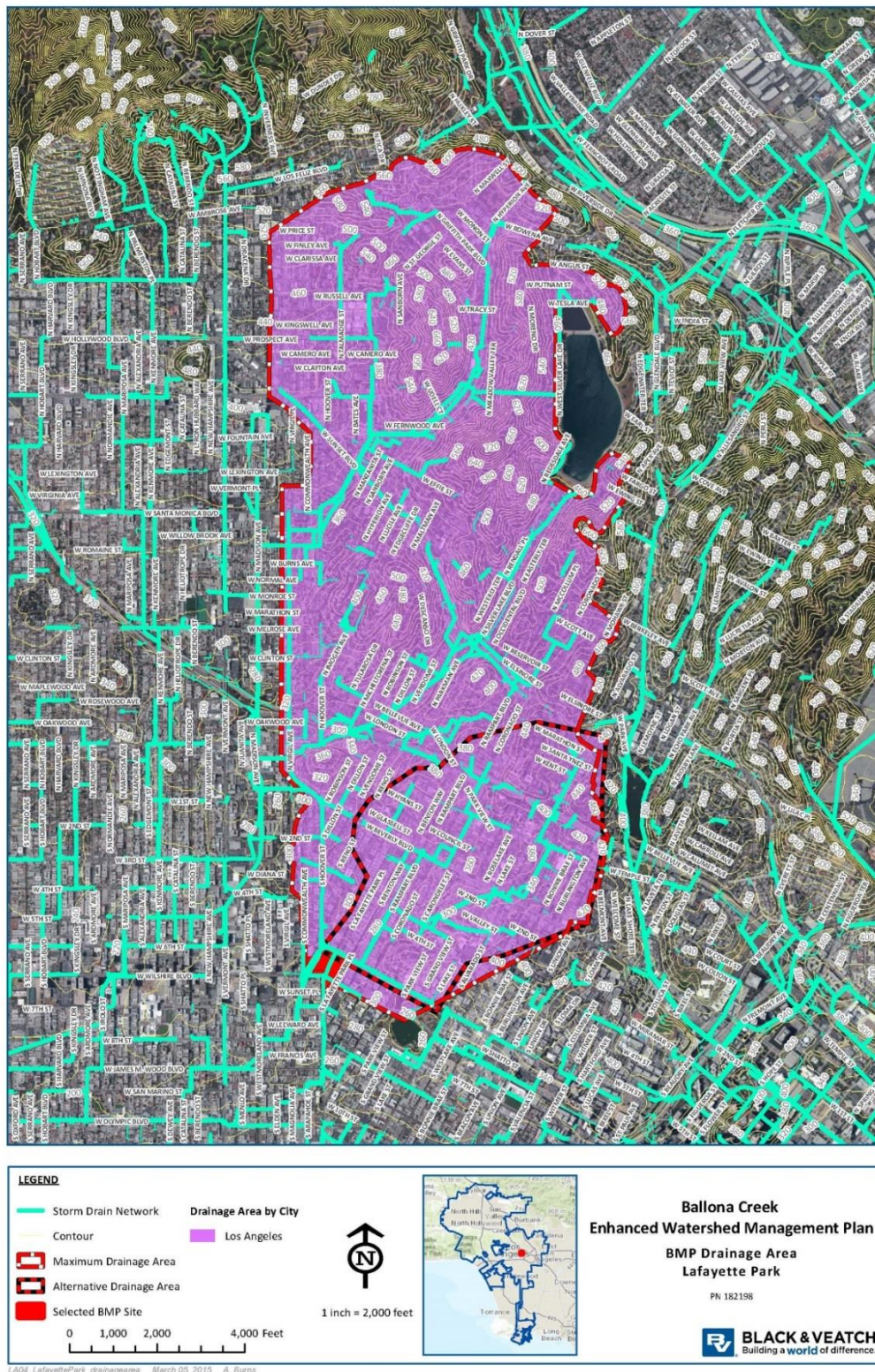


Figure 4-29 Lafayette Park Subsurface Infiltration Site – Site Map

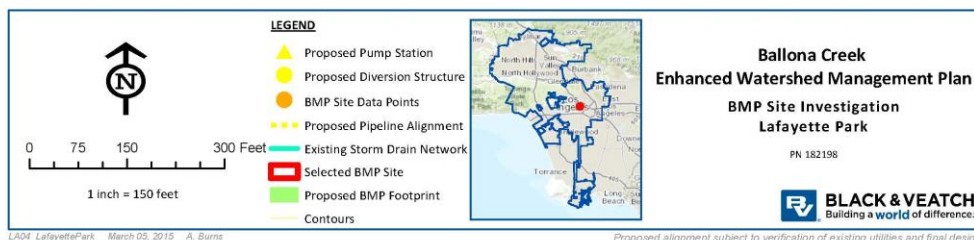


Figure 4-30 Lafayette Park Subsurface Infiltration Site – Drainage Map

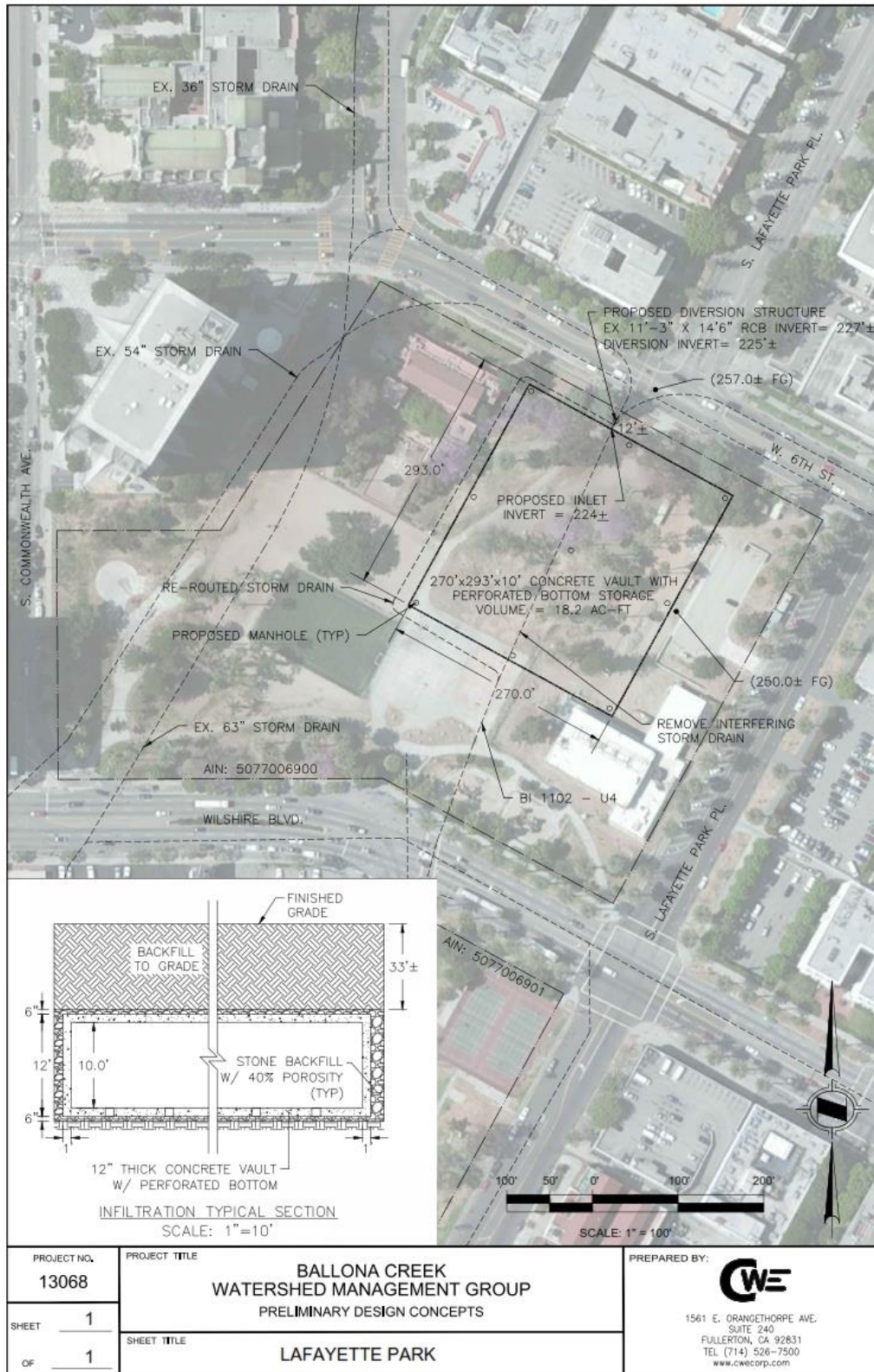


Figure 4-31 Lafayette Park Subsurface Infiltration Site – Preliminary Design Concepts

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. 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

Summary of Lafayette Park (LA04)		
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

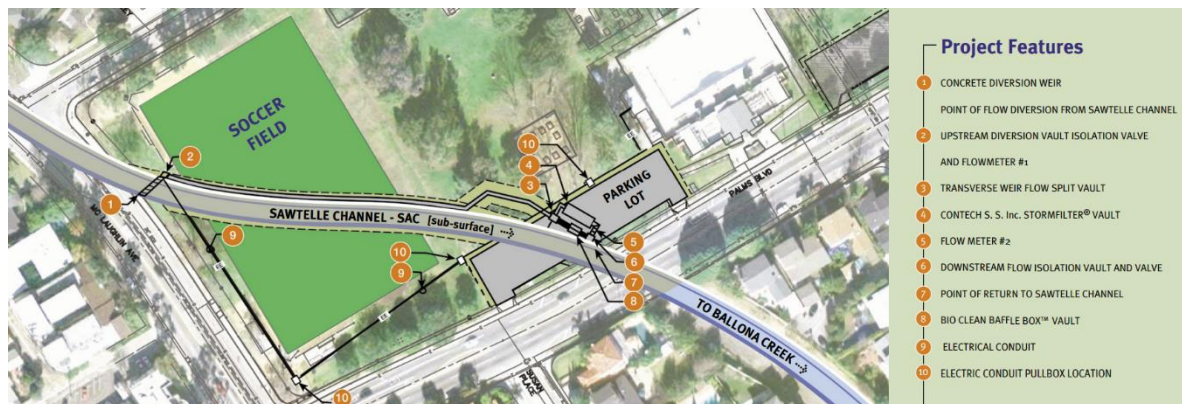


Figure 4-32 Westside Water Quality Improvement Project Components

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*
- *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 WMG 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 WMG 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 of the EWMP will implement vast numbers of distributed, small control measures in available rights-of-way, on residential parcels and on available public parcels (where regional BMPs are not feasible/desirable). This section provides a high-level summary of the green infrastructure programs within the EWMP and highlights several signature projects as an example of the types of efforts that are upcoming and ongoing. 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 (normally less than 10 tributary acres (Figure 5-1). Common LID practices include bioretention, permeable pavement, and other infiltration BMPs that prevent runoff from leaving a parcel. Rainfall harvest practices such as cisterns can also be used to capture rainwater - that would otherwise run off a parcel - and use it to offset potable water demands. The types of LID incorporated into the EWMP are the LID ordinance, residential LID, and LID retrofits of public parcels.

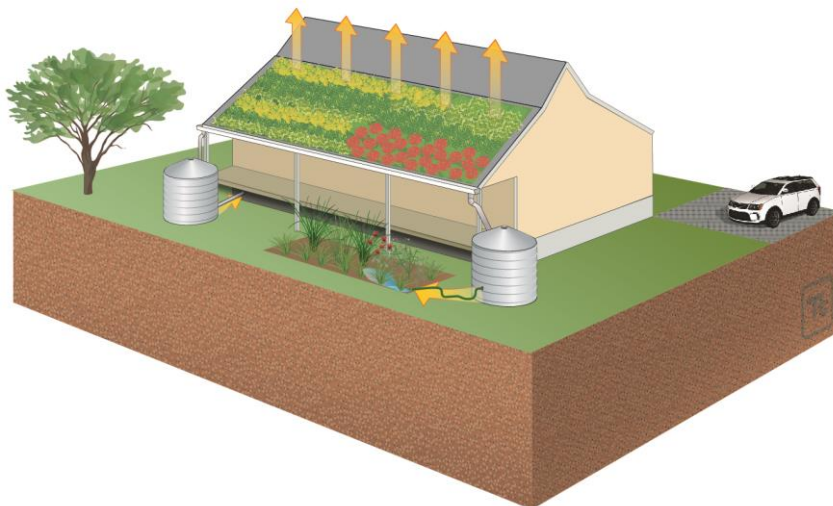


Figure 5-1 Conceptual Schematic of LID Implemented at the Site Scale (arrows indicate water pathways)

Green Streets: these are distributed structural practices that are typically implemented as linear bioretention/biofiltration practices installed parallel to roadways. Systems receive runoff from the gutter via curb cuts or curb extensions⁸ (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/green infrastructure (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 through “programs”, namely watershed-scale LID and green street programs. These programs could be designed to consider the following objectives:

- **Identify and prioritize opportunities** – Individual green infrastructure projects and programs can vary widely in cost efficiency and site applicability. Assessing and comparing individual project opportunities (*e.g.*, Street A vs. Street B) or programs (*e.g.*, residential LID vs. green streets) will help to define the most cost effective decisions.
- **Generate demonstration projects** – A series of early-stage demonstrations will serve several key purposes: (1) facilitate public interest, education, and support in the programs; (2) collect

⁸ 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.

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

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

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

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

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

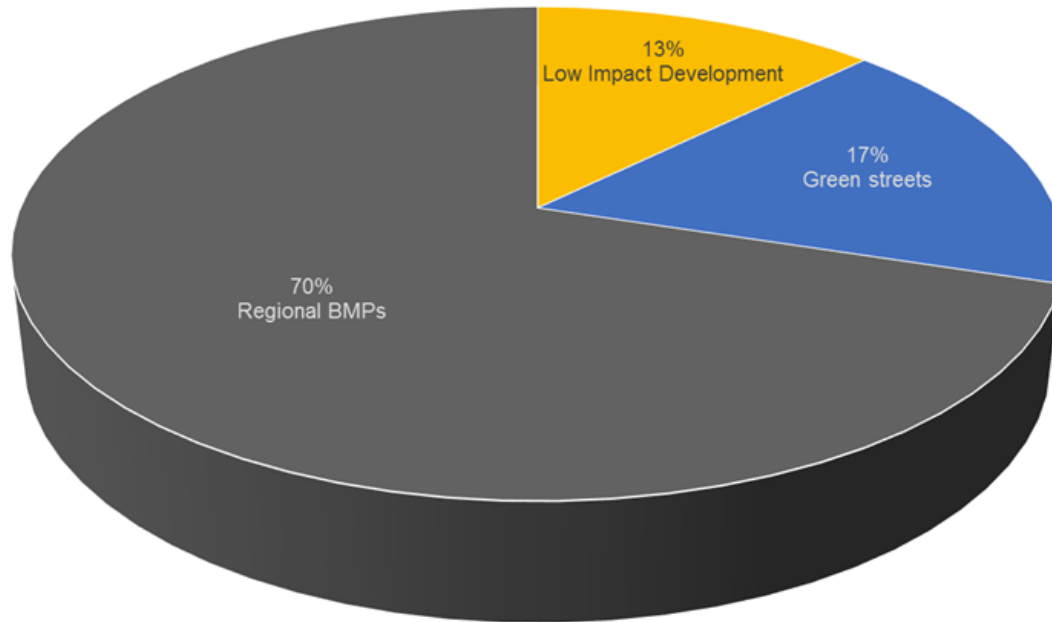


Figure 5-3 Relative Capacity of LID, Green Streets and Regional Control Measures to be implemented by the Ballona Creek EWMP by 2021

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.

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 to be retrofitted with green infrastructure to meet EWMP objectives, as shown in Figure 5-5. While it is anticipated that the implementation of green streets will evolve over the course of adaptive

Green Street Program Highlights:

- Implements green infrastructure in the rights-of-way
- High potential for significant load reduction
- Agencies retain ownership and O&M burden
- Design/construction standards can yield efficiency
- Strategic selection of streets can yield cost savings
- Opportunity for integration with CIP

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

Although the green streets program will carry significant responsibility for achieving EWMP goals, effort on this program must be balanced with other programs, especially the residential LID program and the regional BMP program. For example, downstream of places where the residential LID program is heavily implemented, or upstream of locations where large regional projects are constructed, the need for green street retrofits will be reduced. 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.

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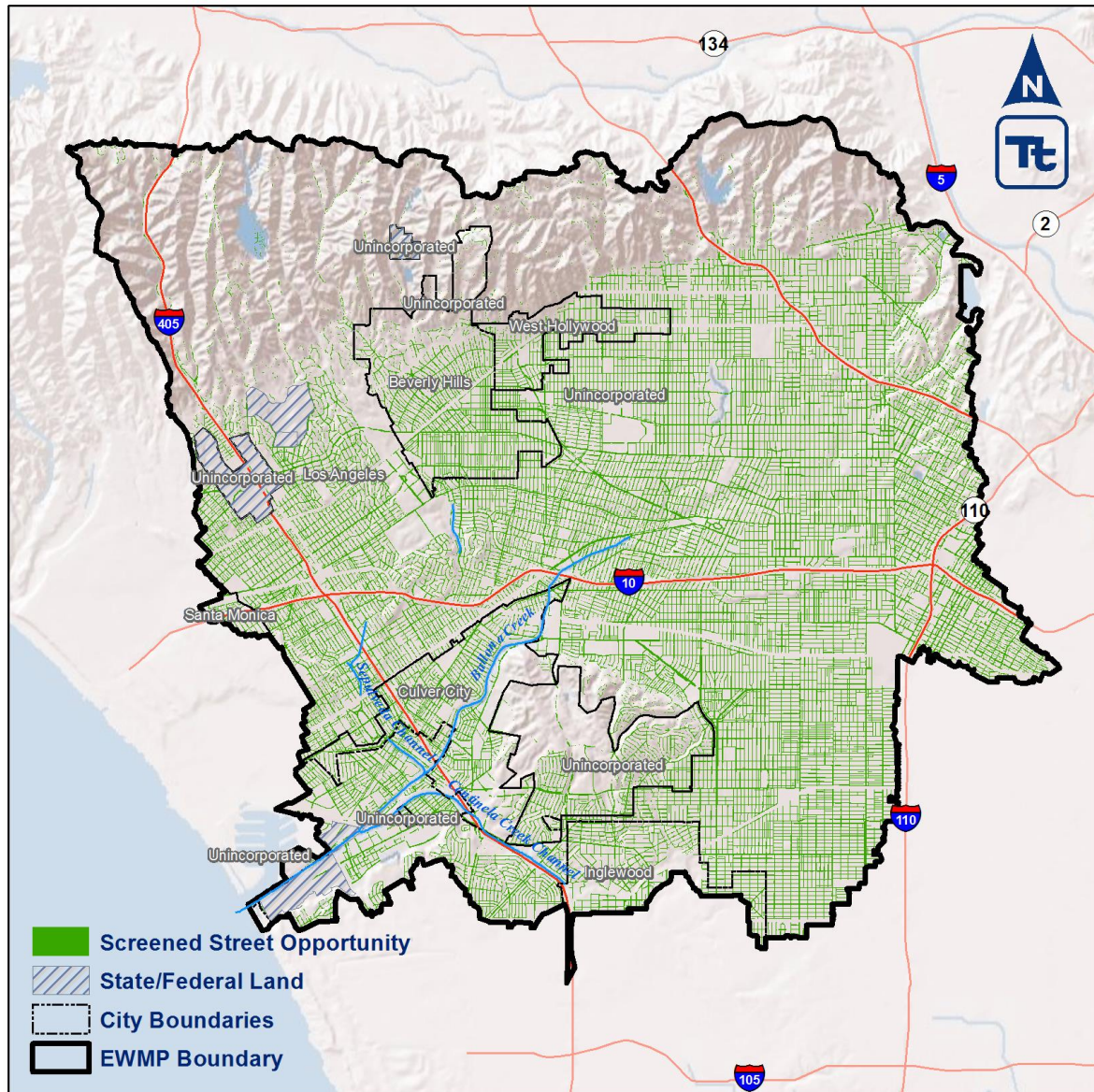


Figure 5-5 Green Street Screened Opportunities in the Ballona Creek EWMP Area

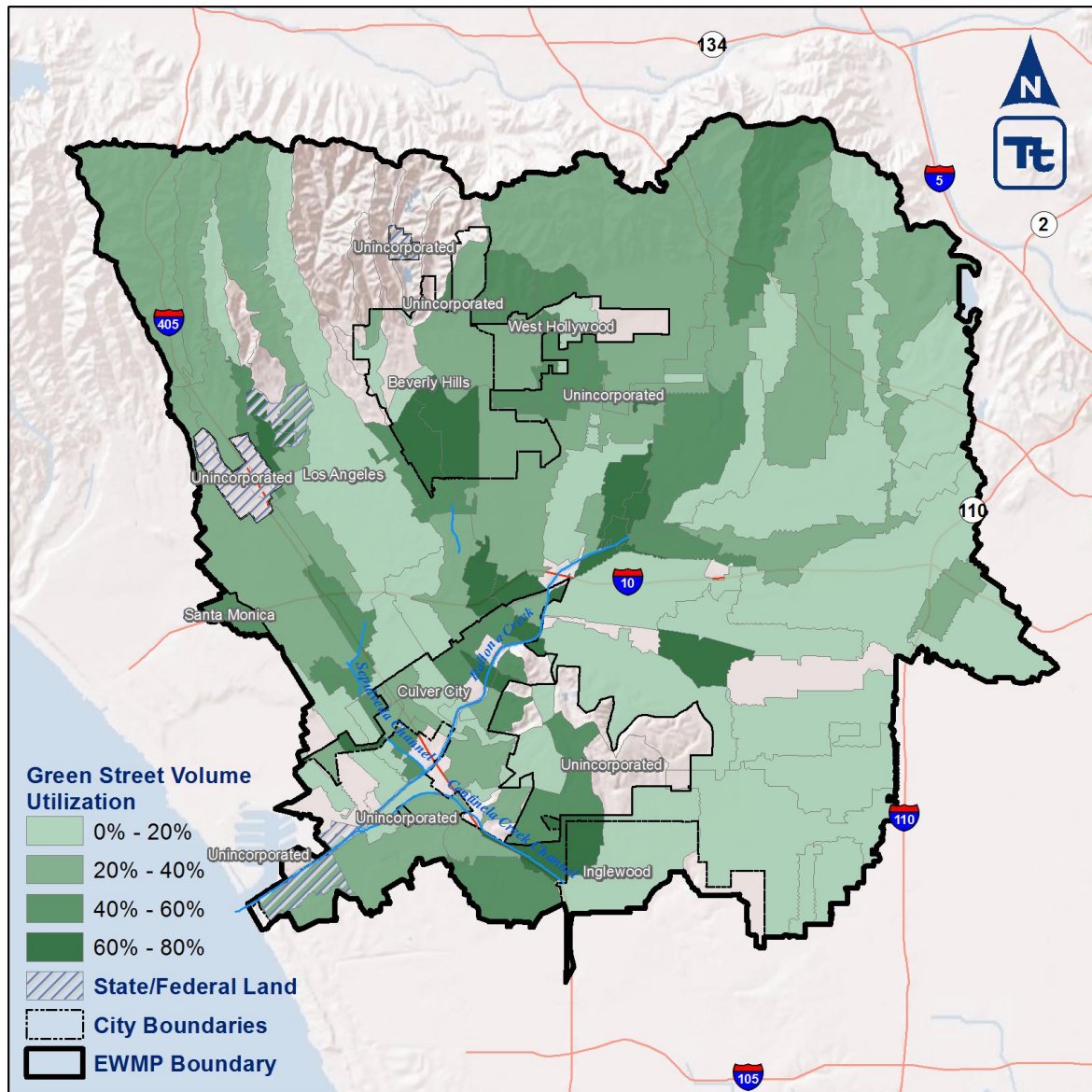


Figure 5-6 Percent of Required Green Street Implementation in the Ballona Creek EWMP Area

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 are provided below. Technical details about how the BMP opportunities were identified and how each BMP was modeled in the RAA are provided in Section 6.3.

5.4.1 LID Ordinance (Redevelopment)

The MS4 Permit and local ordinances now require significant development and redevelopment projects to incorporate LID concepts into their site design. For 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. The key advantage to the WMG 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.

Under the LID ordinance, the WMG agencies 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 redevelopment occurs throughout the watershed, it will be important for the WMG agencies to track

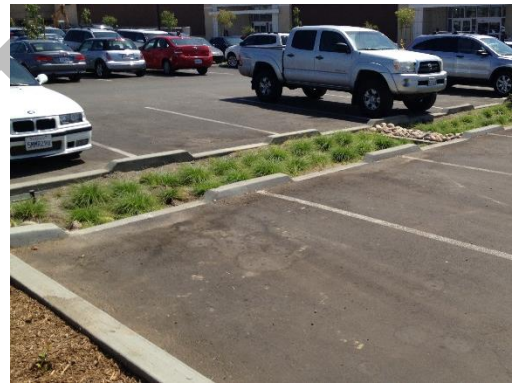


Figure 5-7 Biofiltration in a Redeveloped Shopping Center Parking Lot

LID Ordinance Highlights:

- Redevelopment projects improve water quality
- Costs to WMG agencies minimal
- Requires strong standards and oversight
- Benefit is proportional to growth / number of redeveloped parcels

BMP implementation and compare to the projections made by the RAA. Ultimately, a strong LID ordinance program provides an inexpensive strategy to continually make progress towards EWMP goals.

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. Runoff from residential parcels is often directly-connected to a curb and gutter or other conveyance system on the street. Treating runoff through a voluntary program at the residential parcel scale can significantly offset the need for regional or green infrastructure BMPs and could reduce the overall operations and maintenance burden on the WMG agencies. 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.

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

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.

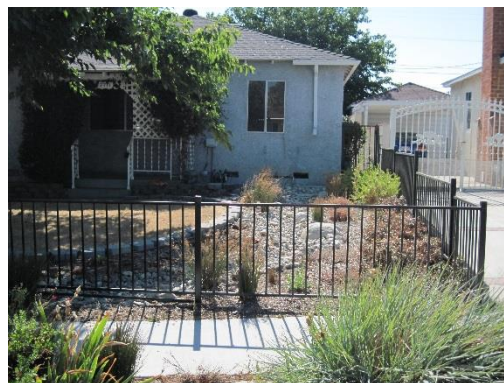


Figure 5-8 Residential LID Retrofit in the Form of a Xeriscaped Infiltration Swale

Residential LID Program Highlights:

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



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

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.

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

demonstrate LID practices. Not only will these demonstrations help the WMG agencies 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).

5.4.4 Existing and Planned BMPs

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

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 City of Los Angeles' 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 objectives.



Figure 5-9 Bioretention and Permeable Pavement at the Los Angeles Zoological Park

Sites that attract significant public traffic, such as libraries, City Hall, and parks can also provide excellent forums to



Figure 5-10 Recently Constructed Biofiltration in a Parking Lot

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 distributed stormwater capture and treatment 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 Upper LA Watershed could yield 21,017 to 42,034 acre-feet per year; similarly the Ballona Creek Watershed could yield 3,665 to 7,872 acre-feet per year.

At a Glance:

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

Building upon this analysis and the collaborative work already completed, TreePeople proposes two residential neighborhood pilot-to-scale landscape transformation areas to capture stormwater in the following Upper LA Watershed candidate neighborhoods: Pacoima, Sylmar, and Sun Valley; and/or in the following Ballona Creek/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 cisterns and rain tanks for capture and use), entirely on private residential properties. Key elements of the proposed design include the evaluation of active control configurations and detailed BMP performance and operations monitoring.

The purpose of this project is twofold: (1) to further demonstrate and quantify the viability of a residential BMP retrofit program – especially as an alternative or complement to capital projects such as regional BMPs or green streets; and (2) fully explore (in a test environment) the feasibility and

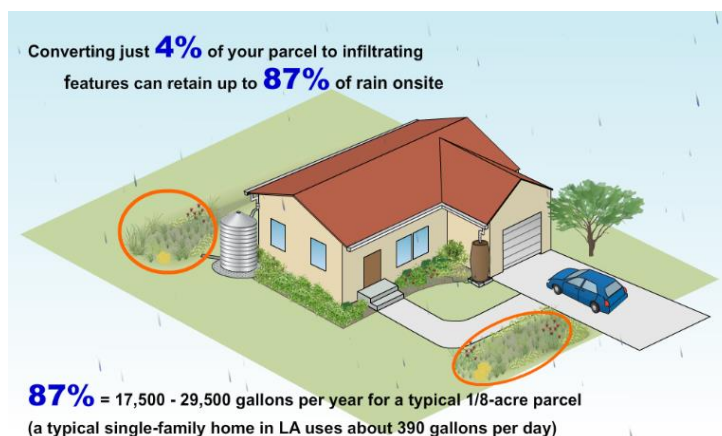


Figure 5-11 Landscape Transformation

potential depth of cross-agency collaboration and cooperation in executing a tangible, in-the-ground, program-level project. Several elements of the program will be explored, including the costs of implementation, the depth of homeowner engagement, BMP effectiveness, and varied physical configurations. Ultimately, the pilot-to-scale project will retrofit a number of private parcels, evaluate the cost and performance of the systems, and

identify any barriers that might limit the extent or effectiveness of scaling up the program. Based on the

findings of the study, a range of potential implementation scenarios will be summarized to estimate the total potential impact in terms of program cost, water quality improvement, and water supply augmentation. A full account of the collaborative effort will also be provided and summarized to provide meaningful feedback and guidance on how to further improve the management of a mutually beneficial cross-agency program.

5.5.2 Vermont Avenue Stormwater Capture and Green Street Project

At a Glance:

- **Location:** Vermont Ave from Gage Ave to Florence Ave, South Los Angeles
- **Control Measures:** ½ mile of Green Streets
- **Expected Completion:** December 2016
- **Approx. Cost:** \$5 million

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.

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 5-18 depicts

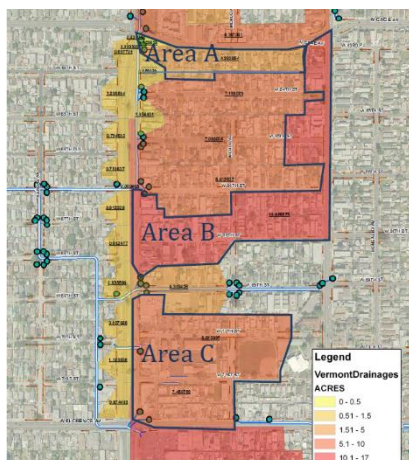


Figure 5-14 Capture Goal for Subareas



Figure 5-12 A Proposed bio-Filtration Island



Figure 5-13 Existing Wet-Weather Flooding and Ponding Along the Proposed Vermont Avenue Project Site

typical flooding and ponding conditions in the project area. The project's total drainage area is 85.6 acres.

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 5-19). 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 (Figure 5-17) has also been identified for additional treatment and beautification in Area A.

5.5.3 Westwood Neighborhood Greenway

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 ~\$2.5M



Figure 5-15 Artist Rendering of Project Components

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 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 (Figure 5.20).

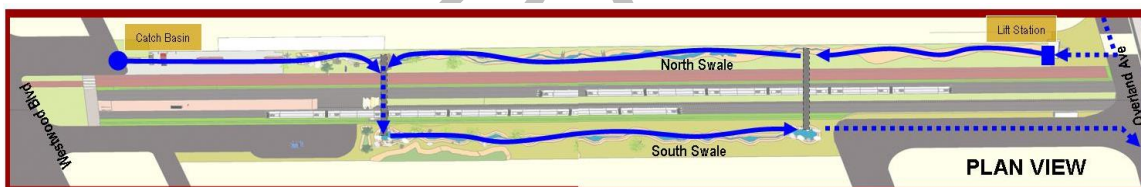


Figure 5-16 Flow Diagram of the Streams (Dotted lines represent underground flow)

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 5-21). During the dry-weather approximately 23 to 135 gallons per minute of DWF 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 (Figure 5-22). This project proposes catch basins and underground culvert on the north side to capture storm water 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. Excess treated water will flow back into Overland drain through the return flow structure.

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 S. Centinela Avenue from West Pico Boulevard southward to Ocean Park Boulevard. 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 S. Centinela Avenue – one 63-inch City of Los Angeles pipe transporting runoff from a 180-acre area of Los Angeles and a 93-inch County of Los Angeles storm drain draining a 245-acre area in Santa Monica. This stretch of South Centinela Avenue is in a residential area, and the storm drain below drains a highly urbanized 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 and to maximize volume to harvest.

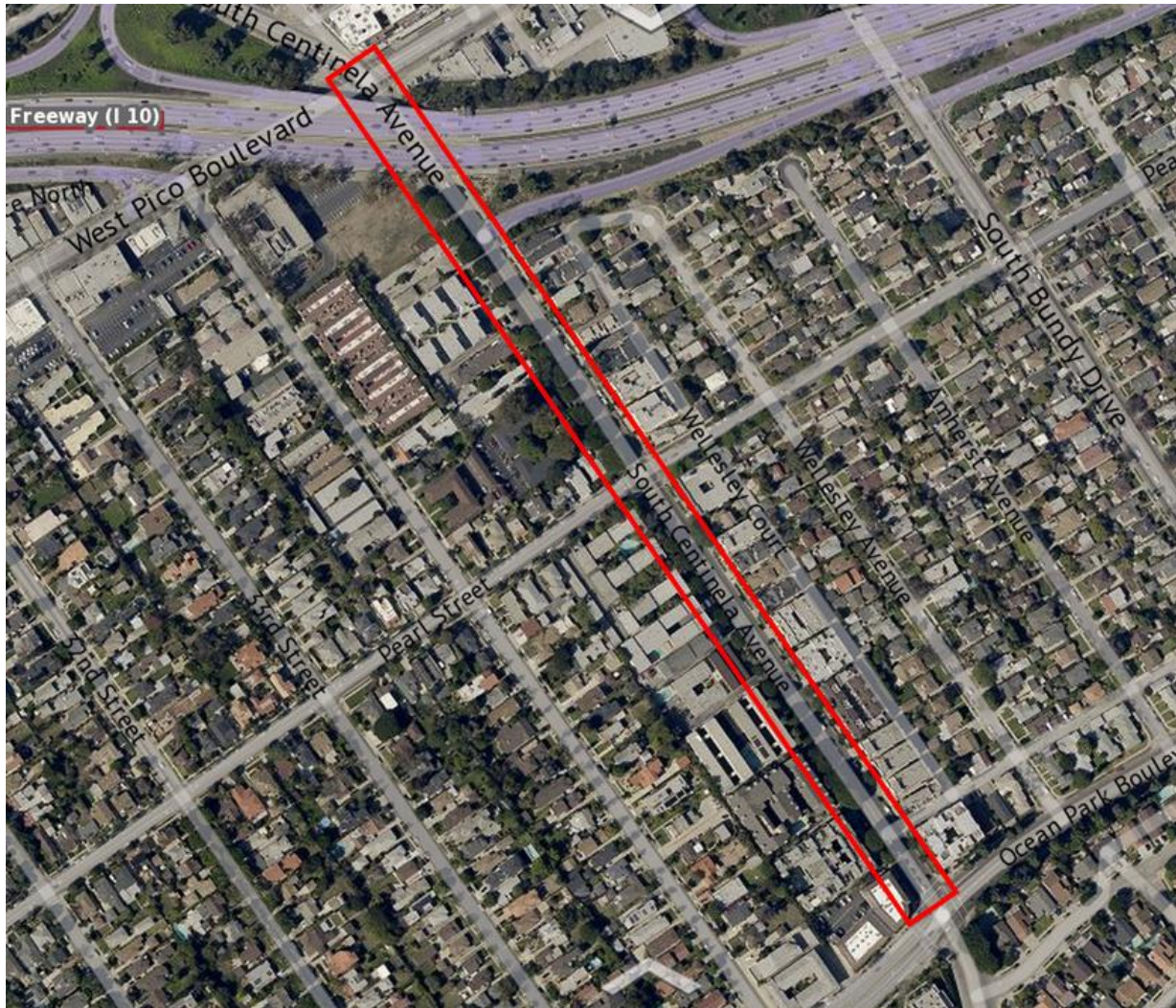


Figure 5-18 Location of Proposed Centinela Avenue Hybrid Green Street Regional Project

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 Minimum Control Measures (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
- Planning and Land Development Program

Specific institutional BMPs currently implemented by each jurisdiction as part of these stormwater program categories are reported in the Los Angeles County MS4 Permit Unified Annual Report⁹.

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 5.A., and key items are noted below:

Table 5-2 Permit Requirements

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

⁹ Los Angeles County provides access to Permittee Annual Reports at the following website:
<http://ladpw.org/wmd/NPDESRSA/AnnualReport/>

None of the Ballona Creek jurisdictions have elected to implement additional institutional control measures to achieve a total ten percent reduction. Over time, it is anticipated that additional Ballona Creek jurisdictions will implement enhanced institutional control measures and offset the need for structural control measures. The Ballona Creek watershed and the entire region would greatly benefit from studies that quantify the performance of institutional control measures.

DRAFT

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 – RWQCB, 2012). 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 (*i.e.*, 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)
- 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). 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.

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 WMMS¹⁰ 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 2,566 subwatersheds. Of those, the BC EWMP area encompasses 180 subwatersheds¹¹ (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.

¹⁰ 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.

¹¹ To support evaluation of regional BMPs, some of these subwatersheds were further grouped by "pour point" to receiving waters.

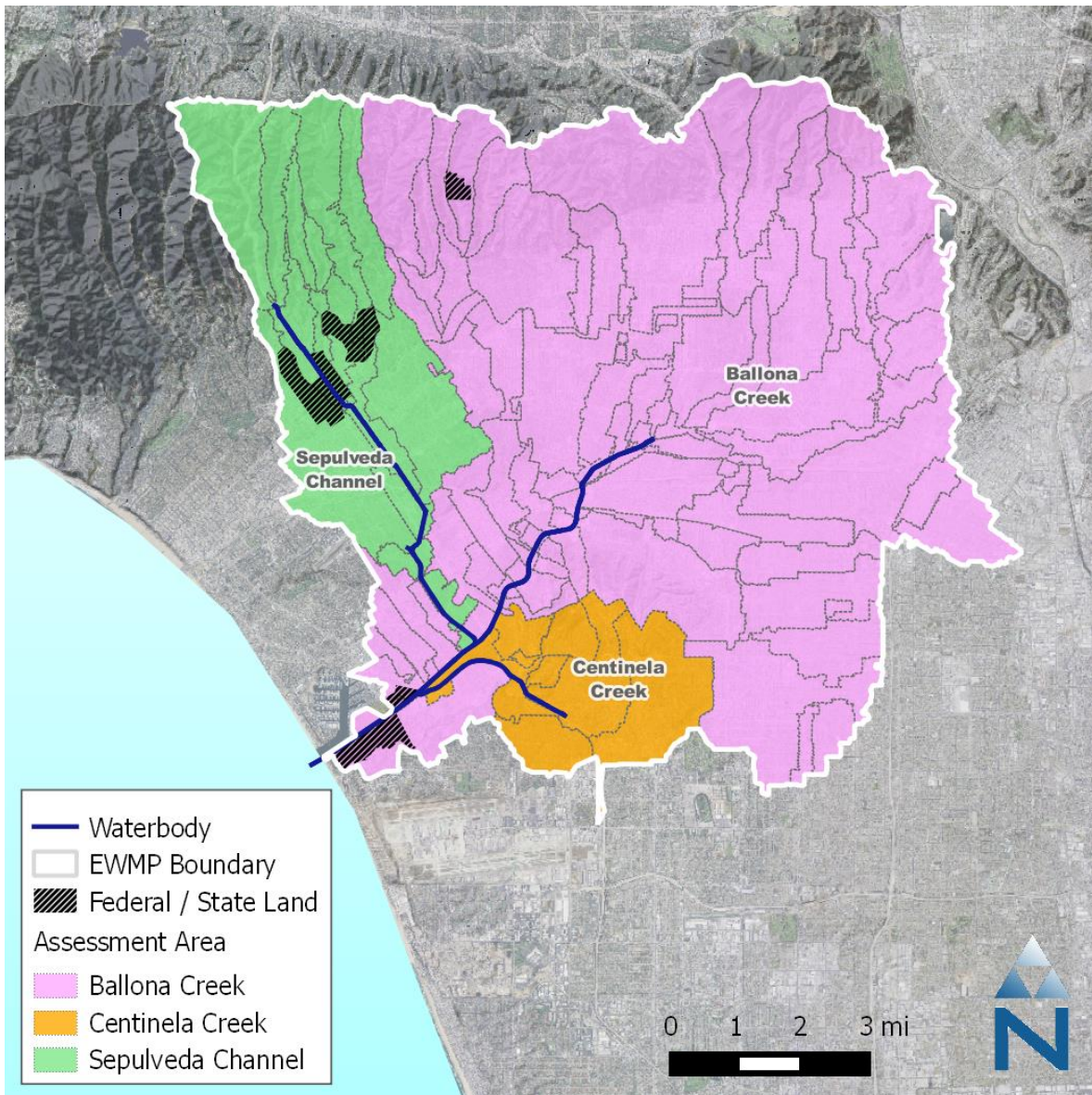


Figure 6-1 BCWMA and 180 Subwatersheds Represented by WMMS

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.

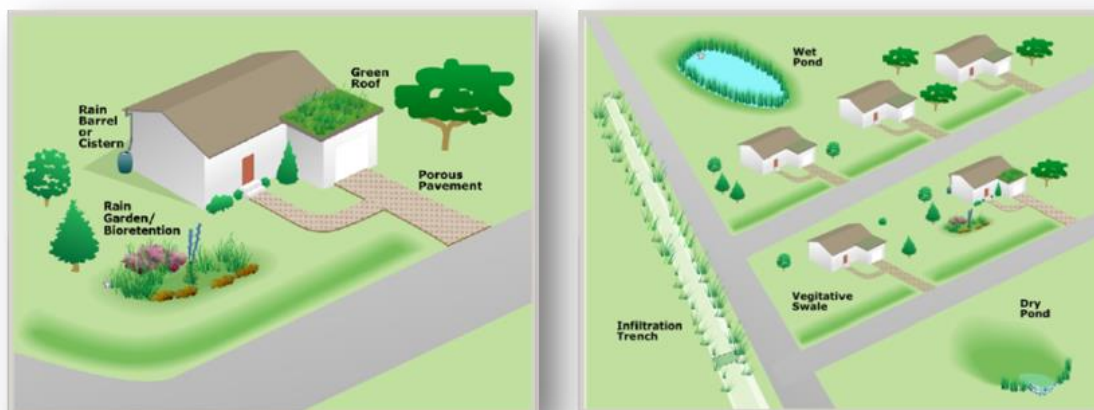


Figure 6-2 SUSTAIN Model Interface Illustrating BMP Opportunities in Watershed Settings

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 database¹² 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)¹³.

6.2 Baseline Critical Conditions and Required Pollutant Reductions

6.2.1 Assessment Areas

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

6.2.2 Calibration

A fundamental element of the RAA is simulating baseline/existing conditions in the watershed prior to implementation of control measures. For the 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:

¹² The BMP cost database from WMMS was updated for this EWMP, as described in Section 6.6.

¹³ 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, 2011¹⁴.
- Simulated pollutants include total suspended solids, *E. coli*, total copper, total zinc, and total lead.
- 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 Los Angeles County Department of Public Works (LACDPW) at mass emission stations in Ballona Creek (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.

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)	10/1/2001 – 9/30/2007	Total Annual Volume	-1.5%	Very Good
		Highest 10% of Flows	-1.5%	Very Good

¹⁴ All stormwater control measures implemented prior to September 30, 2011 are assumed to be implicitly represented within the baseline conditions.

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
<i>E.coli</i> *	54	-31.6	Fair

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

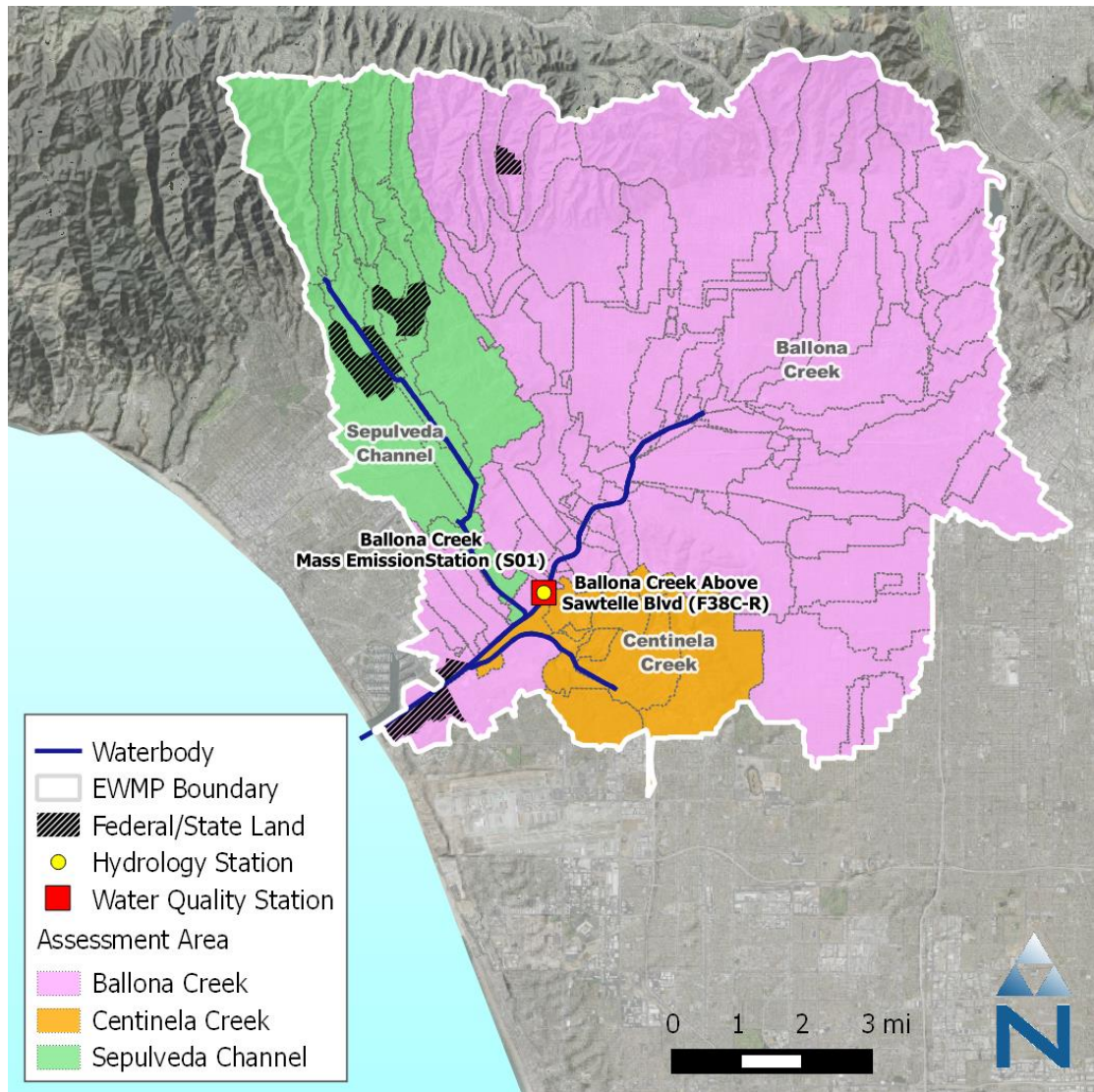


Figure 6-3 Hydrology and Water Quality Calibration Stations for BC RAA

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.
- 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.

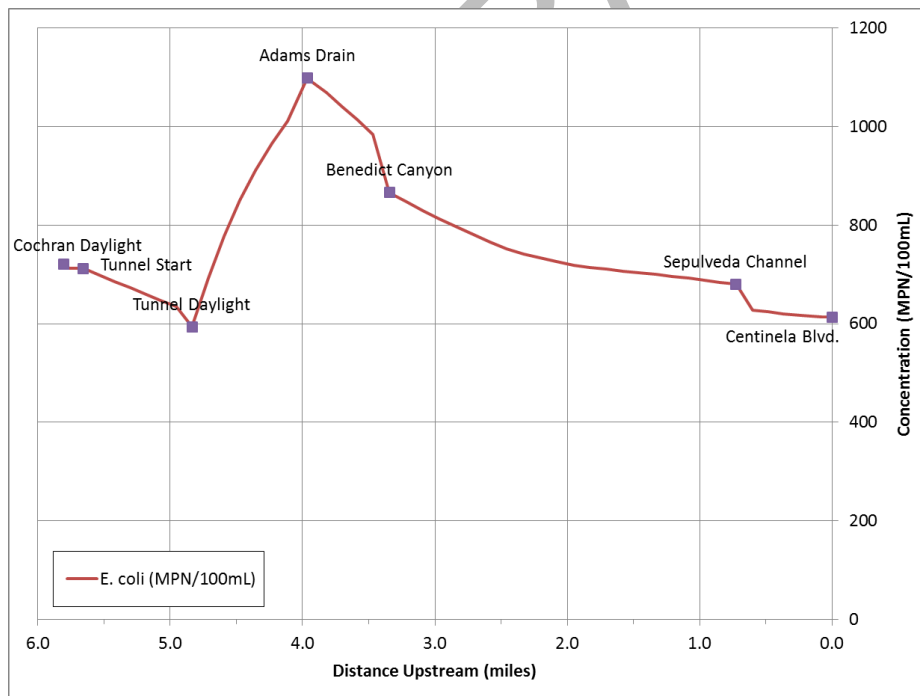


Figure 6-4 Simulated Baseline *E. coli* Concentrations in Ballona Creek

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

The MS4 Permit effectively prohibits discharges of non-stormwater¹⁵ (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 use¹⁶ in each of the subwatersheds within the EWMP area and whose *sink* is evapotranspiration and retention by wet weather EWMP control measures.
- **Non-stormwater generated by outdoor water use based on extensive literature review:** The amount of non-stormwater generated in each 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

¹⁵ 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.

¹⁶ 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 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.

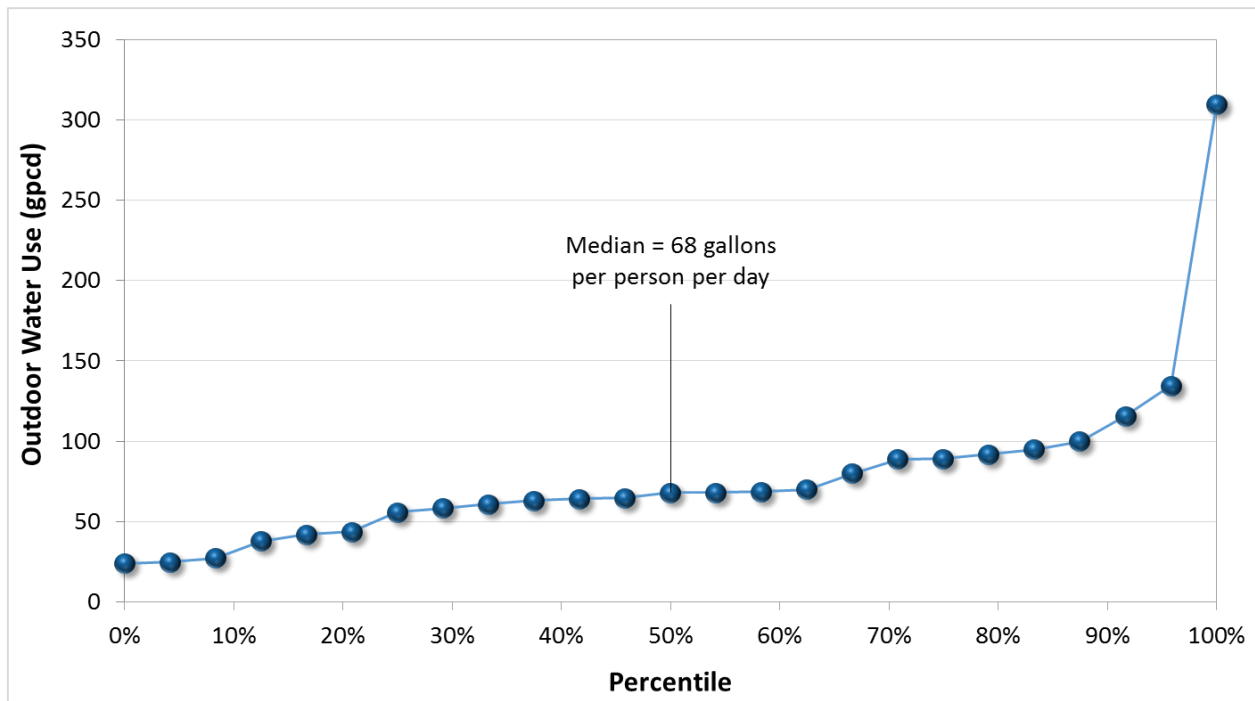


Figure 6-5 Outdoor Water Use Estimates from Literature Review

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 – RWQCB, 2012) and the Basin Plan (see Receiving Water Limitations, Section V of the Permit – RWQCB, 2012). 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, nitrogen, phosphorous, and *E. coli*. The targets for *modeled* pollutants are listed in Table 6-3, organized by pollutant class. For the remaining (non-modeled) Water Quality Priorities, the RAA uses analyses of monitoring data to demonstrate that control of one or more “limiting pollutants” will address the non-modeled pollutants (as discussed in the next subsection).

Table 6-3 Targets for Modeled Water Quality Priority Pollutants

Pollutant Class	Pollutant	Target for RAA (units are µg/L except when noted otherwise)				Assessment Area where Target Applies to Address Water Quality Priority		
		Dry Weather	Source	Wet Weather	Source	Ballona Creek	Sepulveda Channel	Centinela Creek
Metals	THIS TABLE IS STILL IN PROCESS OF BEING DEVELOPED							
Bacteria								
Legacy								

1 – Based on total metals. When the Ballona Creek Metals TMDL specifies a WLA (the WQO source is “TMDL”), the WLA is used as the target. Where the TMDL does not apply (the WQO source is “CTR”), hardness assumed to be 175 mg/L as CaCO₃, which is the hardness used to develop Ballona Creek WLAs in the Ballona Creek Metals TMDL. When applicable, dry weather targets were based on chronic WQOs and wet weather targets are based on acute WQOs.

2 – The High Flow Suspension applies to all assessment areas in Ballona Creek. Dry weather target based on 30-day geometric mean WQO while wet weather target is based on single sample maximum WQO.

6.2.5 Critical Conditions and Required Reductions

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

6.2.5.1 Wet Weather Critical Conditions

A key consideration of the RAA is the “critical condition” under which water quality targets must be achieved. Stormwater management for different size storms generally requires different size BMPs. For example, for most pollutant 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 as the critical condition. In turn, the BC RAA analyzes the volume of runoff during each rolling 24-hour period¹⁷ of the 10-year simulation when water quality targets were exceeded, referred to as the “Exceedance Volume” (see Figure 6-4). The storm that produces the 90th Percentile Exceedance Volume¹⁸ is the critical condition for metals and the overall primary critical condition for management¹⁹ 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 were assumed to *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 is a 24-

¹⁷ 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.

¹⁸ 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.

¹⁹ 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.

hour storm. The EWMP retains²⁰ the runoff from the critical bacteria storm (from each subwatershed outlet, prior to discharge to receiving waters) to achieve *E. coli* WQBELs.

3. **Annual Average Toxics 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.

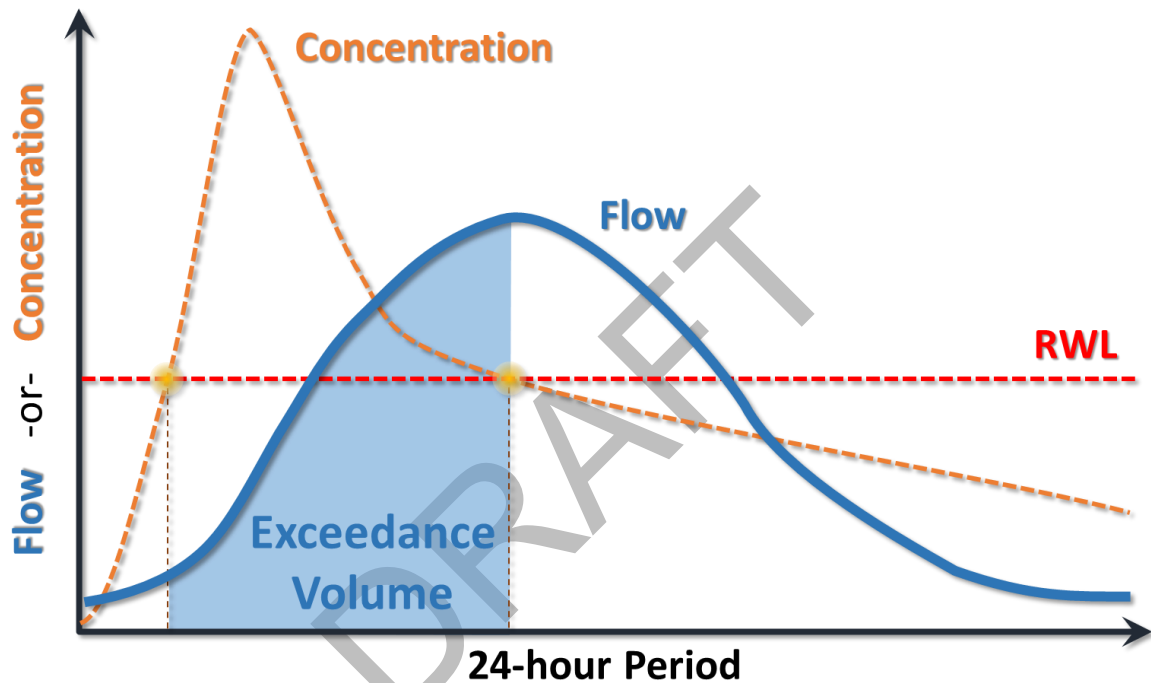


Figure 6-6 Illustration of How Metals Exceedance Volume is Calculated for Critical Condition Determination

²⁰ Addressing bacteria through 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 10-year simulation (out of a total of 87,660 periods)	7,270	6,723	5,465
Average EV	755	123	63
10th percentile EV	135	21	6
25th percentile EV	201	35	15
Median EV	392	73	36
75th percentile EV	915	161	92
90th percentile EV	1,929	307	163

Note: The storm that generates the 90th 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 along the LA River, 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 6-6, 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).

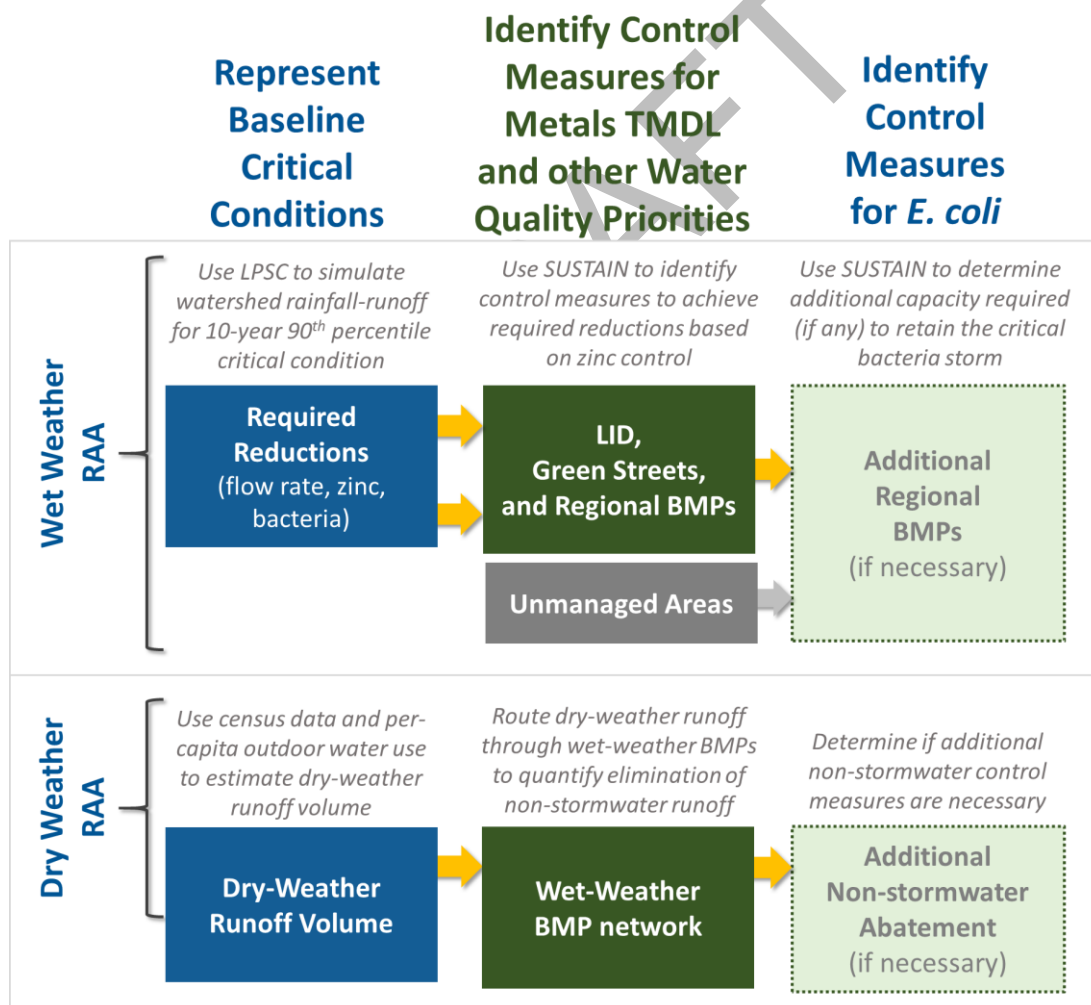


Figure 6-7 RAA Process for Establishing Critical Conditions and Addressing Water Quality Priorities

Table 6-5 Limiting Pollutant Selection and Justification for RAA

Pollutant Class	Pollutant	Dry Weather Approach to Addressing Pollutant				Wet Weather Approach to Addressing Pollutant		
		Dry Weather	Source	Wet Weather	Source	Ballona Creek	Sepulveda Channel	Centinela Creek
Metals	THIS TABLE IS STILL IN PROCESS OF BEING DEVELOPED BASED ON REVIEW OF WATER QUALITY MONITORING DATA							
Bacteria								
Legacy								

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 to be implemented by 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 BCWMG is held to achieving the 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.

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)	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
	Loading during 90 th percentile/final condition (pounds) ³	1,983	416	211
	Ratio used to gradually phase from interim to final required reduction	0.40	0.41	0.26
Final Compliance with E. coli	Runoff volume to be retained	Runoff from critical bacteria storm is retained prior to discharge to receiving water		

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

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

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

6.3 Representation of EWMP Control Measures

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

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

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

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

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

6.3.1 BMP Opportunities

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

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 jurisdiction. For those jurisdictions that elected to assume 10 percent, an enhanced set of institutional control measures is presented in the EWMP Implementation Strategy.
Low Impact Development	Ordinance	Acreage subject to redevelopment based on growth rates reported by City of Los Angeles.
	Planned	BMPs constructed after September 2011 were included based on list submitted in Ballona Creek EWMP Work Plan.
	on Residential	One percent of residential parcels enrolled per year, starting in 2017.
	on Public	Parcels flagged as opportunities based on screening for slopes, soil contamination, and ownership.
Green Streets	Green Streets	Available opportunity approximated for each subwatershed based upon street types and slopes.
Regional	Very High projects on Public	Top 20 ranked parcels from regional BMP selection process.
	High & Medium projects on Public	Parcels flagged as opportunities based on screening and prioritization conducted for regional project selection process.
	on Private	Control measures located on acquired private parcels to capture runoff near the subwatershed or jurisdiction outlet.

In addition to the spatial opportunity screening process, which highlighted potential roadblocks to BMP implementation, the preferences of the WMG agencies 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	Institutional	LID Ordinance	Residential LID	LID on Municipal Parcels	Permeable Pavement	Very High/High Regional	Regional/LID on Schools
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	Yes
West Hollywood	5%	Yes	Yes	Yes	Yes	Yes	Yes ²¹

²¹ Also prefer to include non-WMG-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. For Very High regional BMPs, geotechnical field work will be performed to estimate site-specific infiltration rates.
- **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 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. This required a thorough understanding of the watershed setting (to determine commonly available BMP footprints, typical drainage areas, and conditions that warranted pumping), innovative use of existing datasets to estimate spatially varied infiltration rates, familiarity with local codes and standard BMP design practices to set design profiles, and access to a large database of BMP performance metrics to estimate pollutant load removal effectiveness. 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.

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

BMP Category	Type	Key Design Parameters
Institutional	Institutional	None, not modeled explicitly.
Low Impact Development	Ordinance	Bioretention/Biofiltration sized to capture 85 th percentile runoff from parcel. Underdrains required if subsoil infiltration rate less than 0.3 inches per hour (in/hr).
	Planned	Bioretention/Biofiltration sized to capture 85 th percentile runoff from parcel. Underdrains required if subsoil infiltration rate less than 0.3 in/hr.
	on Residential	Bioretention sized to approximately 4 percent of parcel area (typical sizing to capture 85 th percentile runoff)
	on Public	Bioretention/Biofiltration sized to capture 85 th percentile runoff from parcel. Underdrains required if subsoil infiltration rate less than 0.3 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. 50 percent of the street length retrofittable. Underdrains required if subsoil infiltration rate less than 0.3 in/hr.
Regional	Very High Projects on Public	BMP footprint delineated and ponding depth specified based on site configuration, topography, depth to groundwater, and infrastructure. Pump specified if greater than 100 feet from major storm drain using an optimum diversion rate (0.09 cfs/acre).
	High & Medium Projects on Public	Same as Very High except ponding 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 20-year life cycle costs including O&M using the following variables: (A) is the area of the BMP footprint in square feet, (Vt) is the total volume of the BMP in cubic feet, (Vm) is the volume of the BMP soil media in cubic feet, and (Vu) is the volume of the BMP underdrain in cubic feet.

6.4 BMP Selection

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

6.4.1 Selection of Control Measures for 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 6-6, 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 for each subwatershed in the EWMP area:** an example set of “BMP solutions” is shown in Figure 6-7, 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 for each jurisdiction 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 6-8 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 for the required reduction:** 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 6-9 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.

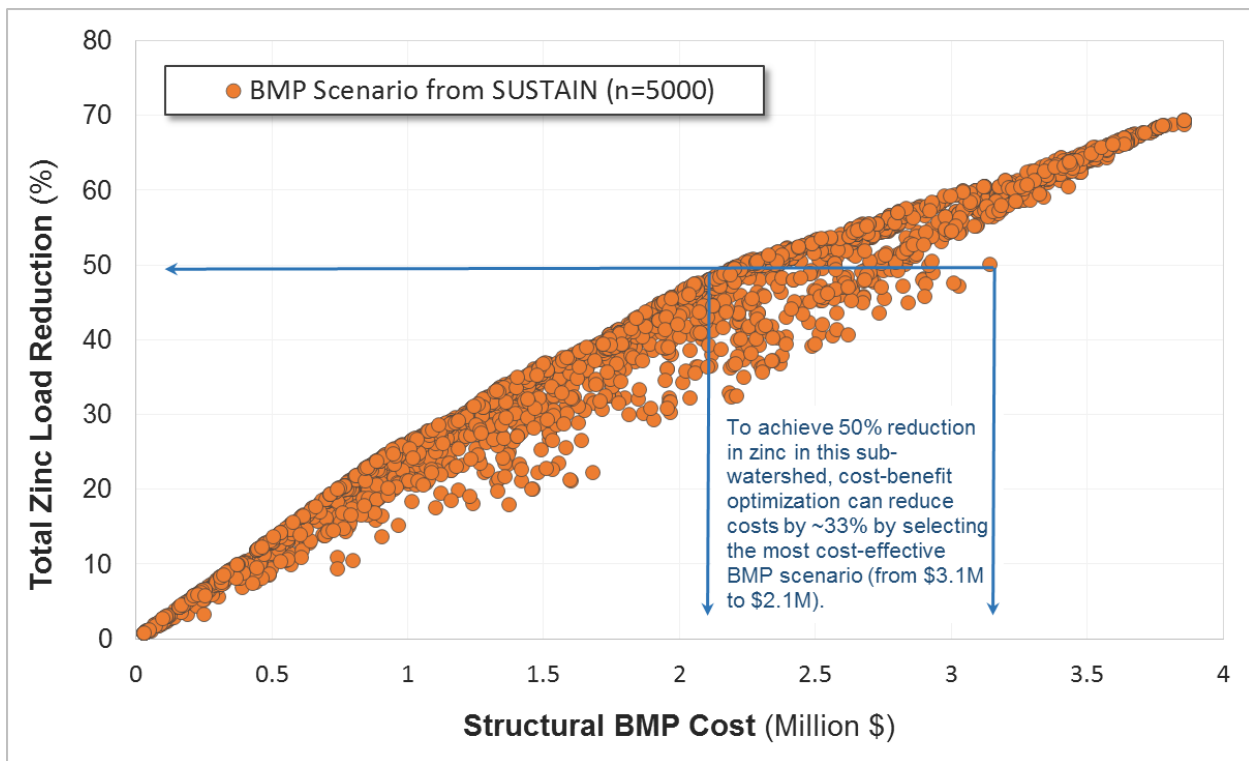


Figure 6-8 Example BMP Solutions for a Selected Subwatershed and Advantage of Cost-Benefit Optimization

This figure shows an optimization output for a single subwatershed. A similar curve was generated for each of the 180 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.

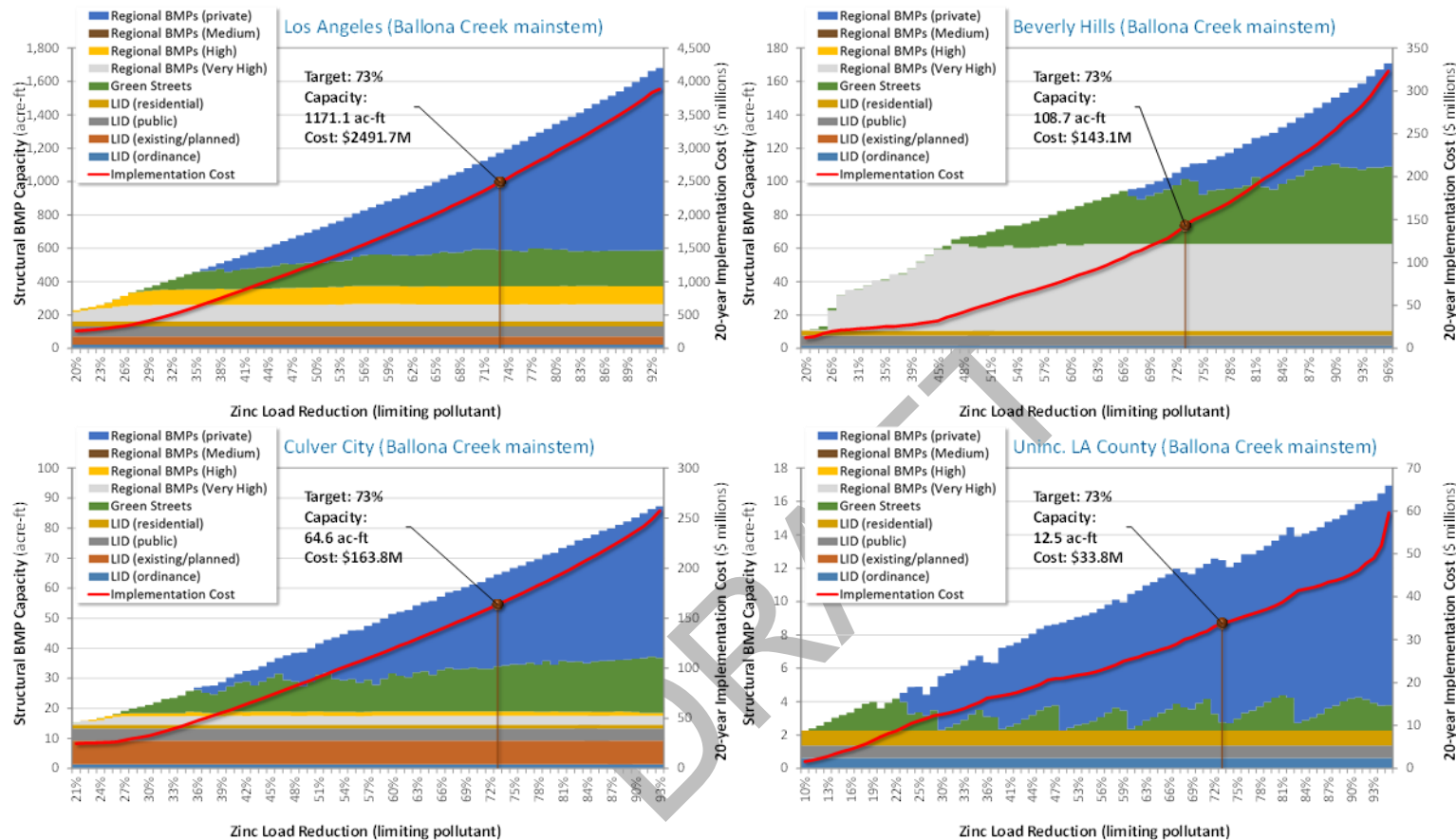


Figure 6-9 Example Cost Optimization Curves for a Watershed: Ballona Creek (mainstem).

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 39 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.

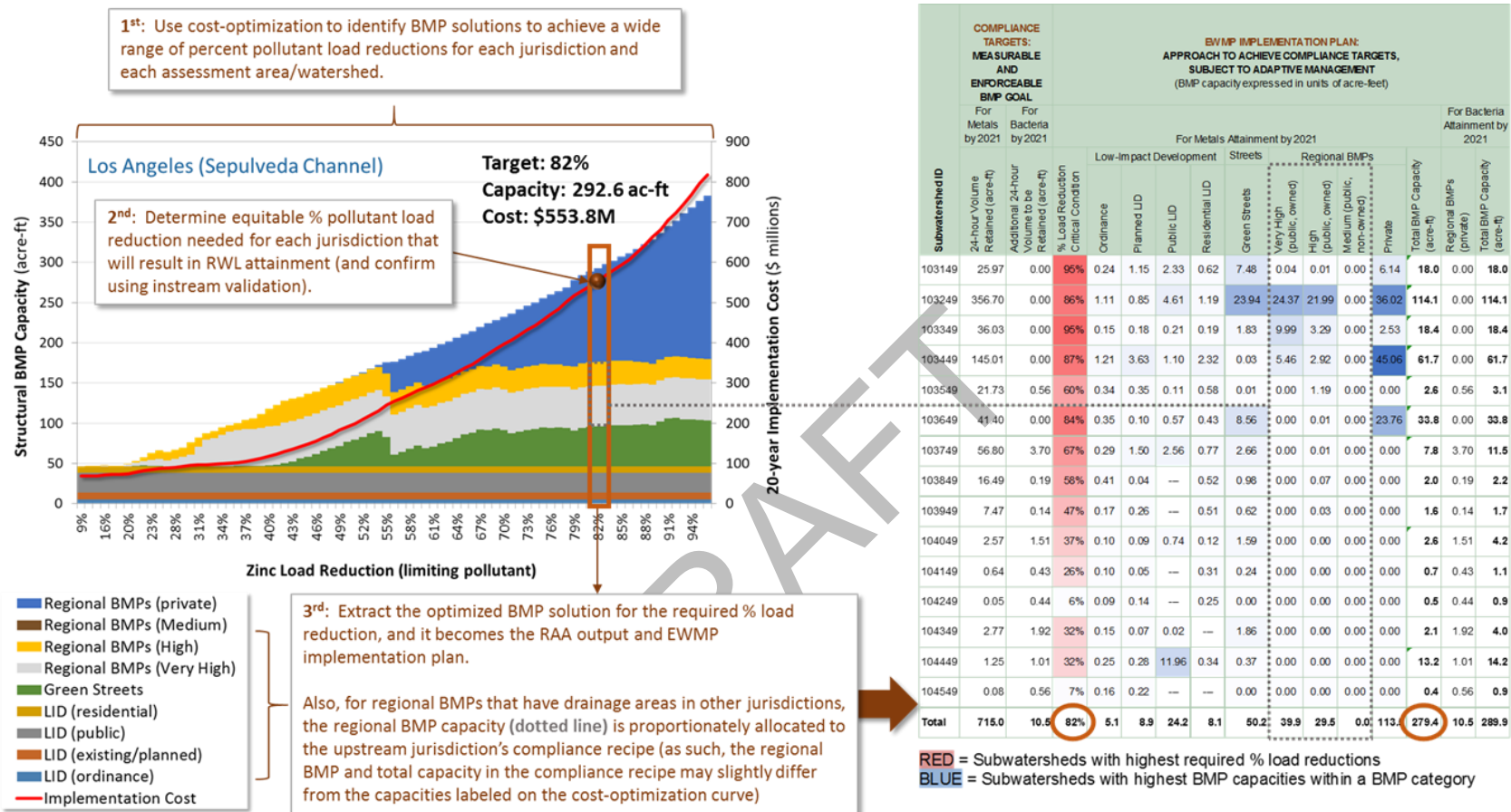


Figure 6-10 Illustration of How the EWMP Implementation Strategy is Extracted from a Cost Optimization Curve

This illustration uses the City of Los Angeles jurisdiction in the 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 zinc²² (2012)²³
- Achieve 50 percent of the reduction for metals (2016)
- Achieve 100 percent of the reduction for metals (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 6-10).
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.

²² 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.

²³ While the 25 percent reduction milestone for 2012 has passed, the control measures are still evaluated by the RAA for planning purposes. The control measures that correspond to a 75 percent reduction are also shown for reference, even though the 75 percent milestone is not in the Ballona Creek Metals TMDL.

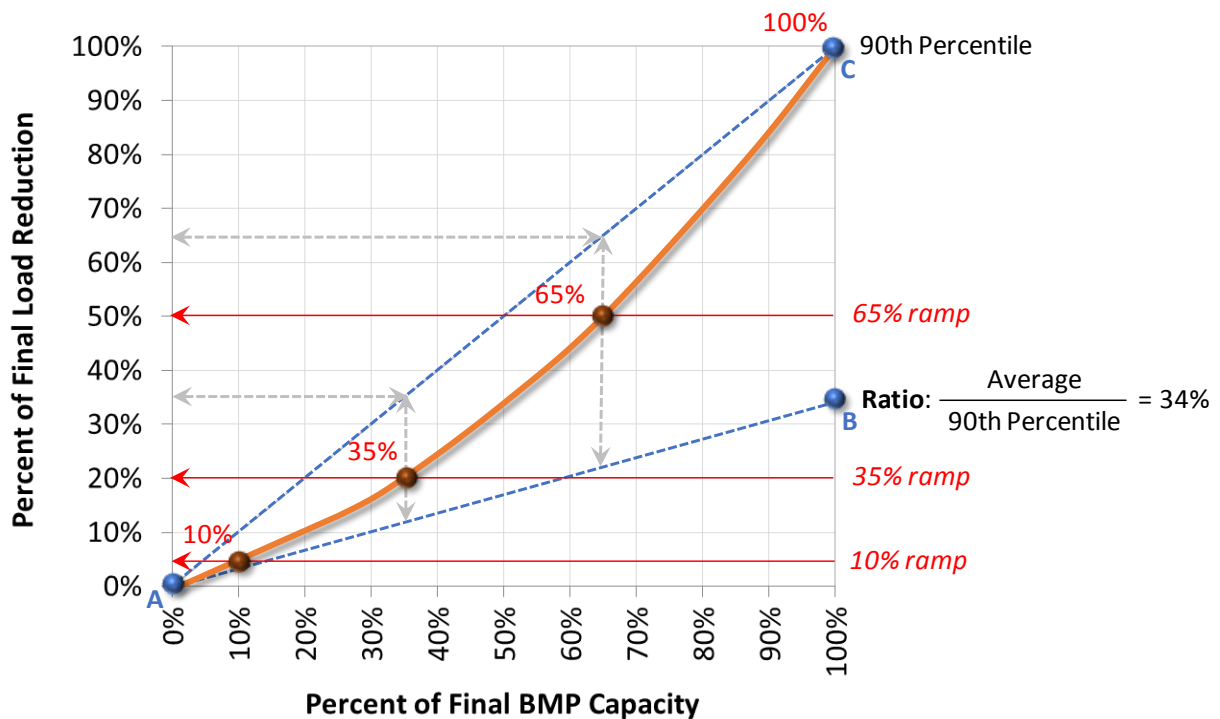


Figure 6-11 Illustration of Gradually Phasing from Average to Critical Conditions for Interim Milestones

The orange “translator” line in this figure phases from average to final by relying entirely on average conditions at 0 percent final BMP capacity and then phases to relying entirely on final conditions at 100 percent BMP capacity. In the example, the average:final ratio is 0.34 (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 0.34). A reduction of 35 percent under average conditions represents a 20 percent reduction under final conditions. A 65 percent reduction under average conditions represents a 50 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 1.0, 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)
- 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 volumes²⁴ 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 ultimate metric for EWMP implementation is the volume of stormwater managed by implemented control measures. The stormwater volume to be managed²⁵ is considered the measurable and enforceable goal that will be used by the Regional Board to assess BMP-based compliance. To support future compliance determinations and adaptive management, the volume of

²⁴ 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.

²⁵ 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 *implicit* 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.

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

stormwater to be managed is reported along with the capacities of control measures to be implemented by each jurisdiction in the EWMP Implementation Strategy.

- **EWMP Implementation Strategy:** the network of 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 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.

7.2 Which Stormwater Control Measures Correspond to Final Compliance by 2021?

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 with the establishment of widespread multi-benefit projects and green infrastructure. The EWMP Implementation Strategy identifies the location and type of control measures to be implemented by 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 to be implemented by each jurisdiction across the entire BCWMA area.** Figure 7-1 summarize control measure sub-categories that will be implemented by 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 7-3 is a map of the “density” of control measure capacities to be implemented 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.

The network of LID, green streets and regional BMPs in the EWMP Implementation Strategy represents approximately **7 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**.

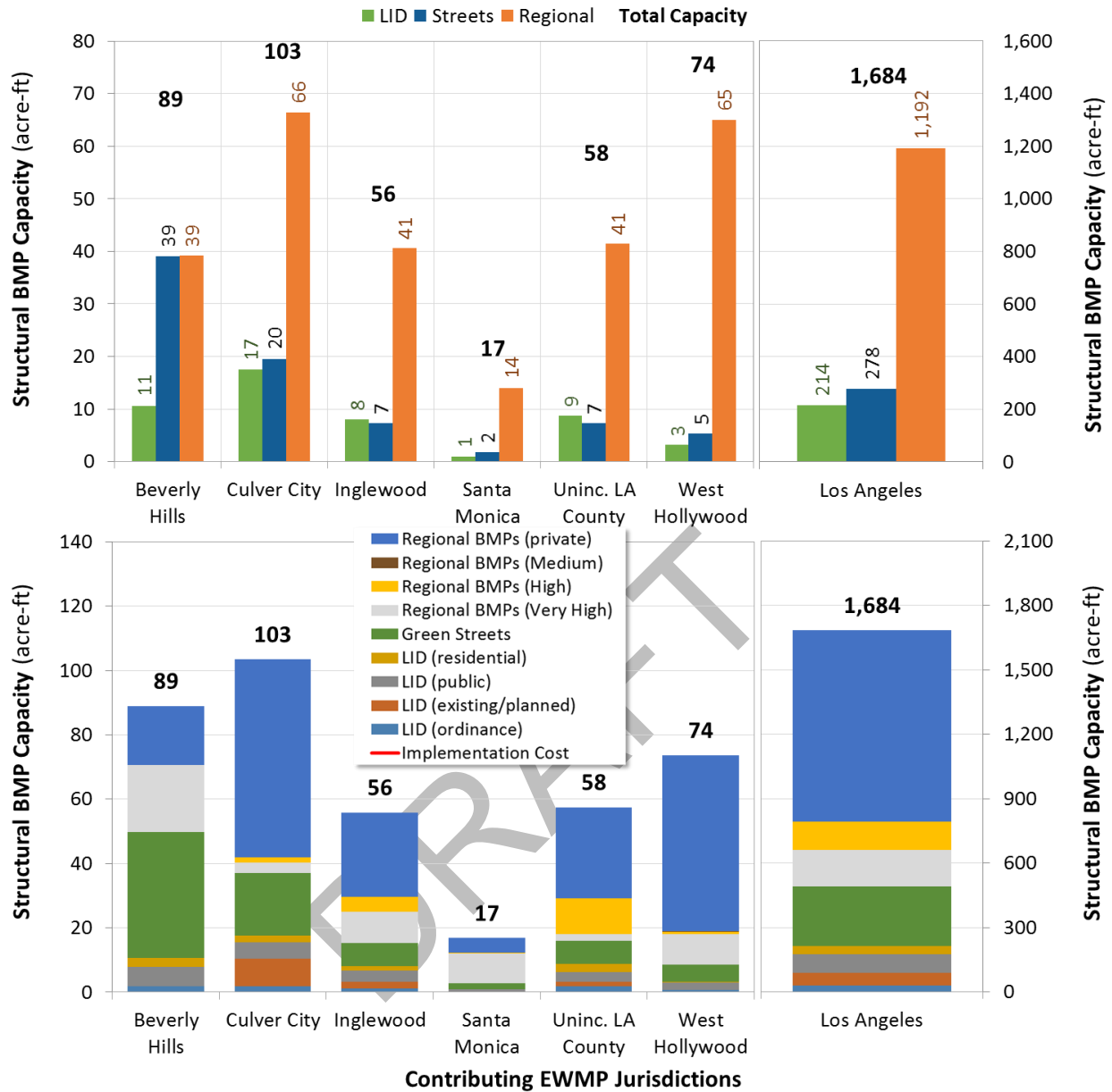


Figure 7-1 BC EWMP Implementation Strategy for Final Compliance by 2021

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.

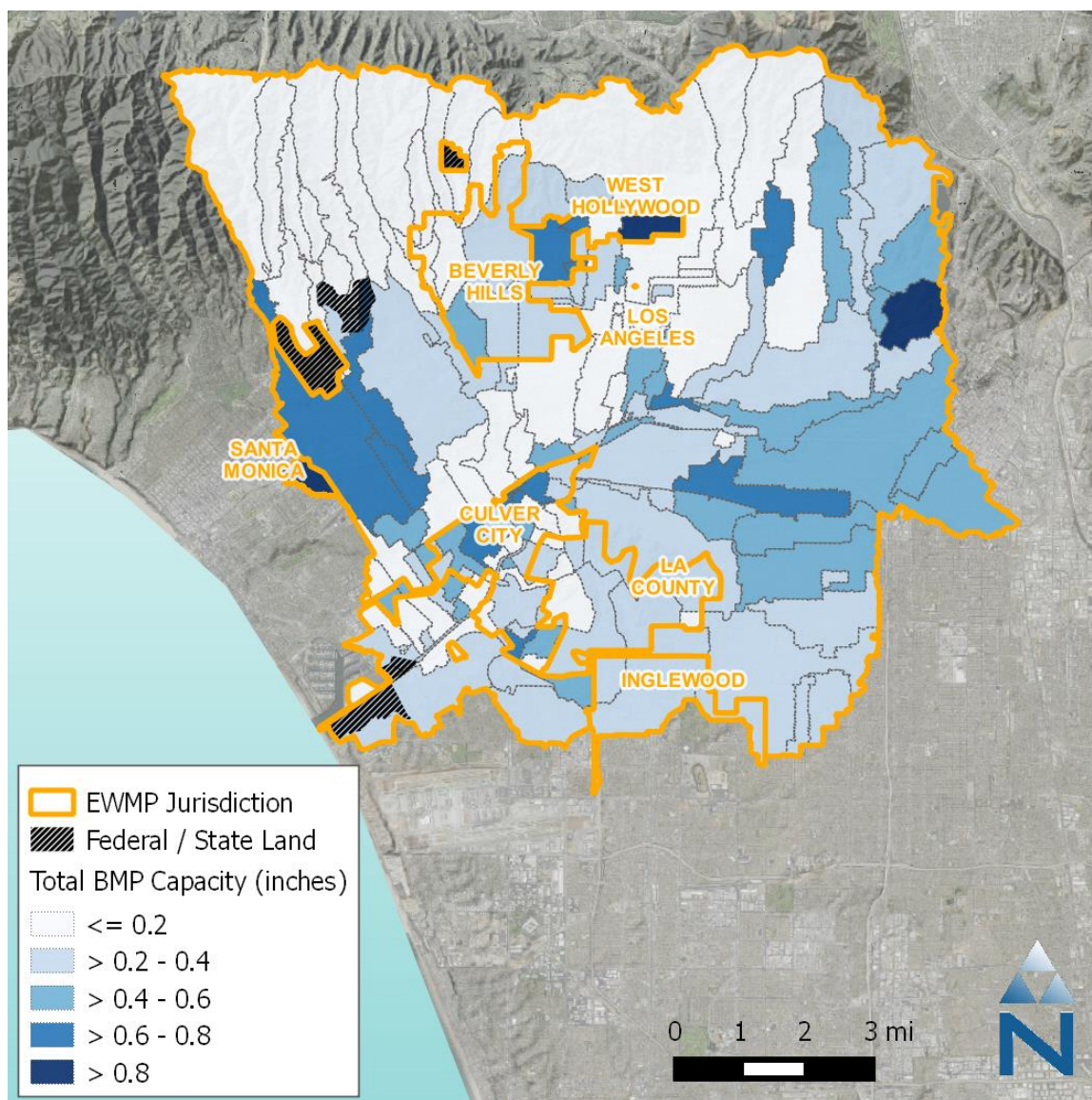


Figure 7-2 EWMP Implementation Strategy by Subwatershed for Metals and Other Water Quality Priorities (except E. coli)

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 (*i.e.*, 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.

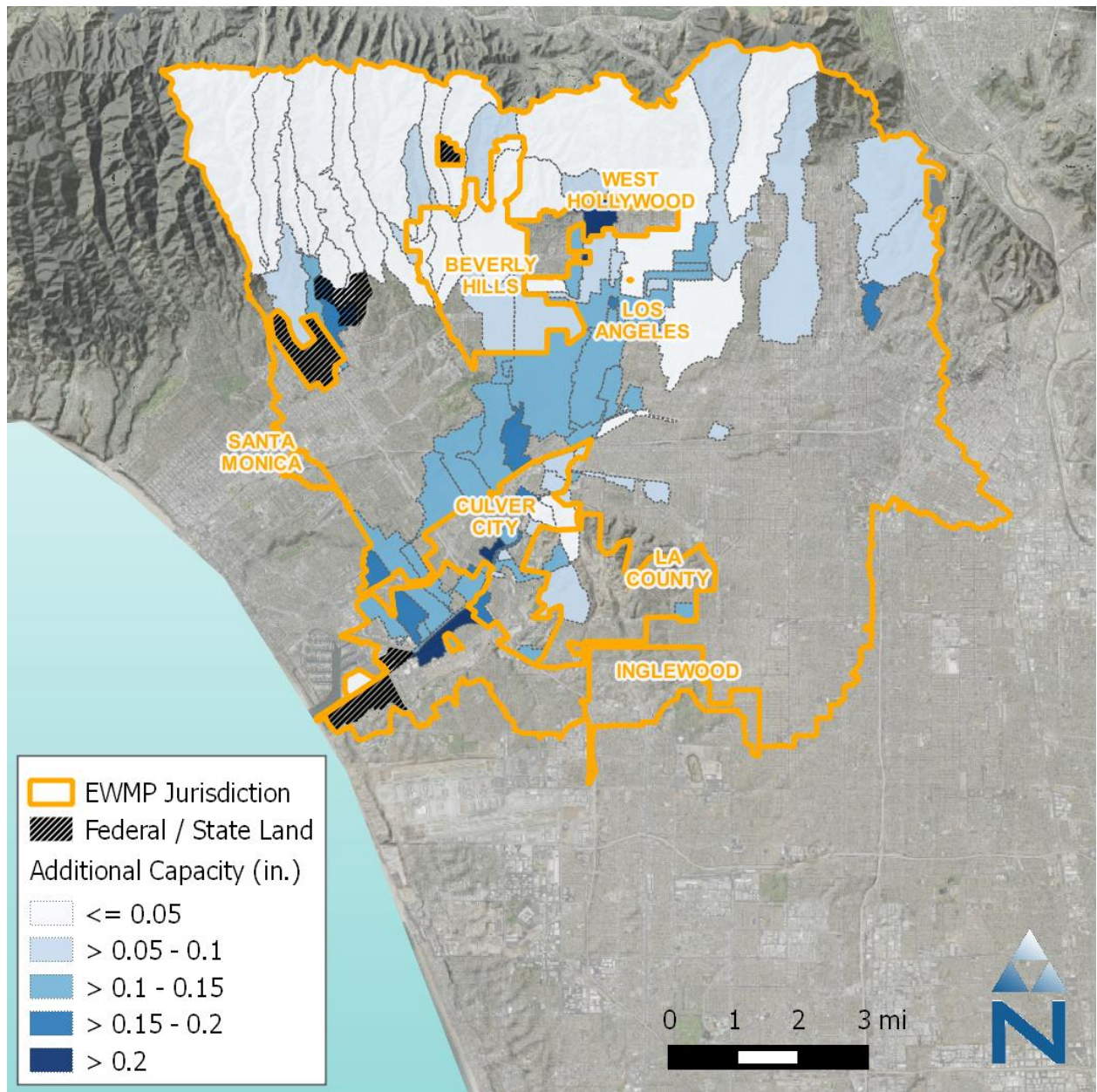


Figure 7-3 Additional Control Measures in EWMP Implementation Strategy to Address E. coli

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.

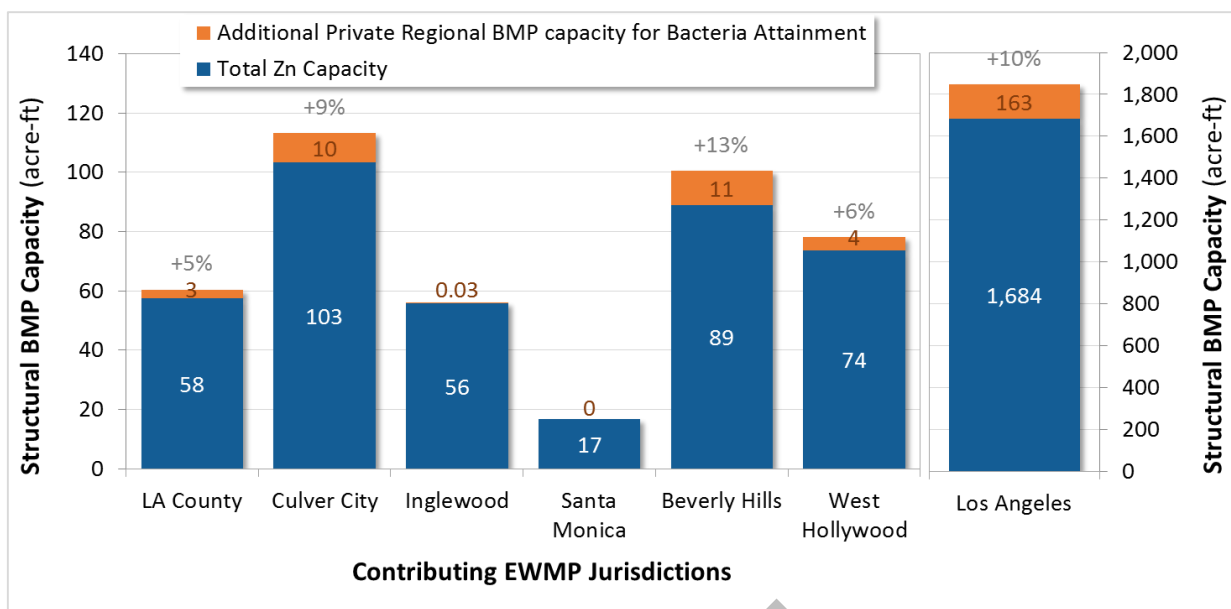


Figure 7-4 Additional Control Measures in EWMP Implementation Strategy to Address *E. coli*

The bars in Figure 7-4 represent the total control measure capacity in the EWMP Implementation Strategy, and the relative 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 milestones of the BC Metals TMDL and also attainment of final compliance targets for the Bacteria TMDL by 2021, as follows:

- Achieve 50 percent of the required zinc reduction by 2016; and
- Achieve 100 percent of the required zinc reduction by 2021; and
- Final compliance with bacteria WQBELs (2021).

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

- **Summary of control measure capacities to be implemented by jurisdictions in each assessment area/watershed:** Figures 7-5 through 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 to be implemented by each jurisdictions:** Shown in Figure 7-8 through Figure 7-15 are panels that summarize the EWMP Implementation Strategy for each individual jurisdiction including control measure scheduling.
- **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.

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 likely 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.

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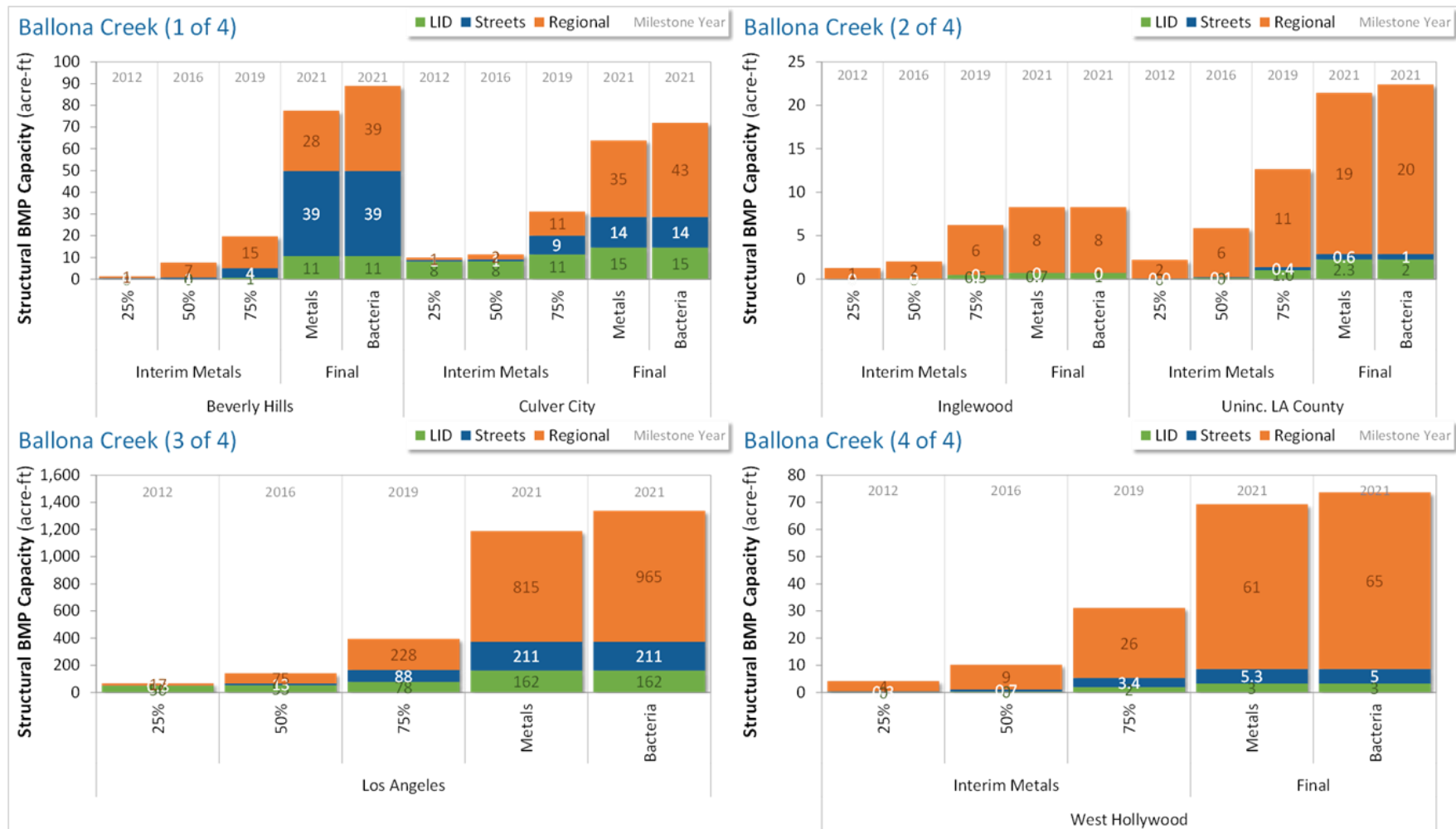


Figure 7-6 Ballona Creek: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street and regional BMP capacity to be implemented over time 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.

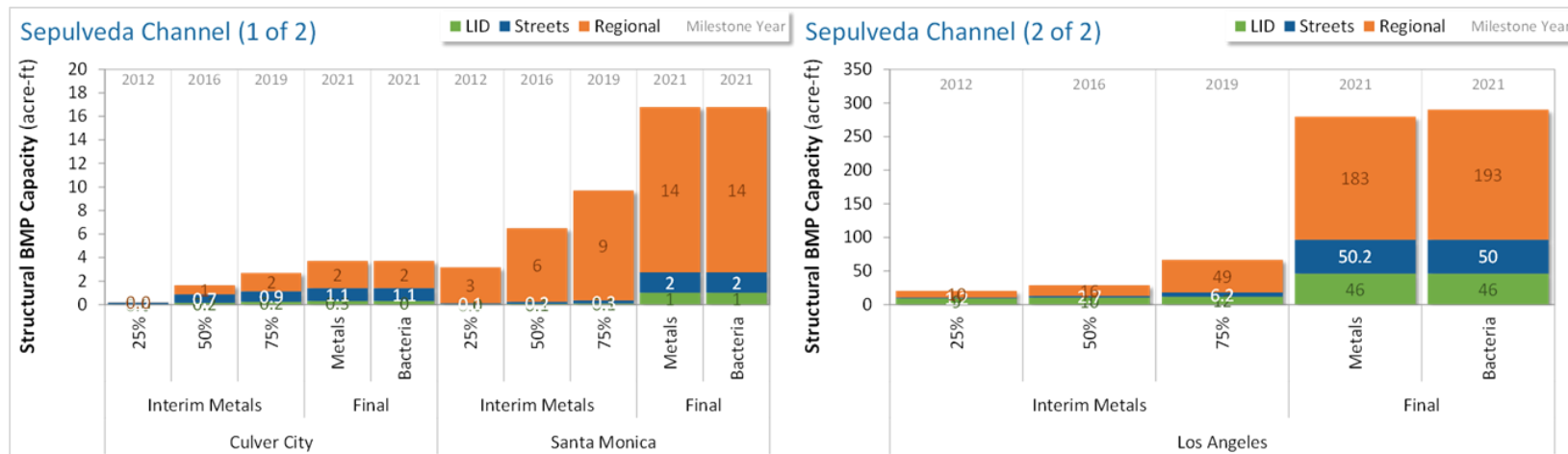


Figure 7-7 Sepulveda Channel: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

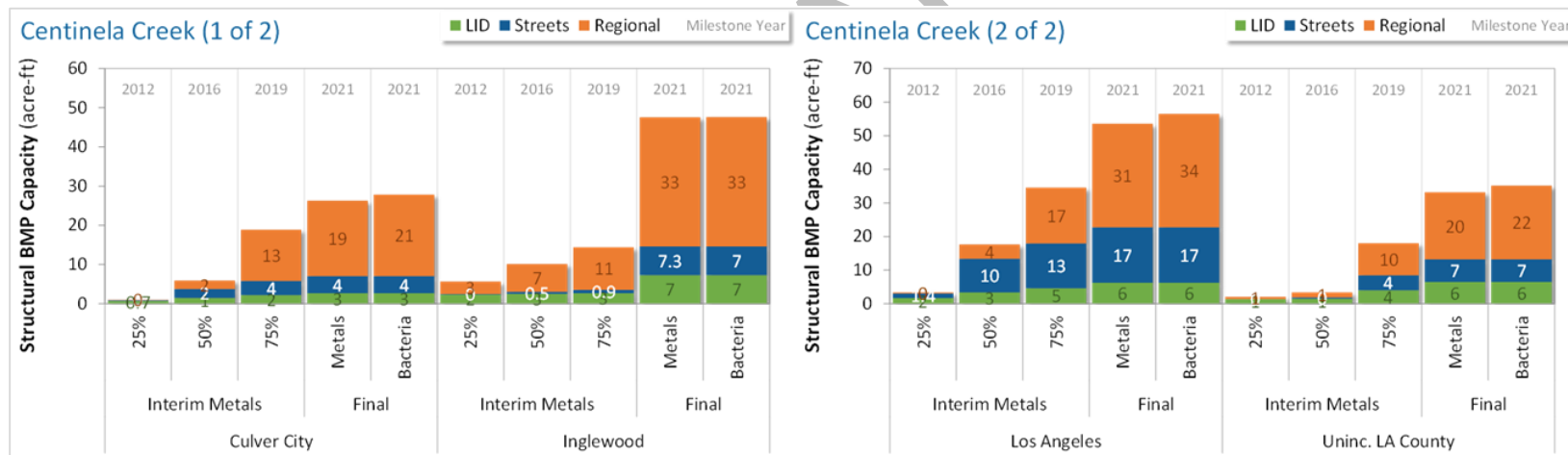


Figure 7-8 Centinela Channel: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street, and regional BMP capacity to be implemented over time to achieve each EWMP/TMDL milestone. 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.

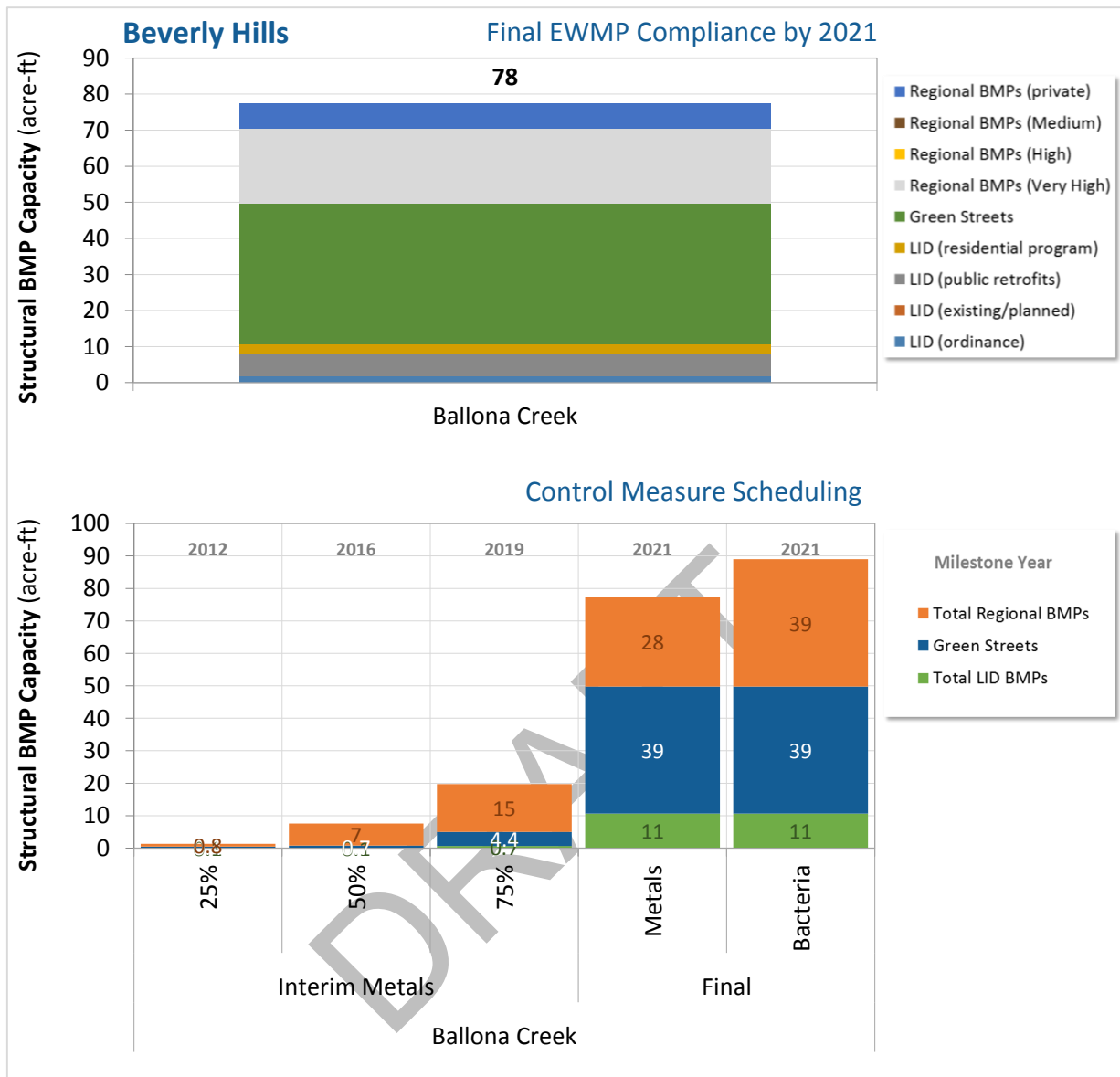


Figure 7-9 Beverly Hills: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street and regional BMP capacity to be implemented over time 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. These capacities are also presented in detail in Appendix 7C.

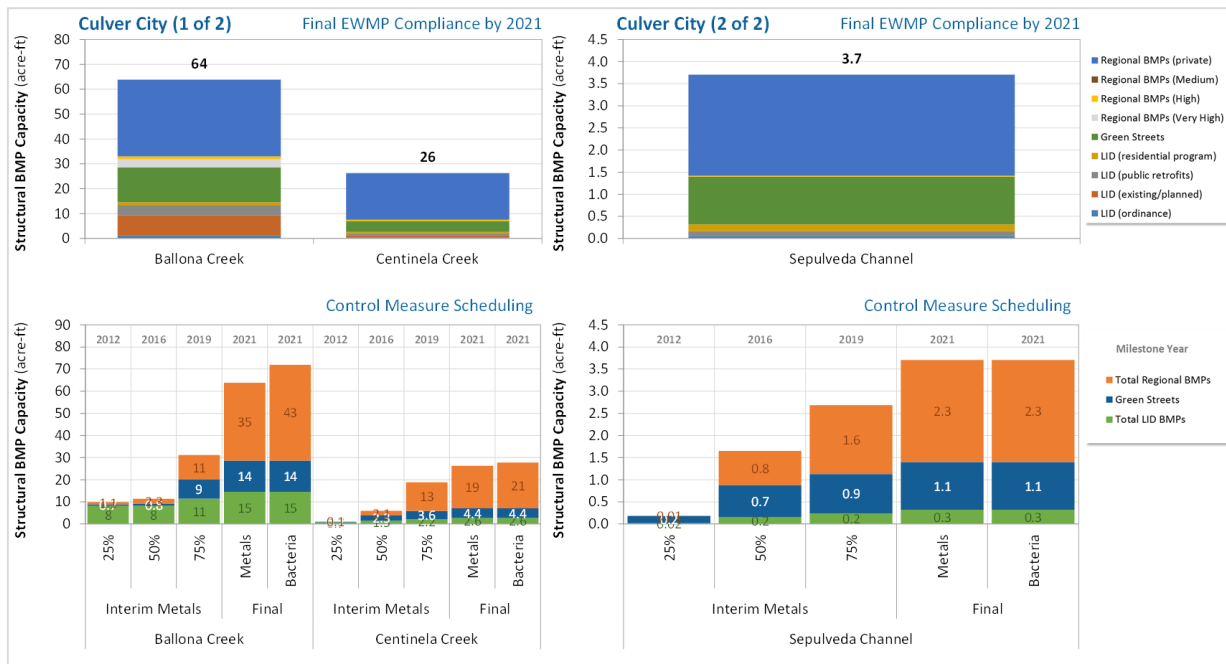


Figure 7-10 Culver City: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street and regional BMP capacity to be implemented over time 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. These capacities are also presented in detail in Appendix 7C. Note that y-axis scales differ among panels.

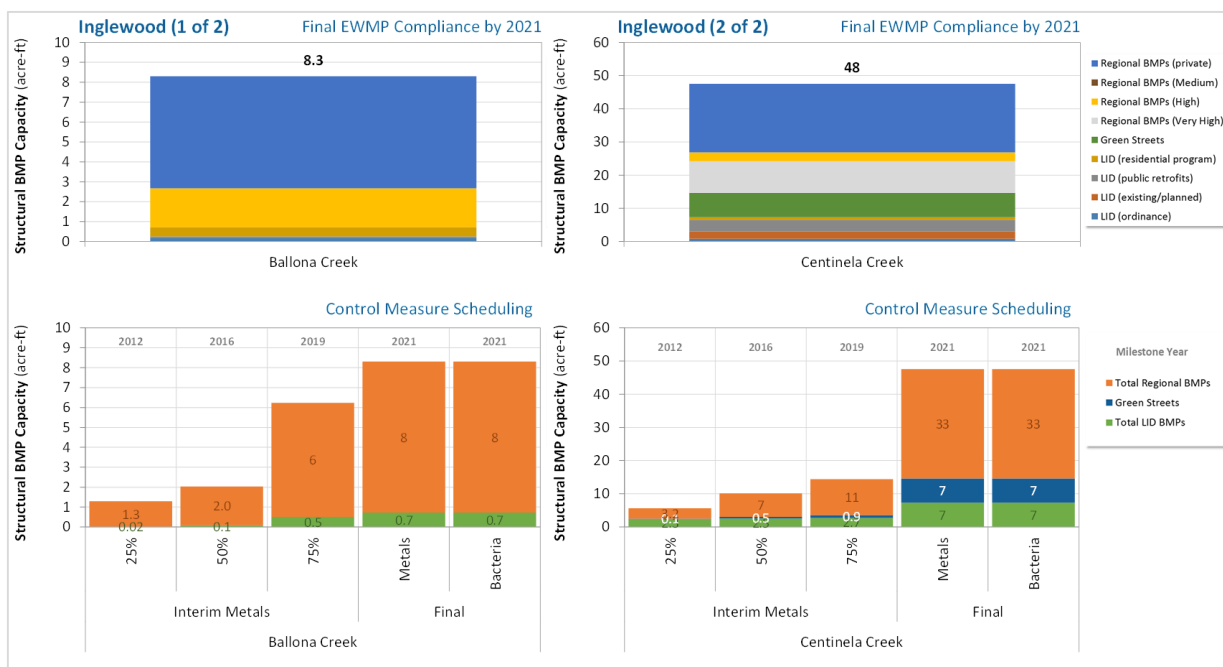


Figure 7-11 Inglewood: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street and regional BMP capacity to be implemented over time 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. These capacities are also presented in detail in Appendix 7C. Note that y-axis scales differ among panels.

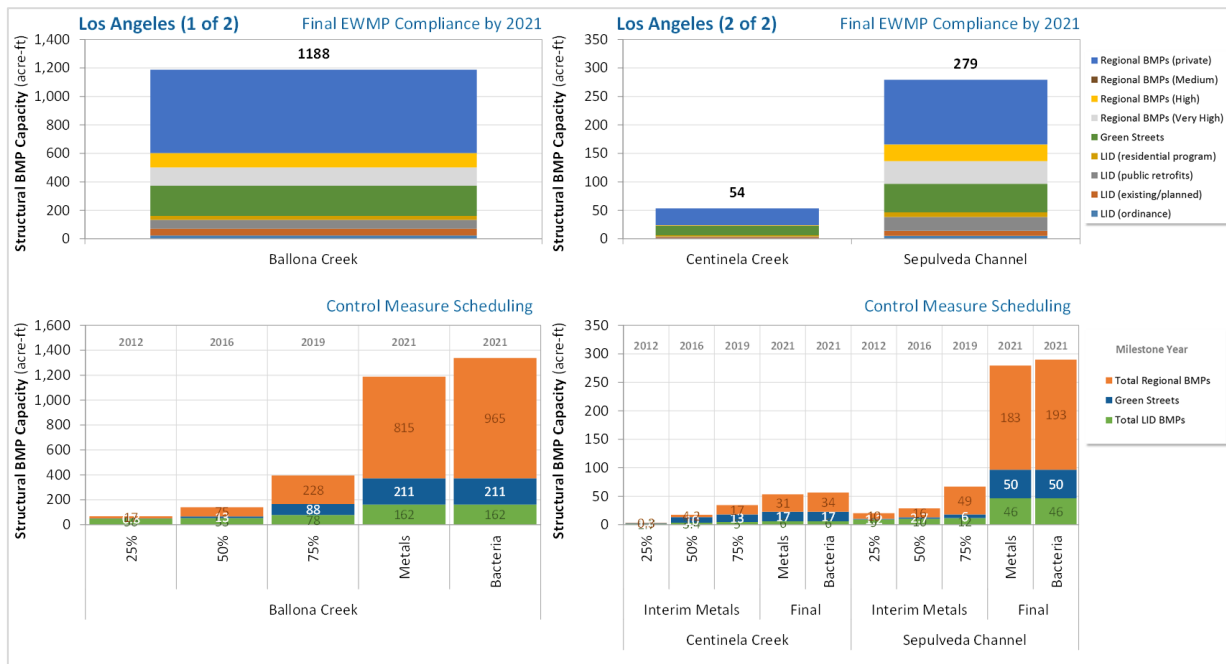


Figure 7-12 Los Angeles: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street and regional BMP capacity to be implemented over time 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. These capacities are also presented in detail in Appendix 7C. Note that y-axis scales differ among panels.

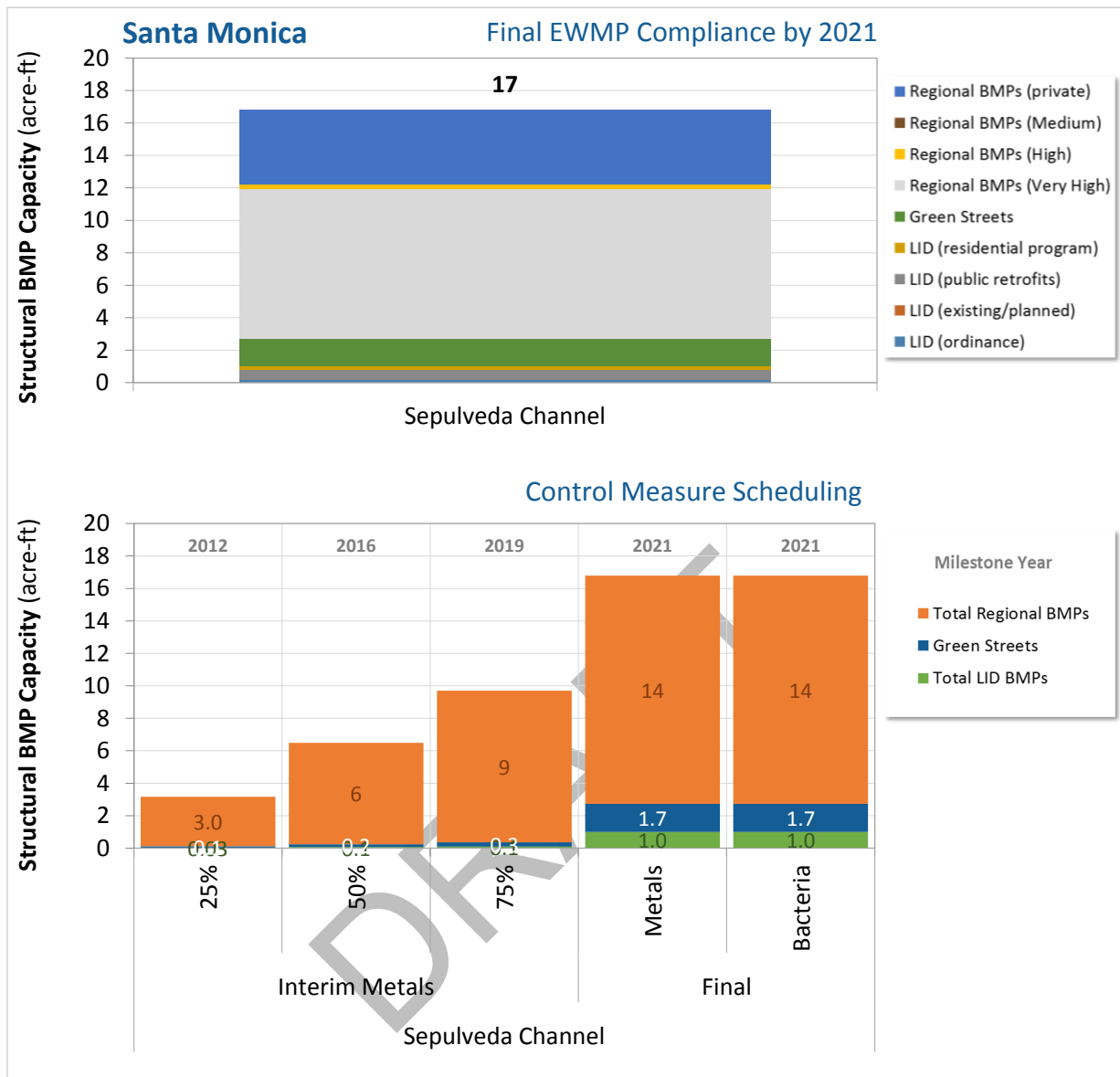


Figure 7-13 Santa Monica: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street and regional BMP capacity to be implemented over time 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. These capacities are also presented in detail in Appendix 7C.

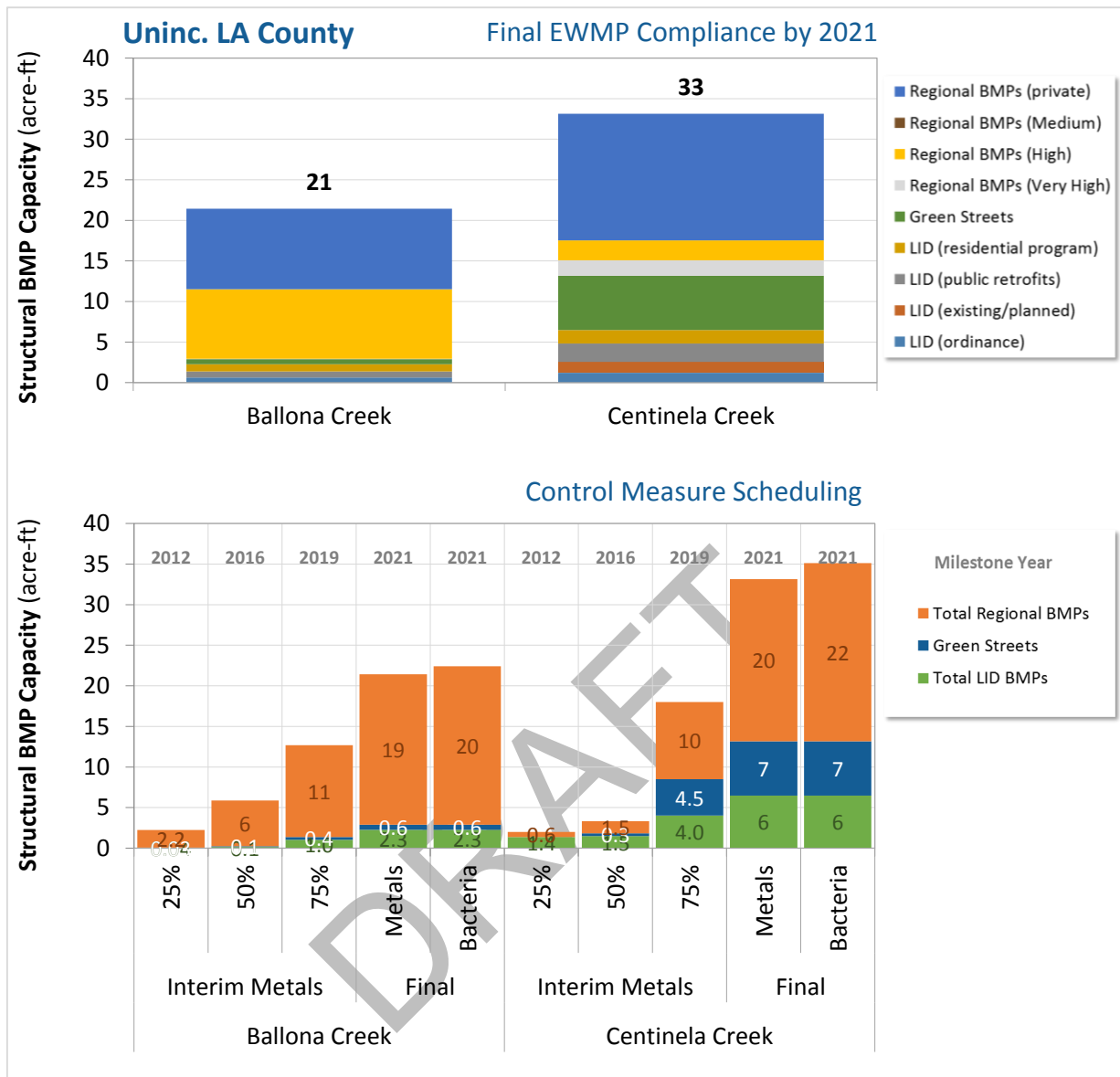


Figure 7-14 Uninc. LA County: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street and regional BMP capacity to be implemented over time 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. These capacities are also presented in detail in Appendix 7C.

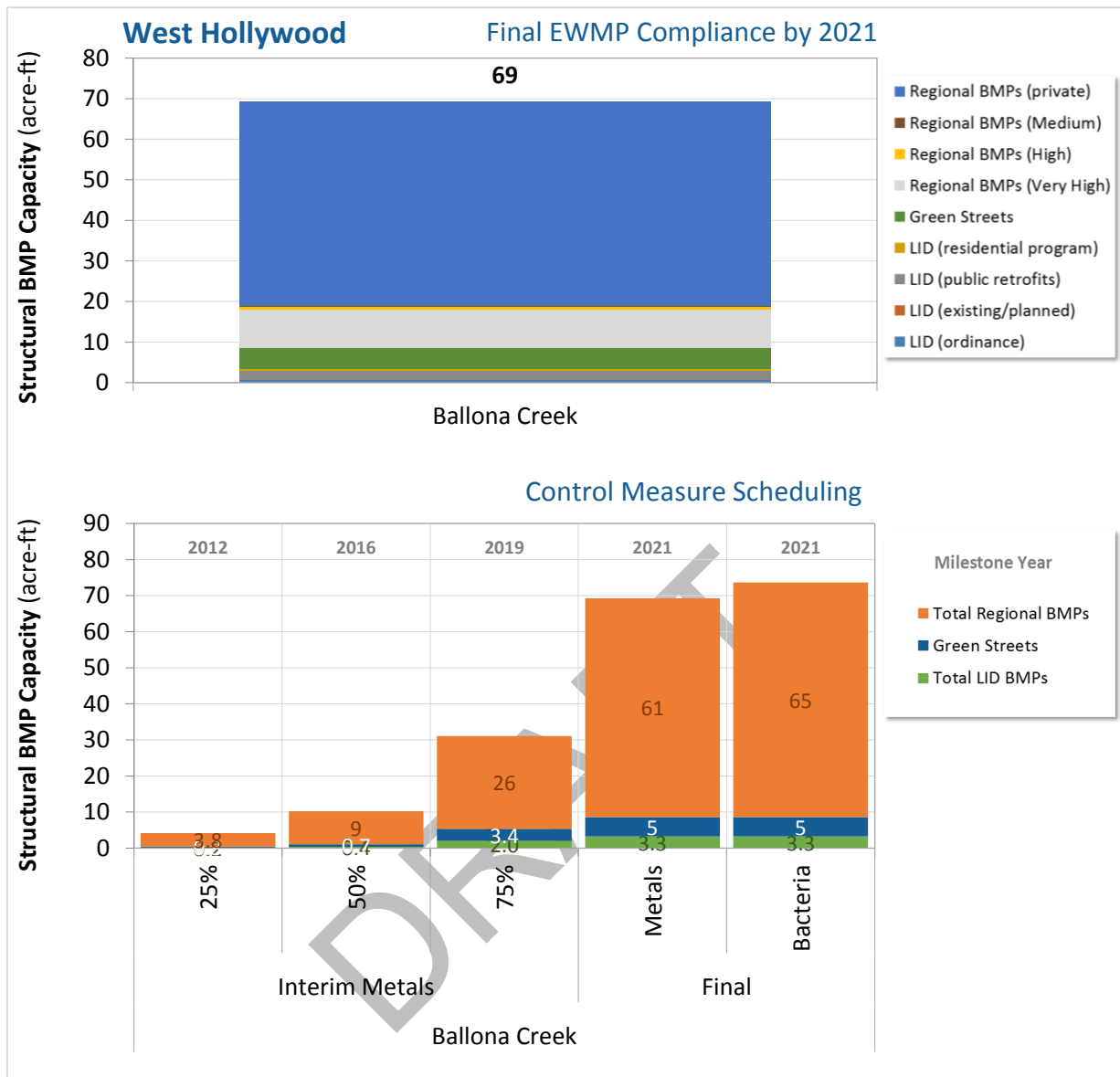


Figure 7-15 West Hollywood: Scheduling of EWMP Implementation Strategy to Achieve EWMP/TMDL Milestones

These bars represent the LID, green street and regional BMP capacity to be implemented over time 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. These 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 2040. The following subsections consider attainment of RWLs for metals and bacteria (Section 6.B describes the dry weather RAA).

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 Plan RAA provides assurance of addressing metals RWLs for the following reasons:

1. During dry weather, exceedances of metals RWLs are currently rare, as described in Section 6.5.4. As such, existing MCMs have reasonable assurance of attaining metals RWLs (see Table 6-6).
2. 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.
3. 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 7-16.

Combined, these three components of dry-weather strategy provide assurance that metals RWLs will be attained.

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 (NOTF).** The NOTF is in process of being retrofitted to capture, disinfect and return²⁶ 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.

²⁶ 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).

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.

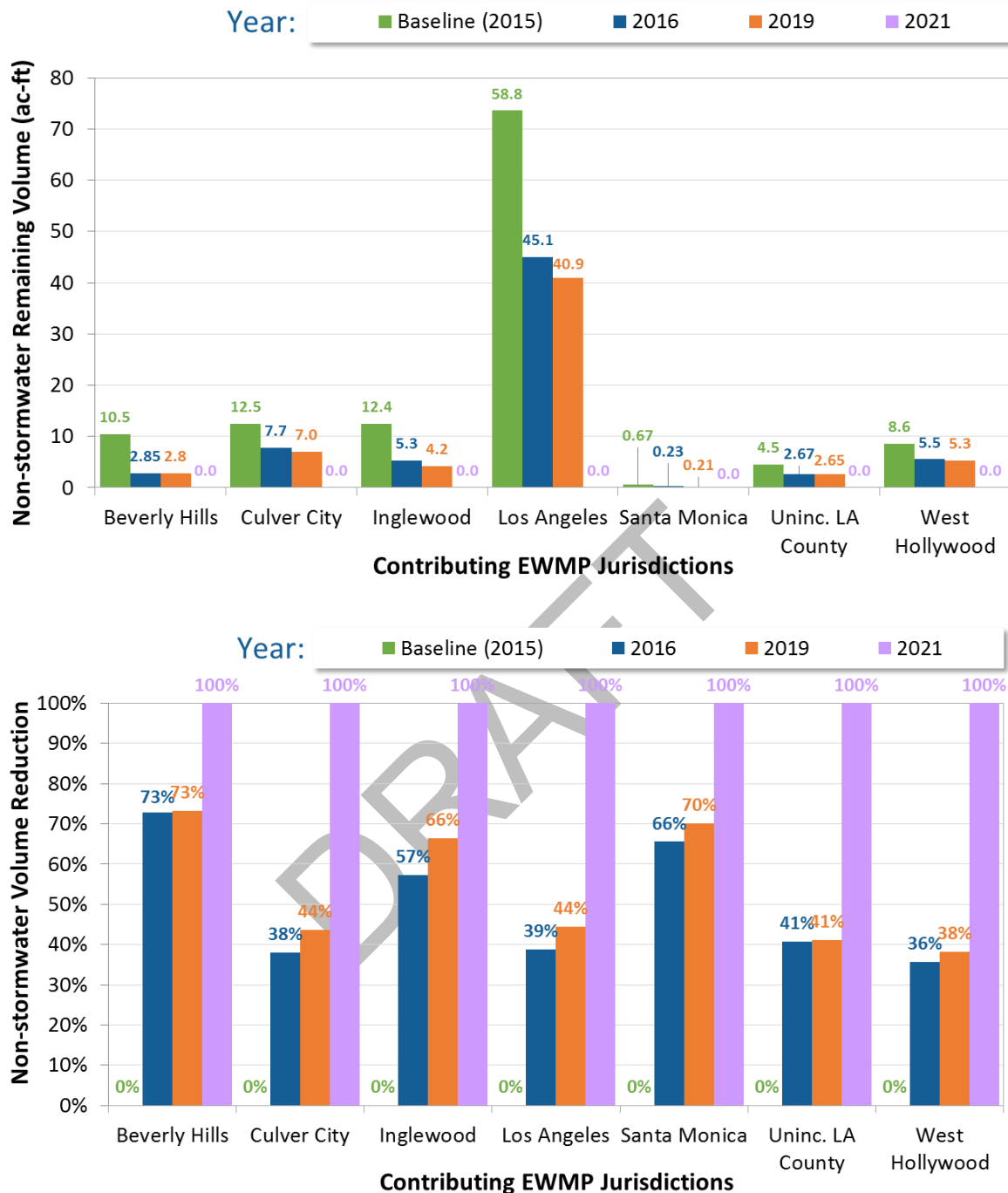


Figure 7-16 Schedule for Eliminating Non-Stormwater Discharges in BC

Figure 7-16 shows the effect of the wet-weather control measures in the EWMP Implementation Strategy on non-stormwater discharges in Ballona Creek watershed. 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 weather compliance dates from the Ballona Creek Metals TMDL are sufficient to achieve the milestones.

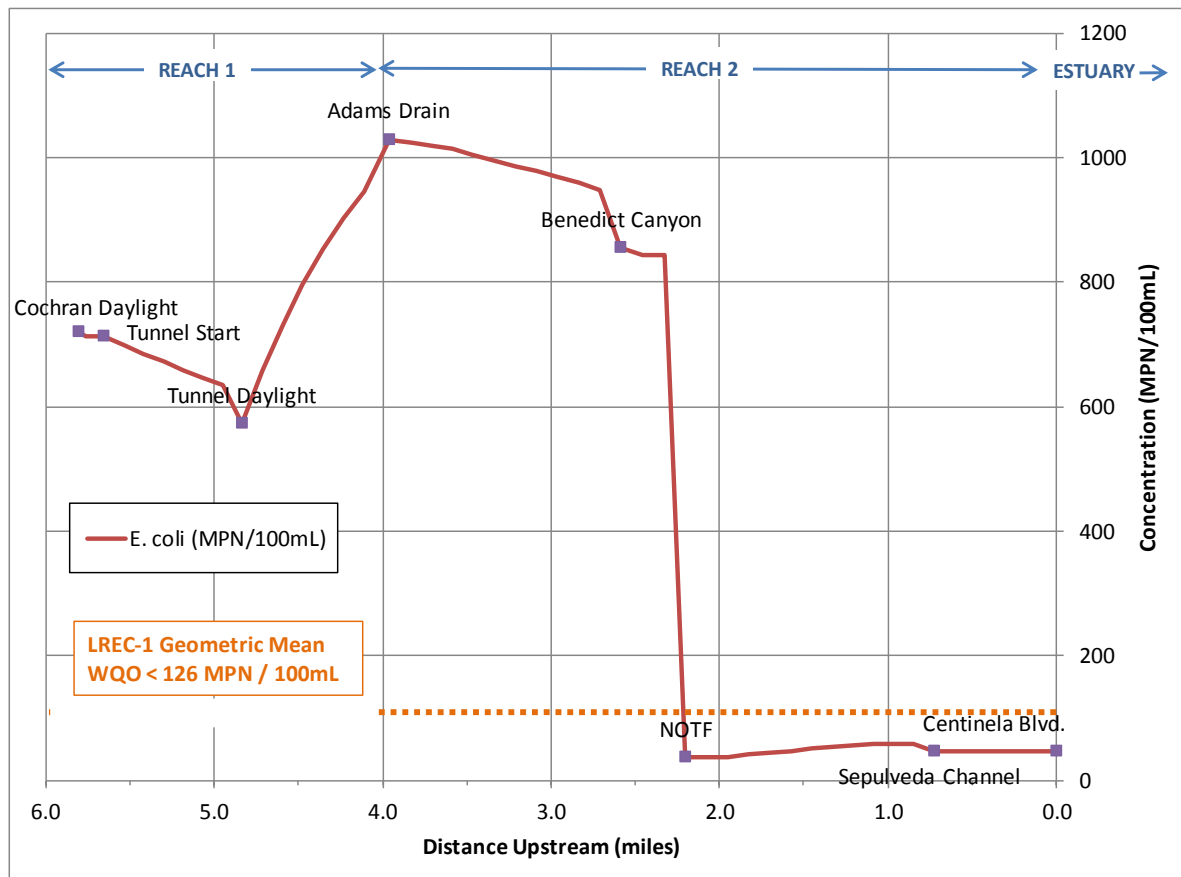


Figure 7-17 Concentration of E.coli in Ballona Creek with NOTF and Sepulveda Channel LFTF Operational

Figure 7-17 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 – 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).

Section 8

Compliance Determination and Adaptive Management Framework

At its core, the EWMP is a regulatory document to support compliance determination with the MS4 Permit, and over time the EWMP will be adapted to become more effective as new program elements are implemented, regulations change and additional information and data are gathered. This section discusses the anticipated approach to compliance determination and discusses key elements of adaptive management. Adaptive management is a critical component of the EWMP implementation process, as the EWMP looks forward to 2021 and beyond and watershed conditions, stormwater science and water quality regulations will certainly change over the coming decades. Over time, monitoring data collected by the CIMP will provide information on water quality conditions and the effectiveness of control measures, which can be compared to predictions by the RAA. In addition, EWMP members will update their EWMP Implementation Strategy based on new identified opportunities (*e.g.*, identifying a newly available public parcel for 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 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 WQBELs. By developing and implementing an approved EWMP, the BC EWMP Group is provided another type of compliance determination, based on whether the Compliance Targets and/or non-stormwater control measures²⁷ in the EWMP Implementation Strategy have been implemented. 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 is based on review of 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.

Compliance should be determined separately for each constituent and condition (wet or dry). While the limiting pollutant analysis determined the control measures that will address all pollutants, it is not necessary to fully control zinc and *E. coli* to address the other Water Quality Priorities. For example, many pollutants addressed by this EWMP have reasonable assurance of being addressed by

²⁷ 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.

existing MCMs and control measures – namely those pollutants listed in Table 3-5 and all the pollutants for which detections and/or exceedances were never documented during development of the Water Quality Priorities, as detailed in Appendix 3.A. If exceedances of those pollutants occur, then the MCMs and control measures should be based on evaluation of whether the existing level of implementation for MCMs and control measures (as of June 2015) has been maintained.

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 and the support expressed by the State Board for the EWMP process, 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).

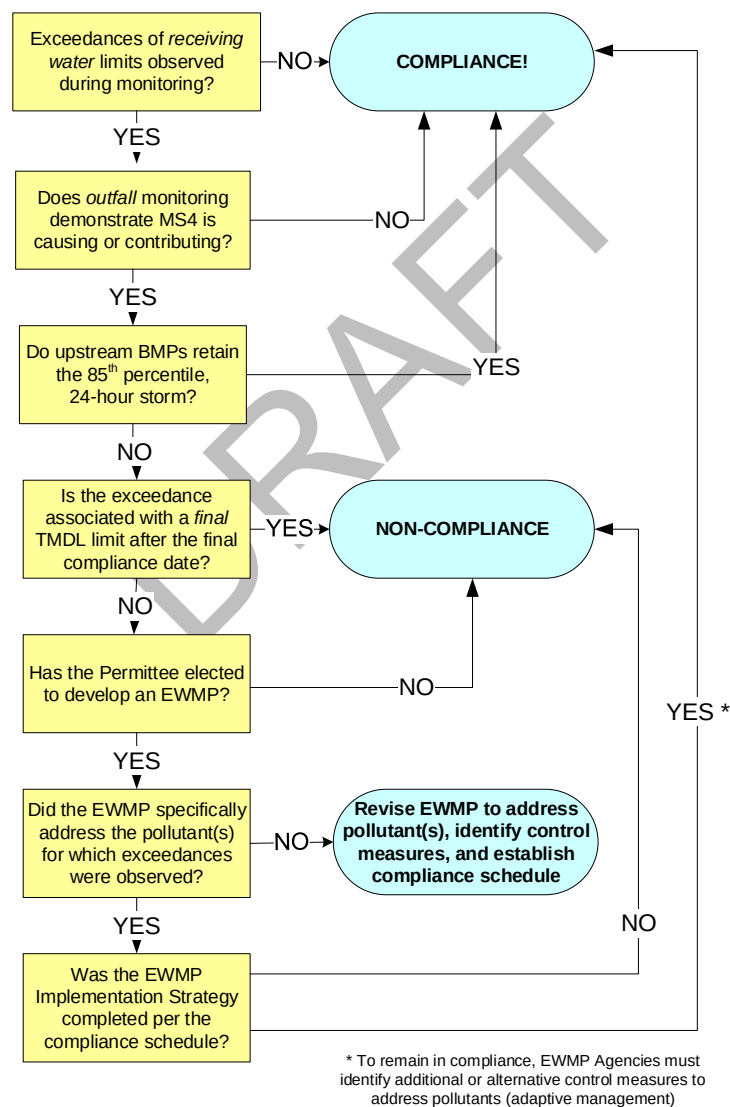


Figure 8-1 MS4 Permit Compliance Determination Process

8.2 Adaptive Management Framework

The Permit specifies the adaptive management process will be revisited every two years to 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) Progress toward achieving interim and/or final WQBELs and/or RWLs.
 - 3) Achievement of interim milestones.
 - 4) Re-evaluation of water quality priorities and source assessment.
 - 5) Availability of new information other than the Permittees’ monitoring program.
 - 6) Regional Water Board recommendations; and
 - 7) Recommendations through a public participation process.
- ii Based on the results of the adaptive management process, Permittees shall report any modifications necessary to improve the effectiveness of the EWMP in the Annual Report.
- iii Permittees shall implement any modifications to the EWMP upon approval by the Regional Board or within 60 days of submittal if the Regional Board expresses no objections.”

The EWMP adaptive management process will incorporate new monitoring data collected through implementation of the CIMP or other programs, experience gained from BMP implementation, and/or changes to the water quality standards (*i.e.*, beneficial uses or WQBELs and/or RWLs). 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 and bacteria TMDLs 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 be 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 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 allow for 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 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. It is anticipated the RAA will be updated at least once every six years. For example, as additional control measures are implemented in LA County, new data may become available regarding performance of control measures for reduction pollutants.

In turn, the performance metrics in the RAA could be updated. Other types of data that could support RAA updates include soil infiltration data, revised catchment delineations, modified operations to impoundments/reservoirs, and major changes to the quality or volume of effluent discharges from 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 (*i.e.*, specified volumes of stormwater are managed), the type of control measure implemented does not affect compliance determination. As the EWMP is implemented over time, it is *expected* that refined strategies will identify a different suite of opportunities or different BMP designs from that which was assumed for the RAA. It will, therefore, be important to track BMP implementation so adjustments can be made when checking progress towards achieving Compliance Targets. To illustrate how control measure preferences could be modified during adaptive management, an example is 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.

(Current Fixed Goal)		(Flexible)											
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 2026	For Bacteria by 2040	For Metals Attainment by 2021										For Bacteria Attainment by 2021	
24-hour Volume Retained (acre-ft)	Additional 24-hour Volume to be Retained (acre-ft)	% Load Reduction Critical Condition	Low-Impact Development				Streets	Regional BMPs				Total BMP Capacity (acre-ft)	Total BMP Capacity (acre-ft)
			Ordinance	Planned LID	Public LID	Residential LID	Green Streets	Very High (public, owned)	High (public, owned)	Medium (public, non-owned)	Private		
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	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
Adaptive Management: Burden Transferred from Regional Projects to Newly Identified High-Efficiency Green Street Opportunities													
Scenario 2:	41%	0.49	0.30	--	4.35	8.92	0.00	0.29	0.00	0.00	14.4	--	14.4
Adaptive Management: Remaining Capacities for Bacteria and Public LID are Offset by Residential LID													
Scenario 3:	41%	0.49	0.30	--	0.87	--	--	--	--	--	8.0	9.7	9.7
Adaptive Management: Regional BMP Located at Subwatershed Outlet													

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

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

DRAFT

Section 9

EWMP Implementation Costs and Financial Strategy

The purpose of this section is to present costs for constructing, operating and maintaining the control measures in the EWMP Implementation Strategy, along with the financial strategy for addressing those costs. For the purposes of the EWMP, the financial strategy is defined as the strategic options available to the Permittees for financing the program costs associated with the MS4 Permit. Currently, a funding source for all of the activities described in this EWMP has not been determined. The section provides an overview of the following components of the EWMP financial strategy:

- Estimates of costs to construct, operate and maintain required control measures (9.1.1);
- Assessment of impact of program costs on Group members (9.1.2);
- Review of existing policies, revenues and costs affecting stormwater (9.1.3); and
- Identification of financial strategies for financing program costs including next steps (9.1.4).

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 is 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 WMMS²⁸. The cost functions are based on generic, modular cost functions developed specifically for Los Angeles County. The cost functions²⁹ 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 provided here are considered to be planning level only (order of magnitude), and can be refined as EWMP implementations progresses with the use of actual BMP implementation costs. Costs for enhanced 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.

²⁸ 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.

²⁹ 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 BMP Cost Functions for Final Compliance RAA (20-year, including O&M)

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

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

Details on the cost functions used for the cost estimate are provided in the documentation for the WMMS model (<http://dpw.lacounty.gov/wmd/wmms/res.aspx>). The costs for structural BMPs provided here are considered to be planning-level, or order of magnitude costs, 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.

9.1.1 EWMP Costs by BMP and TMDL Milestones

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

Table 9-2 Total Costs by Milestone for each 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	
		Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Beverly Hills	LID	0.27	0.65	3.81	4.60	0.00	4.92	4.07	4.92
	Streets	1.83		25.16		0.00		26.99	
	Regional	3.42		1.69		0.00		5.11	
	Private	0.00		14.71		24.28		39.00	
	Subtotal	5.52		45.37		24.28		75.17	
Culver City	LID	1.34	1.20	2.05	3.65	0.00	3.92	3.39	3.92
	Streets	5.91		7.56		0.00		13.48	
	Regional	1.16		0.04		0.00		1.20	
	Private	12.95		96.94		20.49		130.37	
	Subtotal	21.36		106.59		20.49		148.43	
Inglewood	LID	0.24	0.32	2.14	2.03	0.00	2.03	2.38	20.3
	Streets	0.34		4.69		0.00		5.03	
	Regional	2.22		1.27		0.00		3.50	
	Private	0.00		55.71		0.07		55.78	
	Subtotal	2.80		63.81		0.07		66.69	
Los Angeles	LID	12.86	14.12	47.81	57.25	0.00	61.79	60.67	61.79
	Streets	50.09		150.93		0.00		201.02	
	Regional	62.05		11.56		0.00		73.61	
	Private	6.57		1,537.41		345.89		1,889.87	
	Subtotal	131.56		1,747.71		345.89		2,225.17	
Santa Monica	LID	0.04	0.19	0.40	0.59	0.00	0.59	0.44	0.59
	Streets	0.12		1.08		0.00		1.20	
	Regional	1.53		0.79		0.00		2.32	
	Private	0.00		9.70		0.00		9.70	
	Subtotal	1.69		11.96		0.00		13.66	
Uninc. LA County	LID	0.35	0.40	1.82	1.93	0.00	2.02	2.18	2.02
	Streets	0.78		4.27		0.00		5.06	
	Regional	2.24		0.95		0.00		3.19	
	Private	0.00		54.08		6.21		60.29	
	Subtotal	3.38		61.12		6.21		70.71	
West Hollywood	LID	0.79	0.62	0.76	2.34	0.00	2.46	1.55	2.46
	Streets	1.88		1.80		0.00		3.68	
	Regional	2.49		0.02		0.00		2.51	
	Private	0.00		106.75		9.32		116.07	
	Subtotal	5.16		109.33		9.32		123.82	
Total		171.48	17.50	2,145.89	72.40	406.28	77.74	2,723.65	77.74

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	75.17	4.92	0.00	0.00	0.00	0.00	75.17	4.92
Culver City	95.94	2.72	46.80	1.03	5.69	0.17	148.43	3.92
Inglewood	12.49	0.22	54.20	1.82	0.00	0.00	66.69	2.03
Los Angeles	1,812.70	47.74	82.03	2.49	330.45	11.57	2,225.17	61.79
Santa Monica	0.00	0.00	0.00	0.00	13.66	0.59	13.66	0.59
Uninc. LA County	26.19	0.65	44.52	1.36	0.00	0.00	70.71	2.02
West Hollywood	123.82	2.46	0.00	0.00	0.00	0.00	123.82	2.46
Total	2,146.30	58.72	227.55	6.70	349.79	12.33	2723.65	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 costs by the number of parcels in the watershed. The calculated total is \$9,422 per parcel. It should be noted that this is 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.

9.1.4 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 options to address the expected *additional* costs, and does not address funding requirements for *existing* stormwater programs.

Table 9-4 Existing Stormwater Costs

Jurisdiction	Existing Utility?	Funding Source	Description of Costs	Total Costs
Beverly Hills	Yes	Stormwater Fund/General Fund	Management, Outreach, Inspections, O&M and Capital	~\$4M/yr (excluding CIP)
Culver City	No	General Fund	Management, MCMs, TMDLs	~\$500,000/yr
Inglewood	Yes	Sewer Fund	O&M and Capital, Runoff Investigation	\$2.2M/yr
Los Angeles	Yes	Stormwater Fund	O&M and Capital, Planning, Enforcement and Monitoring	~\$30M/yr
Santa Monica	Yes	Stormwater Fund/General Fund	O&M and Capital, Outreach, Inspections, Management	~\$13.7M/yr
Unincorporated LA County	Yes	General Fund	Management, Outreach, inspection, enforcement, monitoring	~80M/yr (County wide)
West Hollywood	No	General Fund	Management, Outreach, Inspections	~\$1M/yr

9.2 Financial Strategies

The financial strategy to fund the LID, green streets and regional projects in the EWMP will require a regional strategy. The capital and operating costs for those control measures are large and will span decades. It will be important for each jurisdiction to have the opportunity customize the financial strategy to the preferences of its community. As such, the financial strategy presented in this EWMP outlines a set of multiple approaches that allows each jurisdiction to consider and select those strategies that best fit their specific preferences. The detailed financial strategy for EWMP costs will be highly dependent and vary by permittee.

The following are high-level alternatives that can be examined for each jurisdiction or the entire EWMP Group. The alternatives are categorized by type. 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.

9.2.1 Grants

The financial strategies available to the permittees associated with grants are:

Description
Apply for grants through the recently passed Prop 1 – 2014 Water Bond. Over \$400M is available for stormwater capture, IRWMP and urban creek restoration projects.
Apply for other grants (state and federal) for stormwater improvement, beach water quality improvement, and green infrastructure projects. (e.g., Prop. 84, CBI, etc.)

9.2.2 Fees and Charges

The financial strategies available to the permittees associated with fees and charges are:

Description
Use existing revenue streams for stormwater/water supply/flood control projects to support stormwater quality projects
AB 2403 – Use the new state law to pass rate increase for stormwater projects that have a water-supply benefit and minimize the Proposition 218 process.
Use revenue generated from a Stormwater Impact Fee (or “In-Lieu” Fee) to comply with LID ordinances to fund a mitigation bank for regional projects.
Increase solid waste management fees to cover the cost of enhanced street sweeping and other measures to reduce trash for compliance with TMDLs.
Consider adopting water conservation fees that would provide funding for reducing irrigated runoff in order to both conserve groundwater and reduce dry weather pollution.
Continue to pursue a county-wide stormwater parcel tax initiative (modified after the 2012 Clean Water Clean Beaches Initiative). This could be tied to AB 2403 too.
Consider assessments on car rentals since some of the pollution in our waterways is from rental cars driven on local streets.

9.2.3 Legislative and Policy

The financial strategies available to the permittees that require legislative or policy changes are summarized below:

Description
Develop stormwater retention credit trading market to use private equity.
Ask the Metropolitan Water District (MWD) of Southern California to reevaluate their approach for managing the Local Resource Program (LRP) to fund stormwater capture and use projects that offset the use of imported water supplies.
Pursue pollutant source control legislation patterned after SB 346 that either limits pollutants of concerns in products (e.g., copper in brake pads, or zinc in tires) or assesses a fee on those products that can be used by local governments to mitigate those pollutants.
Form Special Assessment Districts and fees tailored to the WMGs.
Explore the use of Enhanced Infrastructure Finance Districts tailored to the WMGs, as outlined in recently adopted (2014) California legislation SB628.
2014 Water Resources Reform and Development Act of 2014 (WRRDA). Various funding opportunities should be explored.

9.3 Future Steps

The financial strategies mentioned herein are options for funding sources, some or all of which will need to be implemented to develop a comprehensive financial solution. As each jurisdiction determines the appropriate funding source, they could consider the following items as well:

- Development of public support for financial strategies through outreach efforts
- Creation of an inter-jurisdictional BCWMG Financial Subcommittee;
- Development of a more formal Stormwater Program Financial Plan which would typically include the following components:
 - Implementation of New Fee or Charge;
 - Establishment of New Enterprise Fund;
 - Cash and Debt Financing;
 - Operating and Capital Reserves;
 - Cash Flow Modeling.

The BC EWMP Group as a whole, as well as individual Group members are currently prioritizing and selecting the specific financing strategies that best fit their needs. It is anticipated that a more fully developed financial plan will be developed and implemented by the EWMP Group in the coming months and years based on the strategic options selected as most likely to be successful.

Section 10

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.
- CREST 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
- 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 Bacterial Indicator Densities in Ballona Creek, Ballona Estuary, and Sepulveda Channel Implementation Plan (Draft). November 2009.
- 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.

- 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 and USEPA (U.S. Environmental Protection Agency). 2002. The Loading Simulation Program in C++ (LSPC) Watershed Modeling System – User's Manual. Tetra Tech, Fairfax, VA, and U.S. Environmental Protection Agency, Washington, DC.
- 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, CA, by Tetra Tech, Pasadena, CA.
- 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, CA.
- University of Florida. (2012). Mercury Spills. Available at: <http://www.ehs.ufl.edu/programs/ih/mercury/>
- USEPA (U.S. Environmental Protection Agency). 2003. Fact Sheet: Loading Simulation Program in C++. USEPA, Watershed and Water Quality Modeling Technical Support Center, Athens, GA. Available at: <http://www.epa.gov/athens/wwqtsc/LSPC.pdf>
- 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. 1999. Preliminary Data Summary of Urban Storm Water Best Management Practices, EPA-821-R-99-012, August 1999 (Chapter 5).
- 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).
- 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.

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Appendix 1.A

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Appendix 2.A

Legal Authority Ordinance Citations

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Appendix 2.B

Legal Authority Documentation

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Appendix 3.A

Detailed Description of Water Quality Priorities

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Appendix 3.B

Supporting Information for the Receiving Water Analysis

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Appendix 3.C

Supporting Information for the Discharge Analysis

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Appendix 3.D

Common Sources of Key Pollutants of Concern in the Ballona Creek WMA

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Appendix 4.A

Structural Control Measure Fact Sheets

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Appendix 4.B

Regional Project Selection Process

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Appendix 4.C

Engineering & Environmental Feasibility for Selected Signature Projects

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Appendix 5.A

Comparison of 2001 Permit MCMs to 2012 Permit MCMs

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Appendix 6.A

Model Calibration & Parameters

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Appendix 6.B1

Dry Weather RAA for E.coli Control Measures

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Appendix 6.B2

Dry Weather RAA and Non-Stormwater Analysis

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Appendix 6.C

Control Measure Opportunity Assessment

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Appendix 6.D

Control Measure Design and Representation

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Appendix 6.E

Green Streets Results Synthesis and List of Opportunities

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Appendix 6.F

Detailed List of Existing and Planned Control Measures

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Appendix 6.G

Cost Optimization Curves

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Appendix 6.H

Approach for Gradual Phasing from Average Interim Conditions to Critical Final Conditions

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Appendix 7.A

Detailed Recipe for Final EWMP Compliance (Compliance Targets and EWMP Implementation Strategy)

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Appendix 7.B

Subwatershed Maps with Control Measure Capacity

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Appendix 7.C

Scheduling of Control Measures for EWMP and TMDL Milestones

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