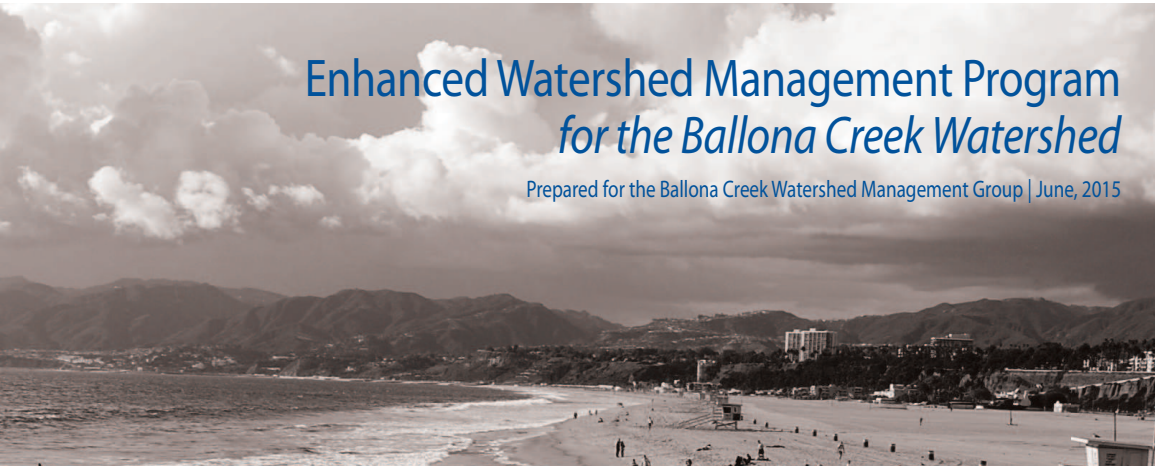




Enhanced Watershed Management Program for the Ballona Creek Watershed

Prepared for the Ballona Creek Watershed Management Group | June, 2015





ACKNOWLEDGMENT

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

Ballona Creek Watershed Management Group

PROJECT TEAM

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



CONSULTANT TEAM

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

The Ballona Creek Watershed is an important watershed in southern California. The land use is dense and heavily urbanized. The Ballona Creek Watershed has been subject to numerous water quality planning and compliance efforts and the EWMP leveraged those efforts and identified additional projects to address water quality issues.

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

Elements of the EWMP

The objective of the EWMP Plan is to determine the network of control measures (often referred to as best management practices [BMPs]) that will achieve required pollutant reductions while also providing multiple benefits to the community and leveraging sustainable green infrastructure practices. This EWMP includes the following elements (Figure ES-1):

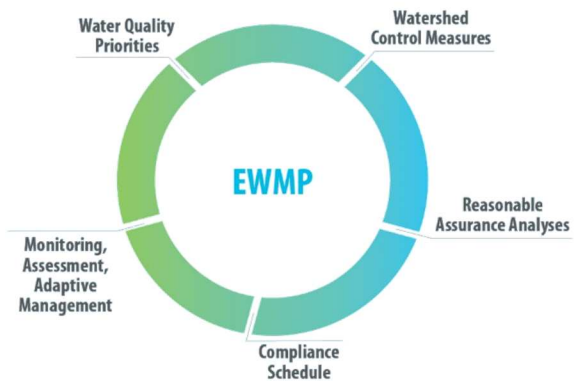


Figure ES-1 EWMP Elements

ES.1 Water Quality Priorities

The identification of Water Quality Priorities (Section 3 of the EWMP) was an important first step in the EWMP Plan development process. The Water Quality Priorities highlight the pollutants and waterbodies that are potentially not attaining water quality standards. The Water Quality Priorities are a driver of the control measures in the EWMP. For example, if a water quality objective is not being attained, additional pollutant reduction is required and thus more or larger control measures are

needed to achieve those reductions. Over 55,000 data records of water quality monitoring were compiled and analyzed to determine three categories of Water Quality Priorities based on whether TMDLs have been developed for waterbody-pollutants, whether water quality exceedances have occurred in the last ten years and whether the stormwater system is a likely source of these pollutants. The water quality prioritization process of the Permit determines the water body-pollutant combinations (WBPCs) that will be addressed by the EWMP. The Permit defines three categories of Water Quality Priorities:

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

The applicable TMDLs are the highest priority for stormwater quality compliance, and thus scheduling for addressing Water Quality Priorities was developed based on TMDL milestones (e.g., interim and final numeric limits) and other representative Los Angeles Regional Water Quality Control Board (Regional Board) adopted TMDLs. The scheduling of low impact development (LID), green streets and regional BMP implementation for the EWMP is based on the milestones of the applicable metals and bacteria TMDLs, as follows:

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

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

ES.2 Watershed Control Measures

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

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

Low-Impact Development:

these are distributed structural practices that capture, infiltrate, store and use, and/or treat runoff at the parcel (normally less than 10 tributary acres (Figure ES-2). Common LID practices include bioretention, permeable pavement, and other infiltration BMPs that prevent runoff from leaving a parcel. Rainfall harvest practices such as cisterns can also be used to capture rainwater – that would otherwise run off a parcel – and use it to offset

non-potable water demands. The types of LID incorporated into the EWMP are the LID ordinance, residential LID, and LID retrofits of public parcels. Since the vast majority (nearly 70 percent) of runoff from the developed portion of the watershed is generated from impervious areas on parcels, LID is a natural choice as a key EWMP strategy to treat runoff from parcel-based impervious areas. LID can be viewed as the “first line of defense” due to the fact that the water is treated on-site before it runs off from the parcel and travels downstream.

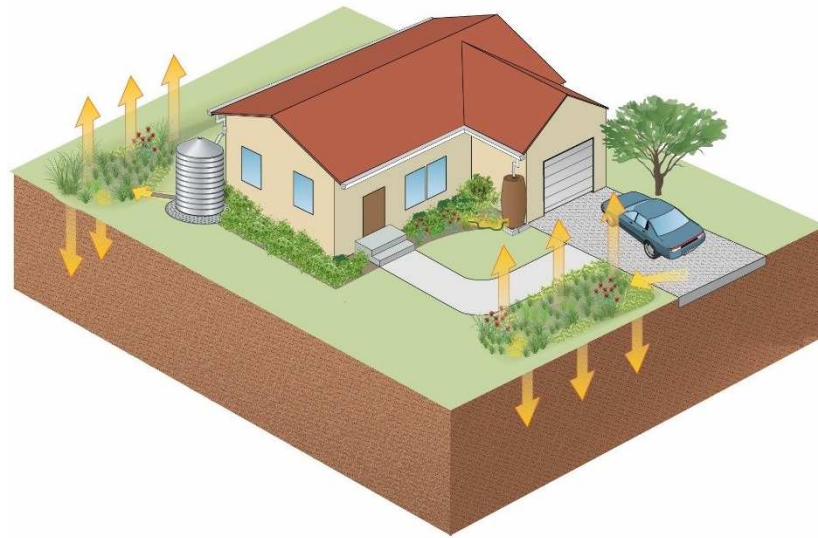


Figure ES-2 Conceptual Schematic of LID Implemented on a Parcel (arrows indicate water pathways)



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

Green Streets: these are distributed structural practices that are typically implemented as linear bioretention/ biofiltration practices installed parallel to roadways (discussed in Section 5). These systems receive runoff from the gutter via curb cuts or curb extensions (sometimes called bump outs) and infiltrate it through native or engineered soil media (Figure ES-3). Permeable pavement can also be implemented in tandem, or as a standalone practice, in parking lanes of roads. As shown in Figure ES-4, a high percentage of streets are planned for green street retrofits for the EWMP Implementation Strategy. Green

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 tens to hundreds of acres. Regional projects are designed to receive large volumes of runoff from extensive upstream areas and can provide a cost-effective mechanism for infiltration and pollutant reduction (Figure ES-5). Runoff is typically diverted to regional projects after it has already entered storm drains and engineered channels. Routing offsite runoff to public parcels (versus treating surface runoff near its source, as with green streets and LID) often allows regional BMPs to be placed in cost-effective locations with the best available BMP opportunity. The BC EWMP includes over 68 regional BMPs, including 10 signature, multi-benefit regional projects (Figure ES-6). Of these 10, 4 regional projects will retain the stormwater volume from the 85th percentile, 24-hour storm. The EWMP also includes regional projects on private land to assure pollutant reductions are achieved.

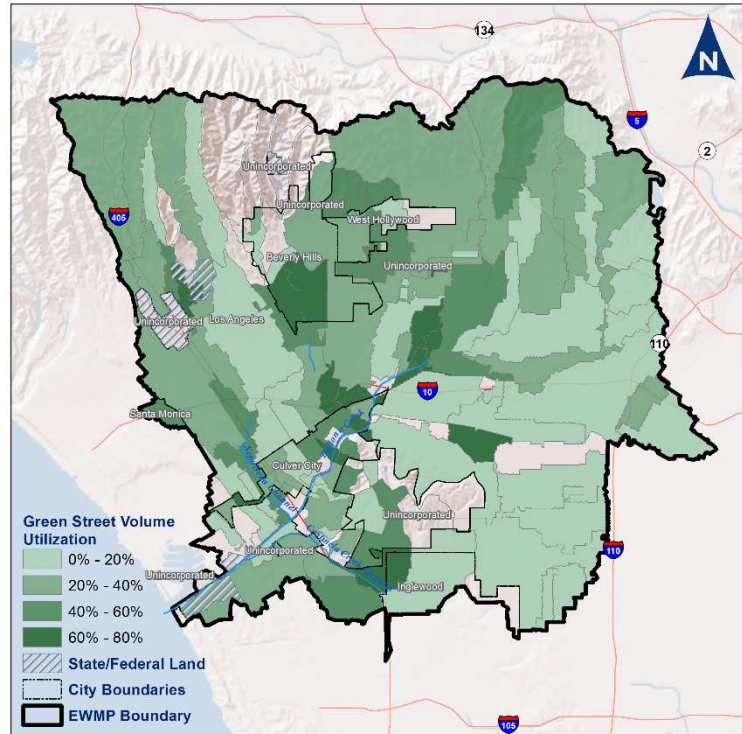


Figure ES-4 Planned Percent of Streets for Green Street Retrofit in Ballona Creek Watershed

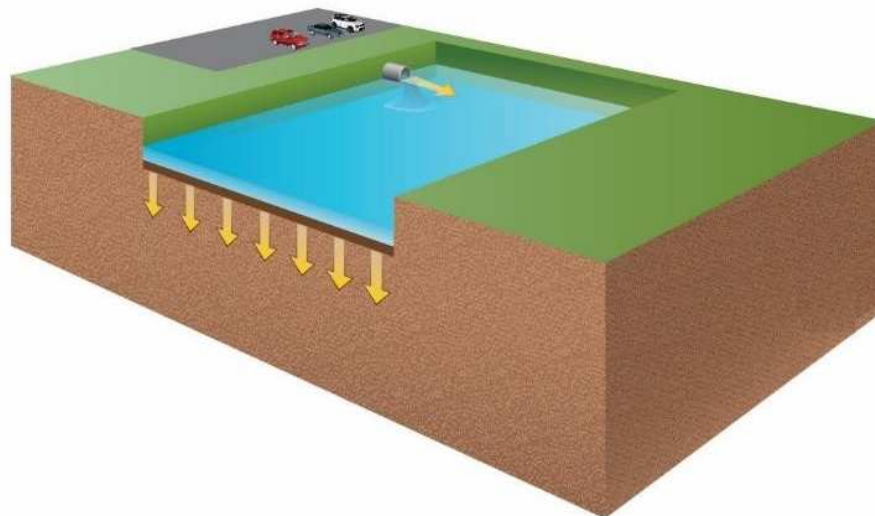


Figure ES-5 Conceptual Schematic of a Regional Project (arrows indicate water pathways)



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

ES.3 Reasonable Assurance Analysis

A key element of the EWMP is the Reasonable Assurance Analysis (RAA) (presented in Section 6), which was used to quantitatively demonstrate that the EWMP Implementation Strategy will address the Water Quality Priorities. While the Permit prescribes the RAA as a quantitative demonstration that control measures will be effective, the RAA also uses a modeling process to identify and select potential control measures to be implemented by the EWMP. The Watershed Management Modeling System (WMMS) is the basis for the modeling system used to conduct the RAA for the BC EWMP. WMMS is specified in the 2012 MS4 Permit as an approved tool to conduct the RAA. The Los Angeles County Flood Control District, through a joint effort with U.S. Environmental Protection Agency (USEPA),

developed WMMS specifically to support informed decisions for managing stormwater. The RAA modeling system incorporates three primary tools:

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

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

- Wet weather – zinc and *Escherichia coli* (*E. coli*): according to the modeling analysis and review of monitoring data, control of zinc and *E. coli* requires BMP capacities that are the largest among the Water Quality Priority pollutants, and thus control of zinc and *E. coli* has assurance of addressing the other BC wet weather Water Quality Priorities. The RAA for BC first identifies the control measures to attain zinc limits (during the zinc critical condition) and then identifies additional capacity, if any, needed to achieve *E. coli* limits.
- Dry weather – *E. coli*: among all the pollutants monitored during dry weather at mass emission stations in LA County, *E. coli* most frequently exceeds receiving water limits (RWLs). During monitoring “snapshots” of over 100 outfalls along the LA River, over 85 percent of samples

exceeded limits for *E. coli* during dry weather in the Bacterial Source Identification Study along the Los Angeles River (CREST, 2008). Among the Water Quality Priority pollutants, achievement of dry weather RWLs for *E. coli* will be the most challenging.

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

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

The WMMS was used to consider millions of BMP scenarios and the EWMP Implementation Strategy was selected based on the most cost-effective scenarios, while also incorporating preferences of the EWMP Group.

ES.4 Detailed EWMP Implementation Strategy and Compliance Schedule

The EWMP Implementation Strategy (presented in Section 7 of the EWMP) is the “recipe for compliance” of each jurisdiction to address Water Quality Priorities and comply with the provisions of the MS4 Permit. The EWMP Implementation Strategy includes individual recipes for each of the eight jurisdictions and each watershed/assessment area – Ballona Creek, Centinela Creek, and Sepulveda Channel – a total of 180 subwatersheds (see Figure 6-1 for a map of these assessment areas). Implementation of the EWMP Implementation Strategy will provide a BMP-based compliance pathway for each jurisdiction under the MS4 Permit.

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

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

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

identified, the portion of the Implementation Strategy that is the regional BMPs on private land could be reduced.

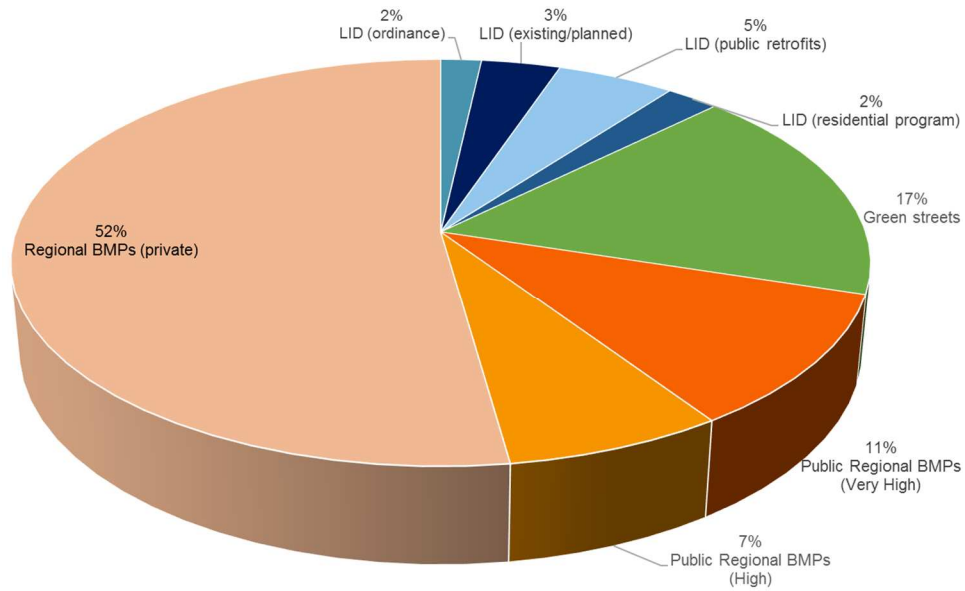


Figure ES-7 BMPs Planned for Ballona Creek Watershed¹

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 (Figure ES-8) are provided a specific set of LID, green streets and regional control measures. The BMP density is higher in some areas [dark blue] because either [1] relatively high load reductions are required or [2] BMPs in those areas were relatively cost-effective (e.g., due to high soil infiltration rates). The EWMP includes tabular versions of the map to the right in detailed appendices for each jurisdiction. The total capacity of LID, green streets and regional BMPs to be implemented by each jurisdiction by 2021 (the final compliance date for addressing metals and bacteria) is shown in Figure ES-9. The strategy varies by jurisdiction depending on the pollutant reduction requirements and BMP

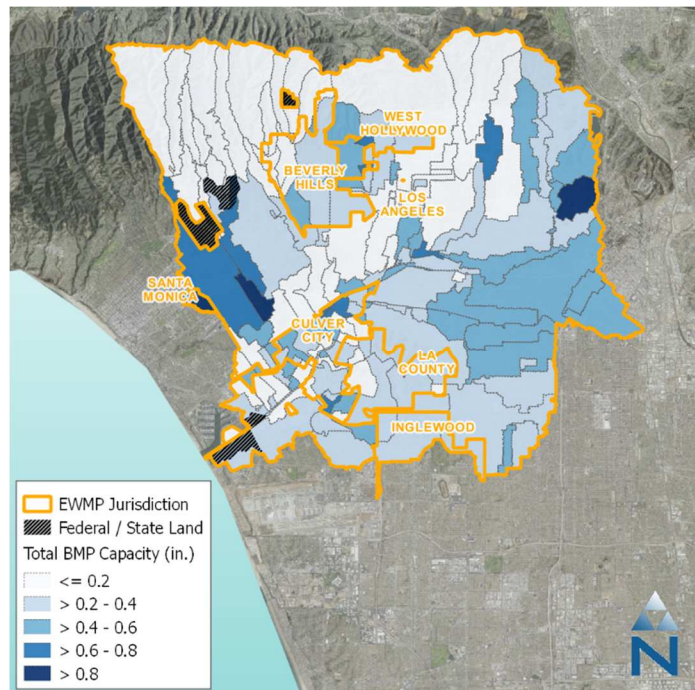


Figure ES-8 BMP Density in Ballona Creek Watershed by Subwatersheds

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

preferences. The top panel groups the BMP types into LID, green streets and regional BMPs, while the bottom panel provides more resolution for the BMP sub-categories

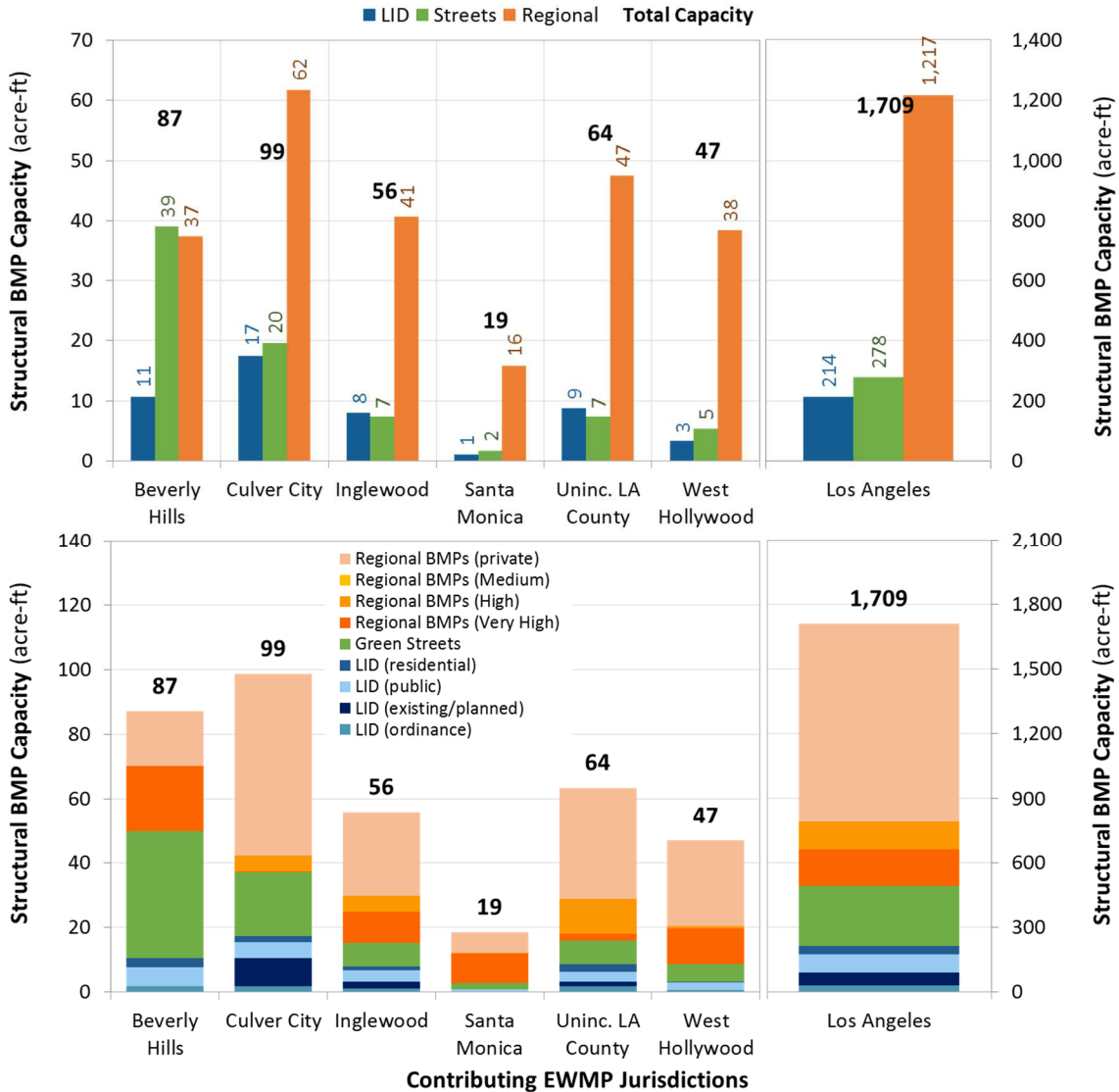


Figure ES-9 BMP Capacity in Ballona Creek Watershed by EWMP Jurisdictions²

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

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

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

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

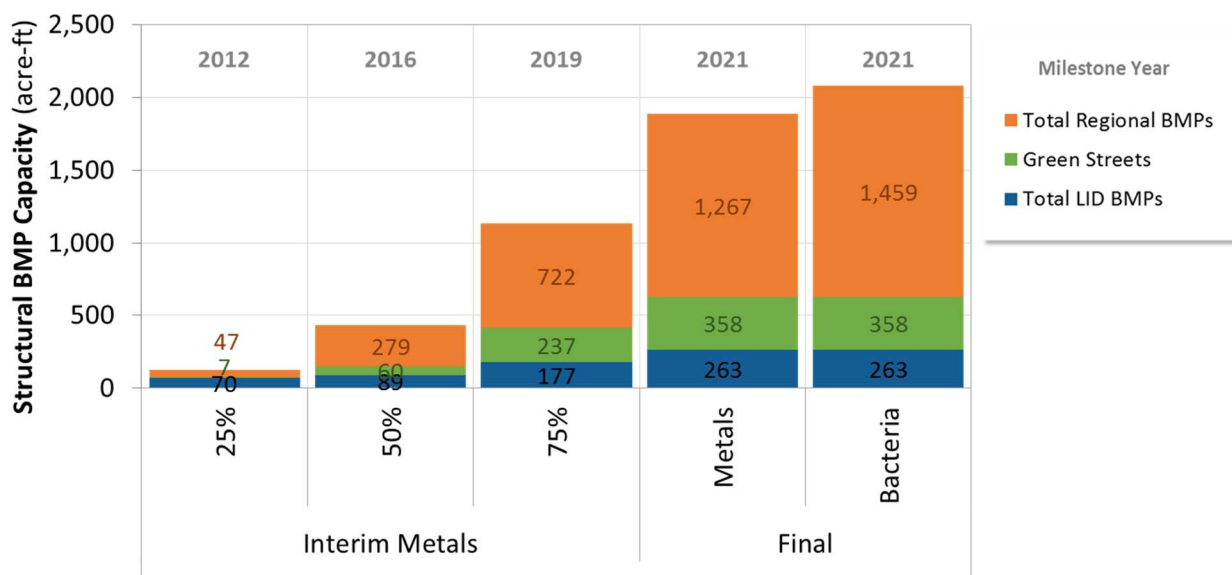


Figure ES-10 EWMP Implementation Strategy Schedule

ES.5 EWMP Implementation Costs and Financial Strategy

The total estimated capital cost is approximately \$2.7B, over the course of six years. The costs provided here are considered to be planning level only (order of magnitude), and can be refined as EWMP implementations progresses with the use of actual BMP implementation costs. Funds have not been identified in the EWMP Implementation Plan but will be pursued. Potential funding sources and alternatives that could be evaluated by each Group Member include grants, fees and charges, legislative and policy remedies.

The costs to implement the EWMP will require orders of magnitude increases in stormwater program funding. The capital costs to address Water Quality Priorities by 2021 are approximately \$2.7B, which is approximately \$9,422 per parcel, with total operations and maintenance costs exceeding \$77M per year (Table ES-1). Expenditures for the EWMP Implementation Strategy will need to be coordinated with other regional efforts to improve habitat, promote greenways and increase access to Ballona Creek. In order to garner community support for financing the costs, it will likely be necessary to quantify the multi-benefits of the LID, green streets, and regional projects including improved aesthetics, increase recreational opportunity, water supply augmentation and climate change resiliency. The financial strategy presented in this EWMP outlines a set of multiple approaches that allows each jurisdiction to consider and select the strategies that best fit their specific preferences.

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

Agency	Present to 50% Metals TMDL Milestone (2016)		50% Metals TMDL Milestone (2016) to Final Compliance with Metals TMDL (2021)		50% Metals TMDL Milestone (2016) to Final Compliance with Bacteria TMDL (2021)		Total at Final (2021)	
	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr	Capital	O&M/yr
Beverly Hills	5.43	0.64	45.37	4.59	21.15	4.87	71.95	4.87
Culver City	20.98	1.12	96.02	3.52	20.79	3.79	137.80	3.79
Inglewood	7.81	0.40	58.63	2.04	0.07	2.04	66.51	2.04
Los Angeles	99.53	9.90	1,835.46	57.94	346.85	62.50	2,281.84	62.50
Santa Monica	2.71	0.31	14.65	0.64	0.00	0.64	17.36	0.64
Uninc. LA County	14.45	0.79	63.25	2.10	6.23	2.18	83.93	2.18
West Hollywood	2.91	0.34	50.17	1.57	11.18	1.72	64.26	1.72
Total	153.82	13.50	2,163.55	72.40	406.28	77.74	2,723.65	77.74