Addendum to Enhanced Watershed Management Program for the Dominguez Channel Watershed Management Area Group:

Incorporation of City of Lawndale

DECEMBER 11, 2015

THIS PAGE INTENTIONALLY LEFT BLANK

Contents

Figures

Tables

1 INTRODUCTION

This appendix presents an addendum to incorporate the City of Lawndale (Lawndale) into the Enhanced Watershed Management Program for the Dominguez Channel Watershed Management Area Group (DC EWMP). The draft DC EWMP submitted in June 2015 by the Dominguez Channel Watershed Management Area Group (DC WMG) included the cities of Los Angeles, El Segundo, Hawthorne, Inglewood, and Lomita and the County of Los Angeles and the Los Angeles County Flood Control District (LACFCD). On August 12, 2015 Lawndale provided a Notice of Intent to join the DC EWMP to the Los Angeles Regional Water Quality Control Board (Regional Board).[1] This addendum provides the analysis needed to fully incorporate Lawndale into the DC EWMP and presents the EWMP Implementation Plan for Lawndale. Through submittal of this addendum, Lawndale will receive the compliance benefits provided by the MS4 Permit for jurisdictions that develop Enhanced Watershed Management Programs. The revised extent of the DC WMG is presented in Figure 1-1 after the incorporation of the cities of Lawndale and Carson. Shown in Table 1-1 is a summary of the relative jurisdictional areas after incorporation of Lawndale and Carson into the DC WMG, and Figure 1-1 shows the jurisdictional boundaries of the DC WMG and the major tributary/assessment areas for the DC EWMP.

This addendum is focused on the Lawndale-specific analyses to incorporate the City of Lawndale into the DC EWMP. When possible, the reader is referred to the DC EWMP for details on methodology and analyses that apply to the entire DC EWMP Group. To support review of this document, the format and organization of this addendum follows the DC EWMP. When a cross-reference within this addendum refers to a section of the main body of the DC EWMP, the reference includes "of the DC EWMP". Otherwise, the cross-reference is referring to a section within this addendum.

Table 1-1. Summary of DC WMG Member Jurisdictional Areas

DC WMG Member	Total Area (acres)	Percent of Group [2]
City of Carson	11,942.9	23.5%
City of El Segundo [1]	1,252.2	2.5%
City of Hawthorne [1]	3,891.9	7.7%
City of Inglewood [1]	3,884.3	7.6%
City of Lawndale	1,259.5	2.5%
City of Lomita [1]	1,227.7	2.4%
City of Los Angeles [1]	19,177.3	37.8%
Los Angeles County [1]	8,140.9	16.0%
LACFCD	n/a	n/a
Total	**50,776.7**	**100.0%**

1: Total area as presented in Section 1 of the DC EWMP
2: Percent of Group re-calculated based on total area after including the Cities of Carson and Lawndale

---

[1] The City of Carson submitted an NOI on August 26, 2015 and is incorporated through a separate addendum.
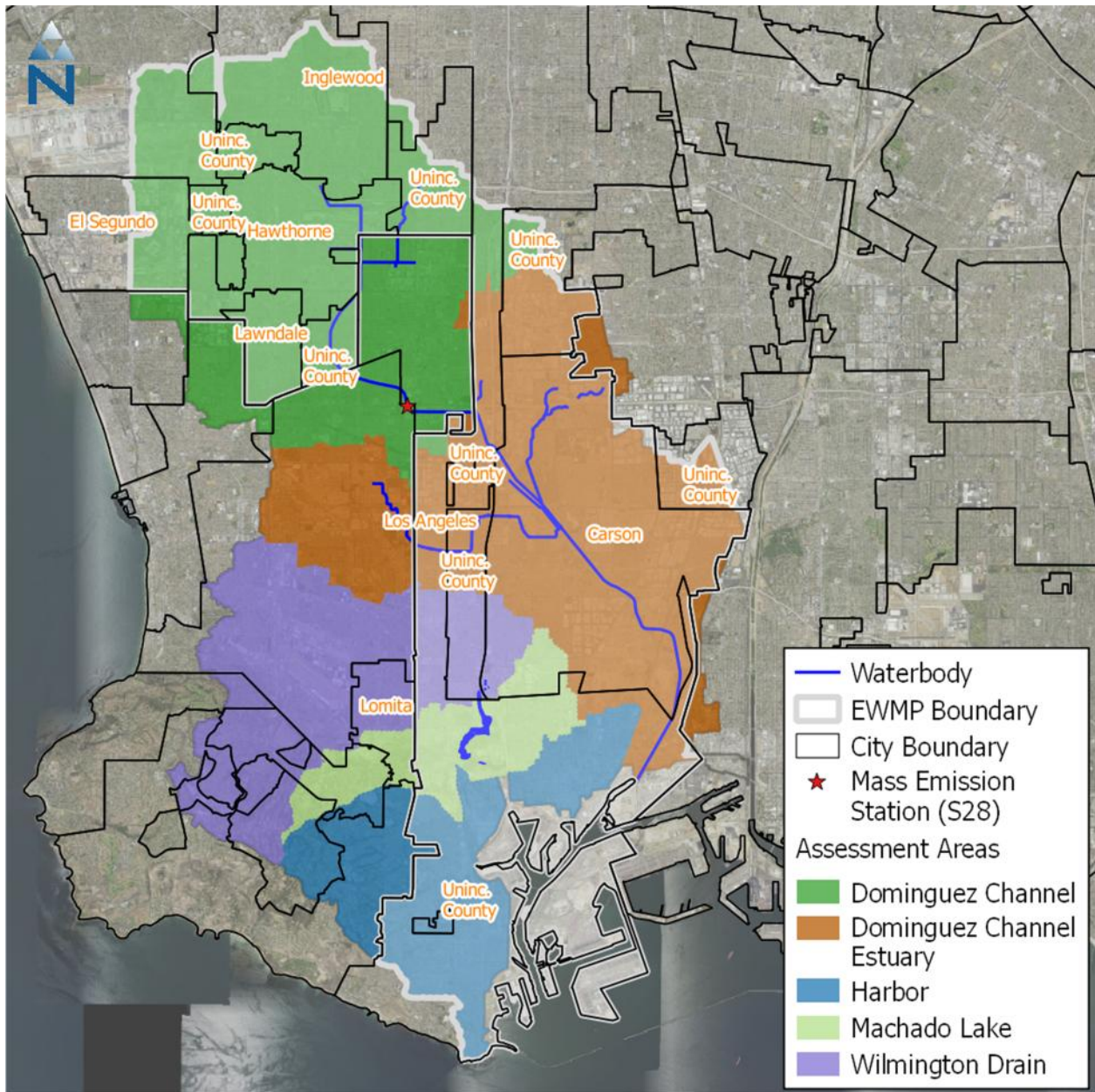
Figure 1-1. Jurisdictional boundaries and tributary areas of the DC WMG after incorporation of Lawndale and Carson.

2 WATER QUALITY PRIORITIES

Lawndale is located within the Dominguez Channel Watershed Management Area, which was analyzed in Water Quality Priorities section (Section 2) of the DC EWMP. The receiving waters for Lawndale is the freshwater portion of Dominguez Channel above Vermont Avenue. This receiving water body was fully evaluated in the DC EWMP. The Water Quality Priorities for Dominguez Channel (lined portion above Vermont Avenue) are presented in Table 2-4 of the DC EWMP. The inclusion of Lawndale does not necessitate any additional Water Quality Priorities (TMDLs, 303(d) listings, or otherwise). The primary Water Quality Priorities that drive the watershed control measures

for Lawndale are zinc (Category 1 Water Quality Priority) and indicator bacteria (Category 2 Water Quality Priority). As demonstrated in subsequent sections, by addressing these two Water Quality Priorities, the other Water Quality Priorities will also be addressed.

3 WATERSHED CONTROL MEASURES

The Permit requires the identification of Watershed Control Measures, which are strategies, institutional measures, and BMPs[2] that will be implemented through the EWMP individually or collectively at a watershed-scale to address Water Quality Priorities. Section 3 of the DC EWMP describes the categories of BMPs used to develop the DC EWMP (and simulated by the RAA), summarizes existing and planned structural BMPs, and describes the institutional control measures that will be implemented including customization of MCMs.

Two overarching categories of BMPs are discussed throughout the EWMP:

- **Structural BMPs**: these BMPs retain, divert or treat stormwater and/or non-stormwater, and can either be distributed throughout the watershed or sited regionally.
- **Institutional BMPs:** these BMPs encompass the Minimum Control Measures (MCMs) outlined in the permit, other non-structural BMPs, and any other source control measures, such as community education programs.

Furthermore, the three main sub-categories of structural BMPs incorporated into the EWMP include low-impact development (LID), green streets, and regional projects, as defined below:

- **Low impact development (LID):** Distributed structural practices intended to treat runoff relatively close to the source and typically implemented at a single-parcel- or few-parcel level (normally less than 10 tributary acres).
- **Green streets:** Distributed structural practices intended to treat runoff within public transportation rights-of-way (normally less than 10 tributary acres).
- **Regional BMPs:** Constructed structural practices intended to treat runoff from a contributing area of multiple parcels (normally on the order of 10s or 100s of acres or larger).

Lawndale evaluated the menu of control measures used for development of the DC EWMP and determined which of the institutional and structural control measures are best suited for its stormwater program. The menu of institutional, LID, green street and regional project control measures selected by Lawndale is summarized in Table 3-1. Additional information regarding the selected control measures are provided in the following subsections, organized by control measure type.

---

[2] In this EWMP, the terms "control measures" and "best management practices (BMPs)" are used interchangeably.

Table 3-1. Summary of Control Measures Selected by City of Lawndale for EWMP Development

Control Measure Type	Control Measure Subcategory for EWMP / RAA	Incorporation Approach for EWMP for Lawndale
Institutional	Enhanced institutional	5% baseline for 2012 Permit MCMs, plus additional 5% reduction due to catch basin inserts and/or enhanced street sweeping
LID	Planned & Existing Projects	Yes, these projects were determined to already be incorporated into the baseline for the DC EWMP (constructed prior to 2011)
	New & Re-Development	Yes, incorporated based on projected growth rates
Green streets	Green streets with permeable pavement and/or alternative infiltration strategies	Yes, incorporated suitable streets as opportunities for green streets
Regional projects	Public Regional (identified)	Yes, three (3) major regional BMP opportunities are incorporated into EWMP
	Additional Regional (to be determined)	Yes, incorporated Additional Regional into RAA, as necessary, to provide assurance that load reductions can be achieved.

3.1   Lawndale Regional Projects

The screening process similar to the one described in the DC EWMP was used to identify potential suitable parcels for siting regional projects in Lawndale. This similar screening process followed Steps 1-6 presented in Section 4.2.4 of the DC EWMP where tax exempt parcels are identified based on the Assessor Identification Number (AIN). These parcels all end with a 3-digit number in the 900's. Tax exempt parcels were grouped into tiers representing how closely-held the property is by the City of Lawndale parcels. Parcels less than 0.25 acres or that are part of a waterway were excluded. Remaining parcels were evaluated by Lawndale to identify a list of potential regional projects, and each potential parcel was included or excluded based on their local knowledge of the sites, ownership, logistics, etc.

3.1.1   Regional Projects on Public Parcels

Regional projects were identified using a detailed spatial analysis, beginning with an initial screening based on potential constraints, and culminating with an identification of publically-owned parcels potentially suitable for regional projects. Based on the screening analysis, three primary sites were identified as potentially suitable for potential regional projects on public parcels. Table 3-2 summarized the Regional BMP opportunities identified through the screening process and

incorporated into the RAA model for Lawndale. Figure 3-1 shows the extent of contributing drainage areas to each of the potential regional projects. These regional projects were not subject to concept design; instead, preliminary coarse design parameters were assumed based on an initial evaluation of the sites using readily available desktop GIS data sets. During EWMP implementation, the design details for these regional projects would be further refined. During adaptive management, these project designs could be modified, supplemented by additional projects or replaced entirely by other projects, as long as the equivalent water quality benefit is achieved overall.

Table 3-2. Summary of Identified Regional BMPs for Lawndale

Description	Address	Approximate Location (Lat/Long)	Approximate Available Footprint (acres)	Potential Upstream Area to be Intercepted (acres)
Redevelopment Agency Empty Lot	4400 Manhattan Beach Blvd, Lawndale, CA 90260	33 53' 14" N 118 21' 10.3" W	1.14	574
William Anderson Elementary/Will Rogers Middle School	4110 W 154th St, Lawndale, CA 90260	33 53' 22.9" N 118 20' 44.7" W	7.01	399
Alondra Park	3850 Manhattan Beach Blvd, Lawndale, CA 90260	33 53' 12.4" N 118 20' 34.3" W	9.76	7,008

3.1.2   Additional Regional Projects

In some cases, the required pollutant reductions to achieve RWLs may be greater than can be achieved with identified opportunities for MCMs, LID, green streets and regional projects. As such, to provide reasonable assurance, another category of regional BMP – Additional Regional – is included in the RAA and EWMP Implementation Plan. Because specific opportunities for land acquisition and/or public-private partnerships cannot be confirmed during the timeframe of the EWMP development, the RAA modeling described in Section 4 reports a conceptual volume of infiltration basins required in each subwatershed to achieve the required pollutant reductions. As presented in Section 7 of this addendum (Costs and Financial Strategies), the Additional Regional may or may not require land acquisition, depending on the types of public-public and public-private partnerships identified by Lawndale.
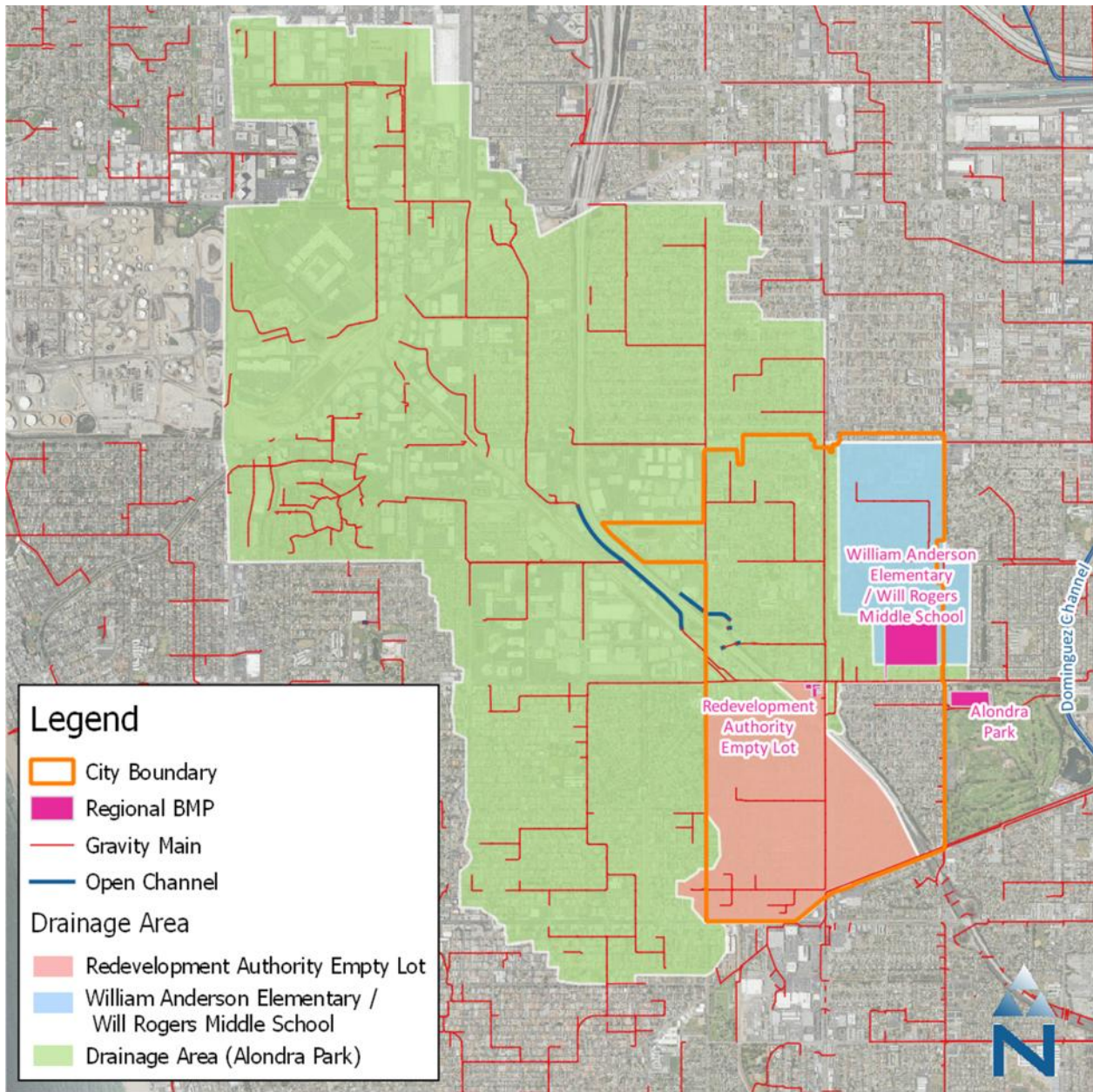
Figure 3-1. Regional BMP Opportunities Identified in Lawndale.

3.2 LID Programs

A key element of the structural BMP strategy for the DC EWMP is to assume that LID will be distributed throughout the watershed. For the purposes of this EWMP, it is assumed that LID is defined as a series of distributed structural practices that capture, infiltrate and/or treat runoff at the parcel scale. Common LID practices include bioretention, permeable pavement and other infiltration BMPs that manage runoff at the source. Rainfall harvest practices such as cisterns can also be used to capture rainwater that would otherwise run off a parcel and offset potable water demands. For the RAA, and in accordance with the City's LID ordinance, LID BMPs are designed to capture the 85th percentile storm from the parcels on which they are located.

Figure 3-2 shows the extent of LID opportunities throughout Lawndale while the following summarizes key details about each of the LID program components:

- <u>LID due to Redevelopment</u> – the most widespread LID for the EWMP Implementation Plan is LID due to redevelopment (funded by the developer). Average annual redevelopment rates released by the City of Los Angeles were used to project the area that is expected to be developed, as presented in Table 4-5 of the DC EWMP. The projected benefit of LID due to development in terms of water quality and stormwater capture was incorporated into the EWMP.
- <u>Existing and Planned BMPs</u> –Lawndale completed the Rogers Park Improvement Project in August 2014, installing below grade retention to capture three quarters of an inch of rain. This project is co-located at the William Anderson Elementary/Will Rogers Middle School identified for a potential regional project in Section 3.1. This LID project is incorporated into the EWMP. Other existing BMPs were determined to be a part of the baseline water quality and not explicitly included.

Note that Figure 3-2 shows the assumed LID BMP *opportunities*; the actual *capacity* of LID control measures projected to be implemented by developers is presented in Section 5.

3.3 Green Streets

The Permit specifies that EWMPs should "incorporate effective technologies, approaches and practices, including green infrastructure." Rights-of-way along streets may be the most extensive opportunity for the DC WMG to implement green infrastructure on public land. In developed areas, curb and gutter in the road provides the primary means of conveying stormwater (and associated pollutants) directly to storm drain inlets and receiving waters. Green streets provide an opportunity to intercept this runoff prior to entering the MS4 and treat it within the public right-of-way. Green streets are typically implemented as linear bioretention/biofiltration practices installed parallel to roadways. 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.

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. As with LID, green streets tend to be distributed practices that are deployed throughout a watershed to treat runoff near the source. Key advantages of green streets are that they are located on land directly controlled by public entities, and can intercept runoff from larger upstream drainage areas when compared to LID projects.

The methods for screening potential street opportunities is described in Attachment R of the DC EWMP. Screening for green street opportunity throughout Lawndale followed a similar procedure by filtering out suitable road functional classes based on the Census 2010 TIGER roads data set. When applied to Lawndale, this screening procedure identified over 35 lane miles of *potential* frontage length for green streets, as shown in Figure 3-2. Note that Figure 3-2 shows the green street BMP *opportunities* (suitable streets); the *capacity* of green streets to be implemented for Lawndale's EWMP Implementation Plan (per the RAA) is presented in Section 5.
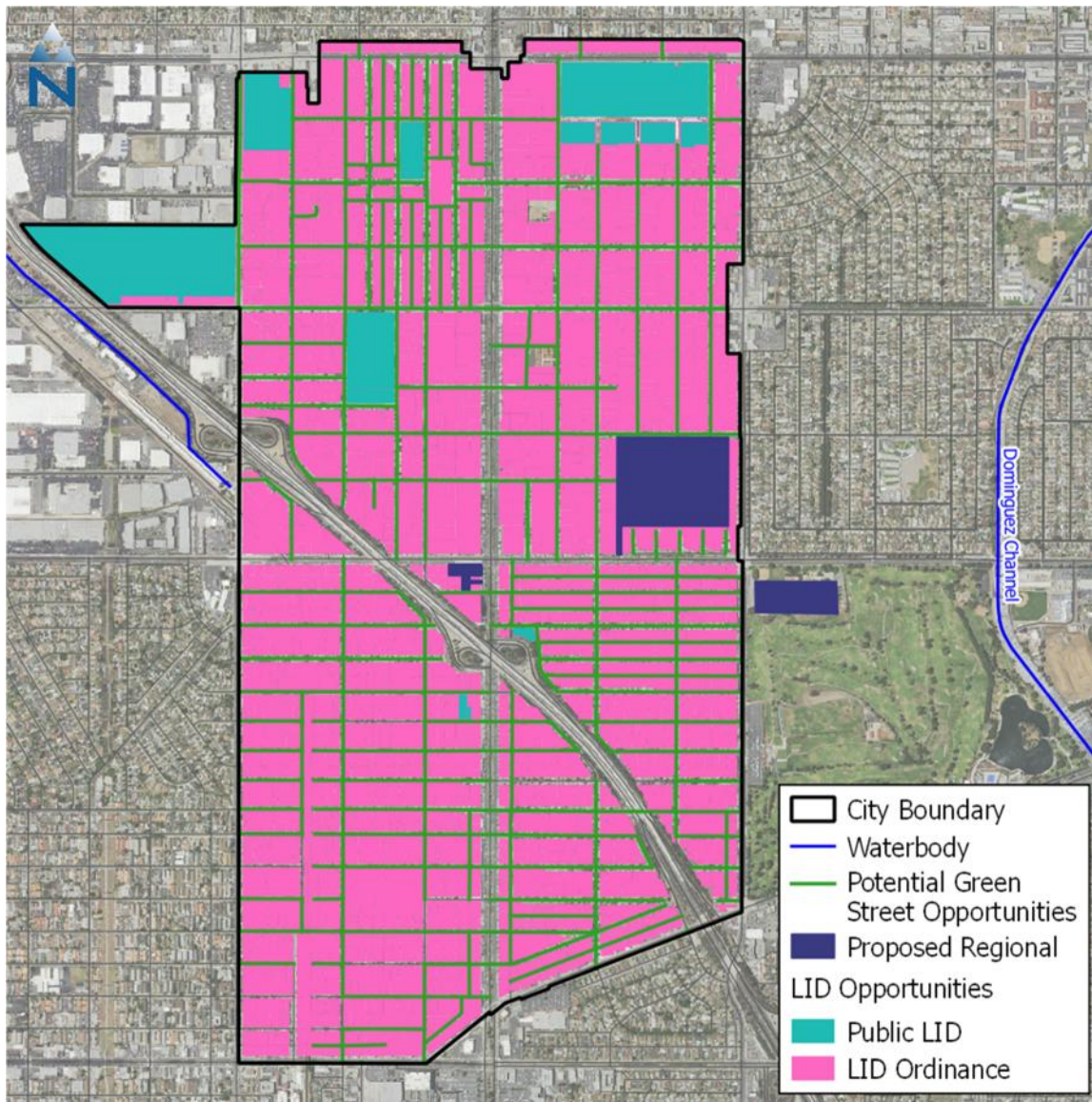
Figure 3-2. Opportunities for LID Identified in Lawndale.

3.4 Institutional BMPs

Institutional BMPs are a fundamental component of Lawndale's stormwater program, including the MCMs required by the Permit. For development of this initial EWMP, Lawndale has elected to not customize the baseline MCMs in the 2012 Permit. Consistent with the DC EWMP, the Lawndale RAA assumes that implementation of the MCMs in the 2012 Permit will represent a 5% increase in pollutant reduction when compared to the MCMs under the previous Permit (see Section 4.1 of the EWMP). In addition, Lawndale will be implementing additional institutional control measures to achieve at least an additional 5% reduction, for a total of 10% reduction due to institutional control measures, including the following:

- The City began having its streets swept using regenerative air street sweepers during the current permit term, which represents in increased pollutant reduction above and beyond the baseline.
- Installation of trash excluders on or in its Priority A catch basins in 2017. This will also increase the inspection and potential clean out of these catch basins.

- Implementation of a program to monitor the trash in the areas of the Priority A catch basins and increase the frequency of street sweeping in these areas if deemed necessary.

During adaptive management, Lawndale may identify additional institutional control measures to reduce pollutants and incorporate them into the EWMP (perhaps including higher % reductions than 10%).

4 REASONABLE ASSURANCE ANALYSIS

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 DC WMG with selection of control measures. In particular, the RAA was used to evaluate the many different scenarios/combinations of LID, green streets and regional BMPs (as described in Section 3) that could potentially be used by Lawndale to comply with the RWLs and WQBELs of the Permit. The RAA modeling system was then used to select the control measures that are most cost-effective for achieving the required pollutant reductions. The selected control measures are referred to as the "EWMP Implementation Plan" for Lawndale (described in Section 5).

The RAA for Lawndale follows the framework established in Section 3 of the DC EWMP. In 2014, the Regional Board issued RAA Guidelines (RWQCB, 2014), which outline expectations for developing RAAs, and those guidelines were followed closely during development of this RAA. This section presents some of the key metrics associated with the RAA, including required pollutant reductions for Lawndale receiving waters. As possible, details of the RAA are not repeated here. Instead, the reader should refer to Section 4 of the DC EWMP.

This section highlights key metrics associated with the RAA as follows:
- Overview of modeling approach and modeling domain (4.1)
- Baseline watershed model calibration (4.2)
- Baseline critical conditions and required pollutant reductions (4.3)
- Representation of control measures in RAA (4.4)
- Approach for selecting control measures for the EWMP Implementation Plan (4.5)

4.1 Overview of RAA Modeling Approach

The Watershed Management Modeling System (WMMS) is the modeling system used to conduct the RAA for the Lawndale EWMP. WMMS is specified in the Permit as an approved tool to conduct the RAA. WMMS includes a comprehensive watershed model of the entire Los Angeles County area that represents the unique hydrology and hydraulics features and characterizes pollutant loading and downstream transport for all of the key TMDL constituents.

There are 130 subwatersheds in the Dominguez Channel and Estuary Watershed portion of the WMMS model (Figure 4-1). Figure 4-2 zooms into the 9 subwatersheds and one receiving water/assessment area that intersect the Lawndale jurisdictional boundary.
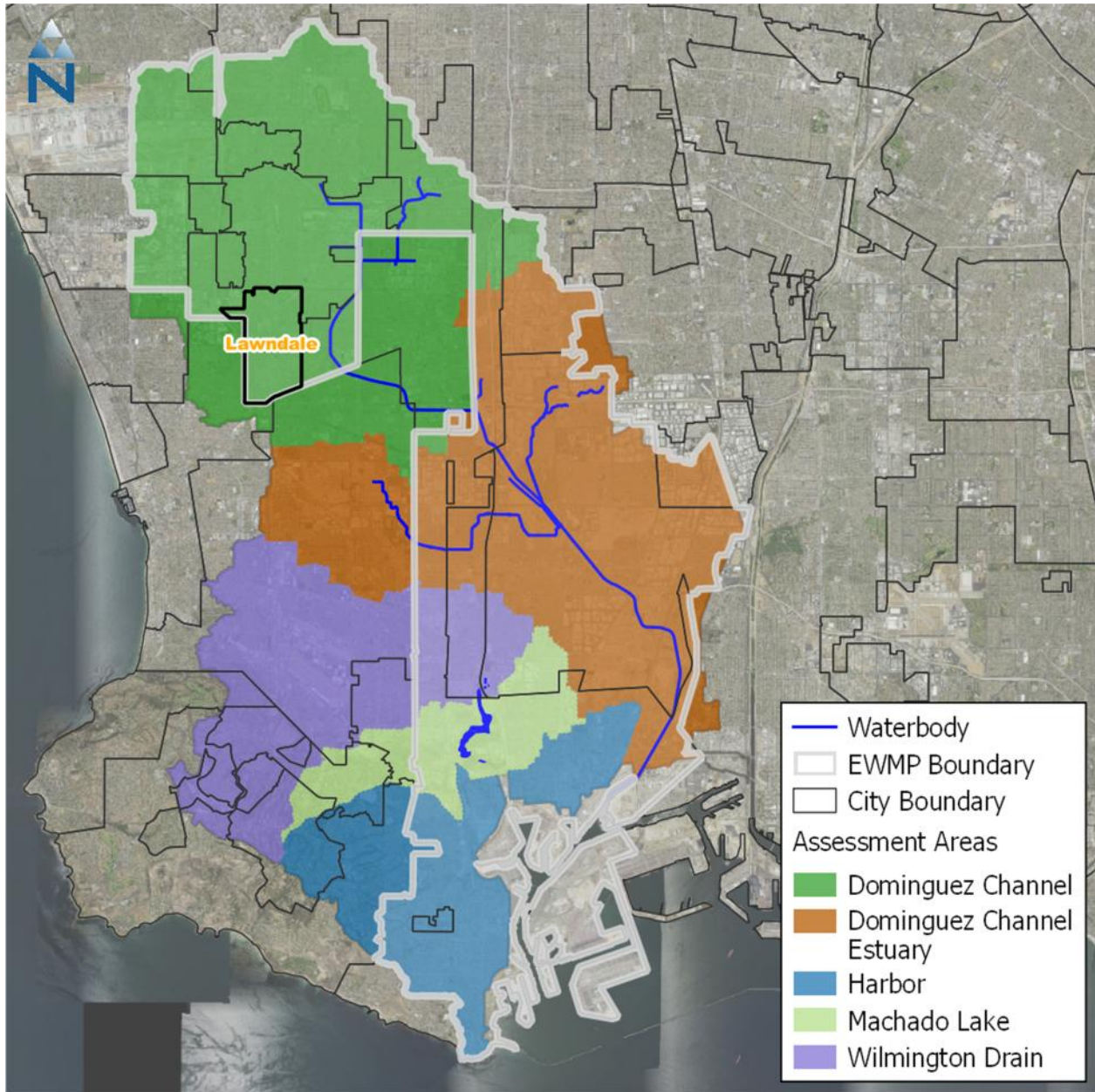
Figure 4-1. Location of Lawndale within the DC EWMP Area and nearby tributary / assessment areas.
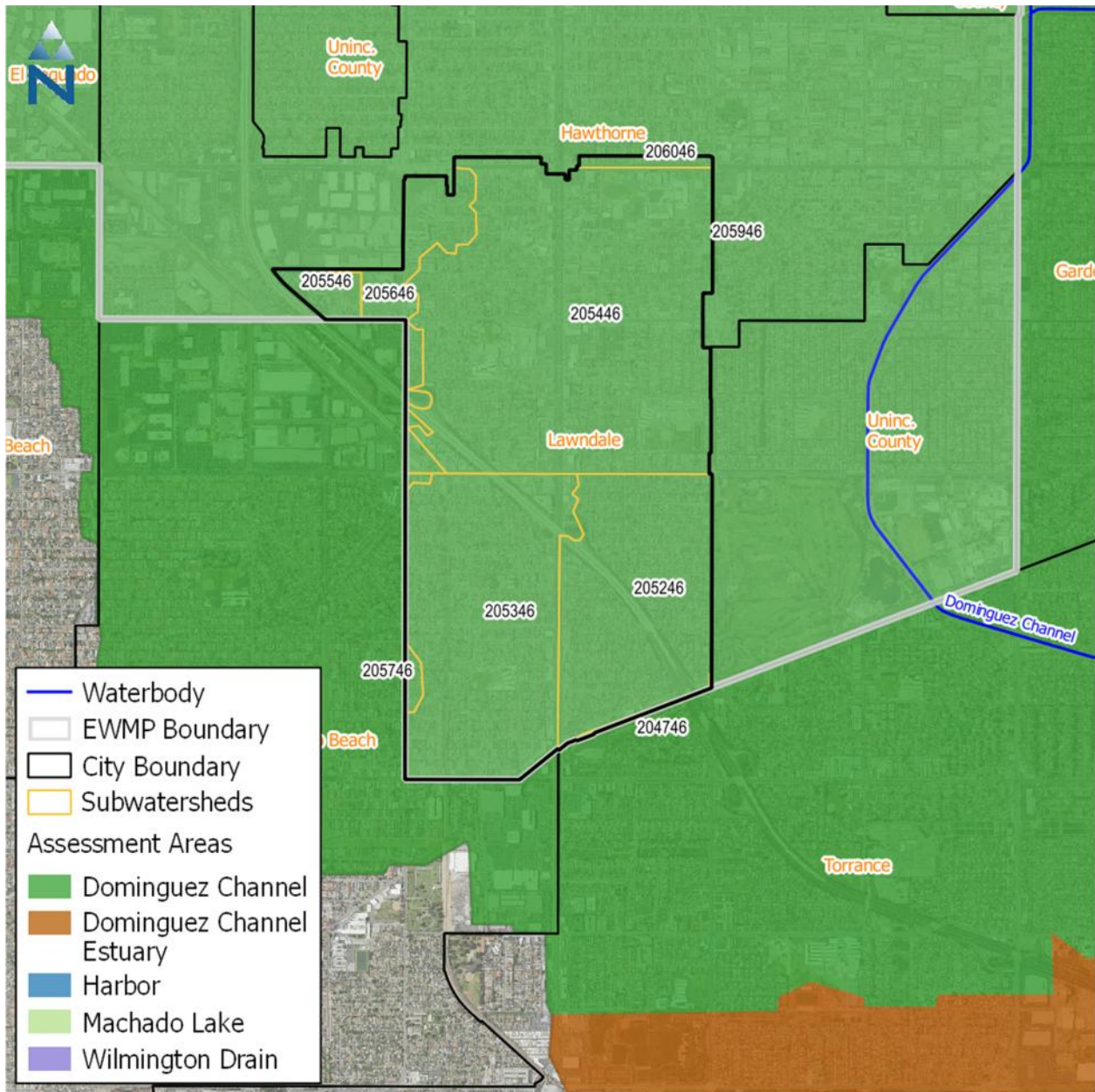
Figure 4-2. Zoomed in view of Lawndale subwatersheds and receiving waters.

4.2   Baseline Watershed Model Calibration

The objective of baseline watershed model calibration is to develop a watershed model that accurately predicts the receiving water hydrology and water quality in the Dominguez Channel watershed. Given that the instream flow gage is the point of reference for model calibration, establishing a baseline model focuses on identifying features and processes that occur between the point where runoff originates and the gage where flow and water quality are measured. The Dominguez Channel portion of the *original* WMMS model was uncalibrated because flow and water quality data were either not available or not accessible when WMMS was originally developed. As such, the WMMS model was updated, as described in Section 4 of the DC EWMP, in order to improve the calibration.   The calibration

primarily relied upon flow and water quality monitoring data provided by the LACFCD from the S28 mass emission station on Dominguez Channel at Artesia Blvd. S28 is in the freshwater portion of Dominguez Channel, upstream of the tidally-influenced reaches of channel. The area upstream of S28 represents approximately 30% of the total drainage area for Dominguez Channel and Dominguez Channel Estuary, as shown in Table 4-1. The drainage area upstream of S28 is also representative in terms of land use and rainfall distribution, as shown in Table 4-1.

The baseline model used for the DC EWMP was applied directly to the RAA for Lawndale. Calibration performance and comparison to the RAA Guidelines is provided in Section 4 of the DC EWMP.

Table 4-1. Comparison of land use distribution upstream of the S28 gage versus the entire Dominguez Channel and Estuary watershed

Land Use		Land Use Distribution[1] by Drainage Area			
		Dominguez Channel and Estuary Watershed		Dominguez Channel at Artesia Blvd (S28)	
		Acres	Percent	Acres	Percent
Impervious	Residential	10,889	16%	4,176	20%
	Commercial	5,854	8%	2,256	11%
	Institutional	2,670	4%	907	4%
	Industrial	10,412	15%	2,035	10%
	Roads	10,258	15%	3,958	19%
Urban Pervious		26,581	38%	7,493	35%
Non-Urban		3,455	5%	382	2%
Total		70,119	100%	21,208	100%

1: Color gradient shows relative land use distribution from least (white) to greatest (red).

4.3   Baseline Critical Conditions and Required Pollutant Reductions

The critical condition for the DC EWMP is the storm that produces the 90th percentile pollutant load. The RAA and EWMP Implementation Strategy are based around achieving required pollutant load reduction to attain the water quality targets during that critical condition. The primary water quality targets in Dominguez Channel (Lawndale's single receiving water) are shown in Table 3-7 of the DC EMWP. The baseline 90th percentile loading for the limiting pollutants for Dominguez Channel – zinc and bacteria – was determined along with the required reductions to achieve the corresponding water quality targets. Shown in Table 4-2 are the calculated required pollutant reductions for interim and final compliance for Dominguez Channel. The simulated required zinc reduction, 86%, is quite high compared to other waterbodies in the region, which ultimately drives the overall capacity of BMPs in Lawndale's EWMP Implementation Strategy.

In accordance with the RAA Guidelines, the interim required reductions are based on the average storm while the final required reductions are based on the 90th percentile storm event. The ratio of

average to 90th percentile loading (shown in Table 4-4) is used to phase from interim to final compliance over the course of the EWMP implementation schedule.

It is noted that for bacteria (E. coli), a slightly different approach was used. Rather than rely on load reduction, the RAA is based on retention of the runoff from the 90th percentile "critical bacteria storm". The 90th percentile critical bacteria storm accounts for allowable exceedance days and the High Flow Suspension, using the LA River Bacteria TMDL as a template. The LA River Bacteria TMDL includes 10 allowable exceedance days in addition to High Flow Suspension days. See the draft Upper LA River EWMP (ULAR Group, 2015) for additional details on the RAA methodology used to address bacteria.

Table 4-2. Required Pollutant Reductions for Interim and Final Compliance for Lawndale Assessment Areas

Condition and Pollutant Addressed	Reduction Metric	Dominguez Channel RAA Assessment Area
Final Compliance with Metals and Other Water Quality Priorities (except *E. coli*)	Required Load Reduction [1]	86%
	Allowable load during 90th percentile/final condition (pounds)	76.0
	Loading during 90th percentile/final condition (pounds) [2]	625.7
Interim Compliance with Metals and Other Water Quality Priorities (except *E. coli*)	Loading during average/interim condition (pounds) [3]	182.3
	Ratio used to gradually phase from interim to final reduction (Average:90th Percentile)	0.29
Final Compliance with *E. coli*	Runoff volume to be retained [4]	Runoff from critical bacteria storm is retained prior to discharge to receiving water (excluding open space subwatersheds)

1 – Based on control of zinc during storm that generates the 90th percentile zinc load
2 – Loading of zinc at mouth of watershed from storm that generates the 90th percentile zinc load
3 – Loading of zinc at mouth of watershed from storm that generates the average zinc load
4 – Critical bacteria storm methodology is consistent with the Upper Los Angeles River EWMP (ULAR Group 2015)

4.4   Representation of EWMP Control Measures

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. An overview of menu of control measures selected by Lawndale for inclusion

in the EWMP and the analysis/screening of potential BMP opportunities in the city limits was presented in Section 3. Additional details on the assumptions used to represent the control measures in the RAA (including assumed design details) are provided in Table 4-2.

The RAA for Lawndale introduces a key analytical element – application of the BMP model SUSTAIN – which was not previously applied in the original DC EWMP. By applying SUSTAIN, the EWMP Implementation Strategy for Lawndale is able to benefit from optimization, which helps to increase the cost efficiency of the BMP network. The design assumptions in Table 4-5 were used within the SUSTAIN model to represent BMPs and their performance.

Table 4-3. Summary of EWMP control measure opportunities included in RAA

BMP Category	Sub-Type	Description of BMP Program	RAA Assumptions regarding BMP Design Parameters
Institutional	MCMs and/or Enhanced MCMs	For 5% reduction: implement new MCMs in 2012 Permit. For additional 5% reduction Lawndale identified additional control measures and schedule for implementation. Examples include enhanced street sweeping and implementation of catch basin inserts.	None, not modeled explicitly.
LID	LID Ordinance (New/ Redevelopment)	BMP implementation assumed to equal redevelopment growth rates reported by Los Angeles Bureau of Sanitation (see Table 4.5 of the DC EWMP). Lawndale will track redevelopment and verify that that LID is implemented at projected rate, based on capacities and schedules in Section 5.	Bioretention/Biofiltration sized to capture 85th percentile runoff from parcel. Underdrains modeled if subsoil infiltration rate less than 0.3 in/hr.
	Existing and Planned BMPs	Planned LID BMPs will be implemented as planned, according to projects constructed after 2011 that were listed in Section 3.2	Bioretention/Biofiltration sized to capture 85th percentile runoff from parcel. Underdrains modeled if subsoil infiltration rate less than 0.3 in/hr.
Green Streets	Green Streets	Lawndale will implement green street projects according to the specified capacities and schedule in Section 5.	Bioretention/biofiltration is 4-ft wide. Permeable pavement/subsurface storage is 5-ft wide and used in tandem with bioretention/biofiltration. 50% of street length retrofittable. Underdrains modeled if subsoil infiltration rate less than 0.3 in/hr.

BMP Category	Sub-Type	Description of BMP Program	RAA Assumptions regarding BMP Design Parameters
Regional	Redevelopment Agency Empty Lot	Lawndale will implement regional projects (other regional projects on public land) according to the specified capacities in Section 5. Pending more detailed site evaluation in the future, these regional BMPs were assumed to be a 3-ft-deep infiltration basin.	BMP footprint delineated and depth specified based on site configuration, topography, depth to groundwater, and other infrastructure. Pump specified if greater than 100 ft from major storm drain. See Section 3.1 for drainage area details.
	Will Rogers Middle School		
	Alondra Park		
	Additional Regional BMPs (TBD)	Lawndale will implement additional regional projects, if necessary, according to the specified capacities in Section 5. At this time, the exact location of these BMPs are unknown and could ultimately be located on either public or private land. These BMPs are scheduled for later in the EWMP schedule, and locations will be identified (or replaced with equivalent BMPs) during implementation and adaptive management.	Assumed 3-ft-deep infiltration basin at subwatershed outlets. Maximum footprint = 5% of contributing area.

4.5 Selection of Control Measures for Pollutant Reduction Plan

The RAA process is an important tool for assisting EWMP agencies with selection of control measures for the EWMP Implementation Plan. 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.   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.

4.5.1   Selection of Control Measures for Final Wet Weather Compliance

The RAA process for Lawndale first determined the control measures to achieve zinc RWLs under critical conditions and then determined the additional capacity (if any) to retain the critical bacteria storm. The optimization modeling is conducted stepwise to determine the control measures for final compliance that are selected for the EWMP Implementation Plan, 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 4-3, 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 9 subwatersheds in Lawndale provide the basis for cost optimization.

2. By rolling up the most cost-effective BMP solutions at the subwatershed level, the most cost-effective EWMP Implementation Plan can be estimated. The cumulative "cost- optimization curves" for the subwatersheds becomes the overall cost optimization curves for Lawndale, as presented in Figure 4-4. Note that the three regional BMPs dominate the cost-optimization curve for Lawndale, as they are relatively large and are able to retain much of the runoff from Lawndale.

3. Extract the cost-effective scenarios for the required zinc reduction: the required zinc reduction specified in Table 4-2 (86%) determines the specific combination of LID, green streets and regional BMPs that is selected from the cost optimization curves. The Lawndale assessment area was held to the same percent reduction as other jurisdictions contributing to the same waterbodies. The selected scenarios become the EWMP Implementation Plan, and comprise a detailed "recipe for compliance" for Lawndale.

4. After the control measures for zinc are determined, the critical bacteria storm is routed through them: 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.

Figure 4-5 illustrates the process described above for using optimization to determine the combination of LID, green streets and regional BMPs that make up the EWMP Implementation Plan.
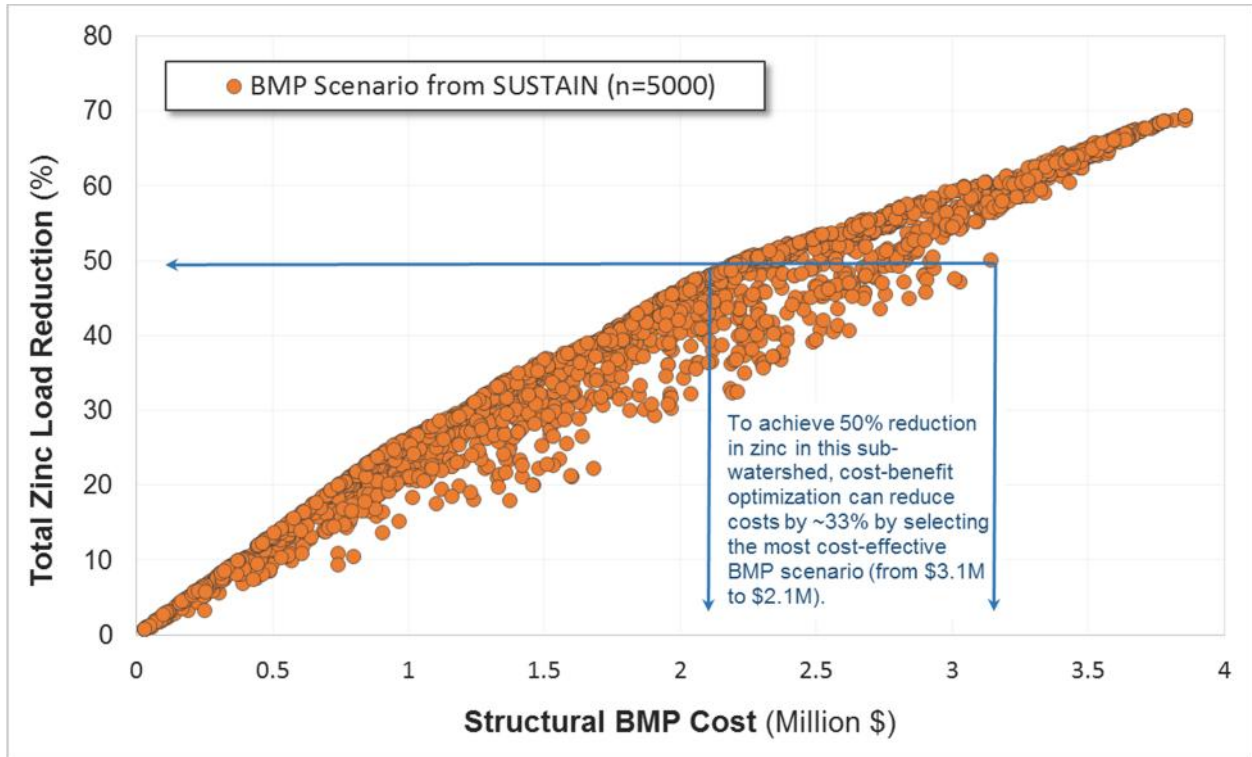
Figure 4-3. Example BMP solutions for a selected subwatershed and advantage of cost-benefit optimization.
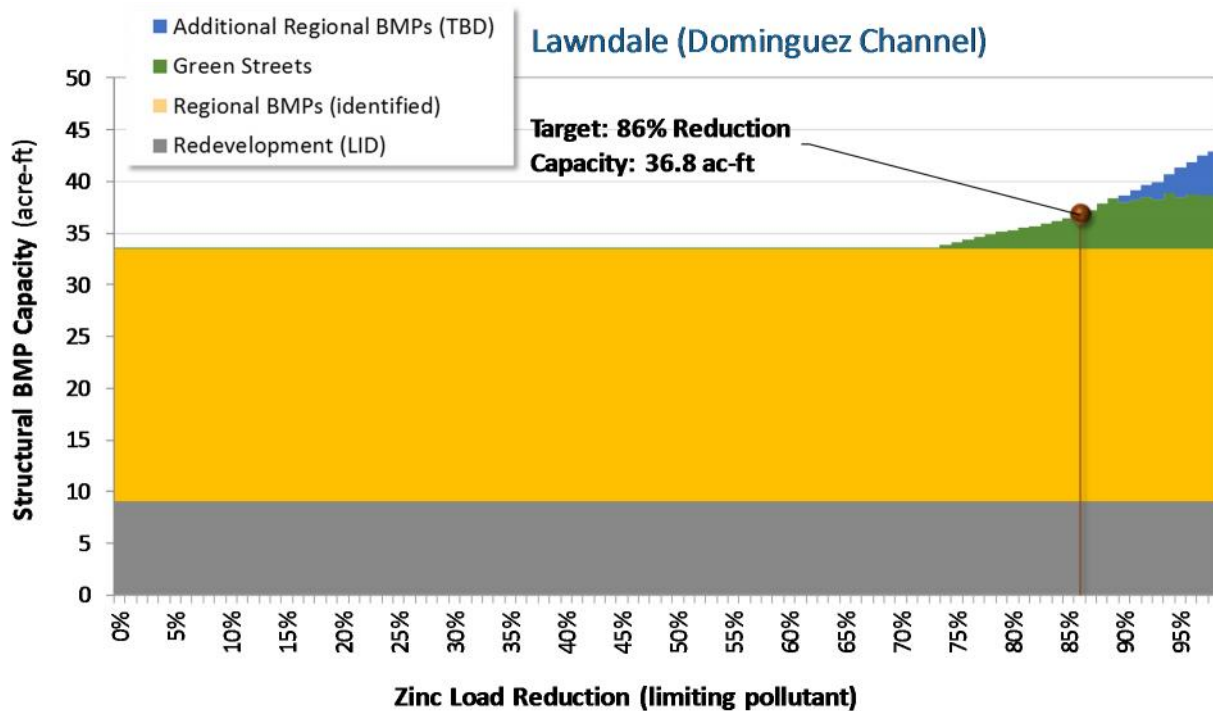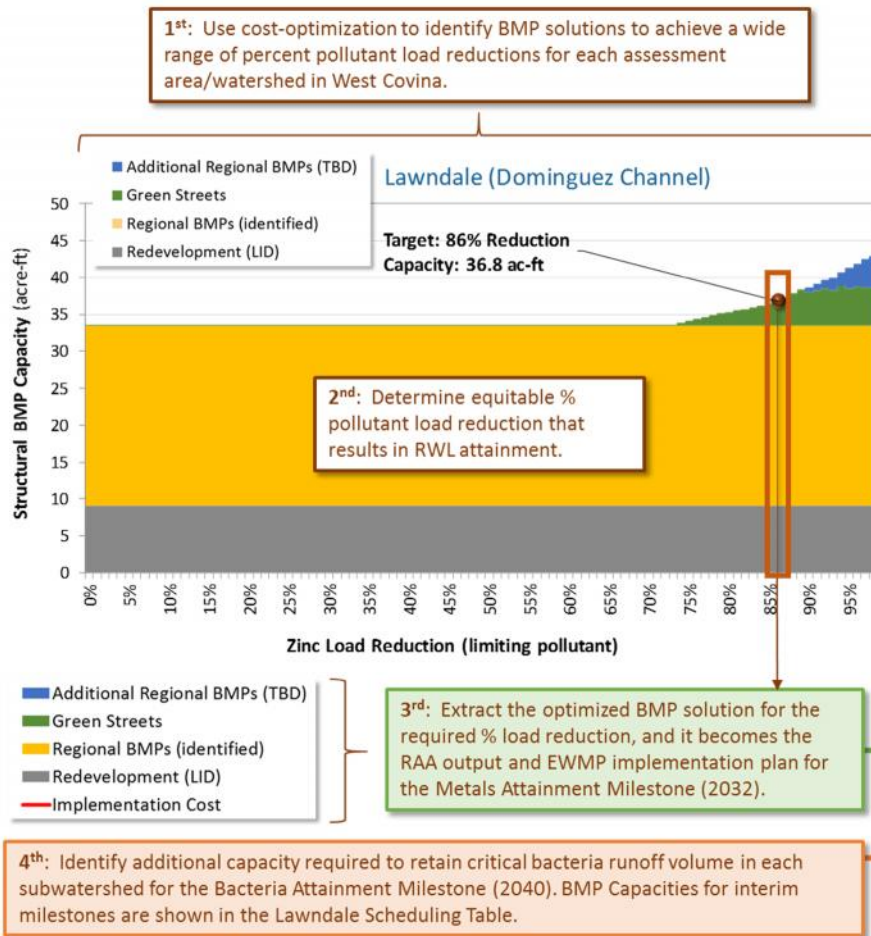

Figure 4-4. Cost Optimization curves for Lawndale in Dominguez Channel watershed.

This graph shows the optimized BMP solutions for the City of Lawndale. The optimization curve represents thousands of BMP scenarios that were evaluated for cost-effectiveness.

Figure 4-5. Illustration of how the EWMP Implementation Plan is extracted from a cost optimization curve.

This illustration is of Lawndale's area in the Dominguez Channel watershed. Four steps are shown for RAA development: developing cost-optimized BMP solutions for a wide range of % load reductions (1st, uppermost text box), determining the equitable % load reduction needed to attain RWLs for the corresponding receiving water (2nd, middle text box), extracting the BMP solution for metals attainment (3rd, bottom text box), and identifying additional capacity for bacteria attainment (4th, bottom text box). Other details of the EWMP Implementation Plan are presented in Section 5. Note that while each assessment area/watershed achieves the required 89.5% reduction in aggregate, subwatersheds *within* the jurisdiction have variable reductions based on optimization (which is why some subwatersheds have high % reductions [red shaded rows in table] and others have low % reductions).

4.5.2   Schdeduling of Control Measures for Interim Wet Weather Compliance

With the EWMP Implementation Plan for final compliance determined, the remaining step for the wet weather RAA is scheduling of control measures *over time* to achieve interim milestones. Following an identical approach as the DC EWMP, the following wet weather milestones were utilized for development of the Lawndale EWMP Implementation Plan, primarily based on achieving the final limits of the DC Toxics TMDL by 2032 and addressing bacteria by 2040:

- Achieve 50% of the reduction for zinc[3] (2026)
- Achieve 75% of the reduction for zinc (2029)
- Final compliance with zinc RWLs (2032)
- Final compliance with bacteria WQBELs (2040)

5 EWMP IMPLEMENTATION PLAN

The EWMP Implementation Plan is the "recipe for compliance" for Lawndale 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 Plan. The RAA also assures those control measures will address the Water Quality Priorities within the specified compliance schedules. The EWMP Implementation Plan includes a recipe for the Dominguez Channel, Lawndale's single receiving water (see Figure 4-2 for a map of these assessment areas). Implementation of the EWMP Implementation Plan will provide a BMP-based compliance pathway for Lawndale to achieve the MS4 Permit. This section describes the EWMP Implementation Plan for Lawndale and the pace of its implementation to achieve applicable milestones, through the following subsections:

- Elements of the EWMP Implementation Plan (5.1)
- Stormwater control measures to be implemented by 2040 for final compliance (5.2)
- Scheduling of stormwater control measures to achieve TMDL and EWMP milestones (5.3)

5.1   Elements of the EWMP Implementation Plan

The EWMP Implementation Plan for Lawndale is expressed in terms of [1] the volumes[4] of stormwater and non-stormwater to be managed by Lawndale 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 EWMP Implementation Plan 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 managed[5] by Lawndale is considered a measurable

---

[3] While these milestones are expressed as reduction in zinc, because zinc is a limiting pollutant, achievement of zinc RWLs assures even greater reduction in other Water Quality Priority pollutants.

[4] Volume is used rather than pollutant loading because volume reduction is more readily tracked and reported by MS4 agencies. The volume reductions are actually a *water quality* improvement metric based on required pollutant reductions.

[5] The volume is determined by reporting the amount of water that would be retained (infiltrated) by BMPs

goal that will be used to assess BMP-based compliance. To support future compliance determination and adaptive management, the volume of stormwater is reported along with the capacities of control measures to be implemented by Lawndale in the EWMP Implementation Plan.

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

5.2 Stormwater Control Measures to be Implemented by 2040 for Final Compliance

The EWMP will guide stormwater management in Lawndale for the coming decades, and the control measures to be implemented have the potential to transform communities including widespread green infrastructure. The EWMP Implementation Plan identifies the location and type of control measures to be implemented by Lawndale for final compliance by 2040, which includes addressing all Water Quality Priorities including the limiting pollutants total zinc and *E. coli*. The EWMP Implementation Plan for final compliance is presented as the following components:

- **Summary of total capacity of control measures to be implemented by Lawndale across the entire EWMP area:** bar graphs are used to summarize the control measure capacities that comprise the EWMP Implementation Plan. Shown in Figure 5-1 are the bar graphs that detail the various sub-categories of control measures to be implemented by Lawndale across its jurisdiction, along with a comparison to other jurisdictions in the DC WMG. Figure 5-2 shows the relative capacity by different BMP types.
- **Detailed recipe for compliance including volumes of stormwater to be managed by Lawndale and control measure capacities:** the EWMP Implementation Plan is detailed for each subwatershed in the EWMP area (generally 1 to 2 square mile drainages). Shown in Figure 5-3 is a map of the "density" of control measure capacities to be implemented to address zinc and other Water Quality Priorities (through controlling zinc). Because the required reductions for zinc are so high, no additional control measures beyond those presented in Figure 5-3 are required to address *E. coli*. This map is shown in a tabular form in Table 5-1 (by subwatershed), and the scheduling of control measures (by milestone) is shown in Table 5-2. These tables show both the volumes of stormwater to be managed in each subwatershed

---

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.

While the EWMP Implementation Plan 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.

(Compliance Targets) and the control measures to achieve those volume reductions (EWMP Implementation Plan). Separate Compliance Targets and EWMP Implementation Plans are provided for Metals and Other Water Quality Priorities and *E. coli*.

In addition to the scheduled stormwater capture milesones detailed in Table 5-2, the City will also advance the planning for identified potential regional projects, as follows:

- **Alondra Park project:** by December 2017, the City will have completed the following:
  - Coordination with other jurisdictions in the wet weather capture area to evaluate feasibility of cost-sharing for project construction and maintenance;
  - Pursuit of funding to construct the facility to manage the wet weather capture area, either through grants, loans, or stormwater fees;
  - Determination through partnering with other jurisdictions if an alternate design is feasible to manage additional stormwater volume to offset costs of the other regional projects below. As the project will capture stormwater from the majority of the City drainage area, an alternative design that provides more capture could lessen the need for other BMPs. This evaluation will consider site constraints of the parking lot at Alondra Park, construction costs, and long-term site disturbance that would be necessary.

- **Redevelopment Agency Empty Lot project:** by December 2017, the City will have completed the following:
  - Determination of whether the site will be subject to redevelopment and
    - If so, the City will determine whether it is feasible and desirable to incorporate capacity for regional stormwater capture into the site and associated costs
    - If not, the City will further evaluate whether the Alondra Park project can be modified to increase necessary treatment capacity. This evaluation will consider site constraints of the parking lot at Alondra Park, construction costs, and long-term site disturbance that would be necessary.
  - Pursuit of funding to construct the facility, if the project is determined to be feasible and desirable.

- **William Anderson Elementary/Will Rogers Middle School project:** by December 2017, the City will have completed the following:
  - The City will determine whether it is feasible and desirable to incorporate capacity for regional stormwater capture into the site and associated costs
    - If not, the City will further evaluate whether the Alondra Park project can be modified to increase necessary treatment capacity. This evaluation will consider site constraints of the parking lot at Alondra Park, construction costs, and long-term site disturbance that would be necessary.
    - If the project is determined to be feasible and desirable, the City will pursue funding to construct the facility.

If, over the course of further planning for these regional projects, it is determined the projects are not feasible or desirable, then equivalent projects will be identified in terms of stormwater managed.
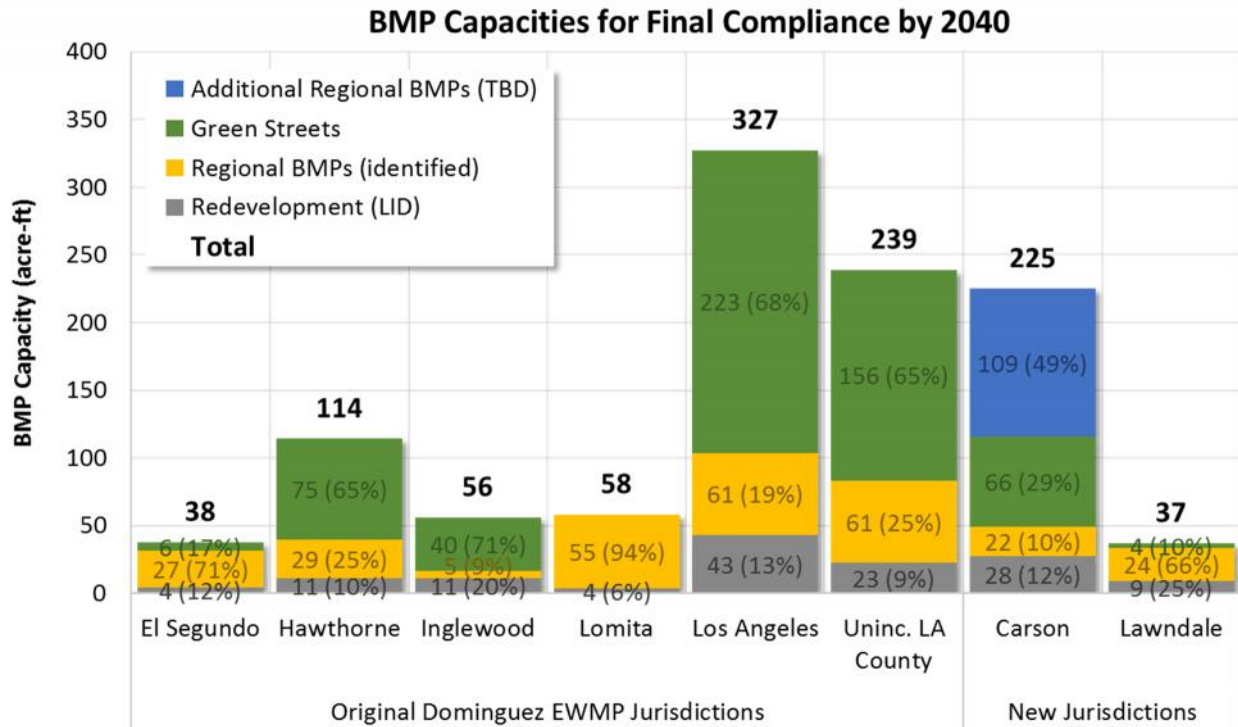
Figure 5-1. DC EWMP Implementation Plan for Final Compliance by 2040 including Lawndale.

This graph shows the total structural BMP capacity required for each DC EWMP jurisdiction including Lawndale to attain RWLs. It also shows BMP types (LID, green streets and regional BMPs). For Carson (among the new jurisdictions), additional Regional BMPs (to be determined) were shown to be needed when the screened opportunity for optimization modeling was found to be insufficient to achieve compliance targets. In contrast, Lawndale BMP opportunity was found to be sufficient to avoid the need for Additional Regional BMPs.
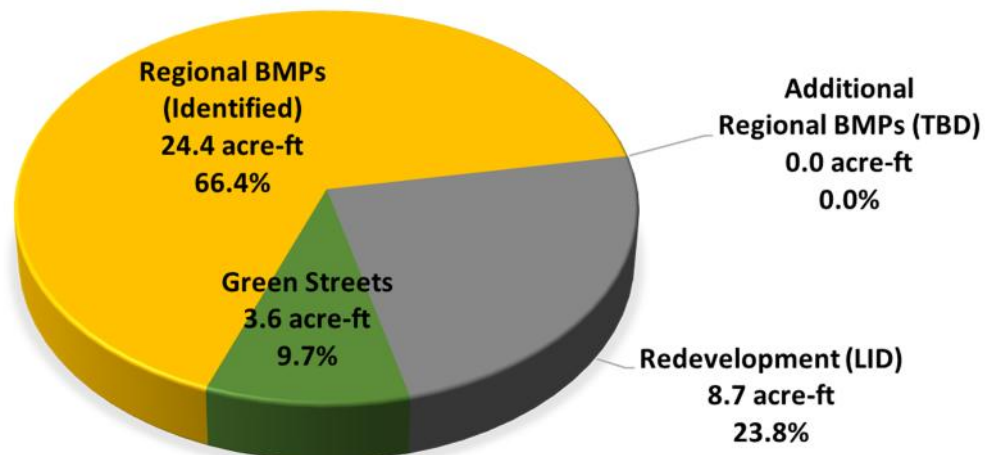

Figure 5-2. BMP distribution in Lawndale's EWMP Implementation Plan.

This figure shows relative capacity distribution for different types of control measures for the final 2040 EWMP milestone.
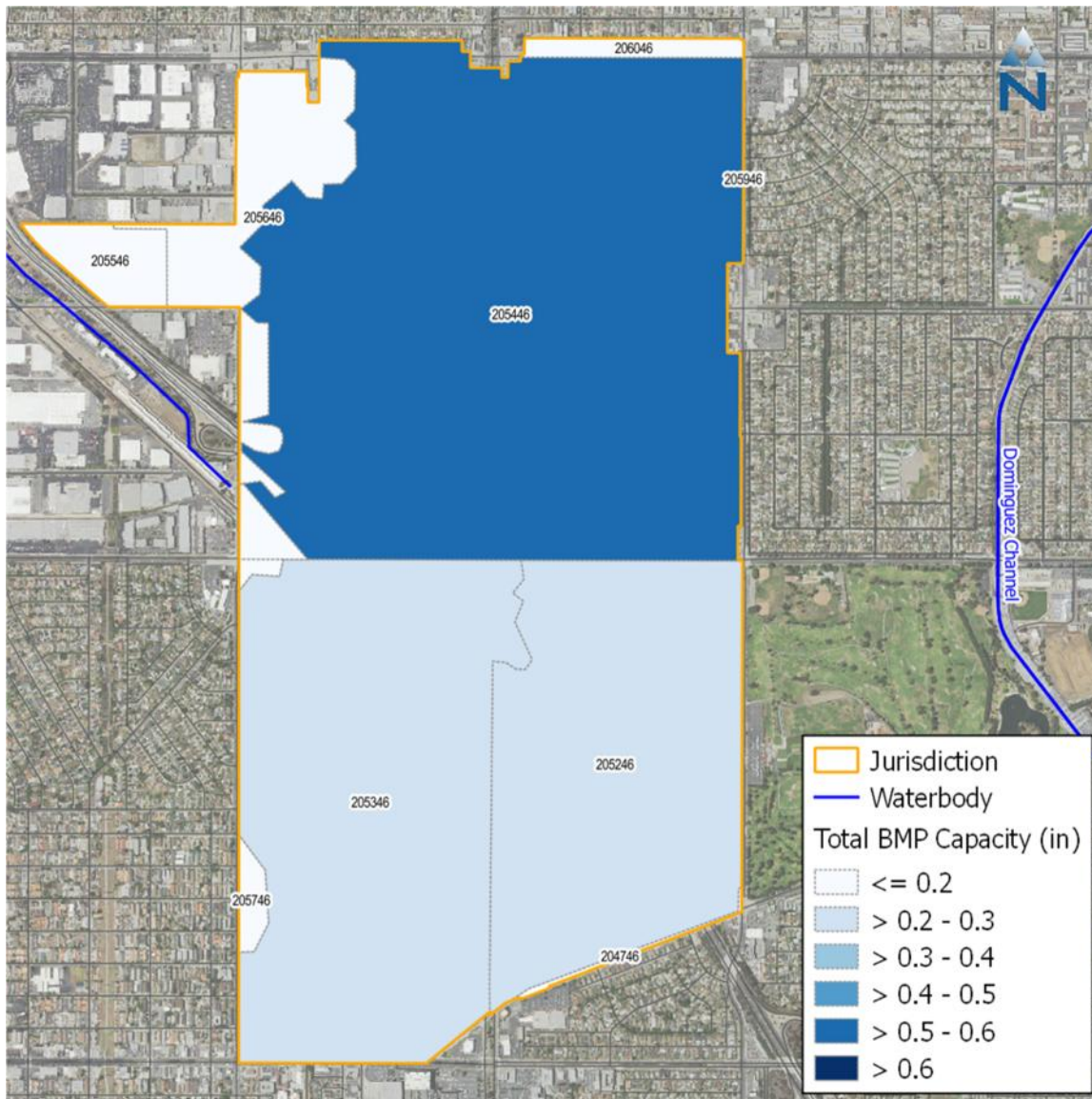
Figure 5-3. Lawndale EWMP Implementation Plan by subwatershed for metals and other water quality priorities (except E. coli).

This map presents Lawndale's EWMP Implementation Plan for Metals and Other Water Quality Priorities as control measure "density" by subwatershed. The BMP density is higher in some areas [dark blue] because those are the subwatersheds where most of the BMP capacity will be implemented. The BMP capacities are normalized by area (i.e., the BMP capacity for each subwatershed [in units of acre-feet] was divided by the subwatershed area [in units of acres] to express the BMP capacity in units of depth [inches]). This map presents the total BMP capacity for metals attainment summarized in Table 5-1 (by subwatershed) and Table 5-2 (by milestone). Note that while each jurisdiction that drains to Dominguez Channel is held to an equivalent % reduction (86%), subwatersheds within an assessment area may have variable reductions based on optimization or due to increase BMP opportunity in those areas (in this case, potential sites for regional BMPs).

Table 5-1. Lawndale, Dominguez Channel: RAA Output and EWMP Implementation Plan for Final Compliance by 2040

Subwatershed ID	COMPLIANCE TARGETS: BMP PERFORMANCE GOAL		EWMP IMPLEMENTATION PLAN: APPROACH TO ACHIEVE COMPLIANCE TARGETS, SUBJECT TO ADAPTIVE MANAGEMENT (BMP capacity expressed in units of acre-feet)							
	For Toxics by 2032	For Bacteria by 2040	Harbor Toxics TMDL and other WQPs by 2032						For Bacteria Attainment by 2040	
				LID	Streets	Regional BMPs				
	24-hour Volume Managed (acre-ft)	Additional 24-hour Volume Managed (acre-ft)	% Load Reduction Critical Condition	Redevelopment	Green Streets	Regional BMPs (identified)	Additional Regional BMPs (TBD)	Total BMP Capacity (acre-ft)	Regional BMPs (additional)	Cumulative BMP Capacity for Final Compliance (acre-ft)
204746	0.02	0.00	31%	0.00	0.01	---	---	0.01	0.00	0.01
205246	4.53	0.00	81%	1.92	2.07	---	---	3.99	0.00	3.99
205346	8.14	0.00	86%	2.70	0.53	3.34	---	6.57	0.00	6.57
205446	22.20	0.00	95%	3.91	---	21.02	---	24.93	0.00	24.93
205546	0.08	0.00	15%	0.04	0.03	---	---	0.07	0.00	0.07
205646	1.37	0.00	76%	0.15	0.82	---	---	0.98	0.00	0.98
205746	0.10	0.00	60%	0.01	0.06	---	---	0.07	0.00	0.07
205946	0.00	---	40%	---	0.00	---	---	0.00	---	0.00
206046	0.06	0.00	26%	0.01	0.04	---	---	0.05	0.00	0.05
Total	36.50	0.00	86%	8.74	3.57	24.37	0.00	36.68	0.00	36.68

Table 5-2. Lawndale: RAA Output and EWMP for Interim Milestones and Final Compliance

Assessment Area	COMPLIANCE TARGETS: BMP PERFORMANCE GOAL		EWMP IMPLEMENTATION PLAN: APPROACH TO ACHIEVE COMPLIANCE TARGETS, SUBJECT TO ADAPTIVE MANAGEMENT (BMP capacity expressed in units of acre-feet)				
			LID	Streets	Regional BMPs		
	EWMP Milestone	24-hour Volume Managed (acre-ft)	Redevelop-ment	Green Streets	Regional BMPs (identified)	Additional Regional BMPs (TBD)	Total BMP Capacity (acre-ft)
Dominguez Channel	50% Milestone (2026)	29.1	4.8	---	24.4	---	29.1
	75% Milestone (2029)	29.1	4.8	---	24.4	---	29.1
	Final Metals (2032)	36.5	8.7	3.6	24.4	---	36.7
	Final Bacteria (2040)	36.5	8.7	3.6	24.4	0.0	36.7
Total	---	36.5	8.7	3.6	24.4	0.0	36.7

6 ADAPTIVE MANAGEMENT FRAMEWORK

Incorporation of Lawndale into the DC EWMP does not necessitate any revision to the adaptive management methodology. Refer to Section 6 of the DC EWMP for details regarding adaptive management. In general, over time the monitoring data will be used to refine the estimated pollutant reductions and selected BMPs for implementation will evolve. As BMPs are "substituted", Lawndale will demonstrate equivalent performance for achieving the volume-based Compliance Targets.

7 IMPLEMENTATION COSTS & FINANCIAL STRATEGY

This section presents costs for constructing the control measures in the EWMP Implementation Strategy, along with the financial strategy for addressing those costs. For the purposes of the EWMP, the financial strategy is defined as the strategic options available to the Group members for financing the program costs associated with the MS4 Permit. The section provides an overview of the following components of the EWMP financial strategy:

- Estimated EWMP Costs (Section 7.1)
- Financial Strategy (Section 7.2)

7.1 Estimated EWMP Costs

Order-of-magnitude cost estimates were generated for Lawndale's EWMP Implementation Plan. The general approach for developing cost estimates is based on "cost functions" shown in Table 7-1, that describe cost as a function of BMP size parameters (volume, depth, area, etc.). These cost functions were applied to the quantity of each category of control measure presented in Section 5 (Table 5-1 and Table 5-2) by milestone. Cost functions for the Regional BMPs were derived from other detailed regional BMP cost estimates generated for the DC EWMP, including the concept design for the signature project for City of Carson. Cost functions for Green Streets are consistent on a volumetric basis with those used for the DC EWMP.

The estimated capital costs for all control measures in the EWMP Implementation Strategy (LID, Green Streets, and Regional) are shown in Table 7-2. The capital costs are reported for the same milestones detailed in Section 5.2 of the DC EWMP. The implementation cost schedule relies on initial capital costs to achieve the control measure capacities at the milestone year.

Figure 7-1 presents a summary of annual and cumulative capital costs over the duration of the compliance timeframe between 2017 and 2040. Annual operation and maintenance costs (O&M) were estimated consistent with the methodologies presented in Section 7 of the DC EWMP. Annual O&M costs for Regional Projects was estimated at 1.5% of construction cost, and annual O&M costs for Green Streets was estimated at 1% of construction cost.

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

Table 7-1. Summary of Annualized BMP Cost Estimation Formulas (ULAR Group, 2015)

BMP Type	Formula for Estimating Capital Cost ($)
Redevelopment (LID)	--
Green Streets	Cost = 47.77 (V_t)
Regional BMPs (identified)	Cost = 21.81 (V_t)
Additional Regional BMPs (TBD)	Cost = 21.81 (V_t) + [129.01 (A)][1]

(V_t) is the total volume of the BMP in cubic feet, and
(V_m) is the volume of the BMP soil media in cubic feet.
1: Optional Term represents $129.01/square foot to account for private land acquisition costs if needed. For Lawndale, additional regional BMPs were not needed, and this term was never applied.

Table 7-2. Summary of Lawndale cumulative Capital Cost by Milestone

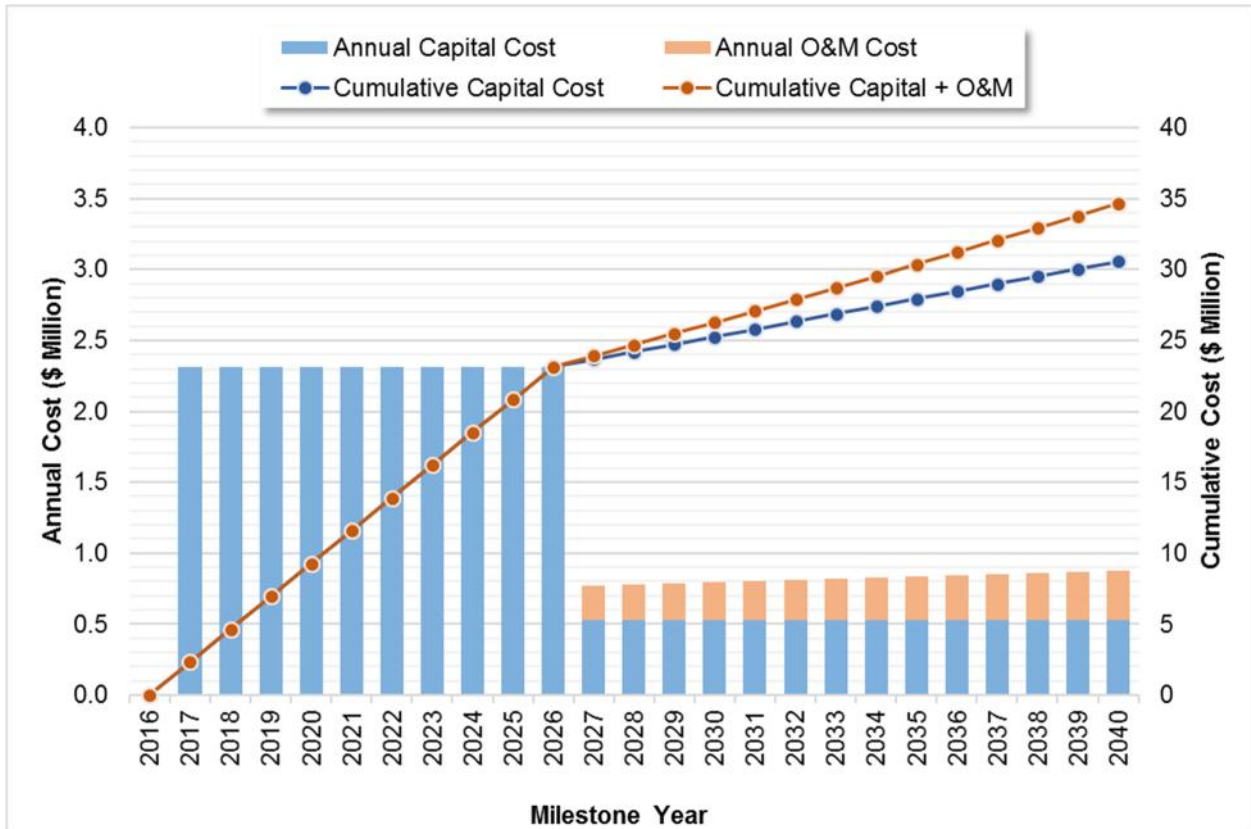| Milestone	50% (2026)	75% (2029)	Final Metals (2032)	Final Bacteria (2040)
Redevelopment	--	--	--	--
Green Streets	--	--	$7,428,674	$7,428,674
Regional Projects	$23,147,700	$23,147,700	$23,147,700	$23,147,700
Additional Regional	--	--	--	--
Total Capital Cost	**$23,147,700**	**$23,147,700**	**30,581,040**	**30,581,040**

Figure 7-1. Summary of Lawndale implementation cost distribution over compliance timeframe.

7.2 Financial Strategies

Financial strategies and funding sources for the City of Lawndale are consistent with those identified in Section 7.2 of the DC EWMP.

8 REFERENCES

ULAR Group (Upper Los Angeles River EWMP Group). 2015. *DRAFT Enhanced Watershed Management Program.* Prepared by the Upper Los Angeles River EWMP Group. Submitted June 2015.