
Addendum to Enhanced Watershed Management Program for the Dominguez Channel Watershed Management Area Group: Incorporation of City of Carson

DECEMBER 16, 2015

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1 INTRODUCTION

This appendix presents an addendum to incorporate the City of Carson (Carson) 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 26, 2015 the city of Carson 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 Carson into the DC EWMP and presents the EWMP Implementation Plan for Carson. Through submittal of this addendum, Carson 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. Table 1-2 is a summary of the relative areas in Carson that drain to the major receiving waters.

This addendum is focused on the Carson-specific analyses to incorporate the City of Carson into the DC EWMP, including the portion of Carson within the Los Angeles River watershed. 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 a section within this addendum.

¹ The City of Lawndale submitted an NOI on August 12, 2015 and is incorporated through a separate 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

Table 1-2. City of Carson area distribution by Assessment Area

Assessment Area	Total Area (acres)	Percent of Total
Dominguez Channel Estuary	10,555.3	88.4%
Machado Lake	560.8	4.7%
Wilmington Drain	657.7	5.5%
Compton Creek	169.1	1.4%
Total	11,942.9	100.0%

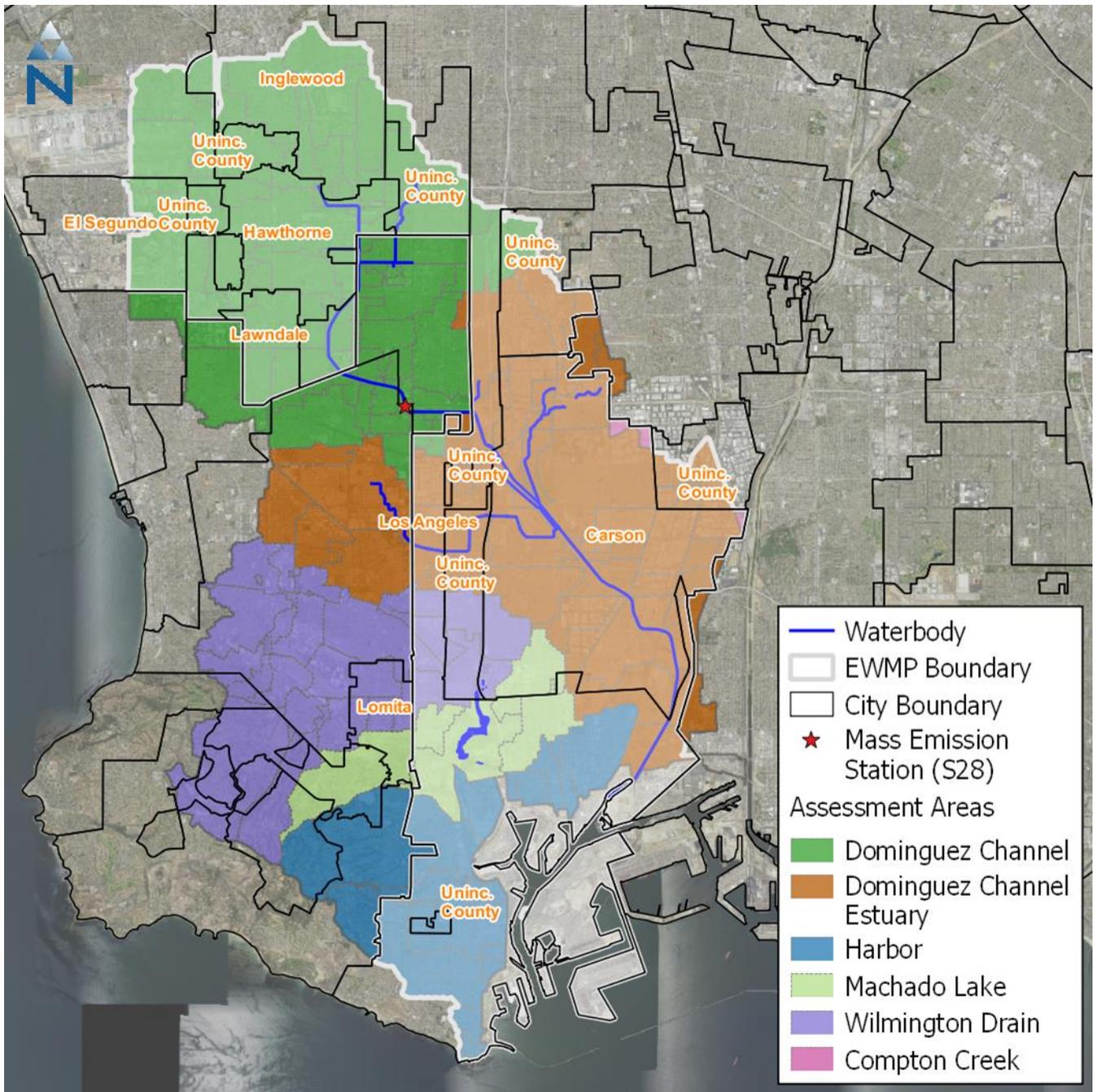


Figure 1-1. Jurisdictional boundaries and tributary areas of the DC WMG after incorporation of Lawndale and Carson.

2 WATER QUALITY PRIORITIES

Carson is located within the Dominguez Channel Watershed Management Area, which was analyzed in Water Quality Priorities section (Section 2) of the DC EWMP. As shown in Figure 1-1, the receiving waters for Carson are the freshwater portion of Dominguez Channel (above Vermont Avenue), the Dominguez Channel Estuary, Machado Lake and Wilmington Drain (which feeds into Machado Lake). These receiving waters were fully evaluated in the DC EWMP, and their Water Quality Priorities are presented in Table 2-4 of the DC EWMP. The inclusion of Carson does not necessitate any additional Water Quality Priorities (TMDLs, 303(d) listings, or otherwise). The primary Water Quality Priorities that generally drive the watershed control measures for Carson are zinc (Category 1 Water Quality Priority, DC channel and estuary), nitrogen (Category 3 Water Quality Priority, Wilmington Drain) and indicator bacteria (Category 2 Water Quality Priority, all waterbodies). As demonstrated in subsequent sections, by addressing these three 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 BMPs² 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 BMP's, 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).

Carson 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

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

by Carson is summarized in Table 3-1. Additional information regarding the selected control measures are provided in the following subsections, organized by control measure type.

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

Control Measure Type	Control Measure Subcategory for EWMP / RAA	Incorporation Approach for EWMP for Carson
Institutional	Enhanced institutional	5% baseline for 2012 Permit MCMs, plus additional 5% reduction due to catch basin inserts
LID	Planned & Existing Projects	Yes, these projects were incorporated, either explicitly or, for those constructed prior to 2011, implicitly as part of the baseline for the DC EWMP
	New & Re-Development	Yes, incorporated based on projected growth rates
Green streets	Green streets with permeable pavement	Yes, incorporated suitable streets as opportunities for green streets
Regional projects	Public Regional (identified)	Yes, two (2) major regional BMP opportunities are incorporated into EWMP, one of which is presented as a concept design and BMP factsheet similar to those presented in Section 4.2 of the DC 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 Carson 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 Carson. 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 Carson. Parcels less than 0.25 acres or that are part of a waterway were excluded. Remaining parcels were evaluated by the Carson 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, and the like.

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, two (2) primary sites were identified as potentially suitable for potential regional projects on public parcels. Table 3-2 summarizes the Regional BMP opportunities identified through the screening process and incorporated into the RAA model for Carson. Figure 3-1 shows the extent of contributing drainage areas to the two identified the potential regional projects. As described in the next subsection, the Carriage Crest Park project was subject to detailed concept design.

The Civic Center project was represented through preliminary, coarse design parameters based on an initial evaluation of the sites using readily-available desktop GIS data sets. During EWMP implementation, the design details for the Civic Center regional project would be further refined. The City is currently in discussions regarding a potential development on and adjacent to the Civic Center property, and the details of that redevelopment project will need to be advanced before the design of the Civic Center project is evaluated in detail.

During adaptive management, the designs for the Carriage Crest Park and Civic Center projects could be modified, the projects could be supplemented by additional projects, or the projects could be replaced entirely by other projects, as long as the equivalent stormwater capture benefit is achieved overall (as described in Section 5)

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

Description	Address	Approximate Location (Lat/Long)	Approximate Available Footprint (acres)	Potential Upstream Area to be Intercepted (acres)
Carriage Crest Park	23800 Figueroa St, Carson, CA 90745	33 48' 32.2" N / 118 17' 5.1" W	1.4	180 ¹
City Hall / Civic Center	55 Civic Plaza Dr, Carson, CA 90745	33 49' 56.3" N / 118 15' 35.8" W	3.07	1,110

1 – Wet-weather drainage area is 180 acres. Additional dry weather capture area totals 938 acres. Refer to Figure 3-1 and Figure 3-2 for illustration of the drainage areas.

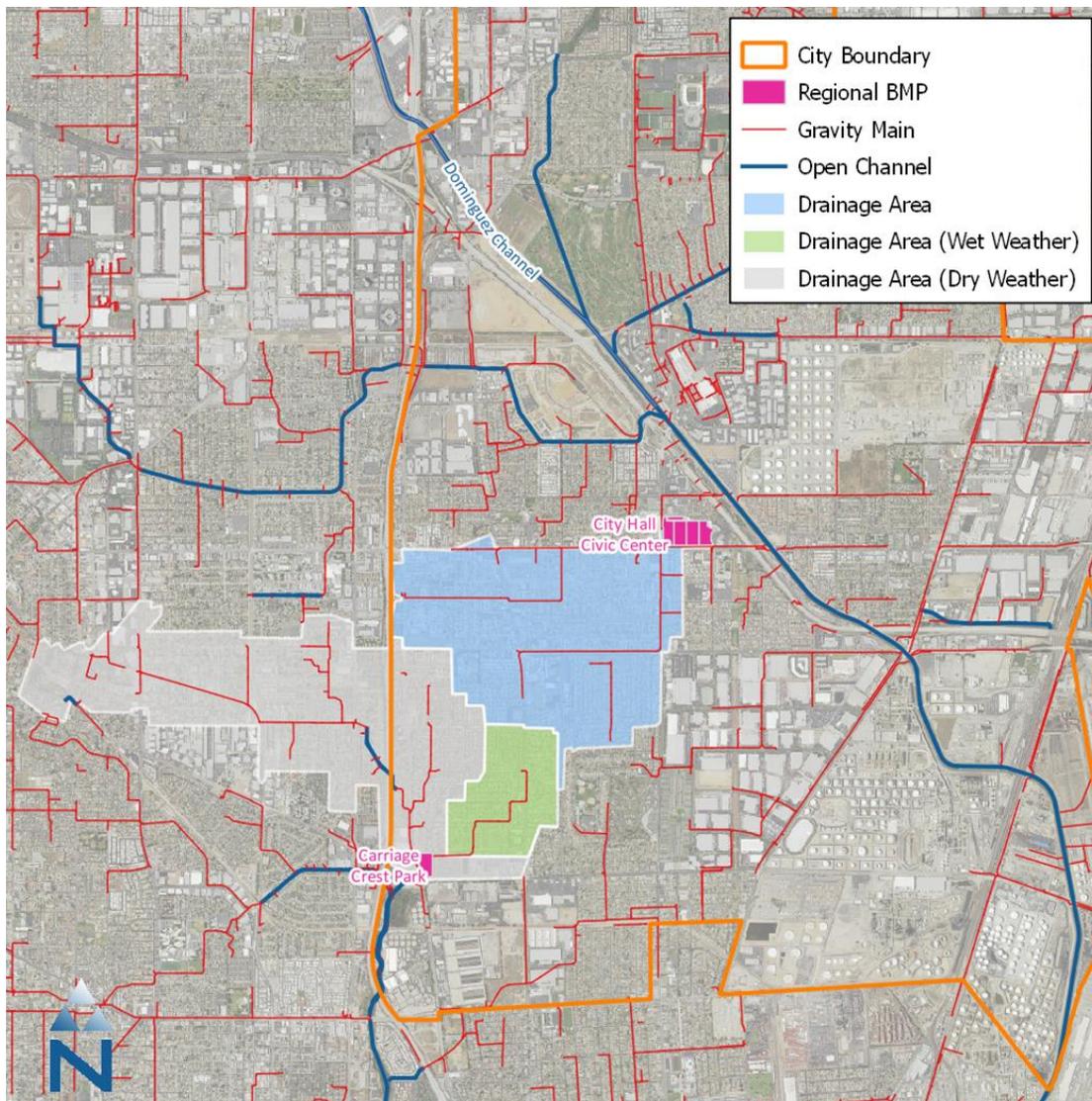


Figure 3-1. Regional BMP Opportunities Identified in Carson.

3.1.2 Carriage Crest Park Concept Design

Carriage Crest Park was identified as a high opportunity site for a regional stormwater capture project due to its proximity to two large storm drains (and thus large treatment area) and potential for multi-jurisdictional partnership. The park is owned and operated by the City of Carson. Due to its proximity to a storm drain junction, the site has access to two potential diversion points. As shown in Figure 3-2, this allows for capture from a 180-acre drainage area completely within the City and a 938-acre drainage area that crosses four neighboring jurisdictions. A preliminary sizing analysis concluded the site has adequate space for a structure footprint capable of treating the 85th percentile, 24-hour runoff event from the 180-acre drainage area, referred to as the “wet weather capture area” (green shading in Figure 3-2). A second diversion is proposed to also treat dry weather flows from the 938-acre “dry weather capture area” (orange shading). This configuration would maximize the urban area that benefits from the BMP, and also could promote collaboration with neighboring jurisdictions (cities of Los Angeles and Torrance and Unincorporated Los Angeles County).

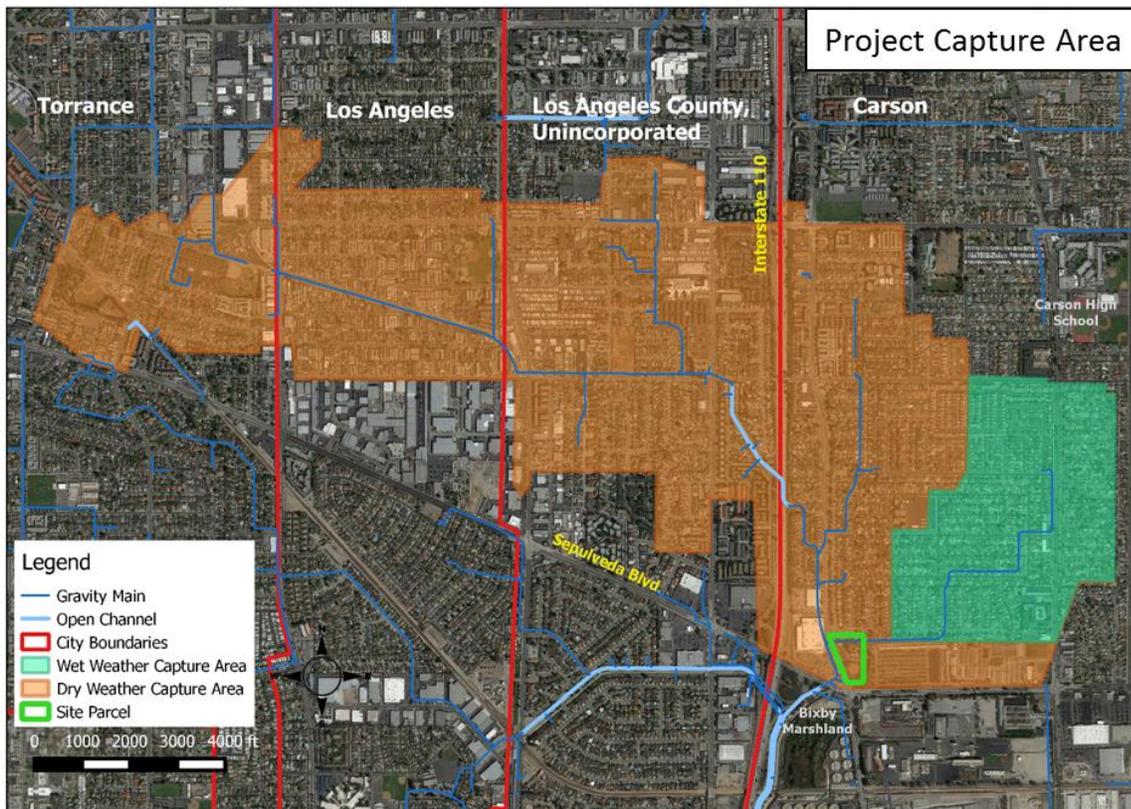


Figure 3-2. Carriage Crest park site parcel and capture areas.

The proposed concept for the Carriage Crest regional BMP consists of an offline infiltration gallery below the ballfield of Carriage Crest Park. The gallery would consist of either a 255' by 240' by 6.5' concrete chamber or twenty 255' rows of 120" corrugated metal pipe. As shown in Figure 3-3, for the wet weather capture area, stormwater would be diverted from the existing 69" drain in the northern section of the park to treat the 85th percentile, 24-hour runoff volume. For the dry weather capture area, a second diversion from the existing double 129" x 79" concrete box drain under South Figueroa Street will be considered to treat dry weather flows of up to 2 cubic feet per second (cfs). Diversion structures are required – the wet weather diversion would be sized to handle the peak design storm flow rate (approximately 14 cfs) and the dry weather diversion would be sized to handle the peak dry weather flow rate (less than 2 cfs). Due to relatively deep invert elevation of the existing storm drains (approximately 9 feet below ground surface), pumping may be required to lift the water to the BMP.

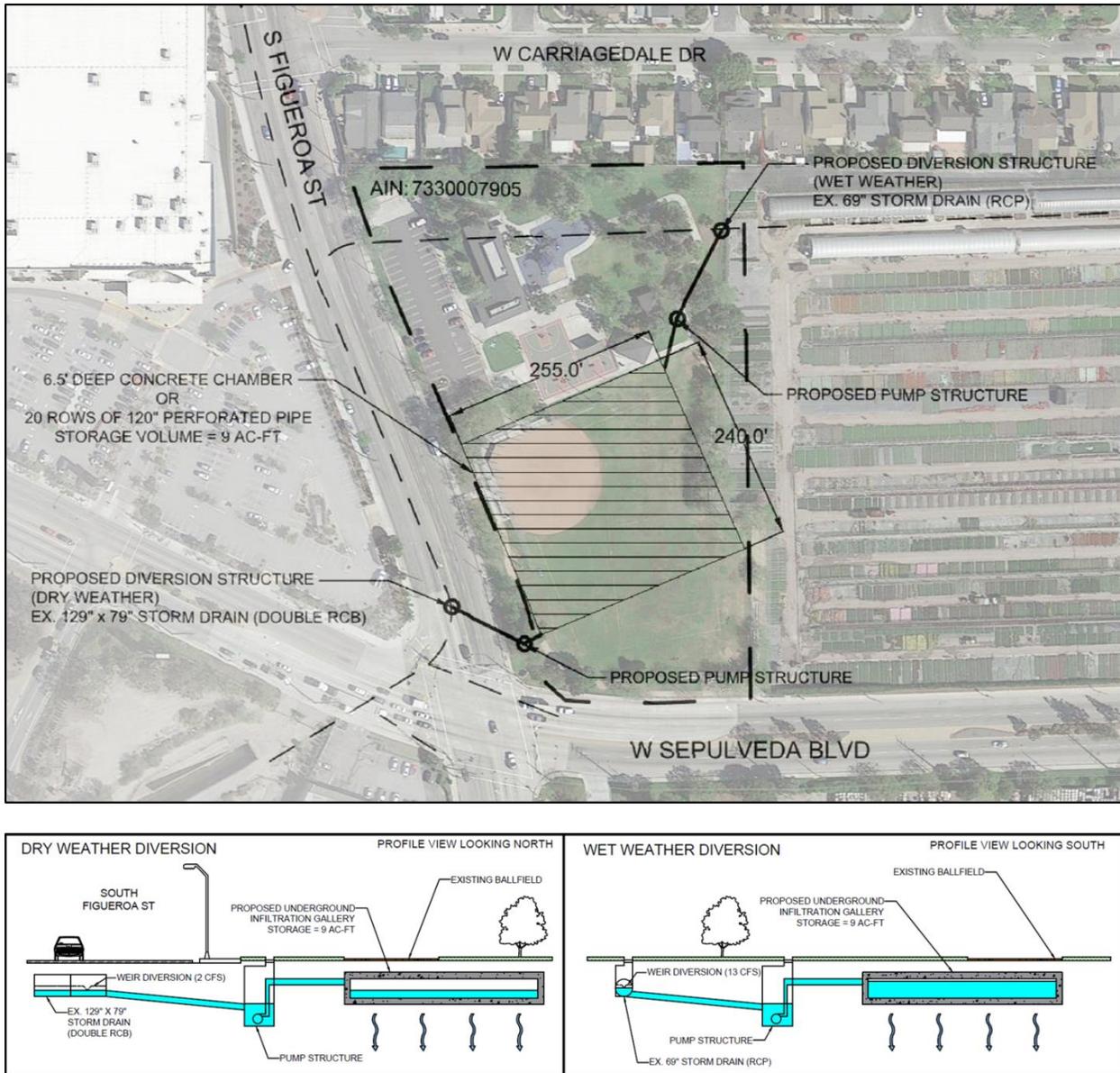


Figure 3-3. Plan (top) and profile (bottom) design considerations for the Carriage Crest Park regional stormwater facility.

3.1.3 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 Carson.

As an example of Additional Regional, the City is discussing leasing a parcel adjacent to the Carriage Crest Park site from the Los Angeles County Sanitation District, which could allow the Carriage Crest project to be expanded in a subsequent phase to capture additional runoff/drainage area. In this example, the City could avoid land acquisition costs, but would incur costs to lease the land.

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 3-4 shows the extent of LID opportunities throughout Carson while the following summarizes key details about each of the LID program components:

- LID due to Redevelopment – 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.
- Existing and Planned BMPs – Three existing/planned projects were incorporated for the City of Carson. These include a major redevelopment project at Del Amo Blvd. & Main Street, a smaller scale redevelopment for The Avalon at the corner of Carson & Avalon, and 720 E. Carson St. These LID projects are incorporated into the EWMP and RAA. Other existing BMPs were determined to be a part of the baseline water quality and not explicitly included.

Note that Figure 3-4 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, however, 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 are described in Attachment R of the DC EWMP. Screening for green street opportunities throughout Carson followed a similar procedure by filtering out suitable road functional classes based on the Census 2010 TIGER roads data set. When applied to Carson, this screening procedure identified over 150 lane miles of *potential* length for green streets, as shown in Figure 3-4. Note that Figure 3-4 shows the green street BMP *opportunities* (suitable streets); the *capacity* of green streets to be implemented for Carson's EWMP Implementation Plan (per the RAA) is presented in Section 5.

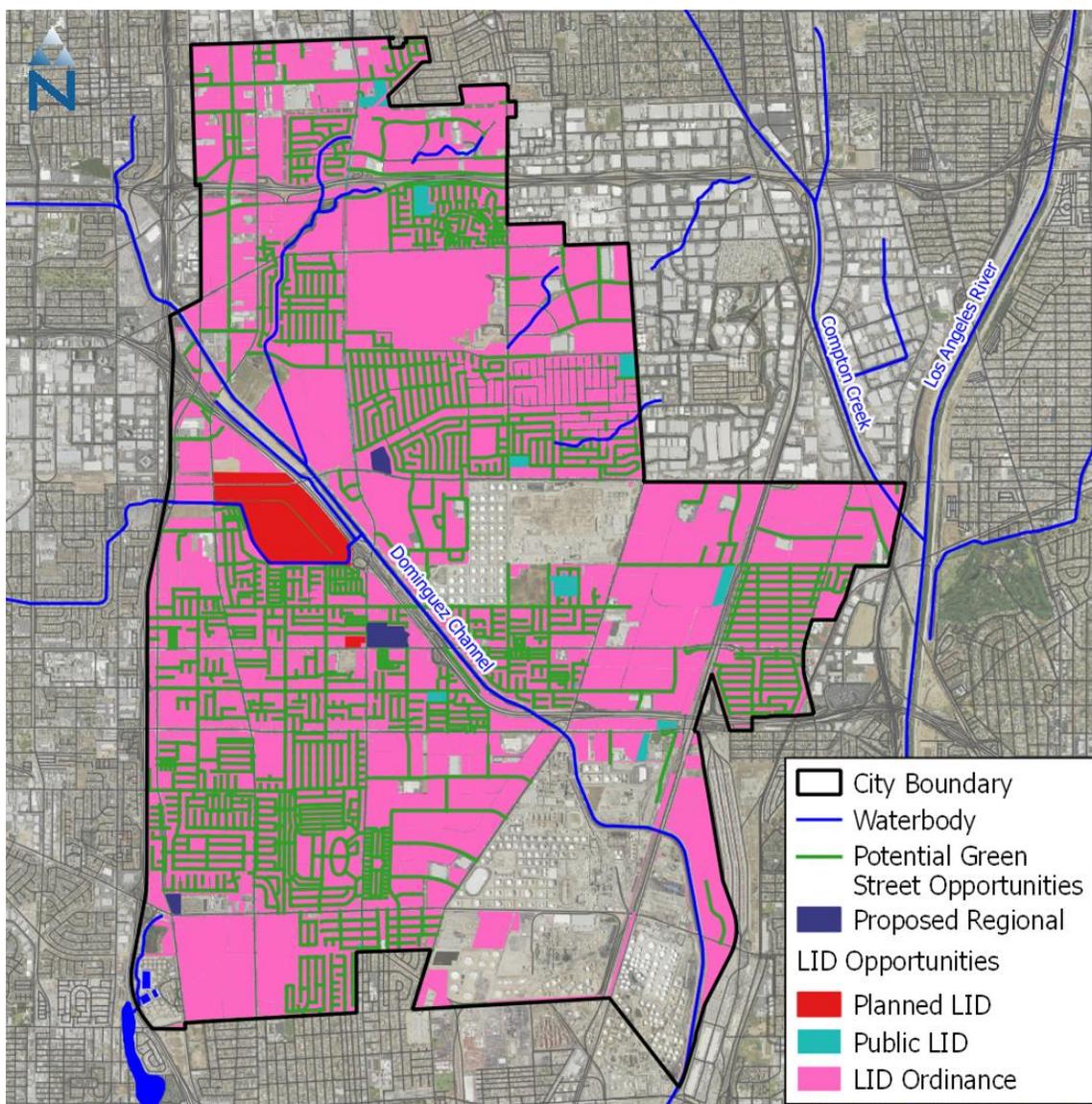


Figure 3-4. Opportunities for LID Identified in Carson.

3.4 Institutional BMPs

Institutional BMPs are a fundamental component of Carson’s stormwater program, including the MCMs required by the Permit. For development of this initial EWMP, Carson has elected to not customize the baseline MCMs in the 2012 Permit. Consistent with the DC EWMP, the Carson 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). Carson will also 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:

- Implementation of 920 trash control devices, both automatic retractable screens (ARS) and connector pipe screen (CPS) devices, by 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 will increase the frequency of street sweeping in these areas if deemed necessary.

During adaptive management, Carson 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 Carson 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 Carson (described in Section 5).

The RAA for Carson 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 Carson 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 Carson EWMP. WMMS is specified in the Permit as an approved tool to conduct the RAA. The 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 (Tetra Tech 2010a, 2010b).

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 36 subwatersheds and four receiving water/assessment area that the Carson jurisdictional boundary intersects.

In addition to the structural control measures to retain runoff, the EWMP also includes actions in Machado Lake that are anticipated to address nutrient TMDL requirements (Section 2.5 of the DC EWMP). As such, the control measures in the portions of Carson that drain to Wilmington Drain and Machado Lake are driven by control of bacteria.

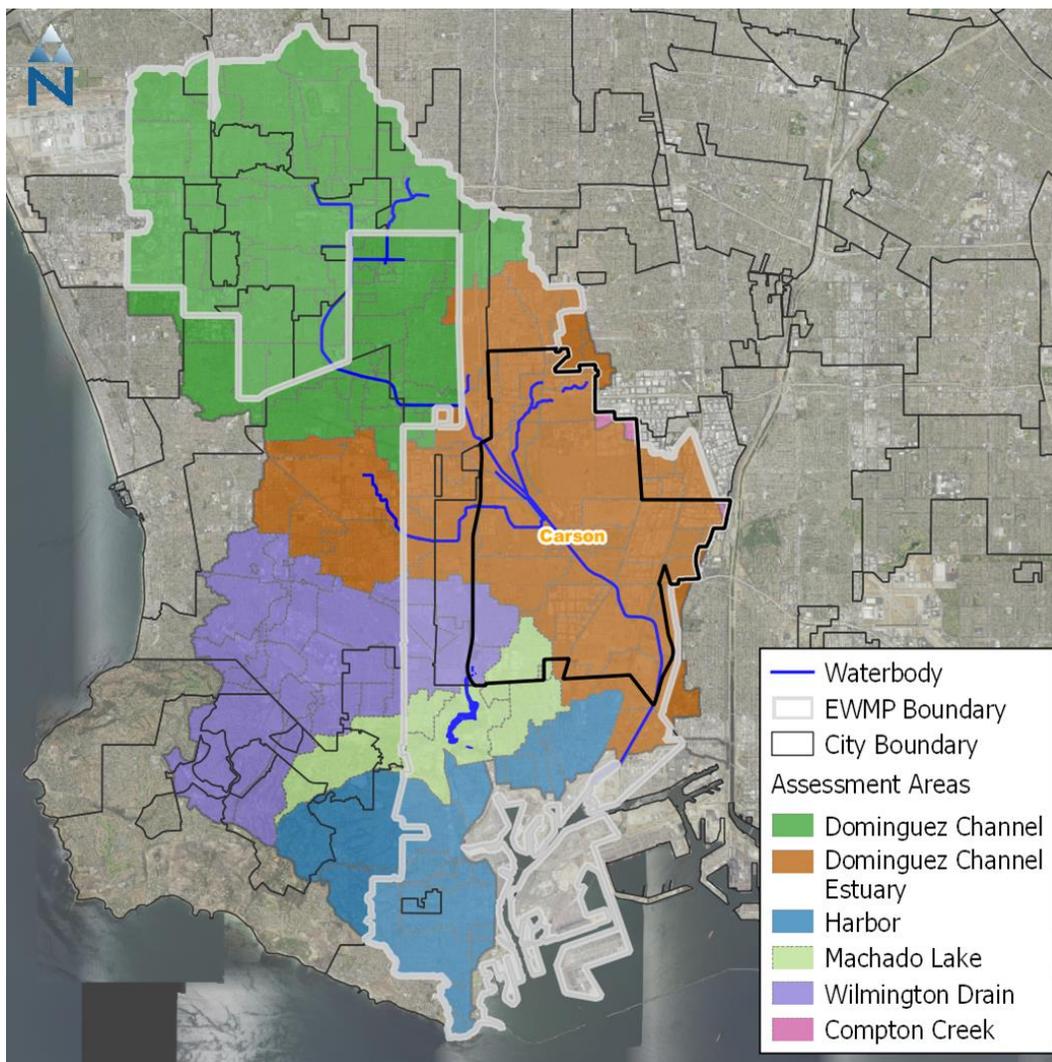


Figure 4-1. Location of Carson within the DC EWMP Area.

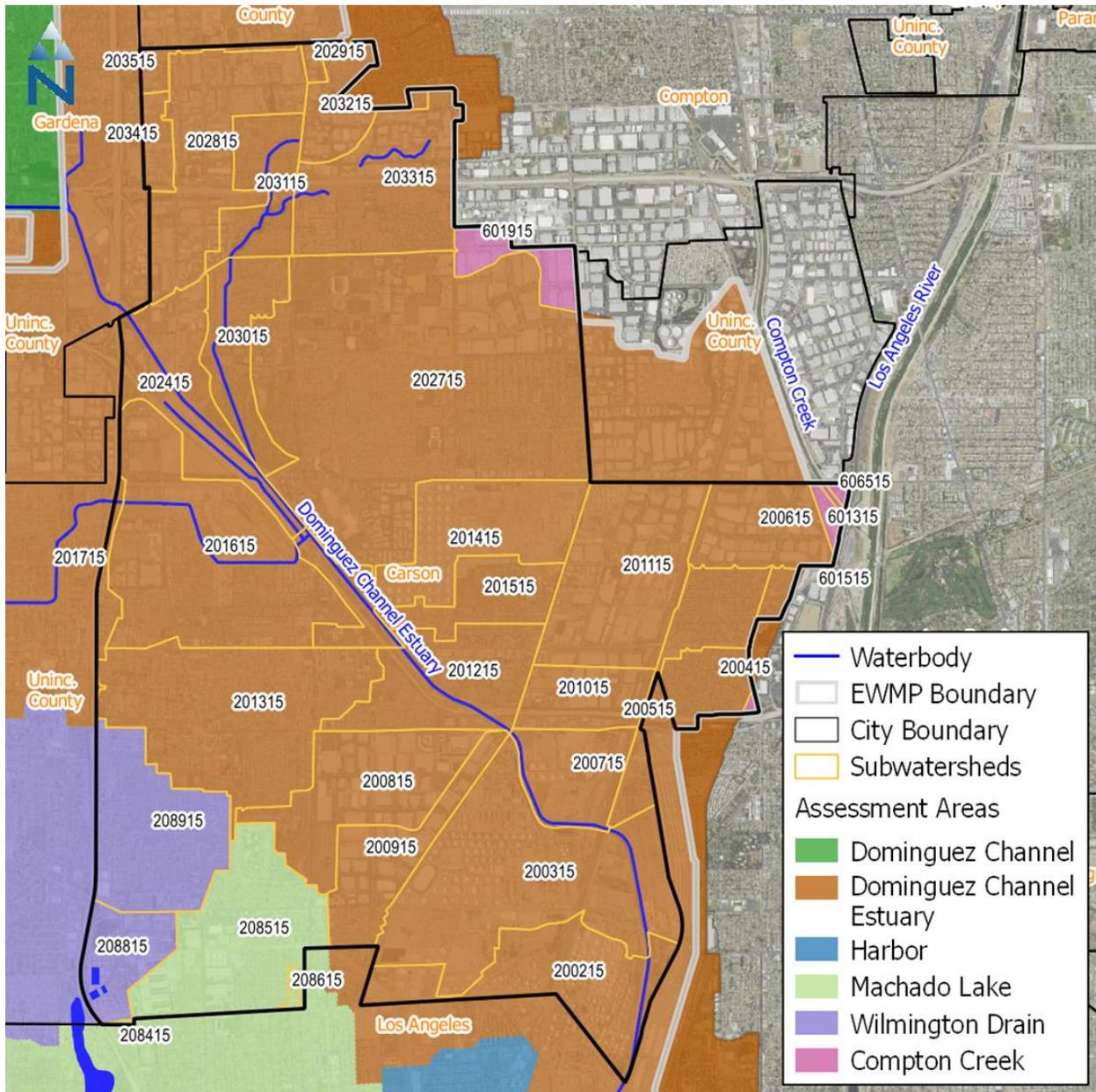


Figure 4-2. Zoomed in view of Carson subwatersheds and receiving waters.

4.2 Baseline Watershed Model Calibration

The objective of baseline watershed model calibration is to develop a watershed model that is representative of receiving water hydrology and water quality in the Dominguez Channel watershed. The baseline model used for the DC EWMP was applied directly to the RAA for Carson. Calibration performance and comparison to the RAA Guidelines are provided in Section 4 of the DC EWMP.

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.

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 Plan are based on achieving required pollutant load reduction to attain the water quality targets during that critical condition. The primary water quality targets for Carson's assessment areas are shown in Table 3-7 of the DC EMWP. The baseline 90th percentile loading for the limiting pollutants for each assessment area 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. 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 Carson's EWMP Implementation Plan.

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 4-2) 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 from the DC EMWP was used. Rather than rely on load reduction, the RAA is based on full retention of the runoff from the 90th percentile “critical bacteria storm.” See the draft Upper LA River EWMP (ULAR Group, 2015) for details on the RAA methodology used to address bacteria. The 90th percentile critical bacteria storm accounts for allowable exceedance days and the High Flow Suspension, using the MS4 wasteload allocations from 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.

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

Condition and Pollutant Addressed	Reduction Metric	Dominguez Estuary	Wilmington Drain	Machado Lake
<u>Final Compliance</u> with Metals and Other Water Quality Priorities (except <i>E. coli</i>)	Required Load Reduction ¹	86.2% (total zinc) ²	Runoff from critical bacteria storm is retained prior to discharge to receiving water	
	Allowable load during 90 th percentile/final condition (pounds)	145.1		
	Loading during 90 th percentile/final condition (pounds) ³	1,051.4		
<u>Interim Compliance</u> with Metals and Other Water Quality Priorities (except <i>E. coli</i>)	Loading during average/interim condition (pounds) ⁴	319.8		
	Ratio used to gradually phase from interim to final reduction (Average:90 th Percentile)	0.30		
<u>Final Compliance</u> with <i>E. coli</i>	Runoff volume to be retained ⁵	Runoff from critical bacteria storm is retained prior to discharge to receiving water		

1 – Based on control of zinc (Dominguez Channel Estuary) during storm that generates the 90th percentile load for the respective pollutant
 2 – For Dominguez Channel Estuary, the total zinc target was set to 95.14 ug/L, which is the CTR criteria for saltwater
 3 – Loading of zinc or nitrogen at mouth of watershed from storm that generates the 90th percentile zinc load
 4 – Loading of zinc or nitrogen at mouth of watershed from storm that generates the average zinc load
 5 – 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 Carson for inclusion in the EWMP and the analysis/screening of potential BMP opportunities in the city limits was presented in Section 3.

The RAA for Carson 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 Plan for Carson is able to benefit from optimization, which helps to increase the cost efficiency of the BMP network. The design assumptions in Table 4-3 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 the additional 5% reduction, Carson identified trash control measures for implementation.	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). Carson 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 85 th 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 85 th percentile runoff from parcel. Underdrains modeled if subsoil infiltration rate less than 0.3 in/hr.
Green Streets	Green Streets	Carson 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	Carriage Crest Park	Carson will implement regional projects according to the specified capacities in Section 5. Details of the project design are presented in Section 3.1.2 and in the project factsheet.	BMP footprint delineated and depth specified based on site configuration, topography, depth to groundwater, and other infrastructure. See Section 3.1 for drainage area details.
	City Hall / Civic Center	Carson will implement other regional projects, potentially at the City Hall / Civic Center site, according to the specified capacities in Section 5. Due to uncertainty pending more detailed site evaluation, this regional BMPs was assumed to be a 3-ft-deepinfiltration basin.	
	Additional Regional BMPs (TBD)	Carson will implement undetermined regional projects, if necessary, according to the specified capacities in Section 5. During adaptive management, the City will strive to find additional opportunities for BMPs on public land to avoid this category of BMP / land acquisition. For example, the City is discussing leasing a parcel adjacent to the Carriage Crest Park site from the Los Angeles County Sanitation District, which could allow the Carriage Crest project to be expanded in a future phase to capture additional runoff/drainage area.	Assumed 3-ft-deep infiltration basin at subwatershed outlets. Maximum footprint = 5% of contributing area.

4.5 BMP Selection for EWMP Implementation 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 Carson first determined the control measures to achieve the required load reductions 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 millions of scenarios considered for an individual subwatershed in the EWMP area. Notice the different scales for each assessment area (most BMP capacity is in Dominguez Estuary). 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 (or, for Wilmington Drain, nitrogen) if BMPs were implemented at those opportunities with varying sizes. The most cost-effective BMP solutions for each of the 36 subwatersheds in Carson provide the basis for cost optimization. The optimization curve for Wilmington Drain is dominated by the Carriage Crest Park regional stormwater facility.
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 Carson, as presented in Figure 4-4. The optimized point on each curve includes a “recipe for compliance” for all the subwatersheds within that assessment area.
3. Extract the cost-effective scenarios for the required reduction: the required zinc or nitrogen reductions specified in Table 4-2 determine the specific scenario that is selected from the cost optimization curves. The Carson assessment areas would be held to the same percent reduction as other jurisdictions contributing to the same waterbodies. The selected scenarios become the EWMP Implementation Plan. 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.

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.

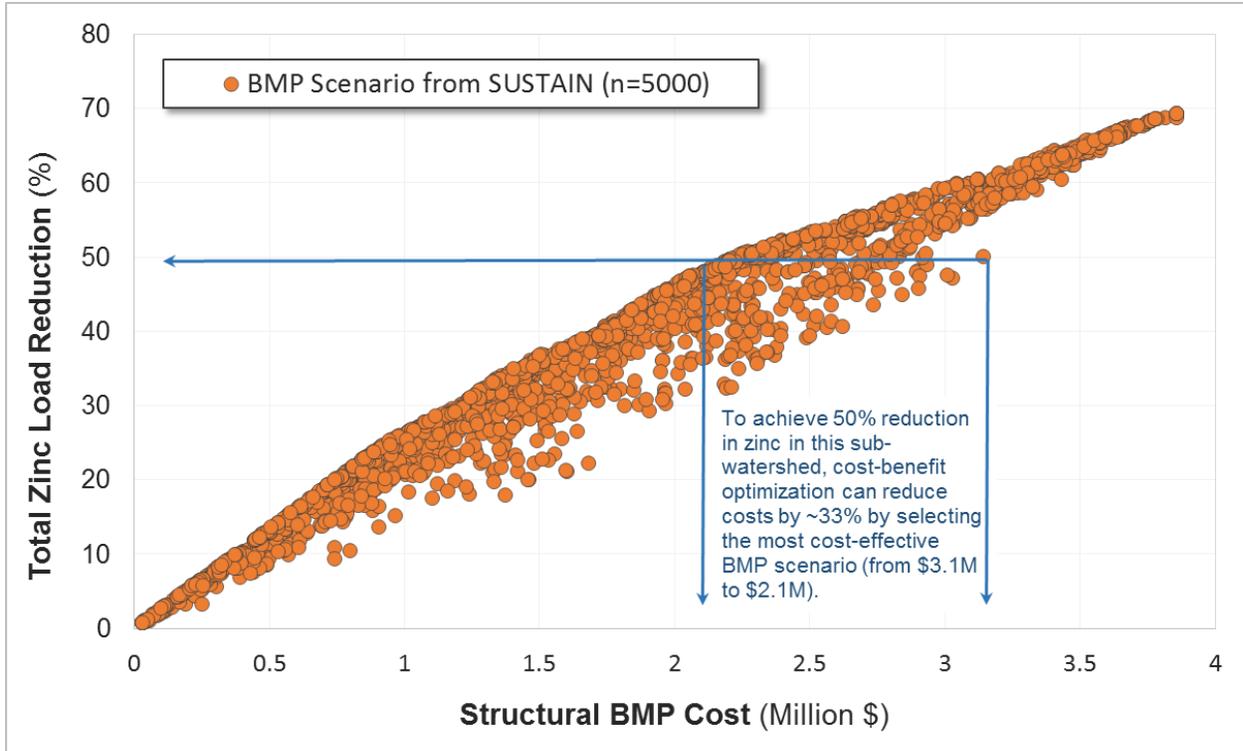


Figure 4-3. Example BMP solutions for a selected subwatershed and advantage of cost-benefit optimization.

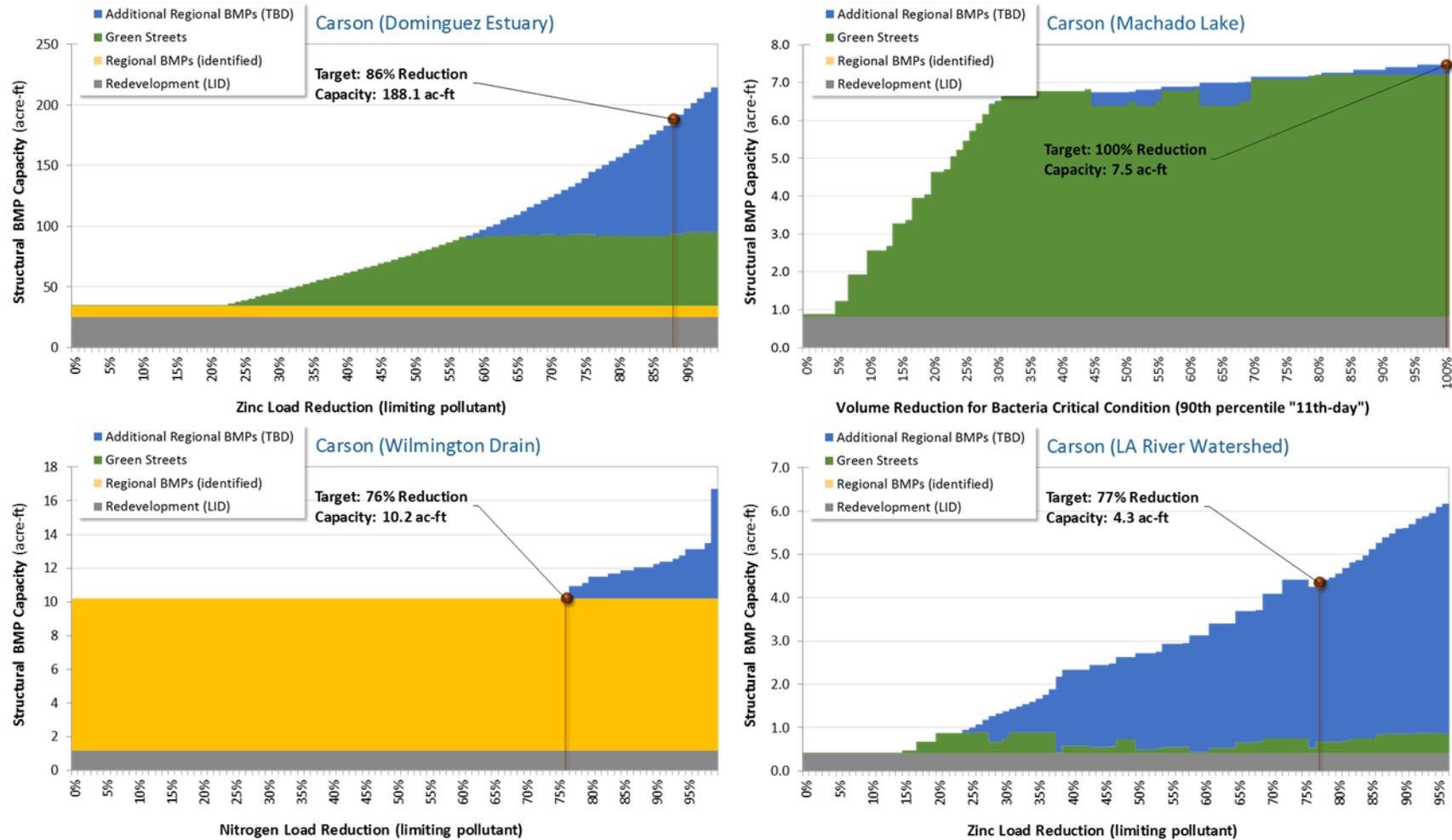


Figure 4-4. Cost Optimization curves for Carson assessment areas.

This graph shows the set of optimized BMP solutions for the four assessment areas in Carson. These optimization curves represent over 1 million BMP scenarios that were evaluated for cost-effectiveness. The required reduction varies by assessment area; the curves vary with BMP opportunity.

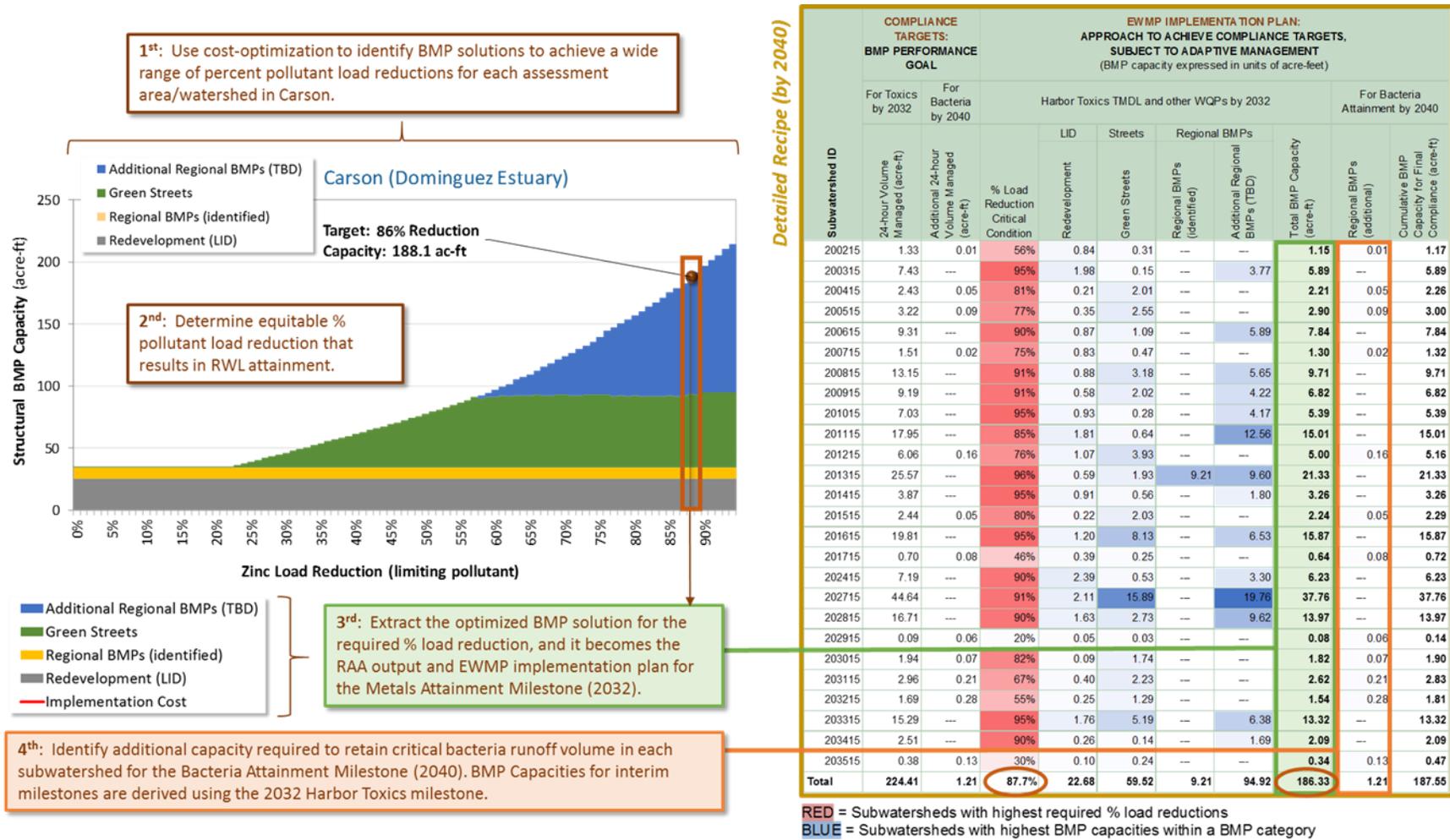


Figure 4-5. Illustration of how the EWMP Implementation Plan is extracted from a cost optimization curve.

This illustration Carson’s area in the Dominguez Estuary watershed as an example. 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 Selection 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 used for development of the Carson EWMP Implementation Plan, primarily based on the achieving the final limits of the DC Toxics TMDL by 2032 and addressing bacteria by 2040:

- Achieve 50% of the reduction for zinc³ (2026)
- Achieve 75% of the reduction for zinc (2029)
- Final compliance with zinc RWLs (2032)
- Final compliance with total nitrogen RWLs (2040)
- Final compliance with bacteria WQBELs (2040)

The exception was the small area of Carson that drains to the Los Angeles River watershed. For this area, the zinc/metals milestones of 50% and 100% were set for 2024 and 2028, respectively, and the bacteria milestone is set for 2037. These milestones are also consistent with the ULAR EWMP.

5 EWMP IMPLEMENTATION PLAN

The EWMP Implementation Plan is the “recipe for compliance” for Carson 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 of Carson’s assessment areas (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 Carson to achieve the MS4 Permit. This section describes the EWMP Implementation Plan for Carson 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)

5.1 Elements of the EWMP Implementation Plan

The EWMP Implementation Plan for Carson is expressed in terms of [1] the volumes⁴ of stormwater and non-stormwater to be managed by Carson 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:

³ While these milestones are expressed as reduction in zinc, because zinc is a limiting pollutant (see Section 3.3.5 of the DC EWMP), achievement of zinc RWLs by these dates 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.

- **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 managed⁵ by Carson is considered a measurable 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 Carson 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 Carson for the coming decades, and the control measures to be implemented have the potential to transform communities including widespread incorporation of green infrastructure. The EWMP Implementation Plan identifies the location and type of control measures to be implemented by Carson for final compliance by 2040, which includes to addressing all Water Quality Priorities including the limiting pollutants total zinc, total nitrogen and *E. coli*. The EWMP Implementation Plan for final compliance⁶ is presented as the following components:

- **Summary of total capacity of control measures to be implemented by Carson 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 is the bar graph that details the various sub-categories of control measures to be implemented by Carson across its jurisdiction, compared to other jurisdictions in the DC WMG. Figure 5-2 shows the Carson control measures by Assessment Area. Figure 5-3 shows the relative capacity by different BMP types.
- **Detailed recipe for compliance including volumes of stormwater to be managed by Carson 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 The volume is determined by reporting the amount of water that would be retained (infiltrated) by BMPs over the course of a 24-hour period under the critical 90th percentile storm condition. Additional volume would be *treated* by these BMPs, but that additional treatment is *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.

⁶ For the small area that drains to the LA River/Compton Creek, the final compliance date is 2037.

5-4 is a map of the “density” of control measure capacities to be implemented to address metals and other Water Quality Priorities (through controlling zinc). Details of the map are shown in Table 5-1 through Table 5-4 (by subwatershed in each assessment area) and Table 5-5 (by milestone for all assessment areas). The tables also present the volumes of stormwater to be managed in each subwatershed (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 milestones detailed in Table 5-5, planning milestones are also incorporated into the EWMP Implementation Plan. More detail on the planning milestones in Table 5-5 can be found in Section 5.2 of the DC EWMP. In addition, the City will also advance the planning for identified potential regional projects, as follows:

- **Carriage Crest Park project:** by December 2017, the City will have completed the following:
 - Pursuit of funding to construct the facility to manage the wet weather capture area, either through grants, loans or stormwater fees;
 - Coordination with jurisdictions in the dry weather capture area to evaluate feasibility of cost-sharing for project construction and maintenance;
 - Determination of whether the parcel adjacent to Carriage Crest Park is available for leasing or acquisition in order to site expand the project design to capture wet weather flows from the dry weather capture area
- **Civic Center 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 a regional project can be located under the existing parking lots at Civic Center, including construction costs while taking into account the long-term site disturbance that would be necessary.
 - Pursuit of funding to construct the facility, if the facilitate is determined to be feasible and desirable.

If, over the course of further planning for the Carriage Crest and Civic Center projects, it is determined the projects are not feasible or desirable, then equivalent projects will be identified in terms of stormwater managed.

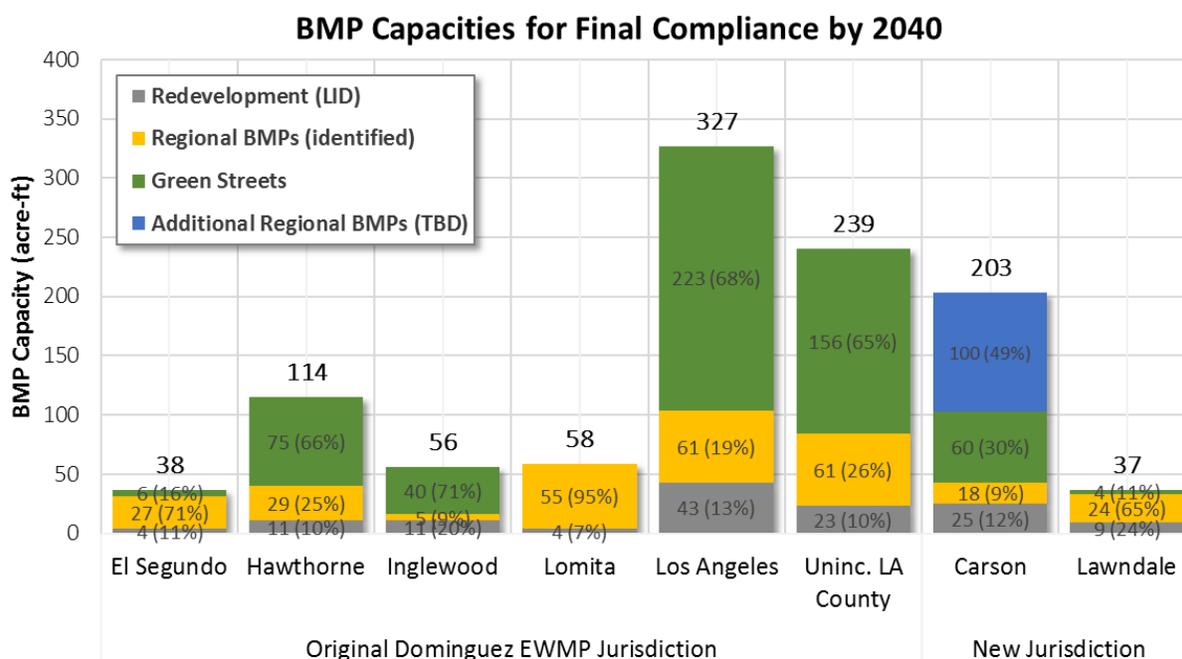


Figure 5-1. DC EWMP Implementation Plan for Final Compliance by 2040 including Carson.

This graph shows the total structural BMP capacity required for each DC EWMP jurisdiction including Carson 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. For the small area of Carson that drains to the LA River / Compton Creek, the final compliance date is set to 2037.

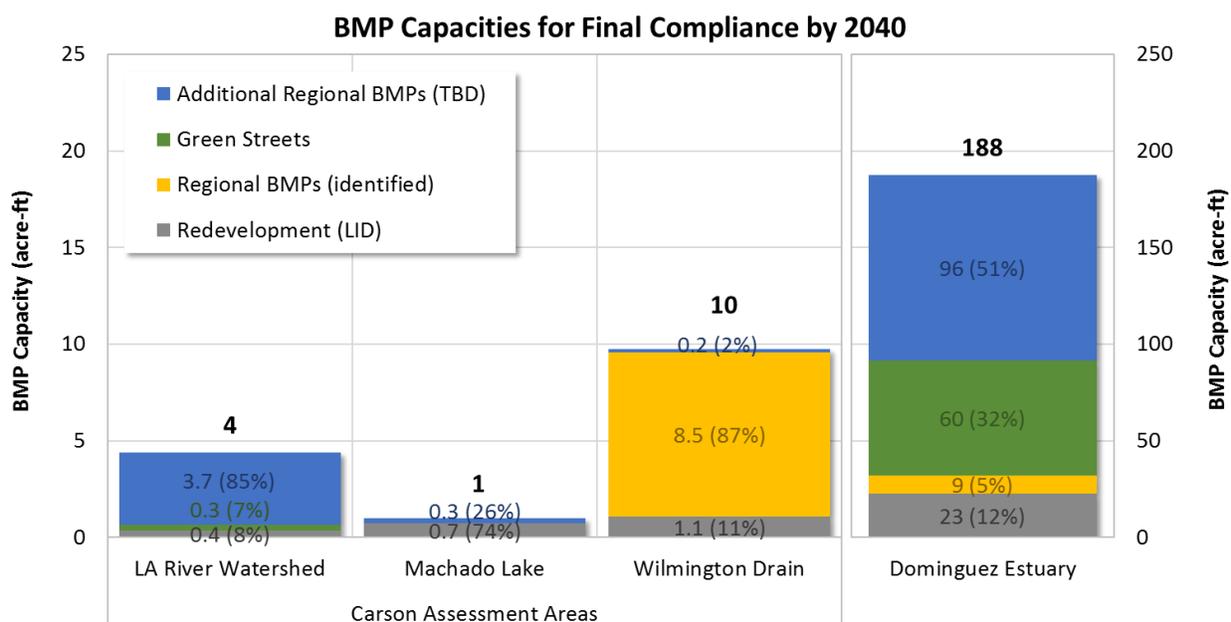


Figure 5-2. EWMP Implementation Plan for Carson for each Watershed / Assessment Area.

Note the different scale for Dominguez Estuary. For the small area of Carson that drains to the LA River / Compton Creek, the final compliance date is set to 2037.

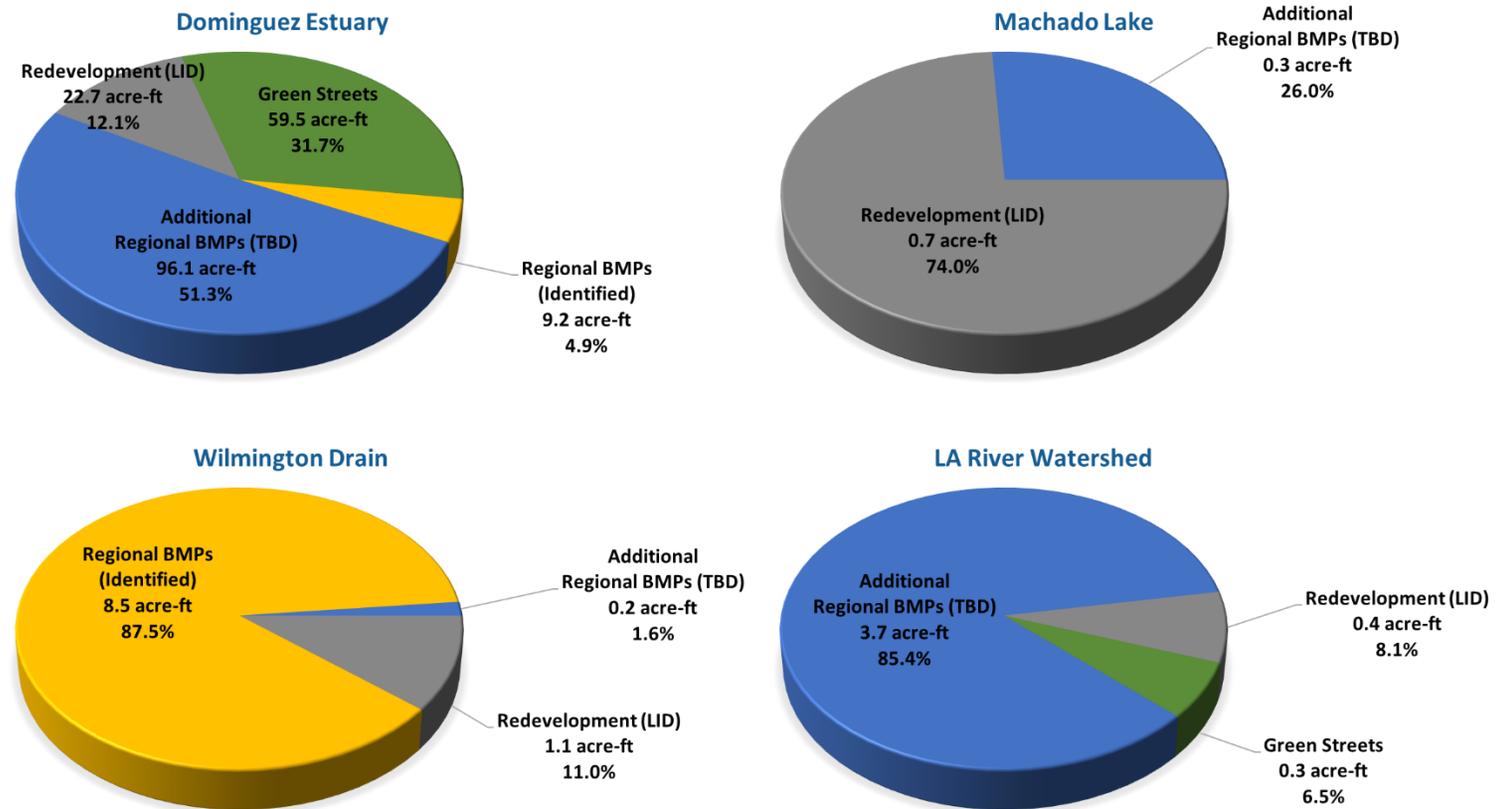


Figure 5-3. BMP distribution in Carson’s EWMP Implementation Plan by watershed / assessment area.

This figure shows control measure capacity distribution for the final 2040 EWMP milestone, organized by watershed / assessment area. For the small area of Carson that drains to the LA River / Compton Creek, the final compliance date is set to 2037.

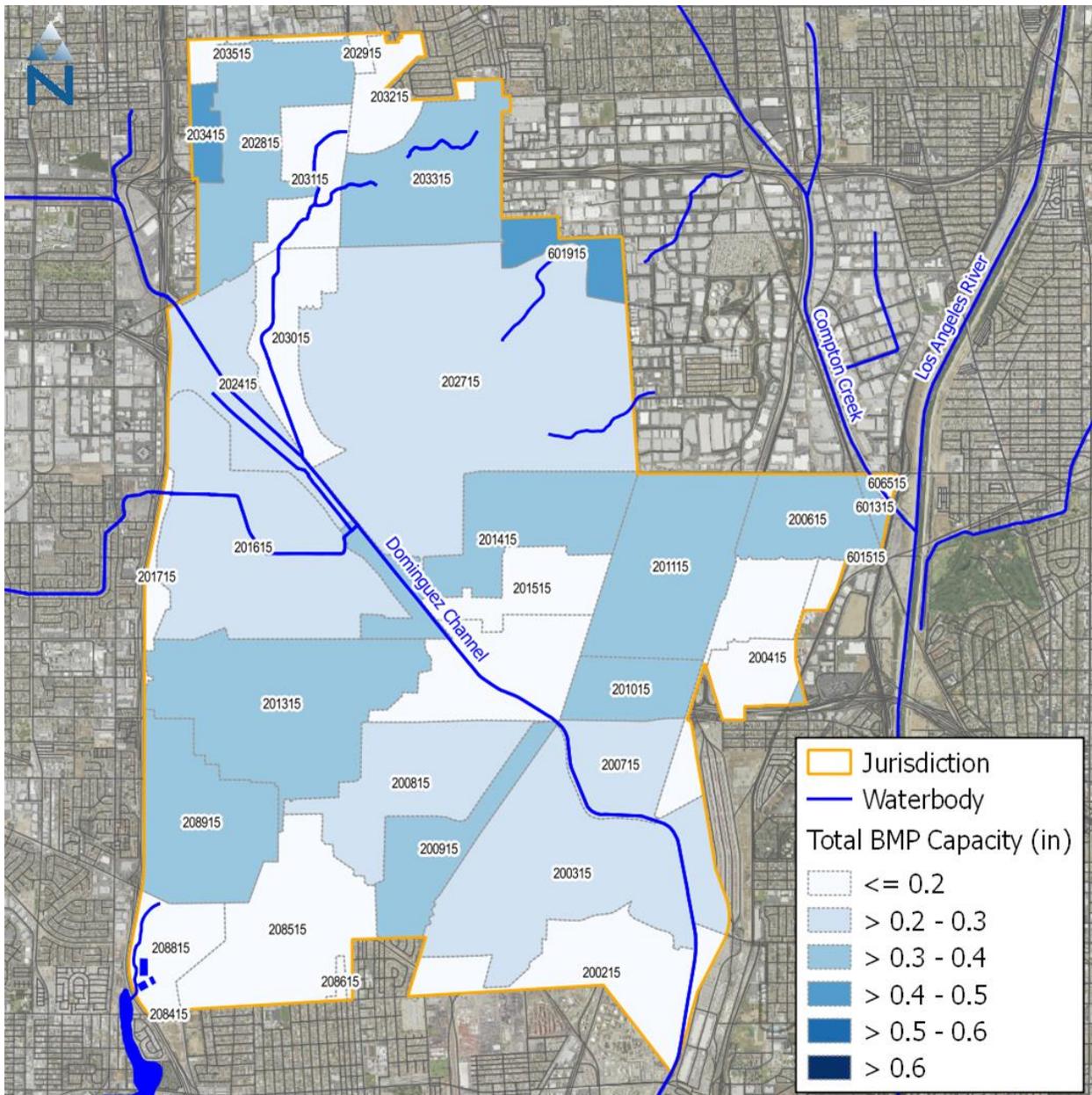


Figure 5-4. Carson EWMP Implementation Plan by subwatershed for metals and other water quality priorities (except *E. coli*).

This map presents Carson’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 either [1] relatively high load reductions are required or [2] BMPs in those areas were relatively cost-effective (e.g., due to high soil infiltration rates). The BMP capacities are normalized by area (i.e., the BMP capacity for each subwatershed [in units of acre-feet] was divided by the subwatershed area [in units of acres] to express the BMP capacity in units of depth [inches]). This map presents the total BMP capacity for metals attainment summarized in Table 5-1 through Table 5-4 (by subwatershed) and Table 5-5 (by milestone). Note that while each jurisdiction within an assessment area/watershed would be held to an equivalent % reduction (as the other jurisdictions), subwatersheds within an assessment area may have variable reductions based on optimization (another reason why some subwatersheds are dark blue while others are light blue).

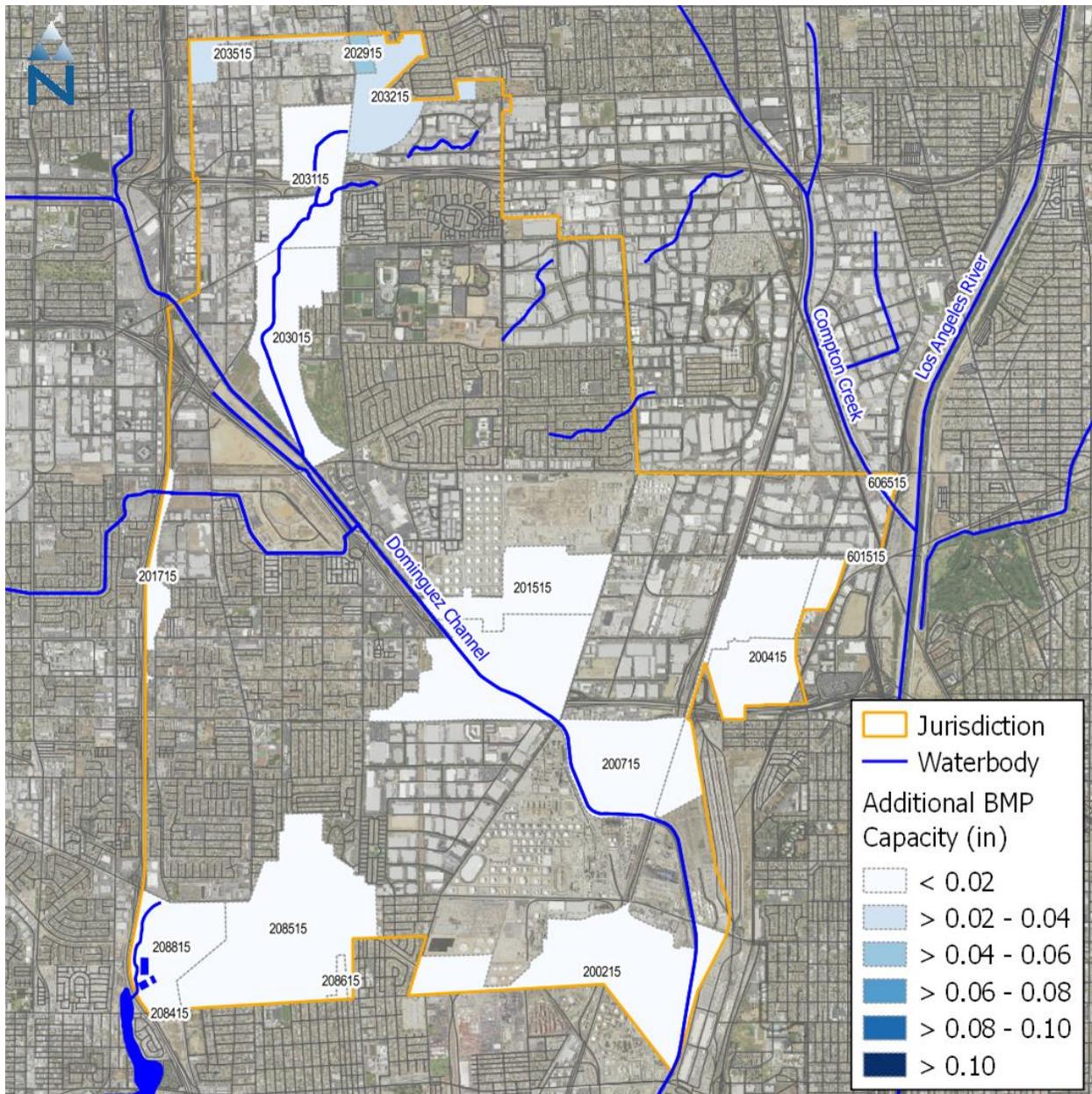


Figure 5-5. Map of additional control measures in EWMP Implementation Plan to address *E. coli*.

This map uses the same approach as Figure 5-4 to presents the additional capacity in the EWMP Implementation Plan to address *E. coli* (beyond the control measures to be implemented to address Metals and Other Water Quality Priorities). Note the BMP capacities are much less than in Figure 5-4 because the control measures for Metals and Other Water Quality Priorities retain much of the critical bacteria storm. Some subwatersheds are not shaded because zero additional capacity is required. These additional capacities are detailed in Table 5-1 through Table 5-4.

Table 5-1. Carson, LA River Watershed: RAA Output and EWMP Implementation Plan

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	Metals TMDL and other WQPs by 2028						For Bacteria Attainment by 2037	
	24-hour Volume Managed (acre-ft)	Additional 24-hour Volume Managed (acre-ft)	% Load Reduction Critical Condition	LID		Streets	Regional BMPs		Total BMP Capacity (acre-ft)	Regional BMPs (additional)
Redevelopment				Green Streets	Regional BMPs (identified)	Additional Regional BMPs (TBD)				
601315	0.87	---	73%	0.07	---	---	0.68	0.76	---	0.76
601515	0.00	0.00	45%	0.00	0.00	---	---	0.00	0.00	0.00
601715	0.02	0.01	15%	0.02	---	---	---	0.02	0.01	0.03
601915	3.96	---	85%	0.24	0.26	---	3.03	3.53	---	3.53
606515	0.05	0.01	20%	0.02	0.02	---	---	0.05	0.01	0.06
Total	4.90	0.03	77%	0.36	0.29	0.00	3.71	4.35	0.03	4.38

Table 5-2. Carson, Dominguez Estuary: RAA Output and EWMP Implementation Plan

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	
	24-hour Volume Managed (acre-ft)	Additional 24-hour Volume Managed (acre-ft)	% Load Reduction Critical Condition	LID	Streets	Regional BMPs		Total BMP Capacity (acre-ft)	Regional BMPs (additional)	Cumulative BMP Capacity for Final Compliance (acre-ft)
			Redevelopment	Green Streets	Regional BMPs (identified)	Additional Regional BMPs (TBD)				
200215	1.33	0.01	56%	0.84	0.31	---	---	1.15	0.01	1.17
200315	7.43	---	95%	1.98	0.15	---	3.77	5.89	---	5.89
200415	2.43	0.05	81%	0.21	2.01	---	---	2.21	0.05	2.26
200515	3.22	0.09	77%	0.35	2.55	---	---	2.90	0.09	3.00
200615	9.31	---	90%	0.87	1.09	---	5.89	7.84	---	7.84
200715	1.51	0.02	75%	0.83	0.47	---	---	1.30	0.02	1.32
200815	13.15	---	91%	0.88	3.18	---	5.65	9.71	---	9.71
200915	9.19	---	91%	0.58	2.02	---	4.22	6.82	---	6.82
201015	7.03	---	95%	0.93	0.28	---	4.17	5.39	---	5.39
201115	17.95	---	85%	1.81	0.64	---	12.56	15.01	---	15.01
201215	6.06	0.16	76%	1.07	3.93	---	---	5.00	0.16	5.16
201315	25.57	---	96%	0.59	1.93	9.21	9.60	21.33	---	21.33
201415	3.87	---	95%	0.91	0.56	---	1.80	3.26	---	3.26
201515	2.44	0.05	80%	0.22	2.03	---	---	2.24	0.05	2.29
201615	19.81	---	95%	1.20	8.13	---	6.53	15.87	---	15.87
201715	0.70	0.08	46%	0.39	0.25	---	---	0.64	0.08	0.72
202415	7.19	---	90%	2.39	0.53	---	3.30	6.23	---	6.23
202715	44.64	---	91%	2.11	15.89	---	19.76	37.76	---	37.76
202815	16.71	---	90%	1.63	2.73	---	9.62	13.97	---	13.97
202915	0.09	0.06	20%	0.05	0.03	---	---	0.08	0.06	0.14

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	
	24-hour Volume Managed (acre-ft)	Additional 24-hour Volume Managed (acre-ft)	% Load Reduction Critical Condition	LID Redevelopment	Streets Green Streets	Regional BMPs		Total BMP Capacity (acre-ft)	Regional BMPs (additional)	Cumulative BMP Capacity for Final Compliance (acre-ft)
203015	1.94	0.07	82%	0.09	1.74	---	---	1.82	0.07	1.90
203115	2.96	0.21	67%	0.40	2.23	---	---	2.62	0.21	2.83
203215	1.69	0.28	55%	0.25	1.29	---	---	1.54	0.28	1.81
203315	15.29	---	95%	1.76	5.19	---	6.38	13.32	---	13.32
203415	2.51	---	90%	0.26	0.14	---	1.69	2.09	---	2.09
203515	0.38	0.13	30%	0.10	0.24	---	---	0.34	0.13	0.47
Total	224.41	1.21	88%	22.68	59.52	9.21	94.92	186.33	1.21	187.55

Table 5-3. Carson, Machado Lake: RAA Output and EWMP Implementation Plan

Subwatershed ID	COMPLIANCE TARGET: BMP PERFORMANCE GOAL	EWMP IMPLEMENTATION PLAN: APPROACH TO ACHIEVE COMPLIANCE TARGETS, SUBJECT TO ADAPTIVE MANAGEMENT (BMP capacity expressed in units of acre-feet)				
	For Bacteria by 2040	For Bacteria Attainment by 2040				
	24-hour Volume Managed (acre-ft)	LID	Streets	Regional BMPs		Total BMP Capacity (acre-ft)
Redevelopment		Green Streets	Regional BMPs (identified)	Additional Regional BMPs (TBD)		
208415	0.00	0.00	---	---	0.00	0.01
208515	0.63	0.73	---	---	0.61	1.34
208615	0.01	0.01	---	---	0.00	0.01
Total	0.64	0.74	0.00	0.00	0.61	1.00

Table 5-4. Carson, Wilmington Drain: RAA Output and EWMP Implementation Plan

Subwatershed ID	COMPLIANCE TARGET: BMP PERFORMANCE GOAL	EWMP IMPLEMENTATION PLAN: APPROACH TO ACHIEVE COMPLIANCE TARGETS, SUBJECT TO ADAPTIVE MANAGEMENT (BMP capacity expressed in units of acre-feet)				
	For Bacteria by 2040	For Bacteria Attainment by 2040				
	24-hour Volume Managed (acre-ft)	LID	Streets	Regional BMPs		Total BMP Capacity (acre-ft)
Redevelopment		Green Streets	Regional BMPs (identified)	Additional Regional BMPs (TBD)		
208815	0.17	0.62	---	---	0.15	0.77
208915	0.40	0.45	---	8.5	---	8.95
Total	0.57	1.07	0.00	8.5	0.15	9.72

Table 5-5. Carson: RAA Output and EWMP for Interim 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)				
	EWMP Milestone	24-hour Volume Managed (acre-ft)	LID	Streets	Regional BMPs		Total BMP Capacity (acre-ft)
			Redevelop- ment	Green Streets	Regional BMPs (identified)	Additional Regional BMPs (TBD)	
LA River Watershed	31% Milestone (2017)	1.4	0.2	0.3	---	0.8	1.3
	50% Milestone (2024)	2.5	0.3	0.3	---	1.7	2.2
	Final Metals (2028)	4.9	0.4	0.3	---	3.7	4.4
	Final Bacteria (2037)	4.9	0.4	0.3	---	3.7	4.4
Dominguez Estuary	Planning Milestones	See Section 5.2 of the DC EWMP for details of planning milestones ¹ . Also see regional BMP milestones in Section 5.2 of this addenda (p. 25)					
	50% Milestone (2026)	73.0	9.3	40.6	9.2	---	59.2
	75% Milestone (2029)	159.8	17.7	59.5	9.2	45.1	131.5
	Final Metals (2032)	224.4	22.7	59.5	9.2	94.9	186.3
	Final Bacteria (2040)	225.6	22.7	59.5	9.2	96.1	187.5
Machado Lake	Planning Milestones	See Section 5.2 of the DC EWMP for details of planning milestones ¹ . Also see regional BMP milestones in Section 5.2 of this addenda (p. 25)					
	Final Bacteria (2040)	0.6	0.7	---	---	0.3	1.0
Wilmington Drain	Planning Milestones	See Section 5.2 of the DC EWMP for details of planning milestones ¹ . Also see regional BMP milestones in Section 5.2 of this addenda (p. 25)					
	Final Bacteria (2040)	0.6	1.1	---	8.5	0.2	9.7
Total	---	226.8	24.9	59.5	17.7	100.3	202.9

1 – In response to comments from the Regional Board on the DC EWMP, the EWMP is incorporating planning milestones for structural control measures. Those milestones will be into the revised DC EWMP, to be submitted to the Regional Board in early 2016.

6 ADAPTIVE MANAGEMENT FRAMEWORK

Incorporation of Carson 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,” Carson 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 Plan, 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 Carson’s EWMP Implementation Plan. The general approach for developing cost estimates is based on “cost functions” shown in Table 7-1, which describe cost as a function of BMP size parameters (e.g. volume, depth, area). These cost functions were applied to the quantity of each category of control measure presented in Section 5 (Table 5-1 through Table 5-5) 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 Carriage Crest Park regional stormwater facility presented in Section 3.1.2. Cost functions for Green Streets are consistent on a volumetric basis with those used for the DC EWMP.

Both lower-bound and upper-bound estimated capital costs for all control measures in the EWMP Implementation Plan (LID, Green Streets, and Regional) are shown in Table 7-2 and Table 7-3. The cost per volume capacity for regional BMPs was assumed to be \$950,000 per acre-foot, and \$48 per cubic foot for green streets. The upper-bound cost estimate incorporates the optional term in the Additional Regional BMP cost function describing private land acquisition at approximately \$5.6M per acre (see Table 7-1). While this upper-bound cost estimate acknowledges uncertainty surrounding potential BMP site that have yet to be determined, these facilities may or may not require land acquisition depending on the nature of future opportunities identified by Carson. 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 and Figure 7-2 presents summaries 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, and are projected in Figure 7-1 and Figure 7-2. 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

Note: (V_t) is the total storage volume of the BMP in cubic feet

1: **Optional Term** represents \$129.01/square foot to account for private land acquisition costs where needed.

Source: ULAR Group 2015.

Table 7-2. Summary of Carson cumulative Capital Cost by Milestone (lower-bound estimate, excluding land acquisition for additional regional BMPs)

Area / BMP Category		50% Milestone (2026)	75% Milestone (2029)	Final Metals (2032)	Final Bacteria (2040)
Compton Creek ¹	Redevelopment (LID)	--	--	--	--
	Green Streets	\$595,084	\$595,084	\$595,084	\$595,084
	Regional BMPs	--	--	--	--
	Additional Regional	\$719,080	\$1,600,433	\$3,525,475	\$3,551,462
Dominguez Estuary	Redevelopment (LID)	--	--	--	--
	Green Streets	\$84,488,498	\$123,855,219	\$123,855,219	\$123,855,219
	Regional BMPs	\$8,749,500	\$8,752,370	\$8,752,370	\$8,752,370
	Additional Regional	--	\$42,807,230	\$90,172,209	\$91,324,643
Machado Lake	Redevelopment (LID)	--	--	--	--
	Green Streets	--	--	--	--
	Regional BMPs	--	--	--	--
	Additional Regional	--	--	--	\$579,500
Wilmington Drain	Redevelopment (LID)	--	--	--	--
	Green Streets	--	--	--	--
	Regional BMPs	--	--	--	\$8,822,385
	Additional Regional	--	--	--	\$146,737
Total Cost		\$94,552,162	\$177,610,336	\$226,900,357	\$237,627,400

¹: Milestones for the Compton Creek assessment area follow the schedule from the ULAR EWMP with 31%, 50% and Final milestones for metals in 2017, 2024 and 2028, respectively. The Final Bacteria milestone is in 2037. For presentation in the table, costs have been aligned with the DC EWMP milestones.

Table 7-3. Summary of Carson cumulative Capital Cost by Milestone (upper-bound estimate, including land acquisition for additional regional BMPs)

Area / BMP Category		50% Milestone (2026)	75% Milestone (2029)	Final Metals (2032)	Final Bacteria (2040)
Compton Creek ¹	Redevelopment (LID)	--	--	--	--
	Green Streets	\$595,084	\$595,084	\$595,084	\$595,084
	Regional BMPs	--	--	--	--
	Additional Regional	\$2,136,974	\$4,756,193	\$10,477,064	\$10,554,292
Dominguez Estuary	Redevelopment (LID)	--	--	--	--
	Green Streets	\$84,488,498	\$123,855,219	\$123,855,219	\$123,855,219
	Regional BMPs	\$8,749,500	\$8,752,370	\$8,752,370	\$8,752,370
	Additional Regional	--	\$127,215,210	\$267,975,214	\$271,400,036
Machado Lake	Redevelopment (LID)	--	--	--	--
	Green Streets	--	--	--	--
	Regional BMPs	--	--	--	--
	Additional Regional	--	--	--	\$1,722,167
Wilmington Drain	Redevelopment (LID)	--	--	--	--
	Green Streets	--	--	--	--
	Regional BMPs	--	--	--	\$8,822,385
	Additional Regional	--	--	--	\$436,075
Total Cost		\$95,970,056	\$265,174,076	\$411,654,951	\$426,137,628

1: Milestones for the Compton Creek assessment area follow the schedule from the ULAR EWMP with 31%, 50% and Final milestones for metals in 2017, 2024 and 2028, respectively. The Final Bacteria milestone is in 2037. For presentation in the table, costs have been aligned with the DC EWMP milestones.

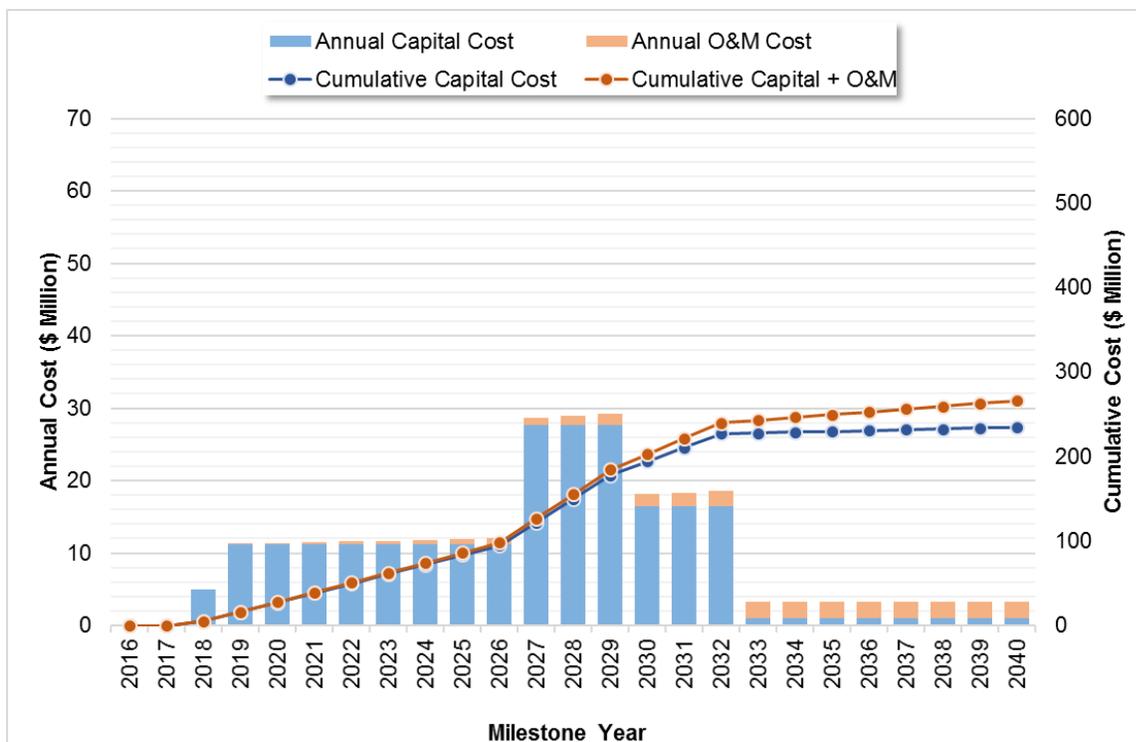


Figure 7-1. Summary of Carson implementation cost distribution (lower bound, excluding land acquisition for additional regional BMPs) over compliance timeframe.

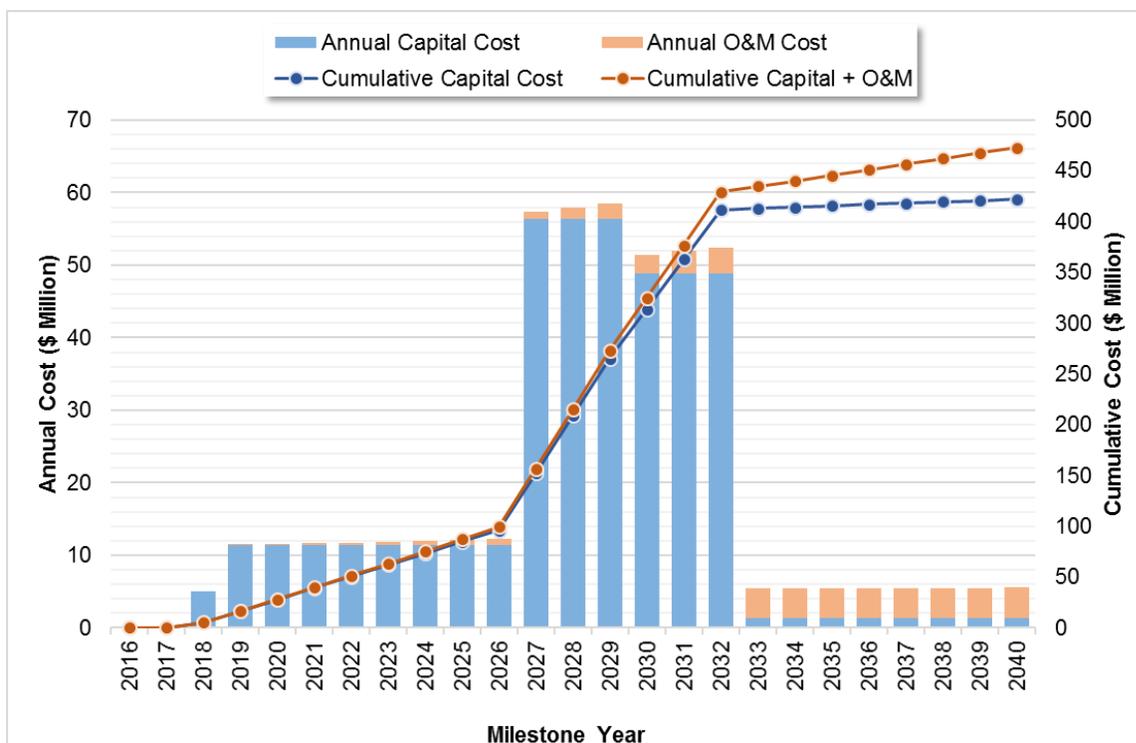


Figure 7-2. Summary of Carson implementation cost distribution (upper bound, including land acquisition for additional regional BMPs) over compliance timeframe.

7.2 Financial Strategies

Financial strategies and funding sources for the City of Carson 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.