Enhanced Watershed Management Program FOR THE DOMINGUEZ CHANNEL WATERSHED MANAGEMENT AREA GROUP

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DRAFT

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Acronyms

ARS	Automatic Retractable Screen
ASCE	American Society of Civil Engineers
BMP	Best Management Practice
BOE	Bureau of Engineering
CASQA	California Stormwater Quality Association
CEQA	California Environmental Quality Act
CIMIS	California Irrigation Management Information System
CO	Current Organics
CPI	Catchment Priority Index
CPS	Connector Pipe Screen
CTR	California Toxics Rule
CWA	Clean Water Act
DC WMA	Dominguez Channel Watershed Management Area
DC WMG	Dominguez Channel Watershed Management Group
DWMMP	Dominguez Watershed Management Master Plan
EMC	Event Mean Concentration
ERL	Effect Range Low
ERM	Effect Range Median
ETo	Evapotranspiration
EWMP	Enhanced Watershed Management Program
GIS	Geographic Information System
GLAC	Greater Los Angeles County
GPS	Global Positioning System
HHWC	Household Hazardous Waste Collection
HO	Historical Organics
HRU	Hydrologic Response Units
HSPF	Hydrologic Simulation Program - FORTRAN
IC/ID	Illicit Connection/Illicit Discharge
IGP	Industrial General Permit
IRWMP	Integrated Regional Watershed Management Plan
LABOS	Los Angeles Bureau of Sanitation
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LARWQCB	Los Angeles Regional Water Quality Control Board
LB	Long Beach
LID	Low Impact Development
LSPC	Loading Simulation Program in C++
LWQMP	Lake Water Quality Management Plan
MCM	Minimum Control Measure
MEP	Maximum Extent Practicable
MFAC	Minimum Frequency of Assessment and Collection
MOA	Memorandum of Agreement

MS4	Municipal Separate Storm and Sewer System
NCDC	National Climatic Data Center
NEXGEN	Next Generation Radar
NIMS	Nonlinearity-Interval Mapping Scheme
NOI	Notice of Intent
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
PIPP	Public Information and Participation Program
POLA	Port of Los Angeles
POLB	Port of Long Beach
PPP	Pollution Prevention Plan
QA/QC	Quality Assurance/Quality Control
RAA	Reasonable Assurance Analysis
RWL	Receiving Water Limitation
SBPAT	Structural BMP Prioritization and Analysis Tool
SCCWRP	Southern California Coastal Water Research Project
SIC	Standard Industrial Classification
SQO	Sediment Quality Objectives
SRP	Spill Response Plan
SUSMP	Standard Urban Stormwater Mitigation Plan
SUSTAIN	System for Urban Stormwater Treatment and Analysis Integration
SWAMP	Surface Water Ambient Monitoring Program
SWMM	Storm Water Management Model
SWPPP	Stormwater Pollution Prevention Plan
TAC	Technical Advisory Committee
TBD	To Be Determined
TIWRP	Terminal Island Water Reclamation Plant
TMDL	Total Maximum Daily Load
TSO	Time Schedule Order
USEPA	United States Environmental Protection Agency
WBPC	Water Body-Pollutant Combination
WDR	Waste Discharge Requirement
WLA	Waste Load Allocation
WMA	Watershed Management Area
WMMS	Watershed Management Modeling System
WMP	Watershed Management Program
WQBEL	Water Quality Based Effluent Limitation
WQO	Water Quality Objective

Units

µg/kg	Microgram per kilogram
µg/L	Microgram per liter
cfu	Colony Forming Unit
g/day	Grams per day
g/yr	Grams per year
kg	Kilogram
kg/yr	Kilograms per year
mg/L	Milligram per liter
mg/kg	Milligram per kilogram
mL	Milliliter
MPN	Most Probable Number
TUc	Toxic Unit Chronic

Executive Summary

The Dominguez Channel Watershed consists of 133 square miles are area east of the Palos Verdes hills, South of Los Angeles International Airport and extends south to the Port complex. This Enhanced Watershed Management Plan has been prepared pursuant to the requirements set forth by Order No. R4-2012-0175, Los Angeles County Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit (MS4 Permit). This EWMP has been prepared by the Cities of El Segundo, Hawthorne, Inglewood, Lomita, Los Angeles and the Los Angeles County Department of Pubic Works and the Los Angeles County Flood Control District, collectively known as the Dominguez Channel Watershed Management Group (DC WMG).

The DC WMG comprises approximately 55 square miles of the 133 square mile watershed. The receiving waters to which the Watershed discharge include:

- Dominguez Channel (concrete lined channel upstream of Vermont Avenue).
- Dominguez Channel Estuary (downstream of Vermont Avenue, generally within the tidal prism).
- Wilmington Drain (creek draining into Machado Lake).
- Machado Lake (mostly terminal lake, but occasionally overflowing to the Dominguez Channel Estuary).
- Greater Los Angeles Harbor (divided for administrative purposes into different sections).

These receiving waters have various impairments, for which some have Total Maximum Daily Loads (TMDLs) adopted. This EWMP has evaluated the TMDLS, 303(d) listings, and Water Quality Objective (WQO) exceedances, and established the water quality priorities. In general, Table ES-1 shows the basic water quality priorities with Category 1 being those constituents for which there are TMDLs, Category 2 those constituents for which there are 303(d) listings, and category 3 those constituents for which there are exceedances of WQOs.

Table ES-1: Generalized Water Quality Priorities

Water Body	Category 1	Category 2	Category 3
Dominguez Channel	Metals, Toxicity	Bacteria, Ammonia, Diazinon	Metals, Organics, pH, Dissolved Oxygen
Torrance Lateral	Copper, Lead, Zinc	Bacteria	Metals, pH, Nutrients, Organics (sed.)
Dominguez Estuary	Metals (dissolved, sed., & tissue), Organics (tissue & sed.), Benthic Community Effects, Sediment Toxicity	Ammonia, Bacteria	Metals (dissolved & sed.), Bacteria
Machado Lake	Trash, Phosphorus, Nutrients, Organics (sed.), Dissolved Oxygen	None	Bacteria, pH
Wilmington Drain	None	Bacteria, Copper, Lead, Bacteria	Nutrients, Organics (sed.)
LA Harbor	Metals, Organics (tissue & sed.), Benthic Community Effects, Sediment Toxicity	None	Metals, Bacteria

Figure ES-1 shows the watershed, the WGM area, some unique characteristics of the watershed, and regional projects identified in this EWMP.

Some unique characteristics of this watershed include:

- Industrial: more refining and chemicals
- Superfund Sites (Del Amo and Montrose)
- Transportation Corridors (Ports, 405, 110, 91, 105, rail corridors)

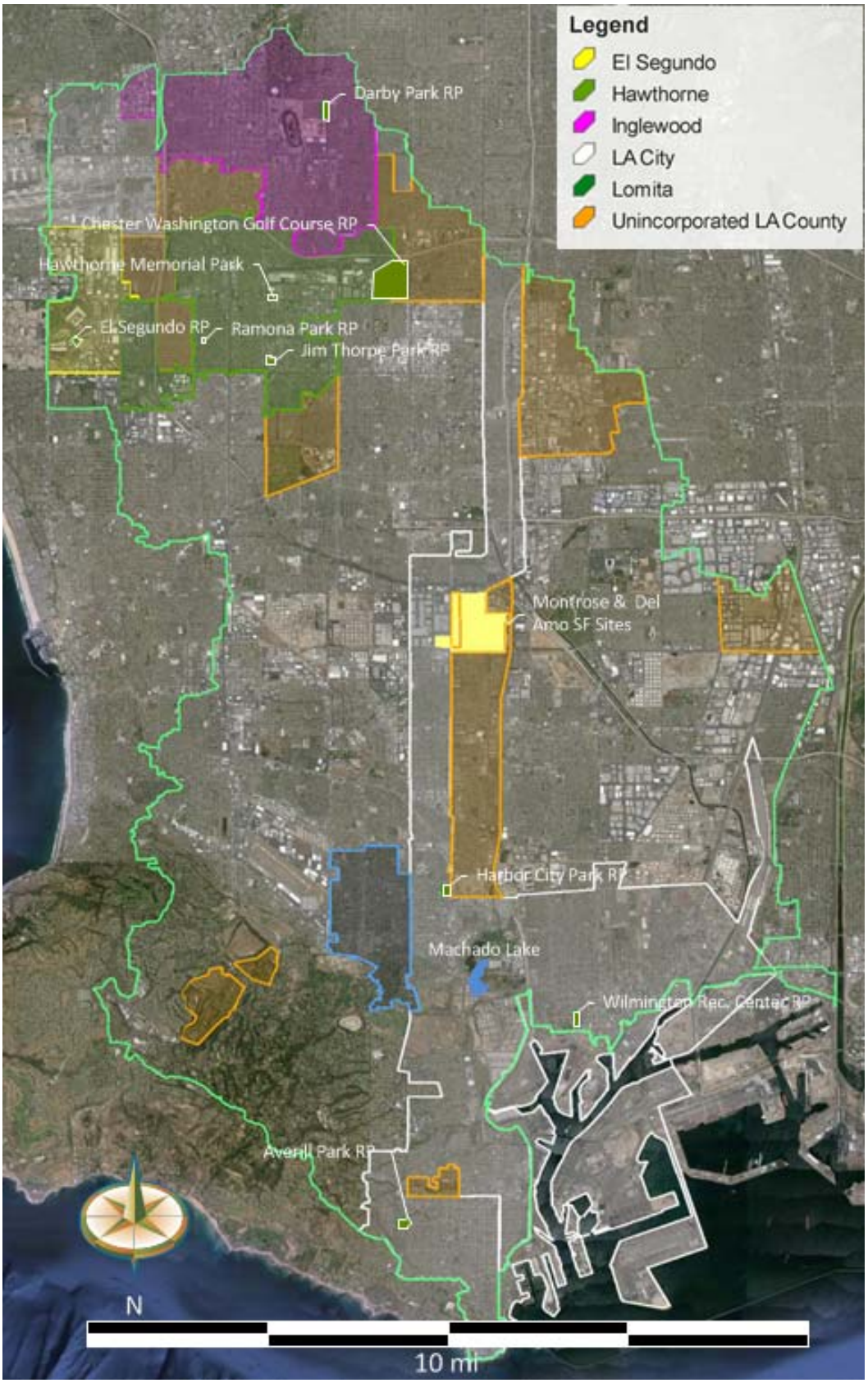

Figure ES-1: Dominguez Channel Watershed, and Watershed Management Group

Table ES-2 shows the percent land use in the DC WMG area.

Table ES-2: DC WMG Land Use

Land Use Category	Percentage
Agriculture	0.3%
Commercial	18.4%
Industrial	15.7%
Multi-Family Residential	14.2%
Single Family Residential	27.7%
Open	7.8%
Other Urban	15.9%
Total:	100%

In this EWMP, a watershed model was used to estimate the amount of water that needed to be controlled in order to meet the planning objectives of the EWMP. The planning objectives, as outlined in the MS4 permit and subsequent clarification from the Regional Water Quality Control Board are either:

- Capture and retain the 85th percentile storm from a catchment.
- Show through modeling that the Water Quality Objectives, Water Quality Based Effluent Limits, Waste Load Allocations, collectively referred to as Receiving Water Limitations, would be achieved.
- Show that projects achieve sufficient control to prevent discharge of the 90th percentile mass load.

In this EWMP, the Watershed Management Modeling System (WMMS) developed the Los Angeles County Flood Control District was used to estimate the volumetric and mass loads of the pollutants of concern or surrogates for which there were monitoring data against which to calibrate. The following steps were taken:

- The model was calibrated against flow and concentration data at the available receiving water monitoring station(s) for the data record extending from 2002 through 2012.
- The model was then used to simulate baseline volumetric and mass loads.
- The mass that would need to not discharge due to removal of volumes of water or concentrations of pollutants was estimated to achieve the planning objectives as outlined above.
- Projects were developed to reduce mass loads to achieve the planning objectives.
    - Five percent mass load reduction was estimated due to implementation of MCMs.
    - Volumetric (and mass) load reductions were estimated based on projected new and re-development within the watershed and implementation of onsite retention resulting rom Low Impact Development (LID) ordinances the DC WMG agencies have in place.
    - Regional projects were identified that could capture and retain the 85th percentile storm for some catchment.
    - Other permitted entities, such as industrial permittees and non-participating permitted cities and transportation agencies were modeled as compliant with the planning objectives noted above.
    - Green streets projects were identified to capture and retain the volume of water that needed to be retained to achieve the mass load reductions needed to meet the planning objectives noted above after the MCM implementation, new and re-development LID implementation, and regional project implementation was modeled.
- Concept plans were developed for regional projects.
- Optimal locations for green streets were established based on hydrologic and mass load reduction considerations.
- Probable opinions of capital and operations and maintenance costs were developed.
- Implementation schedules were established to achieve mass load reduction milestones.

- Cash flow modeling was completed to show expenditures anticipated per year based on the probable opinions of capital and operations and maintenance costs.
- Additional costs and steps needed to make captured water a water supply for municipal use were researched and presented.
- Options for a financial strategy were researched and presented.

Management of existing sediment in the Dominguez Channel Estuary and greater Harbor is not evaluated in this EWMP. Those activities will be developed under a separate Sediment Management Program.

The search for regional project opportunities focused on open space parcels already owned by DC WMG agencies, where a reasonably large catchment of the DC WMG could be routed to the parcel for retention (generally greater than 10 acres), and there were no specific fatal flows preventing capture and retention of water, such as liquefaction zones, superfund sites, or abandoned landfills.

Nine regional project sites were identified. Table ES-3 shows the project sites. Each will be able to retain the 85th percentile 24 hour storm from a reasonably large subcatchment within the DC WMG. Due to the significant development of the watershed (93%), green streets proved to be a more readily implementable solution than regional projects.

Table ES-3: Regional Project Sites Identified

Recommended Project Site	Ownership	Drainage Area (ac)	Storage Volume (ac-ft)
Darby Park	Inglewood	106	5.2
El Segundo	El Segundo	574	27.0
Ramona Park	Hawthorne	273	12.9
Jim Thorpe Park		378	16.0
Hawthorne Memorial Park		202	8.2
Chester Washington Golf Course (North) [1]	Los Angeles County	636	26.4
Chester Washington Golf Course (South) [1]		542	26.1
Harbor City Park	City of Los Angeles	4,460	80.7
Wilmington Recreation Center		273	12.9
Averill Park		1,376	21.4
[1] Facility is owned by the County, but operated under lease by American Golf.			

Table ES-4 shows the "recipe for compliance," or the load reduction estimated and modeled for each category of BMP.

Table ES-4: Recipe for Compliance

Element	Load Reduction
MCMs	5.0%
LID Ordinances	6.9%
Regional Projects	6.6%
Green Streets	81.5%

Figure ES-2 shows the EWMP regional projects and green streets proposed for implementation to meet the planning objectives.

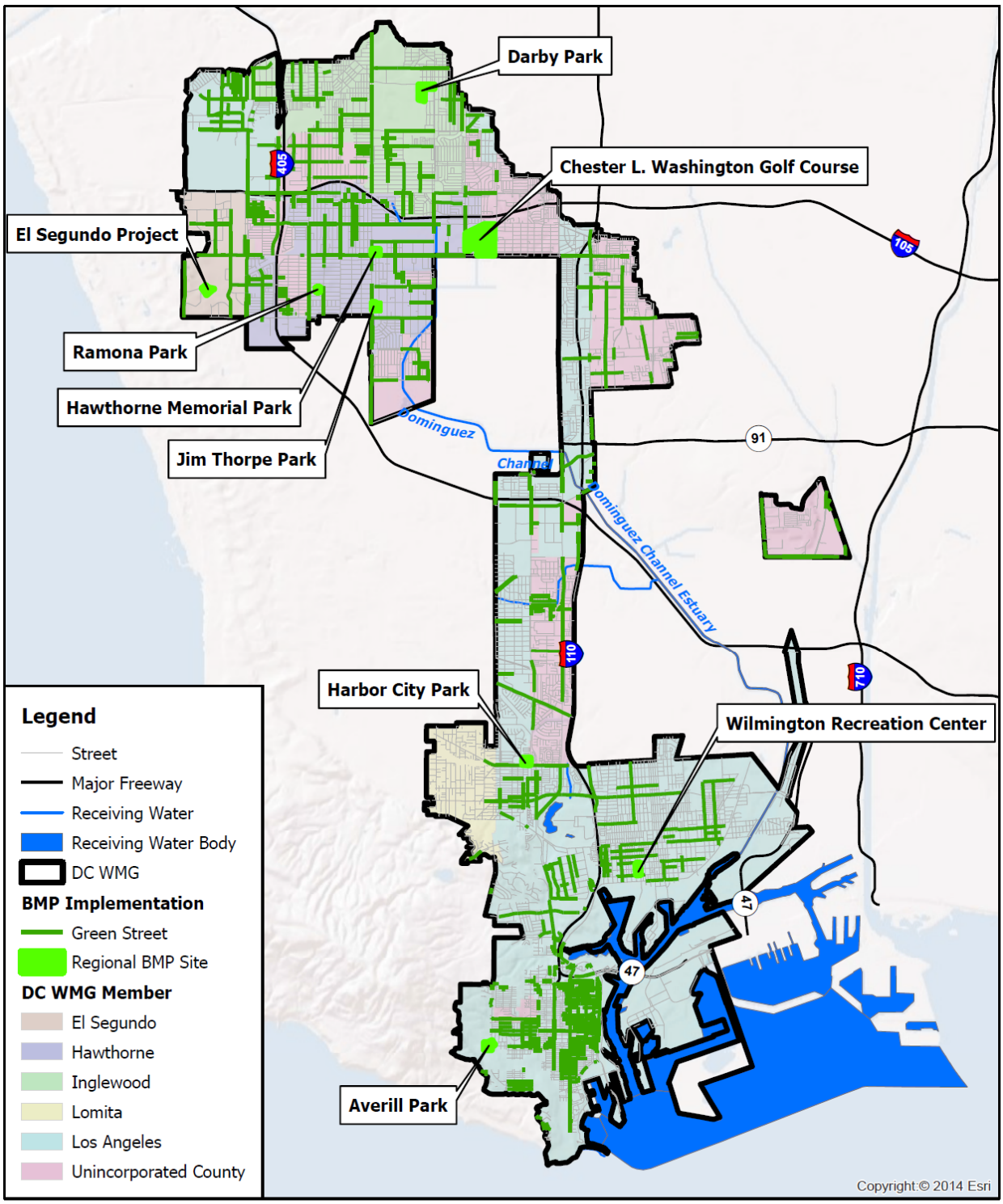

Figure ES-2: EWMP Projects.

Opinions of Probable Costs were developed using engineering unit costs for projects with engineering judgment based on experience designing and constructing similar projects. Operations and Maintenance cost opinions were developed as a percent of capital costs based on California Stormwater Quality Association (CASQA) guidance. Table ES-5 shows the opinions of probable total capital and annual operations and maintenance costs at build out. Future costs are not discounted to present values and they are not escalated for inflation. Tables ES-6 and ES-7 show the load reductions to occur at specific milestones based on project implementation schedules.

Table ES-5: Opinion of Probable Costs

Type	Capital Cost	Annual O&M at Build-out
MCMs	$0	Current budgets
LID + Redevelopment	$0	Current budgets
Regional BMPs	$239,000,000	$2,200,000
Green Streets	$1,850,000,000	$16,300,000
Total Cost	$2,089,000,000	$18,500,000

Table ES-6 Load Reductions based on Control Measure Implementation				
Control Measure Implementation	**Load Reduction (kg)**			
	2017 Metal (25%)	**2023 Metal (75%)**	**2027 Metal (90%)**	**2032 Metal (100%)**
Enhanced MCMs	0.37	1.12	1.49	1.86
New and Re-Development	0.31	1.22	1.82	2.58
Green Streets	8.61	23.1	27.71	30.3
Regional projects	0	2.44	2.44	2.44
Target Load Reduction:	9.29	27.88	33.46	37.18
Total Load Reduction:	9.29	27.88	33.46	37.18
Percent of Final Target:	25%	75%	90%	100%

TableES-7: Nitrogen Load Reductions based on Control Measure Implementation		
Control Measure Implementation	**Total Nitrogen Load Reduction[1] (kg)**	
	2017	**2018 Nutrient (100%)**
Enhanced MCMs	12.77	25.55
New and Re-Development	6.42	7.83
Green Streets	619.50	1244.04
Regional BMPs		
Harbor City Park	-	-
Target Load Reduction:	638.71	1277.42
Total Load Reduction:	638.71	1277.42
Percent of Final Target:	50%	100%
[1] Only applicable to the area draining to Machado Lake.		

Table ES-8 shows the green street implementation schedule needed to achieve the milestones shown in Tables ES-6 and ES-7. Table ES -9 shows the regional project implementation schedule needed to achieve those milestones.

Table ES-8: Green Street Implementation Schedule

Implementation Year	Number of Lane Miles
2017	181
2018	38
2019	50
2020	50
2021	50
2022	50
2023	50
2024	33
2025	33
2026	33
2027	33
2028	27
2029	27
2030	27
2031	27
2032	27
2033	-

Table ES-9: Regional Project Timeline

Regional Project	Completion Year
Jim Thorpe Park	2021
Averill Park	2022
Darby Park	2022
Hawthorne Memorial Park	2022
Ramona Park	2022
Wilmington Recreation Center	2022
Chester Washington Golf Course	2023
El Segundo	2023
Harbor City Park	2023

Figure ES-3 shows the annual opinions of cost for program implementation to meet the milestones shown in Tables ES-6 and ES-7.

An adaptive management process was developed as required in the MS4 permit. Figure ES-4 shows a decision process for adaptive management. As shown in this flow chart, the primary tool proposed for evaluating if implementing the EWMP is meeting the planning objectives is the model. Since the model is used to estimate the ability of the EWMP projects to achieve the planning objectives, and the model is calibrated on a relatively small number of sampling locations, using the CIMP results to determine if the projects, as modeled, are meeting the planning objectives, is the primary tool for adaptive management.

Since implementation of the EWMP will result mostly in volume reduction, checking flow rates at monitoring stations during specific storms and checking model simulations of those same storms and antecedent conditions will provide a valuable calibration check. This calibration check than then be used to either 1) update the model calibration and run simulations to see if the EWMP projects need modifications, or 2) stay the course.

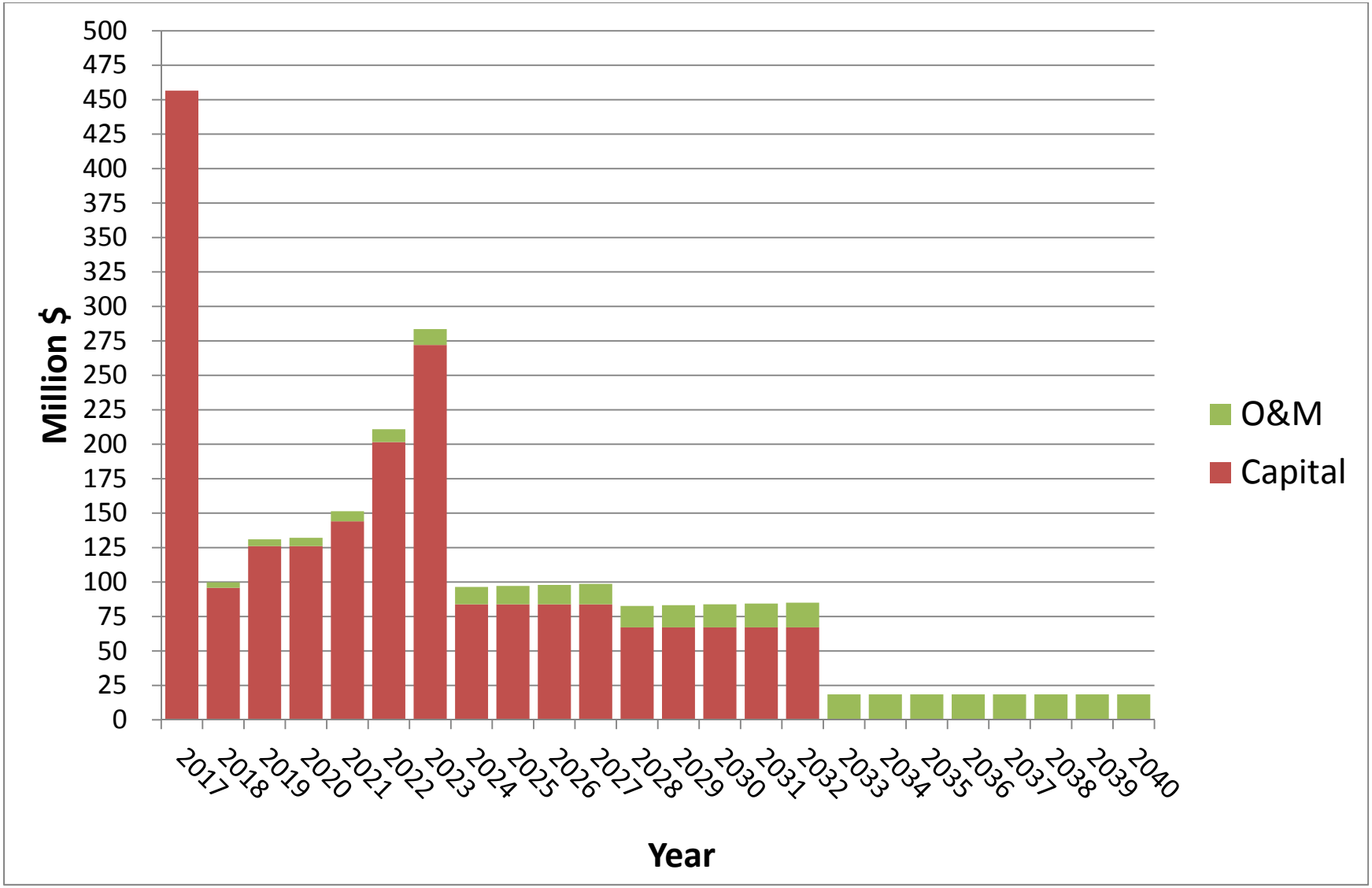

Figure ES-3: Annual Cost Opinion Projections to meet compliance schedule

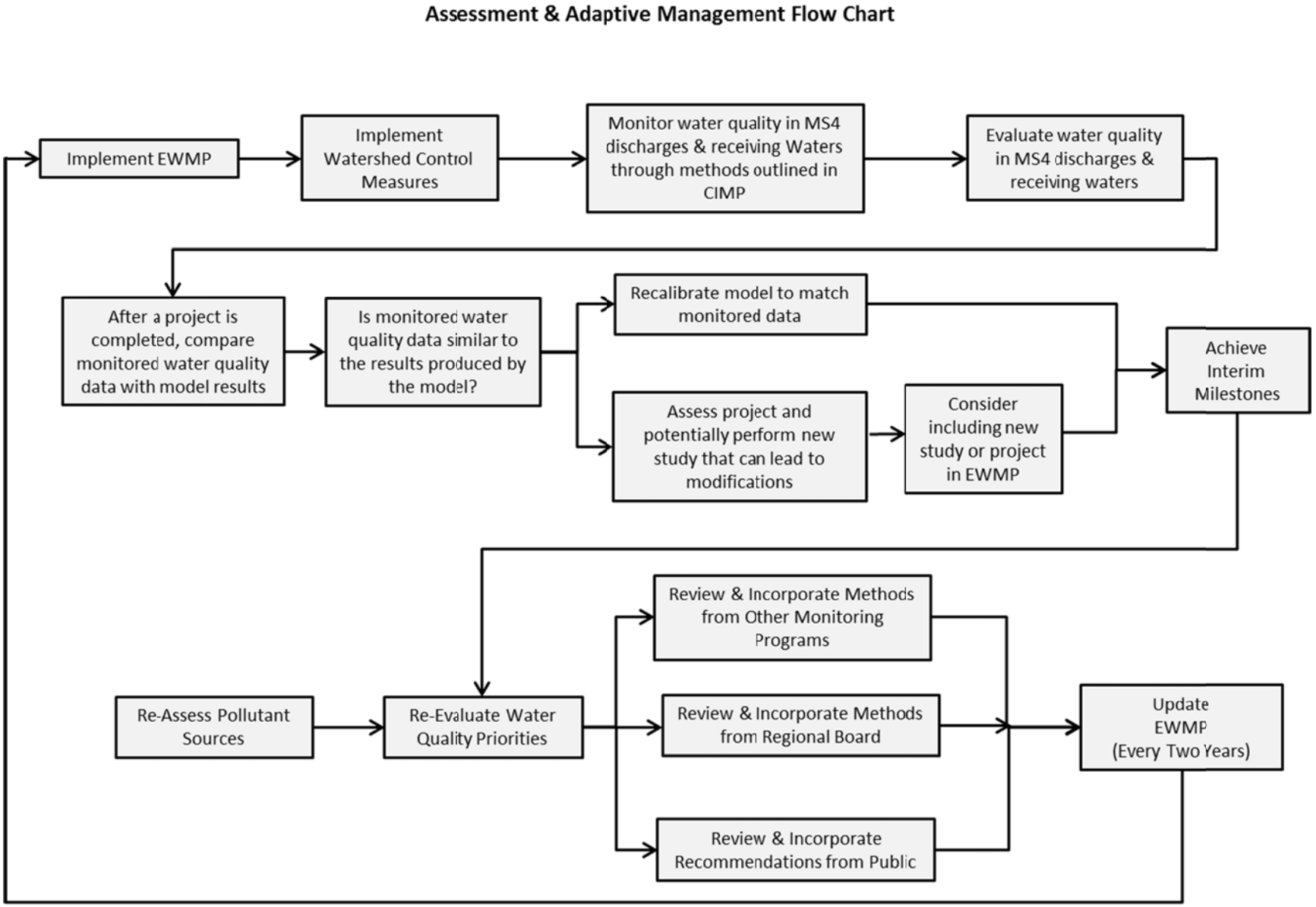

Figure ES-4: Adaptive Management Flow Chart

1. Introduction

The Dominguez Channel Watershed Management Area Group (DC WMG) has developed this Enhanced Watershed Management Program (EWMP) pursuant to the requirements set forth by Order No. R4-2012-0175, Los Angeles County Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit (MS4 Permit). This section describes the applicability of the EWMP, watershed background and geographical characteristics, regulatory requirements set forth by the MS4 Permit, the EWMP development process, and an overview of this EWMP.

1.1 Applicability of EWMP

The agencies participating in this EWMP are the Cities of El Segundo, Hawthorne, Inglewood, Lomita and Los Angeles, the unincorporated areas of the County of Los Angeles, and the Los Angeles County Flood Control District (LACFCD). The area break down for the DC WMG is provided in Table 1-1. Attachment A, Figure A.1 provides a map of the Dominguez Channel Watershed Management Area (WMA) boundaries and the delineations of the areas of the DC WMG participating in the development of this EWMP. Attachment A, Figure A.2 provides a map illustrating the boundaries of the jurisdictions within the DC WMG area. Additionally other MS4 Permittees in the watershed that are not participating in this EWMP are clearly identified. Additionally, his EWMP is voluntarily submitted to assist the LARWQCB in implementing the DC and LA Harbor Waters Toxics Pollutants TMDL. The DC WMG has entered into an Amended Consent Decree with the United States and the State of California, including the LARWQCB, pursuant to which the LARWQCB has released the DC WMG from responsibility for toxic pollutants in the DC and the harbors (NOAA 1999). Accordingly, no inference should be drawn from the submission of this EWMP or from any action or implementation taken pursuant to it that the DC WMG is obligated to implement the TMDL, including this EWMP or any of the TMDL's other obligations or plans, or that the DC WMG has waived any rights under the Amended Consent Decree. Additional information regarding the LACFCD is provided in Attachment P.

Table 1-1.: DC WMG Area

DC WMG Member	Total Area (acres)	Percent of Group
City of El Segundo	1,252.18	3.33%
City of Hawthorne	3,891.93	10.34%
City of Inglewood	3,884.28	10.32%
City of Lomita	1,227.70	3.26%
City of Los Angeles	19,243.25	51.12%
Los Angeles County	8,140.91	21.63%
LACFCD	N/A	N/A
Total	37,640.25	100%

1.2 Geographic Scope and Characteristics

The physical and hydrologic watershed characteristics of the Dominguez Channel WMA that are unique to the DC WMG and are further discussed. In addition, the extent of the MS4 and receiving waters addressed by this EWMP are also discussed.

1.2.1 Watershed Characteristics

As described on the Los Angeles County Department of Public Works (LACDPW) website (LACDPW, Dominguez Watershed), the Dominguez Channel WMA is located within the southern portion of Los Angeles County, California, and encompasses approximately 133 square miles of land and water, including the Upper Dominguez Channel Watershed, the Machado Lake Watershed, and the Los Angeles/Long Beach Harbors Watershed as demonstrated in Attachment A, Figure A.2. The DC WMG accounts for just over 58 square miles, approximately 42 percent of the Dominguez Channel WMA. Table 1-2 and Attachment A, Figure A.3 present the land use break down within the DC WMG.

Table 1-2: DC WMG Land Use

Land Use Category	Area (square miles)	Percentage
Agriculture	0.2	0.3%
Commercial	10.7	18.4%
Industrial	9.1	15.7%
Multi-Family Residential	8.3	14.2%
Single Family Residential	16.1	27.7%
Open	4.6	7.8%
Other Urban	9.3	15.9%
Total:	58.3	100%

The hydrologic characteristics of the DC WMG include:

- Low relief terrain except in the southwest (Attachment A, Figure A.4);
- Fully built-out area with a high percentage of impervious area except in the southwest (Attachment A, Figure A.4);
- Soil types ranging from clay to fine sand based on the Los Angeles County Hydrology Manual (2006) (Attachment A, Figure A.5). Infiltration rates range from 0.027 to 0.81 inches per hour;
- Storm intensity range from approximately 4.6 inches per hour in the southeast that increases to 6.2 inches per hour in the northwest, as indicated by the 50-year, 24-hour rainfall intensity distribution (Attachment A, Figure A.6); and
- Storm depth range from approximately 0.25 inches in the south that increases to the north with a local high point over the Palos Verde Hills of 1.05 inches, as indicated by the 85th percentile, 24-hour rainfall depth distribution (Attachment A, Figure A.7).

1.2.2 Water Body Characteristics

The DC WMG is tributary to the water bodies listed below, which have been assessed by the State Water Resources Control Board (State Board). A figure illustrating these water bodies can be found in Attachment A, Figure A.8 and Figure A.9 and a summary of the major characteristics can be found in Table 1-3.

- Dominguez Channel
  - Dominguez Channel (lined portion above Vermont Avenue)
  - Dominguez Channel Estuary (unlined portion below Vermont Avenue)
  - Torrance Carson Channel (Torrance Lateral)
- Machado Lake
  - Machado Lake
  - Wilmington Drain
- Los Angeles Harbor
  - Inner Cabrillo Beach

- Consolidated Slip

1.2.2.1. Dominguez Channel

The lined portion of the Dominguez Channel above Vermont Avenue is 6.7 miles, spanning from Imperial Highway near Interstate 105 to Vermont Avenue near Interstate 110 (USEPA, 2014b). Three miles of the lined portion of the Dominguez Channel are within the DC WMG jurisdiction The Basin Plan has identified the existing beneficial uses as RARE and REC-2 and potential beneficial uses as WARM, WILD, and REC-1 for the lined portion of the Dominguez Channel. Further downstream, below Vermont Avenue, is the unlined portion of the Dominguez Channel commonly referred to as the Dominguez Channel Estuary. The estuary is approximately 0.22 square miles, 140.8 acres (8.2 miles in length) spanning from the downstream end of the lined portion of the Dominguez Channel to the Los Angeles Harbor, just south of Anaheim Street and west of Interstate 710 (USEPA, 2014b). Approximately 2.2 miles of the Dominguez Channel Estuary is within the DC WMG jurisdiction. The Basin Plan has identified the existing beneficial uses as COMM, EST, MAR, WILD, RARE, MIGR, SPWN, REC-1, and REC-2 and a potential beneficial use as NAV for the Dominguez Channel Estuary. The Torrance Carson Channel, also referred to as Torrance Lateral, is 3.4 miles in length and tributary to the Dominguez Channel Estuary. The Torrance Lateral spans from Western Avenue south of Torrance Boulevard to its confluence with the Dominguez Channel Estuary near Avalon Boulevard and Interstate 405. 1.8 miles of the Torrance Lateral is within the DC WMG jurisdiction. The water quality associated with these water bodies is discussed in Section 2 Water Quality Priorities**.**

1.2.2.2. Machado Lake

Machado Lake is considered a freshwater reservoir or lake approximately 40 acres in size located adjacent to Vermont Avenue south of its intersection with Pacific Coast Highway (USEPA, 2014b). The Basin Plan has identified the existing beneficial uses as WARM, WILD, RARE, WET, REC-1, and REC-2. Machado Lake is comprised of upper and lower basins separated by a lower earthen dam. The upper basin contains the 40-acre recreational lake created by the impoundment of stormwater runoff while the lower basin is a seasonal freshwater marsh of roughly 63 acres. The Wilmington Drain is a LACFCD facility managed by LACDPW tributary to Machado Lake. The earthen bottom section is characterized as a soft bottom vegetated channel, approximately 3,000 feet long. This portion of Wilmington Drain spans from Pacific Coast Highway to just north of Lomita Boulevard, bordered by mostly residential land uses to the west and the Interstate 110 to the east. Just south of Interstate 110 and upstream, the channel is concrete lined. Beneficial uses for the Wilmington Drain were identified based on the tributary rule, therefore have the same beneficial uses as Machado Lake (LARWQCB, 1994). The water quality associated with these water bodies is discussed in Section 1.

1.2.2.3. Los Angeles Harbor

There are many components that make up the Los Angeles Harbor as a whole, as illustrated in Attachment A, Figure A.8. The Dominguez Channel WMA empties into the northeast side of the Consolidated Slip, the most upstream portion of the Los Angeles Harbor, located downstream of the Dominguez Channel Estuary near Anaheim Street west of Interstate 710 and spans to Shore Road where it confluences with the Los Angeles Inner Harbor. This portion of the harbor is approximately 0.06 square miles, 13.5 acres (USEPA, 2014b). The Basin Plan designates beneficial uses to "all other inner areas", including the Consolidated Slip. Existing beneficial uses for the inner harbor areas include IND, NAV, REC-2, COMM, MAR, and RARE and potential beneficial uses include REC-1 and SHELL. The Los Angeles Inner Harbor is approximately 3,003 acres and is located downstream of the Consolidated Slip. The Inner Harbor includes portions of both the Los Angeles Harbor and Long Beach Harbor (USEPA, 2014b). The Fish Harbor which is located within the Los Angeles Harbor area, is approximately 0.14 square miles, 91 acres, located east of the harbor near Wharf Street, is also considered part of the Inner Harbor area (USEPA, 2014b) and has the same beneficial uses. The inner and outer portions of Cabrillo Beach are also a part of the Los Angeles Harbor. Inner Cabrillo Beach is considered a bay/harbor and is located to the west of Fish Harbor, adjacent to Shoshonean Road, approximately 0.13 square miles, 82 acres. Outer Cabrillo Beach is considered a coastal shoreline approximately 0.58 miles long on the south

side of the peninsula bordering inner and outer Cabrillo Beach (USEPA, 2014). The Basin Plan has identified existing beneficial uses for Cabrillo Beach as NAV, REC-1, REC-2, COMM, MAR, WILD, MIGR, SPWN, and SHELL. The water quality associated with the Los Angeles Harbor water bodies is discussed in Section 1.

Table 1-3: Summary of DC WMG Water Bodies

Water Body		Existing Beneficial Uses	Potential Beneficial Uses
Dominguez Channel	Lined portion above Vermont Avenue (Freshwater)	RARE, REC-2	WARM, WILD, REC-1, MUN[1]
	Unlined portion below Vermont Avenue (Estuary)	COMM, EST, MAR, WILD, RARE, MIGR, SPWN, REC-1, REC-2	NAV
	Torrance Carson Channel[2]	RARE, REC-2	WARM, WILD, REC-1, MUN[1]
Machado Lake	Machado Lake	WARM, WILD, WET, REC-1, REC-2	None
	Wilmington Drain[3]	WARM, WILD, WET, REC-1, REC-2	None
Los Angeles Harbor	Consolidated Slip	IND, NAV, REC-2, COMM, MAR, RARE	REC-1, SHELL
	Inner Harbor	IND, NAV, REC-2, COMM, MAR, RARE	REC-1, SHELL
	Fish Harbor	IND, NAV, REC-2, COMM, MAR, RARE	REC-1, SHELL
	Inner Cabrillo Beach	NAV, REC-1, REC-2, COMM, MAR, WILD, MIGR, SPWN, SHELL	None
	Outer Cabrillo Beach	NAV, REC-1, REC-2, COMM, MAR, WILD, MIGR, SPWN, SHELL	None

[1] MUN designation is P*. Associated water quality objectives are not applicable until such time as the use is confirmed.
[2] Beneficial uses based on TMDL Staff Report (LARWQCB, 2011).
[3] Beneficial uses based on the tributary rule (LARWQCB, 1994).

1.3 Regulatory Framework

In 1972, provisions of the Federal Water Pollution Control Act, also referred to as the Clean Water Act (CWA), were amended so that the discharge of pollutants to waters of the United States from any point source is effectively prohibited, unless the discharge is in compliance with a NPDES permit. In 1987 the CWA was amended, also called the Water Quality Act of 1987, to require United States Environmental Protection Agency (USEPA) to establish a program to address storm water discharges. In response, EPA promulgated the NPDES storm water permit application regulations. These regulations required that facilities with storm water discharges "…from a large or medium municipal storm sewer system; or (3) a discharge which EPA or the state/tribe determines to contribute to a violation of a water quality standard or which…" apply for an NPDES permit. On November 16, 1990, the USEPA published final regulations that established application requirements for stormwater permits for MS4s serving a population of over 100,000 (Phase I communities) and certain industrial facilities, including construction sites greater than 5 acres. On December 8, 1999, the USEPA published the final regulations for communities under 100,000 (Phase II MS4s) and operators of construction sites between one and five acres.

The State of California Porter-Cologne Act (Water Code 13000, et seq.) is the principal legislation for controlling stormwater pollutants in California, requiring the development of Basin Plans for drainage basins within California. Each plan serves as a blueprint for protecting water quality within the various watersheds. These basin plans are used in turn to identify more specific controls for discharges (e.g., wastewater treatment plant effluent, urban runoff, and agriculture drainage). Under Porter-Cologne, specific controls are implemented through permits called Waste Discharge Requirements (WDRs) issued by the nine Regional Water Quality Control Boards. For discharges to surface waters, the WDR also serves as an NPDES permit.

The Los Angeles Regional Water Quality Control Board (LARWQCB or Regional Board) adopted WDRs for MS4 discharges within the Coastal Watersheds of Los Angeles County on June 18, 1990, (Order No. 90-079; NPDES Permit No. CA0061654). The WDRs were later amended on December 13, 2001 (Order No. 01-182; NPDES Permit No. CAS004001 (as amended)) after which several Permittees submitted separate Report of Waste Discharges (ROWDs). Because of the complexity of the networking of the MS4 within the Los Angeles area, it was determined that a system-wide permit was appropriate and Order No. R4-2012-0175; NPDES Permit No. CAS004001 was adopted on November 8, 2012. The MS4 Permit became effective on December 28, 2012. The MS4 Permit contains effluent limitations, receiving water limitations (RWLs), Minimum Control Measures (MCMs), Total Maximum Daily Load (TMDL) provisions, and outlines the process for developing watershed management programs (WMPs), including the EWMP. The MS4 Permit incorporates the TMDL Waste Load Allocations (WLAs) applicable to dry- and wet-weather as Water Quality-Based Effluent Limitations (WQBELs) and/or Receiving Water Limitations (RWLs). Part V.A (pages 38-39) of the MS4 Permit requires compliance with the WQBELs as outlined in the respective TMDLs.

1.3.1 MS4 Permit Requirements

Part VI.C.1.g (page 47) of the MS4 Permit states that Permittees may elect to develop an EWMP that comprehensively evaluates opportunities within the participating WMA as a whole for collaboration among Permittees and other partners on multi-benefit regional projects, referred to as regional EWMP projects, that wherever feasible retain non-stormwater runoff and stormwater runoff from the 85th percentile, 24-hour storm event for drainage areas tributary to the project. These regional EWMP projects should also incorporate other benefits including flood control and water supply. In the drainage areas where regional EWMP projects are not feasible, a Reasonable Assurance Analysis (RAA) should be included to demonstrate that applicable WQBELs and RWLs will be achieved through implementation of other watershed control measures. According to Parts VI.C.1.g.i.-ix (pages 48-49) of the MS4 Permit the EWMP must:

i. Be consistent with the provisions in Part VI.C.1.a.-f (pages 46-47) and VI.C.5-C.8 (pages 58-66);
ii. Incorporate applicable State agency input on priority setting and other key implementation issues;
iii. Provide for meeting water quality standards and other CWA obligations by utilizing provisions in the CWA and its implementing regulations, policies, and guidance;
iv. Include multi-benefit regional projects to ensure that MS4 discharges achieve compliance with final WQBELs set forth in Part VI.E (page 141) of the MS4 Permit and do not cause or contribute to exceedances of receiving water limitations in Part V.A (page 38) of the MS4 Permit by retaining through infiltration or capture and reuse the stormwater volume from the 85th percentile, 24-hour storm for the drainage areas tributary to the multi-benefit regional projects;
v. In drainage areas where retention of the stormwater volume from the 85th percentile, 24-hour storm event is not technically feasible, include other watershed control measures to ensure that MS4 discharges achieve compliance with interim and final WQBELs set forth in Part VI.E (page 141) of the MS4 Permit with compliance deadlines occurring after approval of an EWMP and to

ensure that MS4 discharges do not cause or contribute to exceedances of receiving water limitations in Part V.A (page 38) of the MS4 Permit;

vi. Maximize the effectiveness of funds through analysis of alternatives and the selection and sequencing of actions needed to address human health and water quality related challenges and non-compliance;

vii. Incorporate effective innovative technologies, approaches and practices including green infrastructure;

viii. Ensure that existing requirements to comply with technology-based effluent limitations and core requirements (e.g., including elimination of non-stormwater discharges of pollutants through the MS4, and controls to reduce the discharge of pollutants in stormwater to the maximum extent practicable) are not delayed; and

ix. Ensure that a financial strategy is in place.

Part VI.C.4.c.iv (page 53-58) of the MS4 Permit states that Permittees that elect to collaborate and develop an EWMP, such as the DC WMG, shall submit the Work Plan for development of the EWMP no later than June 28, 2014. The draft EWMP shall be submitted no later than June 28, 2015. These deadlines stand true if the conditions described in Parts VI.C.4.c.iv.(1)-(3) (page 57) of the MS4 Permit are met in greater than fifty percent of the land area in the watershed. The conditions of Parts VI.C.4.c.iv.(1)-(3) (page 57) are required within six months of the MS4 Permit effective date and are as follows:

1. Demonstrate there are Low Impact Development (LID) ordinances in place that meet the requirements of the Planning and Land Development Program as described by Part VI.D.7 (pages 94-113) of the MS4 Permit;
2. Demonstrate that green streets policies are in place; and
3. Submit a Notice of Intent (NOI) to develop an EWMP (Attachment W).

The DC WMG has met these conditions. The requirements of the EWMP Work Plan are specified in the MS4 Permit Part VI.C.5 (pages 58-65) as the EWMP Program Development and focuses on the following tasks which were expanded on in the June 2014 Work Plan.

a. Identification of water quality priorities;
b. Selection of watershed control measures; and
c. Compliance schedules.

1.3.2 Relevant TMDLs

A TMDL is a regulatory term used to describe a value of the maximum amount of a pollutant that a water body can receive while still meeting water quality standards. Attachment N of the MS4 Permit, titled "TMDLs in Dominguez Channel and Greater Harbor Waters Watershed Management Area" lists information on TMDLs and incorporates WQBELs and RWLs relevant to the DC WMG including the TMDLs identified in Table 1-4.

Table 1-4: DC WMG TMDLs and Effective Dates		
TMDL	**LARWQCB Resolution Number**	**Effective Date and/or Approval Date**
Los Angeles Harbor Bacteria TMDL	R12-007[1]	November 7, 2013
	2004-011	March 10, 2005
Machado Lake Trash TMDL	2007-006	March 6, 2008
Machado Lake Nutrient TMDL	2008-006	March 11, 2009
Machado Lake Pesticides and PCBs TMDL[2]	R10-008	March 20, 2012
DC and LA Harbor Waters Toxic Pollutants TMDL	R11-008	March 23, 2012

[1] Reconsideration of Certain Technical Matters of the Los Angeles Harbor Inner Cabrillo Beach and Main Ship Channel Bacteria TMDL

[2] Also referred to as the Machado Lake Toxics TMDL

Table 1-5 demonstrates which DC WMG members are affected by each of the TMDLs per Attachment K, Table K.4, of the MS4 Permit. The Water Quality Objectives (WQOs) associated with each of the TMDLs are included in Attachment B.

Table 1-5: Applicability of DC WMG TMDLs					
DC WMG Participating Agency	**Los Angeles Harbor Bacteria TMDL**	**Machado Lake Trash TMDL**	**Machado Lake Nutrient TMDL**	**Machado Lake Pesticides and PCBs TMDL**	**DC and LA Harbor Waters Toxic Pollutants TMDL[1]**
City of El Segundo					X
City of Hawthorne					X
City of Inglewood					X
City of Los Angeles	X	X	X	X	X
City of Lomita		X	X	X	
County of Los Angeles	X	X	X	X	X
LACFCD	X	X	X	X	X

[1] The requirements of the MS4 Permit to implement the obligations of this TMDL do not apply to a Permittee to the extent that it is determined that the Permittee has been released from that obligation pursuant to the Amended Consent decree entered in *United States v. Montrose Chemical Corp.*, Case No. 90-3122 AAH (JRx).

1.4 EWMP Development Process

According to Part VI.C.1.f.v (page 48) of the MS4 Permit, each watershed management program (WMPs and EWMPs) must provide appropriate opportunity for meaningful stakeholder input, including, but not limited to, a permit-wide watershed management program Technical Advisory Committee (TAC) that will advise and participate in the development of the WMP or EWMP at month six through the date of approval. The MS4 Permit requires that the TAC include at least one Permittee representative from each WMA for which a WMP or EWMP is being developed and must include a minimum of one public representative from a non-governmental organization with public membership and staff from the

Regional Board and USEPA Region IX. The DC WMG has been part of the TAC and has provided input on the various topics discussed. Additionally the DC WMG is working with local and regional stakeholders to receive input for the EWMP process.

The DC WMG developed a list of stakeholders in order to establish the stakeholder participants, as well as provide guidance on how to engage the identified key stakeholders. The stakeholders include:

- Key administrators, stormwater program managers, council districts, etc.;
- Environmental and community organizations; and
- Collaborating governmental agencies such as the Regional Board, USEPA Region IX, United States Army Corps of Engineers, water districts, and other WMP or EWMP agencies.

A series of three EWMP stakeholder workshops are conducted, on April 10, 2014, November 20, 2014, and March 19, 2015. Each workshop was held at the Witherbee Auditorium at LA Zoo. More than 500 invitations were sent out to stakeholders. Workshop No. 1 was intended to initiate the process for receiving input from a broad stakeholder group. This workshop initiated the stakeholder process and addressed the EWMP watersheds of the Los Angeles River, Ballona Creek, Marina del Rey, Santa Monica Bay Jurisdictions 2 and 3, and the DC WMG. The agenda consisted of introducing the planned EWMP stakeholder process, explaining the relevance and context of the EWMP process, and solicit input from stakeholders for the Draft EWMP Work Plan and ideas on potential projects.

The second workshop discussed the planning progress, discussed the regional projects identified to date, and continued to solicit input from the stakeholders on regional project opportunities, planning criteria to incorporate, the additional benefits sought from the EWMP projects, and other desired outcomes from the program.

The third workshop discussed the draft EWMP, the projects identified, the load reductions that would occur from project implementation, any additional benefits communities would see from implementation of the projects, and the schedules and costs for implementation of the EWMP.

The following preparation was conducted for the workshops:

- Meeting notices (one page flier) distributed via email to identified stakeholders and posted on the City of Los Angeles a website for EWMP materials and activities at least one month prior to the workshop;
- Material for each workshop distributed and posted to the www.lastormwater.org website;
- A draft workshop summary, including presentation materials, distributed no later than two weeks after each workshop to solicit additional stakeholder feedback;
- Locations of the workshops that are reasonably accessible and accommodates up to 250 attendees;
- Lunch was provided, courtesy of the consulting firms developing the plans, for persons interested in staying for lunch.

In addition to distributing workshop material through the Los Angeles Stormwater website, the DC WMG also set up a web site that persons could obtain free accounts in and upload project proposals. This facilitated community inputs into the project development process.

The stakeholder process is important to the EWMP development process so that communication is occurring, and ideas are being discussed in an appropriate timeframe so that conflicts can be resolved early on.

1.5 EWMP Overview

In June 2014, the EWMP Work Plan was developed as required as part of the DC WMG EWMP development process per Part VI.C.4.c.iv (page 57) of the MS4 Permit.

The EWMP Work Plan documented the progress thus far in the development of the EWMP by detailing the water quality priorities within the DC WMG, identifying the existing and potential control measures, as well as the approach to identifying additional projects, and outlining the approach to the RAA, as required by the MS4 Permit. The purpose of identifying significant watershed characteristics and presenting an approach was so that stakeholders could become involved, and feedback could be solicited and incorporated into the EWMP.

That EWMP Work Plan has been used as the frame for this EWMP. This EWMP provides the results of the efforts outlined in the EWMP Work Plan and includes the relevant previous information as well as the final RAA, projects for implementation consideration, a framework for assessment and adaptive management, cost and financial strategies, and a discussion on legal authority. This EWMP includes the following sections:

- **Water Quality Priorities**
  The receiving waters are identified and characterized based on the available water quality data. Water body Pollutant Classifications are developed so that each water body-pollutant combination can be classified into an appropriate category in order to develop an approach to prioritizing the identified water quality priorities.

- **Reasonable Assurance Analysis** Approach
  The modeling system and approach to conducting the RAA is presented in this section. The modeling system being used by the DC WMG is highlighted along with the process and modeling approach. The spatial domain, time period, water quality, and BMP model integration are described. Lastly, the output from the RAA is detailed and examples are provided.

- **Watershed Control Measures**
  This section outlines the existing and potential control measures. Watershed control measures consist of both structural and non-structural Best Management Practices (BMPs). Existing structural BMPs are identified and planning documents are reviewed in order to identify potential regional projects. In addition, identified and selected additional regional and distributed BMPs are included. The current minimum control measures are described and an approach to modifying the programs, as well as potential modifications, is presented.

- **EWMP Implementation Schedule**
  This section presents schedules for project implementation and how the RAA predicts the resulting load reductions that are expected to meet TMDL milestones and milestones established in this EWMP to address non-TMDL water quality priorities.

-

- **Assessment and Adaptive Management** Framework
  This section outlines the assessment and adaptive management framework to support the adaptive management of the EWMP. Additionally, the linkage between the assessment and the reporting requirements of the Permit is also established.

-

- **EWMP Implementation Costs and Financial** Strategy
  This section summarizes the costs of implementing the EWMP. Cost ranges were developed for the implementation, operation, and maintenance of the selected BMPs. A summary of potential funding sources or strategies to implement the EWMP is also presented.

-

- **Legal** Authority
  This section demonstrates that Permittees have the necessary legal authority to implement the BMPs identified in the EWMP or the legal authority exists to compel implementation of the BMPs.

2. Water Quality Priorities

Identification of the water quality priorities in the DC WMG is a key component of the EWMP process. Part VI.C.5.a (page 58-60) of the MS4 Permit outlines the pertinent elements of the prioritization process as follows:

1. Water quality characterization (VI.C.5.a.i, page 58) based on available monitoring data, TMDLs, 303(d) lists, storm water annual reports, etc.;
2. Water body-pollutant classification (VI.C.5.a.ii, page 59) to identify water body-pollutant combinations that fall into three MS4 Permit-defined categories;
3. Source assessment (VI.C.5.a.iii, page 59) for the water body-pollutant combinations in the three categories; and
4. Prioritization of the water body-pollutant combinations (VI.C.5.a.iv, page 60).

The three MS4 Permit defined categories are:

- **Category 1** (Highest Priority): Water body-pollutant combinations for which WQBELs and/or RWLs are established in Part VI.E (page 141) and Attachment N of the MS4 Permit.
- **Category 2** (High Priority): Pollutants for which data indicate water quality impairment in the receiving water according to the State's Water Quality Control Policy for Developing California's CWA Section 303(d) List (State Listing Policy) and for which MS4 discharges may be causing or contributing to the impairment.
- **Category 3** (Medium Priority): Pollutants for which there are insufficient data to indicate water quality impairment in the receiving water according to the State's Listing Policy, but which exceed applicable receiving water limitations contained in the MS4 Permit and for which MS4 discharges may be causing or contributing to the exceedance.

The following sections presented below describe the characterization and prioritization of those water body-pollutant combinations (WBPCs) found to be issues in DC WMG.

2.1 Water Quality Characterization

Water quality monitoring data and reports were gathered for the Dominguez Channel water body segments (including the lined portion above Vermont Avenue, the unlined Dominguez Channel Estuary, and the Torrance Lateral), the Machado Lake water body segments (including the Wilmington Drain), and the Los Angeles Harbor (including the Consolidated Slip and Cabrillo Beach). The raw data available was assessed for quality and compiled into a database by wet-weather and dry-weather conditions and locations. Sources for this data included:

- LACDPW Dominguez Channel MS4 NPDES Mass Emission Monitoring;
- AMEC's Port of Los Angeles (POLA) Artesia Pollutograph Study;
- City of Los Angeles Bureau of Sanitation (LABOS) Special Ammonia Sampling and Status and Trends Monitoring Programs in the Dominguez Channel; and
- LABOS Machado Lake Water Quality Monitoring Program and Nutrient TMDL Monitoring Program.

The sampling locations for the data are shown in Attachment C (Figures C.1 and C.2) and additional details regarding the available data, including which sampling effort was conducted at each site, are presented in Attachment D.

In addition to the sampling data, water and sediment quality monitoring reports were collected and reviewed as part of the characterization. These reports are summarized in Table 2-1.

Table 2-1: Monitoring Reports Reviewed for Water Quality Characterization		
Source	**Water Body(ies)**	**Date Range**
LACDPW NPDES MS4 Stormwater Monitoring Reports	Dominguez Channel Mass Emission Station	2002-2012
	Dominguez Channel Tributary Monitoring	2008-2011
Surface Water Ambient Monitoring Program (SWAMP)	Dominguez Channel, Machado Lake and LA/LB Harbor	2003
Dominguez Channel/Consolidated Slip Erosion Study	Dominguez Channel Estuary and Consolidated Slip	2011
Southern California Bight Regional Monitoring Program	LA/LB Harbor	2003 2008
POLA water data	Inner, Fish, and Outer Harbor	2005
Port of Long Beach (POLB) water data	Inner Harbor	2006
POLA/POLB Sediment Survey	Inner and Outer Harbor	2006
City of LA Terminal Island Water Reclamation Plant Biennial Assessment Report	Outer Harbor	2002/2003 2008/2009 2010/2011
Southern California Coastal Water Research Project (SCCWRP) DDE Inventory	Inner and Outer Harbor	2003
Consolidated Slip Restoration Project Concept Plan Supplemental Report	Dominguez Channel, Dominguez Channel Estuary, Torrance Lateral, and Consolidated Slip	2002
SCCWRP Atmospheric Deposition in LA/LB Harbor study	Consolidated Slip	2006
Wilmington Drain Sediment Characterization Study - LACDPW and City of Los Angeles Bureau of Engineering (BOE)	Wilmington Drain	2007
City of LA Machado Lake Nutrients and Toxics TMDL Lake Water Quality Management Plan	Machado Lake and Wilmington Drain	2001-2009

Basin Plan; the TMDLs for Dominguez Channel, Machado Lake, and the Los Angeles Harbor adopted as Basin Plan Amendments; other amendments to the Basin Plan Water Quality Standards; and the California Toxics Rule (CTR) (USEPA, 2000) were used to evaluate whether data exceeded RWLs. Applicable WQOs were established based on existing and potential beneficial uses for each water body segment and the weather conditions the samples were collected under.

The data analysis applied criteria for potential beneficial uses in addition to existing uses as a conservative measure. In doing so, water quality monitoring samples from the lined portion of the Dominguez Channel were screened against criteria applicable for the protection of REC-1 beneficial uses. Criteria for the protection of human health for the consumption of organisms only were applied to segments with either existing or potential REC-1 beneficial uses under both dry- and wet-weather conditions. Where human health criteria were not applicable or established, chronic water quality criteria for the protection of aquatic life were applied to dry-weather samples and acute water quality criteria were applied to wet-weather samples to account for the shorter exposure period consistent with TMDLs in the region.

Water body segments were classified as either freshwater or saltwater to apply the correct WQOs. The lined portion of the Dominguez Channel, as well as tributaries (i.e., the Torrance Lateral), were classified

as freshwater, while portions of the Los Angeles Harbor were classified as marine (saltwater). Due to tidal influence in the estuarine portion of the WMA and a lack of salinity data at the sampling locations in the Estuary, water quality samples from the Estuary were screened against both salt and freshwater criteria and the more stringent of the two criteria under the physical conditions at the time of sampling was used. Future confirmation of the salinity level at these monitoring locations can further refine these assumptions.

Hardness measurements at the time of sampling were used to calculate hardness-dependent dissolved metals WQOs. When hardness was not recorded, the median hardness for dry-weather samples at each sample site was used for dry-weather conditions and a value of 50 mg/L was used for wet-weather based on the hardness used in the TMDL for Toxic Pollutants in the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters.

2.1.1 Characterization of Receiving Water Quality

Statistical summaries of the water quality monitoring (raw) data are presented in Attachment D. Tables of the observed exceedances over the monitoring period and exceedances over the past five years (starting in January 2008) are summarized in Table 2-2 to Table 2-4 below. The last ten years of data was identified and evaluated based on the requirements specified in the RAA Guidelines and the most recent five years of data was focused on, as it is the most relevant. Note that metals were evaluated in dissolved form. For details on the WQOs utilized to measure exceedances, refer to the Attachment D.

Table 2-2: Summary of Exceedances for the Dominguez Channel Monitoring Locations

				Mainstream of Dominguez Channel								Tributaries			
				El Segundo Blvd		Mass Emission Station, S-28 (Artesia Blvd)		Western Ave		Vermont Ave		Yukon Ave		Carson Plaza Dr	
		Date Range		Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years
Constituent	Weather	From	To	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N
Copper[A]	Wet	7/25/02	2/22/07	5/11	-	21/39	12/20	4/11	-	1/4	-	3/4	-	1/4	-
	Dry	4/26/01	5/26/09	35/83	2/16	7/33	5/22	16/82	0/16	7/47	0/16	14/45	3/15	9/36	0/8
Lead[A]	Wet	7/25/02	2/22/07	2/11	-	5/34	5/20	3/11	-	1/3	-	1/4	-	1/4	-
	Dry	4/26/01	5/26/09	8/81	1/16	1/30	1/22	2/81	1/16	1/47	1/16	2/46	1/15	0/36	0/8
Zinc[A]	Wet	7/25/02	2/22/07	3/11	-	18/39	11/20	2/11	-	0/4	-	1/4	-	0/4	-
	Dry	4/26/01	5/26/09	0/82	0/16	2/33	2/22	0/82	0/16	0/47	0/16	1/42	0/15	0/36	0/8
Cadmium	Wet	7/25/02	2/22/07	1/11	-	-	-	0/11	-	0/4	-	0/4	-	0/4	-
	Dry	4/26/01	5/26/09	0/82	0/16	-	-	1/82	0/16	0/47	0/16	0/46	0/15	0/36	0/8
Chromium	Dry	4/26/01	5/26/09	1/83	0/16	-	-	0/83	0/16	1/47	1/16	2/46	0/15	0/36	0/8
Mercury	Wet	7/25/02	8/25/05	2/10	-	0/37	0/20	2/10	-	0/3	-	0/3	-	0/3	-
	Dry	4/26/01	2/24/06	8/46	-	1/65	0/22	7/46	-	0/11	-	0/11	-	0/9	-
Thallium	Dry	3/31/05	2/24/06	2/47	-	-	-	1/47	-	0/11	-	0/11	-	0/9	-
Selenium	Dry	5/31/01	5/26/09	0/82	0/17	-	-	0/82	0/17	0/48	0/17	0/47	0/16	7/37	7/9
E. coli[B]	Wet	11/29/01	12/23/08	24/38	22/34	4/4	4/4	29/38	6/6	19/38	5/6	10/12	1/2	9/12	1/2
	Dry	4/3/01	5/26/09	120/250	5/6	5/5	5/5	194/250	27/34	113/250	30/34	41/71	9/15	48/77	6/15
Fecal Coliform	Wet	11/8/02	1/24/13	-	-	44/46	21/21	-	-	-	-	-	-	-	-
	Dry	10/10/02	4/9/13	-	-	19/27	12/18	-	-	-	-	-	-	-	-
Ammonia	Dry	7/1/09	8/13/09	1/7	1/7	-	-	0/7	0/7	0/7	0/7	-	-	-	-
Diazinon	Wet	10/31/06	6/12/13	-	-	3/31	0/20	-	-	-	-	-	-	-	-
	Dry	2/11/03	1/24/13	-	-	0/28	0/22	-	-	-	-	-	-	-	-
Bis(2-Ethylhexl) phthalate	Wet	10/28/03	6/12/13	-	-	3/31	0/21	-	-	-	-	-	-	-	-
	Dry	10/31/03	1/24/13	-	-	1/30	0/23	-	-	-	-	-	-	-	-

Table 2-2: Summary of Exceedances for the Dominguez Channel Monitoring Locations

				Mainstream of Dominguez Channel								Tributaries			
				El Segundo Blvd		Mass Emission Station, S-28 (Artesia Blvd)		Western Ave		Vermont Ave		Yukon Ave		Carson Plaza Dr	
		Date Range		Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years
Constituent	Weather	From	To	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N
pH	Wet	11/8/02	1/24/13	-	-	5/39	3/20	-	-	-	-	-	-	-	-
	Dry	10/10/02	6/12/13	-	-	9/33	8/22	-	-	-	-	-	-	-	-
Dissolved Oxygen	Wet	11/8/2002	1/24/2013	-	-	1/42	0/18	-	-	-	-	-	-	-	-

E/N = Number of Exceedances/Number of Samples
- = No Data
[A] Copper, Lead, and Zinc measurements for Sampling Station S-28 were taken on the following dates: 2/27/2006 - 1/24/2013 (wet) and 5/16/2005-6/12/2013 (dry)
[B] E. Coli at Sampling Station S-28 was taken on the following dates: 10/11/2012 - 1/24/2013 (wet) and 10/10/2012-4/9/2013 (dry)

Table 2-3: Summary of Exceedances at the Torrance Lateral Monitoring Location

				Main Street	
		Date Range		Overall	Past 5 Years
Constituent	Weather	From	To	E/N	E/N
Copper	Wet	4/28/2005	2/22/2007	1/4	-
	Dry	1/27/2005	5/26/2009	7/47	1/16
Lead	Wet	4/28/2005	2/22/2007	1/3	-
	Dry	1/27/2005	5/26/2009	1/47	1/16
Zinc	Wet	4/28/2005	2/22/2007	1/4	-
Cadmium	Wet	4/28/2005	2/22/2007	1/4	-
	Dry	1/27/2005	5/26/2009	1/47	0/16
E. coli	Wet	2/27/2003	12/23/2008	7/12	2/2
	Dry	1/17/2002	5/26/2009	42/77	13/15

E/N = Number of Exceedances/Number of Samples

- = No Data

Table 2-4: Summary of Exceedances for the Dominguez Channel Estuary Monitoring Locations							
				Wilmington Avenue		Henry Ford Avenue	
		Date Range		Overall	Past 5 Years	Overall	Past 5 Years
Constituent	**Weather**	**From**	**To**	**E/N**	**E/N**	**E/N**	**E/N**
Copper	Wet	7/25/2002	2/22/2007	10/11	-	5/10	-
	Dry	4/26/2001	5/26/2009	44/72	10/10	43/73	9/10
Lead	Wet	7/25/2002	2/22/2007	0/11	-	2/11	-
	Dry	4/26/2001	5/26/2009	12/72	1/9	14/75	1/10
Zinc	Wet	7/25/2002	2/22/2007	2/10	-	1/11	-
	Dry	4/26/2001	5/26/2009	4/75	2/10	0/74	0/10
Silver	Dry	4/26/2001	5/26/2009	1/75	0/9	3/74	0/9
Nickel	Wet	7/25/2002	2/22/2007	1/11	-	1/11	-
	Dry	4/26/2001	5/26/2009	16/75	6/10	16/75	6/10
Mercury	Dry	4/26/2001	2/24/2006	10/46	-	8/45	-
Thallium	Wet	7/25/2002	8/25/2005	1/10	-	1/9	-
	Dry	4/26/2001	1/26/2006	4/47	-	4/46	-
Enterococcus	Wet	11/29/2001	12/23/2008	28/38	5/6	21/38	3/6
	Dry	4/3/2001	5/26/2009	31/250	4/34	12/250	0/34
Total Coliform	Wet	11/29/2001	12/23/2008	33/38	5/6	26/38	4/6
	Dry	4/3/2001	5/26/2009	57/250	5/34	11/250	2/34

E/N = Number of Exceedances/Number of Samples
- = No Data

Table 2-5: Summary of Exceedances for the Machado Lake Monitoring Locations

				Machado Lake, ML-1		Machado Lake, ML-2		Machado Lake, ML-3		Machado Lake, ML-4		Project 77 Drain		Project 510 Drain	
		Date Range		Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years	Overall	Past 5 Years
Constituent	Weather	From	To	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N	E/N
E.Coli	Wet	12/20/07	12/20/07	1/1	-	1/1	-	1/1	-	-	-	-	-	-	-
	Dry	12/26/07	9/29/08	24/54	24/54	18/55	17/54	43/55	43/54	8/47	8/47	2/4	1/3	0/1	-
Total Phosphorus	Wet	5/23/08	2/17/09	1/2	1/1	1/1	1/1	-	-	-	-	-	-	-	-
	Dry	5/19/08	2/7/11	43/52	45/45	45/45	45/45	-	-	-	-	-	-	-	-
Total Nitrogen	Wet	4/17/07	2/17/09	5/6	3/4	4/5	3/4	1/1	1/1	1/1	1/1	6/6	3/3	1/1	-
	Dry	6/16/06	2/7/11	89/106	70/87	92/106	74/87	45/47	45/47	44/47	44/47	40/41	31/32	29/31	22/22
Chlorophyll-a	Wet	5/23/08	2/17/09	1/2	1/2	1/2	1/2	1/1	1/1	1/1	1/1	-	-	-	-
	Dry	5/19/08	2/7/11	43/55	43/55	46/55	46/55	20/20	20/20	19/19	19/19	-	-	-	-
Dissolved Oxygen	Wet	12/26/12	12/26/12	1/1	1/1	1/1	1/1	-	-	-	-	-	-	-	-
	Dry	4/4/11	12/10/12	37/45	37/45	41/45	41/45	-	-	-	-	-	-	-	-

E/N = Number of Exceedances/Number of Samples
- = No Data

Table 2-6: Summary of Exceedances at the Wilmington Drain Monitoring Location

				Wilmington Drain	
		Date Range		Overall	Past 5 Years
Constituent	Weather	From	To	E/N	E/N
E. Coli	Dry	12/26/2007	2/27/2008	1/4	0/3
Total Nitrogen	Wet	11/30/2007	2/17/2009	6/6	3/3
	Dry	10/19/2007	2/2/2009	30/30	21/21

E/N = Number of Exceedances/Number of Samples
- = No Data

The monitoring reports reviewed during the water quality characterization were for the Dominguez Channel, Machado Lake and Los Angeles Harbor areas. For those programs that investigated sediment quality, exceedances of the Effect Range Low (ERL) sediment quality thresholds were used to assess water body impairment. It was also noted if chemical concentrations exceeded the higher Effect Range Median (ERM) threshold. Significant findings from these reports are summarized in Table 2-7, Table 2-8, and Table 2-9 for the Dominguez Channel water body segments, Machado Lake water body segments, and the Los Angeles Harbor water body segments respectively.

Table 2-7: Summary of Exceedances for Monitoring Programs for the Dominguez Channel

Water Body	Program	Date Range	Exceedances
Dominguez Channel	LACDPW NPDES MS4 Stormwater Monitoring	2008-2013	Wet-weather: Copper (diss.), Lead (diss.), and Zinc (diss.), Cyanide, Fecal coliforms, pH Dry-weather: Cyanide, Fecal coliforms, E. coli, pH
	LACDPW NPDES MS4 Stormwater Monitoring	2002-2008	Wet weather: Copper (diss.), Lead (diss.), and Zinc (diss.)
	LACDPW NPDES MS4 Stormwater Monitoring	2002, 2003, 2005	Water column toxicity
	LACDPW NPDES MS4 Stormwater Monitoring	Pre- 2005	Diazinon
	SWAMP	2003	pH
	Consolidated Slip Restoration Project Concept Plan Supplemental Report	2002	Sediment (ERM): Zinc
Torrance Lateral	LACDPW NPDES MS4 Stormwater Monitoring	2008-2012	Wet-Weather: Copper (diss.), Lead (diss.), and Zinc (diss.), Cyanide, Fecal coliforms, pH Dry-Weather: Fecal coliforms, pH, ammonia
	Consolidated Slip Restoration Project Concept Plan Supplemental Report	2002	Sediment (ERM): Lead, Zinc, DDT, PCBs, and PAHs
Dominguez Channel Estuary	Consolidated Slip Erosion Study	2011	Sediment (ERM): Chromium, Copper, Lead, Zinc, Mercury, Silver, DDT, PCBs, Chlordane, Dieldrin Sediment (ERL): Arsenic, Cadmium, Chromium, Copper, Lead, Zinc, Mercury, Nickel, Silver, Total PCBs, DDT, PAHs, Chlordane, and Dieldrin
	SWAP Report	2003	Benthic community effects
	Consolidated Slip Restoration Project Concept Plan Supplemental Report	2002	ERM: Copper, Lead, Zinc, DDT, and PCBs

Table 2-8: Summary of Exceedances for Monitoring Programs for Machado Lake			
Water Body	**Program**	**Date Range**	**Exceedances**
Machado Lake	Machado Lake Nutrients and Toxics TMDL Lake Water Quality Management Plan (Regional Board sediment data set)	2009	Sediment: Chlordane, Total DDT, Total PCBs
	SWAP Report	2003	Dissolved Oxygen
Wilmington Drain	Regional Board Sediment Data	2008	Sediment: Chlordane, Total DDT, Dieldrin
	Wilmington Drain Sediment Characterization Study	2007	Sediment: Chlordane, Total DDT, Total PCBs

Table 2-9: Summary of Exceedances for Monitoring Programs for the Los Angeles Harbor			
Water Body	**Program**	**Date Range**	**Exceedances**
LA Harbor	Southern California Bight Regional Monitoring Program	2008	Sediment (ERL): DDT, Copper
	Southern California Bight Regional Monitoring Program	2003	Sediment (ERL): DDT, Copper, Nickel, Mercury, Sediment Toxicity
Inner Harbor	POLA/POLB Sediment Survey	2006	Copper (diss.), DDT (diss.)
	SWAP Report	2003	Silver (diss.)
	Southern California Bight Regional Monitoring Program	2003	PCBs
Outer Harbor	City of LA Terminal Island Water Reclamation Plant (TIWRP) Biennial Assessment Report	2010-2011	Sediment (ERL): Cadmium, Copper, Nickel, DDT, Total PCBs
	TIRP Biennial Assessment Report	2008-2011	Total PCBs (tissue), Total DDT (tissue)
	POLA/POLB sediment survey	2006	Copper (diss.), DDT (diss.)
	SWAP Report	2003	Silver (diss.)
Consolidated Slip	Consolidated Slip Erosion Study	2011	Sediment (ERM): PCBs, DDT, Chlordane, Dieldrin Sediment (ERL): Arsenic, Cadmium, Chromium, Copper, Lead, Zinc, Mercury, Nickel, Silver, Total PCBs, DDT, PAHs, Chlordane, Dieldrin
	SCCWRP Atmospheric Deposition in LA/LB Harbor study	2006	Total DDT (diss.) and Total PCBs (diss.)
	Consolidated Slip Restoration Project Concept Plan Supplemental Report	2002	Sediment (ERM): Copper, Lead, Zinc, Mercury, Total PCBs, DDT, PAHs, Chlordane and Dieldrin

2.1.2 Characterization of Discharge Quality

Stormwater and non-stormwater discharges were characterized based on available data. The available receiving water monitoring data was used to evaluate potential stormwater and non-stormwater discharge data. This was done by calibrating the Los Angeles County Watershed Management Modeling System (WMMS) against the available data from the receiving water monitoring stations. The calibration procedures and the fits achieved are described in Section 1

Reasonable Assurance Analysis Approach. This calibration procedure provides a rough approximation of potential stormwater and non-stormwater discharges because the number of monitoring locations are highly limited. In addition, data will become available through the future Coordinated Integrated Monitoring Program (CIMP) Outfall Monitoring which will be utilized.

2.2 Water Body Pollutant Classification

Using the data analysis and results from additional monitoring reports, WBPCs were classified into one of the three MS4 Permit categories (Category 1-3). Those WBPCs with a TMDL were classified as Category 1, those WBPCs listed on the State's 303(d) list as impairing a particular water body segment were classified as Category 2, and those remaining WBPCs without an associated TMDL or on the State's 303(d) list, but showing exceedances of water quality criteria were classified as Category 3. A summary of these categorizations is presented in Table 2-10.

Table 2-10: Categorized Water Body-Pollutant Combinations

Water Body	Category 1 (TMDL)	Category 2 (303(d) List)	Category 3 (Other)
Dominguez Channel (lined portion above Vermont Ave)	Copper (diss.), Lead (diss.), Zinc (diss.), Toxicity	Indicator Bacteria, Ammonia, Diazinon	Cadmium(diss.), Chromium (diss.), Mercury (diss.), Thallium (diss.), Bis(2-Ethylhexl) phthalate, pH, Dissolved Oxygen
Torrance Lateral	Copper (diss.), Lead (diss.), Zinc (diss.)	Coliform Bacteria	Cadmium (diss.), Cyanide, pH, Ammonia, PCBs (sed.), DDT (sed.)
Dominguez Estuary (unlined portion below Vermont Ave)	Cadmium (sed.), Copper (diss. and sed.), Lead (diss., sed., & tissue), Zinc (diss. & sed.), DDT (tissue & sed.), PCBs (sed.), Chlordane (tissue & sed.), Dieldrin (tissue & sed.), PAHs (sed.), Benthic Community Effects, Sediment Toxicity	Ammonia, Coliform Bacteria	Arsenic (sed.), Chromium (sed.), Silver (diss. & sed.), Nickel (diss.), Mercury (sed.), Thallium (diss.)
Machado Lake	Trash, Total Phosphorus, Total Nitrogen, Ammonia, Chlorophyll-a, PCBs (sed.), DDT (sed.), Chlordane (sed.), Dieldrin (sed.), Dissolved Oxygen	None	E. coli, pH
Wilmington Drain	None	Coliform Bacteria, Copper (diss.), Lead (diss.)	Total Nitrogen, DDT (sed.), PCBs (sed.), Chlordane, Dieldrin (sed.)
LA Harbor[1] - Cabrillo Marina	DDT (tissue & sed.), PCBs (tissue & sed.), PAHs	None	None

Table 2-10: Categorized Water Body-Pollutant Combinations			
Water Body	**Category 1 (TMDL)**	**Category 2 (303(d) List)**	**Category 3 (Other)**
LA Harbor[1] - Consolidated Slip	Cadmium, Chromium, Copper, Lead, Mercury, Zinc, DDT (tissue & sed.), PCBs (tissue & sed.), PAHs (sed.), Chlordane (tissue & sed.), Dieldrin, Toxaphene (tissue), Benthic Community Effects, Sediment Toxicity	None	Arsenic, Silver, Nickel
LA Harbor[1] - Fish Harbor	Copper, Lead, Mercury, Zinc, DDT (tissue & sed.), PCBs (tissue & sed.), Chlordane, PAHs, Sediment Toxicity	None	None
LA/LB Inner Harbor[1]	Copper, Zinc, DDT (tissue & sed.), PCBs (tissue & sed.), PAHs, Benthic Community Effects, Sediment Toxicity, Indicator Bacteria	None	Copper (diss.), Silver (diss.)
LA/LB Outer Harbor[1]	DDT (tissue & sed.), PCBs (tissue & sed.), Sediment Toxicity	None	Cadmium, Nickel, Silver (diss.), Copper (diss. & sed.), Mercury
LA Harbor[1] - Inner Cabrillo Beach	Indicator Bacteria, DDT (sed. & tissue), PCBs (tissue & sed.)	None	None

[1] Los Angeles Harbor metals and organic pollutants issues are for sediment unless otherwise noted.

To assist with future prioritization efforts, the categorized WBPCs were divided into the subcategories described in Table 2-11.

Table 2-11: Categorized Water Body-Pollutant Combinations		
Category	**Water Body-Pollutant Combinations**	**Description**
1	**Category 1A:** WBPCs with past due or current Permit term TMDL deadlines with exceedances in the past 5 years.	WBPCs with TMDLs with past due or current MS4 Permit term interim and/or final limits. These pollutants are the highest priority for the current MS4 Permit term.
	Category 1B: WBPCs with TMDL deadlines beyond the Permit term with exceedances in the past 5 years.	The MS4 Permit does not require the prioritization of TMDL interim and/or final deadlines outside of the Permit term or USEPA TMDLs, which do not have implementation schedules. To ensure EWMPs consider long term planning requirements and utilize the available compliance mechanisms, these WBPCs should be considered during BMP planning and scheduling, and during CIMP development.
	Category 1C: WBPCs addressed in USEPA TMDL without a Regional Board adopted Implementation Plan.	
	Category 1D: WBPCs with past due or current Permit term TMDL deadlines but have there have been no exceedances in the past 5 years.	WBPCs where specific actions may end up not being identified because recent exceedances have not been observed and specific actions may not be necessary. The CIMP should address these WBPCs to support future re-prioritization.
2	**Category 2A:** 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements with exceedances in the past 5 years.	WBPCs with confirmed impairment or exceedances of RWLs. WBPCs in a similar class[1] as those with TMDLs are identified. WBPCs currently on the 303(d) List are differentiated from those that are not to support utilization of EWMP compliance mechanisms.
	Category 2B: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements that are not a "pollutant"2 (e.g., toxicity).	WBPCs where specific actions may not be identifiable because the cause of the impairment or exceedances is not resolved. Either routine monitoring or special studies identified in the CIMP should support identification of a "pollutant" linked to the impairment and re-prioritization in the future.
	Category 2C: 303(d) Listed WBPCs or WBPCs that meet 303(d) Listing requirements but there have been no exceedances in the past 5 years.	WBPCs where specific actions for implementation may end up not being identified because recent exceedances have not been observed (and thus specific BMPs may not be necessary). Pollutants that are in a similar class[1] as those with TMDLs are identified. Either routine monitoring or special studies identified in the CIMP should ensure these WBPCs are addressed to support re-prioritization in the future.
3	**Category 3A:** Other WBPCs that have exceeded in the past 5 years.	Pollutants that are in a similar class[1] as those with TMDLs are identified.
	Category 3B: Other WBPCs that are not a "pollutant"2 (e.g., toxicity).	WBPCs where specific actions may not be identifiable because the cause of the impairment or exceedances is not resolved. Either routine monitoring or special studies identified in the CIMP should support identification of a "pollutant" linked to the impairment and re-prioritization in the future.
	Category 3C: Other WBPCs that have exceeded in the past 10 years, but not in	Pollutants that are in a similar class[1] as those with TMDLs are identified.

Table 2-11: Categorized Water Body-Pollutant Combinations		
Category	**Water Body-Pollutant Combinations**	**Description**
	past 5 years.	
	Category 3D: WBPCs identified by the DC WMG.	No other WBPCs were identified for consideration in EWMP planning.

Those pollutants with similar fate and transport mechanisms that can be addressed with the same types of control measures were also grouped into classes. These classes include:

- Bacteria
- Metals
- Nutrients
- Trash
- Historical Organics (HO) – organic compounds including pesticides that are no longer in use such as PCBs and DDT
- Current Organics (CO) – organic Compounds such as pesticides and PAHs that are still in use
- To be determined (TBD) – conditions such as pH, dissolved oxygen, and toxicity that are not classified as pollutants and will need further investigation before grouping into other classes

The tables below list the subcategorized WBPCs for DC WMG (Table 2-12), Torrance Lateral (Table 2-13:), Dominguez Channel Estuary (Table 2-14), Machado Lake (Table 2-15), Wilmington Drain (Table 2-16), the Consolidated Slip (Table 2-17), and the rest of the Los Angeles Harbor areas (Table 2-18). Those designations that only apply to a specific weather condition (wet or dry) were marked as such. Exceedances of CTR WQOs for dissolved copper, lead, and zinc were observed within the past five years in both dry- and wet-weather in the Dominguez Channel, yet these constituents have been categorized separately due to the TMDL for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters only addressing wet-weather exceedances for these metals in the Channel. Refer to Table 2-11 for a description of the subcategories. Subcategorizations may change as more recent monitoring data becomes available for evaluation.

Table 2-12: Summary of Dominguez Channel Subcategorized WBPCs

Class	Constituents[1]	Subcategory
Metal	Dissolved Copper (Wet)	1A
Metal	Dissolved Lead (Wet)	1A
Metal	Dissolved Zinc (Wet)	1A
TBD	Toxicity	1D
Bacteria	Indicator Bacteria	2A
Nutrients	Ammonia (Dry)	2A
HO	Diazinon	2C
Metals	Dissolved Copper (Dry)	3A
Metals	Dissolved Lead (Dry)	3A
Metals	Dissolved Zinc (Dry)	3A
Metals	Dissolved Chromium (Dry)	3A
TBD	Cyanide	3A
TBD	pH	3B
Metals	Dissolved Cadmium	3C
Metals	Dissolved Mercury	3C
Metals	Dissolved Thallium (Dry)	3C
CO	Bis (2-Ethylhexl) phthalate	3C
TBD	Dissolved Oxygen	3C

[1] If the constituent is noted as wet or dry, then the priority is only based on wet- or dry-weather.
TBD = To Be Determined
HO = Historical Organics
CO = Current Organics

Table 2-13: Summary of Torrance Lateral Subcategorized WBPCs		
Class	**Constituents[1]**	**Subcategory**
Metal	Dissolved Copper (Wet)	1A
Metal	Dissolved Lead (Wet)	1A
Metal	Dissolved Zinc (Wet)	1A
Bacteria	Coliform Bacteria	2A
Metals	Dissolved Copper (Dry)	3A
Metals	Dissolved Lead (Dry)	3A
TBD	Cyanide	3A
TBD	pH	3A
Nutrients	Ammonia (Dry)	3A
Metals	Dissolved Zinc (Dry)	3C
Metals	Dissolved Cadmium	3C
HO	DDT	3C
HO	PCBs	3C

[1] If the constituent is noted as wet or dry, then the priority is only based on wet- or dry-weather.
TBD = To Be Determined
HO = Historical Organics

Table 2-14: Summary of Dominguez Channel Estuary Subcategorized WBPCs		
Class	**Constituents[1]**	**Subcategory**
Metals	Cadmium (Sediment)	1A
Metals	Copper (Dissolved and Sediment)	1A
Metals	Lead (Dissolved and Sediment)	1A
Metals	Zinc (Dissolved and Sediment)	1A
HO	DDT (Sediment)	1A
HO	PCBs (Sediment)	1A
HO	Chlordane (Sediment)	1A
HO	Dieldrin (Sediment)	1A
CO	PAHs (Sediment)	1A
TBD	Benthic Community Effects	1D
TBD	Sediment Toxicity	1D
Bacteria	Coliform Bacteria	2A
Nutrients	Ammonia (Dry)	2C
Metals	Arsenic (Sediment)	3A
Metals	Chromium (Sediment)	3A
Metals	Mercury (Sediment)	3A
Metals	Silver (Sediment)	3A
Metals	Dissolved Silver (Dry)	3C
Metals	Dissolved Nickel	3C
Metals	Dissolved Mercury (Dry)	3C
Metals	Thallium (Dissolved)	3C

Table 2-14: Summary of Dominguez Channel Estuary Subcategorized WBPCs		
Class	**Constituents[1]**	**Subcategory**

[1] If the constituent is noted as wet or dry, then the priority is only based on wet- or dry-weather.
TBD = To Be Determined
HO = Historical Organics
CO = Current Organics

Table 2-15: Summary of Machado Lake Subcategorized WBPCs		
Class	**Constituents[1]**	**Subcategory**
Trash	Trash	1A
Nutrients	Total Phosphorus	1A
Nutrients	Total Nitrogen	1A
TBD	Dissolved Oxygen	1A
Nutrients	Chlorophyll-a	1A
HO	PCBs (Sediment)	1B
HO	DDT (Sediment)	1B
HO	Chlordane (Sediment)	1B
HO	Dieldrin (Sediment)	1D
Nutrients	Ammonia	1D
Bacteria	E. coli (Dry)	3A
TBD	pH	3C

[1] If the constituent is noted as wet or dry, then the priority is only based on wet- or dry-weather.
TBD = To Be Determined
HO = Historical Organics

Table 2-16: Summary of Wilmington Drain Subcategorized WBPCs		
Class	**Constituents**	**Subcategory**
Bacteria	Coliform Bacteria	2C
Metals	Dissolved Copper	2C
Metals	Dissolved Lead	2C
Nutrients	Total Nitrogen	3A
HO	DDT (Sediment)	3A
HO	Chlordane (Sediment)	3A
HO	Dieldrin (Sediment)	3A
HO	PCBs (Sediment)	3C

HO = Historical Organics

Table 2-17: Summary of Consolidated Slip Subcategorized WBPCs		
Class	**Constituents**	**Subcategory**
Metals	Cadmium (Sediment)	1A
Metals	Chromium (Sediment)	1A
Metals	Copper (Sediment)	1A
Metals	Lead (Sediment)	1A
Metals	Mercury (Sediment)	1A

Table 2-17: Summary of Consolidated Slip Subcategorized WBPCs		
Class	**Constituents**	**Subcategory**
Metals	Zinc (Sediment)	1A
HO	DDT (Sediment)	1A
HO	PCBs (Sediment)	1A
CO	PAHs (Sediment)	1A
HO	Chlordane (Sediment)	1A
HO	Dieldrin (Sediment)	1A
HO	Toxaphene (Sediment)	1D
TBD	Benthic Community Effects	1D
TBD	Sediment Toxicity	1D
Metals	Silver (Sediment)	3A
Metals	Arsenic (Sediment)	3A
Metals	Nickel (Sediment)	3A

TBD = To Be Determined
HO = Historical Organics
CO = Current Organics

Table 2-18: Summary of Other Los Angeles Harbor Subcategorized WBPCs		
Class	**Constituents**	**Subcategory**
Fish Harbor		
Metals	Copper (Sediment)	1D
Metals	Lead (Sediment)	1D
Metals	Mercury (Sediment)	1D
Metals	Zinc (Sediment)	1D
HO	DDT (Sediment & Tissue)	1D
HO	PCBs (Sediment & Tissue)	1D
HO	Chlordane (Sediment)	1D
CO	PAHs (Sediment)	1D
TBD	Sediment Toxicity	1D
Inner Cabrillo Beach		
Bacteria	Indicator Bacteria	1A
HO	DDT (Sediment & Tissue)	1D
HO	PCBs (Sediment & Tissue)	1D
Cabrillo Marina		
HO	DDT (Sediment & Tissue)	1D
HO	PCBs (Sediment & Tissue)	1D
CO	PAHs (Sediment)	1D
Los Angeles/Long Beach Inner Harbor		
Bacteria	Indicator Bacteria	1D
Metals	Copper (Sediment)	1D
Metals	Zinc (Sediment)	1D
HO	DDT (Sediment & Tissue)	1D

Table 2-18: Summary of Other Los Angeles Harbor Subcategorized WBPCs		
Class	**Constituents**	**Subcategory**
HO	PCBs (Sediment & Tissue)	1D
CO	PAHs (Sediment)	1D
TBD	Benthic Community Effects	1D
TBD	Sediment Toxicity	1D
Metals	Dissolved Copper	3C
Metals	Dissolved Silver	3C
Los Angeles/Long Beach Outer Harbor		
HO	DDT (Sediment & Tissue)	1A
HO	PCBs (Sediment & Tissue)	1A
TBD	Sediment Toxicity	1D
Metals	Cadmium (Sediment)	3A
Metals	Copper (Sediment)	3A
Metals	Nickel (Sediment)	3A
Metals	Mercury (Sediment)	3C
Metals	Dissolved Copper	3C
Metals	Dissolved Silver	3C

TBD = To Be Determined
HO = Historical Organics
CO = Current Organics

Some WBPCs, such as sediment toxicity and benthic community effects are classified as not showing exceedances in the past five years, primarily due to the fact that few samples have been collected in the last 5 years. The POLA and POLB are currently conducting bioaccumulation modeling and studies, fish tissue studies, and additional sediment triad studies to ascertain observed effects associated with elevated sediment concentrations of toxic compounds in the Harbor. These WBPCs can be reclassified when more recent data becomes available.

Per Part VI.C.2.a.iii (pages 51-52), pollutants for which there are exceedances of receiving water limitations, but which the water body is not identified as impaired on the 303(d) List will be addressed in the EWMP process. For most of the watershed, the most critical requirements are associated with the DC and LA Harbor Waters Toxic Pollutants TMDL as well as the Machado Lake Nutrients and Machado Lake Toxics TMDLs.

In order to address the limiting pollutant, various control measures will be implemented.
In addition to addressing the priority pollutant, the DC WMG will also comply with the requirements set forth by the MS4 Permit in regards to Category 2 and 3 pollutants. Pursuant to the MS4 Permit, Parts VI.C.2.a.ii.(5) (pages 50-51) and VI.C.2.a.iii.(2).(d) (page 52), interim and final milestones for WBPCs identified as Category 2 or 3 in Section 2 will be established as described below. These milestones may be established as a percent of the MS4 drainage area required to meet WQOs with dates as soon as possible and the time between dates not exceeding one year. If the dates established in the EWMP as the final compliance dates are beyond the term of the MS4 Permit there will be additional requirements as follows:

- **Category 2** (WBPCs with a pollutant identified on the 303(d) list):
  - Areas that have regional EWMP projects will continue to implement control measures established in the EWMP.
  - Other areas will initiate development of a stakeholder proposed TMDL.

- **Category 3** (WBPCs with a pollutant not identified in a TMDL or listed on the 303(d) list):
  - Areas that have regional EWMP projects will continue to implement control measures established in the EWMP.
  - Other areas will request that the Regional Board approve EWMP modifications to include additional WBPCs.

2.3 Source Assessment

Due to the nature of the DC WMG being fully built out, highly impervious, and highly industrial and the limited resolution of the water quality data available, the source assessment was limited to an initial first look based on land use and watershed areas according to the Los Angeles County-Wide Structural BMP Prioritization Methodology Guidance Manual (2006).

2.3.1 Catchment Priority Index

The catchment priorities index (CPI) is a means of ranking sub-watersheds against one another based on land use to identify the higher priority watersheds as demonstrated in Attachment C, Figure C.3. The method is based on Event Mean Concentrations (EMCs) developed for different land use types and the areal weighting of different land uses within a given subwatershed. The subwatersheds are ranked against one another to develop a CPI score for each subwatershed. The watersheds with the highest score are considered the highest priorities. The analysis was completed using the GIS platform ArcGIS. The GIS analysis was based on data developed by the City of Los Angeles and the County of Los Angeles.

The initial source assessment took into account which sub-watersheds could be contributing to downstream water quality impairments and exceedances. Priority pollutants such as metals and bacteria were weighted heavier than pollutants of less concern in the watershed. Additional weight was given to sub-watersheds potentially contributing to water body segments with TMDLs or 303(d) listed impairments for particular pollutants.

2.3.2 Potential Sources of Contamination

There are several potential point and nonpoint sources of contamination in the DC WMG. Point sources include stormwater and urban runoff flowing through the MS4 as well as other MS4 discharges, such as those from refineries, generating plants, port operations, and the Terminal Island Water Reclamation Plant that discharges into the Outer Harbor. MS4 outfalls are shown in Figure C.4 in Attachment C. Nonpoint sources include contaminated sediments already in receiving waters and atmospheric deposition.

Major sources of metals contamination in the Los Angeles Harbor may be attributed to the large number of vessels that utilize the facility. Copper contamination in the Harbor may be attributed to the copper containing anti-fouling paints used to protect boats and the wood preservatives used on docks and pilings.

The DC WMG also contains two Superfund Sites that are historically large contributors of organic pollutants: the Montrose Chemical Corporation Site, and the Del Amo Facility Site. The Montrose site manufactured DDT from 1947 to 1982 and the compound can still be found in the soils around the site. Stormwater runoff from this site can contain DDT from the soils. The Del Amo Facility was once the center of large-scale industrial activities such as production of synthetic rubber, a styrene plant, and a butadiene plant. Groundwater and soils in the area are contaminated with volatile organic compounds (VOCs), PAHs, and minor amounts of pesticides, PCBs, and heavy metals. The two Superfund Sites are located next to one other near the Torrance Lateral as shown in Figure C.4 in Attachment C.

Future monitoring data and results will refine the location of contamination, which in turn will refine the identification of potential sources of contamination.

2.4 Approach to Prioritization

To complete an initial prioritization of the WBPCs, pollutants were sub-categorized based on TMDL compliance schedules and exceedance frequencies as outlined in Section 2.2. Those WBPCs that have TMDLs with past due interim and/or final deadlines or with interim and/or final deadlines within the MS4 Permit term will be prioritized higher than those pollutants without TMDLs or with TMDL schedules outside the MS4 Permit term. Other receiving water considerations will include pollutants on the 303(d) list and WBPCs that show exceedances within the last 5 years. The requirements for WBPCs categorized as Category 2 or 3 will be addressed as described below.

Several of the water quality issues identified for the Dominguez Channel, Machado Lake, and the LA Harbor can be addressed using similar Best Management Practices (BMPs) designed to address existing TMDLs. In such cases similar compliance schedules may be applied as used in the existing TMDL. This is based on similarities between WBPCs, as explained below. The following general approach was applied to the two categories of WBPCs.

Category 2 - Constituents on the State's 2010 303(d) List

Those WBPCs on the State's 2010 303(d) list that are not addressed by a TMDL were evaluated for their similarity to WBPCs that are addressed by TMDLs as follows:

1. Similar pollutant class as a TMDL-addressed constituent: Schedule according to an established TMDL (e.g., metals that do not have TMDLs are treated similarly to metals that do. The non-TMDL metals have similar chemical characteristics to the TMDL metals and, therefore, will be removed by the same measures similar to the TMDL metals).
2. Different pollutant class than a TMDL-addressed constituent: Develop a schedule with milestones to address the exceedances. These milestones include monitoring under the Coordinated Integrated Monitoring Program (CIMP) and source identification and control over the time frame for implementation of the TMDL with the longest time frame (e.g., the Dominguez Channel does not have a TMDL for a WBPC similar to ammonia so this constituent is handled separately). As specified in part IV.E.2.b and IV.E.2.d of the permit, implementation schedules for pollutants not addressed by a TMDL are fulfilled based on implementation of an EWMP.

Category 3 - Constituents Exceeding Water Quality Objectives, but not on the 2010 303(d) List

Receiving water exceedances for WBPCs not addressed in a TMDL or on the State's 2010 303(d) list were also evaluated for their similarity to WBPCs that are addressed with a TMDL. Due to the limited amount of recent water quality monitoring data available for this watershed for several water bodies and constituents, it was determined that additional monitoring would be required for most constituents in this category to confirm exceedances of water quality objectives.

Future water quality monitoring conducted as part of the CIMP will further characterize and refine the locations of contamination, which will in turn refine the characterization, source identification and, potentially, prioritization.

2.5 Compliance Schedule

Compliance schedules with applicable milestones were developed for the receiving water bodies in the DC WMA. Attachment X shows the detailed schedule. Notes below explain some additional considerations. In general, as shown in Attachment X, pollutants for which there are not adopted TMDLs will be reduced to the planning objectives in conjunction with pollutants for which there are adopted TMDLs because of the multi-pollutant effectiveness of the planned BMPs.

Dominguez Channel

The *TMDL for Toxic Pollutants in the Dominguez Channel and Greater Los Angeles and Long Beach Harbors* (DC/Harbor Toxics TMDL) addresses metals, historical organics, and current organics on a timeframe from March 23, 2012 to March 23, 2032. The DC/Harbor Toxics TMDL contains three implementation phases for the Dominguez Channel, Torrance Lateral, and Dominguez Channel Estuary, and three implementation phases for the Greater Los Angeles and Long Beach Harbor Waters (including Consolidated Slip). The Phases are summarized as follows:

- Phase I: Reduce sediment transport from point sources.
- Phase II: Implement additional BMPs and site remedial actions based on the success of upstream source control, evaluation of TMDL monitoring data collected during Phase I, and target point source reduction activities.
- Phase III: Implement secondary and additional remedial actions as necessary to be in compliance with final allocations by the end of the implementation period.

These implementation phases are not assigned load reduction interim targets in the DC/Harbor Toxics TMDL, but they do provide implementation milestones that can be attributed to other constituents in a similar class (e.g., metals, historical organics, and current organics) that are not addressed in the TMDL. Because no numeric milestones are attributed to the implementation phases, the following interim numeric milestones were developed for the EWMP:

- Phase I: 25 percent reduction to the receiving water limitation in the constituent compared to a baseline established through the RAA Process in Section 1.
- Phase II: 75 percent reduction to the receiving water limitation in the constituent compared to a baseline established through the RAA Process in Section 1.
- Phase III: Attainment of established receiving water limitations.

These numeric milestones are based on the time period assigned for each phase in the DC/Harbors Toxics TMDL, with Phase I to be implemented within five years of the effective date of the TMDL, Phase II to be implemented within the subsequent ten years, and Phase III to be implemented within the final five years.

Those constituents on the 303(d) list, for which a TMDL has not yet been established, would normally require the development of a TMDL. Because a large portion of the data used for the Water Quality Priorities portion of the EWMP was more than five years old, additional monitoring under the CIMP is recommended as an initial milestone. This will help to assess whether exceedance issues are current and in need of further action or if implementation programs established for other TMDLs are already addressing these other water quality issues. It is likely that sediment management measures and BMPs that will be implemented through the initial phases of the DC/Harbor Toxics TMDL will also reduce other constituents. Progress toward reducing exceedances of these constituents can be monitored through the CIMP and will be assessed at the completion of Phase I (March 23, 2017).

During the development of the DC/Harbor Toxics TMDL, the U.S. EPA found that Diazinon, a WBPC currently on the 2010 303(d) list for the Dominguez Channel, was not at levels above water quality benchmarks for this water body. The assessment concluded that the water body was attaining standards for Diazinon and did not require the development of a TMDL for that pollutant. Since its banning in 2005, Diazinon levels have decreased in the Dominguez Channel and are thought to no longer be the cause of impairment to the water body. The constituent will continue to be monitored under the CIMP efforts, and monitoring results will be used to support delisting efforts.

During the renegotiation of the Consent Decree, the U.S. EPA determined that ammonia levels in the Dominguez Channel and the Dominguez Channel Estuary were meeting water quality objectives. This WBPC remains on the 2010 303(d) list for these water bodies, though the State may consider delisting it

during the next 305b/303d Integrated Report. For this reason, ammonia remains a water quality priority, but is assumed to be in compliance with water quality objectives. Monitoring under the CIMP efforts will be used to either support or negate its delisting as a cause of impairment.

If constituents not addressed by a TMDL that are not in a chemical class of those constituents addressed by a TMDL show ongoing exceedances, an action plan will be developed to identify and mitigate sources of those pollutants within the time frame of complete implementation of the DC/Harbor Toxics TMDL. Progress toward reducing loading of the constituents will be assessed at the end of Phase I, and, if necessary, treatment measures for these water quality issues incorporated into BMPs for Phase II of the DC/Harbor Toxics TMDL. These constituents will continue to be monitored under the CIMP and adaptive management will be utilized to ensure BMPs are effective at reducing concentrations in receiving waters. If deemed necessary, an action plan will be developed during Phase II. This reasoning was applied to constituents such as bacteria. This was considered a reasonable planning horizon where the watershed could be evaluated for the effectiveness of BMPs on these constituents and additional measures taken, if necessary.

Machado Lake

Monitoring requirements for the *TMDL for Eutrophic, Algae, Ammonia, and Odors (nutrient) in Machado Lake* (Machado Lake Nutrients TMDL) and *Machado Lake Pesticides and PCBs TMDL* (Machado Lake Toxics TMDL) will monitor the success of implemented projects under the CIMP efforts. The *Multipollutant TMDL Implementation Plan for the County of Los Angeles Unincorporated Area of the Machado Lake Watershed* developed in response to the TMDLs includes monitoring and reporting programs for nutrients, toxics, metals, and bacteria in areas tributary to Machado Lake and will help identify potential sources of the pollutants. Data from both programs will be used to determine if Machado Lake needs to be listed as impaired for bacteria or if current rehabilitation efforts are effective at reducing the constituent concentrations. Additional information on the implementation plans and projects funded under Los Angeles Proposition O for the Machado Lake TMDLs are included in Section 0.

Wilmington Drain

No TMDL has been established for the Wilmington Drain, though one for coliform bacteria and one for metals (dissolved copper and dissolved lead) were scheduled to be issued in 2014 and 2019, respectively. During the renegotiation of the Consent Decree, the U.S. EPA determined that metals in the Wilmington Drain were meeting water quality objectives and that TMDL development was not necessary at that time. Metals remain on the State's 2010 303(d) list for the Wilmington Drain, but may be considered for delisting during the next 305b/303d Integrated Report. Both metals and bacteria will be monitored through the CIMP and will be addressed through TMDL development or in accordance with the approach outlined for constituents not addressed by a TMDL that are not in the same chemical class as those constituents addressed by a TMDL. As noted for the Dominguez Channel, it was assumed that if monitoring showed continued exceedances of water quality criteria, source identification and additional measures would be taken to achieve water quality criteria in the timeframe of complete implementation of the DC/Harbor Toxics TMDL.

Other constituents that showed exceedances of water quality objectives for the Wilmington Drain, but are not on the State's 303(d) list, include total nitrogen and historical organics (DDT, chlordane, Dieldrin, and PCBs). The Wilmington Drain is included in the monitoring programs for the Machado Lake Nutrients TMDL and Machado Lake Toxics TMDL. Because of this, the Wilmington drain will be monitored for nutrients and historical organics under the CIMP.

Los Angeles Harbor Waters

The DC/Harbor Toxics TMDL contains three implementation phases for the Greater Los Angeles and Long Beach Harbor Waters (including Consolidated Slip). These phases and the associated compliance timelines are the same as are summarized above for the Dominguez Channel. The same implementation

milestones described for the Dominguez Channel will be applied to the Los Angeles Harbor Waters for metals and toxics.

The *Los Angeles Harbor Bacteria TMDL (Inner Cabrillo Beach and Main Ship Channel)* (LA Harbor Bacteria TMDL) addressed bacteria exceedances in the Main Ship and Inner Cabrillo Beach portions of the Los Angeles Harbor. Monitoring will continue at both these sites, though compliance targets have been attained at the Main Ship Channel. Details on the planned projects and plans for LA Harbor are provided in Section 0.

3. Reasonable Assurance Analysis Approach

As specified in Part VI.C.1.g of the MS4 Permit, an EWMP comprehensively evaluates the opportunities within the participating jurisdictions for collaborations on multi-benefit regional projects that, wherever feasible, retain all non-stormwater and stormwater runoff from the 85th percentile, 24-hour storm event from the tributary watershed. These projects are also referred to as regional EWMP projects. Based on the MS4 Permit, areas that drain to regional EWMP projects are considered in compliance with all water quality standards, while all other areas have to be modeled in an RAA to demonstrate compliance. Control measures, inclusive of distributed BMPs such as green streets, modified MCMs, and regional BMP projects, will be included in the RAA to demonstrate that compliance criterion are satisfied.

This section explains the methodology of the RAA for the DC WMG EWMP as summarized below. The methodology used for conducting the RAA is based on the DC WMG EWMP Work Plan (2014). The RAA developed for the DC WMG is in conformance with the RAA Guidelines developed by the Regional Water Quality Control Board (RWQCB or Regional Board).

- The Watershed Management Modeling System (WMMS) developed by the Los Angeles County Flood Control District (LACFCD) was calibrated with flow and water quality data specific to the DC WMG and then used to estimate the current pollutant loads and provide an initial evaluation of the types and quantities of control measures needed to achieve MS4 Permit objectives.
- The Load Simulation Program in C++ (LSPC) software was used to estimate the pollutant load reductions expected from different control measure implementation scenarios through a calibration process. This step is part of an iterative process that evaluates the required implementation levels at various target time periods to demonstrate compliance with MS4 Permit objectives.

Attachment Y discusses in detail the model setup, calibration and validation process associated with stormwater flow through the system and the corresponding water quality. The incremental approach for demonstrating compliance with MS4 Permit requirements is also discussed and includes the implementation of modified MCMs, industrial and other permitted sites, regional BMP projects, and green streets. A cost estimate and schedule for implementation have been developed for inclusion in the EWMP based on the RAA and are provided in later sections of this document.

The purpose of the RAA is to demonstrate that the implementation scenarios proposed in the EWMP will meet the MS4 Permit effluent and receiving water limits for priority pollutants of concern within the DC WMG. This is done by demonstrating load reductions for the 85th percentile 24-hour storm and the 90th percentile load. Load reductions are used instead of concentrations. This is necessary for two reasons: first, the entire watershed (Dominguez Channel Watershed Management Area [DC WMA]) is not participating as part of the DC WMG and the approaches they are taking may be different than the DC WMG; second, capture and infiltration systems will reduce the loads delivered, but may not change concentrations of flows that reach the regulated water bodies. Total loads in the water bodies will be tied to contributions from all entities within the watershed. For these reasons, load reductions are considered a better metric for analysis.

3.1 Modeling System

The RAA for the DC WMG was conducted using the BMP modeling system Watershed Management Modeling System (WMMS). WMMS is a regional model developed by the LACFCD and is comprised of two main components: Loading Simulation Program in C++ (LSPC) and the Regional Optimization system. LSPC was developed from the Hydrologic Simulation Program - FORTRAN (HSPF) used for simulating hydrology, sediment, and general water quality. The model generates runoff based on rainfall, snow, and groundwater inputs, estimates pollutant loading and transport based on point source data, aerial

deposition, and non-point source loadings, estimates chemical and transport interactions within stream reaches, and can provide water quality data based on the interactions for specified locations. WMMS and the LSPC modeling component are included in the list of approved watershed models for conducting a RAA outlined in Part VI.C.5.b.iv.(5) of the MS4 Permit.

Additional information regarding WMMS and LSPCS is available from the Los Angeles County Department of Public Works (LACDPW) (2008, 2010a, 2010b, 2010c, 2011, 2013). Information pertaining to the LSPC engine is available from the United States Environmental Protection Agency (USEPA, 2003). The documents can be found on the WMMS homepage (http://dpw.lacounty.gov/wmd/wmms/) where it can also be downloaded.

3.2 RAA Process Approach

The following sections discuss the RAA process approaches for wet weather and dry weather.

3.2.1 Dry-Weather Modeling Approach

The approach to the dry-weather portion of the DC WMG RAA was to evaluate the volume and sediment reduction potential provided by proposed regional and distributed BMP projects to estimate how much of the dry-weather flows would be addressed. This approach does not include the use of a hydrologic predictive model due to data set limitations and significant spatial variation throughout the DC WMG in terms of anticipated dry-weather flows. Dry-weather flows were evaluated using measured flow rates where available, otherwise estimates of daily yields were used. Estimated daily yields were derived from local dry-weather flow monitoring data within the region and is summarized in Table 3-1. Flows captured through regional BMP implementation were subtracted from the total assumed non-stormwater flows to quantify pollutant load reductions which are based on the ratio of total flow reduction. The simplest case is 100 percent capture which prevents all flows from reaching receiving waters, thus there is no load and the load reduction is equal to 100 percent. The BMPs used for this analysis are discussed further in Section 4.

Table 3-1: Average Monthly Dry-Weather Flow in DC WMG

Month	Average Flow (cfs)	Average Flow (cfs) / Acre
January	5.54	0.00026
February	6.71	0.00032
March	6.95	0.00033
April	7.50	0.00035
May	5.40	0.00025
June	8.61	0.00041
July	6.45	0.00030
August	5.20	0.00024
September	4.74	0.00022
October	5.68	0.00027
November	4.30	0.00020
December	4.71	0.00022

3.2.2 Wet-Weather Modeling Approach

The wet-weather RAA approach allowed for estimating MCM and BMP implementation to meet Water Quality Objectives (WQOs) and incorporate DC WMG agency preferences regarding exceedance risk

tolerance, pollutant prioritization, and structural BMP implementation scenarios, while considering stakeholder input through a transparent process.

The wet-weather RAA approach involved the estimation of both the existing pollutant loads (baseline) and target load reductions as a percentage of the total load. WMMS provided optimized load reduction targets, recommended distribution of BMPs, and cost estimates, however, limited guidance on BMP placement is provided and the model does not optimize bacteria or trash Total Maximum Daily Load (TMDL) compliance as required by the MS4 Permit.

Once the baseline conditions were estimated, watershed control measures were selected and modeled to be implemented over time to meet target Waste Load Allocations (WLAs). The selected control measures, such as regional BMP projects, distributed BMPs (green streets), and Minimum Control Measures (MCMs), were then modeled at various stages within the implementation time frame to estimate the quantity, location, and timing of BMP implementation to meet the interim and final WLAs applicable to the DC WMG. Targets for the RAA are based on interim time steps throughout the MS4 Permit time frame, which were presented in the DC WMG EWMP Work Plan (2014) and are summarized below:

- March 10, 2010 (Final WLAs Los Angeles Inner Harbor Bacteria TMDL)
- March 6, 2016 (Final WLAs Machado Lake Trash TMDL)
- September 11, 2018 (WLAs Machado Lake Nutrients TMDL)
- September 30, 2019 (Wet-Weather WLAs Machado Lake Pesticides and PCBs TMDL)
- September 30, 2025 (Internal Date for Construction Schedule Evaluation)
- March 23, 2032 (Wet-Weather Freshwater WQBEL Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL)

3.3 Modeling Approach

Demonstrating compliance through the RAA is an iterative process. The model includes different BMP scenarios at the compliance time steps and different approaches to BMP implementation are modeled to evaluate the most cost effective approach. The iterative process involves model calibration, model validation, baseline simulation, evaluation of the limiting pollutant, evaluation of required volume and load reductions, and control measure implementation, all of which are further detailed in Attachment Y. A brief overview is presented in the sections below.

3.3.1 Model Calibration

LSPC Calibration

Calibration refers to the adjustment or fine-tuning of modeling parameters to reproduce model outputs that match, within some tolerable variance, observations of field monitoring data. The goal of the LSPC model calibration was to obtain physically realistic model predictions by selecting parameter values that reflect the unique characteristics of the DC WMA. Spatial and temporal aspects were evaluated through the calibration process. Model calibration and validation were necessary to demonstrate the calibrated model properly assessed all the model parameters and modeling conditions that can affect model results for hydrologic and water quality analyses. The Regional Board provided acceptable model calibration criteria in Table 3.0 of the RAA Guidelines.

Water Quality Calibration

The LACFCD operates the Los Angeles County Monitoring Program to provide technical data and information to support effective watershed stormwater quality management programs in Los Angeles County which includes MES S28 as previously mentioned. MES are equipped with automated water samplers and stage recorders that collect both composite and grab samples during storm events. The

subwatershed tributary to MES S28 is comprised of 42 subbasins within the greater DC WMA. Although MES S28 is located in the upper half of the DC WMA, the subwatershed land use and hydrological characteristics are representative of the entire DC WMA with respect to water quality constituent composition and concentrations. As more water quality data is collected through the Coordinated Integrated Monitoring Program (CIMP), validation and fine tuning of the water quality parameters may be possible. The data collected at MES S28 is collected as an event mean concentration (EMC), which is done by either collecting one sample throughout the event or combining multiple samples collected throughout time into a combined sample for lab analysis. Event pollutographs have not been collected at MES S28, where the collected (observed) sample concentrations are averaged over the length of the rain event or a single grab sample is collected. The model is run on a daily basis and the simulated daily values are averaged over the time frame of the observed rain event. For example, an observed rain event may last two to three days and the observed EMC is derived from the number of samples collected (at the particular location) and mixed together and averaged over the length of event. The simulated results are taken from the same time period and averaged to derive a simulated EMC.

The model used for the DC WMG RAA was calibrated based on the following water quality calibration parameters.

- Total Suspended Solids (TSS)
- Metal parameters – copper, lead, and zinc
- Fecal coliform
- Total nitrogen and total phosphorus

3.3.2 Model Validation

After the model was calibrated it was validated. During the calibration effort, hydrology, sediment, and general water quality parameters were varied to develop a best fit of Hydrologic Response Unit (HRU) and EMC responses. The validation effort evaluated responses at tributary stations (TS) where the record is not long enough to be used for calibration, but may be used to evaluate performance of the model by comparing simulated model results with the observed record at each TS. The tributary stations are located at the following locations, all within LACFCD facilities:

- TS 19: Reinforced concrete rectangular channel at Figueroa Street, south of Del Amo Boulevard
- TS 20: Del Amo Channel - reinforced concrete trapezoidal channel at Avalon Boulevard
- TS 21: Reinforced concrete rectangular channel near 173rd Street and Merit Avenue
- TS 22: Hollypark Drain - reinforced concrete rectangular channel at 135th Street
- TS 23: Yukon Lateral - reinforced concrete rectangular channel at Crenshaw Boulevard
- TS 24: Dominguez Channel - reinforced concrete box near 116th Street and Isis Avenue

The validation effort used simulated model results of the general water quality constituents – TSS, copper, lead, zinc, fecal coliform, total nitrogen, and total phosphorus, and compared them to the observed records at TS19 – 24. Validation of the baseline condition at the various temporary stations has bias numbers that reflect the lack of long term records and the potential issue of the EMC of observed samples not being representative of the event pollutographs during collection. It is expected that as more data is collected through CIMP efforts, the calibration of the model may be refined for areas tributary to the TS locations.

3.3.3 Baseline Simulation

A baseline analysis was performed as part of the DC WMG RAA which represents the current watershed condition with the currently implemented stormwater programs. Stormwater runoff was simulated based on the time series record of rainfall between October 2002 and September 2012. This period represents

the most recent 10 years of record as required by the MS4 Permit. The water quality constituent mass loading is estimated by multiplying the stormwater runoff volume by the water quality constituent concentration. As part of the baseline analysis, the industrial permitted and other permitted facilities were identified. These facilities are modeled as compliant, as they are covered under a stormwater permit and not regulated by the jurisdiction in which they are located. These facilities are illustrated and listed in Attachments L and M.

The baseline hydrology and simulated constituent loading serves as the basis for compliance. Watershed control measures, including structural and non-structural BMPs, will be implemented over time to meet the required load reductions. The load reductions represent the difference between the baseline conditions and the water quality objectives. The 85th percentile, 24-hour rainfall event baseline simulation is based on the LACFCD 85th percentile rainfall isohyets and unit hyetograph, consistent with the Standard Urban Stormwater Mitigation Plan (SUSMP) and Low Impact Development (LID) methods used within the County. The loads for this event are generated by the model. The volume of runoff for capture under this criterion is estimated from the LSPC output to be 1,523 acre-feet.

The 90th percentile load baseline is estimated from the 2002-2012 water years based on the loads generated before any BMPs are implemented. Table 3-2 summarizes the results of the LSPC simulation of the load analysis. The table demonstrates that the 90th percentile load exceeds the WQO for all constituents with associated TMDLs. The objective loads are the final target for the simulated constituents.

Table 3-2: 90th Percentile Baseline Load Analysis

Constituent	Storm Event	P_{90} Load (kg)	Objective Load (kg)	Objective Conc.
Copper	12/6/2010	55.09	2.43	9.7 µg/L
Lead	2/3/2008	11.55	78.28	42.7 µg/L
Zinc	12/18/2007	206.19	73.15	69.6 µg/L
Fecal Coliform	2/20/2004	1.83E+16 MPN	4.24E+12 MPN	400 MPN/100mL
Nitrogen	2/3/2008	4,178.56	1,833.15	1.0 mg/L
Phosphorus	2/1/2004	373.33	41.80	0.1 mg/L

Table 3-3 summarizes the results of the LSPC simulation for the water years beginning the first day of October and ending the final day of September from 2002 to 2012. The table compares the six major water quality constituents with adopted TMDLs and identifies the annual load and corresponding volume for each year analyzed. The average annual loads are also provided for the simulation period.

Table 3-3: Annual Loads and Volume

Start	End	Volume (ac-ft)	TSS (kg)	Copper (kg)	Lead (kg)	Zinc (kg)	Fecal Coliform (MPN)	Total Nitrogen (kg)	Total Phosphorus (kg)
10/1/02	9/30/03	28,176	5,751,624	1,652	357	6,609	5.26E+17	128,488	11,645
10/1/03	9/30/04	16,124	3,186,236	1,069	246	4,678	2.67E+17	92,126	8,072
10/1/04	9/30/05	63,052	10,135,667	2,479	460	8,099	1.07E+18	170,289	17,009
10/1/05	9/30/06	17,258	4,077,368	1,471	340	6,492	2.75E+17	127,412	11,065
10/1/06	9/30/07	4,260	2,013,598	923	207	4,141	5.85E+16	83,243	7,144
10/1/07	9/30/08	26,364	4,259,504	1,142	253	4,743	4.75E+17	94,214	8,525
10/1/08	9/30/09	16,176	3,189,703	1,029	238	4,507	2.68E+17	88,229	7,730
10/1/09	9/30/10	32,110	6,605,300	1,953	386	6,935	5.79E+17	140,018	13,301

Table 3-3: Annual Loads and Volume									
Start	**End**	**Volume (ac-ft)**	**TSS (kg)**	**Copper (kg)**	**Lead (kg)**	**Zinc (kg)**	**Fecal Coliform (MPN)**	**Total Nitrogen (kg)**	**Total Phosphorus (kg)**
10/1/10	9/30/11	40,607	7,036,469	1,978	399	7,317	7.06E+17	148,667	14,002
10/1/11	9/30/12	12,367	3,638,359	1,435	337	6,342	1.93E+17	122,404	10,543
Average Annual:		**25,649**	**4,989,383**	**1,513**	**322**	**5,986**	**4.42E+17**	**119,509**	**10,904**

3.3.4 Evaluation of Required Volume and Load Reductions

The DC WMG RAA examines the 85th percentile, 24-hour storm event volume and the 90th percentile constituent load to estimate the limiting pollutant and the corresponding volumes of required treatment. The limiting pollutant is the constituent with the highest mass load associated with a relevant TMDL. This section discusses the limiting pollutant evaluation, 85th percentile, 24-hour storm volume, and the 90th percentile, 24-hour storm load. These factors establish the control measure implementation requirements. Evaluation of the limiting pollutant requires estimating the volumes and loads associated with the 85th percentile, 24-hour runoff volume and the 90th percentile load for baseline conditions and multiple pollutants. Once these values are estimated, the limiting pollutant can be evaluated. The limiting pollutant is that pollutant for which the greatest amount of volume control is required to achieve the 90th percentile load reduction.

85th Percentile, 24-Hour Storm Event Volume

The 85th percentile, 24-hour storm event represents the rainfall event that is greater than 85 percent of all rainfall events over 0.1 inches in a 24-hour period. The 85th percentile isohyetal map developed by LACDPW was used to estimate the appropriate rainfall value for each subarea within the DC WMA. The total rainfall for each subarea was distributed temporally over the 24-hour period using the Los Angeles County unit hyetograph to remain consistent with the SUSMP and LID criteria. This rainfall event was placed in a rainfall file for use with LSPC and the model was run to estimate runoff volumes to compare the 90th percentile volumes on an equal basis. Another analysis was done using the LACDPW Tc (time of concentration) Calculator, developed to simplify use of the modified rational method. The results from LSPC and the Tc Calculator models were reasonably similar and so the LSPC output was used in all future evaluations of the runoff volume from the 85th percentile, 24-hour storm. Figure 1 shows the rainfall hyetograph of the 85th percentile, 24-hour storm, along with the associated runoff hydrograph for the DC WMG. The total runoff volume for the 85th percentile, 24-hour storm is 1,523 acre-feet within the DC WMG jurisdiction.

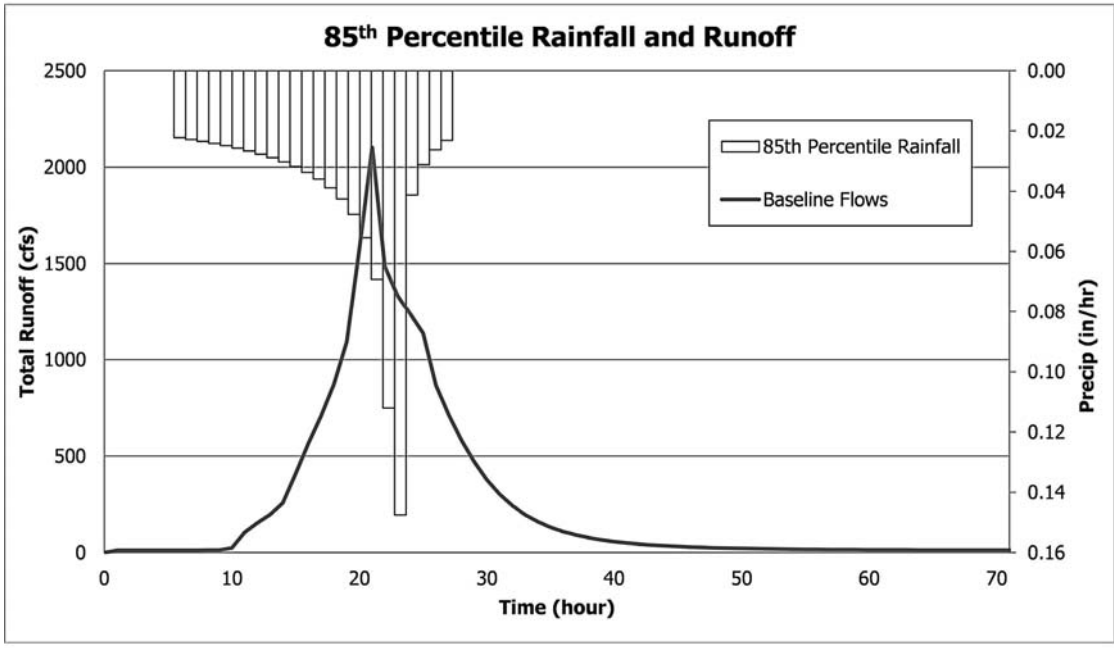

Figure 1: 85th Percentile, 24-Hour Storm Hyetograph and Runoff Hydrograph

90th Percentile, 24-Hour Storm Event Constituent Load

The 90th percentile load related to entire DC WMG was estimated using LSPC. The 90th percentile constituent loads represent the daily constituent loads that are greater than 89 percent and less than 10 percent of all simulated loads at the output station. The method for estimating the 90th percentile load was to sort all flow days greater than 63 cubic feet per second (cfs) from the calibrated hydrology simulation model for the time series beginning on October 1, 2002 and ending on September 30, 2012. This method is consistent with the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL. Any flow days less than 63 cfs were considered dry-weather and were removed from the analysis and treated separately. Flow days greater than 63 cfs have simulated hourly constituent loads in concentration units associated with model storm events and an hourly storm volume was estimated from the runoff hydrograph. The hourly and daily mass loads were the product of the simulated storm volume and the simulated hourly constituent concentration for DC WMG flows. The 90th percentile load was estimated from the simulated daily load. Concentration units ranged from micrograms per liter (µg/L) for metal constituents to milligrams per liter (mg/L) for nitrogen and phosphorus to number per liter (#/L) for fecal coliform. The volume capture for the 90th percentile load was estimated on the day of the actual event plus the following day if flows were greater than 63 cfs on the second day.

Baseline simulations were run with no storm runoff volume reduction. Table 3-4 summarizes the six water quality constituents and the date of the 90th percentile event derived from the simulated model results following the criteria previously outlined in the preceding paragraph. The volume associated with the 90th percentile load is shown along with the expected and objective concentrations and loads.

Table 3-4: 90th Percentile Constituent Load Events

Constituent	Date	Volume[1] (ac-ft)	Concentration[2]			Load[3]		
			Units	Expected	Objective[3]	Units	Expected	Objective
Copper	11/6/2002	1129.93	µg/L	112.74	kg	157.04	11/6/2002	1129.93
Lead	12/12/2011	1547.37	µg/L	19.49	kg	37.18	12/12/2011	1547.37

Table 3-4: 90th Percentile Constituent Load Events								
Constituent	Date	Volume[1] (ac-ft)	Concentration[2]			Load[3]		
			Units	Expected	Objective[3]	Units	Expected	Objective
Zinc	11/12/2003	614.47	µg/L	819.63	kg	620.67	11/12/2003	614.47
Fecal Coliform	1/6/2005	336.16	MPN/100 mL	1.37E+06	MPN	5.69E+15	1/6/2005	336.16
Total Nitrogen[4]	2/27/2006	67.43	mg/L	4.93	kg	409.80	2/27/2006	67.43
Total Phosphorus	2/27/2006	67.43	mg/L	0.42	kg	35.79	2/27/2006	67.43

[1] 24-hour volume.
[2] Concentration is the LSPC modeled value using the storm runoff hydrograph for the date specified.
[3] Expected and objective loads equal the concentration multiplied by the volume of storm runoff.
[4] This load is based on one subarea within the Machado Lake subwatershed.

3.3.5 Limiting Pollutant Evaluation

The limiting pollutant idea is the concept that if the constituent with the highest loads or most difficult to treat is captured and treated, all other constituent requirements will be achieved. Meeting MS4 Permit WLAs in the DC WMG as required in adopted TMDLs requires achieving control of the limiting pollutant. The limiting pollutant will control implementation actions as the needs associated with it are either more stringent or are required within a limited time frame.

The results of the 90th percentile constituent loads presented in Table 3-4, show that the 90th percentile volume associated with lead is greatest. Therefore, lead was estimated to be the limiting priority pollutant for DC WMG. Total nitrogen is the limiting priority pollutant for the area draining to Machado Lake. Lead as the limiting pollutant is a result of the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL while the Machado Lake Nutrients TMDL dictates total nitrogen in the Machado Lake drainage area. The stormwater volume used for demonstrating compliance is associated with lead and total nitrogen, as they are the limiting pollutants. It can be assumed that by mitigating these pollutants the other constituents will also be in compliance.

The loads in Dominguez Channel are influenced by both the flow volume and the constituent concentrations. A large storm with low concentrations may create a load equal to a small storm with high concentrations. The 87th through 90rd percentile events for lead were evaluated to estimate the statistical range of volumes and loads at the model outlet to see which events produced regional rainfall and volumes for the watershed. Table 3-5 shows the events analyzed and the range in volumes, concentrations, and loads for events with loads of approximately the same magnitude as the 90th percentile load event. The bold values in the table show the numerically selected 90th percentile load.

Table 3-5: Percentile Loads for Dominguez Channel Storm Events				
Date	Flow (cfs)	Volume (ac-ft)	Concentration (µg/l)	Lead Load (kg)
1/21/2012	327	648	48.63	38.86
12/28/2004	2,573	5,104	6.00	37.77
9/22/2007	274	543	56.36	37.72
12/12/2011	780	1,547	19.49	37.18
12/25/2003	380	753	39.73	36.87
11/4/2008	143	283	105.60	36.79

Table 3-5: Percentile Loads for Dominguez Channel Storm Events				
Date	**Flow (cfs)**	**Volume (ac-ft)**	**Concentration (µg/l)**	**Lead Load (kg)**
11/6/2002	**570**	**1,130**	**24.90**	**34.81**
3/15/2003	2,414	4,788	5.80	34.09
3/20/2011	1,786	3,541	7.71	33.67
10/17/2004	629	1,247	21.80	33.47
3/28/2006	1,116	2,213	11.60	31.68
11/1/2003	171	339	75.28	31.43
12/15/2008	1,701	3,374	7.10	29.55
5/22/2006	321	636	36.10	28.34

Statistical analysis of the data shown in Table 3-5 provided the data shown in Table 3-6. Table 3-6 includes statistical values for both loads and volumes which were used in selecting the final modeled storm event for analysis of the 90th percentile load for permit compliance evaluation.

Table 3-6: Percentile Load Statistics for Dominguez Channel Storm Events		
Statistical Analysis	**Volume (ac-ft)**	**Lead Load (kg)**
Mean	1,868	34.45
Standard Error	445	0.88
Median	1,189	34.45
Standard Deviation	1,666	3.28
Sample Variance	2,774,911	10.76
Kurtosis	-0.40	-0.84
Skewness	1.00	-0.48
Range	4,821	10.52
Minimum	283	28.34
Maximum	5,104	38.86
95% Confidence Range for Mean	962	1.89

The values in the table show the relatively wide range of variability. Based on the results of the statistical analysis and engineering judgment, the storm from December 12, 2011, was chosen to represent the 90th percentile load event in DC WMA. This event has a load that is about 10 percent higher than the statistical 90th percentile load, with a volume that is about 30 percent higher. The storm that generated this volume and load was spatially consistent over the entire DC WMA. The value for volume falls well within the 95 percent confidence interval and the load is just slightly outside the 95 percent confidence interval on the high side. The volume generated is also consistent with the with the 85th percentile 24-hour storm volume.

3.4 Volume and Load Reduction Strategies

Various load reduction strategies were used to achieve compliance through the RAA including non-structural and structural BMPs. This is considered the "recipe for compliance" and is shown generally in Figure 2. Control measures are implemented strategically throughout the compliance period at specific time steps so that the interim and final WQOs are met. The three types of control measures that are the focus of the volume and load reduction strategy are non-structural BMPs (MCMs and LID ordinances),

regional projects, and distributed projects (green streets). Details can be found in Section 4. Figure 3 shows the target load reduction for the 90th percentile load using the identified elements. The schedule of implementation is discussed in Section 5 and represents a feasible implementation timeline considering regional BMP implementation will take a long time while MCMs and distributed BMPs may be implemented with less planning, engineering, and design effort.

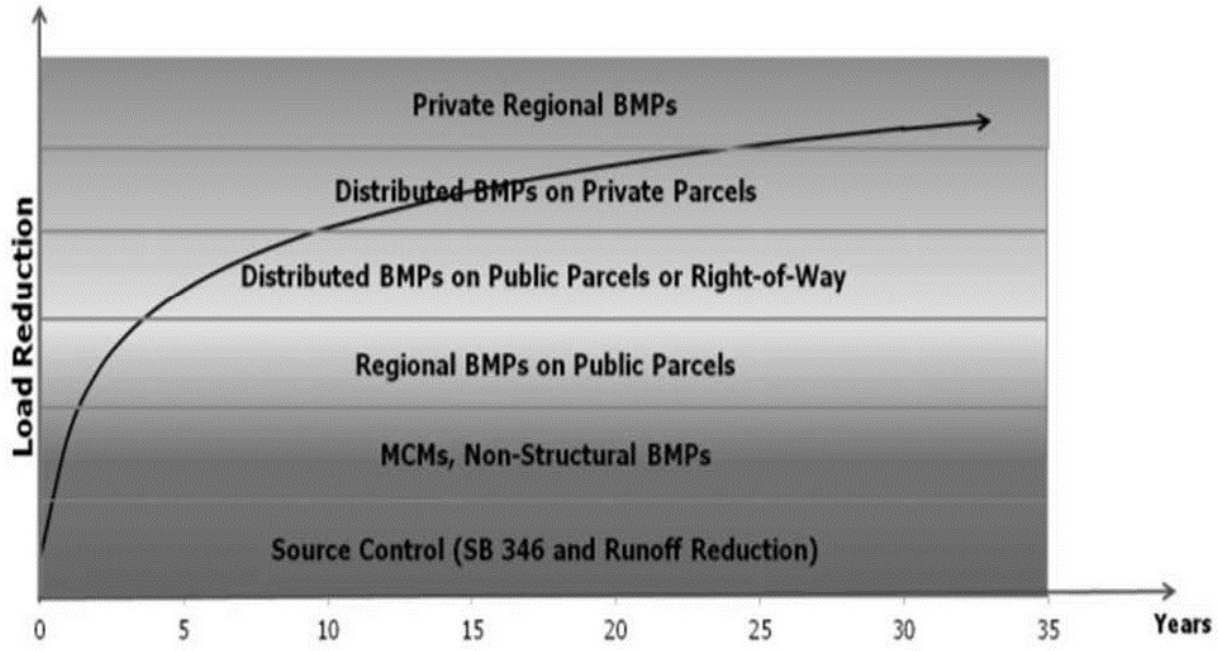

Figure 2: Pollution Reduction Strategies

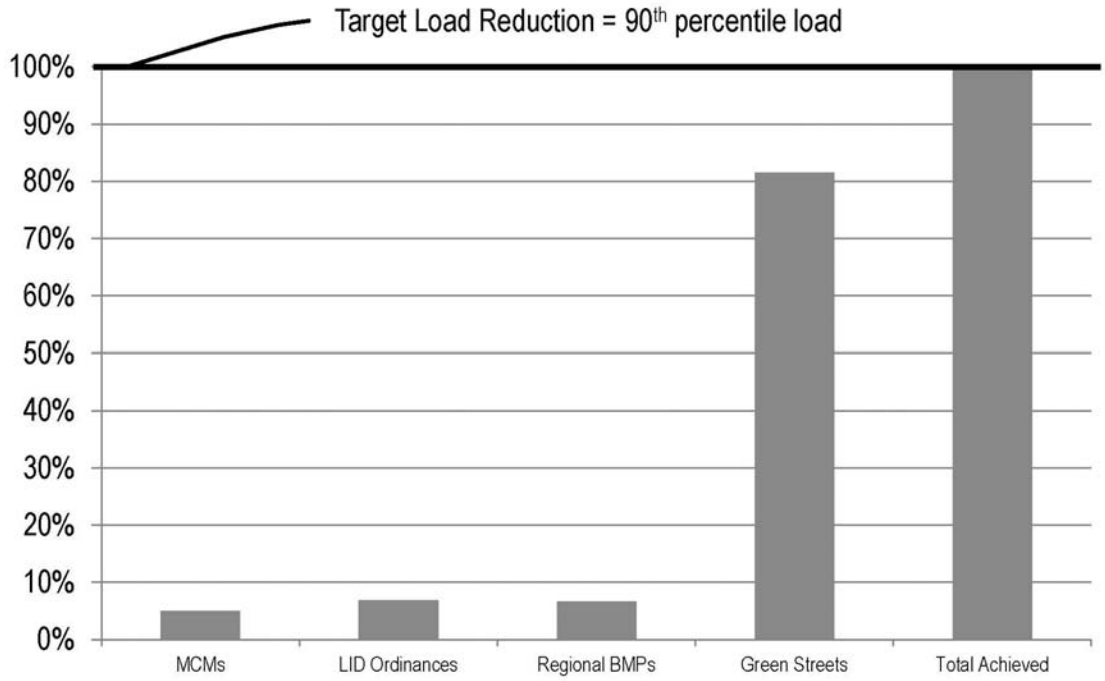

Figure 3: Target Load Reduction

4. Watershed Control Measures

In order to comply with EWMP requirements, an evaluation was performed that considered opportunities within the participating Permittees jurisdictions to utilize multi-benefit regional projects that, when feasible, retain non-stormwater discharge and the flows produced by the 85th percentile, 24-hour storm event. A review of relevant TMDL implementation plans and watershed management plans was performed to identify previously identified regional projects within the DC WMG. These projects were then evaluated to identify if they meet the regional EWMP project criteria. An approach was then developed and used to evaluate additional potential regional project sites. This section includes the approach and results of the evaluation.

The control measures analyzed and proposed in this EWMP are for reducing discharges of pollutants to the receiving waters to meet the planning objectives. Measures for managing sediments already within the Estuary are being developed as part of the Contaminated Sediment Management Plan: Dominguez Channel Estuary submitted to the Regional Water Quality Control Board in March of 2014 and are not described in this EWMP.

4.1 MCMs / Institutional BMPs

MS4 Permit Part VI.C.5.b.iv.(1) (pages 61-62) directs that the MCMs identified in Parts VI.D.4 to VI.D.10 (pages 70-141) be incorporated as part of the EWMP. The placement of this reference section within the EWMP portion of the permit (Part VI.C, pages 47-67) allows the MCMs in the subsequent section (VI.D, pages 67-141) to be assessed for potential effectiveness and even modified to emphasize the pollution control priorities identified within the EWMP Plan. Part VI.C.5.b.iv.(1).(c) (page 62) explicitly allows some MCM sections to be deleted, and wholly replaced, when accompanied by appropriate justification. The Planning and Land Development Program, is not identified as an MCM that must be evaluated for potential modifications or elimination. The general MCMs categories identified in Part VI.D (pages 67-141) of the MS4 Permit are listed below. Some of the MCM categories are also applicable to the LACFCD, as identified indicated with an asterisk (*).

1. Public Information and Participation Program (PIPP) (Part VI.D.5, pages 86-88)*
2. Industrial/Commercial Facilities Program (Part VI.D.6, pages 88-94)*
3. Planning and Land Development Program (Part VI.D.7, pages 94-113)
4. Development and Construction Program (Part VI.D.8, pages 113-130)
5. Public Agency Activities Program (Part VI.D.9. pages 130-137)*
6. Illicit Connections and Illicit Discharges (IC/ID) Detection and Elimination Program (Part VI.D.10, pages 137-141)*

The 2012 MS4 Permit (VI.D.1.b.ii, page 68) requires that the MCM programs, as specified in the 2001 MS4 Permit, continue to be implemented until the EWMP is approved by the Regional Board. The same six categories listed above were to be implemented under the 2001 MS4 Permit, with the 2012 MS4 Permit having more stringent requirements, some of which are listed below. Attachment H provides a detailed comparison of the program requirements of the 2001 MS4 Permit and the current 2012 MS4 Permit.

- New requirements for erosion and sediment control procedures, especially for sites less than one acre, and for Erosion and Sediment Control Plans;
- Additional tracking requirements as part of the Industrial/Commercial Facilities Program; and
- Extensive new requirements for LID and hydromodification controls as part of the Planning and Land Development Program.

MCMs are considered a subset of institutional BMPs (City of Los Angeles, 2013). Institutional BMPs are non-constructed control measures that prevent the release of flow/pollutants or transport of pollutants within the MS4 area (City of Los Angeles, 2013). Institutional BMPs include:

- Irrigation control
- Brake pad replacement
- Replacement of lead in wheel weights
- Street sweeping
- Catch basin cleaning
- Downspout disconnect program

4.1.1 Summary of Existing MCMs/Institutional BMPs

The existing MCMs/institutional BMPs within the DC WMG were evaluated and summarized based on the Los Angeles County Unified Annual Stormwater Reports for the Fiscal Years 2010-2011 and 2011-2012. Tables summarizing the existing MCMs/Institutional BMPs by DC WMG are presented in Attachment I.

4.1.2 Potential Approaches to Modifying MCMs/Institutional BMPs

In order for the DC WMG to identify potential MCM/institutional BMP modifications, it is essential to first evaluate the effectiveness of the existing programs. Once the baseline effectiveness is established, it can be used as a basis to compare with the potential MCM modification. A response to a comment made by the Los Angeles Permit Group regarding the MS4 Permit MCM program stated that "the criterion to allow customization is based on showing equivalent effectiveness" (LARWQCB, 2012). Once the effectiveness is assessed, customization alternatives may be evaluated to assess if they would be equally effective. Potential modifications to MCM programs are being considered, as they may provide load reductions and bring the DC WMG closer to the achievement of WQOs. Alternatively, if MCMs are not modified, implementation of structural controls will be required. This section identifies a program effectiveness assessment strategy, assessment measures, and assesses the effectiveness of the existing MCMs in order to identify potential MCM/institutional BMP modifications.

Program Effectiveness Assessment Strategy

The stormwater management program is comprised of the MCMs discussed in Section 4.1.1 which are implemented with the intent of reducing pollutants in urban and stormwater discharges. MCM implementation programs are an iterative process and the MS4 Permit has recognized this. Part VI.D.1.a (page 67) of the MS4 Permit states that Permittees may implement the programs described in the MS4 Permit, or may customize them as set forth in an approved EWMP or WMP. Assessing the existing MCM implementation, as well as the MS4 Permit requirements, will assist in identifying potential additional or modified actions that might further the MCMs objectives and water quality protection outcomes.

Water quality protection outcomes are the result of an activity, program element, or the overall program and have been characterized by the California Stormwater Quality Association (CASQA) in terms of six levels. Figure 4 shows these levels as a progression from activity-based to water quality based outcomes and illustrates the successive steps toward the ultimate goal of achieving and protecting receiving water quality. Levels 1 to 3 are considered to be implementation based outcomes, level 4 marks a transition from implementation to water quality based outcomes, and levels 5 and 6 emphasize water quality outcomes. Each level has a different value and emphasis in informing the regional management process and levels, or activities, are not always equally important, necessary, or even possible in every instance (CASQA, 2007).

Assessment Measures

Assessment measures can be categorized many different ways. In this EWMP, two categories are recognized, one related to the short term confirmation of BMP implementation and the other to long term verification of environmental improvement. In essence, the categorization of measures reflects two basic assessment questions:

- Are program elements being implemented correctly?
- Are environmental improvements being realized?

Figure 4: CASQA Classification of Outcome Levels

Programmatic and environmental indicators are conceived by the USEPA as having a hierarchical relationship as shown in Figure 5. This relationship further illustrates the fact that environmental outcomes rest on, or follow from, jurisdictional program implementation. Moreover, it recognizes that scientifically robust evidence of changing water quality indicators will follow ongoing program implementation and should not be anticipated concurrently.

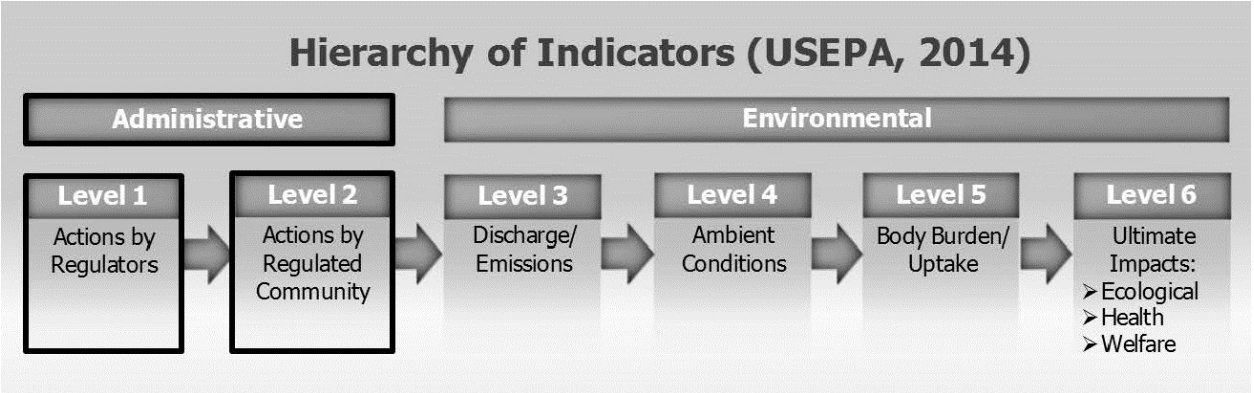

Figure 5: Hierarchy of Indicators

Key attributes of MCM and water quality assessment include:

- Measurability (statistically and repetitively measurable);
- Relevance (significant, demonstrable relationship to strategy and objectives);
- Reliability (easily documented and reproducible);
- Availability (based upon data obtainable at reasonable cost);
- Scientific validity (based on sound science); and
- Replicability (capable of being regularly assessed to develop trends).

Effectiveness Assessment

Assessing program effectiveness is a challenge for MS4 program managers across California, and the DC WMG appreciate and acknowledge the effort of CASQA to develop and publish the Municipal Stormwater Program Effectiveness Assessment Guidance (CASQA, 2007). During the EWMP development process, DC WMG has followed these guidelines in assessing the MCMs in order to satisfy the requirements of the MS4 Permit and reduce the discharge of pollutants from the MS4. While program effectiveness assessment is a key step in the iterative adaptive process of program implementation, it is also part of the evolving management process. Section Potential MCM/Institutional BMP Modifications provides potential MCM modifications that were considered during the EWMP development process.

Potential MCM/Institutional BMP Modifications

The approach described in this section was used during the EWMP development process to evaluate if modifications to MCMs/institutional BMPs would be beneficial. Table 4-1 identifies potential modifications that were considered by DC WMG.

Table 4-1: Summary of Potential Non-Structural BMP Enhancements

Potential Modification or Enhancement	Justification
Public Information and Participation Program (PIPP)	
Develop a Grassroots Committee.[1]	Community leaders may have stronger community connections, thus a better platform to provide educational and outreach materials.
Industrial/Commercial Facilities Program	
Evaluate operations of industrial facilities inspected to verify whether their operations are subject to Industrial General Permit (IGP).[1]	Identifying activities at industrial/commercial facilities where the SIC code does not require coverage under IGP will require facilities to get coverage and comply with requirements in IGP.
Development and Construction Program	

Table 4-1: Summary of Potential Non-Structural BMP Enhancements	
Potential Modification or Enhancement	**Justification**
Recommend monitoring and sampling as part of the Erosion and Sediment Control Plan requirements.	Conducting monitoring, sampling, and inspections will give the DC WMG more presence at construction sites which will most likely result in more thorough BMP implementation by developers and contractors.
Inspect construction sites where Erosion and Sediment Control Plans have been approved.	
Public Agency Activities Program	
More frequent street sweeping, especially in areas that lack full capture certified trash control devices.	Implementing a more vigorous street sweeping schedule will allow debris to be captured before they can be transported downstream.
Utilize street sweeping using the regenerative air vacuum equipment in land use areas that generate high metals loads.[2]	Vacuum street cleaners would be more effective at removing metals compared to sweepers.
Set maximum street sweeper speeds to optimize effectiveness in removing trash, debris, and sediments.[2]	Traveling at speeds recommended by street sweeping manufacturers will improve the sweeping effectiveness at removing pollutants.
Sweeping center median gutters, and "pork chop" islands at street intersections.	Sweeping areas that are not normally swept may capture additional pollutants.
Revise curb miles cleaned as an indicator to volume of trash collected.	Volume of trash collected provides a better indication of the program effectiveness.
Enhanced maintenance of catch basins, especially those with connector pipe screens.[1]	Enhanced maintenance will prevent sediments and debris from accumulating and traveling downstream.
Illicit Discharge/Illicit Connection (IC/ID) Program	
Municipal Codes that include enforcement action such as the issuance of Notice of Violations (NOVs) for illicit connections.[1]	Utilizing violations will give the DC WMG a greater presence and the threat of a penalty may have a greater influence over developers and others.
Municipal Codes that require follow up inspections within ten days for illicit connections.[1]	Implementing a time schedule for follow up inspections will ensure that the cleanup is completed in a timely manner.
Abatement and cleanup required within one day of discovery.	Current procedures allow for up to 72 hours, therefore a quicker response will positively correlate to a lower load contribution.
Other Institutional BMPs	
Enhanced Irrigation Control	
Promote replacement of grass with xeriscape vegetation.	Installing artificial turf and/or drought tolerant plants, or installing weather based irrigation controllers, will conserve water and reduce runoff associated with irrigation which is often the source of dry-weather flows, which are often the most concentrated with pollutants.
Promote replacement of grass with drought tolerant native plant species.	
Outreach the focuses on the installation of weather based irrigation controllers.	
Perform landscape irrigation audits.	Actions that require residents to become aware of their water usage as well as limiting it may reduce the amount of irrigation occurring, thus reducing runoff due to excess irrigation.
Implement water budgets.	
Inform residents on other types of BMPs or irrigation equipment that may be utilized.	
Downspout Disconnection Program	
Implement a second phase of the downspout disconnect program.	Implementing a downspout disconnect program will promote water conservation and reuse, by

Table 4-1: Summary of Potential Non-Structural BMP Enhancements	
Potential Modification or Enhancement	**Justification**
Expand the downspout disconnect program to include additional area within DC WMG.	capturing stormwater runoff for irrigation use, thus reducing the volume of water reaching the storm drain system.

[1] Potential modification applicable to LACFCD.
[2] Applicable to LACFCD's parking lot sweeping.

4.1.3 MCM Evaluation Methodology

In February 2014, the "MCM Evaluation Methodology" technical memorandum (memo) was prepared for the DC WMG. The memo and its September 2014 addenda (Attachment S) presented research findings that may be used to quantify pollutant load reductions as well as the uncertainties associated with those findings.

The memo demonstrated that strategies addressing polluting behaviors using various MCMs may be anticipated to produce a wide range of pollutant load reduction. Factors influencing the results include the level of control the City has over the strategy, and the constructs that are affected by the outreach campaigns (guilt, social norm, etc.). The range of pollutant load reduction could be as low as around 2% for a minor pollutant that is a partial consequence of a strategy, to as high as 72% for a major pollutant that is entirely the consequence of a behavior that the City has significant control over (i.e. City staff behaviors).

It should be noted that these pollutant reductions were *per behavior* and no single behavior was expected to be responsible for all of the pollutants entering the watershed. Each of the corrections to behaviors and implementation of potential behaviors will only affect some fraction of the pollutant entering the watershed as there are typically numerous sources of a pollutant. That fraction was not evaluated. Additionally, the percent reduction would apply only to the location where the strategy was employed. Some strategies are geospatially broad (e.g. public education and outreach), while others are geographically constrained (e.g. keeping trash receptacles covered at municipal maintenance facilities). The geospatial contribution of pollutants and reductions in loads are not evaluated as part of this analysis.

Description of the MCM Evaluation Methodology

This EWMP is a process of planning projects and control measures within the watershed and estimating the pollutant load reductions and resulting receiving water concentrations that would occur when those projects and control measures are implemented. A number of the control measures anticipated are activities within MCM categories. To estimate changes in runoff and receiving water quality based on expanding MCMs, a modeling effort was proposed. The model requires some estimate of the pollutant load reduction that may occur on parcels where MCMs are effective within the watershed.

The MCMs reviewed require behavior change among people in order to be successfully implemented. Key to estimating pollutant load reductions from behaviors, then, is understanding what behaviors are being targeted, the likelihood of behavior change, and the impact of those behaviors on pollutant loads.

To develop the model, research of pro-environmental behavior and meta-analytic studies was conducted. This provided a model to consistently estimate the likelihood of behavior change from differing levels of MCM efforts. This model took into consideration the varying public education and outreach approaches and baseline characteristics of the population and allowed us to estimate that given a certain investment in public education and outreach efforts, some percent of the public will be likely to change behaviors that will result in reducing the loading of a given pollutant. For example, with certain investments in public education and outreach, the literature suggests that one can see approximately 18% of the

population outreached changing to a lower pollutant behavior for certain pollutant types. The type of pollutant depends on the behavior change investment. For example, an investment in a campaign to educate, inform, and obtain behavior change associated with pet waste management would affect bacteria, but not necessarily sediment, metals, or pesticides. From the research conducted, the percent of people likely to adopt a less polluting behavior given a certain level of MCM investment can be estimated.

The next step was to estimate the expected reduction in a given pollutant when behavior changes to a lower polluting behavior. For each behavior type, we categorized the pollutants as *entirely*, *largely*, or *partially* the consequence of the polluting behavior the strategy addresses. This is based primarily on the amount of control a strategy has on behavior. The consequence of *entirely*, *largely*, and *partially* polluting behaviors is set at 100%, 66%, and 33%, respectively. Using the studies reviewed, it is reasonable to state that pollutant load reductions from different behavior changes can be categorized as high, medium, or low for those parcels or areas where the behavior change is expected to occur. No pollutant was considered to be removed 100% in any of the behaviors, so the highest value considered was 90%. Thus, reasonable values for high, medium, and low reduction are 90%, 60%, and 30%, respectively. For the distinct purpose of estimating percent pollutant load reduction in the EWMP planning effort, we estimated that low pollutant load reduction would be between approximately 10 and 30 percent, medium pollutant load reduction would between 20 and 60 percent, and high pollutant load reduction would be between 30 and 90 percent.

Finally, developed a potential range of pollutant load reductions from different behaviors across stormwater pollutant types was developed. The 18% value is the most commonly observed impact of public education and outreach from a pure problem awareness campaign and represents the low range of reduction. An 80% value is the estimated effectiveness of pollution prevention and good housekeeping efforts mandated by municipalities and represents the high range of reduction. This gave us a model that is based on as much reputable data and research as is available to provide some basis for pollutant load reductions for classes of pollutants under different investments in MCMs.

Average Percent Removal

To streamline the modeling of pollutant load reduction, a generalized average percent removal that can be used for all MCMs to be implemented and for all pollutants was estimated.

As described above, the memo presented the pollutant load reductions that may be anticipated from potential MCMs as a range of percent removals. The MCMs evaluated were based on the Center for Watershed Protection's (CWP's) most common residential and public behaviors that contribute pollutants to watersheds.

To estimate an appropriate overall percent removal, a more select list of MCMs that may be expected to be implemented by the City was to be compiled. Attachment H was used as a guide for future MCMs. MCM categories that were found to have new activities to implement for the 2012 MS4 permit are as follows:

- Public Information and Participations Program
- Industrial/Commercial Facilities Program
- Planning and Land Development Program
- Development and Construction Program
- Illicit Connection and Illicit Discharge Detection and Elimination Program (IC/ID Program)
- Public Agency Activities Program

Specific MCMs in each of the categories were then compared to the memo's "Appendix A – List of Estimated Pollutant Behavior Impact Ranges" to estimate percent removal of pollutants for each constituent potentially attributable to the MCM. Any MCMs not previously evaluated were evaluated here using the same process. MCMs that were not specific to a behavior or activity associated with a set of pollutants (e.g., Public Education – Activity Specific) but had some type of related activity otherwise

stated or implied in the document were evaluated as an activity associated with the non-specific MCMs (e.g., Public Education – Activity Specific: *Pet Waste Pick-Up*). The results of this effort are shown in the Attachment S. The high-end range of the values represented the pollutant removal that may be anticipated from strategies with which the City has significant direct control (i.e. city staff are performing the behavior desired). The low-end range of the values would be anticipated with strategies associated with only public behavior change.

Each MCM was then evaluated to determine if it would be considered City controlled or public education. Although many activities in several other categories could be considered more heavily controlled, only the activities in the Public Agency Activities Program were considered to be under City control. This is a more conservative approach in that it would tend to under-estimate pollutant load reductions as a factor of safety. The average percent removal of all activities was then calculated for each constituent.

Table 4-2 presents an example showing two activities and the average percent removal of each constituent. For example, operations and maintenance of roads would be controlled by the City. The previous memo presented both the high and low range of percent removal that may be anticipated. Those values are shown in Table 4-2. Because this is a City controlled activity, the higher percent removal could be used and the value used to calculate the average percent pollutant removal is shown with a highlight in Table 4-2. An activity like pet waste pickup would rely more on public education and participation and the lower value could be used (shown highlighted). It should be noted that this value does not include any additional behavioral factors that certain messaging campaigns may create, such as guilt, that would increase the percent removal that may be anticipated.

Table 4-2: Range of Pollutant Load Reduction Effectiveness (%)

Pollutant Generating Activity	Sediment		Nutrients		Metals		Bacteria		Trash		Toxins	
Description	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
O&M for streets and roads.	10.7%	47.5%	3.6%	15.8%	7.1%	31.7%	0.0%	0.0%	7.1%	31.7%	3.6%	15.8%
Public Education - Pet Waste Pick Up	0.0%	0.0%	10.7%	47.5%	0.0%	0.0%	10.7%	47.5%	0.0%	0.0%	0.0%	0.0%
Average Percent	23.8%		13.3%		15.8%		5.3%		15.8%		7.9%	

Results

Using the values as described above (high value for city controlled activities, low value for public activities) for each constituent, the average removals for each of the constituents (sediment, nutrients, metals, bacteria, trash, and toxins) were calculated. The results are presented in Table 4-3 below.

Table 4-3: Average Pollutant Removal per Constituent

Description	%

Table 4-3: Average Pollutant Removal per Constituent	
Description	**%**
Sediment	19.6%
Nutrients	11.7%
Metals	14.4%
Bacteria	6.5%
Trash	13.0%
Toxins	10.4%
Average of the Averages Above	12.6%

Conclusions

The overall average percent removal for all constituents and all activities is 12.6%. Because the lower public education value used does not consider any of the other constructs that are affected by the outreach campaigns (guilt, social norm, etc.), this overall percent removal may be lower than what will be observed. When considering the pollutant load removal of all activities, 5% may be conservatively and generally applied.

Assumptions and Limitations

The following assumptions and limitations should be taken into account when considering using the values presented.

- The percent removals are not based on specific geographic areas and may not apply equally to all geographic areas. For example, activities with a high degree of City control where they are performed by City employees, these may only apply to areas where City employees act, such as maintenance facilities or public buildings and may represent a fairly small portion of the entire pollutant load to a watershed of a particular pollutant. This geospatial variance is not taken into consideration in the averaging techniques employed.
- If only pollutant removals for activities with low degrees of City control – i.e. those that require public behavior change were to be included, the overall average percent removals would be lower. This assumes that the activities affecting public behavior change do not achieve all the constructs necessary to maximize behavior change (Intention, Moral Norm, Attitude, Perceived Behavioral Control, Guilt, Social Norm, Internal Attribution, Problem Awareness).
- If all the constructs necessary to maximize behavior change were successfully achieved throughout the population of the City, then the percent removals would potentially be higher than the average values presented herein.
- The percent reductions are based on a theoretical assessment of the potential reduction that could occur for a specific pollutant within a limited geography should a behavior actually change with respect to the release of that pollutant. Specific field studies are few that have measured changes in pollutant loads as correlated with behavior change.
- The data is more thorough for the measurement of behavior change through the use of survey instruments and observations of random samples through a population to correlate the constructs with changed behavior. The relationship between the behavior change and a measured concentration of a pollutant in runoff is more tenuous and the authors are relying on theoretical relationships between behavior associated with use of certain materials and pollutant releases during the uses of those materials.

4.1.4 New and Re-Development

Part VI.C.4.c.i.(1) of the MS4 Permit requires Permittees to develop and implement a LID ordinances applicable to new and re-development projects meeting specified thresholds of disturbance. Average annual redevelopment rates released by the City of Los Angeles (LAR UR2 WMA, 2014) were used to project the area that is expected to be developed between the modeled milestone dates. It can be assumed that the new and re-development projects will implement BMPs as required by the MS4 Permit, thus providing a load reduction based on the 85th percentile rainfall. Table 4-4 summarizes the percent of area re-developed at each of the milestone dates.

Table 4-4: Re-Development Rates by Land Use

Land Use	Annual Development Rate	Percent of Area to be Developed by Milestone Year				
		2017 Metal (25%)	2018 Nutrient (100%)	2023 Metal (75%)	2027 Metal (90%)	2032 Metal (100%)
Commercial	0.15	0.30	0.45	1.20	1.8	2.55
Education	0.16	0.32	0.48	1.28	1.92	2.72
Industrial	0.34	0.68	1.02	2.72	4.08	5.78
Residential	0.18	0.36	0.54	1.44	2.16	3.06
Transportation	2.70	5.40	8.10	21.60	32.4	45.9

Areas being developed as a result of the LID ordinances were modeled using volume reduction BMPs sized for the 85th percentile storm depth. Table 4-5 summarizes the volume reduction associated with the re-developed area within each DC WMG jurisdiction at each of the compliance milestones. The volume identified at each milestone is cumulative starting with 2015. It is expected that the transportation redevelopment will involve green street design; therefore it is not included in the expected volume reduction to avoid double counting of benefits.

Table 4-5: Volume Reduction based on Re-Development						
City	Land Use	Volume Reduction by Milestone Year (acre-feet)				
		2017 Metal (25%)	2018 Nutrient (100%)	2023 Metal (75%)	2027 Metal (90%)	2032 Metal (100%)
El Segundo	Commercial	0.1	0.1	0.4	0.6	0.8
	Education	0.0	0.0	0.0	0.0	0.0
	Industrial	0.4	0.7	1.7	2.6	3.7
	Residential	0.0	0.0	0.0	0.0	0.0
Hawthorne	Commercial	0.2	0.3	0.7	1.0	1.4
	Education	0.0	0.1	0.2	0.3	0.4
	Industrial	0.3	0.5	1.3	1.9	2.6
	Residential	0.6	0.9	2.4	3.6	5.1
Inglewood	Commercial	0.2	0.4	1.0	1.5	2.1
	Education	0.0	0.1	0.2	0.3	0.4
	Industrial	0.3	0.4	1.2	1.7	2.5
	Residential	0.7	1.1	2.9	4.3	6.1
Lomita	Commercial	0.1	0.1	0.2	0.3	0.4
	Education	0.0	0.0	0.0	0.0	0.1
	Industrial	0.0	0.0	0.1	0.1	0.2
	Residential	0.3	0.4	1.1	1.7	2.4
Los Angeles	Commercial	0.6	0.9	2.5	3.7	5.2
	Education	0.1	0.1	0.4	0.6	0.8
	Industrial	4.2	6.3	16.7	25	35.5
	Residential	1.9	2.8	7.6	11.3	16.1
County Unincorporated	Commercial	0.3	0.4	1.0	1.5	2.2
	Education	0.1	0.1	0.2	0.4	0.5
	Industrial	1.2	1.7	4.7	7.0	9.9
	Residential	1.1	1.6	4.2	6.4	9.0
Total:		**12.7**	**19.0**	**50.7**	**75.8**	**107.4**

4.2 Structural BMPs

In order to address the identified priorities within a watershed, structural BMPs made up of both Regional and Distributed BMPs will be utilized.

Regional BMPs

Generally, regional BMPs will be installed on large public parcels or adjacent storm drain outfalls and receiving waters. Some examples of regional BMPs include the following:

- Infiltration Basins
- Detention Basins
- Constructed Wetlands
- Treatment Facilities
- Low Flow Diversions

The strategy employed in this EWMP is to reduce volume to achieve the planning objectives. BMPs that reduce concentrations (treat and release) BMPs tend to achieve less pollutant load reduction per acre of land allocated to the BMP. Additionally, the WMG members seek to achieve the additional benefit of water supply, if possible, among other additional benefits, from implementation of BMPs to meet the water quality planning objectives. This would emphasize BMPs that capture and store or capture and infiltrate water. Thus, the regional project BMP types that are generally sought and evaluated in this EWMP are:

- Infiltration Basins
- Detention Basins

Such regional projects can be structured to provide water for local irrigation or can be structured to augment a potable water supply, such as a municipal supply aquifer.

Distributed BMPs
BMPs installed by private property owners under an agency's new and re-development program are accounted for as described in Section 4.1.4 . and, as such, are not evaluated as distributed BMPs to achieve the water quality planning objectives.

Distributed BMPs for purposes of this EWMP are those BMPs installed directly by one or more of the DC WMG agencies that tend to have smaller footprints and capture and store or infiltrate water from smaller catchments than regional projects. As described above as well, emphasis in this EWMP is on storm water capture, storage, use, and/or infiltration type of BMPs that achieve a volume reduction in the watershed rather than treat and release type BMPs. Thus, the distributed BMPs in this EWMP are primarily:

- Green Streets

To be specific, green streets, in the context of this EWMP, are modifications to streets that allow them to capture, store, and/or infiltrate some volume of water from the catchment leading to that street section. This can include a variety of design features including, but not limited to:

- Porous/Permeable Pavers
- Bioswales/Buffer Strips (that infiltrate)
- Biofiltration (that infiltrate)
- Bioretention (that infiltrate)
- Rainfall Harvesting (Rain Barrels & Cisterns) (in the street right of way)

Figure 6 shows a depiction of possible green street features. The specific features of the green streets in this plan have not been determined yet, but will be evaluated and established on a case by case basis for each street where a green street is considered optimal for meeting the water quality planning objectives.

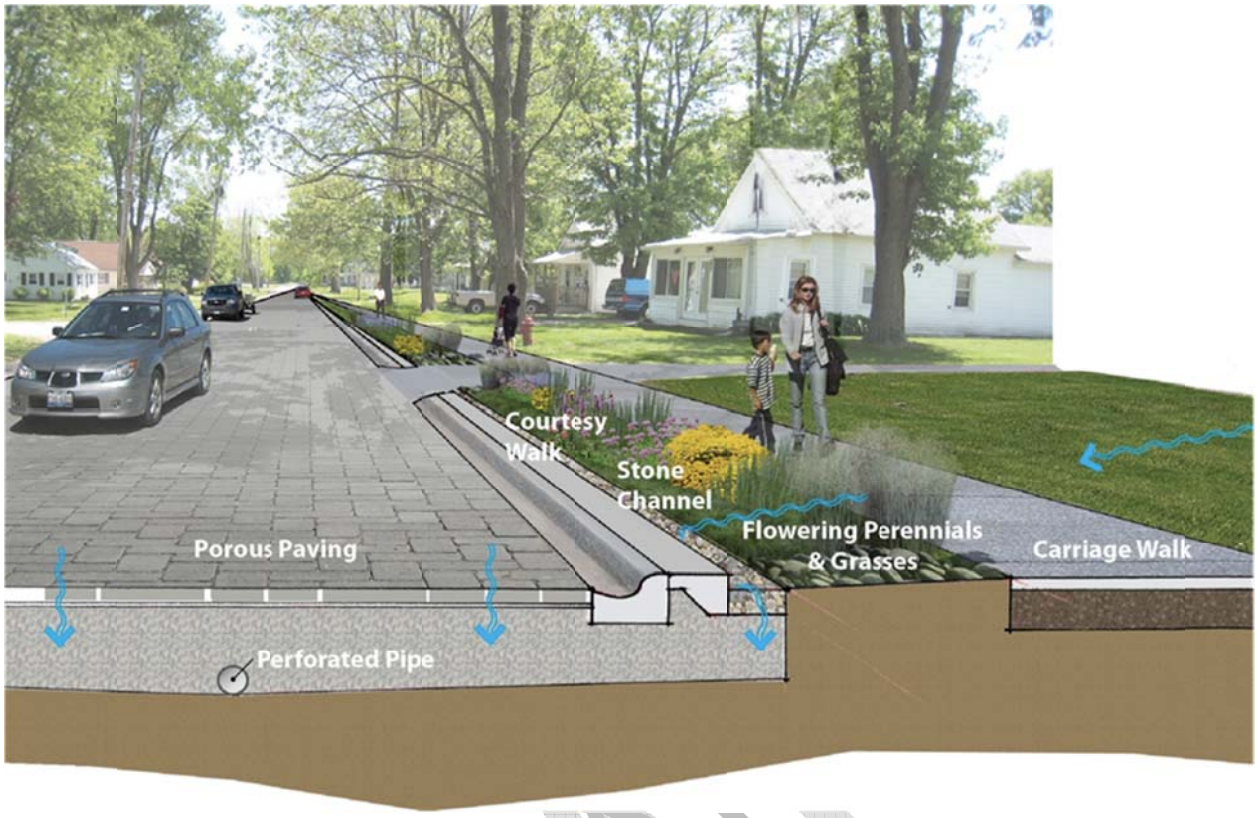

Figure 6: Possible Green Street Features

4.2.1 Categories of Structural BMPs

Table 4-6 illustrates the categories and subcategories of structural BMPs, followed by a detailed discussion of commonly implemented structural BMPs. Different types of regional and distributed BMPs are detailed in Attachment F that fall within the categories listed below.

Table 4-6: Categories and Subcategories of Structural BMPs Within DC WMG

Category	Subcategory	Example BMP Types
Regional	Infiltration	Surface infiltration basin, subsurface infiltration gallery
	Detention	Surface detention basin, subsurface detention gallery
	Constructed Wetland	Constructed wetland, flow-through/linear wetland
	Treatment Facilities	Facilities designed to treat runoff from and return it to the receiving water
	Low Flow Diversions	BMPs that divert runoff to the sanitary sewer (normally dry weather only)
Distributed	Site-Scale Detention	Dry detention pond, wet detention pond, detention chambers, etc.
	Green Infrastructure	**Biofiltration** includes vegetated BMPs with underdrains
		Bioretention includes vegetated BMPs without underdrains
		Permeable pavement
		Green streets (often an aggregate of bioretention, biofiltration and/or permeable pavement)
		Infiltration BMPs include non-vegetated dry wells, infiltration

Table 4-6: Categories and Subcategories of Structural BMPs Within DC WMG		
Category	**Subcategory**	**Example BMP Types**
		trenches, etc.
		Bioswales include vegetative filter strip and vegetative swales
		Rainfall harvest (rain barrels, green roofs and cisterns)
	Flow-through Treatment BMPs	Treatment BMPs with a minor (or non-existent) infiltration component, often modular/vault-type BMPs including cartridge media filters
	Source Control Structural BMPs	Catch basin inserts, screens, hydrodynamic separators, trash enclosures, etc.

4.2.2 Summary of Existing Structural BMPs

To compile information on existing control measures, including MCMs and BMP programs already in effect for each of the participating Permittees in the EWMP, information was extrapolated from the following available sources:

- Los Angeles County Unified Annual Stormwater Report for Fiscal Years 2010-2011 and 2011-2012
  - Summary of MCMs for the Dominguez Channel Watershed
  - Summary of BMPs Installed and Maintained for the Dominguez Channel Watershed
  - Individual Annual Reports for each of the participating Permittees
- Standard Urban Stormwater Mitigation Plans (SUSMP) and LID projects in DC WMG
- City of Los Angeles Green Infrastructure Project List
- Proposition O Project Website (www.lapropo.org)
- Opti Website (http://irwm.rmcwater.com/la/login.php)

The Los Angeles County Unified Annual Stormwater Report for Fiscal Years 2010-2011 and 2011-2012 has been used to create tables identifying the existing structural BMPs installed and maintained by the DC WMG and is included as Attachment G. The information provided by the DC WMG has been incorporated into the tables. Information pertaining to the existing MCMs implemented by the DC WMG are discussed in Section 4.1, and tables created based on the Unified Annual Stormwater Reports for Fiscal Years 2010-2011 and 2011-2012 can be found in Attachment I.

The SUSMP and LID project listings provided by the DC WMG have been used to map the existing distributed BMPs located in Attachment E, Figure E.1. The figure only includes the BMPs for which an address or global positioning system (GPS) coordinates was provided. It is assumed that the SUSMP and LID BMPs were also reported as part of the annual reports. A detailed list of the SUSMP and LID BMPs is provided in Attachment G.

BMPs, including regional BMP projects, implemented prior to the baseline pollutant loads being used for the RAA calibration (2012) are considered part of the baseline. BMPs, including regional projects, that were implemented after the baseline pollutant loads, can be modeled in the RAA in order to demonstrate a load reduction. A few regional projects have been implemented in the DC WMG utilizing Proposition O funding. The Lake Machado Water Quality Improvements Project and the Rosecrans Recreation Center Stormwater Enhancements Project were constructed following the pollutant load baseline estimation and are evaluated below based on EWMP project criteria.

Lake Machado Water Quality Improvements, including Wilmington Drain (Phase 1 of 2)

Specific drivers for the Machado Lake Ecosystem Rehabilitation and Wilmington Drain Multi-Use projects are to improve water quality, meet adopted and future TMDLs, enhance riparian, wetland, and upland

habitat, improve hydrologic and hydraulic conditions, and create and restore recreational amenities (City of Los Angeles, 2009). The project received its Notice to Proceed in May 2013, broke ground on March 22, 2014, and has an anticipated completion date in April 2016 (Prop O, 2014). The Wilmington Drain is a channelized stream that conveys urban runoff and stormwater flows to Machado Lake. The Wilmington Drain feeds more than half of the water that flows into Machado Lake from its 15,553 acre watershed. A majority of the Machado Lake and Wilmington Drain improvements involve enhancing the habitat and incorporating BMPs that will help with treatment components. The area will utilize bioswales in the parking areas, incorporate smart irrigation systems, install trash netting systems, include the use of biofilters and similar vegetated BMPs, and improve the pedestrian trail system (Measure O). This project has been jointly funded by the City of Los Angeles and the LACFCD. The project incorporates numerous distributed BMPs that will reduce the amount of flow reaching downstream receiving waters, but the main intention of the project is to provide treatment. This project is not projected to provide a volume reduction; it would be characterized as a "treat and release" type of project. Because the treatment type is primarily stream bank and lake restoration, anticipated reductions in pollutant concentrations due to the project are somewhat speculative. Because of this, to be appropriately conservative, this project was not modeled in the RAA. Through the adaptive management process, it will be determined if there are load reductions occurring from this project sufficient to offset some of the planned volume reduction projects in this EWMP.

Rosecrans Recreation Center Stormwater Enhancements

The Rosecrans Recreation Center Stormwater Enhancement project was completed in October 2013. The project achieved some of the goals outlined in the 2013 IRWMP and included the installation of smart irrigation systems, bioswales in parking lots, permeable parking lots, vegetated retention basins, infiltration cisterns/irrigation cisterns, a synthetic soccer field, landscaped areas, and decomposed granite pathways. The project treats a tributary watershed of 12.73 acres made up of mostly the park and some surrounding residential areas (CDM Rosecrans Recreation Center, 2006). This project incorporates water capture and use of stormwater; however, most of the water was from outside of the DC WMG area. Because of this, the impact of this project is negligible and does not affect the RAA or meeting the EWMP water quality planning objectives. Through the adaptive management process, it will be determined if there are load reductions occurring from this project sufficient to offset some of the planned volume reduction projects in this EWMP.

4.2.3 Structural BMPs Planned Prior to this EWMP

To identify BMPs the WMG agencies have already planned prior to this EWMP, the following existing implementation plans and watershed management plans were reviewed that may satisfy the EWMP criteria, as specified in Part VI.C.1.g (pages 48-49) of the MS4 Permit:

- 2013 Public Draft Update for the Greater Los Angeles County (GLAC) Integrated Regional Water Management Plan (IRWMP);
- 2013 Proposition O (Clean Water Bond Program) October Monthly Report;
- 2012 GLAC IRWMP Update, the Greater Los Angeles County Open Space for Habitat and Recreation;
- 2012 GLAC IRWM South Bay Subregional Plan;
- 2011 Multi-pollutant TMDL Implementation Plan for the County of Los Angeles Unincorporated Area of Machado Lake Watershed;
- 2004 Dominguez Watershed Management Master Plan (DWMMP);
- 2003 Dry-Weather Discharge Treatment Feasibility Study submitted by the County of Los Angeles Department of Public Works Watershed Management Division;
- Opti, part of the GLAC IRWMP online project database; and
- Los Angeles County Clean Water, Clean Beaches online project database.

The TMDL Implementation Plans developed by DC WMG were also reviewed in an effort to identify planned projects, and may be assessed during the EWMP development process to evaluate if they satisfy EWMP criteria for regional projects and represent feasible implementation options. These projects are included in Attachment E, Figure E.2. Some of the references include broad plans outlining the steps necessary towards improving water quality and recommending different BMPs under different conditions. These documents provided conceptual scenarios without going into great detail. Some of the potential regional BMP projects identified in older references have since been built or are in construction. In addition, valuable information was obtained from Opti and the Los Angeles Clean Water, Clean Beaches online project databases. The data reviewed included no information regarding planned distributed BMP projects. A majority of distributed projects are in response to LID/SUSMP requirements, therefore executed by private developers and not included in public agency planning documents.

TMDL Implementation Plans

Implementation plans often detail activities, costs, anticipated outcomes, and schedules that are required to achieve the objectives of strategic plans such as TMDLs. There are two types of implementation plans, one that is produced by the regulator during the TMDL development process and one that is produced by the parties responsible for TMDL implementation. In more recently approved TMDLs, responsible parties are required to develop implementation plans. The existing implementation plans developed by DC WMG members were reviewed and summarized below. Moving forward the EWMP will provide an implementation plan that addresses the various TMDLs.

Los Angeles Harbor Bacteria TMDL

In a letter dated December 24, 2012, the City of Los Angeles submitted a request to the Regional Board for a Time Schedule Order (TSO) for CB01, the compliance monitoring site at Inner Cabrillo Beach, as described in Attachment B. Pursuant to the TSO, POLA and the City of Los Angeles Department of Public Works Bureau of Sanitation Watershed Protection Division developed a Pollution Prevention Plan (PPP) Work Plan focused on addressing exceedances at CB01 and submitted it to the Regional Board on April 7, 2014.

The PPP includes a source assessment and details other investigations that were performed in order to better understand the bacteria problem in the Harbor. A list of pollution prevention activities, including remedial actions, BMPs, and special studies, was provided in the plan with estimated dates of implementation. Some of the future activities include, but are not limited to, additional observations, evaluating the effectiveness of existing pet waste bag stations near the harbor, repairing fence breaches along Cabrillo Marsh, evaluating the potential for animal screens at the MS4 outfalls and catch basins near the boat ramp, provide additional education and training to people working near the harbor, minimize over-irrigation, and evaluate the feasibility of a low flow diversion system.

An additional method that was implemented to meet the Los Angeles Harbor Bacteria TMDL was the Inner Cabrillo Beach Bacterial Water Quality Improvement Project. The project included recontouring of the beach and drainage improvements to improve water quality. This project was funded by the City of Los Angeles' Proposition O and was completed in July 2014.

Los Angeles Harbor Toxics TMDL

The TMDL for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters came was established in March 2012. For this TMDL, the responsible parties developed a Coordinated Compliance, Monitoring, and Reporting Plan (CCMRP) for the Greater Harbor Waters that will take samples at 22 sites within the watershed. The CCMRP requires that water samples be taken three times a year, sediment monitoring occur twice every five years, and fish tissue sampling occur once every two years.

Machado Lake Nutrient TMDL

The Machado Lake Nutrient TMDL implements load allocations through Memorandum of Agreements (MOAs) or cleanup and abatement orders. The responsible parties for the load allocations were required to enter into a MOA within six months of the TMDL effective date. The MOA was to include the development of a Lake Water Quality Management Plan (LWQMP). If the MOA and LWQMP do not result in attainment of load allocations, the MOA will be revoked and load allocations must be implemented through a cleanup and abatement order.

The City of Los Angeles entered into an MOA with the Regional Board on April 7, 2010, and a LWQMP was submitted on September 10, 2010 and approved on February 14, 2011. The LWQMP includes an Implementation Plan section which discusses the specific BMPs that will be constructed by the City of Los Angeles within the Wilmington Drain and in Machado Lake that will help meet Machado Lake Nutrient TMDL loads. The Lake Machado Water Quality Improvements project was discussed in detail, some of which is also described above. A variety of strategies for meeting load allocations are identified in the LWQMP, including strategies that would be implemented both in-lake and adjacent to it.

One strategy that has been implemented to meet the Machado Lake TMDLs is the Machado Ecosystem Project, which is funded by City of Los Angeles Proposition O. The project is comprised of two major phases. The first phase includes sediment dredging, wetland creation, lake-edge aquatic habitat restoration, and removal of invasive plants. The second phase of the project includes the construction of paths around the lake, bioswales, and rip-rap outlets.

A Monitoring and Reporting Plan (MRP) is required by Machado Lake Nutrient and Pesticides and PCBs TMDL. This plan includes monitoring of water quality in storm drain discharges, monitoring of sediment quality in the Wilmington Drain, and identifying pollutant sources upstream of Machado Lake. The MRP lists the constituents that require sampling and the frequency at which they must be sampled. Sampling of sediment within the drain shall occur once a year after the storm season until final compliance is reached in 2019.

The implementation plan identifies the Wilmington Drain project that is currently in construction and has an anticipated completion date of 2016. The Wilmington Drain Project is an outcome of Proposition O, which was approved in 2004. The project includes sediment removal from the channel to increase capacity, bank stabilization, removal of non-native vegetation, and the installation of a trash capture system. Sediment removal from the drain is expected to remove a large amount of pollutants that have accumulated over time.

Multipollutant TMDL Implementation Plan for the County of Los Angeles Unincorporated Area of the Machado Lake Watershed

The Multipollutant TMDL Implementation Plan for the County of Los Angeles Unincorporated Area of the Machado Lake Watershed was submitted to the Regional Board September 12, 2011 and covers the implementation for both the Machado Lake Nutrient TMDL and Pesticides and PCBs TMDL. The plan applies to three unincorporated areas within Los Angeles County that are comprised of mostly residential land uses. This implementation plan is very detailed and identifies the existing structural and non-structural BMPs and describes new or enhanced opportunities. The structural BMPs proposed in the Implementation Plan include bioretention cells and sand filters in parking lots, catch basin inserts, vegetated swales, and porous pavement. The non-structural BMPs consist of public outreach for various types of waste and management of recreational and storage facilities to minimize pollution in urban runoff. The Nutrient and Toxics TMDL requires the development of a Monitoring and Reporting Program that include plans for sampling of nutrients and toxics within the watershed. Continuous flow monitoring will be done at six locations and water quality sampling will take place at three locations. Although no bacteria and metals TMDLs exist for the Machado Lake Watershed, they are included in the Monitoring and Reporting Program to be used for planning purposes.

The Implementation Plan details how it will achieve Lake Machado's nutrient and toxics TMDL by the required compliance date. The Machado Lake Nutrient TMDL must be achieved by September 2018 and the Machado Lake Toxics TMDL must be achieved by September 2019. The Nutrient TMDL has interim requirements that must be met by March 2014. The Implementation Plan includes a detailed schedule that is projected to achieve the interim and final requirements of the Nutrient TMDL by the compliance dates.

Machado Lake Pesticides and PCBs TMDL

Compliance with the Machado Lake Pesticides and PCBs TMDL is assessed the same way the Machado Lake Trash TMDL is assessed. The City of Los Angeles amended their MOA that was previously approved for the Machado Lake Nutrients TMDL on March 20, 2013. The LWQMP associated with the MOA has been previously summarized in the Machado Lake Nutrients TMDL section above. The Multi-Pollutant TMDL Implementation Plan for the County of Los Angeles Unincorporated County covers the implementation for Machado Lake Nutrient TMDL and Pesticides and PCBs TMDL as previously discussed. The LACFCD's Implementation Plan covers the implementation of for the Nutrients TMDL and the Pesticides and PCBs TMDL.

4.2.4 Process of Identifying and Selecting Multi-Benefit Regional Projects (EWMP Regional Projects)

The below approach was generally used to identify, screen, and evaluate potential regional projects. This approach included a watershed based assessment of all publicly-owned and private parcels within the DC WMG to evaluate if they would be suitable to support a regional stormwater enhancement project. The approach to identifying potential regional projects is illustrated in Figure 7. The process is discussed generally in the sections below and in detail in Attachment J.

Table 4-7 lists scoring and ranking criteria and how the parcels were scored based on those criteria. The right most column of Table 4-7 lists if Geographical Information System (GIS) data were useable for autonomous scoring of the parcels. Following the autonomous scoring of the parcels, parcels were visually evaluated to assess if they could conceivably provide sufficient space for a regional project that retains the 85th percentile storm from a catchment area outside the parcel itself.

For visual evaluation, the following screening criteria were adhered to:

1. Score using the GIS approach.
2. Identify Assessors Identification Numbers (AIN) ending in 900s. These represented tax exempt parcels, which, if tax-exempt, were assumed therefore to be government owned and likely owned by a DC WMG agency. Once identified in the Tier 1 list as noted below and considered potentially suitable, ownership research was conducted to verify if they were owned by a DC WMG agency.
3. Specify which Tier a parcel should be categorized in based on its land use.

   Tier 1: 900 coded open space, parks, golf courses, vacant

   Tier 2: 900 coded everything else, with the exception of education

   Tier 3: non-900 coded (privately owned) open space, parks, golf courses, vacant

   Tier 4: education – both 900 and non-900 coded

   Tier 5: everything else – non-900, non-education, non-park/open space/golf course/vacant.
4. Exclude Tier 5; if a Watershed Management Group (WMG) member or stakeholder brings a Tier 5 parcel forward, it can be evaluated further for feasibility.
5. Exclude parcels < 0.25 acres. These would have insufficient space for regional retention.

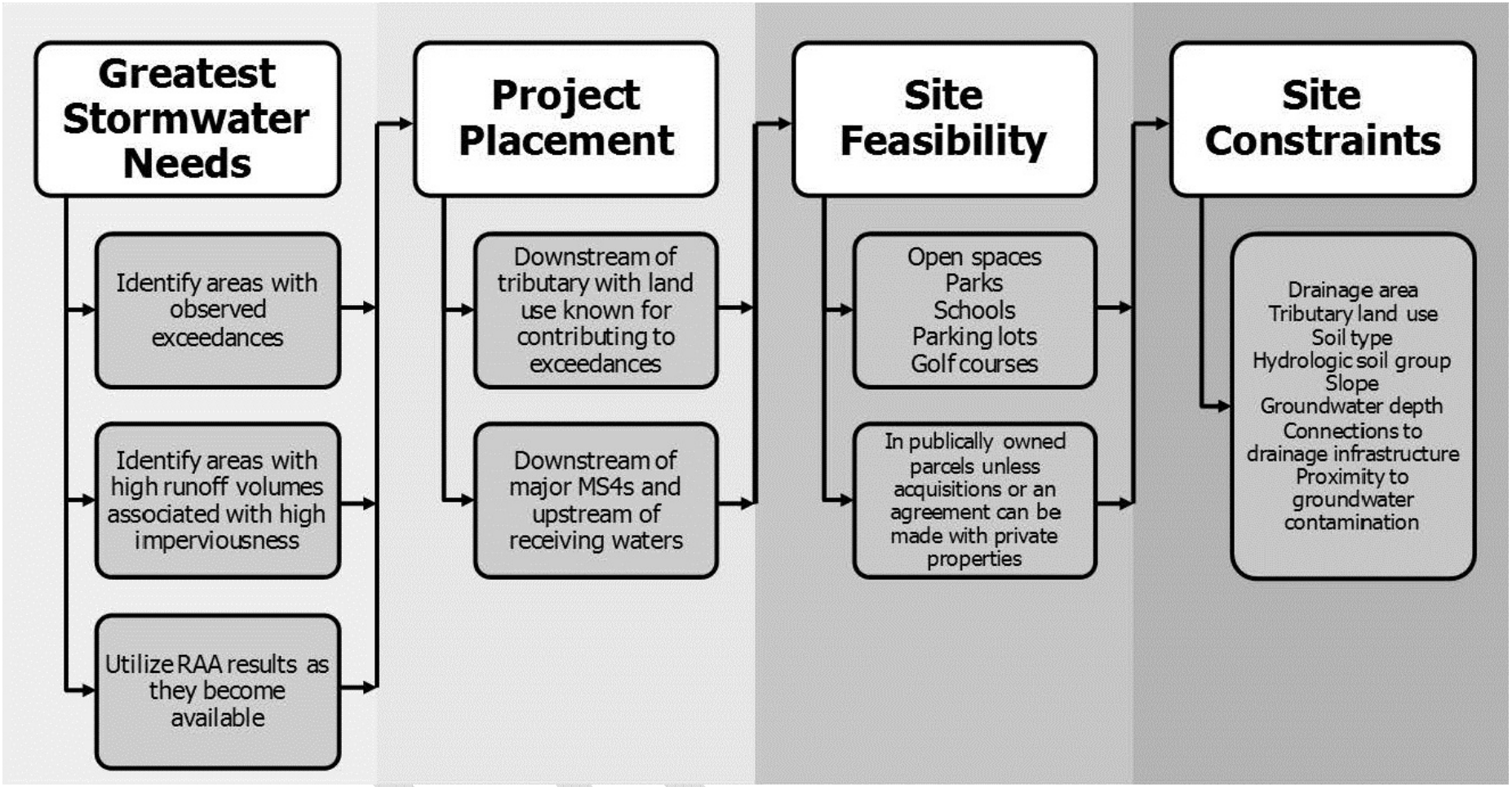

Figure 7: Approach to Identifying Potential Regional Projects

Table 4-7: Ranking Criteria

Criteria		Points						GIS Coverage
		0	1	2	3	4	5	
General Criteria	Proximity to an Outfall (mile) (x2)	3.0 ≤ X	2.5 ≤ X < 3.0	2.0 ≤ X < 2.5	1.5 ≤ X < 2.0	1.0 ≤ X < 1.5	0 ≤ X < 1.0	X
	Proximity to 36" Storm Drain (feet)[1]	1,000 ≤ X	800 ≤ X < 1000	600 ≤ X < 800	400 ≤ X < 600	200 ≤ X < 400	0 ≤ X < 200	X
	Land Use (x2)	Restricted Area (DOD)	Private requiring demolition of structures	Private with large parking lots requiring no changes to land use	Schools and Golf Courses	Public Buildings	Public Open Space	X
	Parcel Size (acre)	X < 0.25	0.25 ≤ X < 1.0	1.0 ≤ X < 2.0	2.0 ≤ X < 3.0	3.0 ≤ X < 4.0	4.0 ≤ X	X
	Catchment Area[2]	X<1	1 ≤ X < 25	25 ≤ X < 50	50 ≤ X < 75	75 ≤ X < 100	100 ≤ X	
Underlying Soil Conditions	Contamination[2]	Superfund	Possible Contamination				Certain no contamination	
	CPI		1	2	3	4	5	X
	Soil Infiltration Rate (inches/hour)	X < 0.3	0.3 ≤ X < 0.5	0.5 ≤ X < 0.7	0.7 ≤ X < 0.9	0.9 ≤ X < 1.1	1.1 ≤ X	X
	Slope (%)	10 < X	5 < X ≤ 10	3 < X ≤ 5	2 < X ≤ 3	1 < X ≤ 2	0 < X ≤ 1	
	Liquefaction Areas	Possible Liquefaction					No Liquefaction	X
	Landslide Areas	Possible Landslide					No Landslide	X
	Depth to Groundwater (feet)[2,3]		X ≤ 10				10 < X	
	Depth to Storm Drain Infrastructure (feet)[2]	15 ≤ X	10 ≤ X < 15	5 ≤ X < 10	3 ≤ X < 5	0 < X < 3	X=0 (open channel/ gutter)	

Notes:
1. Based on distance to midpoint of GIS pipeline segment to centroid of parcel.
2 GIS data coverage not currently available.
3 Site specific conditions may allow variances.

6. Exclude parcels that are part of natural water body.
7. Exclude parcels at edge of the Dominguez Channel (DC) Watershed Management Group Area (WMGA). These would not collect significant water from the DC WMGA jurisdictions.
8. Exclude parcels with more than 60 to 70% buildings based on visual inspection of Google Earth and Google Maps views available on or after December 2014
9. Exclude open space parcels that have been developed based on visual inspection. It is important to note that a number of parcels labeled as "open space" were developed and their land use designation not changed in the parcel data available.
10. Exclude parcels that have less than approximately 10 acres tributary to them. This was not strictly adhered to, but in general, parcels that could collect water from 10 acres upstream of them were preferred.
11. Of the 900 series that survive this screening, review the ownership. If available data indicates the property is owned by WMG agencies, select as potential regional projects.
12. Review the unselected 900 series and the non-900 series that survive this screening and list the top 100 to 200 scores from those.
13. Visually inspect the top 100 to 200 and identify those that may have better potential to explore further based on potential catchment area, potential space on site and size of site, and potential ownership

The potential project footprints are based on stormwater storage areas of sufficient size to infiltrate in 72 hours or to store the 85th percentile storm in 10 feet in depth unless otherwise noted. In most cases, areas needed to infiltrate in 72 hours were larger than the area needed to store the storm volume in 10 feet of depth.

From the tier 1 list, after the additional manual screening, a total of nine parcels were identified that show promise for placement of regional projects that capture some catchment area and may be controlled by Watershed Management Group (WMG) members for: (listed in order from the northern part of the watershed to the southern part)

1. Darby Park
2. El Segundo
3. Ramona Park
4. Jim Thorpe Park
5. Chester Washington Golf Course
6. Hawthorne Memorial Park
7. Harbor City Park
8. Wilmington Recreation Center
9. Averill Park

These top ranked project parcels were recommended for implementation and a preliminary feasibility evaluation was performed. Concept drawings were prepared for the recommended projects and are provided in Attachment Q (*Note: Hawthorne Memorial Park was added as after the concept designs had been prepared and is not available in the attachment*). Table 4-8 lists the recommended projects within the DC WMG and identifies the space available, drainage area, design volume (associated with the 85th percentile, 24-hour rain event), and volume provided based on the concept drawings. The project sites are illustrated in Figure 8.

Table 4-8: Regional Project Site Summary					
Recommended Project Site	**Ownership**	**Parcel Size (ac)**	**Drainage Area (ac)**	**Design Volume (ac-ft)**	**Storage Volume (ac-ft)**
Darby Park	Inglewood	19.5	106	5.2	5.2
El Segundo	El Segundo	6.2	574	27.0	27.0
Ramona Park	Hawthorne	1.7	273	12.9	12.9
Jim Thorpe Park	Hawthorne	7.6	378	16.0	16.0
Hawthorne Memorial Park	Hawthorne	6.6	202	8.2	8.2
Chester Washington Golf Course (North)	County[1]	116	636	25.8	26.4
Chester Washington Golf Course (South)			542	22.0	26.1
Harbor City Park	Los Angeles	14.8	4,460	77.0	80.7
Wilmington Recreation Center	Los Angeles	7.2	273	12.9	12.9
Averill Park	Los Angeles	10.7	1,376	21.4	21.4

[1] Facility is owned by the County, but operated under lease by American Golf.

All of the regional project concepts, with the exception of the El Segundo site, involve subsurface storage that promotes infiltration using perforated steel reinforced poly-ethylene (SRPE) cisterns or a concrete vault with a perforated volume. It was preferable to infiltrate the captured volume of water within 72 hours as that is the presumptive vector (mosquito) control standard for the Los Angeles County Department of Public Health. In some locations, there was unsufficient footprint to infiltrate within 72 hours given the published potential infiltration rates of the site soils as they are currently mapped. In those locations, deeper vaults were considered necessary to capture the control volume. It would infiltrate, but not within 72 hours. These locations were at such depth that, based on prior work siting subsurface retention in Los Angeles County, the Department of Public Health would be likely to consider the depth of the vault to be sufficient to prevent vector breeding from occurring in the vault.

Flows from the existing storm drain system will be diverted to the project sites through gravity. No pump stations were planned at this time. The need for pumping would be evaluated on a case by case basis during project concept planning.

The water captured could potentially be used to supplement irrigation, where the demand justifies such use. If not used for irrigation, it would generally infiltrate into the shallow groundwater basin. To move the water into a drinking water aquifer, injection would be necessary as described in Section 4.2.6.

At the El Segundo site there is an existing pump station. The basin will be re-graded to promote better infiltration and increased capacity. The El Segundo site recharge will increase the groundwater pressures to assist with the West Coast Basin Seawater Barrier.

The recommended regional project sites were modeled in the RAA by setting the drainage area tributary to the sites as compliant when the project provides the 85th percentile, 24-hour storm event volume or greater capture. These projects are considered regional EWMP projects and satisfy the criteria identified in Part VI.C.1.g of the MS4 Permit. All of the regional project sites proposed capture a volume greater than or equal to the 85th percentile, 24-hour storm volume generated from their subcatchments within the DC WMG.

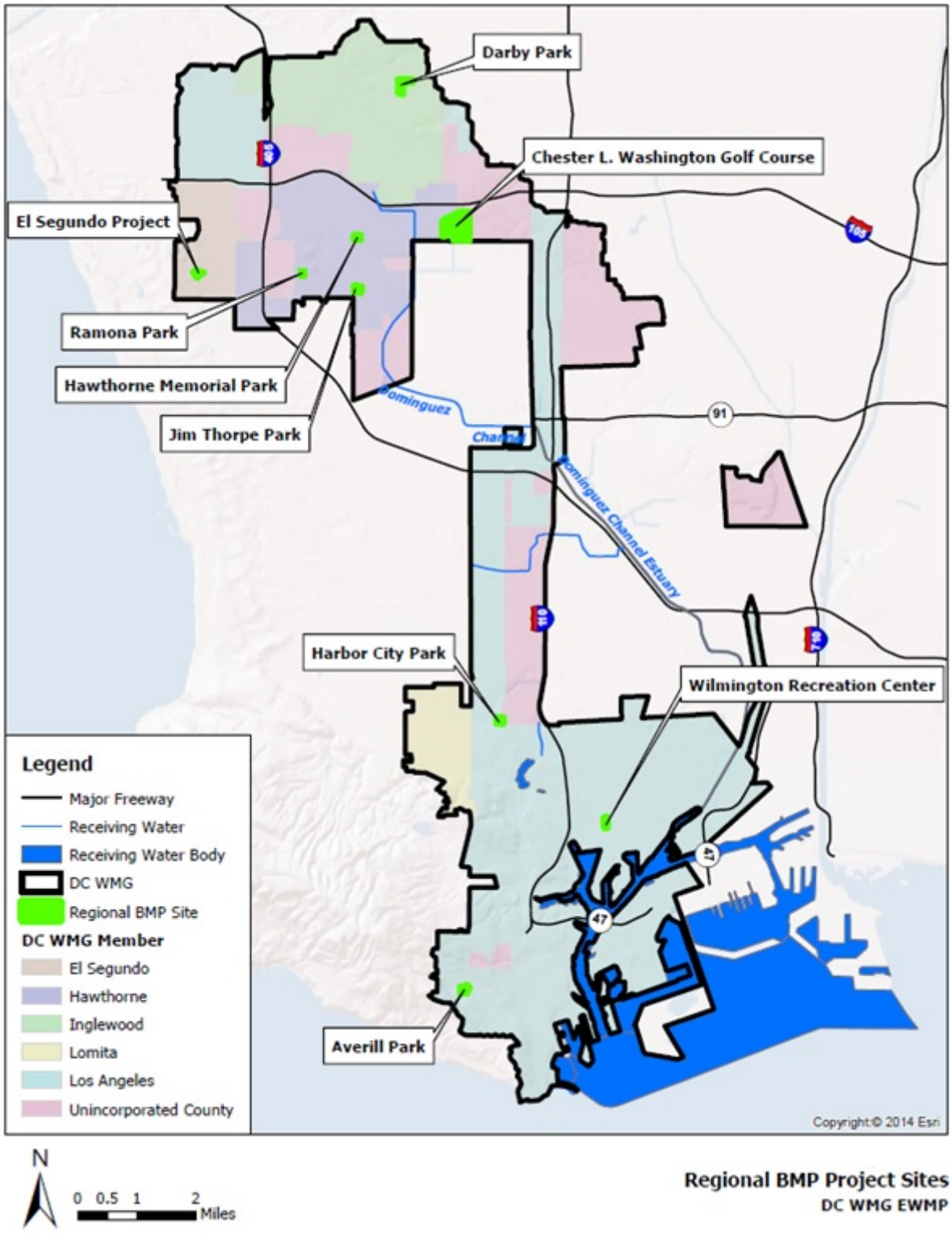

Figure 8: Regional BMP Project Sites

4.2.5 Distributed Projects (Green Streets)

Green streets are consistent with some DC WMG agency plans for various projects. They also provide additional opportunities for volume reduction with the potential for capturing water for municipal use. Once hydrologic and loading scenarios were simulated with the MCM, new and re-development (LID ordinance), and regional BMP implementation, the volume associated with capturing the remainder of the 90th percentile load for the limiting pollutant was estimated. Then, the lane miles of green streets to achieve this storage volume was estimated. The green streets represent distributed BMPs and are modeled to the extent that the required volume reduction is satisfied. Green streets were used as distributed BMPs as they are located in the public right-of-way, are distributed throughout the DC WMG area, and could be implemented as streets are rehabilitated. The volume reduction provided by a green street can be replaced with alternative distributed BMPs as desired.

A green streets analysis was performed for the entire DC WMG area to estimate which streets are most suitable for green street implementation. The following criteria were examined and ranked to establish a green street implementation hierarchy:

1. Slope
2. Soil infiltration capacity
3. Street type

Each criterion was analyzed based on the methodology described in Attachment R. A ranking system was developed, which was used to classify streets in terms of their potential as green streets (high, medium, or low). The analysis was performed using ArcGIS and Microsoft Excel. Once the streets were ranked for their feasibility as green streets, a subarea analysis was conducted to estimate which streets within each subarea could be implemented as a green street to satisfy the 85th percentile storm event volume criteria and the 90th percentile load criteria.

Green Street Implementation Summary

The implementation needs based on the subarea analysis were merged together once completed to estimate the quantity of green streets required by jurisdiction and subarea. Table 4-9 identifies the lane mile needs for each jurisdiction within the DC WMG.

Table 4-9: Green Street Implementation Summary by Jurisdiction

Subarea	Green Street Lane Miles	Percent by Agency
El Segundo	10	1%
Hawthorne	83	11%
Inglewood	80	11%
Lomita	1	0%
Los Angeles	359	49%
County Unincorporated	203	28%
Total:	736	100%

Figure 9 illustrates the lane miles required throughout the DC WMG, compiling the information from the subarea analysis. Similar to the subarea maps, the green street recommendations are shown as bold green lines. The figure also shows the subareas that are completely within a regional project tributary area, as green streets are not required in these subareas as they are mitigated by the regional project. Additionally, the port jurisdiction is shown so that it is clear where green streets will not be implemented due to jurisdictional preferences.

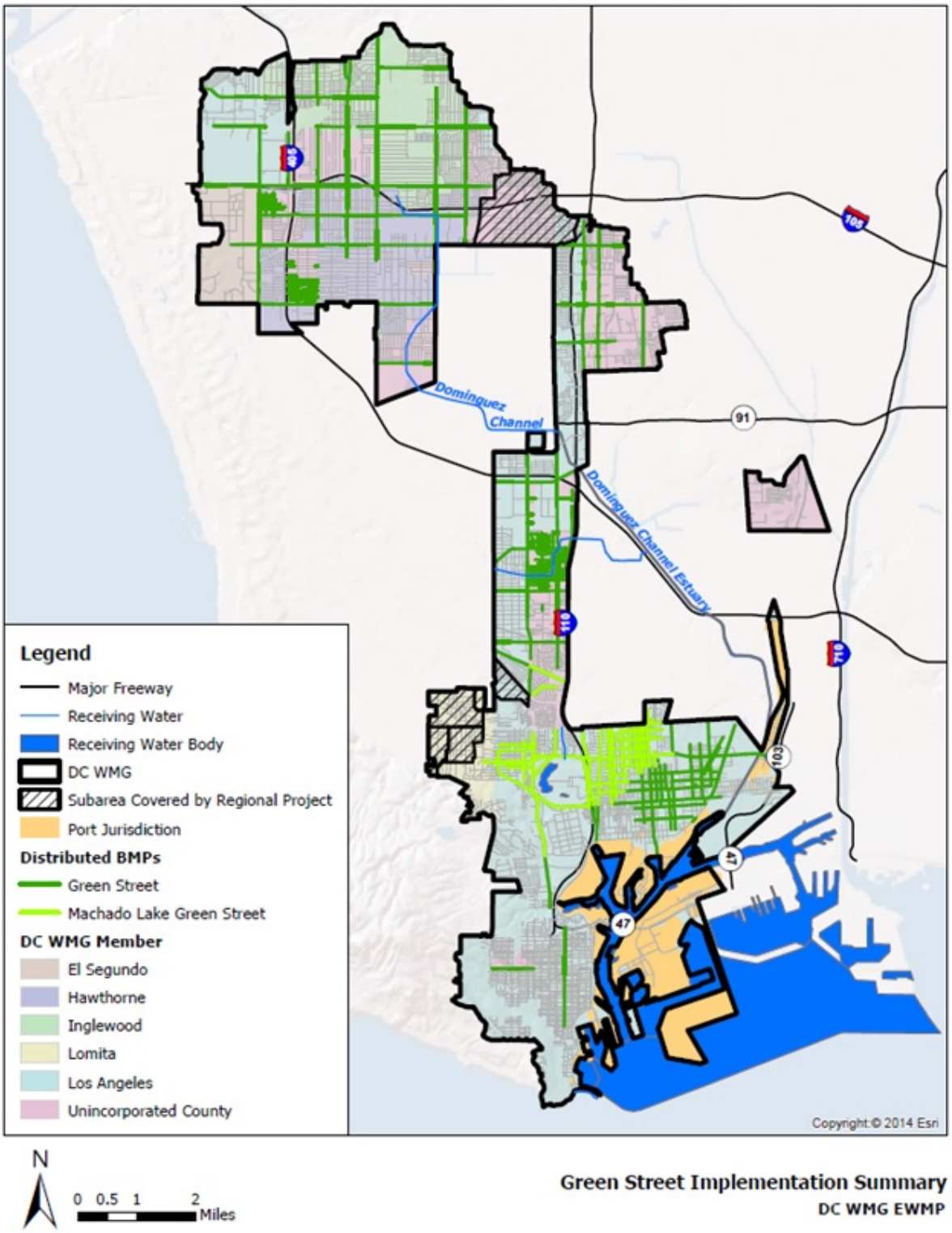

Figure 9: Green Street Implementation Summary

Attachment R contains a subarea summary table listing the subarea requirements along with the lane miles provided. A figure is also included so that subareas names can be associated spatially. A figure for each subarea is not included in this draft EWMP. Where it is impractical to implement enough BMPs

within a specific subarea, other BMPs are implemented in other subareas to provide the required volume and load reductions on a watershed basis.

4.2.6 Multi-Use Benefits from Injection Well Aquifer Recharge

There is a potential for utilizing the captured stormwater for municipal use within the watershed. One way of doing this is to directly irrigate with the stored water. This can offset some potable water uses. However, the irrigation demands tend to be very low shortly after rain occurs and, therefore, it would be necessary to store the water until irrigation demands increase, which does not replenish the storage volume for capturing a subsequent storm. Another option for utilizing the water for municipal use would be to move it to a drinking water aquifer.

In the DC WMG area, the drinking water aquifers (Lynwood and Silverado aquifers) range from 200 to 400 feet below ground surface. The shallow unconfined aquifers are not used for municipal supply due to low yields and uncertain water quality. In order to move captured stormwater to the deeper drinking water aquifers, it would be necessary to inject that water via injection wells. This would require approval from the Regional Water Quality Control Board. Once the water is placed in the drinking water aquifers, then the DC WMG agencies would need to obtain the rights to pump that new water from the drinking water aquifers.

The DC WMG is underlain primarily by the West Coast Groundwater Basin. A small portion of the eastern section of the DC WMG is underlain by the Central Basin Groundwater Basin. Both of these basins are adjudicated. Most water captured by projects in the DCWMG is likely to be injected, if feasible and practicable, into the West Coast Groundwater basin.

Adjudicated Rights in the West Coast Groundwater Basin, as of June 2014, for the cities in the DC WMG are shown Table 4-10.

Table 4-10: West Basin Allowable Pumping Allocation (APA)

Agency	AFY
City of Los Angeles	1,503
El Segundo	953
Hawthorne	1,882
Inglewood	4,450
Lomita	1,352
Total	10,140

The requirements for obtaining increases in Allowable Pumping Allocations (APAs) and requirements for obtaining approval from the Regional Water Quality Control Board to inject captured storm water are presented in Attachment AA and the following was found:

> "… injection of captured stormwater is potentially a viable means of achieving additional water rights within the Dominguez Channel Watershed. Both the Central and West Coast Basin Judgments provide specifically for approval of enhanced water rights as a result of augmentation projects developed by parties to one or both judgments. Whether injection projects developed through EWMP implementation are cost effective and viable will depend greatly on the quality of the stormwater captured, the parties participating and their respective resources, and the volume of water proposed for development. On balance, projects that are solely in the West Coast Basin are likely to be easier to permit from a water rights perspective given the somewhat more

> permissive nature of the West Coast Basin Judgment, as well as the fact that eight of the nine project sites overlie the West Coast Basin. Regulatory approvals from the LA Regional Water Quality Control Board are obtainable, and indeed likely to be supported by Regional Board staff (because of the water supply benefit), if the quality of water to be injected meets or exceeds all water quality objectives in the groundwater basin it overlies."

The key constraint to injection of the water into the potable drinking water aquifers is based on the water quality, rather than adjudicated water rights. The report indicated that to the extent that injected water exceeds receiving water limitations, permitting would require demonstration of no impairment of the municipal beneficial use designation from the Basin Plan, or the implementation of treatment that would eliminate such impairment prior to injection.

Due to the water quality of the stormwater, it is expected that pre-treatment would be necessary. The costs of pre-treatment are related to acquiring storage area and the cost of the pre-treatment. These costs have not been developed for this study. However, a small section discussing the expected capital construction costs and O&M costs for wells to inject the water captured by regional projects and green streets is provided in Section 7 for potential future discussion purposes.

An option being explored by the Water Replenishment District of Southern California (WRD) for replenishing the drinking water aquifers with captured surface water is called an Aquifer Recharge and Recovery Facility (ARRF). This is a system where captured surface water is allowed to infiltrate to the shallow groundwater aquifer, then this shallow groundwater is pumped and then injected into the deeper drinking water aquifer. The infiltration process acts as a natural filter for surface water pollutants, this preventing the need for additional pre-treatment (other than removing trash and sediment to prevent clogging of the infiltration system). WRD has not completed the approval process for ARRF yet, but is may be a promising method for treating captured surface water prior to injecting it. Additionally, this ARRF allows for one to extract the shallow groundwater and inject it months after the rain occurs, when the deeper aquifers have greater storage capacity due to pumping that occurs in the dryer months.

4.2.7 Approach to Identifying Additional Distributed BMPs

Opportunities for additional distributed BMPs may exist at sites that do not fall under SUSMP, LID, or green streets policies. These sites will be further evaluated in order to evaluate if water quality improvements could be incorporated at a relatively low cost. Distributed BMPs also may be incorporated through future stakeholder processes, allowing the stakeholders to provide input on additional distributed BMP locations and types and help to stimulate volunteerism amongst private property owners to implement BMPs on their properties that may achieve a pollutant load reduction benefit. The adaptive management process will be used to evaluate how effective such distributed BMPs are and evaluate if modifications to planned regional or green streets projects are necessary..

4.3 Non-Storm Water Discharge Control Measures

The following section discusses the approach to non-storm water discharge control measures and the non-storm water outfall program.

4.3.1 Potential Approaches to Additional Non-Stormwater Discharge Control Measures

Non-stormwater discharge is from an activity that generally consists of washing down something, over irrigating, or an illicit/illegal connection or discharge. MCMs and other institutional BMPs are in place in an attempt to reduce non-stormwater discharges. One source of non-stormwater discharge that is not addressed through the MCMs and other institutional BMPs are exempt non-stormwater discharges as specified in Part III of the MS4 Permit.

In order to evaluate effective non-stormwater discharge control measures, in addition to those already required, the dry weather discharge monitoring element of the CIMP will be used as an evaluation tool. As specified in the CIMP, the DC WMG will report non-stormwater discharges that occur in their jurisdiction and actions taken to evaluate if they are persistent, exempt and, if non-exempt, actions taken and/or BMPs implemented to eliminate them. Exempt non-stormwater discharges often include non-emergency firefighting activities, discharges from drinking water supplies, dewatering of lakes, landscape irrigation, swimming pool discharges, decorative fountain dewatering, car washes, and street/sidewalk washing per Part III.2 of the MS4 Permit.

Non-Storm Water Outfall Program

This section presents the method for the NSW outfall program component as prepared in the CIMP for the DC WMA Group. The NSW Outfall Monitoring Program is a major component of the monitoring and reporting program (MRP) and is intended to be a collaborative effort between all of the agencies in the DC WMA Group. The NSW outfall monitoring program component is intended to enhance the existing permit required programs that include LACFCD's efforts under the IC/ID Program to detect, investigate, and eliminate the IC/IDs to the MS4, pursuant to Part VI.D.4.d and the responsibilities of the County of Los Angeles and the Cities of El Segundo, Hawthorne, Inglewood, and Los Angeles under Part VI.D.10 of the Permit.

The NSW Monitoring Program is comprised of the following elements.

1. Identification of Outfalls with Significant NSW Discharge
2. Inventory of MS4 Outfalls with NSW Discharge
3. Prioritized Source Identification
4. Identification of Sources of Significant NSW Discharge
5. Monitoring of Significant NSW Discharges Exceeding Criteria

Objectives of the NSW Program

The intent of the NSW Program is to meet the requirements of the NSW Outfall Program (Section II.E.3, Page E-4) outlined in the MRP of the Permit by achieving the following objectives:

a. Evaluate whether a Permittee's discharge is in compliance with applicable non-storm water TMDL WLAs.
b. Evaluate whether a Permittee's discharge exceeds non-storm water action levels, as described in Attachment G of the Permit.
c. Assist the Permittee in identifying illicit discharges as described in Sections VI.D.4.d and VI.D.10 of the Permit.

Approach Overview

The approach to addressing NSW discharges is to implement a programmatic approach to identifying non-storm water discharges and estimating if the discharge is a persistent and significant non-permitted discharge that affects the quality of the downstream receiving water and as such, is a significant NSW discharge. Figure 10 illustrates the process by which these discharges are evaluated and incorporated into the NSW Program. Table 4-11 provides the required program components of the NSW Program and the relative timing required.

In order to address significant NSW discharges in the watershed, a progressive approach consisting of visual inspections, investigations, and evaluations combined with the existing IC/ID enforcement framework that exists for industrial waste dischargers will be used. This process will be a multi-step procedure to categorize outfall sites for their potential for persistent and significant discharge that may affect the water quality of the downstream receiving water body during dry weather. The initial identification of outfalls with significant non-storm water discharges will be utilize screening based on

visual observations (at least three visual surveys) and recorded observational data. The location of these outfalls will be compared against the known permitted discharges in order to eliminate those outfalls from further screening. If necessary, the DCWMA Group may follow up with the permitted dischargers through the existing Industrial Waste permit framework to confirm that the discharge is meeting permit requirements. For other discharges, the agencies would utilize the existing IC/ID investigation framework to track down the source of the non-permitted discharge. The information from the investigation would be used to address illicit discharges. Once the source is determined, or determined to be unknown, and cannot be eliminated the next step will consist of monitoring, and an assessment of impacts to downstream receiving waters based on the monitoring results. This stage would use a combination of flow monitoring and analytical chemistry to assess the pollutant loading contributed by the site. If the site is found to be contributing to an exceedance, the DC WMA Group or the jurisdiction will address the non-storm water discharge through the EWMP.

Table 4-11: NSW Outfall Program Summary Table

NSW Program Component	Description	Timing of Completion
1. Outfall Screening	In order to implement the NSW Outfall Program, the DCWMA Group will implement a screening process to identify outfalls that exhibit significant NSW discharges and those that do not.	Prior to initiating source investigations
2. Develop Inventory of NSW Outfalls with discharge	An inventory will be developed of major MS4 outfalls with known significant NSW discharges and those requiring no further assessment.	
3. Develop Prioritization Criteria	Based on data collected during the Outfall Screening process, the DCWMA Group will identify MS4 outfalls with significant NSW discharges and those requiring no further action.	
4. Prioritized source investigation	The data collected as part of the Outfall Screening process will be used to prioritize outfalls for source investigations.	
5. Identify sources of significant NSW discharges	For outfalls exhibiting significant NSW discharges, source investigations per the established prioritization.	Source investigations will be conducted for 25% of the outfalls with significant NSW discharges by December 28, 2015 and 100% by December 28, 2017.
6. Monitor NSW discharges exceeding criteria	The DCWMA Group will monitor outfalls that have been determined to convey significant NSW discharges comprised of either unknown or non-essential conditionally exempt NSW discharges, or continuing discharges attributed to illicit discharges.	Monitoring will commence after completion of source investigations.

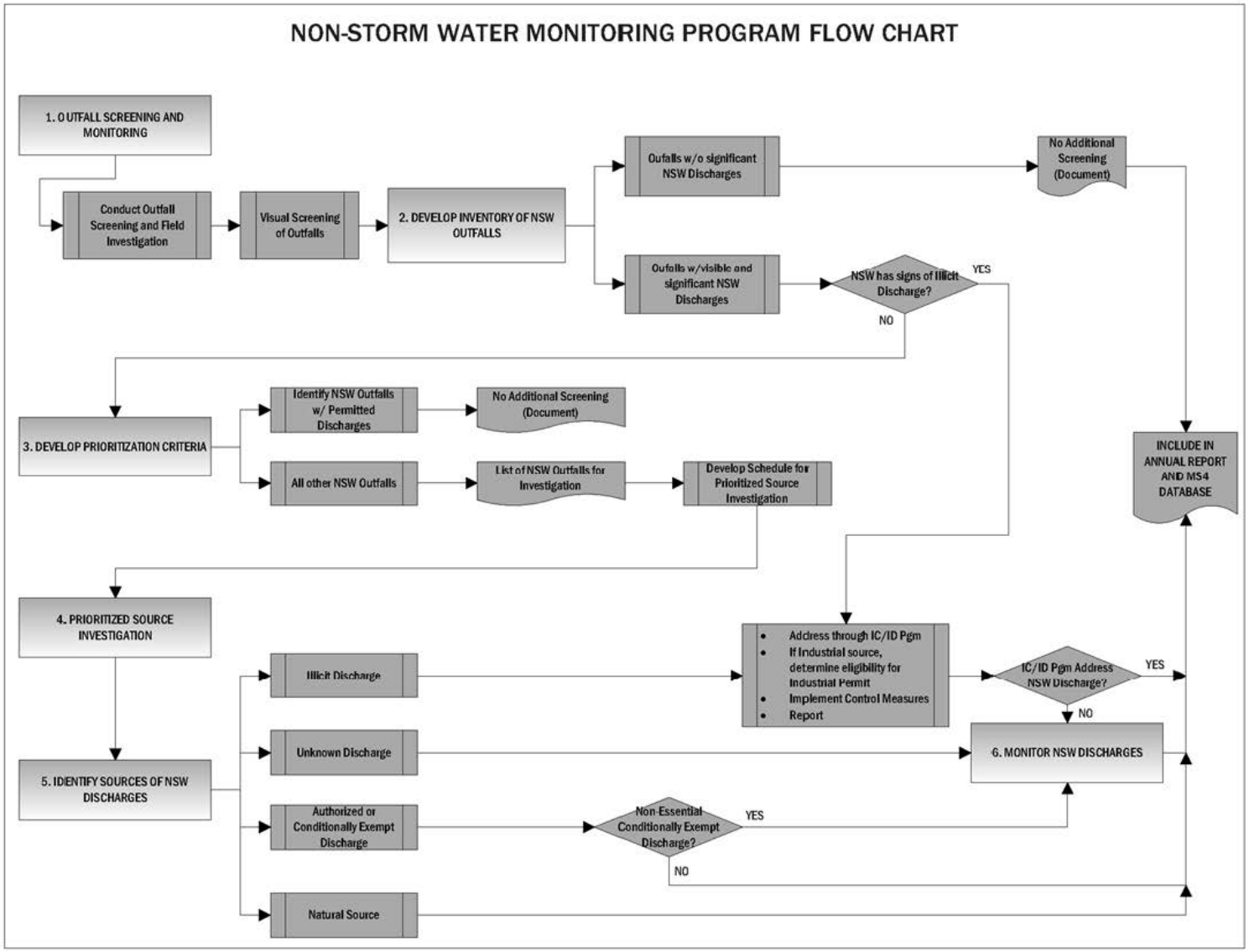

Figure 10: NSW Monitoring Program Process Chart

The LID ordinances, regional projects, and green streets projects, due to their water capture and infiltration capacities will also capture and infiltrate dry weather incidental (non-stormwater) discharges in addition to the wet weather discharges for which they are sized and configured. Analysis suggests that these projects will reduce non-stormwater discharges to meet the water quality planning objectives as they are implemented. The implementation schedules for the projects (Section 5) suggest that the milestones for reducing non stormwater discharges will also be met.

4.4 Summary of BMP Performance Data

To summarize performance data of structural (regional and distributed), and institutional (non-structural) control measures for reducing stormwater and non-stormwater flows and priority pollutants, the following sources were reviewed and performance data was compiled:

- CASQA Development and Municipal BMP Handbooks
- California Department of Transportation (Caltrans) BMP Retrofit Pilot Program Report
- Center for Watershed Protection's National Pollutant Removal Performance Database Vers. 3
- Priority A and B Catch Basin Cleanout Data

Tables summarizing the BMP performance data can be found in Attachment K. The table associated with the CASQA Development and Municipal BMPs handbook provides a general summary of BMP performance within Southern California, while the tables associated with the other sources provides site specific performance data based on site specific testing.

5. EWMP Implementation Schedule

This EWMP will be developed, submitted, and reviewed before it can be approved. The schedule outlined in Table 9 or Part VI.C.4 (pages 53-58) of the MS4 Permit will be followed and is summarized in Table 5-1.

Table 5-1: EWMP Implementation Requirements

MS4 Permit Part	Provision	Due Date
VI.C.4.b (pages 55-56)	Notify Regional Board of intent to develop an EWMP and request submittal date for draft program.	6 months after MS4 Permit effective date (June 2013)
VI.C.4.c.iv (page 57)	For Permittees who elect to collaborate in an EWMP, submit draft plan to Regional Board.	18 months after MS4 effective date (June 2014) provide final Work Plan for EWMP development.
		30 months after MS4 Permit effective date (June 2015) submit draft plan.
VI.C.4.c (pages 56-57)	Comments provided to Permittees by Regional Board.	4 months after submittal of draft plan.
VI.C.4.c (pages 56-57)	Submit final plan to Regional Board.	3 months after receipt of Regional Board comments on draft.
VI.C.4.c (pages 56-57)	Approval or denial of final plan by Regional Board or by Executive officer.	3 months after submittal of the final plan.
VI.C.6 (page 65)	Begin implementation of the EWMP.	Upon approval of the plan.
VI.C.8 (pages 66-67)	Comprehensive evaluation of EWMP and submittal of modifications to plan.	Every two years from date of approval.

In addition to the schedule provided in the MS4 Permit, DC WMG included a schedule with completion dates and associated milestones for EWMP development in their NOI. Currently the DC WMG is on schedule and will continue to work towards achieving the schedule outlined in the NOI and reiterated in Table 5-2. The milestones and due dates identified in the NOI appear to continue to be appropriate; therefore no alternative milestones are presented at this time.

Table 5-2: EWMP Schedule from DC WMG NOI

Milestone	Due Date
Draft Technical Memorandums • Approach to USEPA, TMDL, 303(d) listings, other exceedances of RWLs • Final selection of regional projects • Feasibility analyses of regional projects, customization of MCMs, identification of other BMPs • Project schedules and cost estimates	April 2015
Draft EWMP	May 2015
Final Draft EWMP submitted to Regional Board	June 2015

As noted in Table 5-1, a comprehensive evaluation of the EWMP and modifications are required every two years following the EWMP approval.

5.1 Control Measure Implementation Schedule

Control measures were modeled in the RAA so that compliance was demonstrated at each of the milestones. As previously discussed, milestone dates are defined by the applicable TMDLs. Lead is the limiting priority pollutant for most of the DC WMG. Nitrogen is the limiting pollutant for the areas draining to Machado Lake. Based on the limiting pollutants and water quality priorities, the milestone dates are related to both the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL and the Machado Lake Nutrients TMDL. This section outlines the control measure implementation schedule related to the non-structural BMPs, regional projects, and distributed BMPs (green streets).

5.1.1 Non-Structural BMPs

As discussed in Section 4 non-structural BMPs (MCMs) and the LID (new and re-development) programs that will be implemented and evaluated in the RAA include enhanced MCMs, other non-structural BMPs such as the SB346 (copper brake pad elimination), and the new and re-development LID program. These control measures will be ongoing throughout the simulation period. The load reductions associated with implementing enhanced MCMs will be evenly distributed over time. The new and re-development program will be implemented throughout the simulation period at the rates described in Table 4-4

5.1.2 Regional Projects

The regional projects modeled for the DC WMG RAA must all be implemented prior to the 2023 milestone. Table 5-3 summarizes the anticipated project timeline including the design, bid, and construction phases. Operation and maintenance (O&M) of each of the projects will begin following construction.

Table 5-3: Regional Project Timeline

Regional Project	Design (years)	Bid (months)	Construction (years)	Total Time (years)	Completion Year
Darby Park	1	6	2	3.5	2022
El Segundo	1	6	2	3.5	2023
Ramona Park	1	6	4	5.5	2022
Jim Thorpe Park	1	6	3	4.5	2021
Hawthorne Memorial Park	1	6	3	4.5	2022
Chester Washington Golf Course	2	6	5	7.5	2023
Harbor City Park	1	6	6	7.5	2023
Wilmington Recreation Center	1	6	3	4.5	2022
Averill Park	2	6	3	5.5	2022

5.1.3 Distributed BMPs (Green Streets)

The distribution of green streets implementation is based on the volume/load reductions that are not satisfied by other control measures at each of the compliance deadlines. Additionally, the green streets were distributed over the years so that the cost can be distributed. Table 5-4 summarizes the green street implementation timeline. To achieve compliance with the Machado Lake Nutrients TMDL WLA in 2018, 139 green street miles would be implemented in the Machado Lake watershed before 2018.

Table 5-4: Green Street Implementation Timeline	
Implementation Year	**Lane Miles of Green Streets**
Initial Construction	
2017	181
2018	38
2019	50
2020	50
2021	50
2022	50
2023	50
2024	33
2025	33
2026	33
2027	33
2028	27
2029	27
2030	27
2031	27
2032	27

5.2 RAA of Control Measure Implementation Schedule

This section presents the results of the RAA based on the implementation schedule. To demonstrate compliance the baseline analysis was used to estimate the baseline water quality, which was then compared to the existing water quality based on the calibrated model. The required load reduction was estimated and appropriate control measures were scheduled for implementation so that the planning objectives would be satisfied at each of the applicable milestone dates. As discussed in Section 3, the limiting pollutant for the DC WMG is lead except for areas that drain to Machado Lake where the limiting pollutant is total nitrogen. By demonstrating compliance with the limiting pollutant using volume reduction, it can be reasonably concluded that compliance will be achieved for all other pollutants. Table 5-5 and Table 5-6 summarize the load reductions for lead and total nitrogen due to control measure implementation at the schedule discussed above. The table demonstrates that compliance will be met at each of the milestones as the load reduction is greater than the target. The structural control measures to be implemented by 2032 are illustrated in Figure 11. The load reductions for all other pollutants are provided in Attachment Z.

Table 5-5: Load Reductions based on Control Measure Implementation					
Control Measure Implementation		**Load Reduction (kg)**			
		2017 Metal (25%)	**2023 Metal (75%)**	**2027 Metal (90%)**	**2032 Metal (100%)**
Enhanced MCMs		0.37	1.12	1.49	1.86
New and Re-Development		0.31	1.22	1.82	2.58
Green Streets		8.61	23.1	27.71	30.3
Regional Projects	Darby Park	-	0.17	0.17	0.17
	El Segundo	-	0.14	0.14	0.14
	Ramona Park	-	0.05	0.05	0.05
	Jim Thorpe Park	-	0.11	0.11	0.11
	Hawthorne Memorial Park	-	0.1	0.1	0.1
	Chester Washington Golf Course	-	0.4	0.4	0.4
	Harbor City Park	-	1.26	1.26	1.26
	Wilmington Recreation Center	-	0.2	0.2	0.2
	Averill Park	-	0.01	0.01	0.01
Target Load Reduction:		9.29	27.88	33.46	37.18
Total Load Reduction:		9.29	27.88	33.46	37.18
Percent of Final Target:		25%	75%	90%	100%

Table 5-6: Nitrogen Load Reductions based on Control Measure Implementation		
Control Measure Implementation	**Total Nitrogen Load Reduction[1] (kg)**	
	2017	**2018 Nutrient (100%)**
Enhanced MCMs	12.77	25.55
New and Re-Development	6.42	7.83
Green Streets	619.50	1244.04
Regional BMPs		
Harbor City Park	-	-
Target Load Reduction:	638.71	1277.42
Total Load Reduction:	638.71	1277.42
Percent of Final Target:	50%	100%

[1] Only applicable to the area draining to Machado Lake.

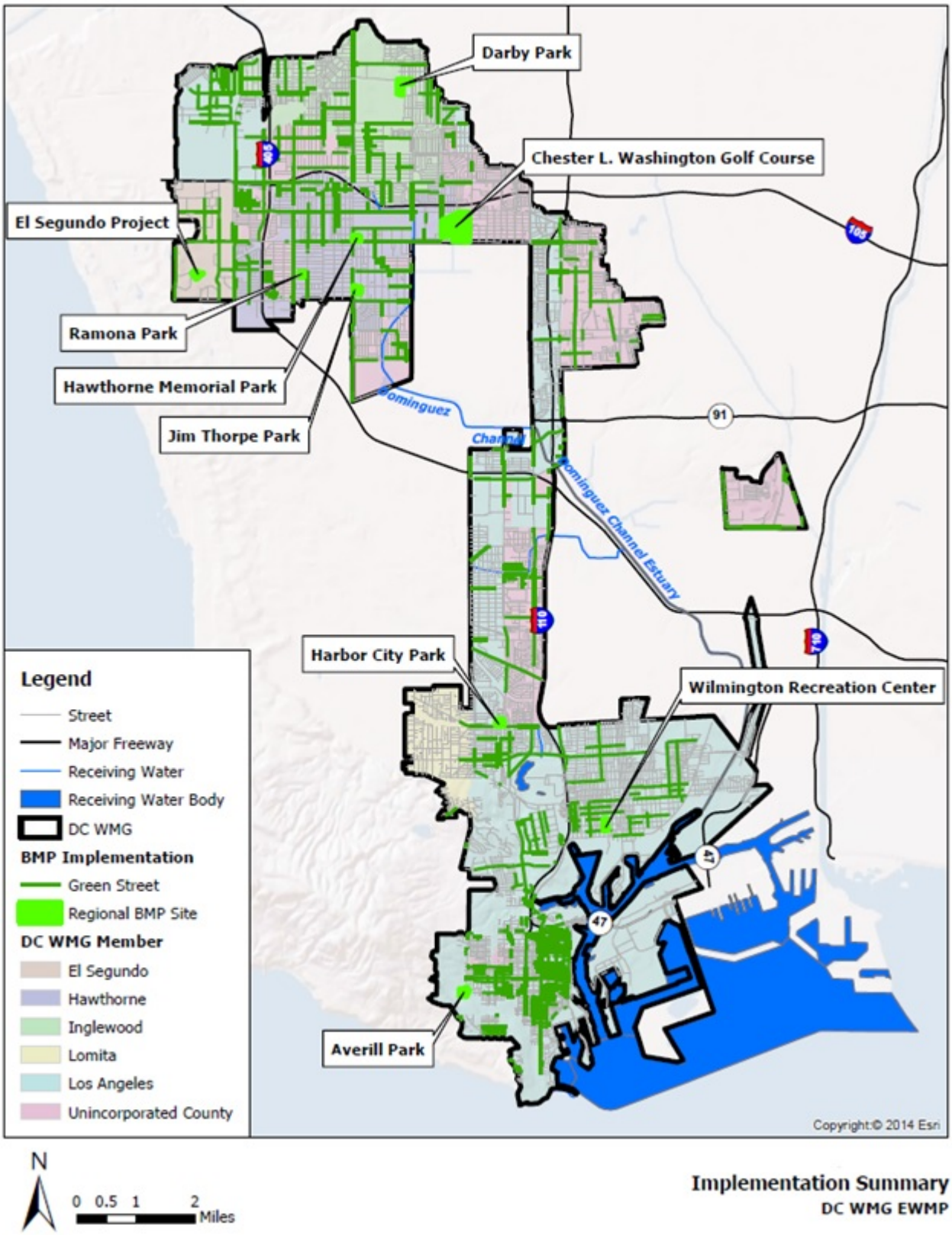

Figure 11: Implementation Summary

The average annual volume captured with the planned projects after full implementation was estimated using the model each year between 2002 and 2011. This analysis assumed that all captured volumes would be removed within 72 hours, either through natural infiltration, or by injecting the water into the drinking water aquifers. Table 5-7 summarizes the average annual volume captured each year along with the average annual captured volume based on control measure implementation.

Table 5-7: Average Annual Volume Summary

Start	End	Year	Total Volume (acre-feet)	Captured Volume (acre-feet)
10/1/02	9/30/03	2002	24,539.52	17,697.39
10/1/03	9/30/04	2003	13,042.74	12,877.47
10/1/04	9/30/05	2004	52,841.59	42,828.68
10/1/05	9/30/06	2005	13,627.09	12,080.21
10/1/06	9/30/07	2006	2,779.42	2,779.42
10/1/07	9/30/08	2007	22,156.96	18,484.86
10/1/08	9/30/09	2008	12,978.46	10,198.33
10/1/09	9/30/10	2009	27,202.60	18,304.00
10/1/10	9/30/11	2010	34,259.42	23,928.29
10/1/11	9/30/12	2011	9,589.05	9,589.05
Average:			21,301.69	16,876.77

It is important to note that not all of the planned BMPs will drain within 72 hours. This will be site and project dependent. However, this analysis suggests that there is a water supply potential associated with this EWMP of approximately 16,877 acre-feet/year (afy) on average. As shown in Table 4-10, the current total APA for the DC WMG agencies is 10,140 afy. The projects in this EWMP have the potential of increasing local groundwater supplies by 166%.

6. Assessment and Adaptive Management Framework

The EWMP is part of an adaptive management process as described in Part VI.C.8 (pages 66-67) of the MS4 Permit. Part VI.C.8 (page 66-67) states that every two years the EWMP will adapt to become more effective, based on, but not limited to, the following:

- Progress towards achieving interim and/or final WQBELs/RWLs according to TMDL schedules;
- Progress towards achieving improved water quality in MS4 discharges and achieving receiving water limitations through implementation of watershed control measures based on an evaluation of outfall-based and receiving water monitoring data;
- Achievement of interim milestones;
- Re-evaluation of the water quality priorities identified for the DC WMG based on more recent water quality data for discharges from the MS4 and receiving waters(s) and a reassessment of sources of pollutants;
- Availability of new information and data from sources other than the Permittees monitoring programs within the DC WMG that informs the effectiveness of the actions implemented;
- Regional Board recommendations; and
- Recommendations for modifications to the EWMP through a public participation process.

The adaptive nature of the EWMP allows the process to be iterative, allowing the DC WMG and other groups to identify a plan that is successful in improving water quality in their region. Figure 12 displays a flow chart of how this framework may be used.

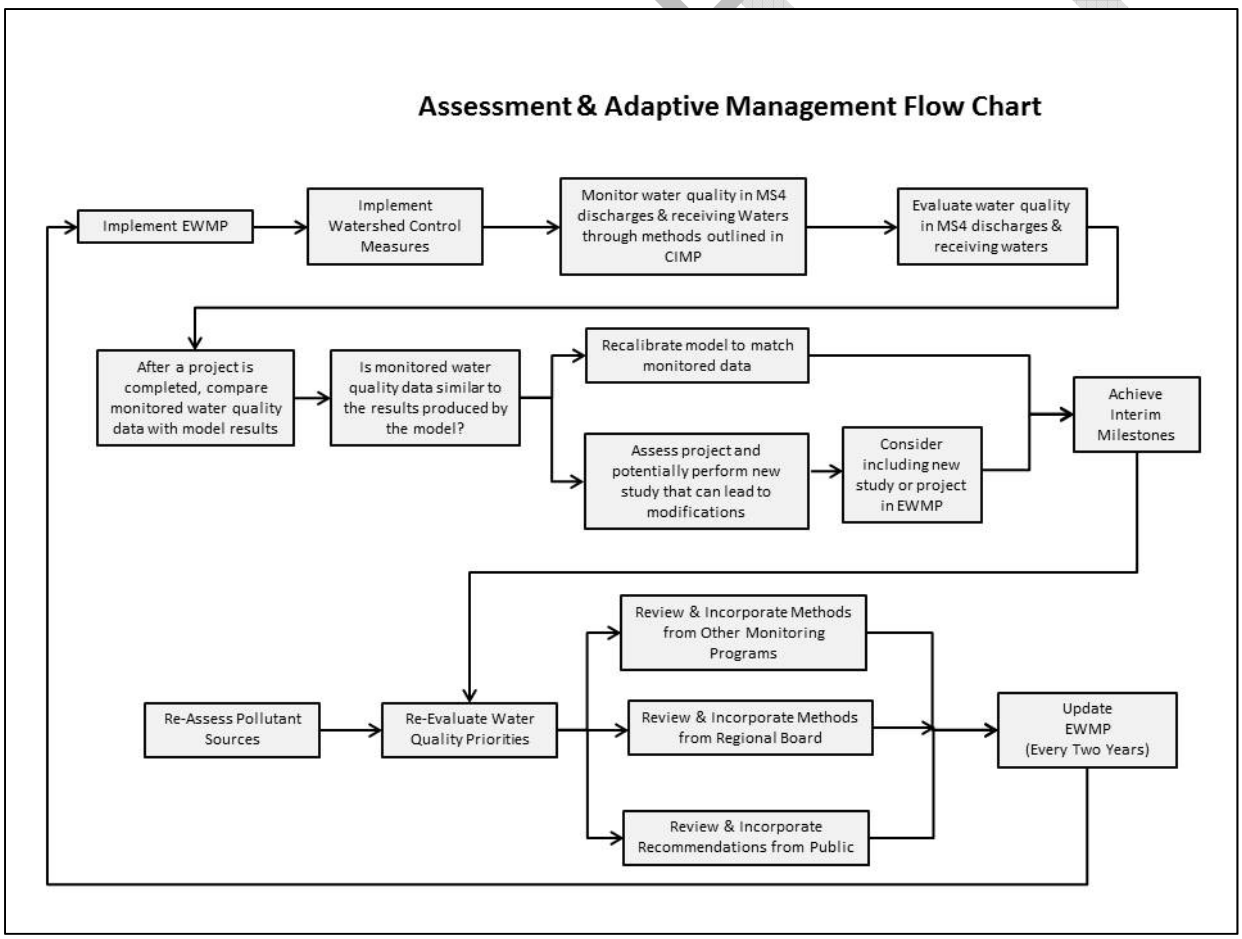

Figure 12: Assessment and Adaptive Management Flow Chart

As shown in this flow chart, the primary tool proposed for evaluating if implementing the EWMP is meeting the planning objectives is the model. Since the model is used to estimate the ability of the EWMP projects to achieve the planning objectives, and the model is calibrated on a relatively small number of sampling locations, using the CIMP results to determine if the projects, as modeled, are meeting the planning objectives, is the primary tool for adaptive management.

Since implementation of the EWMP will result mostly in volume reduction, checking flow rates at monitoring stations during specific storms and checking model simulations of those same storms and antecedent conditions will provide a valuable calibration check. This calibration check than then be used to either 1) update the model calibration and run simulations to see if the EWMP projects need modifications, or 2) stay the course.

7. EWMP Implementation Costs and Financial Strategy

The purpose of this section is to present the financial strategy for addressing the additional costs of implementing the EWMP as described in the 2012 MS4 permit. The definition of a financial strategy varies across industries. In the context of the EWMP, the financial strategy is interpreted to represent the strategic options available to the Permittees to finance the program costs associated with implementing the EWMP.

Currently, most of the projects described in this EWMP are not explicitly funded from a dedicated revenue source. Obtaining funds for all of the activities identified in the EWMP is anticipated to take many years. This section describes the probable costs of the projects, the amount of funding currently available to meet the needs described in the EWMP, and potential funding sources that may be available to fund elements of the program. The section is intended to serve as high level financial strategy by addressing the following items:

- Documentation of probable EWMP program costs;
- Assessment of impact of program costs on Permittees;
- Review of existing policies, revenues and costs affecting stormwater; and
- Identification of financial strategies for financing program costs including identification of future steps needed to implement the financial strategy.

7.1 Program Costs

7.1.1 Probable EWMP Program Costs

The purpose of this section is to present the probable order-of-magnitude cost opinions to implement the EWMP. The cost opinion for program costs were developed using feasibility study level engineering cost estimation procedures. The EWMP identified projects to be completed along a timeline. These projects are broken into four categories: (1) Minimum Control Measures (MCMs), excluding implementation of LID ordinances for new and re-development, (2) LID ordinance implementation for new and re-development, (3) regional projects, and (4) distributed projects, which are primarily green streets.

Non-Structural BMPs

As discussed in Section 4, numerous non-structural BMPs will be implemented:

- MCMs as specified in the MS4 permit.
- Adoption of SB 346, which reduces sources of copper.
- Implementation of LID ordinances in the Permittees new and re-development programs.

For these non-structural BMPs, the incremental costs beyond those currently being spent by the Permittees are expected to be negligible. The enhanced MCMs have been implemented in the current budgets. Administration of the LID ordinances has been implemented in the current budgets. Adoption and phasing in of SB 346 requires no administrative costs on the part of the DC WMG agencies.

Regional Projects

Based on the concept drawings provided in Attachment Q and estimated sizing requirements for the regional projects, preliminary probable capital and operations and maintenance cost opinions were developed for each of the regional projects. The probable cost opinions were developed using standard engineering cost estimation procedures, which rely on published unit costs for work and materials where available and the cost estimator's best judgment based on prior experience with engineering and construction for relative costs (e.g. design = 10% of construction). Table 7-1 summarizes some of the

typical line items included in the cost opinions and their associated assumptions. The items included are broken into three categories: engineering, construction support, and construction.

Table 7-1: Regional Project Probable Cost Opinion Assumptions	
Description	**Assumption(s)**
Engineering	
Design Plan and Specifications	10 percent of construction cost
Permits	Does not include CEQA
Environmental Assessment (CEQA)	Initial study/mitigated negative declaration equivalent to 25 percent of engineering design cost
Construction Support	
Construction Administration and Inspections	10 percent of construction cost
Construction	
Mobilization	10 percent of construction cost
Excavation	Extended arm not needed, bench available for equipment entry, shoring not needed, includes clearing, grubbing, and debris disposal
Fill	Fill from excavated material, no import necessary
Soil Export	30 mile or less haul route
Landscaping and Irrigation	Includes tree replacement
Diversion Pipe	Includes traffic control, road excavation, pipe installation, road restoration, and sidewalk restoration

Table 7-2 summarizes the engineering, construction support, construction, and total costs associated with each of the regional projects included in the RAA. Attachment T includes a more detailed breakdown of associated costs.

Table 7-2: Regional Project Cost Summary				
Regional Project	**Engineering**	**Construction Support**	**Construction**	**Total**
Darby Park	$520,000	$396,000	$4,947,000	$5,863,000
El Segundo	$162,000	$109,000	$1,086,000	$1,357,000
Ramona Park	$1,788,000	$1,410,000	$17,623,000	$20,821,000
Jim Thorpe Park	$1,559,000	$1,116,000	$15,337,000	$18,012,000
Hawthorne Memorial Park	$774,000	$599,000	$7,485,000	$8,858,000
Chester Washington Golf Course	$5,074,000	$4,039,000	$50,488,000	$59,601,000
Harbor City Park	$7,225,000	$5,760,000	$71,994,000	$84,979,000
Wilmington Recreation Center	$1,252,000	$892,000	$12,255,000	$14,399,000
Averill Park	$2,183,000	$1,726,000	$21,568,000	$25,477,000
Total Cost[1]:				**$239,367,000**

The annual operations and maintenance costs were also estimated for the regional projects. Based on the California Stormwater Quality Association (CASQA) BMP Handbooks and experience, one to two percent of the construction cost is recommended as the annual maintenance cost. An annual maintenance cost of 1.5 percent was used for all of the regional projects with a not to exceed cost of

$500,000. Table 7-3 summarizes the annual maintenance costs. All maintenance will start once the project is constructed.

Table 7-3: Regional Project Annual Maintenance Costs	
Regional Project	**Annual Maintenance Cost**
Darby Park	$74,205
El Segundo	$16,290
Ramona Park	$264,345
Jim Thorpe Park	$230,055
Hawthorne Memorial Park	$112,275
Chester Washington Golf Course	$500,000
Harbor City Park	$500,000
Wilmington Recreation Center	$183,825
Averill Park	$323,520

Distributed BMPs (Green Streets)

A probable cost opinion, similar to those developed for the regional projects, was developed for a 1,000 linear foot section of green street within one lane (0.19 lane miles) and is provided in Attachment T. This unit cost opinion is $478 per lineal foot per lane mile of green streets. Based on the implementation schedule summarized in Section 5, the cost per year of green street implementation is shown in Table 7-4. The green streets will also require some maintenance throughout the year to make sure they function as intended. The annual maintenance cost associated with green streets was estimated to be one percent of the construction cost, which is consistent with general CASQA BMP guidance. The maintenance cost will start once the streets have been constructed and are shown to begin the following year. Annual maintenance costs increase as more green streets are added.

Table 7-4: Green Street Implementation Cost			
Implementation Year	**Number of Lane Miles**	**Implementation Cost**	**Annual Maintenance**
2017	181	$456,528,336	-
2018	38	$95,845,728	$4,565,283
2019	50	$126,112,800	$5,523,741
2020	50	$126,112,800	$6,784,869
2021	50	$126,112,800	$8,045,997
2022	50	$126,112,800	$9,307,125
2023	50	$126,112,800	$10,568,253
2024	33	$83,865,012	$11,829,381
2025	33	$83,865,012	$12,668,031
2026	33	$83,865,012	$13,506,681
2027	33	$83,865,012	$14,345,331
2028	27	$67,092,010	$15,183,981
2029	27	$67,092,010	$15,854,901
2030	27	$67,092,010	$16,525,821
2031	27	$67,092,010	$17,196,741
2032	27	$67,092,010	$17,867,662
2033	-	-	$18,538,582

The large capital costs in 2018 are primarily for the Lake Machado subwatershed, which has the nearest implementation milestone based on the nutrients TMDL.

Drinking Water Aquifer Recharge by Injection Wells

The project cost opinions provided above do not include costs for injecting water into the drinking water aquifers. Because much of the volume reduction proposed is through green streets, and a survey to identify collection points within green streets systems where injection wells can be effectively used has not been completed yet, the number of injection wells and total amount of water that can be feasibly injected is highly uncertain. For this reason, the incremental probable cost opinion for implementing one injection well and the amount of water that injection well can potentially move into the drinking water aquifer is provided in this section.

The probable cost opinion for an injection well is based on the Alamitos and West Coast Seawater Barriers operated by LACDPW along with engineering experience. LACDPW staff suggested that an average injection well can consistently inject at a rate of 0.35 cubic feet per second (cfs). If a well would be sited such that, it would be able to operate constantly for 3 days following a storm (there was that much volume accumulated), this would provide approximately 2 acre-feet of water per well per operational period. Table 7-5 shows the probable cost opinions for such a well based on information provided by LACDPW. Based on the operating history of the LACDPW injection barriers, each well generally needs to be redeveloped every two years replaced every 25 years due to well degradation that occurs from scaling and other processes. Injected water would need to be filtered to maintain well life to within these parameters. Amore detailed probable cost opinion that includes probable opinions of design costs, construction support, and construction costs is provided in Attachment T. Future costs are not discounted to present value and not escalated for inflation.

Table 7-5: Injection Well Cost Summary per Well

Cost Item Description	Total Cost
Engineering, Construction Support, and Construction	$1,000,000
Annual Maintenance of Injection Wells	$100,000
Well Redevelopment (every 2 years)	$2,000
Well Head Replacement (every 25 years)	$1,000,000

Opinion of Probable Cost Summary

The probable cost opinions associated with regional and distributed project implementation were placed along the implementation timeline to show a potential future cash flow scenario. All cost opinions are shown in 2014 dollars. Future costs are neither discounted nor escalated. Figure 13 shows the probable capital and O&M cost opinions per year based on the implementation schedule.

Future replacement costs based on expected useful lives of the systems are not shown in Figure 13. Injection well costs are not shown Figure 13.

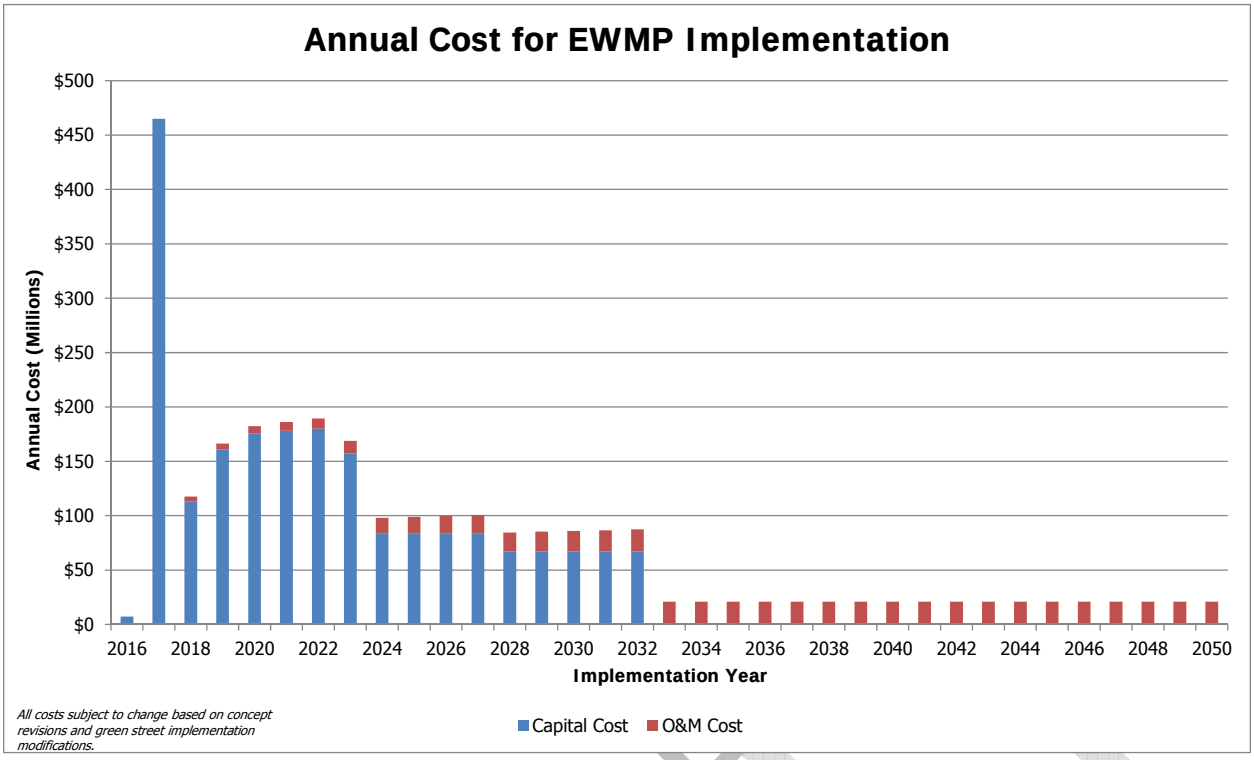

Figure 13: Annual Cost for EWMP Implementation

EWMP Costs by Type

The total probable cost opinions by type are shown in Table 7-6.

Table 7-6: Total Estimated EWMP Costs by Type

Type	Capital Cost	Annual O&M at Build-out
MCMs	$0	Current budgets
LID + Redevelopment	$0	Current budgets
Regional BMPs	$239,000,000	$2,200,000
Green Streets	$1,850,000,000	$16,300,000
Total	$2,089,000,000	$18,500,000

7.1.2 Existing Stormwater Programs

The co-Permittees have been addressing stormwater discharge requirements since adoption of the first phase I NPDES MS4 permit in the early 1990s. They have increased their budgets since that time to meet additional compliance needs. Co-Permittees have existing recurring costs associated with stormwater activities in excess of $50M annually (across all watersheds in which they reside). Table 7-7 is a summary listing of current expenditures and associated revenue sources. Given that the DC WMG agencies have, for the most part, implemented enhanced MCMs and have adopted LID ordinances and are administering their new and re-development programs, it is expected that these recurring costs will continue, for the most part, as is. CIMP monitoring costs are not included in Table 7-7 and are not in the EWMP

implementation costs. The purpose of this financial strategy is focused on developing a set of options to address the expected additional costs associated with compliance with the new MS4 permit, and is not intended to incorporate the costs of the existing stormwater activities.

TABLE 7-7: Existing Stormwater Costs

Jurisdiction	Existing Utility? (Yes/No)	Funding Source	Description of Costs	Total Costs ($)
City of Los Angeles	Yes	Stormwater Fee Plan Check and Grants	O&M and Capital, Planning, Program Management, Monitoring, Emergency Repairs	~$3M/yr (Dominguez Channel Area; not including Prop O)
Los Angeles County	Yes	General Fund, Gasoline Tax, Solid Waste Fund, Prop C, and Prop A	Management, Outreach, Inspection, Enforcement, Monitoring	~80M/yr (County wide)
Los Angeles County Flood Control District	No	Flood Control Benefit Assessment	Program Management, O&M, Public Outreach, Monitoring	~36M/yr (County wide)
City of Hawthorne	Yes	General Fund	Program Management, Outreach, Administration	~$335,000/yr
City of Inglewood	Yes	Sewer Fund	O&M and Capital, Runoff Investigation	Not Available
City of El Segundo	Not Available	Not Available	Not Available	Not Available
City of Lomita	No	General Fund	Permit Fee, Match Funding for County Projects	~$73,000/yr

7.2 Financial Strategies

As described in this EWMP, the projects being envisioned represent new infrastructure or revisions to existing infrastructure that will be expected to operate in perpetuity. This new infrastructure or increased costs associated with revising existing infrastructure were never envisioned when the DC WMG agencies were developing their revenue and budgeting models. Therefore, the DC WMG agencies do not currently have revenue sources allocated specifically to this new infrastructure. New revenue sources need to be identified, or revenue sources currently allocated to other programs need to be used to fund the implementation of this EWMP. Flexibility in identifying potential funding opportunities will be important for successful financing of EWMP implementation.

The financial strategy presented in this EWMP outlines a set of multiple approaches that allows each DC WMG agency to select those strategies that best fit their specific circumstances.

The detailed financial strategy for EWMP costs will be highly dependent and vary by agency. Each permittee has different resources as presented in Table 7-7; therefore each permittee will use a different set of options at its disposal. The following are high-level alternatives that can be examined as each

permittee moved forward as a group or as individuals. The alternatives are categorized by type. Acknowledgement is given to *Stormwater Funding Options – Providing Sustainable Water Quality Funding in Los Angeles County,* a report authored by Ken Farfsing and Richard Watson dated May 21, 2014.

Grants and Low Interest Loans

The financial strategies available to the Permittees associated with grants and low interest loans are summarized below and described in further detail in Attachment U:

- Apply for grants through the recently passed Prop 1 – 2014 Water Bond. Over $400M is available for stormwater capture, IRWMP and urban creek restoration projects.
- Apply for other grants (state and federal) for stormwater improvement, beach water quality improvement, and green infrastructure projects. (e.g. Prop. 84, CBI, etc.)
- Apply for a low interest loan through the State Water Resources Control Board's Clean Water State Revolving Fund (CWSRF) program for implementation of programs and projects to control pollution from nonpoint sources and stormwater drainage.

Table 7-8 lists grant and low interest loan programs that could potentially be applied to EWMP projects. They programs range from Federal to State and can apply to transportation, waters supply, water quality, habitat enhancement, recreation, or a range of potential project benefits. Table 7-8 shows which project benefit criteria apply most to the different grant programs. As projects are developed and concept planned, incorporating the benefits that position them for grants and low interest loans can be beneficial in improving odds successfully obtaining such funds.

Table 7-8: Grant and Loan Programs and Project Criteria

Funding Source	Priority Project Elements									
	Drought Preparedness	Increase Local Water Supply	Conservation Programs	Water Quality	Pollution Reduction	Flood Management Programs	Drinking Water Protection	Ecosystem Protection	Restoration	Public Health/ Environmental Impact
EPA Section 319				X	X					
Proposition 1:										
Regional Water Security		X		X				X	X	
Flood Management		X		X				X	X	
, Safe, Reliable Drinking Water		X		X				X	X	
Water Recycling		X		X				X	X	
tem and Watershed Protection		X		X				X	X	
Groundwater Sustainability		X		X				X	X	X
Water Storage Capacity		X		X				X	X	
Clean Beaches Initiatives				X	X			X	X	
TIGER Discretionary *				X						
Supplemental Environmental Project Funds:										
Federal			X	X	X					X
State			X	X	X			X	X	
Clean Water State Revolving Fund	X			X	X					X
California Infrastructure Development Bank – Infrastructure State				X		X				

* Transportation projects that are coordinated with interdisciplinary factors including Stormwater and other infrastructure investments

Fees and Charges

The financial strategies DC WMG agencies may consider associated with fees and charges are:

- Use existing revenue streams for stormwater/water supply/flood control projects to support stormwater quality projects as legally allowable.
- AB 2403 – Use new state law to use water rates for stormwater projects water supply benefits as legally allowable.
- Establish a means by which private developers can fund regional or green streets project in lieu of retaining water on private development. To get sufficient benefit from this, the in lieu project would need to get greater water quality benefit than the retention system on private development.
- Use solid waste management fees to cover the cost of enhanced street sweeping and other measures to reduce trash for compliance with TMDLs.
- Use water rates to fund programs to reduce irrigated runoff.
- Pursue a proposition 218 compliant stormwater fee or tax initiative (modified after the 2012 Clean Water Clean Beaches Initiative).
- Pursue proposition 218 compliant special product taxes on those projects that result in greater amounts of pollution causing water quality impairments. Examples include pesticides, fertilizers, automobile tires or other automotive products. Use the revenue to fund EWMP projects.

Legislative and Policy

The financial strategies DC WMG agencies may consider that require legislative or policy changes are summarized below:

- Lobby the Metropolitan Water District (MWD) of Southern California to reevaluate their approach for managing the Local Resource Program (LRP) to fund stormwater capture and use projects that offset the use of imported water supplies. This is related to a water rate increase in that MWD would incorporate the costs into their imported water rates.
- Pursue pollutant source control legislation patterned after SB 346 that either limits pollutants of concerns in products (e.g. copper in brake pads, or zinc in tires) or assesses a fee on those products that can be used by local governments to mitigate those pollutants.
- Form Special Assessment Districts and fees tailored to the Watershed Management Groups.
- Explore the use of Enhanced Infrastructure Finance Districts tailored to the Watershed Management Group, as outlined in recently adopted (2014) California legislation SB628.
- 2014 Water Resources Reform and Development Act of 2014 (WRRDA). Partner with USACE to model the watershed impervious surface effects on the federal interests under WRRDA to secure USACE cost sharing for EWMP programs.

Future Steps

The financial strategies mentioned herein are options for funding sources, some or all of which can potentially be implemented to develop a comprehensive financial solution. As each DC WMG agency determines the appropriate funding strategy, they will consider the following items as well:

- Development of public support for financial strategies though outreach efforts
- Create inter-jurisdiction WMG financial working group(s)
- Develop of a more formal Stormwater Program Financial Plan that could include the following components:
  - Implementation of New Fee or Charge;

- Establish New Enterprise Fund;
- Cash and Debt Financing;#
- Operating and Capital Reserves;
- Cash Flow Modeling.

The Watershed Management Group as a whole, as well as individual members of the WMG are currently prioritizing and selecting the specific financial strategies that best fit their needs. It is anticipated that a more fully developed financial plan will be developed and implemented by the WMG and/or its individual members in the coming months and years.

8. Legal Authority

As part of the Standard Provisions of the MS4 Permit, Permittees must demonstrate through a certified statement annually that their legal authority to implement and enforce the requirements of the order exists. Legal authority is described in the MS4 Permit (Part VI.A.2, pages 39-41) as follows:

a. Each Permittee must establish and maintain adequate legal authority, within its respective jurisdiction, to control pollutant discharges into and from its MS4 through ordinance, statute, permit, contract or similar means. This legal authority must, at a minimum, authorize or enable the Permittee to:

i. Control the contribution of pollutants to its MS4 from storm water discharges associated with industrial and construction activity and control the quality of storm water discharged from industrial and construction sites. This requirement applies both to industrial and construction sites with coverage under an NPDES permit, as well as to those sites that do not have coverage under an NPDES permit.

ii. Prohibit all non-storm water discharges through the MS4 to receiving waters not otherwise authorized or conditionally exempt pursuant to Part III.A;

iii. Prohibit and eliminate illicit discharges and illicit connections to the MS4;

iv. Control the discharge of spills, dumping, or disposal of materials other than storm water to its MS4;

v. Require compliance with conditions in Permittee ordinances, permits, contracts or orders (i.e., hold dischargers to its MS4 accountable for their contributions of pollutants and flows);

vi. Utilize enforcement mechanisms to require compliance with applicable ordinances, permits, contracts, or orders;

vii. Control the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements among Copermittees;

viii. Control of the contribution of pollutants from one portion of the shared MS4 to another portion of the MS4 through interagency agreements with other owners of the MS4 such as the State of California Department of Transportation;

ix. Carry out all inspections, surveillance, and monitoring procedures necessary to determine compliance and noncompliance with applicable municipal ordinances, permits, contracts and orders, and with the provisions of this Order, including the prohibition of non-storm water discharges into the MS4 and receiving waters. This means the Permittee must have authority to enter, monitor, inspect, take measurements, review and copy records, and require regular reports from entities discharging into its MS4;

x. Require the use of control measures to prevent or reduce the discharge of pollutants to achieve water quality standards/receiving water limitations;

xi. Require that structural BMPs are properly operated and maintained; and

xii. Require documentation on the operation and maintenance of structural BMPs and their effectiveness in reducing the discharge of pollutants to the MS4.

With the exceptions of the City of Inglewood, each of the DC WMG agencies has provided their latest certified statement for inclusion in Attachment V for reference. The City of Inglewood is still in the process of obtaining their certified statement at the time of this writing.

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Attachment A

Watershed Characteristics

Attachment B

DC WMG TMDL Requirements

Attachment C

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Data Sources and Data for Water Quality Analysis

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