Tetra Tech Inc.

Attachment A: Summary of EWMP Amendments

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1.0 INTRODUCTION AND PURPOSE

The Rio Hondo/San Gabriel River Revised Enhanced Watershed Management Program (rEWMP) improves upon some parts of the existing Rio Hondo/San Gabriel River Enhanced Watershed Management Program (EWMP), which was approved by the Los Angeles Regional Water Quality Control Board (Water Quality Control Board) on April 21, 2016. The rEWMP document does not necessarily satisfy all requirements of an EWMP and should not be used as a standalone compliance plan. To clearly identify which sections of the original 2016 EWMP still apply and which were formally amended by the rEWMP, this Attachment A provides an erratum and a redlined version of the 2016 EWMP is included as Appendix A.1.

It is anticipated that additional revisions will be made over time through the adaptive management process.

2.0 ERRATUM TO THE 2016 EWMP

The following erratum notes the specific revisions and amendments to the following redlined version of the 2016 EWMP.

Rev. No.	Page	Section	Line	Revision Type/Description
1	xi	Executive Summary	30	DELETED: 85th percentile storm and
2	xiii	Executive Summary	16	DELETED: .2
3	xiii	Executive Summary	29-31	DELETED: The catchment areas draining to the proposed regional EWMP projects, which are those projects that capture the 85th percentile, 24-hour storm volume, are considered compliant with the MS4 Permit while the RAA was used to demonstrate compliance in other areas.
4	xiv	Executive Summary	1	TABLE ES-1 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
5	xv	Executive Summary	1	FIGURE ES-2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
6	xvi	Executive Summary	10	TABLE ES-2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
7	xvi	Executive Summary	21-25	DELETED: The average annual stormwater capture was determined for the modeled years (2002-2011) and compared to the total average annual volume of runoff. The model demonstrated that based on control measure implementation, the average annual stormwater capture is 14,158 acre-feet and 9,372 acre-feet in the LAR and SGR Watersheds, respectively. Capturing this volume

Rev. No.	Page	Section	Line	Revision Type/Description
				during an average year will allow the Group to address the 90th percentile load as required by the MS4 Permit.
8	xvi	Executive Summary	27-28	DELETED: the 85th percentile storm event volume and the critical storm defined as
9	xvi	Executive Summary	28	DELETED: event
10	xvi	Executive Summary	29	DELETED: event
11	xvi	Executive Summary	32-33	DELETED: lead is the limiting pollutant
12	xvii	Executive Summary	1	TABLE ES-3 AND ES-4 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
13	xvii	Executive Summary	7-9	DELETED: The regional projects modeled for the LAR Watershed portion of the RAA must all be addressed prior to the 2024 milestone. The SGR Watershed must address two regional projects prior to the 2020 milestone and the other two projects must be addressed prior to the 2023 milestone.
14	xviii	Executive Summary	1,7	TABLE ES-5 AND ES-6 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
15	xix	Executive Summary	1	FIGURE ES-3 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
16	xx	Executive Summary	1,7	TABLE ES-7 AND ES-8 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
17	xx	Executive Summary	3,4	DELETED: The unit cost was determined to be $486 per linear foot per lane mile of green streets.
18	xxi	Executive Summary	3,19	FIGURE ES-4 AND TABLE ES-9 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
19	20	1.5	7	DELETED: Regional EWMP projects have been identified and
20	20	1.5	30	DELETED: volume and

Rev. No.	Page	Section	Line	Revision Type/Description
21	20	1.5	31	DELETED: 85th percentile volume analysis and the
22	92	3.2.4.3	27-31	DELETED: The sites selected for future implementation are identified in the table above the bold line. Not all of the sites will be used for Regional projects, as the costs would be too high. It is recommended that the top ranked sites be implemented in the future and were modeled in the RAA to demonstrate compliance, as detailed further in Section 4. These sites are further discussed in Section 3.4.2.
23	93	3.2.4.3	5-9	DELETED: The sites selected for future implementation are identified in the table above the bold line. Not all of the sites will be used for Regional projects, as the costs would be too high. It is recommended that the top ranked sites be implemented in the future and were modeled in the RAA to demonstrate compliance, as detailed further in Section 4. These sites are further discussed in Section 3.4.2.
24	94-100	3.2.5	All	THE ENTIRETY OF SECTION 3.2.5 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F
25	113	3.4.1.1	5	REVISED: 5.2% to 5%
26	115	3.4.1.3	1	TABLE 3-21 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F
27	116	3.4.1.3	1	TABLE 3-22 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F
28	117-123	3.4.2	All	THE ENTIRETY OF SECTION 3.4.2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F
29	123-127	3.4.3	All	THE ENTIRETY OF SECTION 3.4.3 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F

Rev. No.	Page	Section	Line	Revision Type/Description
30	128-169	4	All	THE ENTIRETY OF SECTION 4 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F
31	170-173	5	All	THE ENTIRETY OF SECTION 5 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
32	174-176	6.2	All	THE ENTIRETY OF SECTION 6.2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
33	176-177	6.3	All	THE ENTIRETY OF SECTION 6.3 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
34	177-179	6.4	All	THE ENTIRETY OF SECTION 6.4 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
35	179	6.5	8	DELETED: are over $1.4 billion and
36	180	6.5	6	THE ANNUAL IMPLEMENTATION COSTS IN TABLE 6-6 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA
37		Attachment Q		THE ENTIRETY OF ATTACHMENT Q IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENTS B, C, D, and E
38		Attachment R		THE ENTIRETY OF ATTACHMENT R IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENTS B, C, D, and E
39		Attachment S		THE ENTIRETY OF ATTACHMENT S IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENTS B, C, D, and E
40		Attachment T		THE ENTIRETY OF ATTACHMENT T IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENTS B, C, D, and E

Rev. No.	Page	Section	Line	Revision Type/Description
41		Attachment U		THE ENTIRETY OF ATTACHMENT U IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F
42		Attachment W		THE ENTIRETY OF ATTACHMENT W IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F
43		Attachment X		THE ENTIRETY OF ATTACHMENT X IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT F
44		Attachment Y		THE ENTIRETY OF ATTACHMENT Y IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENTS B, C, D, and E
45		Attachment Z		THE ENTIRETY OF ATTACHMENT Z IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENTS B, C, D, and E

APPENDIX A.1: REDLINED 2016 EWMP

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Acronyms

AB	Assembly Bill
ACS	Alternative Compliance Strategy
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
ATP	Active Transportation Program
BMP	Best Management Practice
BPA	Basin Plan Amendment
BSAF	Biota-Sediment Accumulation Factor
BSI	Bacteria Source Identification
CAMS	Countywide Address Management System
CARE	Community Action for a Renewed Environment
CASQA	California Stormwater Quality Association
CBI	Clean Beaches Initiative
C.C.	Coefficient of Correlation
CEDEN	California Environmental Data Exchange Network
CEQA	California Environmental Quality Act
CGP	Construction General Permit
CIMP	Coordinated Integrated Monitoring Program
CMP	Coordinated Monitoring Program
CREST	Cleaner Rivers through Effective Stakeholder-led TMDLs
CTR	California Toxics Rule
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DO	Dissolved Oxygen
DSA	Division of the State Architect
DTSC	Department of Toxic Substances Control
EEM	Environmental Enhancement and Mitigation
EIR	Environmental Impact Report
EMC	Event Mean Concentration
ESCP	Erosion and Sediment Control Plan
ET	Evapotranspiration
EWMP	Enhanced Watershed Management Program
EWRI	Environmental and Water Resources Institute
FCG	Fish Contaminant Goals
FHWA	Federal Highway Administration
FWC	Flow-Weighted Composite
GIS	Geographic Information System
GLAC	Greater Los Angeles County
HCF	Habitat Conservation Fund
HFS	High Flow Suspension
HRU	Hydrologic Response Unit
HSG	Hydrologic Soil Group

HSIP	Highway Safety Improvement Program
HSPF	Hydrologic Simulation Program-FORTRAN
IBD	International BMP Database
IC/ID	Illicit Connection/Illicit Discharge
IGP	Industrial General Permit
IPM	Integrated Pest Management
IRWMP	Integrated Regional Water Management Plan
ISRF	Infrastructure State Revolving Fund
JPA	Joint Powers Authority
LAC	Los Angeles County
LACSD	Los Angeles County Sanitation Districts
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LADPW	Los Angeles Department of Power and Water
LAR	Los Angeles River
LARWQCB	Los Angeles Regional Water Quality Control Board
LID	Low Impact Development
LRP	Local Resources Program
LRS	Load Reduction Strategy
LSPC	Loading Simulation Program in C++
LUST	Leaking Underground Storage Tank
LWCF	Land and Water Conservation Fund
MCM	Minimum Control Measure
MEP	Maximum Extent Practicable
MS4	Municipal Separate Storm Sewer System
MTA	Metropolitan Transportation Authority
MWD	Metropolitan Water District
NCDC	National Climatic Data Center
NDMA	N-Nitrosodimethylamine
NOI	Notice of Intent
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NPS	Non-Point Source
O&M	Operation and Maintenance
OWTS	Onsite Wastewater Treatment System
P2	Pollution Prevention
PAH	Polycyclic Aromatic Hydrocarbons
PET	Pan Evapotranspiration
PIPP	Public Information and Participation Program
POC	Pollutant of Concern
POTW	Publicly Owned Treatment Works
PTMISEA	Public Transportation Modernization, Improvement, and Service Enhancement Account
QA/QC	Quality Assurance/Quality Control
RAA	Reasonable Assurance Analysis

RCP	Reinforced Concrete Pipe
RH/SGRWQG	Rio Hondo/San Gabriel River Water Quality Group
RMSE	Root Mean Square Error
ROS	Regression-on-Order Statistics
ROWD	Report of Waste Discharge
RPA	Reasonable Potential Analysis
RTP	Recreational Trails Program
RWL	Receiving Water Limitation
SB	Senate Bill
SBPAT	Structural BMP Prioritization and Analysis Tool
SCCWRP	Southern California Coastal Water Research Project
SGR	San Gabriel River
SIC	Standard Industrial Classification
SLOD	Sample Limits of Detection
SMARTS	Storm Water Multiple Application and Report Tracking System
SMB	Santa Monica Bay
SRPE	Steel Reinforced Polyethylene
SSO	Site-Specific Objectives
SUSMP	Standard Urban Stormwater Mitigation Plan
SUSTAIN	System for Urban Stormwater Treatment and Analysis Integration
SWAMP	Surface Water Ambient Monitoring Program
SWGP	Stormwater Grant Program
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TDS	Total Dissolved Solids
TEC	Threshold Effect Concentration
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound
WBPC	Water Body-Pollutant Combination
WCB	Wildlife Conservation Board
WDR	Waste Discharge Requirement
WER	Water Effects Ratios
WERF	Water Environment Research Foundation
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
WRP	Water Reclamation Plant

WRRDA Water Resources Reform and Development Act

Executive Summary

In response to the Phase I Los Angeles County Municipal Separate Storm Sewer System (MS4) Permit, Order No. R4-2012-0175, the Rio Hondo/San Gabriel River Water Quality Group (RH/SGRWQG or the Group) decided to collaborate in the development of an Enhanced Watershed Management Program (EWMP). This Group is comprised of the Cities of Arcadia, Azusa, Bradbury, Duarte, Monrovia, Sierra Madre, the County of Los Angeles, and the Los Angeles County Flood Control District (LACFCD). This EWMP describes the compliance path the Group will utilize to achieve water quality objectives by specified milestone dates.

Several of the Group members participating in this EWMP are in both the Los Angeles River (LAR) and San Gabriel River (SGR) Watersheds. The Group is located in the eastern portion of the LAR Watershed Management Area and the upper portion of the urban SGR Watershed Management Area. The area included in the EWMP encompasses approximately 42 square miles of predominately residential and open space land use. Of the total LAR and SGR Watershed areas, the Group members have jurisdiction over four and three percent of the total watersheds, respectively. The Group area is illustrated in **Figure ES-1**.

This EWMP identifies the water quality priorities relevant to the Group based on limited available water quality data. These priorities are the focus of various implementation efforts required to be in compliance with interim and final water quality objectives. Additionally, the EWMP identifies the existing structural and non-structural Best Management Practices (BMPs) implemented by the Group. Potential regional project sites were identified and evaluated to determine which would be proposed and included in the EWMP's Reasonable Assurance Analysis (RAA). An approach for selecting distributed BMPs, such as green streets, is also included and proposed streets are identified so that required load reductions can be achieved.

The EWMP outlines the approach used for the RAA, detailing the modeling system, calibration process, and estimated baseline conditions. Once the baseline conditions were estimated, the proposed control measures were modeled to demonstrate that applicable water quality objectives will be achieved based on the ~~85th percentile storm and~~ 90th percentile load criterions. Based on the proposed control measures, potential implementation costs and schedules are also identified. Major components of this EWMP include:

Water Quality Priorities

The water quality priorities were identified by characterizing the water bodies using limited available monitoring data and Water Body Pollutant Combinations were then developed. Separate categories of Water Body Pollutant Combinations have been established and are expected to be addressed through the implementation of various control measures proposed in this EWMP. In addition, a source assessment was undertaken and a prioritization was developed based on Total Maximum Daily Loads (TMDLs) and other receiving water considerations. The identification of water quality priorities directed the selection of control measures and future implementation efforts included in the EWMP.

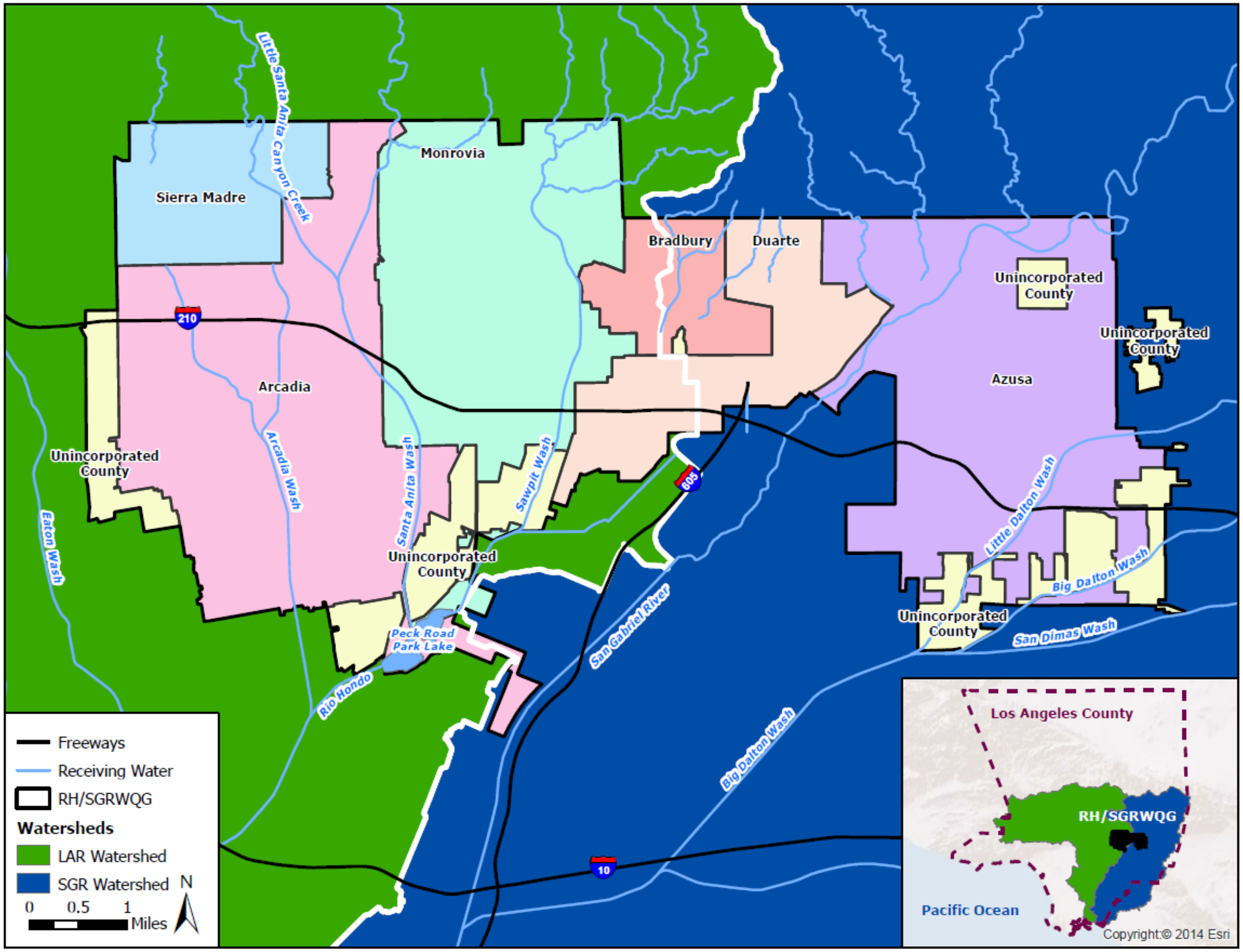


Figure ES-1 EWMP Group Area

Watershed Control Measures

This EWMP identifies both the various control measures that currently exist within the Group area and control measures that will need to be addressed to comply with the applicable objectives within the given timeframe. Various non-structural control measures along with structural control measures (distributed and regional BMPs) are proposed and included in the RAA to demonstrate compliance with water quality objectives.

The MS4 Permit also defines Minimum Control Measures (MCMs) and includes a variety of non-structural control measures. Requirements based on the current MS4 Permit are more stringent than those implemented under the previous permit, and the differences between the two are further discussed in the EWMP. As an example, the 2012 MS4 Permit requires that construction sites under one acre be inspected based on water quality threat, while the 2001 MS4 Permit did not have any inspection requirements for sites under one acre. Some Group members intend to implement enhanced programs beyond what is required in the MS4 Permit. Due to the proposed non-structural control measure implementation, a 5.~~2~~ percent load reduction is being credited in the RAA process. The new and redevelopment program requires developers to mitigate stormwater based on predefined criteria. Projected development rates based on land use were used to quantify the volume reduction associated with new and redevelopment to take credit in the RAA.

Potential regional project sites were identified and evaluated using a tailored screening process. The evaluation of regional projects started with 652 potential parcels and was narrowed down to 41 potential sites which were then analyzed in greater detail. Of these proposed sites, Peck Road Park Lake was considered for a potential regional project; however, this location is considered a Water of the United States and receiving water body, and cannot be considered as a treatment site. Further discussions with the Regional Water Quality Control Board (Regional Board) would be required to fully evaluate this potential site for future possible regional projects.

~~The catchment areas draining to the proposed regional EWMP projects, which are those projects that capture the 85th percentile, 24-hour storm volume, are considered compliant with the MS4 Permit while the RAA was used to demonstrate compliance in other areas.~~ **Table ES-1** contains a list of the proposed regional BMPs identified, the jurisdiction in which the project is located, and whether the project is considered a regional EWMP project (captures the full 85th percentile, 24-hour storm event) or a regional project (does not capture the full volume of a 85th percentile, 24-hour storm event). The table also lists the jurisdictions that would benefit from the proposed projects. Projects are listed in the order in which they ranked after the screening process. The responsible jurisdiction for implementing the projects identified is the jurisdiction in which the project is located. The responsible agency does not imply financial responsibility. Funding agreements will be formed to determine financial responsibility. The contributing jurisdictions identified in the table are the jurisdictions other than the responsible jurisdiction that contribute flow to the project. The locations of the proposed regional projects along with their percent capture compared to the 85th percentile, 24-hour storm event volume are illustrated in **Figure ES-2**.

Table ES-1 Proposed Regional Project BMP Sites

Proposed Project Site	Project Type	Responsible Jurisdiction	Contributing Jurisdiction(s)
LAR Watershed			
Recreation Park	Regional EWMP	Monrovia	-
Arboretum of LAC	Regional EWMP	Arcadia	-
Sierra Vista Park	Regional EWMP	Sierra Madre	-
Royal Oaks Trail (LAR)	Regional EWMP	Bradbury/Duarte	Monrovia and County
L. Garcia Park	Regional EWMP	Monrovia	-
Eisenhower Park	Regional	Arcadia	Monrovia and Sierra Madre
SGR Watershed			
LADWP Easement	Regional	Azusa/County	-
Encanto Park	Regional EWMP	Duarte	Azusa
Memorial Park (Azusa)	Regional EWMP	Azusa	-
Royal Oaks Trail (SGR)	Regional EWMP	Bradbury/Duarte	County

TABLE ES-1 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

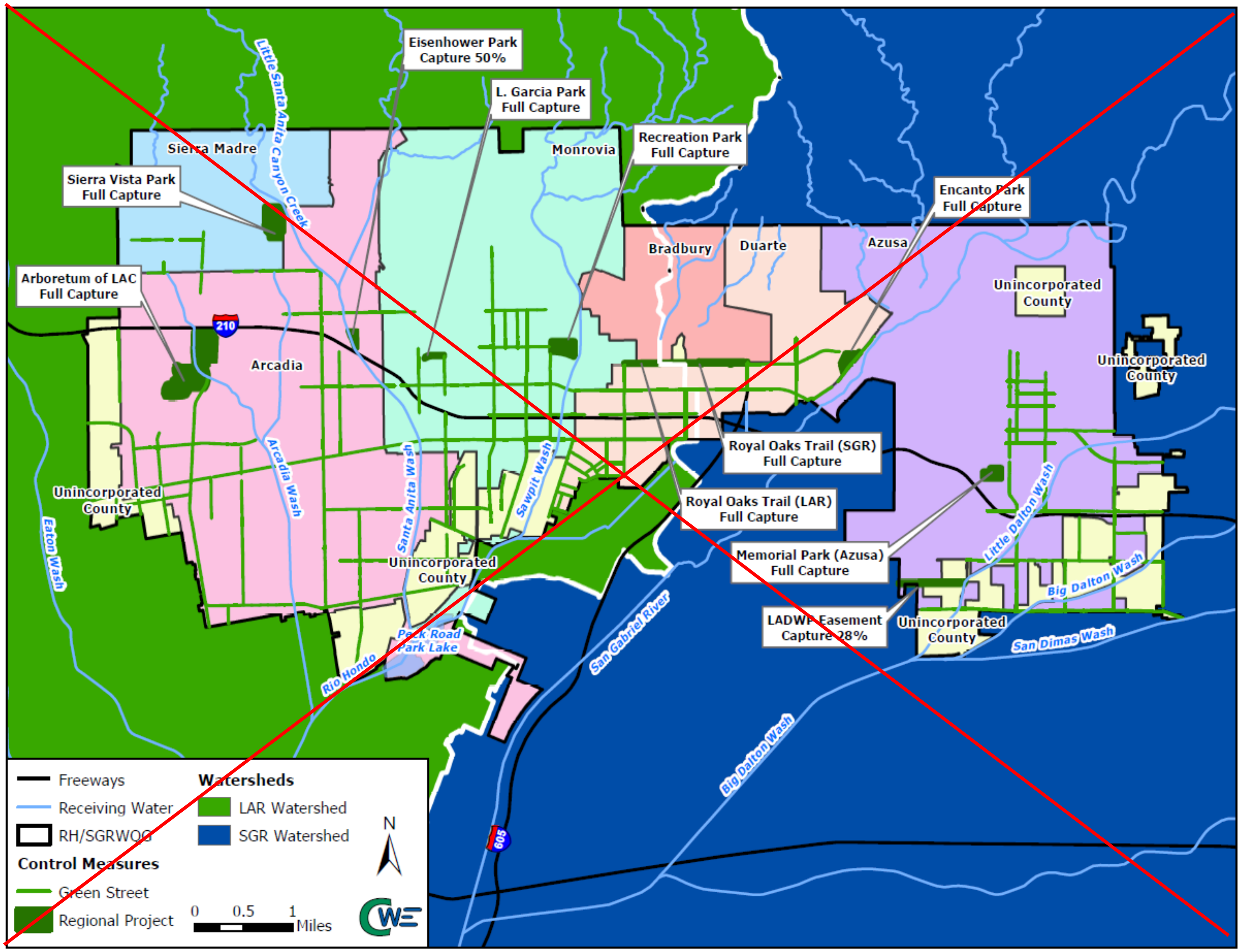


Figure ES-2 Control Measure Implementation Summary

FIGURE ES-2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

Distributed BMPs, such as green streets, were also evaluated and proposed as part of this EWMP to address the estimated load and volume reductions to achieve compliance with water quality objectives. EWMP area roadways were screened to determine the feasibility of implementing green streets. Green streets may also be replaced with alternative distributed BMPs with an equivalent volume. Alternate distributed BMPs may include bioretention systems that collect runoff from impervious surfaces and infiltrate onsite. The Group's subareas were analyzed and streets were selected to achieve the estimated volume and load reductions. The proposed implementation of green streets in lane miles by jurisdiction is summarized in **Table ES-2**. **Figure ES-2** illustrates the proposed distributed control measures within the EWMP area.

Table ES-2 Green Street Implementation Summary by Jurisdiction

Jurisdiction	Green Street Lane Miles			
	LAR Watershed	SGR Watershed	Total	Percent by Agency
Arcadia	123	0	123	28%
Azusa	0	112	112	26%
Bradbury	0	0	0	0%
Duarte	38	16	54	12%
Monrovia	68	0	68	16%
Sierra Madre	6	0	6	1%
County Unincorporated	38	35	73	17%
Total:	**273**	**163**	**436**	**100%**

TABLE ES-2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

Reasonable Assurance Analysis

The objective of the RAA was to demonstrate the ability of the control measures identified in the EWMP to achieve applicable water quality objectives and not cause or contribute to exceedances. The water quality model was calibrated based on land use, geography, estimated baseline water quality, and other parameters and was used to simulate the runoff and corresponding water quality generated within the EWMP area. The EWMP provides details of the modeling approach, calibration, and baseline simulation.

~~The average annual stormwater capture was determined for the modeled years (2002-2011) and compared to the total average annual volume of runoff. The model demonstrated that based on control measure implementation, the average annual stormwater capture is 14,158 acre feet and 9,372 acre feet in the LAR and SGR Watersheds, respectively. Capturing this volume during an average year will allow the Group to address the 90th percentile load as required by the MS4 Permit.~~

An analysis was done to determine ~~the 85th percentile storm event volume and the critical storm defined as~~ the 90th percentile load ~~event~~ within both the LAR and SGR Watersheds. The 90th percentile load ~~event~~ criterion was used to establish the limiting priority pollutant. The selection of the limiting pollutant is based on the concept that if the constituent with the highest volume associated with the 90th percentile load, or that is most difficult to capture, is captured, then all other constituent requirements will be achieved. It was determined that zinc is the limiting pollutant in the LAR Watershed and ~~lead is the limiting pollutant~~ in the SGR Watershed. Based on the proposed control measures, simulations were run to demonstrate that the target load reductions will be met by the predefined milestone dates. **Table ES-3** and **Table ES-4** demonstrate the target load reductions associated with the limiting pollutant will be met by the milestone dates in the LAR and SGR Watersheds, respectively.

Table ES-3 Zinc Load Reduction Based on Control Measure Implementation in the LAR Watershed

Control Measure Implementation	Zinc Load Reduction (kg)	
	2024 (50% Metals)	**2028 (100% Metals)**
Enhanced MCMs	35.20	35.20
New and Re-Development	4.28	16.44
Green Streets	207.50	543.76
Regional BMPs		
Recreation Park	6.73	6.73
Sierra Vista Park	11.76	11.76
Arboretum of LAC	7.14	7.14
Royal Oaks Trail (LAR)	35.86	35.86
L. Garcia Park	15.07	15.07
Eisenhower Park	24.88	24.88
Target Load Reduction:	348.42	696.84
Total Load Reduction:	348.42	696.84
Percent of Final Target:	50%	100%

Table ES-4 Lead Load Reduction Based on Control Measure Implementation in the SGR Watershed

Control Measure Implementation	Lead Load Reduction (kg)			
	2017 (10% Metals)	**2020 (35% Metals)**	**2023 (65% Metals)**	**2026 (100% Metals)**
Enhanced MCMs	2.45	2.45	2.45	2.45
New and Re-Development	0.16	0.40	0.63	0.89
Green Streets	2.30	13.53	24.32	41.26
Regional BMPs				
LADWP Easement	-	0.34	0.34	0.34
Encanto Park	-	0.48	0.48	0.48
Memorial Park (Azusa)	-	-	1.21	1.21
Royal Oaks Trail (SGR)	-	-	2.50	2.50
Target Load Reduction:	4.91	17.20	31.93	49.13
Total Load Reduction:	4.91	17.20	31.93	49.13
Percent of Final Target:	10%	35%	65%	100%

TABLE ES-3 AND ES-4 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

Control Measure Implementation Schedule

Control measures were modeled in the RAA to demonstrate compliance at each of the milestones, which correspond with TMDL schedules. The schedule associated with the required implementation efforts is proposed in this EWMP. ~~The regional projects modeled for the LAR Watershed portion of the RAA must all be addressed prior to the 2024 milestone. The SGR Watershed must address two regional projects prior to the 2020 milestone and the other two projects must be addressed prior to the 2023 milestone.~~ **Table ES-5** summarizes the anticipated completion year for each of the proposed regional projects.

Table ES-5 Regional Project Schedule	
Proposed Project Site	**Completion Year**
LAR Watershed	
Recreation Park	2020
Arboretum of LAC	2021
Sierra Vista Park	2020
Royal Oaks Trail (LAR)	2023
L. Garcia Park	2024
Eisenhower Park	2024
SGR Watershed	
LADWP Easement	2020
Encanto Park	2020
Memorial Park (Azusa)	2023
Royal Oaks Trail (SGR)	2023

The schedule for green street (distributed BMP) implementation was determined and is based on the volume/load reductions that are not satisfied by other control measures at each of the compliance deadlines associated with TMDL schedules. **Table ES-6** summarizes the proposed green street implementation schedule and **Figure ES-3** illustrates the distribution over time.

Table ES-6 Proposed Green Street Implementation Timeline		
Implementation Year	**Lane Miles of Green Streets**	
	LAR Watershed	**SGR Watershed**
2017	-	17.0
2018	-	-
2019	-	-
2020	-	41.0
2021	-	16.0
2022	39.6	16.0
2023	39.7	16.0
2024	39.7	19.0
2025	38.5	19.0
2026	38.5	19.0
2027	38.5	-
2028	38.5	-
Total:	**273.0**	**163.0**

TABLE ES-5 AND ES-6 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

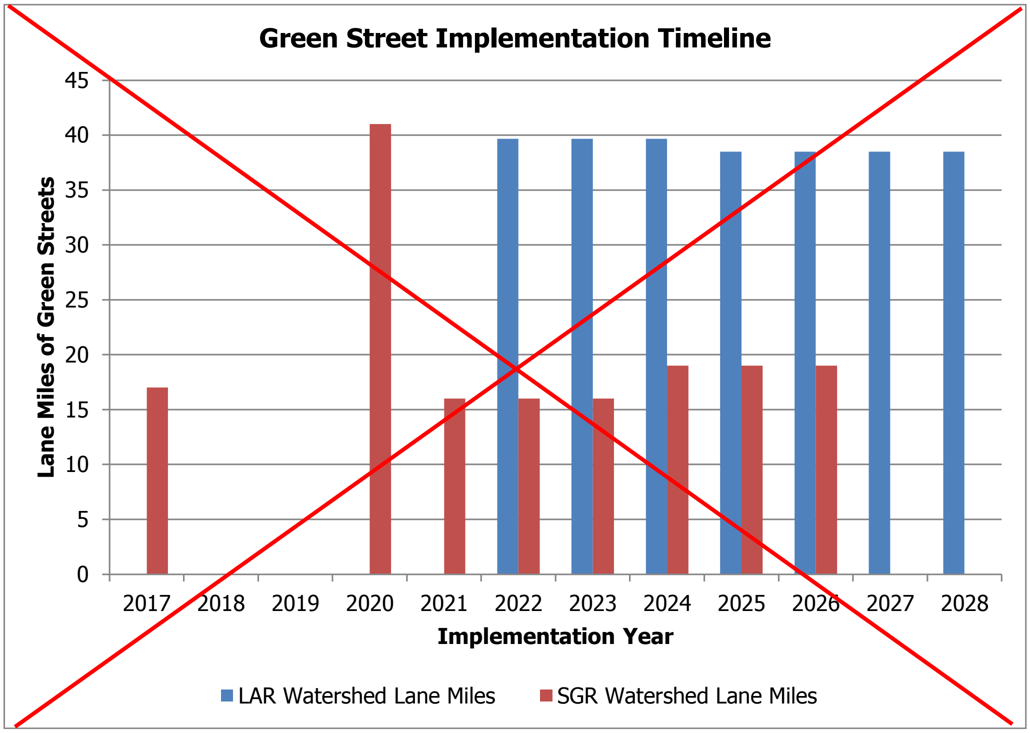


Figure ES-3 Green Street Implementation Summary

FIGURE ES-3 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

Control Measure Implementation Cost

A preliminary cost analysis was performed based on the implementation schedule. Implementation costs were spread out whenever possible keeping in mind that compliance with the water quality objectives must be demonstrated through the RAA. All of the costs are presented in today's dollars, assuming no inflation. The cost increase associated with non-structural control measure implementation is small in comparison to regional and distributed BMP implementation costs; therefore, costs associated with non-structural BMP implementation are not included in the subsequent summary. The capital and operation and maintenance (O&M) cost associated with each of the proposed regional BMPs is summarized in **Table ES-7**.

TABLE ES-7 AND ES-8 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

Table ES-7 Regional Project Cost

Proposed Project Site	Capital Cost	Annual O&M Cost
LAR Watershed		
Recreation Park	$10,251,000	$125,205
Arboretum of LAC	$15,097,000	$369,060
Sierra Vista Park	$4,818,000	$117,330
Royal Oaks Trail (LAR)	$53,109,000	$500,000
L. Garcia Park	$23,323,000	$285,270
Eisenhower Park	$38,402,000	$469,905
LAR Watershed Subtotal:	**$145,000,000**	**$1,866,770**
SGR Watershed		
LADWP Easement	$6,436,000	$156,960
Encanto Park	$16,255,000	$198,720
Memorial Park (Azusa)	$43,830,000	$500,000
Royal Oaks Trail (SGR)	$88,076,000	$500,000
SGR Watershed Subtotal:	**$154,597,000**	**$1,355,680**
Total:	**$299,597,000**	**$3,222,450**

A cost estimate was done for green street implementation in order to determine a unit cost. ~~The unit cost was determined to be $486 per linear foot per lane mile of green streets.~~ Green streets will also require maintenance throughout the year to make sure they function as intended. The capital and O&M costs associated with the proposed green street implementation is summarized in **Table ES-8**.

Table ES-8 Green Street Implementation and Maintenance Costs

Year	LAR Watershed			SGR Watershed		
	Lane Miles	Capital Cost	O&M Cost	Lane Miles	Capital Cost	O&M Cost
2017	-	-	-	17.0	$43,596,432	-
2018	-	-	-	-	-	$435,964
2019	-	-	-	-	-	$435,964
2020	-	-	-	41.0	$105,144,336	$435,964
2021	-	-	-	16.0	$41,031,936	$1,487,408
2022	39.6	$101,554,042	-	16.0	$41,031,936	$1,897,727
2023	39.7	$101,810,491	$1,015,540	16.0	$41,031,936	$2,308,046
2024	39.7	$101,810,491	$2,033,645	19.0	$48,725,424	$2,718,366
2025	38.5	$98,733,096	$3,051,750	19.0	$48,725,424	$3,205,620
2026	38.5	$98,733,096	$4,039,081	19.0	$48,725,424	$3,692,874
2027	38.5	$98,733,096	$5,026,412	-	-	$4,180,128
2028	38.5	$98,733,096	$6,013,743	-	-	$4,180,128
2029	-	-	$7,001,074	-	-	$4,180,128

The annual costs associated with EWMP implementation for the Group is illustrated in **Figure ES-4**. The costs will be high during initial implementation and then be reduced such that only the O&M costs are applied until the BMPs require replacement. The replacement costs are not included in the estimates provided in this EWMP but would be anticipated within 30 to 50 years depending on the type of BMP selected.

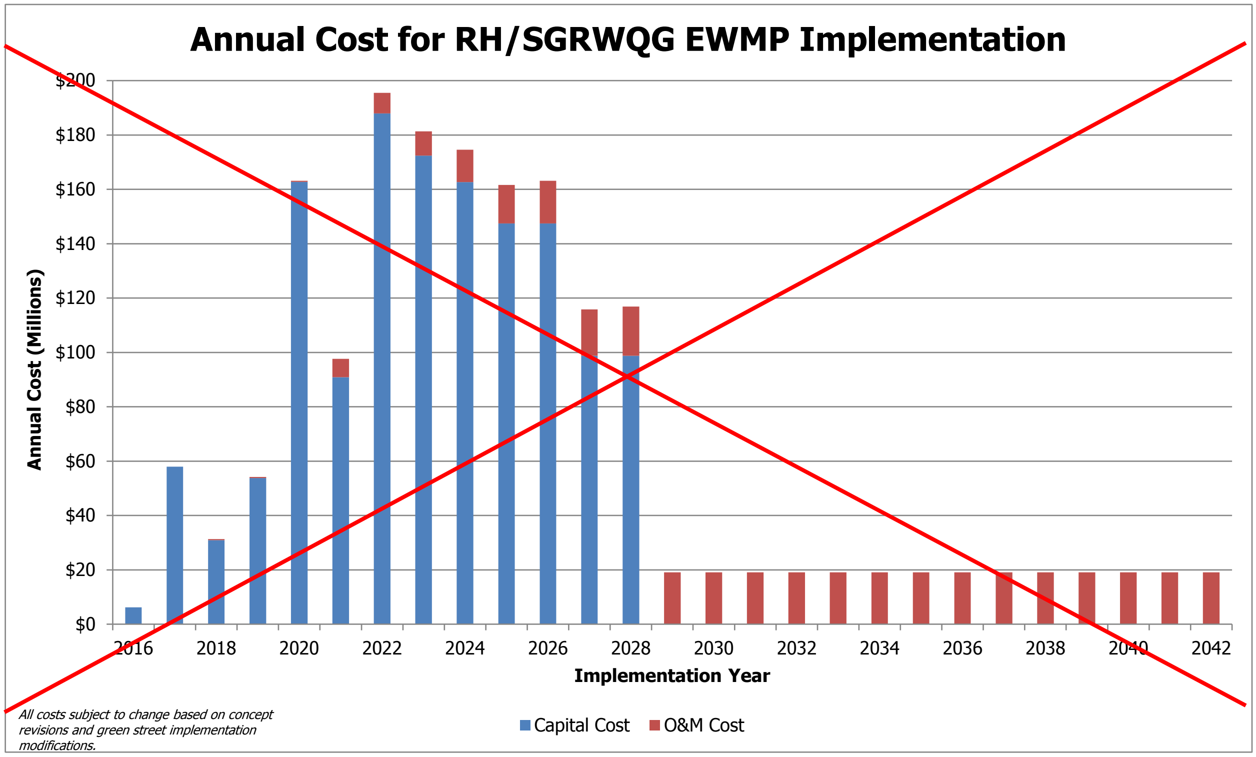


Figure ES-4 Estimated Annual Cost for RH/SGRWQG EWMP Implementation

For funding strategy purposes, the costs were broken down by jurisdictions based on the control measures anticipated within each jurisdictional boundary. For regional projects, the cost share was determined based on the ratio of each jurisdiction within the catchment area tributary to the proposed project. The cost sharing formula will ultimately be determined by the member agencies based on monitoring results and associated project priorities. **Table ES-9** summarizes the implementation cost. The funding strategies discussed in this EWMP include:

- Grants and loans;
- Fees and charges;
- Legislative and policy;
- Partnerships; and
- Investment opportunities.

FIGURE ES-4 AND TABLE ES-9 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

Table ES-9 RH/SGRWQG EWMP Implementation Costs

Control Measures	Cost
Regional Projects	$299,597,000
Green Streets	$1,118,120,256
Total:	**$1,417,717,256**

Adaptive Management Process

Lastly, this EWMP highlights the adaptive management process. The adaptive nature of the EWMP allows the process to be iterative, allowing the Group to identify a plan that is successful in improving water quality in the region. Through the adaptive management process, the EWMP will be updated two years after the Regional Board Executive Officer approval and every two years thereafter, while the RAA will need to be revised and updated by 2021. The data collected through implementation of the Coordinated Integrated Monitoring Program (CIMP) will be used when revising the EWMP as part of the adaptive management process.

1. Introduction

This document describes how the Rio Hondo/San Gabriel River Water Quality Group (RH/SGRWQG) developed an Enhanced Watershed Management Program (EWMP) per the requirements set forth in the Los Angeles County (LAC) National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit (Permit), Order No. R4-2012-0175. This document also describes the path Permittees utilized to complete the EWMP process required in the MS4 Permit. The EWMP addresses water quality priorities in portions of the Rio Hondo and San Gabriel River, and their respective tributaries. A comprehensive stormwater management plan that optimizes stormwater and financial resources has been produced through this EWMP process. The EWMP integrates existing planning efforts and identifies additional opportunities for water quality enhancement through both programmatic and structural controls. In addition, the EWMP incorporates multi-benefit projects that not only improve water quality, but also provide aesthetic, recreational, water supply, and/or community enhancements.

1.1 Applicability of EWMP

Permittees participating in the RH/SGRWQG EWMP include the County of Los Angeles, Los Angeles County Flood Control District (LACFCD), and the Cities of Arcadia, Azusa, Bradbury, Duarte, Monrovia, and Sierra Madre, several of which are in both the Los Angeles River (LAR) and San Gabriel River (SGR) Watersheds. A description of the LACFCD and their involvement in the EWMP process is provided in **Attachment A**. **Figure 1-1** provides a map illustrating the LAR and SGR Watersheds and the jurisdictional boundaries of the RH/SGRWQG members participating in this EWMP. **Table 1-1** describes the size and percentage of each participating member's jurisdiction within the group and the percent contribution to the LAR and SGR Watersheds.

Table 1-1 Jurisdictions within RH/SGRWQG

RH/SGRWQG Member	Area Inside RH/SGRWQG (square miles)	Total Percent of RH/SGRWQG	Percent in LAR Watershed	Percent in SGR Watershed
Arcadia	11.1	27%	98%	2%
Azusa	9.3	22%	0%	100%
Bradbury	1.9	5%	41%	59%
Duarte	3.6	9%	37%	63%
Monrovia	7.9	19%	99%	1%
Sierra Madre	2.8	7%	100%	0%
Los Angeles County	4.6	11%	54%	46%

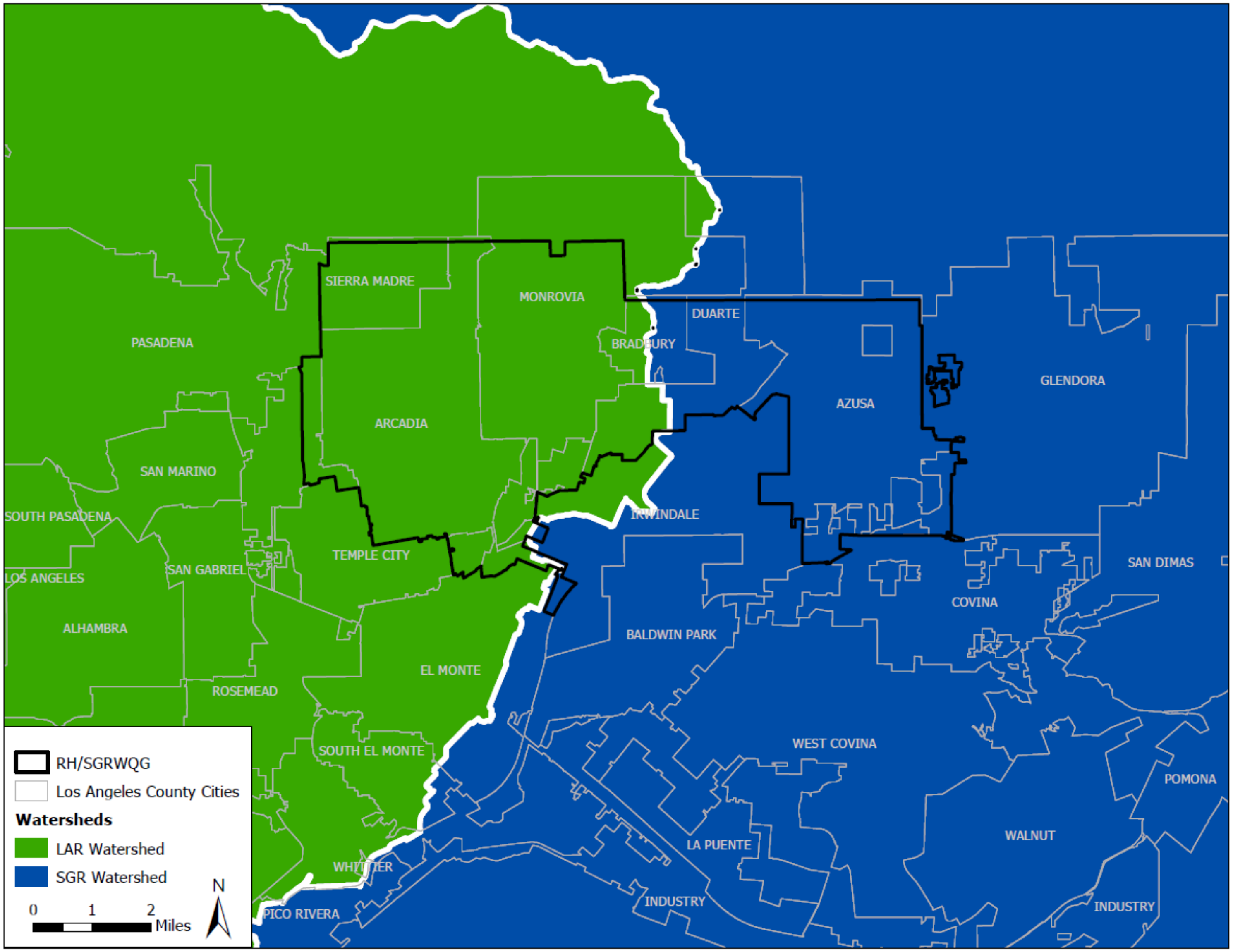


Figure 1-1 RH/SGRWQG and Major Watersheds

1.2 Geographic Scope and Characteristics

The RH/SGRWQG watershed characteristics, including the physical and hydrological conditions, are unique to the area and are presented below, including the extent of the MS4 and receiving waters addressed by this EWMP.

1.2.1 Watershed Characteristics

The RH/SGRWQG is located in the eastern portion of the LAR Watershed and the upper portion of the urban SGR Watershed. The area included in the RH/SGRWQG EWMP encompasses approximately 41 square miles of predominately residential and open space land use and excludes areas in the Angeles National Forest. The RH/SGRWQG members have jurisdiction over four and three percent of the total LAR and SGR Watersheds, respectively. **Table 1-2** depicts the watershed land use categories within the RH/SGRWQG area, corresponding with **Figure 1-2**.

Table 1-2 RH/SGRWQG Land Use Summary

Land Use Category	Area (square miles)	Percentage
Agriculture	1.1	3%
Commercial	3.5	8%
Education	1.1	3%
Industrial	2.8	7%
Multi-Family (MF) Residential	2.8	7%
Single Family (SF) Residential	19.3	47%
Transportation	0.7	1%
Vacant	9.9	24%
Total	**41.2**	**100%**

The hydrologic characteristics of the RH/SGRWQG include:

- Soil types based on the LAC Hydrology Manual (2006), (**Figure 1-3**);
- Storm depth that increases from south to north and has higher depths in the center of the RH/SGRWQG area with a peak in the City of Bradbury, as indicated by the 85th percentile, 24-hour rainfall depth distribution (**Figure 1-4**);
- Storm intensity that increases from south to north, as indicated by the 50-year, 24-hour rainfall intensity distribution (**Figure 1-5**); and
- MS4 outfalls along the Rio Hondo and SGR being identified and investigated through Coordinated Integrated Monitoring Program (CIMP) efforts (**Figure 1-6**).

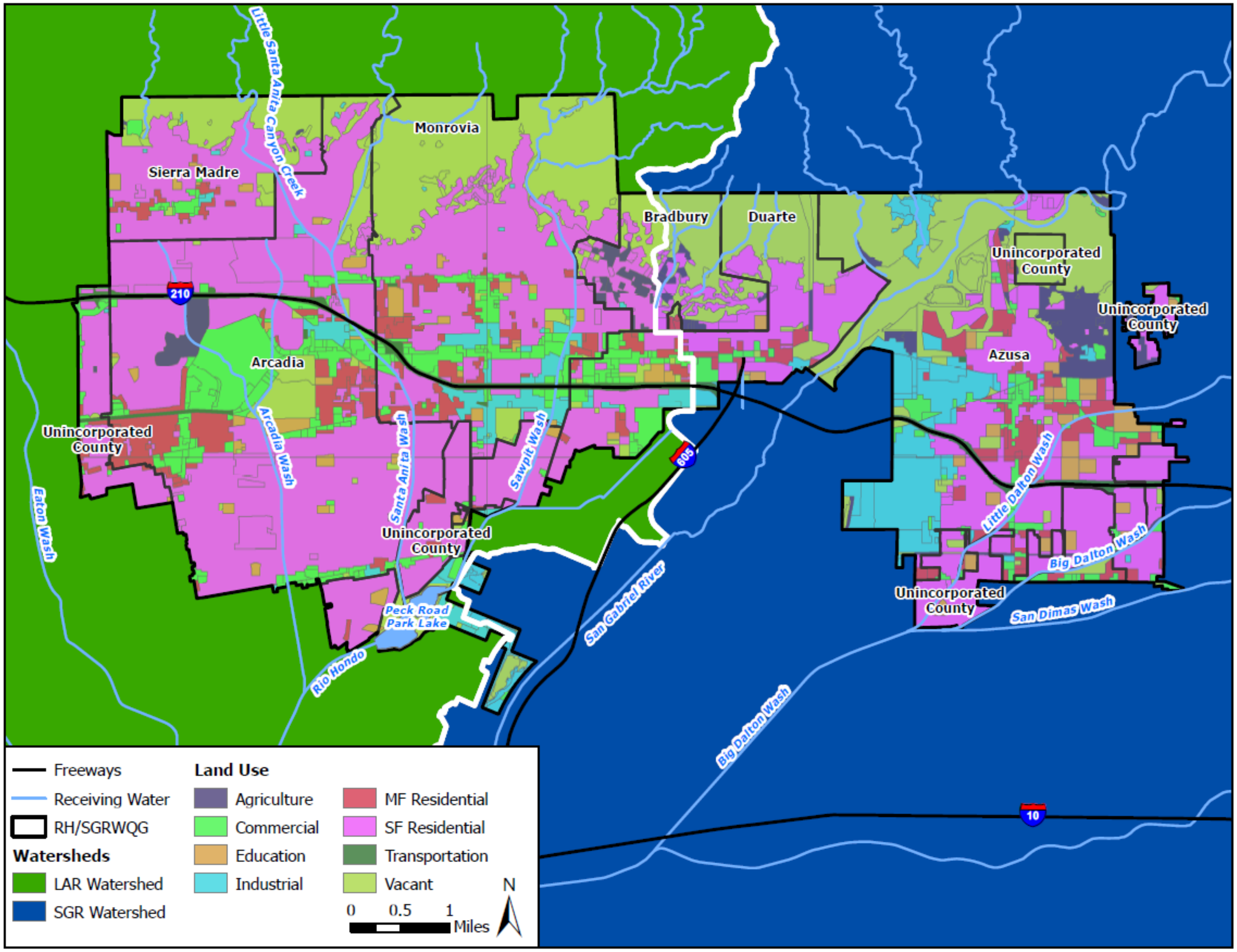


Figure 1-2 RH/SGRWQG Land Use

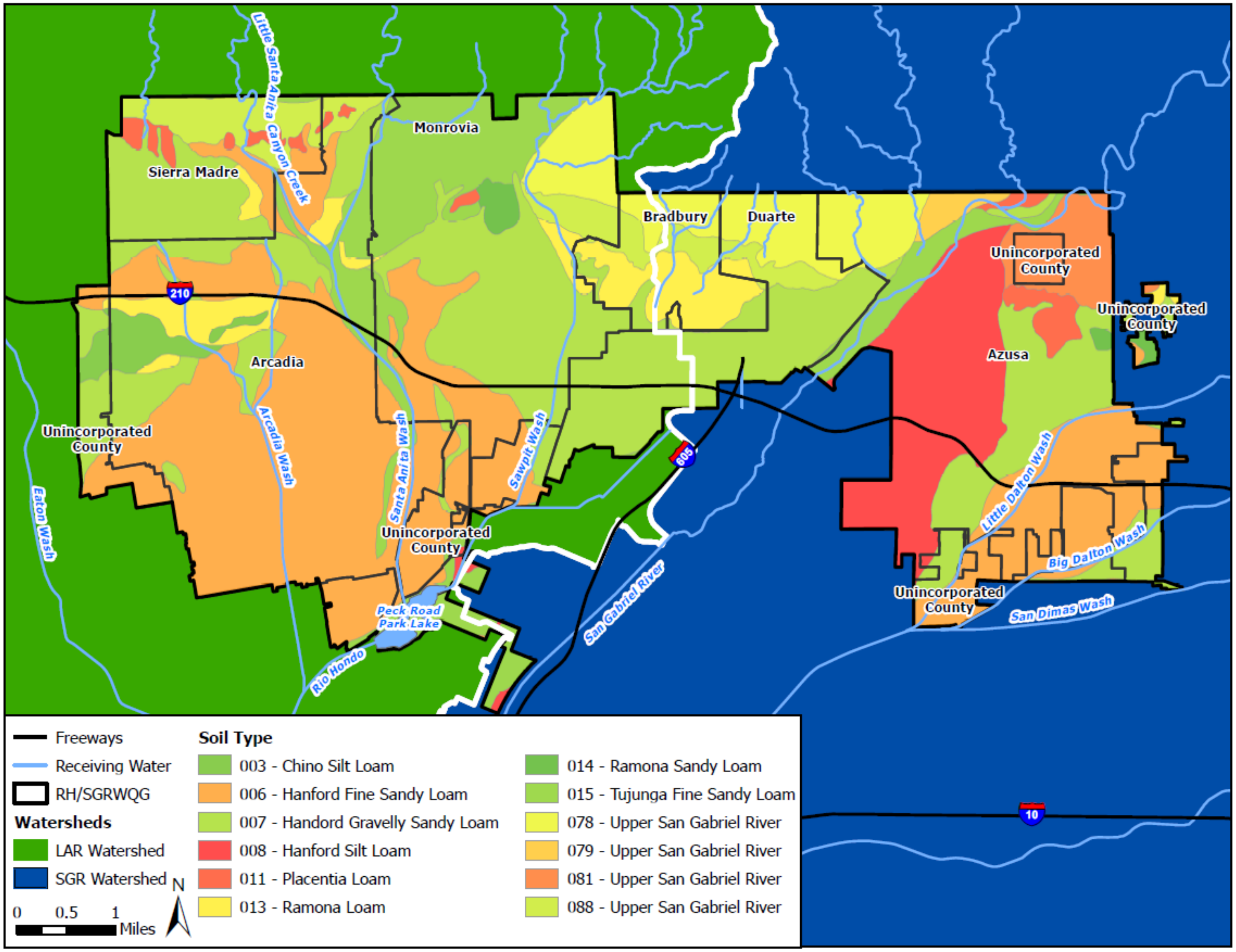


Figure 1-3 RH/SGRWQG Soil Types

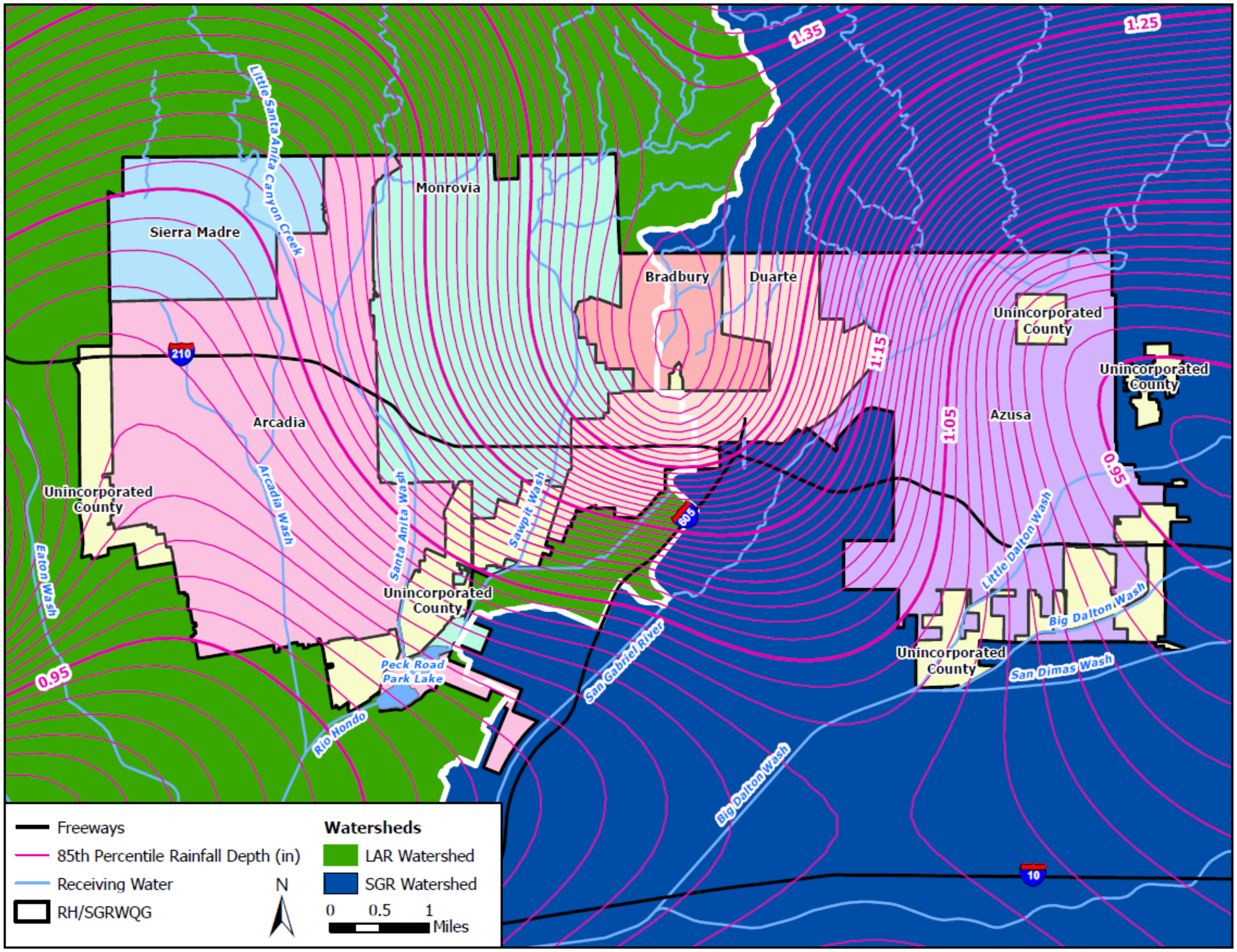


Figure 1-4 85th Percentile, 24-Hour Rainfall Depths

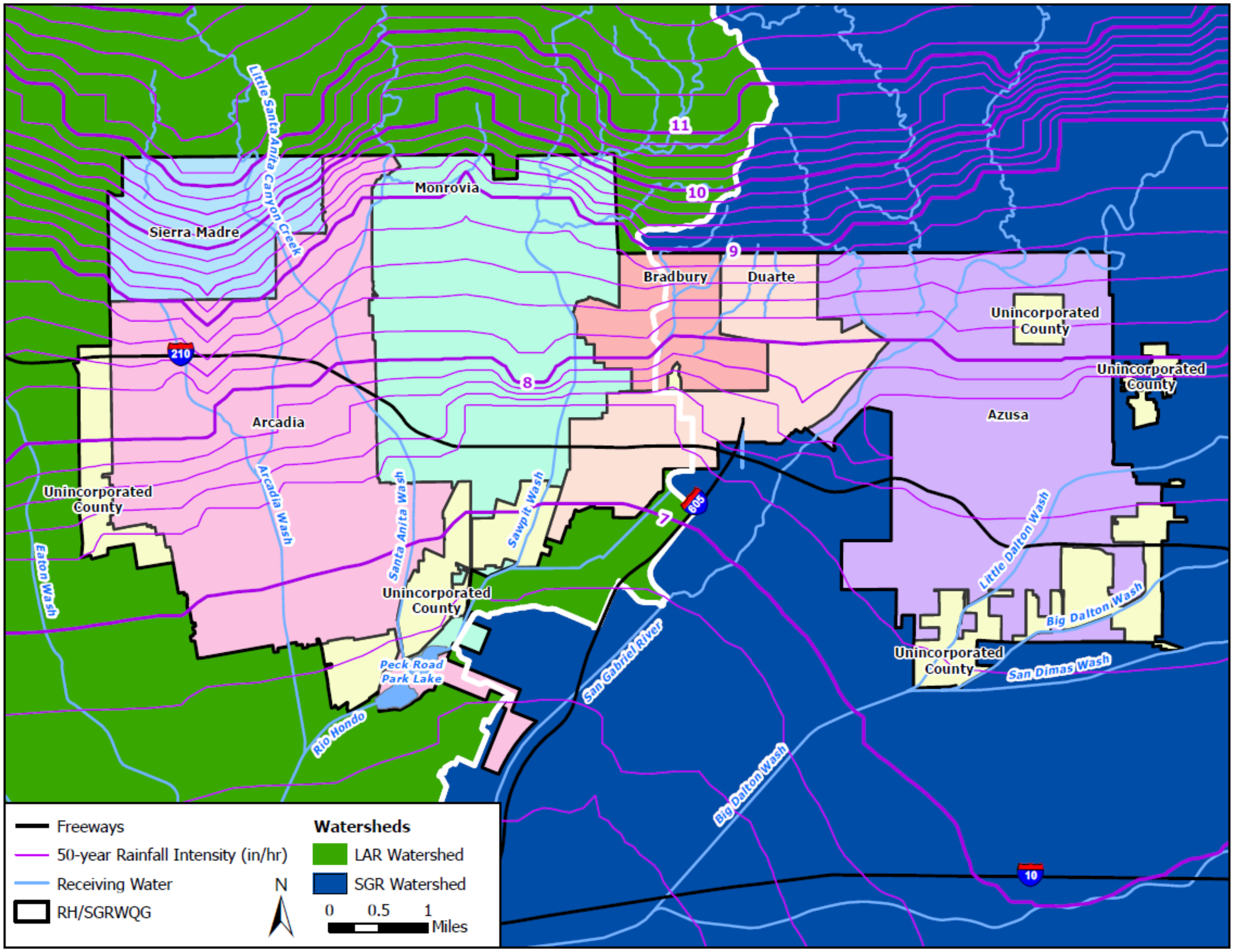


Figure 1-5 50-Year, 24-Hour Rainfall Intensity

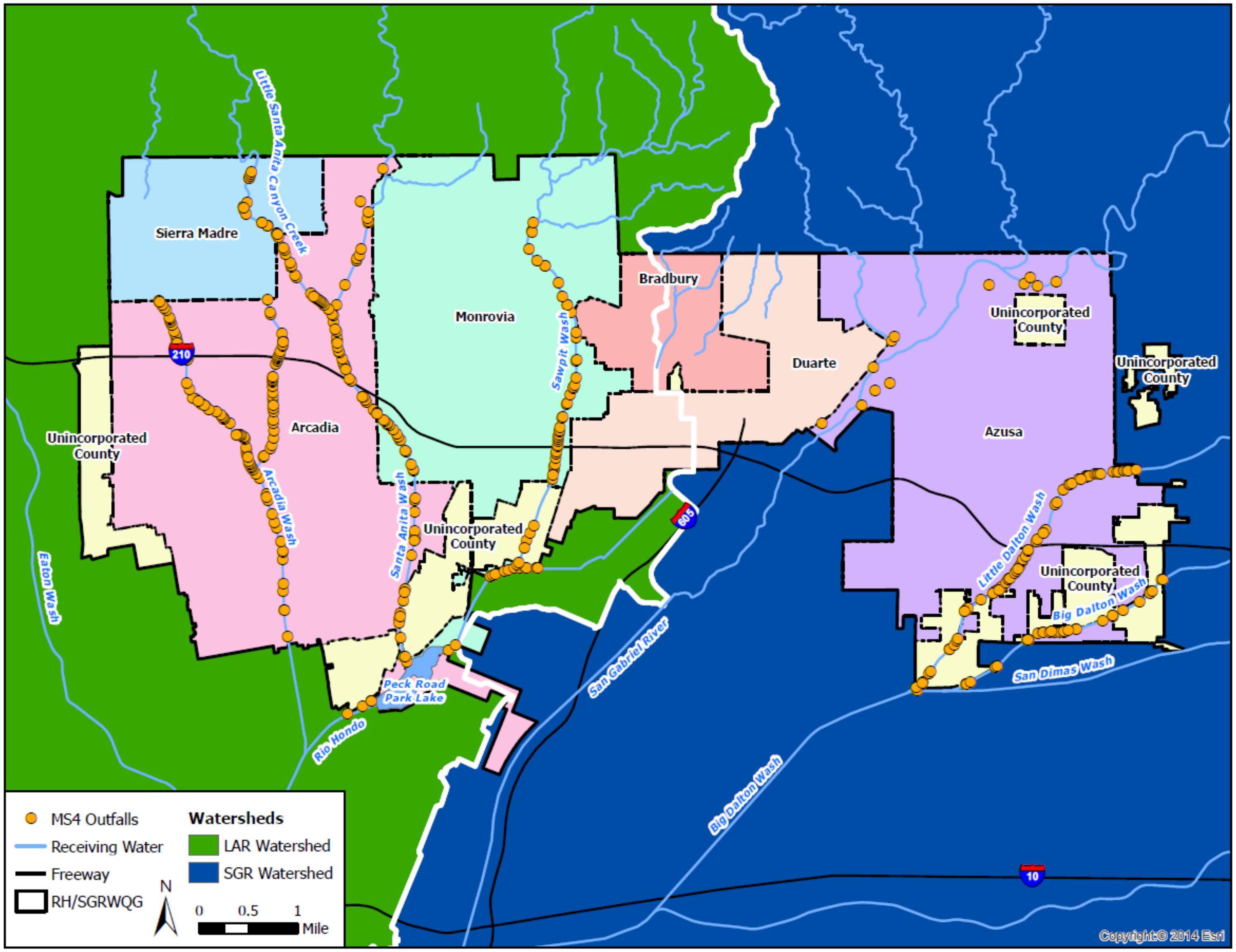


Figure 1-6 MS4 Outfalls

1.2.2 Water Body Characteristics

The RH/SGRWQG area is in both the LAR and SGR Watersheds. Major receiving water bodies located in the RH/SGRWQG area are identified in **Figure 1-7**. The RH/SGRWQG area is hydraulically connected to the downstream reaches in wet-weather, but disconnected in dry-weather as a result of water conservation efforts by the LACFCD at various groundwater recharge facilities and natural infiltration in the soft bottom reaches of the SGR. Future monitoring as part of the CIMP will provide additional evidence as to the level of connection between the RH/SGRWQG area and downstream reaches. Receiving waters within the RH/SGRWQG area include:

- LAR Watershed Water Bodies (tributary to Rio Hondo)
  - Arcadia Wash
  - Little Santa Anita Canyon Creek
  - Santa Anita Wash
  - Monrovia Canyon Wash
  - Sawpit Wash
  - Rio Hondo Reach 3
- SGR Watershed Water Bodies (tributary to SGR)
  - SGR Reach 5
  - Little Dalton Wash
  - Big Dalton Wash
  - San Dimas Wash

Lakes and reservoirs in the EWMP area include:

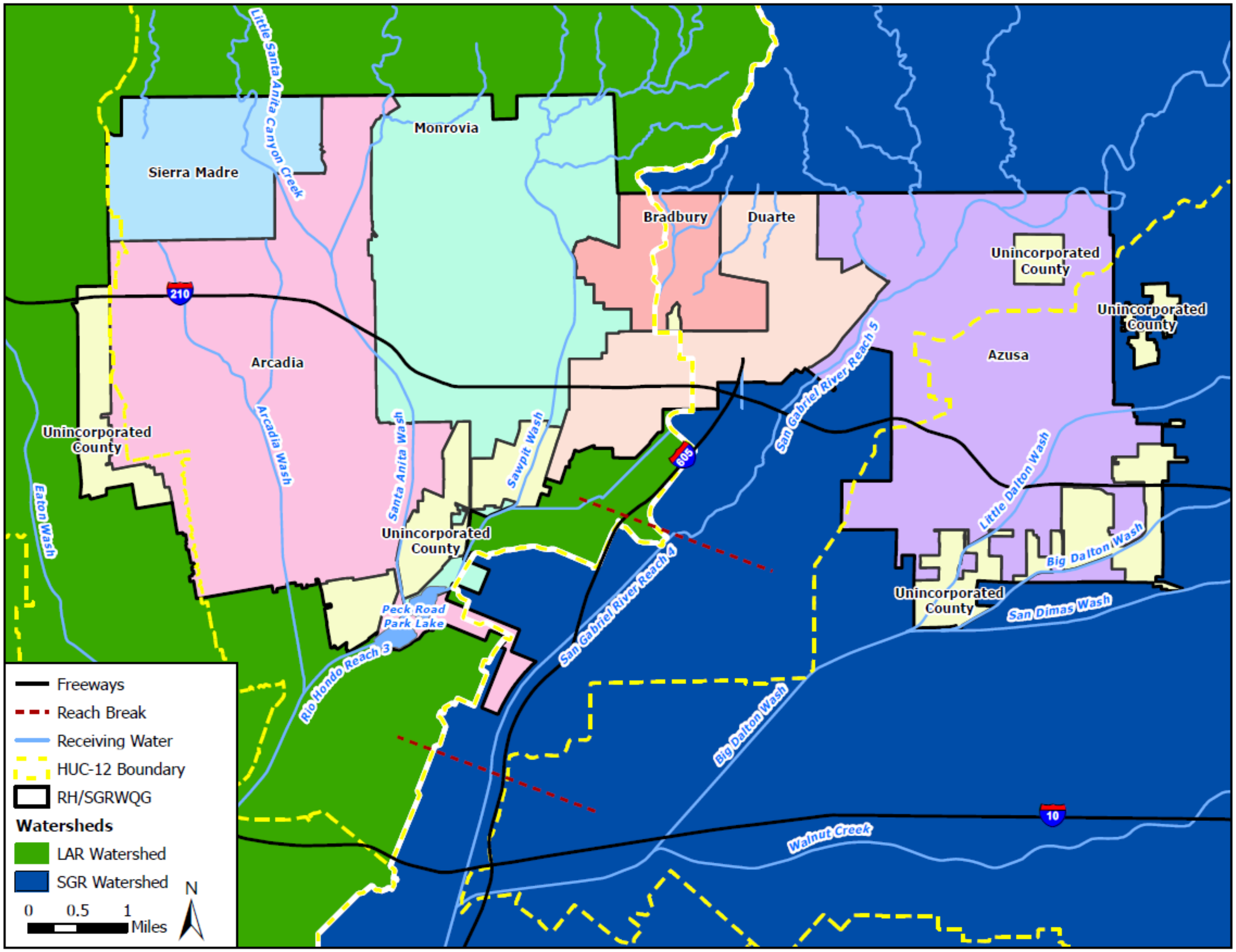
- LAR Watershed Lake
  - Peck Road Park Lake
- SGR Watershed Lake
  - Santa Fe Dam Park Lake

The Santa Fe Dam Park Lake is included in the list of major water bodies in the RH/SGRWQG area; however, there are no MS4 discharges to the lake, thus it will not be included in the EWMP. The water quality associated with these water bodies is discussed in **Section 2**.

The beneficial uses for the applicable water bodies are summarized in **Table 1-3**. The Basin Plan for LAC identifies the following applicable beneficial uses:

1. **Municipal and Domestic Supply (MUN)** – Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.
2. **Industrial Service Supply (IND)** – Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.
3. **Industrial Process Supply (PROC) –** Uses of water for industrial activities that depend primarily on water quality.
4. **Agricultural Supply (AGR) –** Uses of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.
5. **Groundwater Recharge (GWR)** – Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.
6. **Water Contact Recreation (REC-1)** – Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

7. **Non-contact Water Recreation (REC-2)** – Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.
8. **Warm Freshwater Habitat (WARM) –** Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
9. **Wildlife Habitat (WILD) –** Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.
10. **Rare, Threatened, or Endangered Species (RARE) –** Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened, or endangered.
11. **Wetland Habitat (WET) –** Uses of water that support wetland ecosystems including, but not limited to, preservation or enhancement of wetland habitats, vegetation, fish, shellfish, or wildlife and other unique wetland functions which enhance water quality.



1
2 **Figure 1-7 RH/SGRWQG Nearby Water Bodies and Regional Board Reaches**
3

Table 1-3 Beneficial Use Summary of RH/SGRWQG Water Bodies

Water Body		Existing Beneficial Uses	Intermittent Beneficial Uses	Potential Beneficial Uses
LAR Watershed Water Bodies	Arcadia Wash	---	GWR, REC-2	MUN*, REC-1, WARM, WILD
	Little Santa Anita Canyon Creek	WILD	GWR, WARM	MUN*
	Santa Anita Wash	GWR[1], REC-1[1], REC-2, WARM[1], WILD[1], RARE	GWR[2]	MUN*, REC-1[2], WARM[2], WILD[2]
	Monrovia Canyon Wash	WILD, WET	MUN, GWR, REC-1, REC-2, WARM	---
	Sawpit Wash	WILD	MUN, GWR, REC-1, REC-2, WARM	---
	Rio Hondo Reach 3	REC-2, RARE, WET	GWR, REC-1, WILD	MUN*, WARM
LAR Watershed Lake	Peck Road Park Lake[4]	REC-2	GWR, WILD	MUN*, REC-1[3], WARM
SGR Watershed Water Bodies	SGR Reach 5	MUN, IND, PROC, AGR, GWR, REC-1, REC-2, WILD, WARM, COLD	---	---
	Little Dalton Wash	---	GWR, REC-2	MUN*, REC-1[3], WARM, WILD
	Big Dalton Wash	---	GWR, REC-2	MUN*, REC-1[3], WARM, WILD
	San Dimas Wash	GWR[1], WILD, RARE[2]	GWR[2], REC-1[3], REC-2, WARM	MUN*
SGR Watershed Lake	Santa Fe Dam Park Lake	WILD, WET	GWR, REC-2, WARM	REC-1, MUN*

*MUN designations are designated under SB 88-63 and RB 89-03. Some designations may be considered for exemptions at a later date.
[1] Only applies to upper portion of the corresponding water body.
[2] Only applies to lower portion of the corresponding water body.
[3] Access prohibited by Los Angeles County Department of Public Works in concrete-channelized areas.
[4] Beneficial uses were not identified in the Basin Plan for Peck Road Park Lake. Therefore the downstream segment's uses (Rio Hondo Reach 1) apply based on Regional Board input (USEPA, 2012b).

1.3 Regulatory Framework

In 1972, provisions of the Federal Water Pollution Control Act, 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 an NPDES permit. In 1987, the CWA was amended, also called the Water Quality Act of 1987, to require the United States Environmental Protection Agency (USEPA) to establish a program to address stormwater discharges. In response, USEPA promulgated the NPDES stormwater permit application regulations. These regulations required that facilities with stormwater discharges "…from a large or medium municipal storm sewer system; or (3) a discharge which USEPA or the state/tribe determines to contribute to a violation of a water quality standard…" 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 five 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 Water Quality Control 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 the state. 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 WDRs also serve 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 LAC, except those discharges originating from the City of Long Beach MS4 (Order No. R4-2012-0175; NPDES Permit No. CAS004001) 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 RWLs. Part V.A of the MS4 Permit requires compliance with the WQBELs as outlined by the respective TMDLs.

1.3.1 MS4 Permit Requirements

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

i. Be consistent with the provisions in Part VI.C.1.a.-f and VI.C.5-C.8;
ii. Incorporate applicable State agency input on priority setting and other key implementation issues;
iii. Provide for meeting water quality standards and other CWA obligations by utilizing provisions in the CWA and its implementing regulations, policies, and guidance;
iv. Include multi-benefit regional projects to ensure that MS4 discharges achieve compliance with all final WQBELs set forth in Part VI.E of the MS4 Permit and do not cause or contribute to exceedances of RWLs in Part V.A 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 all interim and final WQBELs set forth in Part VI.E 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 RWLs in Part V.A 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 [MEP]) are not delayed; and
ix. Ensure that a financial strategy is in place.

Part VI.C.4.c.iv of the MS4 Permit states that Permittees that elect to collaborate and develop an EWMP, shall submit the Work Plan for development of the EWMP no later than June 28, 2014, 18 months from the effective date of the MS4 Permit. The draft EWMP is to be submitted no later than June 28, 2015, 30 months from the effective date of the MS4 Permit. These deadlines stand true if the conditions described in Parts VI.C.4.c.iv.(1)-(3) of the MS4 Permit are met in greater than 50 percent of the land area in the watershed. In summary, the conditions require demonstrating there are Low Impact Development (LID) ordinances in place and/or commence development of LID ordinances that meet the requirements of the Planning and Land Development Program as described by Part VI.D.7 of the MS4 Permit, demonstrating that green streets policies are in place and/or commence development of a policy, and a Notice of Intent (NOI) to develop an EWMP is submitted, all within six months of the MS4 Permit's effective date. The RH/SGRWQG NOI is provided in **Attachment B**.

1.3.2 Relevant TMDLs

TMDLs applicable to the RH/SGRWQG are listed in **Table 1-4**. The resolutions and effective dates reflect the most recent amendments to the LAR nitrogen and metals TMDLs. Revised WQBELs and RWLs are incorporated into the MS4 Permit by the Regional Board after adoption and approval of the TMDL amendment. TMDL impacted reaches are highlighted in **Figure 1-8** and a detailed summary of the numeric WLAs specified in the MS4 Permit is in **Attachment C**.

The LAR bacteria TMDL is complex, considering dry- and wet-weather conditions, differing implementation strategies, many river segments, allowing for tributary based diversion strategies, and differing implementation schedules that accompany each permutation. Within the RH/SGRWQG area, water operations and management are equally complex and varied. Much of the dry-weather base flow appears to have its origin in rising groundwater or spring flows, which commingle with permitted and non-permitted non-stormwater discharge flows. When these comingled base flows generated in the LAR Watershed portion of the group arrive at Peck Road Park Lake, they are understood to infiltrate and not contribute to the downstream dry-weather impairments that resulted in the adoption of the TMDL. Similarly, base flows emanating from Arcadia Wash, are understood to comingle with flows from other Permittees along the Rio Hondo, primarily members of the Upper Los Angeles River Watershed Group, then infiltrate in unlined river sections behind the western Whittier Narrows Dam or at the downstream County operated Rio Hondo Spreading Grounds. These complexities warrant development of a LAR Bacteria TMDL Alternative Compliance Strategy (ACS) or Load Reduction Strategy (LRS) for the RH/SGRWQG, which may include uniquely different water conservation concepts specific to the particular characteristics of the RH/SGRWQG area. Representatives of the group continue to meet among themselves and with Regional Board staff to identify a cost effective and timely approach to developing such an ACS/LRS. While this effort proceeds and the more complex implications of potential water conserving alternatives are identified and better understood, the RH/SGRWQG will attempt to follow the primary milestone dates identified during the first cycle LAR Bacteria TMDL Rio Hondo LRS implementation schedule. Noting that base flows and dry-weather discharges from the group are unlikely to have contributed to the impairments identified in the TMDL, nearly all water bodies within the greater

Los Angeles region, have periodic exceedances for bacteria and it is likely that this pollutant can be best addressed along with other impairments.

Table 1-4 TMDLs Applicable to the RH/SGRWQG and Downstream Areas

TMDL	LARWQCB Resolution	Effective Date and/or USEPA Approval Date
Los Angeles River Nitrogen Compounds and Related Effects TMDL	2003-009	March 23, 2004
	2012-010	August 7, 2014
Los Angeles River Trash	2007-012	September 23, 2008
	R15-006	June 11, 2015[1]
Los Angeles River Metals TMDL	2007-014	October 29, 2008
	2010-003	November 3, 2011
	R15-004	April 9, 2015[1]
Los Angeles River Bacteria TMDL	2010-007	March 23, 2012
Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxic Pollutants TMDL	2011-008	March 23, 2012
TMDL for Indicator Bacteria in San Gabriel River, Estuary, and Tributaries	R15-005	June 10, 2015[1]
Los Angeles Area Lakes TMDLs for Peck Road Park Lake	N/A (USEPA TMDL)	March 26, 2012
San Gabriel River Metals and Impaired Tributaries Metals and Selenium TMDL		March 26, 2007

[1] Approved by the LARWQCB (effective date not identified)

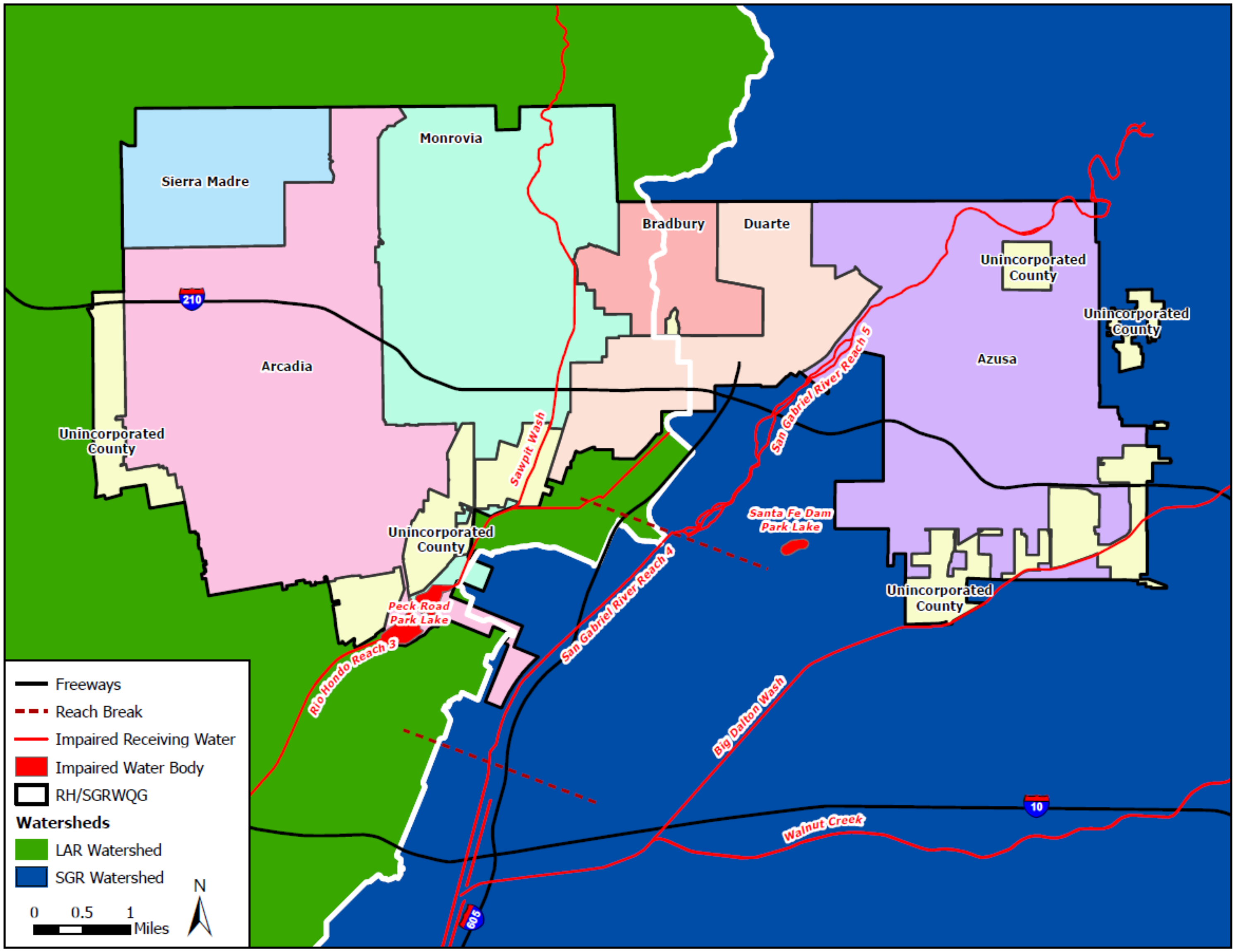


Figure 1-8 RH/SGRWQG Nearby Impaired Water Bodies

Table 1-5 demonstrates which RH/SGRWQG members are affected by each of the TMDLs per Attachment K, Tables K-5, K-6, K-9, and K-10, of the MS4 Permit and applicable TMDL staff reports for TMDLs approved after the MS4 Permit was adopted.

Table 1-5 RH/SGRWQG TMDLs and Applicability

RH/SGRWQG Member	LAR Watershed Trash TMDL	LAR Nitrogen Compounds and Related Effects TMDL	LAR and Tributaries Metals TMDL	LAR Watershed Bacteria TMDL	Los Angeles Area Lakes TMDLs for Peck Road Park Lake	Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxics TMDL[1]	SGR and Impaired Tributaries Metals and Selenium TMDL	TMDL for Indicator Bacteria in the SGR, Estuary, and Tributaries
Arcadia	X	X	X	X	X		X	X
Azusa							X	X
Bradbury	X	X	X	X	X		X	X
Duarte	X	X	X	X	X		X	X
Monrovia	X	X	X	X	X		X	X
Sierra Madre	X	X	X	X	X			
County of Los Angeles	X	X	X	X	X	X	X	X
LACFCD		X	X	X	X	X	X	X

[1] The Cities of Arcadia, Azusa, Bradbury, Duarte, Monrovia, and Sierra Madre have a TMDL obligation to monitor at the mouth of the LAR and SGR Estuaries for the Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters Toxics TMDL.

Regional Board adopted TMDLs include implementation plans providing interim and final compliance dates. **Table 1-6** lists the interim and final compliance dates relevant to the RH/SGRWQG. There are two compliance paths for the LAR dry-weather bacteria TMDL, based on whether or not each jurisdiction, or the group, develops and implements a LRS. The LRS must quantitatively demonstrate that outfall specific actions are sufficient to result in attainment of the final WQOs. Additionally, there are required dry-weather "snapshot" monitoring events where, for each event, every flowing outfall is sampled for bacterial indicators. Six snapshot monitoring events are required prior to LRS implementation and three after to assess effectiveness. Completing the LRS process provides regulatory relief by providing seven additional years before final effluent limitations become effective. The LRS due date and corresponding interim and final compliance milestones for the dry-weather bacteria TMDL for the LAR side of the RH/SGRWQG are included in **Table 1-6**. The RH/SGRWQG plans to develop an ACS/LRS for the LAR Watershed, which is subject to the LAR Bacteria TMDL, as further discussed in the beginning of this subsection.

The Regional Board approved an implementation plan for the SGR Metals TMDL on March 4, 2014. For Peck Road Park Lake there is no established implementation plan; therefore, the milestones and ultimate compliance dates for Peck Road Park Lake have been established through the EWMP process. The compliance dates and milestones for the TMDLs applicable to the RH/SGRWQG are listed in **Table 1-6**, including those for Peck Road Park Lake. **Table 1-7** identifies the WQBELs and WLAs for discharges to Peck Road Park Lake.

Table 1-6 Schedule of TMDL Compliance Milestones Applicable to the RH/SGRWQG

TMDL	Water Bodies	Constituents	Compliance Goal	Weather Condition	Compliance Dates and Milestones (Bolded **numbers** indicate milestone deadlines within the current MS4 Permit term)[1]													
					2012	2013	2014	2015	2016	2017	2020	2023	2024	2026	2028	2030	2036	2037
LAR Nitrogen[2]	All	Ammonia, Nitrate, Nitrite, Nitrate+Nitrite	Meet WQBELs	All	**Pre 2012**													
					Final													
LAR Trash	All	Trash	% Reduction	All	**9/30**	**9/30**	**9/30**	**9/30**	**9/30**									
					70%	**80%**	**90%**	**96.7%**	**100%**									
LAR Metals	All	Copper, Lead, Zinc, Cadmium	% of MS4 area Meets WQBELs	Wet	**1/11**								1/11		1/11			
					25%								50%		100%			
SGR Metals	All	Copper, Lead, Zinc	% of MS4 area Meets WQBELs[3]	Wet						**9/30**	9/30	9/30		9/30				
										10%	35%	65%		100%				
LAR Bacteria	All	*E. Coli*	Meet WQBELs	Dry w/o LRS								9/23						
												Final						
				Dry w/ LRS					**3/23**			9/23				3/23		
									LRS Due[4]			Interim				Final		
				Wet														3/23
																		Final
SGR Bacteria[5]	All	*E. Coli*	Meet WQBELs	Dry										12/1				
														Final				
				Wet													12/1	
																	Final	
LA Area Lakes	Peck Road Park Lake	Total-P, Total-N, Trash Water and Sediment: PCBs, Chlordane, DDT, Dieldrin	Meet WLAs	All	USEPA TMDLs, which do not contain interim milestones or implementation schedule. The MS4 Permit (Part VI.E.3.c, page 145) allows MS4 Permittees to propose a schedule as part of this EWMP. See **Section 2.5** for established schedule.													

[1] The MS4 Permit term is assumed to be five years from the MS4 Permit effective date or December 27, 2017.
[2] See Section "Key Findings Related to the Los Angeles River Nitrogen TMDL" in **Attachment D** for a summary of existing water quality.
[3] Alternatively may be demonstrated as percent of required reduction.
[4] LRS requires coordinated effort by all MS4 Permittees within a segment or tributary. An LRS must quantitatively demonstrate that the actions for specific outfalls are sufficient to result in attainment of the *final* WLAs. Requires six snapshot sampling events prior to LRS and three post-LRS snapshot sampling events. The RH/SGRWQG is investigating an ACS/LRS, as discussed above.
[5] Anticipated schedule assumes TMDL will become effective December 1, 2016. The schedule will be revised through the Adaptive Management Process depending on the effective date.

1

Table 1-7 Applicability of WQBELs and WLAs for Peck Road Park Lake

Constituent	Water Column	Suspended Sediment	Fish Tissue
Total Nitrogen	W		
Total Phosphorus	W		
Trash	W		
Total PCB	W	W	Alt
Total Chlordane	W	W	Alt
Dieldrin	W	W	Alt
Total DDT*	W	W	Alt

W = WLA established by TMDL.
Alt = Alternate compliance options if fish tissue targets are met.
*Total DDT measured in suspended sediment, 4-4' DDT measured in water column.

1.4 EWMP Development Process

According to Part VI.C.1.f.v of the MS4 Permit, each EWMP must provide appropriate opportunity for meaningful stakeholder input, including, but not limited to, a permit-wide WMP Technical Advisory Committee (TAC) that will advise and participate in the development of the EWMP from 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 an EWMP is being developed and one public representative from a non-governmental organization with public membership, and staff from the Regional Board and USEPA Region IX. The RH/SGRWQG has been part of the TAC and provided input on the various topics discussed. Additionally, the RH/SGRWQG is working with local and regional stakeholders to receive input on the EWMP process.

The RH/SGRWQG members have held bi-monthly meetings since the project's initiation and continued to do so throughout the EWMP development process. Two workshops were held to bring together interested parties to provide input and insight into the approach and findings of this EWMP. These workshops solicited input and ideas from stakeholders, specifically in regards to potential multi-benefit regional projects.

The RH/SGRWQG conducted its first stakeholder outreach meeting on May 5, 2014, in collaboration with the Upper San Gabriel River Group. Thirty-nine (39) participants attended the outreach event, including non-governmental organizations, an assembly member representative, Regional Board staff, and other interested stakeholders. The second stakeholder outreach meeting was held on March 9, 2015, also in collaboration with the Upper San Gabriel River Group. This meeting was held at the Los Angeles County Arboretum and ninety-five (95) participants attended the meeting. Similar to the first outreach event, attendants included non-governmental organizations, an assembly member representative, Regional Board staff, news reporters, and other interested stakeholders. This outreach event focused on the potential regional projects being selected for inclusion in the EWMP and allowed stakeholders to provide feedback.

1.5 EWMP Overview

The EWMP details the water quality priorities within the RH/SGRWQG and identifies the existing control measures in place to address those priorities. Additional control measures are proposed over the implementation timeframe so that WQOs can be achieved by the milestones specified in the MS4 Permit or established as part of this EWMP. ~~Regional EWMP projects have been identified and~~ a RAA has been conducted for the areas that are not tributary to regional EWMP projects to demonstrate compliance at each of the applicable milestone dates. Additionally, the control measure implementation schedule and cost have been developed. The EWMP includes the following sections:

- **Section 2 – Water Quality Priorities**
  Receiving water bodies are identified and characterized based on limited available water quality data. Water Body-Pollutant Classifications are developed so that categories can be assigned to each water body-pollutant combination and they can be prioritized. The water quality priorities are the primary "driver" of the EWMP.

- **Section 3 – Watershed Control Measures**
  This section outlines the existing control measures implemented by the RH/SGRWQG. Potential control measures are also identified. Existing structural Best Management Practices (BMPs) are identified and planning documents were reviewed to identify potential regional projects. In addition, the methodology for identifying and selecting additional regional and distributed BMPs is included. The current MCMs are also described. The proposed watershed control measures, both structural and non-structural, are identified and will be implemented to address the water quality priorities.

- **Section 4 – Reasonable Assurance Analysis**
  The details regarding the RAA modeling are presented in this section, including the modeling software and the dry- and wet-weather modeling approaches. The model calibration and validation are presented. The baseline simulation and the estimated ~~volume and~~ load reductions based on the ~~85th percentile volume analysis and the~~ 90th percentile load analysis are discussed and the limiting priority pollutant is established. The pollutant load reductions based on control measure implementation are also identified to demonstrate compliance at each of the applicable milestone dates.

- **Section 5 – Control Measure Implementation Schedule**
  This section identifies the schedule for implementation of the selected watershed control measures. The implementation schedule is such that the interim and final WQOs will be satisfied by the applicable milestone dates.

- **Section 6 – Control Measure Implementation Cost**
  The control measure implementation cost for the proposed control measures is presented in this section. The capital costs and operation and maintenance costs are discussed. The annual cost for the group is identified over the implementation timeframe. Additionally, the funding strategies proposed are identified.

- **Section 7 – Adaptive Management Process**
  The EWMP is part of an adaptive management process laid out in the MS4 Permit. This section discusses future iterations as part of this process.

1.6 2012 MS4 Permit Process and EWMP Implementation

Following Regional Board adoption of the 2012 MS4 Permit as Order R4-2012-0175 on November 8, 2012, thirty-seven cities and three non-governmental organizations filed petitions for review with the State Water Resources Control Board (SWRCB), which were acknowledged in a January 30, 2013 letter, and deemed complete on July 8, 2013. Five of the filing Cities also simultaneously filed Request for Stays, which were denied on June 14, 2013. On April 1, 2014, the SWRCB adopted an Own Motion Review and thirty-five of the petitioners agreed to have their petitions for review placed in abeyance. The SWRCB adopted the new Order on June 12, 2015, and the Regional Board posted revisions to the MS4 Permit shortly thereafter. The following reservation is included as a contingency in the EWMP, while the review processes proceed.

The Cities of Duarte and Huntington Park filed a Petition for Writ of Mandate and Complaint on July 2, 2015, in the Los Angeles Superior Court, in that case entitled The Cities of Duarte and Huntington Park v. State Water Resources Control Board, et al., Los Angeles Superior Court Case No. BS156303 (hereafter, the "Duarte Case"), challenging, among other things, the propriety of the various Permit terms and the subsequently issued State Board Order, Order No. WQ-2015-0075 (issued on June 16, 2015 -hereafter, "State Board Order"). The Duarte Case challenges, among other issues, those Permit terms and State Board Order requirements designed to require that the Permittees strictly comply with numeric effluent limits, either directly by meeting all such numeric limitations, including both interim and final numeric limits, or indirectly through the implementation of "Watershed Management Programs" ("WMPs") or "Enhanced Watershed Management Programs" ("EWMPs") that are to be designed to meet all such numeric effluent limitations.

On July 24, 2015, the City of Gardena also filed a Petition for Writ of Mandate and Complaint in Los Angeles Superior Court entitled City of Gardena v. Regional Water Quality Control Board, et al., Los Angeles Superior Court Case No. BS156342 (hereafter the "Gardena Case") asserting similar claims to those raised in the Duarte Case, among others.

In spite of the pending Duarte and Gardena Cases, the Cities under this EWMP are acting in good faith and moving forward to attempt to comply with all of the applicable terms of the Permit, and look forward to working with the Regional Board to assess and implement the strategies and requirements necessary for compliance. Nevertheless, the Cities believe that many of the terms of the 2012 Permit are invalid, including the terms involving compliance with numeric limits. The Cities hereby expressly reserve and are not waiving, with this submission or otherwise, any of their rights to challenge the need for any EWMP or CIMP, or any other part or portion of the Permit or the State Board Order. In addition, the Cities are not waiving, and hereby expressly reserve, any and all rights they have or may have to seek to recover the costs from the State to develop and implement any EWMP, or CIMP, on the grounds that such requirements are unfunded State mandates, and if funds are not provided by the State, to reimburse the Cities for such programs, to assert that all such requirements are invalid.

2. Water Quality Priorities

The identification of water quality priorities is an important first step in the EWMP process. Water quality priorities provide the basis for implementation and monitoring activities within the EWMP, CIMP, and the selection and scheduling of BMPs during the RAA. Part VI.C.5.a of the MS4 Permit outlines the pertinent elements of the prioritization process as follows:

1. Water quality characterization based on available monitoring data, TMDLs, 303(d) lists, stormwater annual reports, etc.
2. Water body-pollutant classification to identify water body-pollutant combinations (WBPCs) that fall into three MS4 Permit defined categories.
3. Source assessment for the WBPCs in the three categories.
4. Prioritization of the WBPCs.

Based on available information and data analysis, WBPCs are classified into one of the three MS4 Permit categories: Category 1 if WBPCs are subject to established TMDLs; Category 2 if they are on the 303(d) list, or have sufficient measured exceedances of objectives to be listed; and Category 3 if observed exceedances are too infrequent to be listed. The categories are further described in **Table 2-1**. To support development of the EWMP scheduling, subcategories were developed for each of the WBPCs in Category 1, 2, and 3, and are discussed in **Section 2.2**.

Table 2-1 Water Body-Pollutant Combination Categories

Category	Priority	Water Body-Pollutant Combinations (WBPCs)
1	Highest Priority	WBPCs for which TMDL WQBELs and/or RWLs are established in Part VI.E and Attachments O and P of the MS4 Permit.
2	High Priority	WBPCs for which data indicate water quality impairment in the receiving water according to the State's Listing Policy, regardless of whether the pollutant is currently on the 303(d) list and for which the MS4 discharges may be causing or contributing.
3	Medium Priority	WBPCs for which there are insufficient data to indicate impairment in the receiving water according to the State's Listing Policy, but which exceed applicable RWLs contained in the MS4 Permit and for which MS4 discharges may be causing or contributing to the exceedance.

The following sections describe the characterization and prioritization of those WBPCs found to be issues in the RH/SGRWQG area.

2.1 Water Quality Characterization

Per Part VI.C.5.a.i of the MS4 Permit, each EWMP shall include an evaluation of existing water quality conditions, including characterization of stormwater and non-stormwater discharges from the MS4 and receiving water quality, to support identification and prioritization/sequencing of management actions. This section provides a summary of the information considered and analyses conducted to support the classification of WBPCs into the three priority categories. The characterization process consisted of the following steps, which are discussed in the following sections:

1. Identifying the water bodies within the EWMP area.
2. Compiling WBPCs with applicable TMDLs listed in the MS4 Permit.
3. Compiling 303(d) listings from the 2010 303(d) list, the most recent approved list.

4. Gathering additional relevant data and information (e.g., water quality data).
5. Conducting data analysis to evaluate attainment of WQOs (relevant to TMDL requirements, 303(d) impairment listings, and existing water quality data).

Data was obtained from sources including: established TMDLs, 303(d) listings, WQBELs, RWLs, Surface Water Ambient Monitoring Program (SWAMP), and annual reports. The RH/SGRWQG gathered and used the following information to assess water quality and identify water quality priorities:

- Findings from Illicit Connections and Illicit Discharge (IC/ID) Elimination Programs;
- Findings from the Industrial/Commercial Facilities Programs;
- Findings from the Development Construction Programs;
- Findings from the Public Agency Activities Programs;
- TMDL source investigations;
- Findings from monitoring programs, such as TMDL compliance monitoring and receiving water monitoring; and
- Any other pertinent data, information, or studies related to constituent sources and conditions that contribute to the highest water quality priorities.

Monitoring data for sites within the LAR and SGR Watersheds was obtained from the following sources:

- Los Angeles County Department of Public Works (LACDPW) provided long-term monitoring data from the SGR Mass Emission Station (S14) and the tributary monitoring performed on the Rio Hondo (TS06);
- The Council for Watershed Health provided monitoring data from their monitoring activities throughout the watershed;
- The California Environmental Data Exchange Network (CEDEN); and
- Los Angeles County Sanitation Districts (LACSD) provided long-term receiving water monitoring data.

Locations of sites with available water quality data are shown on **Figure 2-1**. Data received from the Council for Watershed Health and CEDEN largely consisted of short term monitoring activities and many sites from these programs were only used for a single sampling event or had a limited number of constituents tested at the sites. All data were screened to identify potential WQO exceedances.

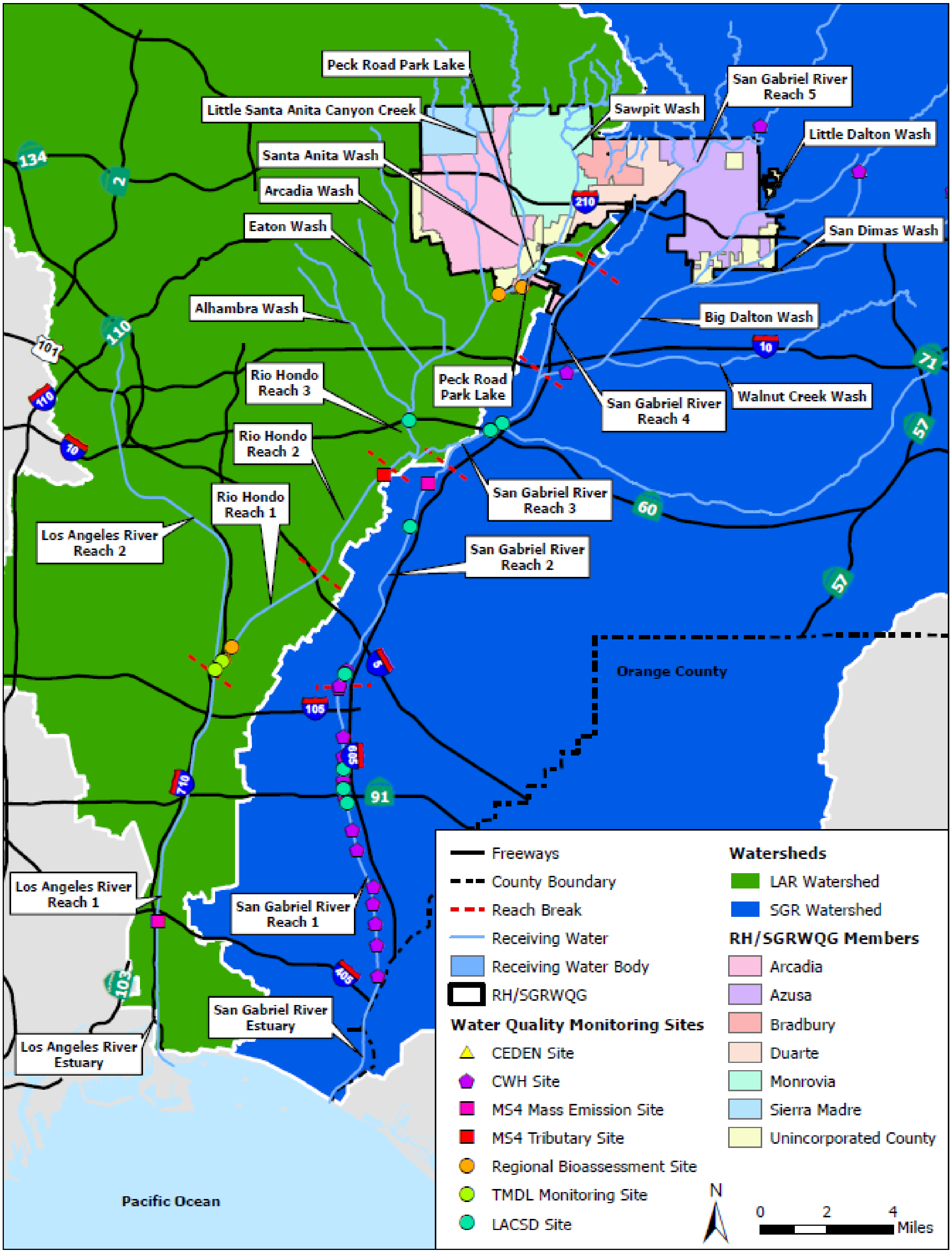


Figure 2-1 RH/SGRWQG Water Bodies, Regional Board Reaches, and Site Locations with Available Water Quality Data

2.1.1 Characterization of Receiving Water Quality

Per Part VI.C.4.a.i of the MS4 Permit, each EWMP must include an evaluation of existing water quality conditions, including a characterization of receiving water quality. **Attachment D** includes additional details on the data analysis and results.

Data were compiled to identify constituents exceeding applicable WQOs. Applicable WQOs were compiled from the California Toxics Rule (CTR), the Basin Plan, and relevant TMDLs. Applicable WQOs were selected based on the beneficial uses identified in **Table 1-3** and identified in **Attachment D**. These WQOs were used to assess exceedance frequency and determine the WBPC categorization.

Reported monitoring data was analyzed to determine constituents exceeding WQOs. The data was screened to ensure each record contained at a minimum the following information: water body identification, an identifiable site location (i.e., GPS coordinates), date of sampling, name of constituent, minimum detection level, reporting level, the result (or in cases where the level was below detection level for the analysis, a flag indicating not detected), units of measurement, sample matrix, sample collection, and an indication of dissolved or total where appropriate. **Table 2-2** quantifies the amount of water quality monitoring data that was obtained and used for water quality prioritization. The data summary is provided for all available data collected within the past 10 years, and for recent data collected within the past 5 years. Water quality data collected through the CIMP will be used to update **Table 2-2** and re-characterize applicable water bodies as part of the adaptive management process, especially Little Santa Anita Canyon Creek, Santa Anita Wash, Monrovia Canyon Wash, Sawpit Wash, and Little Dalton Wash, where water quality data does not currently exist.

Table 2-2 Summary of Available Data

Water Body	All Data (2002-2012)			Previous 5 Years (2007-2012)		
	Total Analyses	Number Detected[1]	Number of Constituents[2]	Total Analyses	Number Detected[1]	Number of Constituents[2]
Rio Hondo Reach 3	12,985	5,796	311	3,658	1,690	218
SGR Reach 5	146	146	53	37	37	37
Big Dalton Wash	20	18	18	0	0	0
San Dimas Wash	17	15	17	0	0	0
Peck Road Park Lake[3]	28	28	17	0	0	0
Totals:	**13,196**	**6,003**	**---**	**3,695**	**1,727**	**---**

[1] Number of analyses where the constituent was present in the sample above the minimum detection level.
[2] Number of distinct constituents. Total copper and dissolved copper are counted as distinct constituents.
[3] Including tributaries to the named water body.

Impaired water bodies and constituents identified in the initial screening were individually evaluated based on the frequency, timing, and magnitude of exceedances within the data based on the category. Constituents subject to a TMDL underwent data review to determine the status of compliance. Constituents on the 303(d) list for a watershed were reviewed to identify the basis for the listing and the current status of exceedances. Constituents potentially exceeding receiving water limits but not already accounted for in a TMDL or the 303(d) list were analyzed based on applicable WQOs.

Based on the data review, constituents that had no observed exceedances in the past five years or would not meet the 303(d) listing criteria for impairment could potentially be delisted. The exceedance frequency over the past five years for the identified constituents is presented in **Table 2-3**. The water quality data are compared to the WQBELs where available or the WQOs to calculate the percent exceeding the limitations. For each WBPC, the number of exceedances and total number of samples analyzed are presented.

Attachment D includes a summary of the key findings from the receiving water data analysis. The key findings highlight outcomes of the data analysis that affected the constituents addressed by the EWMP and the way the constituent is addressed.

Table 2-3 Exceedances Based on Water Quality Data Analysis

Constituent	Data Range	Number of Exceedances/Number of Samples			
		Rio Hondo Reach 3	SGR Reach 5	San Dimas Wash	Big Dalton Wash
Aluminum	All	0/32	---	---	0/1
	5-yrs	---	---	---	---
Ammonia	All	1/187	0/2	0/1	0/1
	5-yrs	0/13	---	---	---
2,3,7,8-TCDD	All	0/6	---	---	---
	5-yrs	0/6	---	---	---
Benzo(a)Pyrene	All	1/54	---	---	---
	5-yrs	1/11	---	---	---
Benzo(b)Fluoranthene	All	2/30	---	---	---
	5-yrs	1/11	---	---	---
Benzo(k)Fluoranthene	All	3/54	---	---	---
	5-yrs	2/11	---	---	---
Bis(2-Ethylhexyl) Phthalate	All	5/11	---	---	---
	5-yrs	---	---	---	---
Chloride	All	3/123	0/1	0/1	0/2
	5-yrs	1/58	0/1	---	
Chrysene	All	1/54	---	---	---
	5-yrs	1/11	---	---	---
Diazinon	All	6/72	---	---	---
	5-yrs	2/19	---	---	---
Dibenzo(a,h)Anthracene	All	3/54	---	---	---
	5-yrs	2/11	---	---	---
Copper	All	11/117	1/4	---	---
	5-yrs	3/52	0/1	---	---
Total Dissolved Solids	All	0/117	0/3	---	---
	5-yrs	0/52	0/1	---	---
Dissolved Oxygen	All	82/220	---	0/1	0/1
	5-yrs	23/59	---	---	---
pH	All	47/222	0/3	0/1	0/1
	5-yrs	5/52	---	---	---
E. coli	All	43/59	---	---	---
	5-yrs	36/52	---	---	---
Fecal Coliform	All	158/220	---	---	---
	5-yrs	35/52	---	---	---

Table 2-3 Exceedances Based on Water Quality Data Analysis

Constituent	Data Range	Number of Exceedances/Number of Samples			
		Rio Hondo Reach 3	SGR Reach 5	San Dimas Wash	Big Dalton Wash
Total Coliform	All	220/220	---	---	---
	5-yrs	52/52	---	---	---
Indeno(1,2,3-cd)Pyrene	All	3/47	---	---	---
	5-yrs	3/9	---	---	---
Mercury	All	2/74	---	---	---
	5-yrs	1/43	---	---	---
N-Nitrosodimethylamine	All	4/51	---	---	---
	5-yrs	0/9	---	---	---
Lead	All	4/117	0/3	---	---
	5-yrs	0/52	0/1	---	---
Nitrate	All	0/192	0/5	0/1	---
	5-yrs	0/24	0/1	---	---
Nitrite	All	0/192	0/1	0/1	---
	5-yrs	0/24	---	---	---
Total Nitrogen	All	1/246	---	---	---
	5-yrs	0/90	---	---	---
Selenium	All	---	0/2	---	---
	5-yrs	---	---	---	---
Cyanide	All	6/92	---	---	---
	5-yrs	0/27	---	---	---
Zinc	All	1/117	0/3	---	---
	5-yrs	0/52	---	---	---

2.1.2 Characterization of Discharge Quality

Per Part VI.C.5.a.i of the MS4 Permit, each EWMP must include a characterization of stormwater and non-stormwater discharges from the MS4. Data is very limited for MS4 discharges within the RH/SGRWQG area. Regional studies, monitoring data, and/or land use data will be further evaluated in the future to characterize discharge quality. In addition, data will become available through CIMP implementation, which will be utilized through the adaptive management process.

2.2 Water Body-Pollutant Classification

Based on available information and data analysis, WBPCs were classified in one of the three MS4 Permit categories described in **Table 2-1**. To reflect the sub-categorization outlined in the Regional Board's RAA Guidelines, subcategories are defined to facilitate scheduling decision support for watershed actions determined as part of the RAA and EWMP process. The subcategories are defined in **Table 2-4** and the categorization is summarized in **Table 2-5**.

Table 2-4 Water Body-Pollutant Combination Subcategory Definitions

Category	Water Body-Pollutant Combinations (WBPCs)	Description
1	**Category 1A:** WBPCs with past due or current MS4 Permit term TMDL deadlines.	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 MS4 Permit term.	The MS4 Permit does not require the prioritization of TMDL interim and/or final deadlines outside of the MS4 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.	
2	**Category 2A:** 303(d) listed WBPCs or WBPCs that meet 303(d) listing requirements.	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] (i.e., 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.
3	**Category 3A:** All other WBPCs with exceedances identified through CIMP implementation.	Pollutants that are in a similar class[1] as those with TMDLs are identified.
	Category 3B: All other WBPCs that are not a "pollutant"[2] (i.e., 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: WBPCs identified by the RH/SGRWQG members.	The RH/SGRWQG members may identify other WBPCs for consideration in EWMP planning.

[1] Pollutants are considered in a similar class if they have similar fate and transport mechanisms, can be addressed via the same types of control measures, and within the same timeline already contemplated as part of the EWMP for the TMDL. (MS4 Permit Part VI.C.2.a.i).

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

Table 2-5 Summary of RH/SGRWQG WBPC Categories

Class[1]	Constituents	Rio Hondo Reach 3	Monrovia Wash	Sawpit Wash	SGR Reach 5	San Dimas Wash	Big Dalton Wash	Peck Road Park Lake
Category 1A: WBPCs with past due or current term TMDL deadlines.								
Nutrients[2]	Ammonia	F	F	F				
	Nitrate	F	F	F				
	Nitrite	F	F	F				
	Nitrate + Nitrite	F	F	F				
Metals[2]	Copper (Wet)	I	I	I				
	Lead (Wet)	I	I	I	I[3]	I[3]	I[3]	
	Zinc (Wet)	I	I	I				
	Cadmium (Wet)	I	I	I				
Trash[2]	Trash	I/F	I/F	I/F				
Category 1B: WBPCs with TMDL deadlines beyond the current MS4 Permit term.								
Metals[2]	Copper (Wet)	F	F	F				
	Lead (Wet)	F	F	F	F[3]	F[3]	F[3]	
	Zinc (Wet)	F	F	F				
	Cadmium (Wet)	F	F	F				
Bacteria[2]	Fecal Coliform	I/F	I/F[4]	I/F[4]				I/F[4]
	E. coli	I/F	I/F[4]	I/F[4]	I/F	I/F	I/F	I/F[4]
Category 1C: WBPCs addressed in USEPA TMDL without an Implementation Plan.[5]								
Nutrients	Total Nitrogen							X
	Total Phosphorus							X
Legacy	PCB (Sediment)							X
	PCB (Water)							X
	Chlordane (Sediment)							X
	Chlordane (Water)							X
	Dieldrin (Sediment)							X
	Dieldrin (Water)							X
	DDT (Sediment)							X

Table 2-5 Summary of RH/SGRWQG WBPC Categories								
Class[1]	**Constituents**	**Rio Hondo Reach 3**	**Monrovia Wash**	**Sawpit Wash**	**SGR Reach 5**	**San Dimas Wash**	**Big Dalton Wash**	**Peck Road Park Lake**
	DDT (Water)							X
Trash	Trash							X
Category 2B: 303(d) listed WBPCs.								
Metals	Lead (Dry)		303(d)[6]					
Other	Bis(2-ethylhexyl) phthalate			303(d)				
Category 3: WBPCs without a TMDL or 303(d) listing.[7,8]								

[1] Pollutants are considered in a similar class if they have similar fate and transport mechanisms, can be addressed via the same types of control measures, and within the same timeline already contemplated as part of the EWMP for the TMDL (MS4 Permit, Part VI.C.2.a.i).

[2] MS4 discharges from Sawpit Wash, Santa Anita Wash, and direct MS4 discharges to Peck Road Park Lake are subject to the LAR Metals TMDL and the LAR Bacteria TMDL.

[3] Grouped wet-weather WLA, expressed as total recoverable metals discharged to all upstream reaches and tributaries of the SGR Reach 2.

[4] These water bodies are hydrologically disconnected from the Rio Hondo and thus the LAR during dry-weather and during some wet-weather events.

[5] USEPA Los Angeles Area Lakes TMDL states that lead is currently meeting numeric targets for water and sediment during wet- and dry-weather; therefore no WLA has been assigned and it has not been identified as a WBPC.

[6] Monrovia Wash is 303(d) listed for lead; however, the LAR Metals TMDL only assigns a dry-weather load allocation for non-point sources and therefore no WLA is assigned for MS4 sources.

[7] Monitoring of Monitoring and Reporting Plan Table E-2 constituents in the first year at Long Term Assessment sites will identify the Category 3 WBPCs.

[8] Pollutants noted with exceedances in **Table 2-3** that are not associated with an existing TMDL or 303(d) listing have not been identified as Category 3 pollutants because the data analyzed is from areas downstream of the RH/SGRWQG (downstream monitoring sites shown in **Figure 2-1**). Once CIMP data has been collected for the group area, Category 3 pollutants will be identified as WBPCs through the Adaptive Management Process, as appropriate. Based on the first CIMP wet-weather monitoring event, exceedances were not detected for potential Category 3 WBPCs.

Notes:

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

The City of Azusa is in the Santa Fe Dam Park Lake subwatershed. The USEPA Los Angeles Area Lakes TMDL for nitrogen, phosphorus, mercury, trash, organochlorine pesticides, and PCBs states that there are no MS4 discharges to Santa Fe Dam Park Lake; therefore, there are no applicable WBPCs.

I/F = Denotes where the MS4 Permit or newly approved TMDL includes interim (I) and/or final (F) effluent and/or RWLs.

X = Identification of a WBPC, but no corresponding MS4 Permit implementation.

303(d) = WBPC on the 2010 303(d) list where the listing was confirmed during data analysis.

2.3 Source Assessment

After the WBPCs were categorized, the next step in the prioritization process was to conduct a source assessment. The MS4 Permit requires that a source assessment be conducted to identify potential sources within the RH/SGRWQG area for the WBPCs in Categories 1 through 3, utilizing existing information. The source assessment, contained herein, draws on readily available information to characterize potential sources of pollutants and assesses whether MS4 discharges are likely to be significant sources of these constituents. Pollutant sources may come from point or non-point sources, described below. Utilizing existing information, the constituents in **Table 2-5** were evaluated to determine if MS4 discharges could be a potential source. Many constituents are typically associated with MS4 discharges and additional investigations are not required. However, for some constituents, MS4 discharges are either not known as significant sources of the constituent or other potential sources are more likely.

2.3.1 Potential Point Sources

Point sources are defined as discrete sources or conveyances that may carry pollutants to surface waters. Point sources are also a primary way pollutants are introduced into the environment. In California, point source discharges are regulated under Federal CWA NPDES Permits and California's Porter-Cologne Water Quality Control Act WDRs. The NPDES Permits in the RH/SGRWQG area include an MS4 Permit, California Department of Transportation (Caltrans) MS4 Permit, Construction General Permit (CGP), Industrial General Permit (IGP), major and minor NPDES Permits, and other general NPDES Permits. Combined NPDES/WDR Permits are issued by the Regional Board for discharges to surface waters. The NPDES Permit types that fall within the Los Angeles Regional Board jurisdiction for the LAR and SGR Watersheds are presented in **Table 2-6**.

The significance of these permitted discharges with respect to their potential contributions of pollutants to the watershed is a function of flow volumes and associated water quality discharge characteristics. The contribution of discharges from dry- or wet-weather runoff also varies. For example, Caltrans, Construction and Industrial General stormwater Permittee discharges can deliver contaminated storm runoff directly into the watershed rivers and tributaries, as well as through the MS4. However, during dry-weather, their pollutant contribution potential is generally low. A broad assessment of the relative potential for pollutant contribution and runoff condition (wet- or dry-weather) of the discharges typically associated with each of the permit types is also presented in **Table 2-6**.

Table 2-6 NPDES Permits for Watersheds within the RH/SGRWQG

Type of NPDES Permit	LAR Watershed Number of Permits[1]	SGR Watershed Number of Permits[2]	Potential for Pollutant Contribution
Publicly Owned Treatment Works	6	5	High (dry-weather)
Municipal Stormwater	3	2	High (wet/dry-weather)
Caltrans Stormwater	-	1	High (wet/dry-weather)
Industrial Stormwater	1,307	526	High (wet-weather)
Construction Stormwater	204	203	High (wet-weather)
Other Major Industrial NPDES Discharges	3	2	High (wet-weather)
Minor NPDES Discharges	15	6	Medium (wet/dry-weather)
General NPDES Permits:			
Construction and Project Dewatering	35	16	Medium (wet-weather)

Table 2-6 NPDES Permits for Watersheds within the RH/SGRWQG			
Type of NPDES Permit	**LAR Watershed Number of Permits[1]**	**SGR Watershed Number of Permits[2]**	**Potential for Pollutant Contribution**
Petroleum Fuel Cleanup Sites	7	5	Medium (dry-weather)
Volatile Organic Compound (VOC) Cleanup Sites	6	4	Medium (dry-weather)
Hydrostatic Test Water	8	4	Low (wet/dry-weather)
Non-Process Wastewater	9	3	Medium (dry-weather)
Potable Water	25	81	Low (wet/dry-weather)

[1] (USEPA, 2005)
[2] (RWQCB, 2015)

2.3.2 Potential Non-Point Sources

Nearly all discharges to the Los Angeles and San Gabriel Rivers, and their tributaries, are regulated as point sources and are predominantly comprised of discharges from water reclamation plants and storm drains. Pollutants from non-point sources are conveyed to surface waters in a diffused manner (i.e., not directly from point source conveyances). However, when contaminants from such non-point sources reach the MS4, they become regulated through the MS4 Permit.

Non-point sources in the RH/SGRWQG area include:

- Atmospheric deposition
- Natural background loading (i.e., metals)
- Onsite Wastewater Treatment Systems (OWTS, a.k.a. septic systems)
- Runoff from the National and State forests in the headwaters of many tributaries
- Sources that occur within the channels of the LAR, SGR, and tributaries (“in-channel sources”) such as:
  - Groundwater discharges
  - Transient population
  - Pet waste
  - Sanitary sewer leaks/spills
  - Illicit/illegal discharges
  - Wildlife and birds
  - Suspension and/or re-growth of sediment-associated pollutants

2.3.3 Specific Constituents

The source assessment for RH/SGRWQG Category 1 through 3 WBPCs was conducted to identify whether MS4 discharges are likely to be causing or contributing to impairments or exceedances. The assessment criteria was evaluated based on the following facts or findings:

- Findings from RH/SGRWQG Illicit Connections and Illicit Discharge Elimination Programs;
- Findings from RH/SGRWQG Industrial/Commercial Facilities Programs;
- Findings from RH/SGRWQG Development Construction Programs;
- Findings from RH/SGRWQG Public Agency Activities Programs;
- TMDL source investigations;
- Watershed model results;

- Findings from RH/SGRWQG monitoring programs, including but not limited to TMDL compliance monitoring and receiving water monitoring; and
- Other pertinent data, information, or studies related to pollutant sources and conditions that contribute to the highest water quality priorities.

During the EWMP development, the RH/SGRWQG compiled summary data from the Illicit Discharge Elimination Program, Industrial/Commercial Facilities Program, Development and Construction Program, and Public Agencies Activities Program to identify whether pollutant sources or trends were apparent. While minimal data is available for these programs in the Individual Annual Reports from each City in response to the 2001 MS4 Permit, the data does not present conclusions or identify sources. For example, the number of illicit connections/discharges eliminated is identified, but the source was unknown.

During the last six years of the 2001 MS4 Permit implementation, inspections were not required as part of the Industrial/Commercial Facilities Program, so the available data was limited, dated, and rudimentary in content. The primary emphasis of the Industrial/Commercial Facilities Program is to inspect whether the industrial/commercial facilities are implementing good housekeeping practices and protective measures. The inspection reports emphasize on the correction of these measures rather than the actual pollutants or monitoring results. Future inspection initiated under 2012 MS4 Permit, Part VI.D.6, will produce more focused and specific source assessment information.

As noted in **Section 2.1**, monitoring data specific to this EWMP area are sparse and through the data analysis it is currently unknown if MS4 discharges from the EWMP area are contributing to water quality issues observed downstream. Monitoring data from non-MS4 Permittees in the RH/SGRWQG were also reviewed; however, not all Industrial General Permittees submitted data to the Storm Water Multiple Application and Report Tracking System (SMARTS) website. Initially, this data was briefly reviewed and appeared to have little diagnostic value in predicting pollutant sources or loads. Following receipt of the Regional Board EWMP comment letter, the analysis was repeated and again the data was found to be of limited value in guiding current pollutant source assessments. In the majority of cases, the monitoring data appeared variable and inconsistent, reported with mistaken concentration units, and the analytical parameters tracked were unrelated to likely facility pollutants or observed watershed impairments.

As apparent from the following subsections, TMDL pollutant source assessments and models reviewed during preparation of the EWMP were inconclusive and overly broad upon which to take actionable source determinations or source control efforts. This follows past Regional Board studies, and the majority of environmental data, which suggest that a few sources are responsible for a significant share of environmental problems. At this time, models are not specific enough to accommodate a few specific sources, let alone the impact of a major source such as copper in brake pads. Current models are inadequate for distinguishing copper loads from a residential area adjacent to a freeway with those from a rural area. Such sources will likely be identified through implementation of the CIMP and the Adaptive Management Process.

2.3.3.1 Nitrogen Compounds, pH, and Phosphorous

The LAR Nitrogen Compounds and Related Effects TMDL asserted that:

> *The principal source of nitrogen compounds to the Los Angeles River is discharges from the Donald C. Tillman WRP, the Los Angeles-Glendale WRP, and the Burbank WRP. During dry-weather period, the major POTWs contribute 84.1 percent of the total dry-weather nitrogen load. Urban runoff, stormwater, and groundwater discharge may also contribute nitrate loads. Further evaluation of these sources is set forth in the Implementation Plan.*

2.3.3.2 Trash

The Trash TMDL for the LAR Watershed asserted the following in the source analysis section of the technical TMDL:

> *The major source of trash in the river results from litter, which is intentionally or accidentally discarded in watershed drainage areas. Transport mechanisms include the following:*
>
> 1. *Storm drains: trash is deposited throughout the watershed and is carried to the various reaches of the river and its tributaries during and after significant rainstorms through storm drains.*
> 2. *Wind action: trash can also blow into the waterways directly.*
> 3. *Direct disposal: direct dumping also occurs.*
>
> *Extensive research has not been done on trash generation or the precise relationship between rainfall and its deposition in waterways. However, it has been found that the amount of gross pollutants entering the stormwater system is rainfall dependent but does not necessarily depend on the source (Walker and Wong, December 1999). The amount of trash which enters the stormwater system depends on the energy available to re-mobilize and transport deposited gross pollutants on street surfaces rather than on the amount of available gross pollutants deposited on street surfaces. The exception to this finding of course would be in the event that there is zero gross pollutants deposited on the street surfaces or other drainages tributary to the storm drain.*
>
> *Where gross pollutants exist, a clear relationship between the gross pollutant load in the stormwater system and the magnitude of the storm event has been established. The limiting mechanism affecting the transport of gross pollutants, in the majority of cases, appears to be remobilization and transport processes (i.e., stormwater rates and velocities).*
>
> *Several studies conclude that urban runoff is the dominant source of trash. The large amount of trash conveyed by urban stormwater to the Los Angeles River is evidenced by the amount of trash that accumulates at the base of storm drains. The amount and type of trash that is washed into the storm drain system appears to be a function of the surrounding land use.*

While this assessment may have been correct several years ago, the RH/SGRWQG Permittees within the LAR Watershed have installed full capture certified devices where ever possible within the jurisdictions. Most of the cities are 90 percent or more compliant with the trash TMDL and are investigating opportunities to complete this implementation effort.

2.3.3.3 Metals

LAR Watershed

The LAR Metals TMDL Coordinated Monitoring Program (CMP) Plan stated the following regarding sources of metals to MS4 discharges:

> *There are significant differences in the sources of metals loadings during dry-weather and wet-weather. During dry-weather, most of the metals loadings are in the dissolved form. The three major publicly owned treatment works (POTWs) that discharge to the river (Tillman WRP, LA-Glendale WRP, and Burbank WRP) constitute the majority of the flow and metals loadings during dry-weather. The storm drains also contribute a large percentage of the loadings during dry-weather because although their flows are typically low, concentrations of metals in urban runoff may be quite high. The remaining portion of the dry-weather flow and metals loadings*

represents a combination of tributary flows, groundwater discharge, and flows from other permitted NPDES discharges within the watershed.

During wet-weather, most of the metals loadings are in the particulate form and are associated with wet-weather stormwater flow. On an annual basis, stormwater contributes about 40 percent of the cadmium loading, 80 percent of the copper loading, 95 percent of the lead loading and 90 percent of the zinc loading. This stormwater flow is permitted through two MS4 permits, a separate Caltrans MS4 permit, a general construction stormwater permit and a general industrial stormwater permit.

Non-point sources of metals may include tributaries that drain the open space areas of the watershed. Direct atmospheric deposition of metals on the river is also a small source. Indirect atmospheric deposition on the land surface that is washed off during storms is a larger source, which is accounted for in the estimates of stormwater loadings.

As summarized in the LAR Metals TMDL CMP Annual Reports, dry-weather monitoring data from stations downstream of the RH/SGRWQG were rarely in exceedance for metals. The exceedances associated with the Rio Hondo monitoring station were generally associated with very low flows and the observation of very high hardness. Either of these observations alone might suggest the MS4 Permit identified concentrations are not relevant to impairments or daily loads. The RH/SGRWQG will continue to monitor for dry-weather metal concentrations, as proposed in the Approved CIMP, and implement the watershed control measures identified in **Section 3.4** to further identify and control the sources of metals in runoff and RH/SGRWQG receiving waters.

SGR Watershed

The SGR and Impaired Tributaries Metals and Selenium TMDL stated the following regarding the sources of metals:

Sources of metals in stormwater include automobile brake pads, vehicle wear, building materials, pesticides, erosion of paint and deposition of air emissions from fuel combustion and industrial facilities.

A Southern California stormwater study conducted between 2001-2005 found that industrial land use sites contributed substantially higher fluxes and event mean concentrations (EMCs) of copper and zinc relative to other land use site categories (e.g., residential, commercial, etc.) (Tiefenthaler et al., 2007, pp. 13-29.). In contrast, the highest fluxes for lead were associated with agriculture, high density residential, and recreational land use sites, while the highest EMCs for lead related to high density residential and industrial land use sites. Industrial sites typically have >70% impervious cover as well as on-site sources of metals which may explain the higher loadings of copper and zinc from industrial land use sites observed in the study. In addition, industrial land use sites were found to contribute substantially higher fluxes of Total Suspended Solids (TSS) relative to other land uses (along with agriculture land use sites). In the Los Cerritos Channel Freshwater Watershed and San Gabriel River Watershed, industrial land use only constitutes 8% and 4% of total land use, respectively.

The contribution of automobile brake pads to copper levels in Los Cerritos Channel and the San Gabriel River could be significant. Deposited onto roads by vehicles, copper from brake pad use is transported by stormwater into water bodies. The Brake Pad Partnership, a multi-stakeholder effort to understand the environmental impacts that may arise from brake pad wear debris from passenger vehicles, conducted a watershed modeling study of copper from brake pads affecting water quality in South San Francisco Bay, as an example area. The study determined that copper from brake pads accounts for up to half of the anthropogenic copper

> *discharged from highly urbanized areas to the San Francisco Bay (Brake Pad Partnership Update, 2007). It is likely that brake pads are a major contributor to copper in stormwater runoff from urbanized areas.*

While this may be true for the potential pollutant sources of lead to the MS4 within the SGR Watershed portion of the RH/SGRWQG area, further source assessment of the MS4 discharge will be conducted to determine the primary source within the RH/SGRWQG MS4s.

2.3.3.4 Bacteria

LAR Watershed

The LAR Watershed Bacteria TMDL made the following assertions regarding the identification of indicator bacteria sources to the LAR:

> *Dry-weather urban runoff and stormwater conveyed by storm drains are the primary sources of elevated bacterial indicator densities to the Los Angeles River Watershed during dry- and wet-weather. The linkage between the numeric targets and the allocations is supported by the following scientific findings:*
>
> 1. *In Southern California, in dry-weather, local sources of bacteria principally drive exceedances (LARWQCB, 2002b; 2003b; 2004a).*
> 2. *Tiefenthaler et al. found that in natural streams bacteria levels were generally higher during lower flow condition (Tiefenthaler et al., 2008).*
> 3. *Ackerman et al. found that storm drains contribute roughly 13 percent of the flow in the Los Angeles River in dry-weather, while Water Reclamation Plants (WRPs) account for roughly 72 percent of the flow in the river during dry-weather. With this flow, storm drains were contributing almost 90 percent of the E. coli loading (Ackerman et al., 2003). E. coli concentrations were found to be as much as four orders of magnitude higher from storm drains than from the WRP discharges.*
> 4. *In the BSI study, the CREST team found that approximately 85 percent of the storm drain samples collected exceeded the E. coli objective. In the reaches investigated, E. coli loading from storm drains and tributaries greatly exceeded the allowable instream loading. The study also found that some of the loading in Reach 2 could not be attributed to the measured storm drain inputs.*
> 5. *In Southern California, in wet-weather, upstream or watershed sources principally cause the bacteria exceedances (LARWQCB, 2002b; 2003c; 2004a).*
> 6. *During wet-weather, WRP discharges may account for as little as 1 percent of the total flow in the river (CREST, 2009a).*
> 7. *Based on three experiments conducted by Noble et al. (1999) to mimic natural conditions in or near Santa Monica Bay (SMB), two in marine water and one in fresh water, bacteria degradation was shown to range from hours to days (Noble et al., 1999). Based on the results of the marine water experiments, the model assumes a first-order decay rate for bacteria of 0.8 d-1 (or 0.45 per day). Degradation rates were shown to be as high as 1.0 d-1 (Noble et al., 1999). These studies show that bacterial degradation and dilution during transport through the watershed do not significantly affect bacterial indicator densities in receiving waters.*

Based on these findings, further source assessment of the MS4 discharges will need to be conducted to determine the primary source of bacteria within the RH/SGRWQG MS4s.

SGR Watershed

The SGR, Estuary and Tributaries Indicator Bacteria TMDL made the following assertions regarding the identification of indicator bacteria sources to the SGR:

> *There are many sources of indicator bacteria to the MS4s. Discharges from MS4s are the primary source of bacteria to SGR in both dry- and wet-weather (Ackerman et. al., 2005 and Grifith et al., 2014.)*
>
> *Based on available data surface runoff (stormwater and non-stormwater discharges) from urbanized areas conveyed via the MS4 is a significant source of bacteria to the SGR and its tributaries. Mass emissions data collected under the Los Angeles County MS4 Permit show elevated levels of bacteria in the river. SCCWRP's data from storm drains and channels draining urban areas also show elevated levels of bacteria, indicating that urban areas are the primary source of bacteria to SGR and its tributaries. Data from throughout the Los Angeles Region further demonstrate that bacteria concentrations are significantly greater in developed areas.*
>
> *The monitoring data show that bacteria loadings from WRPs are significantly less than stormwater loadings. Based on mass emission station data, watershed-wide monitoring data, and SCCWRP's studies, the Los Angeles Water Board staff concludes that stormwater and non-stormwater runoff from urban areas served by the storm drain system (MS4s) is a significant source of bacteria. Storm drain system discharges may have elevated levels of bacteria indicators due to sanitary sewer leaks and spills, illicit connections of sanitary sewer lines to the storm drain system, runoff from homeless encampments, pet waste, and illegal discharges from recreational vehicle holding tanks, among others. Other point sources were analyzed and found to be less significant or there were not enough data to quantify their contribution. Existing point source discharges that have permits containing effluent limits for bacteria will continue to have effluent limits for bacteria. Existing point source discharges that do not have effluent limits for bacteria in their permits are not assigned WLAs. Any future point source discharges must be evaluated to determine whether reasonable potential exists for the discharge to be a source of bacteria that could cause or contribute to an exceedance of the applicable water quality standards. If reasonable potential analysis (RPA) during permitting process does not indicate reasonable potential then effluent limits do not need to be included in the permit. All non-point sources are assigned LAs.*

Similar to the LAR Watershed portion of the RH/SGRWQG area, further source assessment of the MS4 discharge will need to be conducted to determine the primary source of bacteria within the RH/SGRWQG area.

2.3.3.5 Legacy Pollutants – Nutrients, PCB, Chlordane, Dieldrin, and DDT

The Los Angeles Area Lakes TMDLs for Peck Road Park Lake states the following regarding the sources of nutrients for Peck Road Park Lake TMDL impairments:

> *Peck Road Park Lake has been sampled several times over the past two decades. Slight exceedances of the pH target have been observed in the lake and may be due to natural conditions. DO levels in the epilimnion are typically greater than 7 mg/L and impairment due to low DO is not evident in either the historic or recent sampling events (DO levels do approach zero in the deeper waters but no exceedances have been observed relative to the target depths). Readings collected in December 2008 were collected with an uncalibrated meter. Chlorophyll a concentrations are relatively low and no measurements greater than 19 µg/L (historic data) have been reported. The maximum chlorophyll a concentration measured recently is 13.4 µg/L and*

the average concentration is 6.2 µg/L. It does not appear, based on these data, that excessive nutrient loading is causing an impairment. It is unlikely that the source of the odor reported at Peck Road Park Lake is due to elevated nutrient and algal biomass levels. They are likely associated with the trash impairment.

Based on historic and recent monitoring data, Peck Road Park Lake is not impaired by low DO or excessive nutrient loading. Though odor has been noted as a problem at the lake, it is likely not due to eutrophication as no algal blooms have been observed in the lake and chlorophyll a concentrations are relatively low. To protect Peck Road Park Lake from degradation, nutrient loading should remain at or below existing levels as an antidegradation measure to ensure future loading does not increase the chlorophyll a concentration.

Much of the Peck Road Park Lake watershed remains in forested and other undisturbed land uses. As development occurs in this watershed, BMPs will be required such that loading rates are consistent with the allocations established by these TMDLs. Therefore, no load allocation has been set aside for future growth. It is unlikely that any dischargers of significant nutrient loading will be permitted in the watershed. If any sources currently assigned load allocations are later determined to be point sources requiring NPDES permits, those load allocations are to be treated as wasteload allocations for purposes of determining appropriate water quality-based effluent limitations pursuant to 40 CFR 122.44(d)(1).

The TMDL states the sources of PCB for Peck Road Park Lake TMDL impairments are as follows:

PCBs in Peck Road Park Lake are primarily due to historical loading and storage within the lake sediments, with some ongoing contribution by watershed wet-weather loads. Dry-weather loading is assumed to be negligible because hydrophobic contaminants primarily move with particulate matter that is mobilized by higher flows. Stormwater loads from the watershed were estimated based on simulated sediment load and observed PCB concentrations on sediment near inflows to the lake.

Watershed loads of PCBs may arise from spills from industrial and commercial uses, improper disposal, and atmospheric deposition. Industrial and commercial spills will tend to be associated with specific land areas, such as older industrial districts, junk yards, and transformer substations. Improper disposal could have occurred at various locations (indeed, waste PCB oils were sometimes used for dust control on dirt roads in the 1950s). Atmospheric deposition occurs across the entire watershed.

There is no definitive information on specific sources of elevated PCB load within the watershed at this time. Therefore, an average concentration of sediment is applied to all contributing areas. The average concentration of PCBs on incoming sediment was estimated to be 15.38 µg/kg dry weight and the estimated annual sediment load to Peck Road Park Lake is 990.3 tons/yr, including sediment delivered through the water diversion (see Appendix D, Wet Weather Loading). The resulting estimated wet-weather load of PCBs is approximately 13.8 g/yr.

Lake sediments are often the predominant source of PCBs in biota. The bottom sediment serves as a sink for organochlorine compounds that can be recycled through the aquatic life cycle. PCBs are strongly sorbed to sediments and have long half-lives in sediment and water. Incoming loads of PCBs will mainly be adsorbed to particulates from stormwater runoff (eroded sediments from legacy contamination sites or from atmospheric deposition).

The existing sediment PCB concentrations in Peck Road Park Lake are lower than the consensus-based TEC target, and existing fish tissue concentrations are higher than the fish tissue target. Therefore, a sediment target to achieve FCGs is calculated based on biota-sediment *bioaccumulation (a BSAF approach), using the ratio of the FCG to existing fish tissue concentrations of 3.6/34.4 = 0.105. This ratio is applied to the observed in-lake sediment concentration of 12.28 µg/kg dry weight to obtain the site-specific sediment target concentration to achieve fish tissue goals of 1.29 µg/kg dry weight. The fish tissue-based target concentrations were calculated using only recent data (collected in the past 10 years) because the loads and exposure concentrations of PCBs are likely to have declined steadily since the cessation of production and use of the chemical.*

The BSAF-derived sediment target is less than the consensus-based sediment quality guideline TEC of 59.8 µg/kg dry weight. (The consensus-based sediment quality guideline is for the protection of benthic organisms, and explicitly does not address bioaccumulation and human-health risks from the consumption of contaminated fish.) The lower value of the consensus-based TEC target or the BSAF-derived target is selected as the final sediment target. In addition, the CTR criterion for human health (0.17 ng/L) is the selected numeric target for the water column and protects both aquatic life and human health.

The toxicant loading model can be used to estimate the loading rate that would be required to yield the existing sediment concentration under steady-state conditions. This yields an estimate that a load of 1,005 g/yr would be required to maintain observed sediment concentrations under steady-state conditions. The estimated current watershed loading rate is 13.8 g/yr, or 1.4 percent of this amount. Therefore, impairment due to elevated fish tissue concentrations of PCBs in Peck Road Park Lake is primarily due to the storage of historic loads of PCBs in the lake sediment.

The sources of Chlordane for Peck Road Park Lake TMDL impairments are as follows:

Chlordane in Peck Road Park Lake is primarily due to historical loading and storing within the lake sediments, with some ongoing contribution by watershed wet-weather loads. Dry-weather loading is assumed to be negligible because hydrophobic contaminants primarily move with particulate matter that is mobilized by higher flows. Stormwater loads from the watershed were estimated based on simulated sediment load and observed chlordane concentrations on sediment near inflows to the lake. Watershed loads of chlordane may arise from past pesticide applications, improper disposal, and atmospheric deposition. Pesticide applications were most likely associated with agricultural, commercial, and residential areas. Improper disposal could have occurred at various locations, while atmospheric deposition occurs across the entire watershed.

There is no definitive information on specific sources within the watershed at this time. Therefore, an average concentration of sediment is applied to all contributing areas. The average concentration of chlordane on incoming sediment was estimated to be 3.15 µg/kg dry weight, and the annual sediment load to Peck Road Park Lake is 990.3 tons/yr, including sediment delivered through the water. The resulting estimated wet-weather load of chlordane is approximately 2.83 g/yr.

Lake sediments are often the predominant source of total chlordane in biota. The bottom sediment serves as a sink for organochlorine compounds that can be recycled through the aquatic life cycle. Chlordanes are strongly sorbed to sediments and have long half-lives in sediment and water. Incoming loads of total chlordane will mainly be adsorbed to particulates from stormwater runoff (eroded sediments from legacy contamination sites or from atmospheric deposition).

The existing sediment chlordane concentrations in Peck Road Park Lake are lower than the consensus-based TEC target, and existing fish tissue concentrations are higher than the fish *tissue target. Therefore, a sediment target to achieve FCGs is calculated based on biota-sediment bioaccumulation (a BSAF approach), using the ratio of the FCG to existing fish tissue concentrations of 5.6/13.44 = 0.417. This ratio is applied to the observed sediment concentration of 4.14 µg/kg dry weight to obtain the site-specific sediment target concentration to achieve fish tissue goals of 1.73 µg/kg dry weight. The fish tissue-based target concentrations were calculated using only recent data (collected in the past 10 years) because the loads and exposure concentrations of chlordane are likely to have declined steadily since the cessation of production and use of the chemical.*

The BSAF-derived sediment target is less than the consensus-based TEC of 3.24 µg/kg dry weight. (The consensus-based sediment quality guideline is for the protection of benthic organisms, and explicitly does not address bioaccumulation and human-health risks from the consumption of contaminated fish.) The lower value of the consensus-based TEC target or the BSAF-derived target is selected as the final sediment target. In addition, the CTR criterion for human health (0.59 ng/L) is the selected numeric target for the water column and protects both aquatic life and human health.

The toxicant loading model can be used to estimate the loading rate required to yield the existing sediment concentration under steady-state conditions. This yields an estimate that a load of 696 g/yr would be required to maintain observed sediment concentrations under steady state conditions. The estimated watershed loading rate is 2.83 g/yr, or 0.4 percent of this amount. Therefore, impairment due to elevated fish tissue concentrations of chlordane in Peck Road Park Lake is primarily due to the storage of historic loads of chlordane in the lake sediment.

The TMDL states the sources of DDT for Peck Road Park Lake TMDL impairments are as follows:

Total DDTs present in Peck Road Park Lake are primarily due to historical loading and storage within the lake sediments, with some ongoing contribution by watershed wet-weather loads. Dry-weather loading is assumed to be negligible because hydrophobic contaminants primarily move with particulate matter that is mobilized by higher flows. Stormwater loads from the watershed were estimated based on simulated sediment load and observed DDT concentrations on sediment data near inflows to the lake. Watershed loads of DDT may arise from past pesticide applications, improper disposal, and atmospheric deposition. Pesticide applications were most likely associated with agricultural, commercial, and residential areas. Improper disposal could have occurred at various locations, while atmospheric deposition occurs across the entire watershed.

There is no definitive information on specific sources of elevated DDT load within the watershed at this time. Therefore, an average concentration on sediment is applied to all contributing areas. The average concentration of total DDTs on incoming sediment was estimated to be 5.57 µg/kg dry weight, and the annual sediment load to Peck Road Park Lake is 990.3 tons/yr, including sediment delivered through the water diversion. The resulting estimated wet-weather load of total DDTs is approximately 5.0 g/yr.

Lake sediments are often the predominant source of DDT in biota. The bottom sediment serves as a sink for organochlorine compounds that can be recycled through the aquatic life cycle. DDT is strongly sorbed to sediment and has a long half-life in sediment and water. Incoming loads of DDT will mainly be adsorbed to particulates from stormwater runoff (eroded sediments from legacy contamination sites or from atmospheric deposition).

A sediment target to achieve FCGs is calculated based on biota-sediment bioaccumulation (a BSAF approach), using the ratio of the FCG to existing fish tissue concentrations of 21/15.5 = 1.355. This ratio is applied to the estimated lake sediment concentration of 5.09 µg/kg dry *weight to obtain the site-specific sediment target concentration to maintain fish tissue goals of 6.90 µg/kg dry weight. The BSAF-derived sediment target is greater than the estimated existing sediment concentration because the average recent fish tissue concentration does not exceed the fish tissue based target concentration.*

The fish tissue-based target concentrations were calculated using only recent data (collected in the past 10 years) because the loads and exposure concentrations of total DDT are likely to have declined steadily since the cessation of production and use of the chemical.

The BSAF-derived sediment target is greater than the consensus-based TEC for total DDTs of 5.28 µg/kg dry weight. The consensus-based TEC of 5.28 µg/kg dry weight is therefore the most restrictive target and is used as the target in this TMDL. Selection of the consensus-based TEC target protects the benthic biota and ensures continued attainment of the fish tissue based target concentration. The estimated existing concentration in lake of 5.09 µg/kg is less than the TEC, which would imply that no reduction from existing in-lake sediment concentrations may be needed. However, the estimated influent concentration is greater than the TEC.

The toxicant loading model can be used to estimate the loading rate that would be required to yield the existing sediment concentration under steady-state conditions. This yields an estimate that a load of 84 g/yr would be required to maintain observed sediment concentrations under steady-state conditions. The estimated current watershed loading rate is 5 g/yr, or 6 percent of this amount. Thus, concentrations of total DDTs in fish tissue in Peck Road Park Lake appear to be primarily due to the storage of historic loads of DDT in the lake sediment.

The TMDL states the sources of Dieldrin for Peck Road Park Lake TMDL impairments are as follows:

Dieldrin in Peck Road Park Lake is primarily due to historical loading and storage within the lake sediments, with some ongoing contribution by watershed wet-weather loads. Dry-weather loading is assumed to be negligible because hydrophobic contaminants primarily move with particulate matter that is mobilized by higher flows. Stormwater loads from the watershed could not be directly estimated because all sediment and water samples were below detection limits. Watershed loads of dieldrin may arise from past pesticide applications, improper disposal, and atmospheric deposition. Pesticide applications were most likely associated with agricultural, commercial, and residential areas. Improper disposal could have occurred at various locations.

There is no definitive information on specific sources within the watershed at this time. Therefore, an average concentration of sediment is applied to all contributing areas.

An upper-bound analysis for dieldrin is performed using the simulated sediment load and detection limit to determine the maximum potential loading rate of dieldrin from the watershed. The dieldrin sediment concentration is assigned as the upper bound estimate of concentration on influent sediment (0.91 µg/kg dry weight, calculated with non-detects set equal to the individual sample detection limits). The annual sediment load to Peck Road Park Lake, including sediment delivered through the water diversion is 990.3 tons/yr. The resulting estimated upper bound on wet-weather load of dieldrin from the watershed is 0.82 g/yr or less.

Lake sediments are often the predominant source of dieldrin in biota. The bottom sediment serves as a sink for organochlorine compounds that can be recycled through the aquatic life cycle. Dieldrin is strongly sorbed to sediments and has a long half-life in sediment and water. Incoming loads of dieldrin will mainly be adsorbed to particulates from stormwater runoff (eroded sediments from legacy contamination sites or from atmospheric deposition).

The estimated existing sediment dieldrin concentrations in Peck Road Park Lake are lower than the consensus-based TEC target, and existing fish tissue concentrations are higher than the fish tissue target. Therefore, a sediment target based on biota-sediment bioaccumulation (a BSAF approach) is calculated using ratio of the FCG to existing fish tissue concentrations in largemouth bass of 0.46/1.06 = 0.434. Sediment concentrations of dieldrin in Peck Road Park Lake are reported as below detection limits ranging from 0.7 to 1.44 µg/kg dry weight. However, dieldrin is highly bioaccumulative, and low sediment concentrations can lead to unacceptable fish tissue concentrations. Using an estimated concentration of 0.98 µg/kg dry weight based on the average of the sample detection limits, the resulting target concentration would be 0.43 µg/kg dry weight to obtain FCGs. Calculation with a literature-based BSAF suggests that even lower concentrations might be needed. However, the literature based BSAF is highly uncertain and may not be directly applicable to conditions in Peck Road Park Lake. Therefore, the target based on the detection limits is used, with acknowledgment that the estimate may need to be refined if additional data are collected at lower detection limits.

2.3.3.6 Source Assessment Summary

Nutrients, metals, indicator bacteria, and trash are commonly measured in MS4 discharges. While there are no specific measurements for outfalls in the RH/SGRWQG area, it is reasonable to assume the MS4 may contain these constituents. Additionally, where historic contamination exists, legacy pollutants such as PCBs and chlorinated pesticides may be found in MS4 discharges. These classes of compounds represent the Category 1 pollutants, where TMDLs have identified the MS4 as potential sources.

Two constituents identified in the receiving water assessment, cyanide and bis(2-ethylhexyl) phthalate have been associated with potential laboratory Quality Assurance/Quality Control (QA/QC) issues, as it is a known laboratory contaminant. While clear evidence of laboratory contamination is not available, the fact that no exceedances have been observed in the last 5 years suggests that MS4 discharges are unlikely to be a significant source of bis(2-ethylhexyl) phthalate. As a result, bis(2-ethylhexyl) phthalate is not considered to be a water quality priority based on the initial source assessment.

The LACSD and other laboratories have identified concerns with the preservation of cyanide samples for analysis. Analysis of different preservation and analytical methods for cyanide has indicated that artificial increases in cyanide concentrations can be introduced through the preservation and analytical process for cyanide (Stanley, 2012). As a result, LACSD has modified their sampling collection and cyanide analysis procedures to reduce the potential for artificially increasing cyanide concentrations. A review of the cyanide data used in the analysis determined that all samples with exceedances were from the MS4 mass emission station using sample processing methods that could potentially exacerbate cyanide concentrations. As a result, it is possible that some or all of the cyanide exceedances result from the analytical process. However, cyanide is also released from some industrial and commercial activities that could be present in the watershed.

Diazinon was used as an insecticide for agriculture and also as an all-purpose indoor and outdoor commercial pest control product. The majority land use designation within the RH/SGRWQG is residential. In addition, agricultural land use designation within the RH/SGRWQG is located within the City of Bradbury. With these two land use designations, MS4 discharges cannot be excluded as a potential source of diazinon. With the ban on diazinon for commercial use, diazinon receiving water concentrations and exceedances may decrease through the years. Further investigation pertaining to the source of exceedances is necessary to assess if discharges from MS4s are a potential source in the future.

Based on the source assessment and pollutant linkages to the MS4, the water quality priorities were generated and summarized in **Table 2-7**. The table also indicates the potential linkage to the MS4, defined as follows:

- **High** – where TMDLs exist (Category 1 pollutants) that have identified WLAs for the MS4;
- **Medium** – not a clear determination of positive or negative attribution to the MS4; and
- **Low** – where it is likely a source other than the MS4 that contributes to the water quality exceedances.

The EWMP identifies control measures to address the water quality priorities, except for those pollutants where the source is attributed to a non-MS4 source, such as water reclamation plants.

Table 2-7 Water Quality Priorities for the RH/SGRWQG

Category	Class	Pollutant	Water Body	MS4 Linkage
Category 1	Bacteria	Fecal Coliform and *E. Coli*	Rio Hondo Reach 3, Monrovia Wash, Sawpit Wash, and Peck Road Park Lake	High
		E.Coli	SGR Reach 3, San Dimas Wash, and Big Dalton Wash	High
	Legacy	PCBs, Chlordane, Dieldrin, DDT	Peck Road Park Lake	High
	Metals	Cadmium, Copper, Zinc	Rio Hondo Reach 3, Monrovia Wash, and Sawpit Wash	High
		Lead	Rio Hondo Reach 3, Monrovia Wash, Sawpit Wash, SGR Reach 5, San Dimas Wash, and Big Dalton Wash	High
	Nutrients	Ammonia, Nitrate, Nitrite, Nitrate + Nitrite	Rio Hondo Reach 3, Monrovia Wash, and Sawpit Wash	Low
		Total Nitrogen, Total Phosphorus	Peck Road Park Lake	Low
	Trash	Trash	Rio Hondo Reach 3, Monrovia Wash, Sawpit Wash, and Peck Road Park Lake	High
Category 2	Metals	Lead	Monrovia Wash	High
	Other	Bis(2-ethylhexyl) phthalate	Sawpit Wash	Low

2.4 Prioritization

The MS4 Permit outlines a prioritization process that defines how pollutants in the various categories will be considered in scheduling as part of the EWMP. Based on compliance pathways outlined in the MS4 Permit, the scheduling factors considered include the following:

- TMDLs with past due interim and/or final limits and those with interim and/or final limits within the MS4 Permit term (schedule according to TMDL schedule)
- TMDLs with interim and/or final limits outside the MS4 Permit term (schedule according to TMDL schedule)
- Other receiving water exceedances
  - Pollutants in the same class as those addressed in a TMDL (evaluate ability to consider on same timeframe as TMDL)
  - Pollutants on the 303(d) list or in the same class as those on the 303(d) listings (develop schedule to address as soon as possible with milestones)
  - Pollutants with exceedances that are not in the same class as 303(d) listing (conduct monitoring under CIMP to confirm exceedances and if confirmed develop schedule with milestones)
  - Pollutants without exceedances in last 5 years (not prioritized for BMPs, but included in monitoring)

Evaluating whether or not a pollutant is in the same class as either a TMDL or a 303(d) listed pollutant is a critical decision for prioritization and scheduling. The MS4 Permit definition of class is as follows:

> "Pollutants are considered in a similar class if they have similar fate and transport mechanisms, can be addressed via the same types of control measures, and within the same timeline already contemplated as part of the EWMP for the TMDL."

As part of EWMP development and the RAA, prioritizing and sequencing of BMPs considered the aforementioned factors.

2.5 Milestone Schedule for Non-TMDL Pollutants

For WBPCs not addressed through a Regional Board adopted compliance schedule, development of interim milestones and final compliance dates must conform to one of the three MS4 Permit defined schemes (MS4 Permit Parts VI.C.2.i-iii):

1. Pollutants that are in the same class as those addressed in a TMDL for the watershed and for which the water body is identified as impaired on the 303(d) list as of December 28, 2012;
2. Pollutants that are not in the same class as those addressed in a TMDL for the watershed, but for which the water body is identified as impaired on the 303(d) list as of December 28, 2012; or
3. Pollutants for which there are exceedances of RWLs, but for which the water body is not identified as impaired on the 303(d) list as of December 28, 2012.

Pollutants having similar fate and transport mechanisms (e.g., particle associated), making them amenable to treatment using the same control measures, can be referred to as a "BMP class." Alternatively pollutants may be addressed following an existing TMDL timeline, referred to as a "scheduling class." The remaining WBPCs were segregated into these classes as shown in **Table 2-8**. The interim and final compliance schedules identified in **Table 1-6** in **Section 1.3.2** for the Category 1 WBPCs are the backbone upon which numeric milestones and schedule dates for other water quality priorities are proposed.

Table 2-8 Initial Classification for USEPA TMDLs, 303(d) Listings, and Other Exceedances of RWLs

Pollutants	Water Body	Sub-category	BMP Class	RB TMDL in RH/SGRWQG with Same BMP Class?	Scheduling Class	RB TMDL in RH/SGRWQG with Same Scheduling Class?	Initial Classification
Total Nitrogen	Peck Road Park Lake	1C	Nutrients	Yes	Machado Lake Nutrients	Yes	USEPA TMDL
Total Phosphorus	Peck Road Park Lake	1C	Nutrients	Yes	Machado Lake Nutrients	Yes	USEPA TMDL
Trash	Peck Road Park Lake	1C	Trash	Yes	LAR Trash TMDL	Yes	USEPA TMDL
PCBs	Peck Road Park Lake	1C	Sediment	Yes	Machado Lake Toxics[1]	Yes	USEPA TMDL
Chlordane	Peck Road Park Lake	1C	Sediment	Yes	Machado Lake Toxics[1]	Yes	USEPA TMDL
Dieldrin	Peck Road Park Lake	1C	Sediment	Yes	Machado Lake Toxics[1]	Yes	USEPA TMDL
DDT	Peck Road Park Lake	1C	Sediment	Yes	Machado Lake Toxics[1]	Yes	USEPA TMDL
Bis (2-ethylhexyl) phthalate	Sawpit Wash	2C	Sediment	Yes	Machado Lake Toxics[1]	Yes	303(d) listed and same class as pollutants addressed in a TMDL in the watershed

[1] Machado Lake Pesticides and PCBs (Toxics) TMDL

2.5.1 Constituent Relationships

Subcategory 1C WBPCs include those identified in the Peck Road Park Lake TMDLs issued by USEPA. As stated in the technical TMDL, recent monitoring data suggest that nutrient loads and related WQOs are being met, but need to be monitored into the future. Although the nutrient WQOs were being met at the time the TMDL was being developed, a timeline consistent with the Machado Lake Nutrients TMDL is most appropriate so that necessary measures are implemented in the event an exceedance was to occur. The Machado Lake TMDLs will serve as the basis for determining the schedule/timeline for the Peck Road Park Lake TMDLs, as both Machado Lake and Peck Road Park Lake are lakes developed in the early 1970s in urban areas with comparable environments, impairments, and sources (as identified in the TMDLs). As was the case with Machado Lake, the schedule/timeline presented in this EWMP is for MS4 discharges into the lake and do not address polluted bed sediments. Once the MS4 discharges have been addressed, the bed sediment will be assessed and addressed as needed. The trash component of this TMDL is being addressed as a requirement of the Los Angeles River Trash TMDL and the schedule for that TMDL also addresses the Los Angeles Area Lakes TMDLs.

Based on pollutant fate and transport characteristics, Peck Road Park Lake legacy pollutant WBPCs milestone schedules/timelines are most appropriately based upon those identified in the Machado Lake TMDLs. At both locations, the pollutants include organochlorine pesticides and PCBs (or Aroclors) which are no longer in commercial use and typically bind to sediment particles which settle out in non-flowing receiving waters. Their environmental fate is typically through natural attenuation or bioremediation, although sediment removal and disposal may be necessary to more rapidly achieve water and sediment quality objectives.

Subcategory 2C WBPCs include State 2010 Integrated Report, or CWA 303(d) list, identified impairments for bis(2-ethylhexyl) phthalate in Sawpit Wash. Phthalates are common plastizers and laboratory contaminants. Although it is unlikely to still be present, the most appropriate scheduling corollary would be with the Machado Lake Toxics TMDL as the fate and transport of this compound is typical of many organic compounds which tend to bind to particulates and be degraded through natural attenuation. Utilizing the Machado Lake Toxics TMDL timeline will also be consistent with the Peck Road Park Lake timelines discussed above, which is beneficial as Sawpit Wash is tributary to Peck Road Park Lake.

If WBPCs are not assigned to existing TMDL schedules, then the RH/SGRWQG would be required to develop a detailed time schedule, of specific actions to undertake, that will achieve compliance with the numeric WLAs. For such pollutants, the time schedule requested must be as short as possible, taking into account the time since establishment of the TMDL, technological, operational, and economic factors that affect the design, development, and implementation of the control measures that are necessary to comply with the WLAs. If the requested time schedule exceeds one year, the proposed schedule shall include interim requirements and numeric milestones and the date(s) for their achievement. In assessing appropriate schedules for WBPCs, similar, adopted, Regional Board TMDL implementation schedules will be used to the extent possible based on the rationale that they would meet the requirements in as short a time as is possible and considering other factors identified in the MS4 Permit.

2.5.2 Milestones and Schedules

The preferred approach for developing USEPA TMDL, 303(d) listed, or RWL exceedance WBPCs milestone and compliance schedules is to determine whether the pollutants are in the same class as those already being addressed in a Regional Board developed TMDL applicable to the RH/SGRWQG and, if so, align the proposed WBPC milestone and compliance schedule with that developed for the Regional Board TMDL. As previously discussed and summarized in **Table 2-8**, these WBPCs all align with developed Regional Board TMDLs.

2.5.2.1 USEPA Peck Road Park Lake TMDLs

The majority of WBPCs, which may be suitable for milestone identification based on Regional Board TMDL schedules, are associated with the USEPA Peck Road Park Lake TMDLs (2012b); approved by USEPA Region IX on March 26, 2012. Although each USEPA TMDL identified constituent must be evaluated individually, their similarity in fate, transport, source control, and BMP implementation mechanisms, as compared to existing TMDLs, substantiates the assertion that their scheduling should track that of similar TMDLs already being implemented in the region.

Peck Road Park Lake Nutrient TMDL

The nutrient portion of the Peck Road Park Lake TMDLs can be difficult to intuitively translate for EWMP planning purposes, in that its objectives are to control summer in-lake eutrophication, primarily by controlling storm and seasonal diversion flows containing nitrogen and phosphorous. In Section 4.10.1 of the USEPA Los Angeles Area Lakes TMDL, the USEPA asserts that "*The nutrient-response analysis for Peck Road Park Lake indicates that existing levels of nitrogen and phosphorus loading are resulting in attainment of the summer average chlorophyll a target concentration of 20 µg/L and are not significantly impacting dissolved oxygen levels in the waterbody. As an anti-degradation measure, nitrogen and phosphorus TMDLs are allocated based on existing loading.*" While this assertion advocates for overlooking the need to develop a TMDL implementation milestone schedule, variance in flow volumes, especially flows diverted to San Gabriel River, significantly drive the annual pollutant load estimates. The TMDL notes that, as an annual average, over 41 percent of the nitrogen load is attributed to the SGR flows from above urban Reach 4, diverted by LACDPW for water conservation and recharge purposes; however, in many years the actual diversion volume is negligible, while infrequently those flows overwhelmingly predominate. While the TMDL rationally anticipates potential diversion volume aberrations by allowing for three year averaging, it is unclear how comingled spring diversion flows, along with those from non-MS4 NPDES discharges, would be cost-effectively segregated and accounted for during these conditions, nor how they would be integrated to potentially result in unanticipated summer impairments. Therefore this EWMP proposes that the Peck Road Park Lake nutrient TMDL milestone schedule follow the timeline of the Machado Lake Nutrients TMDL, which assumes final compliance 9.5 years after the effective date of the TMDL. Based on this timeline, the final compliance date for nutrients would be January 1, 2026. Ultimately, the RH/SGRWQG concurs with the clarity of the USEPA, that this TMDL is aimed at demonstrating compliance with MS4 Permit anti-degradation requirements. The proposed compliance schedule is summarized in **Table 2-8**.

Peck Road Park Lake PCBs, DDT, Chlordane, and Dieldrin TMDLs

PCBs and organochloride pesticides like DDT, chlordane, and dieldrin bind to suspended sediments and organic particulates, which are then mobilized and transported by storm flows, before settling in quiescent receiving water bodies. As with the other legacy pollutants, commercial sources have been eliminated and controls are mostly targeted at the elimination of sediment sources, runoff reduction, and sediment settling or soil filtration associated with runoff infiltration. Their environmental fate (elimination) is mostly through natural attenuation and augmented biodegradation, although sediment dredging and disposal is a potential engineered alternative. The Peck Road Park Lake PCBs, DDT, Chlordane, and Dieldrin TMDLs established WLAs for inflowing water and suspended sediment based on the CTR water column target. The TMDL determined MS4 discharge baseline load, or sediment-bound concentration, for each of the TMDLs is identified in **Table 2-9** along with the suspended sediment WLA and percent reduction in load or concentration. This EWMP includes an implementation schedule determined by the RH/SGRWQG for control measures to achieve proposed interim numeric milestones and dates, as well as final compliance date(s) that meet the identified sediment borne WQOs. As identified in **Table 2-8**, the Peck Road Park Lake PCBs, DDT, Chlordane, and Dieldrin TMDLs are in the sediment pollutant class for the purpose of scheduling watershed controls.

Table 2-9 Target Load Reductions for Peck Road Park Lake TMDLs			
Peck Road Park Lake TMDL	**Baseline Load (µg/kg dry weight)**	**Suspended Sediment WLA (µg/kg dry weight)**	**Percent Reduction**
PCBs	15.38	1.29	91.6
DDT	5.57	5.28	5.2
Chlordane	3.15	1.73	45.1
Dieldrin	0.91	0.43	53.0

Although the LAR Bacteria TMDL contains a potentially suitable alternative schedule, the most appropriate backbone upon which to build the Peck Road Park Lake PCBs, DDT, Chlordane, and Dieldrin TMDLs schedule is the Machado Lake Pesticides and PCBs (Toxics) TMDL, since it includes PCBs, DDT, and other organochlorine pesticides having similar fate, transport, and BMP class characteristics. The Machado Lake Pesticides and PCBs (Toxics) TMDL identifies a timeline of 7.5 years from the effective date of the TMDL. Using this timeline, the final compliance date is January 1, 2024. However, this proposed date may be modified through the adaptive management process as the effectiveness of proposed control measures to control sediment and associated pollutants are assessed.

Peck Road Park Lake Trash TMDL

The RH/SGRWQG members subject to the Peck Road Park Lake Trash TMDL are concurrently implementing control measures to address the Los Angeles River Trash TMDL and by necessity will follow that TMDL implementation schedule and the interim numeric milestones and final compliance dates identified in **Table 1-6** in **Section 1.3.2**.

2.5.2.2 303(d) Listed WBPCs

The MS4 Permit requires that 303(d) listed WBPCs, in the same class as those addressed by a watershed TMDL, be assigned interim milestone and final compliance schedules corresponding to those for that TMDL. Like many organics, bis(2-ethylhexyl) phthalate binds to suspended sediments and organic particulates, which are then mobilized and transported by storm flows, before settling in quiescent receiving water bodies. Controls are mostly targeted at the elimination of plastic debris, sediment sources, runoff reduction, and sediment settling, or soil filtration, associated with runoff infiltration. Their environmental fate (elimination) is mostly through natural attenuation and augmented biodegradation. For Sawpit Wash and bis(2-ethylhexyl) phthalate the most similar pollutant class characteristics are sediments as found in the Machado Lake Toxics TMDL. The Machado Lake Toxics TMDL has a final compliance date of January 1, 2024, therefore the final compliance date for bis(2-ethylhexyl) phthalate will be the same. However, this proposed date may be modified through the adaptive management process as the effectiveness of proposed control measures to control sediment and associated pollutants are assessed.

2.5.3 Interim Milestones and Compliance Schedule

Interim and final compliance dates in the Machado Lake Nutrients and Machado Lake Pesticides and PCBs (Toxics) TMDLs are the foundation for selecting interim and final milestone dates for WBPCs that do not have a Regional Board approved TMDL. The dates proposed are subject to the procurement of grants or other financial support commensurate with the existing and future fiduciary responsibilities of the RH/SGRWQG members. The dates may be further adjusted based on evolving information developed through the iterative adaptive management process identified in the MS4 Permit or similar Parts within future Permits, LAR Metals TMDL, Water Effect Ratio (WER) Site-Specific Objectives (SSO) BPA approved by the Regional Board in February 2015, the proposed Zinc WER SSO, and new monitoring and impairment data.

Table 2-10 presents the compliance schedule for WBPCs not included in a Regional Board approved TMDL, including USEPA TMDLs and 303(d) listings. **Table 2-11**, **Table 2-12** and **Table 2-13** present the numeric milestones which must be achieved by the dates presented in **Table 2-10**. Note that the compliance WLAs are presented per jurisdiction in the tables, to match the presentation in the MS4 Permit. However, compliance will be established across jurisdictions to the extent covered by monitoring site catchment areas. The schedule identified in this EWMP is subject to change based on changing data, information, legislation, law, and fiscal priorities through the adaptive management process. Any schedule modifications will be consistent with TMDL related compliance schedules and submitted to the Regional Board for review and approval based on the requirements of the MS4 Permit.

Table 2-10 Schedule of WBPCs without a Regional Board Approved TMDL

TMDL	Water Bodies	Constituents	Compliance Goal	Weather Condition	Compliance Dates and Milestones (Bolded **numbers** indicate milestone deadlines within the current Permit term)[1]						
					2016	2017	2018	2020	2022	2024	2026
LA Area Lakes	Peck Road Park Lake	Total-P, Total-N	Meet WLAs	All							1/1
											Final
LA Area Lakes	Peck Road Park Lake	Water and Sediment: PCBs, DDT, Chlordane, Dieldrin	Meet WLAs	All						1/1	
										Final	
LA Area Lakes	Peck Road Park Lake	Trash	Meet WLAs	All	**9/30**						
					100%						
N/A	Sawpit Wash	Bis(2-ethylhexyl) phthalate	Meet RWL	All							3/23
											Final

[1] The current Permit term is assumed to end on December 27, 2017.

Table 2-11 Peck Road Park Lake Nutrients TMDL Milestones

Subwatershed	Milestone Date	Milestone Type	RH/SGRWQG Member	Total Nitrogen (lb/yr)[1]	Total Phosphorus (lb/yr)[1]
All Weather					
Eastern	January 1, 2026	Final WLA	Arcadia	2,320	383
			Bradbury	3,223	497
			Duarte	9,616	1,540
			County of Los Angeles	5,532	924
			Monrovia	38,736	6,243
Near Lake	January 1, 2026	Final WLA	Arcadia	1,115	158
			County of Los Angeles	773	129
			Monrovia	415	60.4
Western	January 1, 2026	Final WLA	Arcadia	16,334	2,840
			County of Los Angeles	2,818	467
			Monrovia	2,678	425
			Sierra Madre	4,254	695

[1] Each WLA must be met at the point of discharge. A three year average will be used to evaluate compliance. However, if applicable water quality criteria for ammonia, dissolved oxygen and pH, and the chlorophyll a target are met in the lake, then the total nitrogen and phosphorus allocations are considered attained.

Note: WLAs are contingent of MS4 Permit Part VI.E.3.

Table 2-12 Peck Road Park Lake PCBs, Chlordane, DDT, and Dieldrin TMDLs Milestones

Subwatershed	Milestone Date	Milestone Type	RH/SGRWQG Member	Suspended Sediment Milestone	Water Column Milestone
PCBs – All Weather					
Eastern	January 1, 2024	Final WLA	Arcadia	1.29 µg/kg dry weight	0.17 ng/L
			Bradbury		
			Duarte		
			County of Los Angeles		
			Monrovia		
Near Lake	January 1, 2024	Final WLA	Arcadia		
			County of Los Angeles		
			Monrovia		
Western	January 1, 2024	Final WLA	Arcadia		
			County of Los Angeles		
			Monrovia		
			Sierra Madre		
Chlordane – All Weather					
Eastern	January 1, 2024	Final WLA	Arcadia	1.73 µg/kg dry weight	0.59 ng/L
			Bradbury		
			Duarte		
			County of Los Angeles		
			Monrovia		
Near Lake	January 1, 2024	Final WLA	Arcadia		
			County of Los Angeles		
			Monrovia		
Western	January 1, 2024	Final WLA	Arcadia		
			County of Los Angeles		
			Monrovia		
			Sierra Madre		

Note: WLAs are contingent of MS4 Permit Part VI.E.3.

Table 2-12 Peck Road Park Lake PCBs, Chlordane, DDT, and Dieldrin TMDLs Milestones

Subwatershed	Milestone Date	Milestone Type	RH/SGRWQG Member	Suspended Sediment Milestone	Water Column Milestone
DDT – All Weather					
Eastern	January 1, 2024	Final WLA	Arcadia	5.28 µg/kg dry weight	0.59 ng/L
			Bradbury		
			Duarte		
			County of Los Angeles		
			Monrovia		
Near Lake	January 1, 2024	Final WLA	Arcadia		
			County of Los Angeles		
			Monrovia		
Western	January 1, 2024	Final WLA	Arcadia		
			County of Los Angeles		
			Monrovia		
			Sierra Madre		
Dieldrin – All Weather					
Eastern	January 1, 2024	Final WLA	Arcadia	0.43 µg/kg dry weight	0.14 ng/L
			Bradbury		
			Duarte		
			County of Los Angeles		
			Monrovia		
Near Lake	January 1, 2024	Final WLA	Arcadia		
			County of Los Angeles		
			Monrovia		
Western	January 1, 2024	Final WLA	Arcadia		
			County of Los Angeles		
			Monrovia		
			Sierra Madre		

Note: WLAs are contingent of MS4 Permit Part VI.E.3.

1

Table 2-13 Milestones for WBPCs without Regional Board Approved TMDL			
Water Body	**Milestone Date**	**Milestone Type**	**Milestone**
Bis(2-ethylhexyl) phthalate – All Weather			
Sawpit Wash	January 1, 2024	Final RWL	1.8 µg/L

3. Watershed Control Measures

The EWMP provides the opportunity for Permittees to customize their stormwater programs to address water quality priorities through the implementation of stormwater BMPs, referred to in the MS4 Permit as watershed control measures. The overarching goal of BMPs in the EWMP is to reduce the impact of stormwater and non-stormwater on receiving water quality and address the water quality priorities. As part of the EWMP development process, various BMP types were evaluated and selected. This section describes the different types of BMPs that were considered for inclusion in the EWMP, with an emphasis on regional BMPs, which were critical to the EWMP development process. Additionally, this section discusses the evaluation process and watershed control measures selected for future consideration.

The three main categories of BMPs include structural, both regional or distributed, and institutional as defined below. The term "regional BMP" is different than "regional EWMP project" in that regional BMP projects are not necessarily able to capture the 85th percentile, 24-hour storm event.

Regional BMPs: Constructed structural practices intended to treat runoff from a contributing area of multiple parcels (normally on the order of 10s or 100s of acres or larger) (**Figure 3-1**)

Distributed BMPs: Constructed structural practices intended to treat runoff relatively close to the source and typically implemented at a single- or few-parcel level (normally less than one acre) (**Figure 3-2**)

Institutional BMPs: Policies, actions and activities intended to prevent pollutants from entering stormwater runoff thus eliminating the source of the pollutants. These BMPs are not constructed.

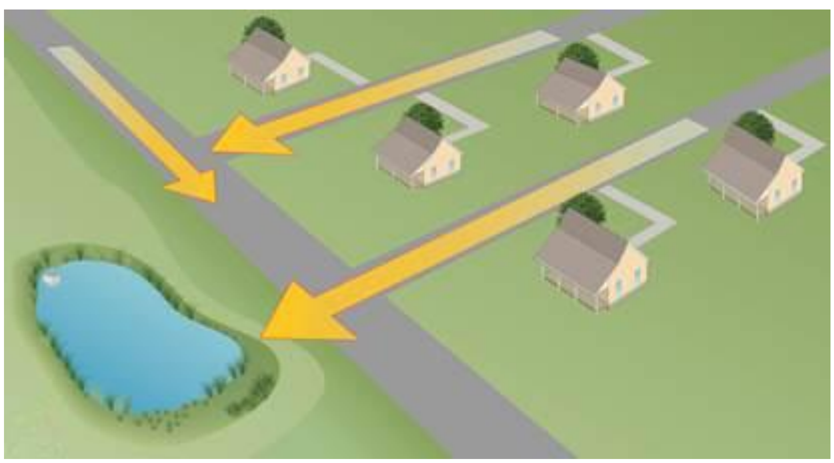


Figure 3-1 Conceptual Schematic of Regional BMP Implementation Approach

Figure 3-2 Conceptual Schematic of Distributed BMP Implementation Approach

This section summarizes existing and potential control measures by identifying existing BMPs and MCMs utilized by the RH/SGRWQG and evaluating performance data of the structural (regional and distributed) BMPs, and institutional (non-structural) control measures being implemented. Potential opportunities for customization of MCMs are identified and the information to support the modifications is also discussed. This section also summarizes the control measures that are proposed as part of this EWMP, which are included in the RAA discussed in **Section 4**.

To comply with the MS4 Permit requirements, an evaluation was performed that considers opportunities within the participating Permittees jurisdictions to utilize multi-benefit regional projects that, when feasible, detain all non-stormwater discharge and the flows produced by the 85th percentile, 24-hour storm event. A review of all relevant TMDL implementation plans and watershed management plans was performed to identify previously identified regional projects within the RH/SGRWQG EWMP area. An approach was developed and used to determine other potential regional project sites. The process was used to assess and select regional project sites for future consideration.

3.1 Non-Structural BMPs

Non-structural BMPs are non-constructed control measures that limit the amount of stormwater runoff or pollutants that are transported within the MS4 area. These control measures are also referred to as institutional BMPs. Most institutional BMPs are implemented to meet MCM requirements in the MS4 Permit.

MS4 Permit Part VI.C.5.b.iv.(1) directs that the MCMs identified in Parts VI.D.4 to VI.D.10 be incorporated as part of the EWMP. Permittees can evaluate the MCMs, identify potential modifications that will address water quality priorities, and provide justification for modification and/or elimination of any MCM that is determined to not be applicable, with the exception of MCMs in the Planning and Land Development Program which may not be eliminated. Customization may include replacement of an MCM for a more effective measure, reduced implementation of an MCM, augmented implementation of the MCM, focusing the MCM on the water quality priority, or elimination of an MCM. The MS4 Permit categorizes institutional BMPs and MCMs into the six program categories listed below. The programs that are applicable to the LACFCD are identified with an asterisk (*).

1. Development Construction Program
2. Industrial/Commercial Facilities Program
3. IC/ID Detection and Elimination Program*
4. Public Agency Activities Program*

5. Planning and Land Development Program
6. Public Information and Participation Program (PIPP)*

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

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

3.1.1 Summary of Existing MCMs/Institutional BMPs

The following MCMs/institutional BMPs are already being implemented by the RH/SGRWQG members:

- Concrete Curing
- Compost Bin Sales and Workshops
- Dog Parks
- Dewatering Operations
- Dust Control
- Erosion Control
- Enhanced Street Sweeping
- Hardscape Design
- Hazardous Waste Management
- Landscape Design
- Liquid Waste Management
- Material Delivery and Storage
- Material Use
- Mulch Give Away
- Paving and Grinding Operations
- Potable Water/Irrigation
- Preserved Existing Vegetation
- Sanitary/Septic Waste Management
- Scheduling
- Solid Waste Management
- Spill Prevention and Control
- Stockpile Management
- Street Sweeping and Vacuuming
- Vehicle and Equipment Fueling
- Vehicle and Equipment Maintenance
- Waste Oil Recycling Center
- Water Conservation Practices
- Water Trucks
- Wind Erosion Control

Attachment P identifies the MCMs/institutional BMPs required by the MS4 Permit and summarizes the existing and planned implementation by RH/SGRWQG members. The new MCMs/institutional BMPs that were not required as part of the 2001 MS4 Permit, but are required as part of the current (2012) MS4 Permit, do not need to be implemented until this EWMP has been approved based on Part VI.D.a.b.ii of the MS4 Permit.

3.1.2 Modifying MCMs/Institutional BMPs

Part VI.C.5.b.iv.(1) of the MS4 Permit directs Permittees to assess MCMs to identify opportunities for focusing resources on the water quality priorities identified in **Section 2**. Each Permittee is encouraged to implement the requirements in Parts VI.D.4 through VI.D.10, or may implement customized actions within each category of control measures as set forth in this EWMP, once approved. Permittees can evaluate the MCMs, identify potential modifications that will address water quality priorities, and provide justification for modification or elimination of any MCM that is determined to be ineffective (with the exception of the Planning and Land Development Program, which may not be eliminated or modified). MCM customization may include replacement, reduced implementation, augmented implementation, focused implementation or elimination.

An approach was developed for evaluating MCMs and/or institutional BMPs for customization to better address the water quality priorities. The steps associated with this process are as follows:

Step 1. Summarize the Current MCM Implementation

The current MCM implementation as reported in the 2010-2011 and 2011-2012 LAC Unified Stormwater Annual Reports is summarized in **Attachment O**.

Step 2. Compare Current MCM Implementation to MS4 Permit

The 2001 MS4 Permit MCM requirements are compared to the requirements specified in the 2012 MS4 Permit in **Attachment P**. This comparison, along with the identification of existing MCM elements being implemented, allow for a general assessment of potential gaps in the current programs. In general, the 2001 MS4 Permit and 2012 MS4 Permit requirements are worded differently and contain different specific requirements that cannot easily be compared. Each of the RH/SGRWQG members implements different programs that comply with the same requirements. As part of this approach, each agency performed more specific assessments to determine if they would benefit from MCM customizations.

As shown in **Attachment P**, gaps between the current program implementation under the 2001 MS4 Permit and the 2012 MS4 Permit MCM requirements are primarily in the Planning and Land Development Program, Construction Program, and Public Agency Activities. For instance:

- *Planning and Land Development Program:* Extensive new requirements for LID and hydromodification control.
- *Construction Program:* New requirements for erosion and sediment control procedures, especially for sites less than 1 acre, and for Erosion and Sediment Control Plans (ESCPs).
- *Public Agency Activities:* MCMs for inventory of Permittee-owned facilities, determine retrofit opportunities, assessment of flood management projects, assessment of flood control facilities, demonstration of Integrated Pest Management (IPM), among others.

For the PIPP, Industrial/Commercial Program, and IC/ID Elimination Program, the 2012 MS4 Permit contains some modifications to existing MCMs and additional detail as compared to the 2001 MS4 Permit. One significant change is the elimination of the Principal Permittee which previously implemented the PIPP on behalf of all Permittees. Now each Permittee is individually responsible for the implementation of the PIPP. For these programs, no other significant new program elements are required as in the MCMs listed above. The MCM requirements and existing implementation served as the basis for further evaluation of MCMs.

Step 3. Develop a List of MCMs that are Candidates for Customization

The first step was to develop a list of the MCMs that may be evaluated for customization. There are two parallel approaches for developing the list:

- Identify MCMs that do not address or only partially address the water quality priorities; or
- Identify MCMs that the stormwater program staff would like to eliminate or customize based on implementation experience.

Each of the MCM programs that may be customized through the EWMP were evaluated to determine if the MCM addresses the water quality priorities identified in **Section 2**. In addition, the potential effectiveness of the MCM program regarding the water quality priorities was determined based on program goals, implementation, and experience. The evaluation also took into account the RH/SGRWQG preferences.

Step 4. Evaluate Existing Information and Data to Develop Justifications for MCM Customization

Based on the list of MCMs that were candidates for modification identified in Step 3, potential general approaches or opportunities for MCM customization were identified. Based on the general approaches or opportunities, the RH/SGRWQG members evaluated the customized MCMs to determine if potential modifications were warranted. **Table 3-1** summarizes the potential modifications identified through this approach. The table also includes non-structural control measures in addition to the MS4 Permit defined MCMs. This table only presents potential enhancements and the proposed non-structural control measures are discussed in **Section 3.4**.

Table 3-1 Summary of Potential Non-Structural BMP Enhancements

Potential Modification or Enhancement	Justification
PIPP	
Develop a Grassroots Committee.	Community leaders may have stronger community connections, thus a better platform to provide educational and outreach materials.
Additional school outreach programs.	Sending home in school packets educational materials to help educate the students and individuals in the household.
Industrial/Commercial Facilities Program	
Evaluate operations of industrial facilities inspected to verify whether their operations are subject to IGP.	Identifying activities at industrial/commercial facilities where the Standard Industrial Classification (SIC) code does not require coverage under IGP will require facilities to get coverage and comply with requirements in the IGP.
Development Construction Program	
Recommend monitoring and sampling as part of the Erosion and Sediment Control Plan requirements.	Requiring developer to conduct self-inspections and monitoring 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 it can be transported downstream.
Utilize regenerative air vacuum equipment for street cleaning in land use areas that generate high metals loads.	Vacuum street cleaners are more effective at removing metals compared to sweepers.
Set maximum street sweeper speeds to optimize effectiveness in removing trash, debris, and sediments.	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.

Table 3-1 Summary of Potential Non-Structural BMP Enhancements

Potential Modification or Enhancement	Justification
Enhanced maintenance of catch basins, especially those with connector pipe screens.	Enhanced maintenance will prevent sediments and debris from accumulating and traveling downstream.
IC/ID Program	
Municipal Codes that include enforcement action such as the issuance of Notice of Violations (NOVs) for illicit connections.	Utilizing violations will give the RH/SGRWQG 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.	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 that 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 downspout disconnect program.	Implementing a downspout disconnect program will promote water conservation and reuse, by capturing stormwater runoff for irrigation use, thus reducing the volume of water reaching the storm drain system.

3.1.3 Approaches to Additional Non-Stormwater Discharge Control Measures

Non-stormwater discharge is often the most polluted, as it is highly concentrated from an activity that generally consists of washing down something or over irrigating. In an attempt to capture what is referred to as the "first flush," water quality requirements often include the mitigation of the 85th percentile, 24-hour storm event or the 0.75-inch storm event, such as regional EWMP projects and SUSMP/LID projects. MCMs and other institutional BMPs are in place in an attempt to reduce non-stormwater discharges as well. Control measures are proposed to address large storm volumes generated within the RH/SGRWQG and it is safe to assume that the proposed control measures will also address non-stormwater discharges within those drainage areas. An analysis was performed to quantify the anticipated load reduction through the implementation of wet-weather controls, which is summarized in **Section 4.2**. Non-stormwater discharges throughout the RH/SGRWQG that are not addressed with wet-weather controls will be addressed through the CIMP non-stormwater discharge source assessment.

3.2 Structural BMPs

As part of the EWMP development process, BMPs that are considered sufficient in addressing water quality priorities and achieving compliance with MS4 Permit WQOs are identified. Structural BMPs vary in function and type, with each BMP providing unique design characteristics and benefits from implementation. The overarching goal of BMP implementation as part of the EWMP process is to reduce the impact of stormwater and non-stormwater flows on receiving water quality. This subsection focuses on the structural BMPs assessed and selected for future consideration to address the water quality priorities and demonstrate compliance through the RAA.

3.2.1 Categories of Structural BMPs

Regional and distributed BMPs are separated into subcategories as shown in **Table 3-2**. These categories are used to compile and describe information on existing, planned, potential, and proposed BMPs. The nomenclature was important for engaging stakeholders as the EWMP was developed.

Table 3-2 Summary of Structural BMP Categories and Major Functions

Category	Subcategory	Example BMP Types
Regional[1]	Infiltration	Surface infiltration basin, subsurface infiltration gallery
	Detention	Surface detention basin, subsurface detention gallery
	Constructed Wetland	Constructed wetland, flow-through/linear wetland
	Treatment Facility	Facilities designed to treat runoff from and return it to the receiving water
	Low Flow Diversion	Facilities designed to divert dry-weather flows to the sanitary sewer, or in some cases, to spreading grounds
Distributed	Site-Scale Detention	Dry detention basin, wet detention pond, detention chambers, etc.
	Green Infrastructure	**Bioretention** and **biofiltration** (vegetated practices with a soil filter media, and the latter with an underdrain)
		Permeable pavement
		Green streets (often an aggregate of bioretention/biofiltration and/or permeable pavement)
		Infiltration BMPs (non-vegetated infiltration trenches, dry wells, rock wells, etc.)
		Bioswales (vegetative filter strips or vegetated swales)
		Rainfall harvest (green roofs, cisterns, rain barrels)
	Flow-Through Treatment BMP	Media/cartridge filters, high-flow biotreatment filters, etc.
	Source Control Treatment BMPs	Catch basin inserts, screens, hydrodynamic separators, trash enclosures, etc.

[1] The term "Regional BMP" does not necessarily indicate the project can capture the 85^{th} percentile storm, as used in the MS4 Permit. The term "Regional EWMP Projects" indicates those regional BMPs that are able (or expected to be able) to capture the 85^{th} percentile storm.

The BMP performance functions that drive BMP performance are presented in each BMP Fact Sheet in **Attachment E**. The three major BMP functions for structural BMPs are infiltration, water quality treatment, and storage, as follows:

1

Infiltration: Runoff is directed to percolate into the underlying soils. Volume reduction and groundwater recharge occur in infiltration practices.

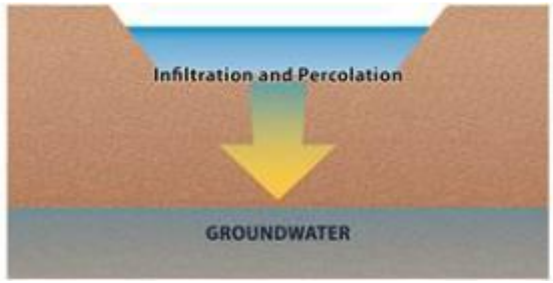


Figure 3-3 Conceptual Diagram Illustrating Infiltration

Storage: Runoff is captured, stored (detained), and slowly released into downstream waters. Storage can reduce the peak flow rate from a site but does not directly reduce runoff volume.

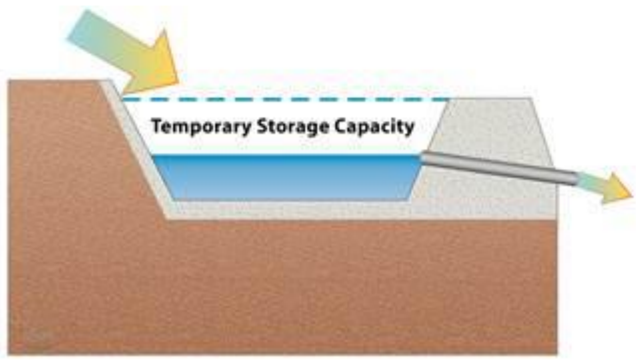


Figure 3-4 Conceptual Diagram Illustrating Storage

Water Quality (WQ) Treatment: Pollutants are removed through various unit processes, including filtration, settling, sedimentation, sorption, straining, and biological or chemical transformations.

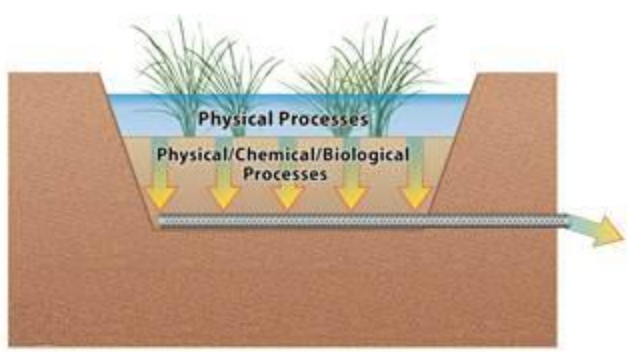


Figure 3-5 Conceptual Diagram Illustrating Water Quality Treatment

2

The preceding BMP functions were incorporated into relative performance gauges (**Figure 3-6**) to graphically represent the functions achieved by each BMP subcategory. Relative performance gauges are used in the BMP Fact Sheets, which are found in **Attachment E**. The circles represent the relative magnitude and range of each performance function for the particular BMP, in order to allow for comparison among different BMP types.

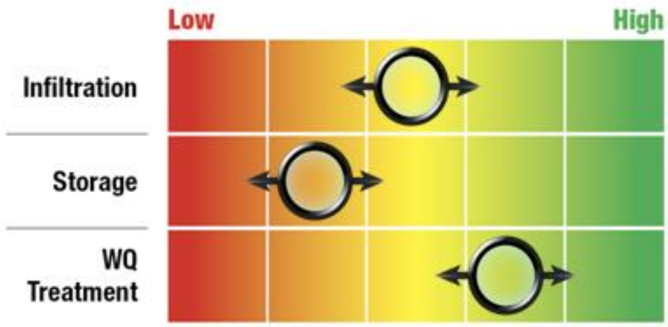


Figure 3-6 Example Relative Performance Gauge for Structural BMPs

Regional BMPs are constructed structural practices intended to treat runoff from a contributing area of multiple parcels (normally on the order of 10s or 100s of acres or larger). Regional practices include infiltration facilities that promote groundwater recharge and detention facilities that encourage settling. Infiltration and detention regional BMPs can be either constructed as open-surface basins or subsurface galleries. Regional practices also include constructed wetlands, which use engineered wetland environments to encourage pollutant removal, treatment facilities, which use conventional wastewater treatment processes to target pollutants of concern (POC), or low flow diversions, which divert flows to the sanitary sewer. Regional BMP Fact Sheets are found in **Attachment E**, and include the following BMPs:

- Infiltration facilities
- Detention facilities
- Constructed wetlands
- Treatment facilities

Distributed BMPs are constructed structural practices intended to treat runoff relatively close to the source and typically implemented at a single- or few-parcel level (normally less than one acre). As described in the BMP Fact Sheets, found in **Attachment E**, distributed BMPs include the following subcategories:

- Site-scale detention facilities
- Green infrastructure
- Flow-through treatment BMPs
- Source control structural BMPs

A major subcategory of distributed BMPs is green infrastructure. The MS4 Permit specifies that EWMPs should "incorporate effective technologies, approaches and practices, including green infrastructure." The primary goal of distributed green infrastructure BMPs is to intercept and treat runoff near its source using resilient natural systems. As opposed to traditional gray infrastructure, green infrastructure relies on contact between runoff, soils, and vegetation to accomplish volume and pollutant reduction. Green infrastructure has been shown to cost-effectively reduce the impacts of wet-weather flows while also reducing BMP maintenance requirements (Kloss et al. 2006). In addition, green infrastructure can provide multiple benefits to the surrounding community, including increased property values, increased enjoyment of surroundings and sense of well-being, increased safety, and reduced crime rate (Ward et al. 2008; Shultz and Schmitz 2008; Wolf 2008; Northeastern Illinois Planning Commission 2004; Hastie 2003; Kuo 2003; Kuo et al. 2001a; Kuo et al. 2001b; Wolf 1998).

Structural BMPs incorporated into the green infrastructure subcategory include the following, as described in the BMP Fact Sheets:

- Bioretention and biofiltration
- Permeable pavement
- Green streets
- Bioswales
- Infiltration BMPs
- Rainfall harvest (green roofs, cisterns, and rain barrels)

3.2.2 Summary of Existing Structural BMPs

The following sources were used to compile information on existing control measures, including MCMs and BMP programs already in effect for each of the participating RH/SGRWQG members:

- Standard Urban Stormwater Mitigation Plan (SUSMP) plan check records
- 2011-2012 Unified Annual Stormwater Report
- Integrated Regional Watershed Management Plan (IRWMP) documents
- Amigos de los Rios website
- RH/SGRWQG NOI for development of an EWMP

Three existing regional BMP projects were identified within the RH/SGRWQG EWMP area and are discussed below. Existing projects include projects that were constructed prior to 2012, as the water quality measured in 2012 serves as the baseline water quality which controls implementation efforts. The three projects are illustrated in **Figure 3-7** and a detailed summary is included in **Attachment F**. A total of 74 existing distributed BMP projects were identified and are summarized in **Table 3-3** and illustrated in **Figure 3-8**. A detailed list of distributed BMPs is provided in **Attachment G**. In addition, the 2011-2012 Unified Annual Stormwater Report was reviewed and a summary of the reported BMPs, categorized based on the categorization described in **Table 3-2**, is in **Attachment H**. The summary was created based on the following assumption: the number of existing BMPs is the number of BMPs reported as maintained in 2011-2012.

Table 3-3 Summary of Existing Distributed BMPs

Jurisdiction	Number of Existing Distributed BMPs Reported by Jurisdiction									
		Green Infrastructure								
	Site-Scale Detention	Bioretention/ Biofiltration	Permeable Pavement	Green Street	Bioswale	Infiltration BMPs	Rainfall Harvest	Flow-Through Treatment BMP	Source Control Structural BMP	Unknown
LA County	--	4	--	--	--	--	6	--	6	3
Arcadia	--	--	--	--	--	--	2	--	1	1
Azusa	--	2	1	--	--	11	1	--	10	2
Bradbury	--	--	--	--	--	--	--	--	--	--
Duarte	--	--	--	--	--	--	1	--	2	1
Monrovia	--	--	--	--	--	8	--	--	2	10
Sierra Madre	--	--	--	--	--	--	--	--	--	--
Total:	**0**	**6**	**1**	**0**	**0**	**19**	**10**	**0**	**21[1]**	**17[1]**

Sources: City of Arcadia Plan Check Approvals, City of Monrovia SUSMP Records, Los Angeles County LID Developments GIS data, IRWMP, and RH/SGRWQG NOI

[1] Total does not match total illustrated in **Figure 3-8** because geographical information is not available.

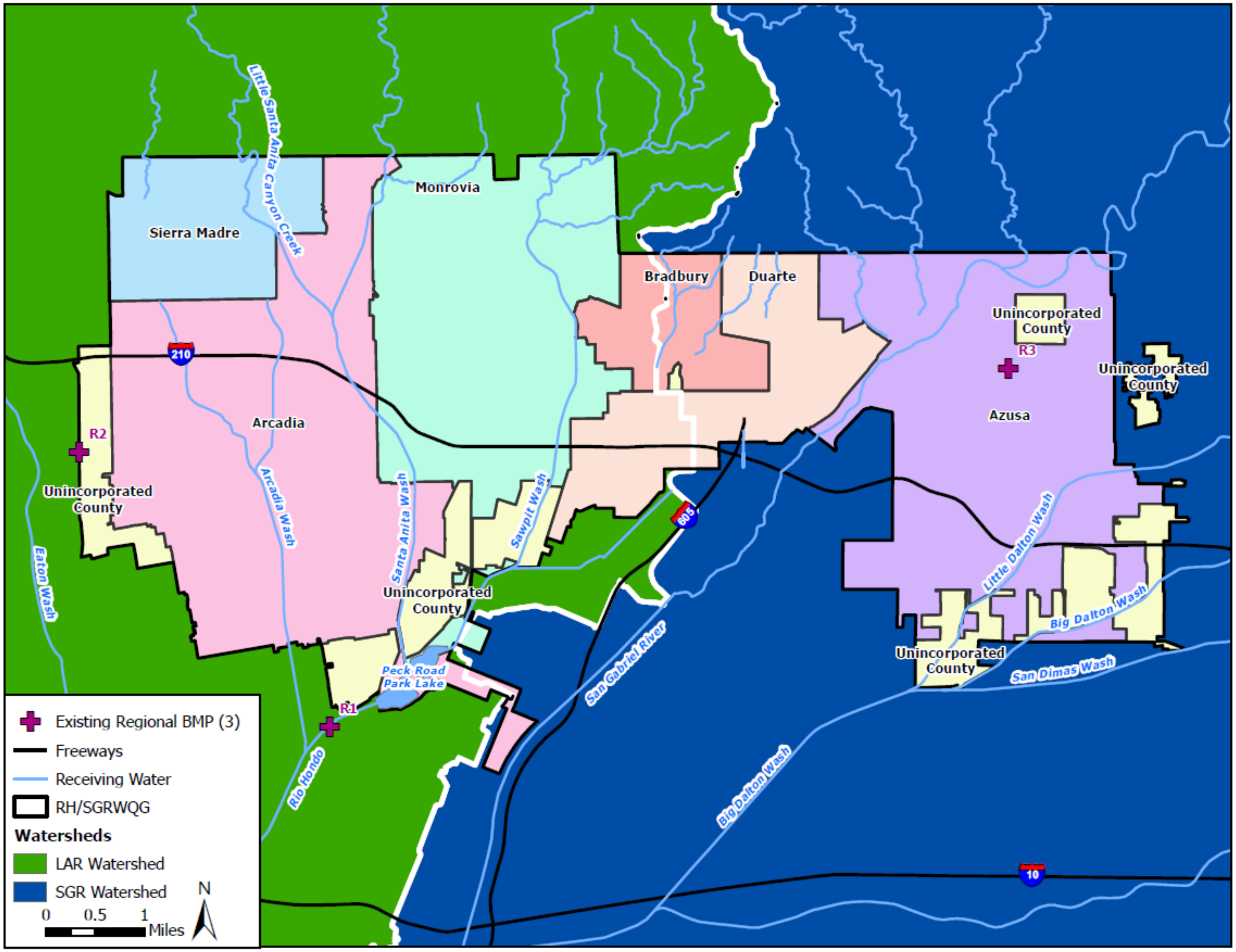


Figure 3-7 Existing Regional BMPs

Notes: BMPs with no spatial data are not shown. Numbering corresponds with project ID numbers listed in **Attachment F**.

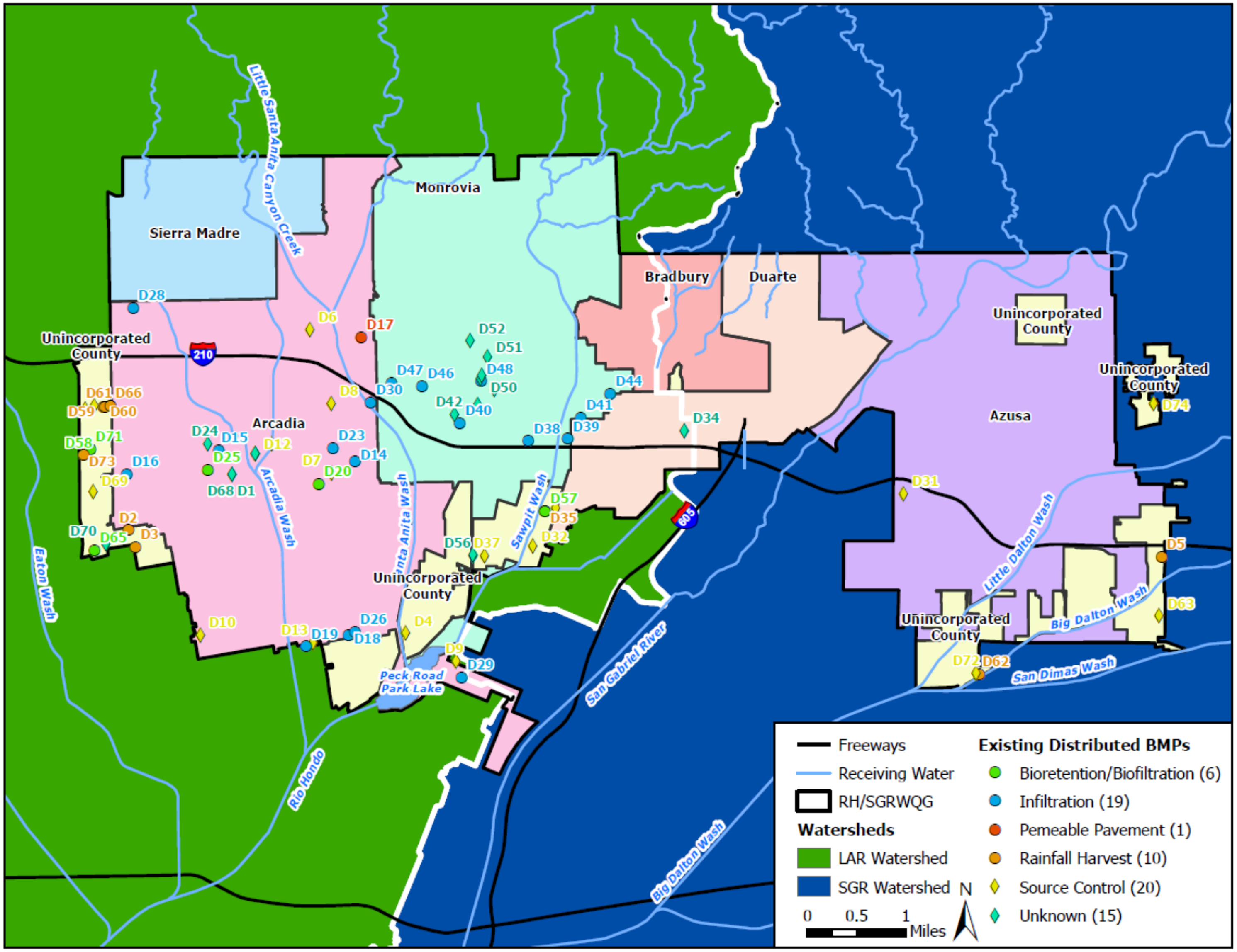


Figure 3-8 Existing Distributed BMPs

Notes: BMPs with no spatial data are not shown. Numbering corresponds with project ID numbers listed in **Attachment G**.

BMPs, including regional BMP projects, implemented prior to the baseline pollutant loads being used for the RAA calibration are considered part of the baseline, while those that were implemented after the baseline pollutant loads were established can be modeled in the RAA to demonstrate a load reduction. Three regional projects have been implemented by the RH/SGRWQG. The projects must be evaluated to determine if they meet EWMP criteria prior to determining if credit can be taken for water quality improvement. Part VI.C.1.g of the MS4 Permit states that wherever feasible, EWMP groups, such as the RH/SGRWQG, should identify and implement regional multi-benefit projects that retain (i) all non-stormwater runoff and (ii) all stormwater runoff from the 85^{th} percentile, 24-hour storm event for the drainage area tributary to the project. The Rio Hondo Trail Enhancements Project, Rosemead Boulevard Improvement Project, and San Gabriel Forest Gateway Interpretive Center Project were constructed following the pollutant load baseline determination. These projects were evaluated to determine if credit towards load reduction from baseline conditions could be used to demonstrate compliance. These projects were identified in planning documents as described in **Section 3.2.3** and were identified as already being constructed or in the construction phase. Each of the projects provides water quality benefits, but not enough information was available to quantify those benefits such that credit could be taken towards demonstrating compliance in the RAA.

Rio Hondo Trail Enhancements

According to the Amigos de los Rios website, the Rio Hondo Trail Enhancement project was completed in 2013. The project included the greening and installation of new gates and signage along 2.1 miles of trail located on the east bank of the Rio Hondo, from Lower Azusa Road to Peck Water Conservation Park. The project incorporated the use of native plants and shrubs, permeable paving, and bioswales. These distributed BMPs enhance runoff water quality in the project area vicinity, but the overall water quality benefits of the project could not be assessed with the limited information available.

Rosemead Boulevard Improvement Project

The Rosemead Boulevard Improvement Project was proposed in late 2007 and completed in February 2012, prior to the issuance of the 2012 MS4 Permit. The project represents the first LAC road to incorporate water quality enhancements. The project incorporated 2.5 miles of roadway improvements along Rosemead Boulevard between Foothill Boulevard and the Temple City boundary. Improvements included, but were not limited to, median landscaping, decorative street lights, tree planting, utility undergrounding, and bioswales. The project installed 1,712 feet of bioswales, contributing to the capture and retention of runoff generated within the project's drainage area (Green Street, 2013).

San Gabriel Forest Gateway Interpretive Center

In 2008, the Forest Gateway Interpretive Center was constructed in coordination with Amigos de los Rios. The San Gabriel Canyon Forest Gateway is a 2.5-acre pocket park and interpretive center in Azusa that provides a unique interface between urban and Angeles National Forest environments marking the entrance to the National Forest. The project is part of Amigos de los Rios efforts to support the Emerald Necklace of East LAC and to make

a greener Los Angeles. The project incorporated various bioswales and utilized native plants and trees. Bioswales remove sediment-associated pollutants by settling and straining and improve water quality. The project received funding from Proposition A.

3.2.3 Planned Structural BMPs

Part VI.C.1.g of the MS4 Permit states that wherever feasible, EWMP groups, such as the RH/SGRWQG, should identify and implement regional multi-benefit projects that retain (i) all non-stormwater runoff and (ii) all stormwater runoff from the 85th percentile, 24-hour storm event for the drainage area tributary to the project. In drainage areas within the EWMP area where retention of the 85th percentile, 24-hour storm event is not feasible, the EWMP must include an RAA to demonstrate that applicable WQBELs and RWLs will be achieved through the implementation of other watershed control measures including regional projects, enhanced MCMs, and distributed BMPs. Previously identified regional projects were identified and evaluated to determine if they would or could meet the above criteria. Documents were also reviewed to identify planned distributed BMPs.

The following documents and websites were reviewed to find previously identified structural BMP projects that address water quality:

- 2006 San Gabriel River Corridor Master Plan
- 2010 Multi-Pollutant TMDL Implementation Plan for the Unincorporated County Area of the Los Angeles River Watershed
- Amigos de los Rios website
- OPTI, part of the Greater Los Angeles County (GLAC) IRWMP online project database
- Los Angeles County Clean Water, Clean Beaches online project database
- Council for Watershed Health website
- Other local news articles

These reference documents include broad concepts, outlining the steps necessary to improve water quality. Recommendations include various BMP types for a range of different conditions; however, some documents do not provide specific BMP details to determine if they would meet EWMP project criteria as presented. Other references identify specific projects and locations, however insufficient detail is provided to evaluate if the project will retain all non-stormwater runoff and stormwater runoff from the 85th percentile, 24-hour storm event. Potential regional BMP projects introduced in the above references are in varying stages of planning, design, construction, or in some instances have already been constructed as identified in **Section 3.2.2**. In addition, valuable information was obtained from OPTI and the Los Angeles Clean Water, Clean Beaches online project databases.

The Implementation Plans relevant to the RH/SGRWQG TMDLs were reviewed in an effort to identify planned projects The planned regional projects identified were evaluated to determine if they satisfy regional EWMP project criteria. If implemented, the drainage areas tributary to projects that satisfy the regional EWMP project criteria will be in compliance with WQOs and those that do not will be modeled in the RAA to incorporate load reductions. Identified projects are listed in **Attachment I** and illustrated in **Figure 3-9**. The list of planned regional projects includes projects that are located downstream of the RH/SGRWQG EWMP area and adjacent to the Rio Hondo or SGR, as the group may be able to benefit from these projects.

Projects identified in **Attachment I** were evaluated to determine if they satisfied the regional EWMP project criteria specified in Part VI.C.1.g of the MS4 Permit or if they provide substantial water quality benefits. Each of the projects has the potential to be designed in a manner which incorporates water quality benefits. However, there is not enough information available to determine if these projects will satisfy EWMP criteria as presented. While regional projects are still in the planning phase, it is possible to modify concepts and designs to incorporate water quality and multi-use benefits to meet the EWMP criteria. If the RH/SGRWQG decides to pursue these projects in the future, the concepts will be further investigated to determine if they satisfy EWMP criteria. If they do not, a feasibility study will be performed to determine how they could be modified. The following four projects exhibited the greatest potential of the planned regional BMP projects to possibly satisfy the regional EWMP project criteria:

- Buena Vista Wetlands
- Hugo Reid Park Infiltration Basin Project
- Monrovia Station Square Project
- Whittier Narrows Park Project

The Buena Vista Wetlands and Hugo Reid Park Infiltration Basin project sites were evaluated as part of the regional project screening further detailed in **Section 3.2.4**. Monrovia Station Square was recently improved and includes distributed water quality improvements (see discussion below); therefore, it was not evaluated as a regional EWMP project. The Whittier Narrow Park Project would benefit the RH/SGRWQG; however, the site is located outside the Group's jurisdiction. This site was not further evaluated for regional EWMP project implementation as part of the RH/SGRWQG EWMP.

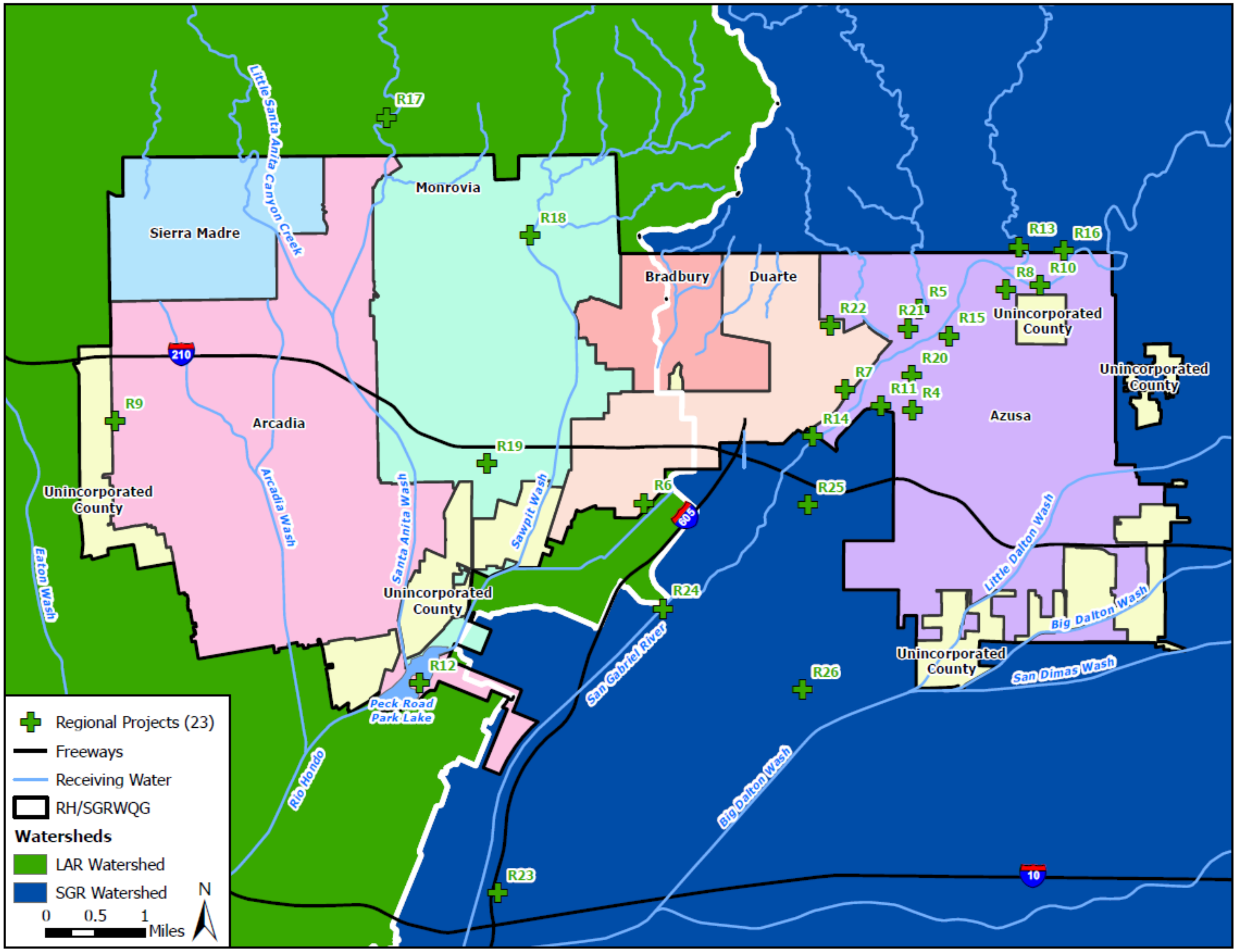


Figure 3-9 Regional BMPs Identified in Planning Documents

Notes: BMPs with no spatial data are not shown. Numbering corresponds with project ID numbers listed in **Attachment I**.

A total of four planned distributed BMP projects were identified and include:

- Azusa River Wilderness Park (City of Azusa)
- Metro Gold Line Infiltration Project (City of Azusa)
- Monrovia Station Square/Transit Village Multi-Benefit Park and Greenway Project (City of Monrovia)
- Santa Anita Park and Shopping Mall Parking Lot BMP (City of Arcadia)

Additionally, the Cities of Arcadia, Bradbury, Duarte, and Monrovia plan to implement full capture trash source control structural BMPs in all areas tributary to the Rio Hondo to comply with the Los Angeles River Trash TMDL. The City of Azusa also plans on implementing full capture trash source control structural BMPs throughout the City.

The planned distributed BMPs are illustrated in **Figure 3-10** and listed in **Attachment J**. In addition to the identified planned distributed BMP projects, the SUSMP requires post-construction structural or treatment control BMPs for new development and redevelopment. In addition, the Planning and Land Development Program in Part VI.D.7 of the MS4 Permit requires implementation of LID and Hydromodification Control BMPs, such as green streets, which are designed to minimize the percentage of impervious surfaces through infiltration, evapotranspiration (ET), and rainfall harvest and use. As development and redevelopment occur, additional structural BMPs will be constructed in accordance with the SUSMP and Planning and Land Development Program to treat or retain the runoff from public and private parcels.

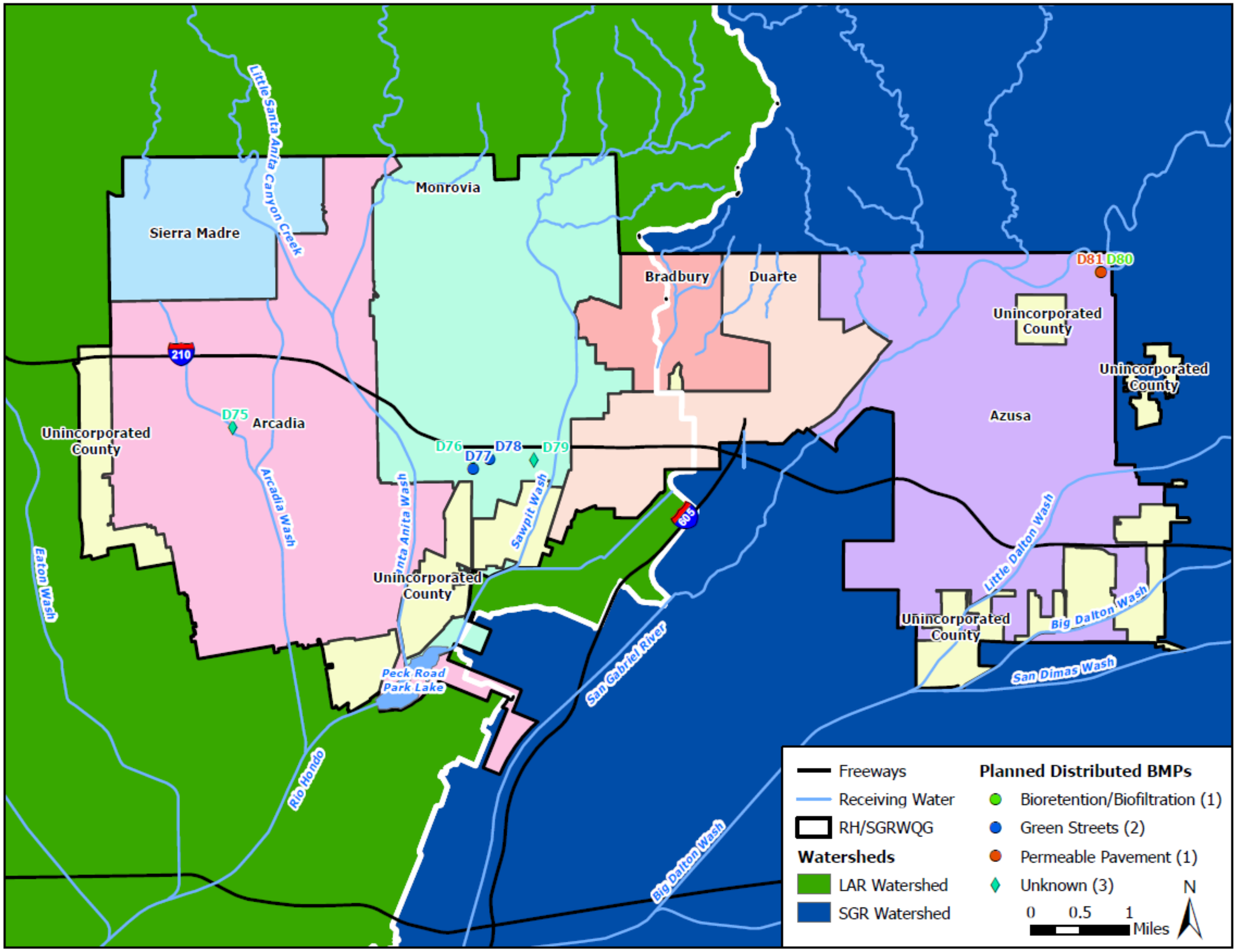


Figure 3-10 Planned Distributed BMPs

Notes: BMPs with no spatial data are not shown. Numbering corresponds with project ID numbers listed in **Attachment J**.

3.2.4 Identifying and Selecting Multi-Benefit Regional Projects

This section presents the approach and process used to identify and select regional projects, including, but not limited to regional EWMP projects. The approach was utilized to identify and screen preferred regional stormwater enhancement projects and support the evaluation of projects that will meet the objectives of the MS4 Permit. The process includes:

1. Compilation and evaluation of regional BMPs from existing planning documents;
2. Identification of additional regional BMPs/project sites;
3. Evaluation of all regional BMPs/project sites; and
4. Recommended projects for implementation.

This approach includes a Geographic Information System (GIS)-based assessment of publicly and privately-owned properties containing sufficient open space (e.g., large parking lots) and other conditions suitable to support a regional stormwater enhancement project. A ranking system was developed and used to screen each potential project sites using the same criteria. Both regional BMP and regional EWMP projects were identified using this process. Regional EWMP projects are able to retain all non-stormwater runoff and stormwater runoff generated by the 85th percentile, 24-hour storm event, whereas regional BMP projects are those stormwater enhancement projects that do not meet the EWMP criteria, but still provide regional water quality benefits. Regional BMP projects are constructed structural BMPs intended to collect and treat runoff from a contributing drainage area composed of multiple parcels, normally on the order of 10s or 100s of acres.

Potential project locations initially included open spaces, whether they are within parks, schools, large parking lots, or golf courses. These sites were identified using available aerial imagery and by utilizing available land use data, which includes these land use classifications. A GIS-based approach allowed the use of both aerial imagery and available map datasets. Once open areas were identified, the potential project sites were further refined and considered input from the group and interested stakeholders.

A GIS model was used to manage spatial data needed for the identification and screening of potential regional projects within the RH/SGRWQG area. Compiled data was used to support the prioritization of potential projects based on location specific criteria supporting the need and project implementation feasibility. The GIS analysis evaluated data critical in identifying high priority catchments, corresponding to those used for the RAA, for regional BMP installation within a watershed, such as land use, pollution generation, hydrology, topography, parcel ownership, existing storm drain flow direction, and infrastructure integration opportunities. The following subsection provides additional details on how this methodology was utilized to identify and rank potential project sites.

3.2.4.1 Potential Regional Project Sites

A list of potential regional BMP project locations within the RH/SGRWQG area was developed utilizing the approach described above. Using GIS land use layers and aerial imagery, several potential project sites were identified. The project sites were identified based on open space and their proximity to receiving water/MS4 infrastructure. Other criteria were evaluated during this phase, and the potential project sites identified represent the long list of potential locations that were narrowed down by using the ranking system described in the following section. The areas identified as potential project sites for regional BMPs within the RH/SGRWQG area are illustrated in **Figure 3-11**.

Based on a preliminary visual screening, the considered site size, proximity to a stormwater conveyance system, and location within the watershed, a list of projects to be further evaluated was determined. The list also includes project sites that were identified by members of the group and interested stakeholders. The 41 sites that were analyzed in greater detail are illustrated in **Figure 3-12** and listed in **Table 3-4**.

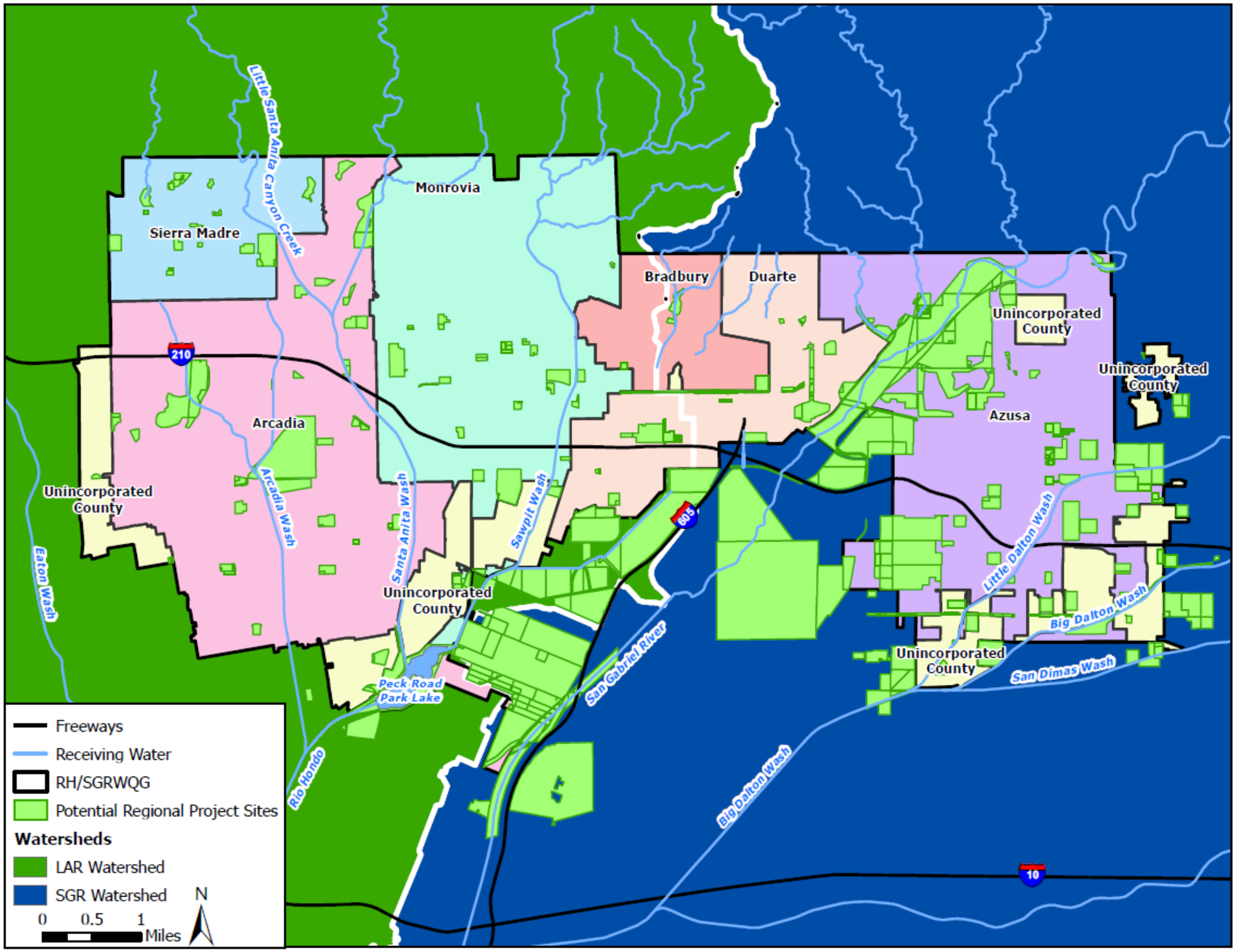


Figure 3-11 Potential Regional Project Sites within the RH/SGRWQG Area

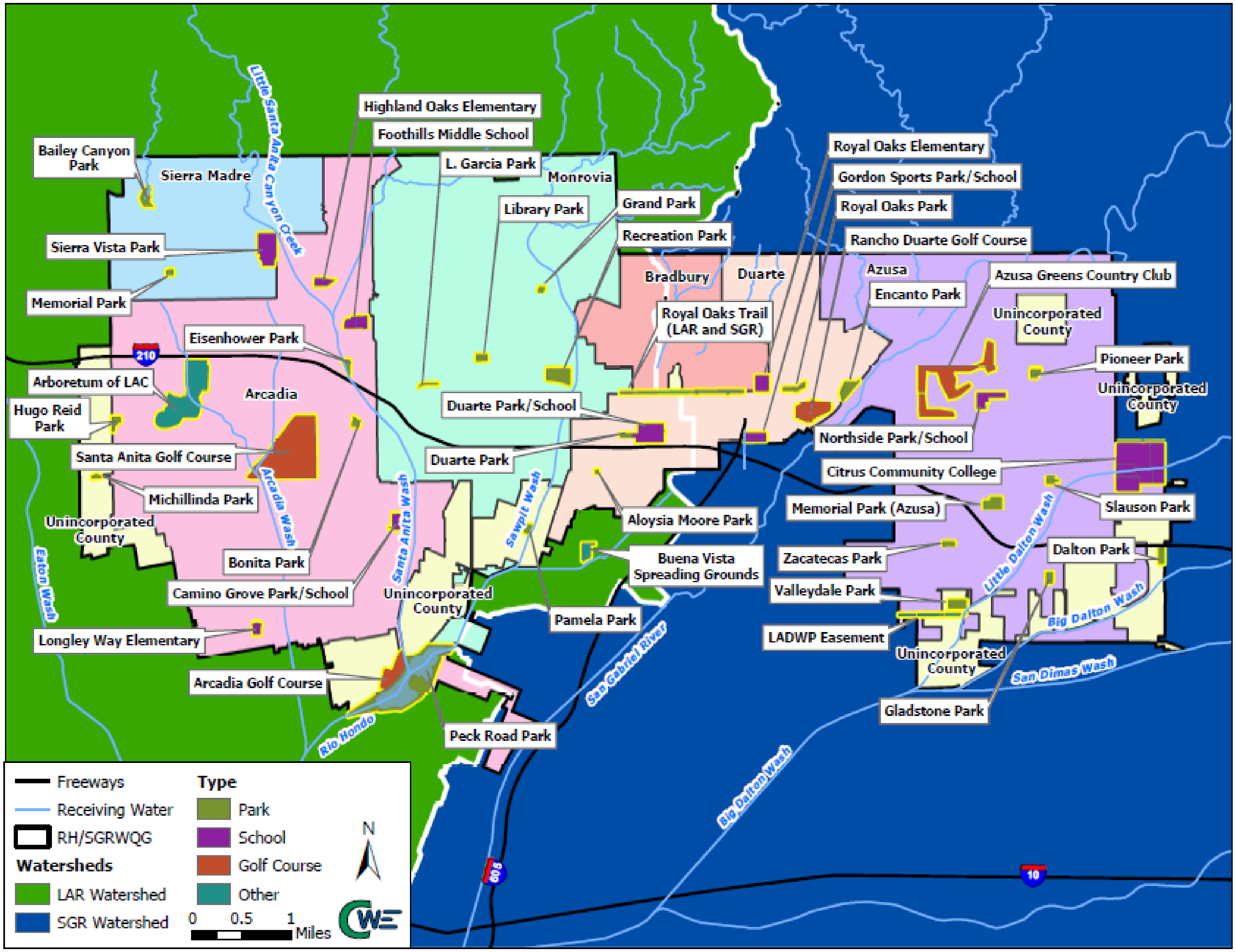


Figure 3-12 Potential Regional Project Sites Analyzed within the RH/SGRWQG Area

Table 3-4 Potential Regional Project Sites

Parks	
Aloysia Moore Park	Memorial Park (Sierra Madre)
Bailey Canyon Park	Michillinda Park
Bonita Park	Northside Park
Dalton Park	Pamela Park
Duarte Park	Peck Road Park
Eisenhower Park	Pioneer Park
Encanto Park	Recreation Park
Gladstone Park	Royal Oaks Park
Grand Park	Sierra Vista Park
Hugo Reid Park[1]	Slauson Park
L. Garcia Park	Valleydale Park
Library Park	Zacatecas Park
Memorial Park (Azusa)	
Golf Courses	
Arcadia Golf Course*	Rancho Duarte Golf Course
Azusa Green Country Club	Santa Anita Golf Course*
Educational Facilities	
Camino Grove Park/School	Gordon Sports Park/School
Citrus Community College	Highland Oaks Elementary
Duarte Park/School	Longley Way Elementary
Foothills Middle School	Royal Oaks Elementary
Other Open Spaces	
Arboretum of LAC*	Los Angeles Department of Water and Power (LADWP) Easement
Buena Vista Spreading Grounds[1]	Royal Oaks Trail

* More than one alternative for site was evaluated
[1] Previously planned projects as described in **Section 3.2.3** (from existing implementation plans)

3.2.4.2 Project Screening

A system scaled from one to ten is utilized for scoring each of the ranking criteria with the best sites having the highest scores. Additionally, a weight coefficient is assigned to each criterion to make some criteria more influential in the overall ranking process. The definition of the ranking criteria used, scoring system developed, available information used for project evaluation, and the weight coefficient of each of the criteria is discussed in this section so it is clear how the results of the Regional BMP Projects Worksheet (included in **Attachment K**) were derived. The ranking criteria used to evaluate and screen projects are listed below.

- General Criteria
  - Proximity to receiving water/MS4 infrastructure
  - Ownership
  - Size of catchment area
  - Size of opportunity site
  - Jurisdictions
  - Catchment area land use and likely pollutants
  - Multi-use opportunities and connectivity

    - Funding opportunities
    - Local knowledge
- Underlying Soil Conditions Criteria
    - Seasonal high groundwater table depth
    - Proximity to groundwater production wells
    - Pollutants in soil or groundwater
    - Geotechnical hazards
    - Soil type

Table 3-5 summarizes the scoring system and weight of each of the criteria. Additional details are provided below.

Table 3-5 Ranking Criteria, Weight, and Scoring System Summary

Ranking Criteria	Weight	Scoring System (10 being best)									
		1	2	3	4	5	6	7	8	9	10
General Criteria											
Proximity to receiving water/MS4 infrastructure	1			> 1000 ft Surface		500-1000 ft		100-500 ft			< 100 ft
Ownership[1]	3	Private									Public
Size of catchment area	1	Currently not used									
Size of opportunity site	3	> 100%	80-100%		50-80%		30-50%		10-30%	5-10%	0-5%
Jurisdictions	1				1			2			3+
Catchment area land use and likely pollutants	2		< 20%			20-50%			50-80%		> 80%
Multi-use opportunities	1	Currently not used									
Funding opportunities	1					Potential funds			Potential partners/ funding		Already looking into it
Local knowledge	2	Varies based on local knowledge									
Underlying Soil Conditions Criteria											
Seasonal high groundwater table depth	1					> 30 ft					< 30 ft
Proximity to groundwater production wells	1					< 200 ft					> 200 ft
Pollutants in soil or groundwater	1	Superfund site[2]				2+ GT[3] sites			1 GT[3] site		0 GT[3] sites
Geotechnical hazards	1		Liq[4] and fault hazards			Liq[4] or fault hazards					No hazards
Soil type	1		> 0.9		0.8-0.9		0.6-0.8		0.4-0.6		< 0.4

[1] Schools scored zero (0)
[2] Superfund sites automatically eliminated
[3] Geotracker
[4] Liquefaction

Proximity to Receiving Water/MS4 Infrastructure

Definition

The "Proximity to Receiving Water/MS4 Infrastructure" criterion is beneficial to determining which regional projects are near a stormwater conveyance system so that runoff can be easily diverted and captured for infiltration. Potential project sites near a receiving water and/or MS4 infrastructure are more likely to be feasible to implement and less costly to divert runoff. In addition to proximity, it is preferred that the potential regional project sites are downstream of the conveyance system so that gravity systems can be used to capture and divert runoff.

Scoring System

The potential project sites located in close proximity to MS4 infrastructure received higher scores, as shown in **Figure 3-13**, because diversion is likely to be less costly due to lower pipe quantities and trenching lengths. The cost is also likely to be less due to shallower systems which require less excavation. Sites that are located upstream of MS4 infrastructure were classified as surface flow and received lower scores as these scenarios are often associated with higher construction costs and may cause more disruption around the project site which is seen as an inconvenience to the public.

1	2	3	4	5	6	7	8	9	10
		>1000 ft Surface		500 – 1000 ft		100 -500 ft			<100 ft

Figure 3-13 Scoring System for Proximity to Receiving Water/MS4 Infrastructure

Weight Coefficient

A weight coefficient of one was given to this criterion.

Available Information

ArcGIS was used to determine the proximity to receiving water/MS4 infrastructure for each of the potential project sites. Data layers available online for LAC, along with other data provided by the group, were used to determine the location of existing infrastructure. Measurements were taken from the side of the potential project parcel closest to the adjacent conveyance system.

Ownership

Definition

The "Ownership" ranking criterion is noteworthy because potential project sites located on private property would be extremely expensive to implement; therefore, utilizing publically owned land represents a more feasible option.

Scoring System

The potential project sites located on publically owned parcels are given high scores and privately owned parcels are given low scores, as shown in **Figure 3-14**. Potential project sites located within schools are given a zero because extensive coordination would be involved and the Division of the State Architect (DSA) does not typically approve long-term infiltration projects on school properties.

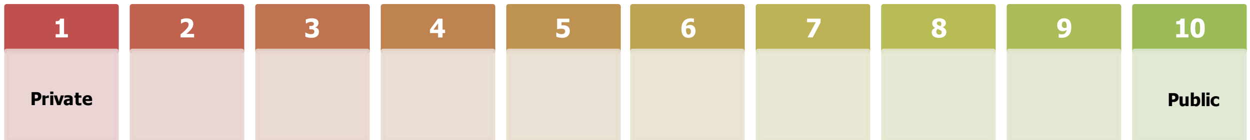


Figure 3-14 Scoring System for Ownership

Weight Coefficient

A weight coefficient of three was given to this criterion to emphasize the benefits and cost savings associated with implementing projects on public property. Additionally, the weight coefficient helps lower the score of the projects associated with schools to emphasize the difficulty working with DSA, especially on infiltration projects.

Available Information

Assessor parcel maps available on the LAC, Office of the Assessor website were used to verify the ownership of the potential project parcels. During preliminary screening, ownership was assumed based on land use types (i.e., parks are generally publically owned, etc.); therefore, most of this information was known through the initial GIS screening. In the RH/SGRWQG area, it is common to find schools with adjacent parks and playgrounds. In these cases the parks are used by the school and therefore would require similar requirements and approval from the DSA.

Size of Catchment Area

Definition

The "Size of Catchment Area" ranking criterion was originally intended to measure and score the size of the catchment area tributary to the potential project. Other ranking criteria already take into account the size of the catchment, for example, the "Jurisdictions," "Size of Opportunity Site," and "Catchment Area Land Use and Likely Pollutants" criterion. These criteria take into account the size of the catchment relative to other criterion. This category is currently not being used to evaluate potential projects based on the narrative provided below in regards to the scoring system.

Scoring System

The scoring system for this criterion is not clear, in that a larger catchment area is not necessarily better than a smaller more manageable one. If a large catchment area is treated it is beneficial to the RH/SGRWQG because a large area would be considered in compliance with the MS4 Permit, but if the entire 85^{th} percentile, 24-hour storm event is not treated then the area cannot be considered in compliance without additional control measures modeled through the RAA process. Other criteria, as specified above, have taken into account the size of the catchment and are able to provide more valuable information than the size alone. Potential project sites with a majority of their catchment area outside of a RH/SGRWQG jurisdiction were automatically taken off of the list for consideration.

Weight Coefficient

A weight coefficient was not provided for this criterion, as it was not used to assess potential project sites.

Available Information

The catchment area for each of the potential projects was delineated using GIS, with the Watershed Management Modeling System (WMMS) subwatershed data as a base. If the project site was situated in a downstream portion of a subwatershed, the subwatershed was cut based on available topography data and storm drain conveyance system routing. In some cases potential projects were located downstream of WMMS subwatershed(s); therefore, the whole subwatershed or multiple subwatersheds would be classified as tributary to the project site. Most projects have more than one option in terms of where flows can be diverted from, thus changing the catchment area delineation. The values determined are based on the diversion scenario that seemed most feasible based on engineering judgment and experience. The subcatchments were delineated for all potential projects and used to score other ranking criteria, as it was determined that a larger catchment size does not necessarily correlate with a more feasible project site. In some cases, a site was assessed based on two different subwatershed delineations.

Size of Opportunity Site

Definition

The "Size of Opportunity Site" was used to identify how much of a parcel would be required to mitigate flows from the 85th percentile, 24-hour storm event based on preliminary calculations assuming the BMP provides ten feet of storage depth. This criterion helps assess the feasibility of implementation because constructing BMPs with storage depths larger than ten feet can be costly and using the entire footprint of a parcel is not feasible due to existing surface and subsurface infrastructure such as buildings and subterranean parking lots that take up portions of the parcel area.

Scoring System

Potential project sites that require less area compared to the total area available (i.e., parcel area) receive higher scores and represent more feasible options, as demonstrated in **Figure 3-15**. Based on standard practice, it is feasible to implement water quality enhancement projects on approximately five percent of a parcel.

1	2	3	4	5	6	7	8	9	10
>100 %	80-100 %		50-80 %		30-50 %		10-30 %	5-10 %	0-5 %

Figure 3-15 Scoring System for Size of Opportunity Site

Weight Coefficient

A weight coefficient of three was given to this criterion because a project site that requires a twenty foot storage depth over the entire parcel is not desirable, or likely to be feasible, and should not be ranked high through this process.

Available Information

Using the rational method and procedures identified in the LAC Hydrology Manual (LACDPW, 2006) the flows generated by the 85th percentile, 24-hour storm event were approximated. The catchment delineations previously described and GIS data was used to identify the dominant soil types, land use, and rainfall depths within the catchment area. The land use composition within the drainage area provides information regarding the percent of impervious area tributary to the potential project site. Most projects have more than one option in terms of where flows can be diverted from, thus changing the catchment area delineation. The values determined are based on the diversion scenario that seemed most feasible based on engineering judgment and experience. GIS parcel data was used to identify the area of the potential project parcels, which was compared to the required BMP footprint assuming the BMP provides a storage depth of ten feet.

Jurisdictions

Definition

The "Jurisdictions" ranking criterion was used to identify how many of the group member's jurisdictions would benefit from project implementation; therefore, what jurisdictions are included within the drainage area tributary to the project site.

Scoring System

Potential project sites that accept flows from more jurisdictions are given higher scores, as shown in **Figure 3-16**, because these projects encourage collaboration, shared cost, better connectivity, and shared benefit.

1	2	3	4	5	6	7	8	9	10
			One			Two			≥ Three

Figure 3-16 Scoring System for Jurisdictions

Weight Coefficient

A weight coefficient of one was given to this criterion because a potential project site should not be ruled out if it only treats what is produced in that jurisdiction.

Available Information

Using the catchment delineation described previously, GIS was used to identify how many jurisdictions were included in the area tributary to the potential project site. Most projects have more than one option in terms of where flows can be diverted from, thus changing the catchment area delineation. The values determined are based on the diversion scenario that seemed most feasible based on engineering judgment and experience.

Catchment Area Land Use and Likely Pollutants

Definition

The "Catchment Area Land Use and Likely Pollutants" criterion was used to identify the land use categories tributary to the potential project site. This criterion is significant because it is beneficial to implement regional projects that will address the water quality priorities in the watershed. Based on the MS4 Permit, the area tributary to a regional EWMP project is considered in compliance with all water quality standards. By addressing the water quality priorities, not only will the area be in compliance, but it will also contribute to downstream receiving water compliance through load reductions.

Scoring System

The scoring system for this criterion is more complex than the others because the water quality priorities are different for the LAR and SGR Watersheds. The scoring system takes into account the watershed that the potential project is treating and land use categories that make up the catchment area. The scoring system is summarized in **Figure 3-17**. The percentages shown in the figure correspond to the summation of land use types associated with the water quality priorities. For the potential projects tributary to the LAR or SGR, the percentages of commercial, industrial, and transportation land uses are summed, as the priority pollutants are metals. For potential projects tributary to Peck Road Park Lake, the percentages of agricultural, commercial, educational, industrial, and open space land uses are summed because pesticides and nutrients are the water quality priorities. Potential sites that better address the water quality priorities are given higher scores.

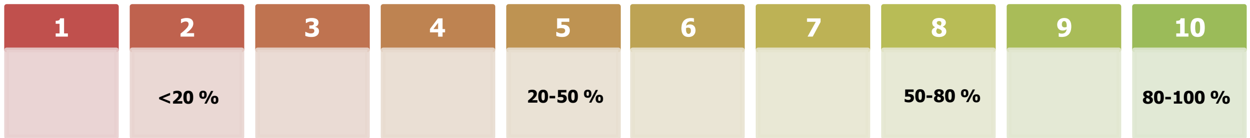


Figure 3-17 Scoring System for Catchment Area Land Use and Likely Pollutants

Weight Coefficient

A weight coefficient of two was given to this criterion because projects that address the water quality priorities should be given more consideration since they will additionally contribute to lower pollutant loads downstream, thus helping larger areas become compliant through the modeling process.

Available Information

Using the catchment delineation described previously, GIS was used to identify the land use composition within the catchment area. The LACDPW GIS land use data was used to define the following more distinct land use categories: agriculture, commercial, education, industrial, multi-family residential, single-family residential, transportation, and vacant. The land uses analyzed are consistent with those summarized in **Table 1-2** and **Figure 1-2**.

Multi-Use Opportunities and Connectivity

Definition

The "Multi-Use Opportunities and Connectivity" criterion was included to evaluate the potential projects for multi-use and connectivity opportunities. This criterion is important because these types of opportunities are encouraged in the MS4 Permit and maximize the use of public funds expended to design, implement, operate, and maintain an improvement project in the community. Potential project concepts and sites that utilize new or existing features such as public amenities (i.e., fishing, hiking trails, swimming, etc.), habitat and wildlife conservation, or stream restoration all have multi-use and connectivity opportunities. This criterion was not used in the screening process and will require a more extensive evaluation of the potential project concepts and existing habitat and environment. This ranking criterion may be used in the future to further evaluate and differentiate potential project sites.

Scoring System

The scoring system for this criterion has not yet been determined.

Weight Coefficient

A weight coefficient has not yet been defined because it is currently not being used to evaluate potential projects.

Available Information

Available information has not been evaluated for this ranking criterion. In the future, sites may be evaluated to determine if these opportunities exist. Existing site conditions will need to be evaluated to determine if the site already supports multi-use and connectivity or if these opportunities can be integrated through project implementation.

Funding Opportunities

Definition

The "Funding Opportunities" criterion was used to evaluate the potential projects for prospective funds which would be available for the project. This criterion is critical because having a funding partner makes implementation much more feasible. In addition to sharing cost, funding opportunities or partnerships may help the public perception of potential projects and help gain public support.

Scoring System

Potential project sites that have already pursued funds through available grant programs are scored the highest as demonstrated in **Figure 3-18**. Potential sites that have obvious potential partners were also scored high. All projects were given some points for this criterion because there are various grant programs that currently exist that would be applicable to regional water quality improvement projects and projects that involve watershed groups.

Figure 3-18 Scoring System for Funding Opportunities

Weight Coefficient

A weight coefficient of one was given to this criterion.

Available Information

Available information regarding funding opportunities and potential partners was collected. Once selected projects are further along in the planning stages, specific funding opportunities will be identified and project sites will be evaluated to determine if project concepts can be prepared in such a way to qualify for available grants and/or loans.

Local Knowledge

Definition

The "Local Knowledge" criterion is used to give potential project sites a set amount of points based on experience and local knowledge. This criterion requires firsthand knowledge and cannot be generated through a routine or spatial analysis.

Scoring System

The scoring system for this criterion is not standardized as it is with other ranking criterion. In the Regional BMP Projects Worksheet (included in **Attachment K**), a score is given to each project site along with an explanation which justifies the score assigned. If thoughts regarding the potential project sites were neutral, a score of five was assigned.

Weight Coefficient

A weight coefficient of two was given to this criterion because local knowledge and experience provides valuable insight that a computer or spatial analysis cannot determine.

Available Information

The RH/SGRWQG members have discussed the various potential project sites and agreed upon a score based on known site conditions and public perception. During the EWMP outreach events, participating stakeholders provided comments on regional project sites that were of interest to them. These comments were also incorporated into this scoring criterion.

Seasonal High Groundwater Table Depth

Definition

The "Seasonal High Groundwater Table Depth" ranking criterion was used to evaluate the groundwater table depth within the potential project site because high groundwater depths do not support infiltration, making retention and infiltration of the 85th percentile, 24-hour storm event difficult. The Los Angeles County Stormwater BMP Design and Maintenance Manual (LACDPW, 2009) recommends a minimum separation of ten feet between the invert of an infiltration BMP and groundwater table to protect groundwater quality.

Scoring System
Potential project sites that have deep groundwater table depths are given higher scores as demonstrated in **Figure 3-19**. The minimum groundwater table depth recorded was used for this evaluation.

1	2	3	4	5	6	7	8	9	10
				<30 ft					>30 ft

Figure 3-19 Scoring System for Seasonal High Groundwater Table Depth

Weight Coefficient
A weight coefficient of one was given to this criterion.

Available Information
LACDPW operates 60 groundwater wells within the RH/SGRWQG area based on information available on their groundwater well web page. Data is available for each of the wells dating back to at least the 1980s. The groundwater well in closest proximity to the potential project site was used as a reference and the average and minimum groundwater table depths were recorded for consideration.

Proximity to Groundwater Production Wells

Definition
The "Proximity to Groundwater Production Wells" criterion is used to identify whether the potential project site is located near a groundwater production well. The California Stormwater Quality Association (CASQA) BMP Handbook for New Development and Redevelopment (CASQA, 2003) explains that groundwater contamination should be considered as an adverse effect of infiltration BMPs; therefore, should not be close enough to contaminated groundwater drinking supplies. The Los Angeles County Stormwater BMP Design and Maintenance Manual (LACDPW, 2009) recommends a minimum of 100 feet of separation between infiltration BMPs and groundwater production wells unless sufficient pretreatment is provided.

Scoring System
Potential project sites that are more than 200 feet away from existing groundwater production wells are given higher scores, as shown in **Figure 3-20**. Sites are given a lower score if they are within 200 feet of a groundwater production well because further analysis may be required to determine if contamination will be a concern or the project would be limited to capture and use because infiltration would not be feasible.

1	2	3	4	5	6	7	8	9	10
				<200 ft					>200 ft

Figure 3-20 Scoring System for Proximity to Groundwater Production Wells

Weight Coefficient

A weight coefficient of one was given to this criterion.

Available Information

The sources listed below were reviewed for the location of groundwater production wells. The locations identified in the documents listed below were then verified using aerial imagery. Aerial imagery was also reviewed independently of the various sources.

- Water Supply Assessment for the City of Arcadia "Caruso Affiliated/Magna Entertainment Corp" (City of Arcadia, 2006)
- Environmental Assessment: Water Supply Wells for the City of Arcadia, California *Longley Well No. 3 and Camino Real Well No. 3* (EPA, 2009)
- Urban Water Management Plans (UWMPs) from 2010 posted on the State of California's Department of Water Resources website (CA.gov) for:
    - Azusa Light & Water;
    - California American Water;
    - Cities of Arcadia, Monrovia, and Sierra Madre;
    - LADWP;
    - San Gabriel Valley Water Company;
    - Upper San Gabriel Valley Municipal Water District; and
    - West Basin Municipal Water District.
- Environmental Impact Reports (EIRs) from the surrounding area

Pollutants in Soil or Groundwater

Definition

The "Pollutants in Soil or Groundwater" criterion was used to assess soil and groundwater contamination within the potential project site and surrounding areas. Identifying existing contamination is vital because infiltration projects are not desirable in areas undergoing mitigation and it would not be beneficial to implement infiltration projects in these areas knowing they may have adverse effects on groundwater quality (LACDPW, 2009).

Scoring System

As shown in **Figure 3-21**, potential project sites that are within Superfund sites are given a low score and sites with little to no soil or groundwater contamination, based on GeoTracker, are given higher scores. Sites that are identified as Superfund sites were automatically considered infeasible and eliminated from further evaluation.

1	2	3	4	5	6	7	8	9	10
Superfund Exists				≥2 GeoTracker Sites			1 GeoTracker Site		0 GeoTracker Sites

Figure 3-21 Scoring System for Pollutants in Soil or Groundwater

Weight Coefficient

A weight coefficient of one was given to this criterion.

Available Information

The location of existing Superfund sites was determined using the San Gabriel Valley Volatile Organic Compound (VOC) Contamination Maps (EPA, 2007). The California SWRCB operates a website called GeoTracker which was used to determine if soil or groundwater contamination exists near the potential project sites. GeoTracker provides information regarding the following cleanup sites: Leaking Underground Tanks (LUST), land disposal, military, Water Discharge Requirements (WDR), Department of Toxic Substances Control (DTSC), and "other." The location along with mitigation measures are provided through the website and documentation was reviewed for open sites located within approximately 1,000 feet of a potential project site. Information was reviewed for nearby sites to determine if the mitigation is in progress or if it should have been closed, but was never officially reported as closed. Data used to determine a score for this criterion only considered open cases that are still mitigating contamination.

Geotechnical Hazards

Definition

The "Geotechnical Hazards" criterion was used to assess the geotechnical hazards in the area that may prohibit the implementation of regional projects. This criterion is included so that geotechnical hazards that may present a high risk of failure or costly implementation are identified and prioritized accordingly. Areas susceptible to liquefaction and earthquake-induced landslides were evaluated to assess existing geotechnical hazards. Fault zone areas were also examined.

Scoring System

Potential project sites that are not within liquefaction or earthquake-induced landslide zones were given high scores, as illustrated in **Figure 3-22**.

1	2	3	4	5	6	7	8	9	10
	Liq. & Fault Zone Hazards			Liq. OR Fault Hazards					No Hazards

Figure 3-22 Scoring System for Geotechnical Hazards

Weight Coefficient

A weight coefficient of one was given to this criterion.

Available Information

The locations of liquefaction and earthquake-induced landslide zones were determined using maps available from the California Department of Conservation (State of California, 2014). The fault zones in the area were obtained from the California Department of Conservation, California Geological Survey (State of California, 2014). Both sources provided GIS data that was overlain with the potential project sites to determine their position relative to existing hazards. Geotechnical hazards were only noted if the potential project site was located within the hazard zone.

Soil Type

Definition

The "Soil Type" criterion was used to assess the type of soil within the potential project site and tributary catchment area, as it plays a critical role in the volume of runoff produced and the ability to infiltrate the runoff captured. The undeveloped runoff coefficient (C_u), the ratio of runoff rate to rainfall intensity, defined in the LACDPW Hydrology Manual (LACDPW, 2006), was used to score this criterion.

Scoring System

Figure 3-23 demonstrates potential project sites that have low undeveloped runoff coefficients are given higher scores, as they are associated with soils that minimize runoff and promote infiltration.

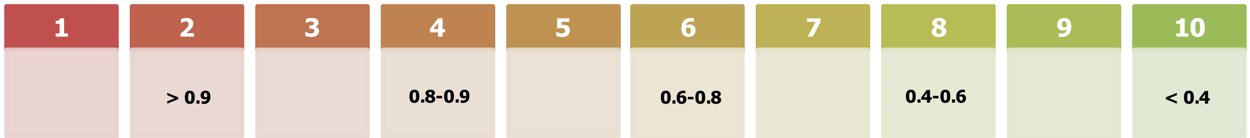


Figure 3-23 Scoring System for Soil Type

Weight Coefficient
A weight coefficient of one was given to this criterion.

Available Information
The LACDPW Hydrology Manual (LACDPW, 2006) classifies the existing soil types in LAC and provides soil curves that identify the relationship between the undeveloped runoff coefficient and rainfall intensity. The soil types used for this analysis are illustrated in **Figure 1-3**. The dominant soil type within the potential project catchment area was identified for each of the sites and the undeveloped runoff coefficient for a rainfall intensity of two inches per hour was obtained from the soil curves. The methodology for obtaining this coefficient is further discussed in the LACDPW Hydrology Manual (LACDPW, 2006).

3.2.4.3 Screening Results

The potential project sites identified in **Table 3-4** were screened based on the criteria outlined above. The results of the screening and data used to determine the ranking are summarized in the Regional BMP Projects Worksheet provided in **Attachment K**. The worksheet only includes projects that were fully evaluated, as some projects were eliminated from the analysis because they are located in the upper portion of the watershed, receive drainage from a catchment outside of the group's jurisdiction, or are located within a Superfund site. The worksheet was completed and each project site was scored. The sites were then ranked according to each watershed, i.e., the projects within the SGR Watershed were compared to each other and not to the potential sites located in the LAR Watershed. A figure identifying the potential project site and the respective catchment area and land use are provided in **Attachment L**, while the rankings are summarized in **Table 3-6** below. ~~The sites selected for future implementation are identified in the table above the bold line. Not all of the sites will be used for Regional projects, as the costs would be too high. It is recommended that the top ranked sites be implemented in the future and were modeled in the RAA to demonstrate compliance, as detailed further in **Section 4**. These sites are further discussed in **Section 3.4.2**~~.

Table 3-6 Ranked Potential Regional Project Sites in the LAR Watershed

Potential Project Site	Score	Rank
Recreation Park	144	1
Arboretum of LAC	142	2
Sierra Vista Park	135	3
Royal Oaks Trail (LAR)	132	4
L. Garcia Park	129	5
Eisenhower Park	128	6
Santa Anita Golf Course Alternative 2	127	7
Hugo Reid Park[1]	126	8
Peck Road Park	125	9
Aloysia Moore Park	124	10
Bailey Canyon Park	123	11

Table 3-6 Ranked Potential Regional Project Sites in the LAR Watershed

Potential Project Site	Score	Rank
Arcadia Golf Course	122	12
Arcadia Golf Course - Regional	122	12
Buena Vista Spreading Grounds[1]	119	14
Library Park	117	15
Arboretum of LAC – Regional	117	15
Duarte Park	114	17
Michillinda Park	114	17
Santa Anita Golf Course	112	19
Memorial Park (Sierra Madre)	101	20
Duarte Park/School	99	21
Camino Grove Park/School	95	22
Highland Oaks Elementary	94	23
Longley Way Elementary	87	24
Foothills Middle School	84	25

[1] Identified in planning documents as described in **Section 3.2.3**.

The results for the potential regional EWMP project sites in the SGR Watershed are summarized in **Table 3-7**. The results were separated by watershed because the estimated volume and load reductions are dependent on the watershed. A figure illustrating the potential project site with its catchment area and land use are provided in **Attachment L**. ~~The sites selected for future implementation are identified in the table above the bold line. Not all of the sites will be used for Regional projects, as the costs would be too high. It is recommended that the top ranked sites be implemented in the future and were modeled in the RAA to demonstrate compliance, as detailed further in **Section 4**. These sites are further discussed in **Section 3.4.2**.~~

Table 3-7 Ranked Potential Regional Project Sites in the SGR Watershed

Potential Project Site	Score	Rank
LADWP Easement	145	1
Encanto Park	139	2
Memorial Park (Azusa)	131	3
Royal Oaks Trail (SGR)	131	3
Northside Park	130	5
Pioneer Park	130	5
Royal Oaks Park	129	7
Gladstone Park	125	8
Azusa Greens Country Club	123	9
Slauson Park	113	10
Royal Oaks Elementary	98	11
Gordon Sports Park/School	80	12

In some instances the potential regional project sites being evaluated were eliminated if it was determined that additional information made the project infeasible or undesirable. The project sites eliminated through partial evaluation are summarized in **Table 3-8**. Project elimination was often a result of insignificant catchment areas due to a location in the upstream portion of the catchment or contamination, including Superfund sites. Figures illustrating the potential project sites that were eliminated are provided in **Attachment L**.

Table 3-8 Eliminated Regional EWMP Project Sites

Potential Project Site	Watershed	Reason for Elimination
Parks		
Bonita Park	LAR	Upstream in subwatershed, no significant catchment
Dalton Park	SGR	Catchment area outside RH/SGRWQG
Grand Park	LAR	Upstream in subwatershed, no significant catchment
Pamela Park	LAR	Proximity to Superfund site
Valleydale Park	SGR	Proximity to Superfund site
Zacatecas Park	SGR	Proximity to Superfund site
Golf Course		
Rancho Duarte Golf Course	SGR	Existing contamination issues
Educational Facilities		
Citrus Community College	SGR	Catchment area outside RH/SGRWQG

3.2.5 Identifying Additional Distributed BMPs

Opportunities for additional distributed BMPs may exist at sites that do not fall under SUSMP, LID, or green streets policies. For example, road resurfacing often includes a grind and overlay back to existing grade, therefore SUSMP/LID and green streets may not be applicable. Since construction is occurring, the site could potentially be retrofitted to include distributed BMPs, if feasible, and if the location is in a high priority area. Distributed BMP options were also solicited through the stakeholder outreach events held during the EWMP development. For this EWMP, green street distributed BMPs were preferred. This section outlines the methodology for analyzing streets for their feasibility as green streets. The volume associated with green streets can also be reallocated to other distributed BMPs that capture an equivalent volume. Green streets were the focus, as roads are being repaired and maintained on a more regular schedule and funds are already available for street rehabilitation to help lessen the cost of implementation.

A green streets analysis was performed for the entire RH/SGRWQG area to determine 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 below. 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 determine which streets within each subarea would need to be implemented as a green street to satisfy the 85th percentile storm event volume criteria or 90th percentile load criteria, whichever is greater. Details regarding the subarea analysis are provided in **Section 3.4.3**.

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Slope

Streets with milder slopes are more appropriate for green streets as they are able to provide a greater capacity than streets with a steeper slope. The slope of each street within the RH/SGRWQG was determined by first creating a raster defining the slopes throughout the area using a contour shapefile. The raster was then converted into a shapefile so that a slope could be assigned to each street. The streets were then ranked based on the slope values as described in **Table 3-9**. **Figure 3-24** illustrates the slopes found within the RH/SGRWQG. The slope ranking values were weighted by a factor of two, as this criterion is more influential in green street feasibility than the street type criteria discussed below.

Table 3-9 Slope Ranking Summary

Slope (%)	Ranking Value
0	10
1	9
2	8
3	6
4	4
5	2

*Note: Streets with slopes above five percent were excluded from the analysis.

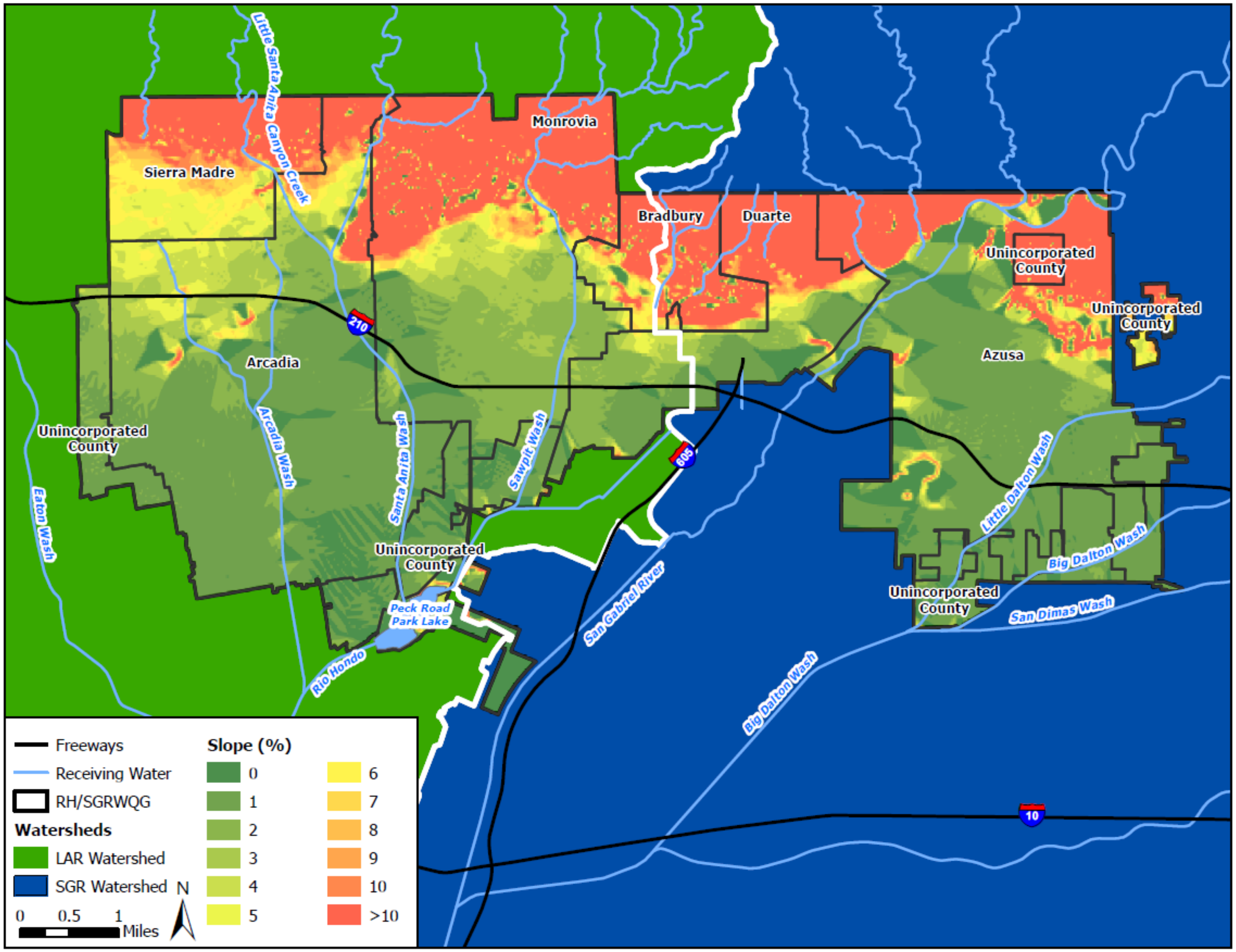
Soil Infiltration Capacity

The soil type along each street was determined and the associated infiltration capacity, or saturated hydraulic conductivity (K_{sat}), was used to rank the streets. The streets with underlying soils with a higher infiltration capacity were assigned a higher score as these streets would offer more of a benefit as green streets than streets whose underlying soils are not conducive to infiltration. The soil types were determined based on the LAC Hydrology Manual (LACDPW, 2006) soil types and the associated infiltration capacities are based on the Structural BMP Prioritization and Analysis Tool (SBPAT). Each street was clipped using the soil shapefile, so that street segments did not cross multiple soil types, and were assigned a ranking value based on **Table 3-10**. **Figure 3-25** contains a figure illustrating the soil types found within the RH/SGRWQG. The soil infiltration capacity criterion was weighted by a factor of three as this is the most important criteria when determining the feasibility of green street implementation.

Table 3-10 Soil Ranking Summary

Soil Type	Infiltration Capacity (K_{sat})	Ranking Value
14	0.81	10
3	0.77	9
15	0.72	8
7	0.66	7
88	0.62	6
78	0.52	5
13	0.45	4
6	0.33	3

*Note: Soil types with an infiltration capacity lower than 0.33 were excluded from the analysis (Soil Types 8, 11, and 81).



1
2 **Figure 3-24 Slopes for Green Street Analysis**

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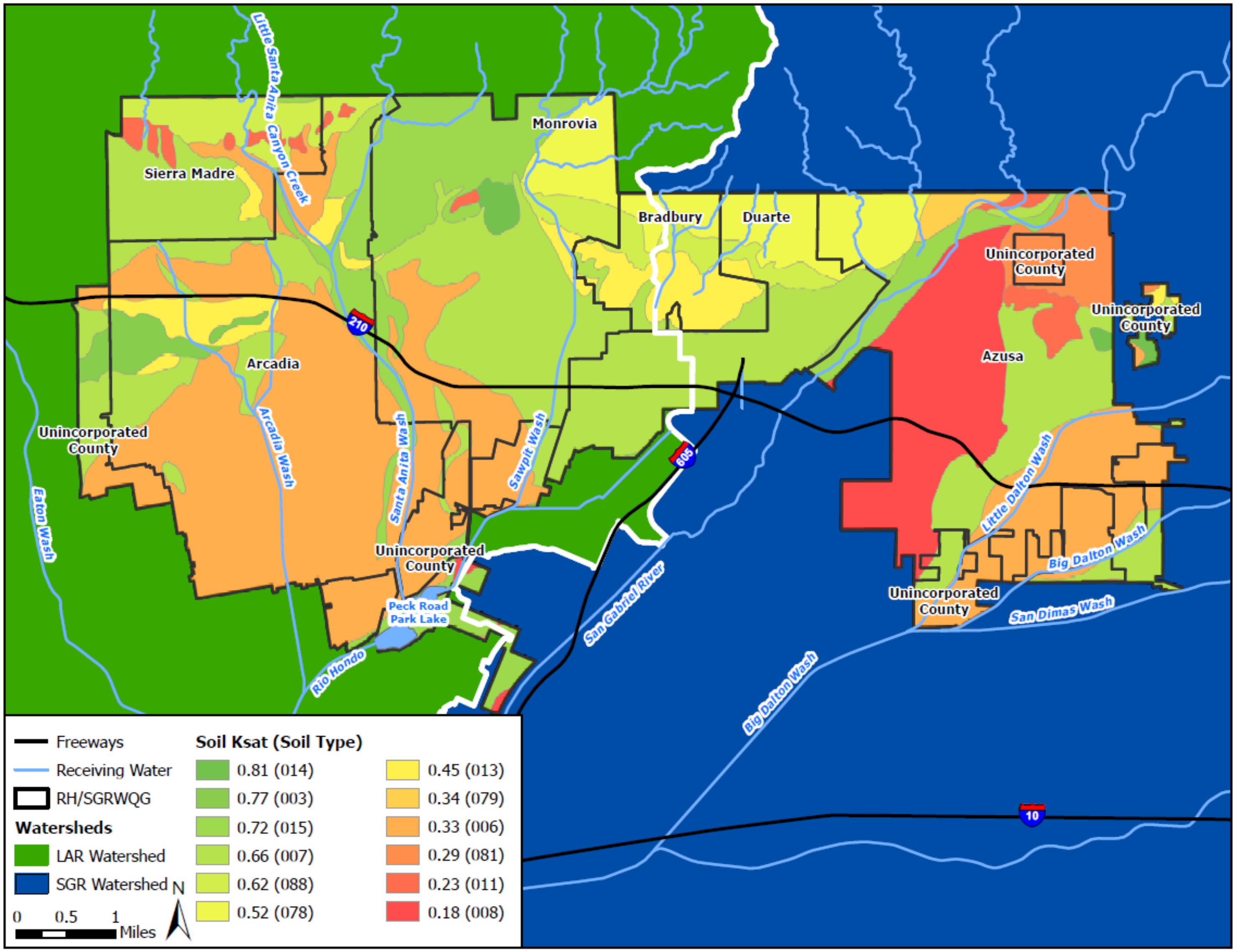

Figure 3-25 Soil Types for Green Street Analysis

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Street Type

The street type was used to rank green street opportunities, as different types of streets offer different opportunities. Wider streets, such as major streets, provide a larger area which can be used to treat stormwater. Private streets and major freeways are some examples of streets that do not provide feasible opportunities. The Countywide Address Management System (CAMS) created a shapefile for street centerlines in Los Angeles County based on the 2010 TIGER roads file developed by the Census Bureau. The CAMS shapefile includes attributes, such as street type, which are not included in the TIGER roads. The attribute in the CAMS shapefile was used to define the street type for the streets within the RH/SGRWQG. Each street within the RH/SGRWQG was classified based on standard street types and were ranked as described in **Table 3-11.** The street type was not weighted as this criterion is not as crucial as the slope and soil infiltration capacity when determining the feasibility of green street implementation.

Table 3-11 Street Type Ranking Summary

Street Type	Ranking Value
Highway and/or Primary-Arterial	10
Secondary-Collector	8
Minor-Local	6
Alley	4

*Note: Street types not included in the list above were excluded from the analysis.

3.1.5.1 Green Street Ranking

During the green street analysis, streets were clipped at the jurisdictional boundaries and tagged with the jurisdiction within which it exists. This was not used to rank the streets, but simply to determine what jurisdiction the street was in so that it was easy to identify the green street needs within each jurisdiction.

After each street was clipped, tagged, and given a ranking value based on the slope, soil, and street type, the score was determined for each street by adding up the value for each of the criteria. As previously discussed, a weight factor was given to each of the criteria to make some more important than others. The slope was weighted by a factor of two, the soil type was weighted by a factor of three, and the street type was not weighted (one). The scores ranged from 19 to 57 and were further classified as described in **Table 3-12**. **Figure 3-26** illustrates the green street rankings within the RH/SGRWQG.

Table 3-12 Green Street Ranking Summary

Score Range	Green Street Ranking
45-57	High
32-44	Medium
19-31	Low

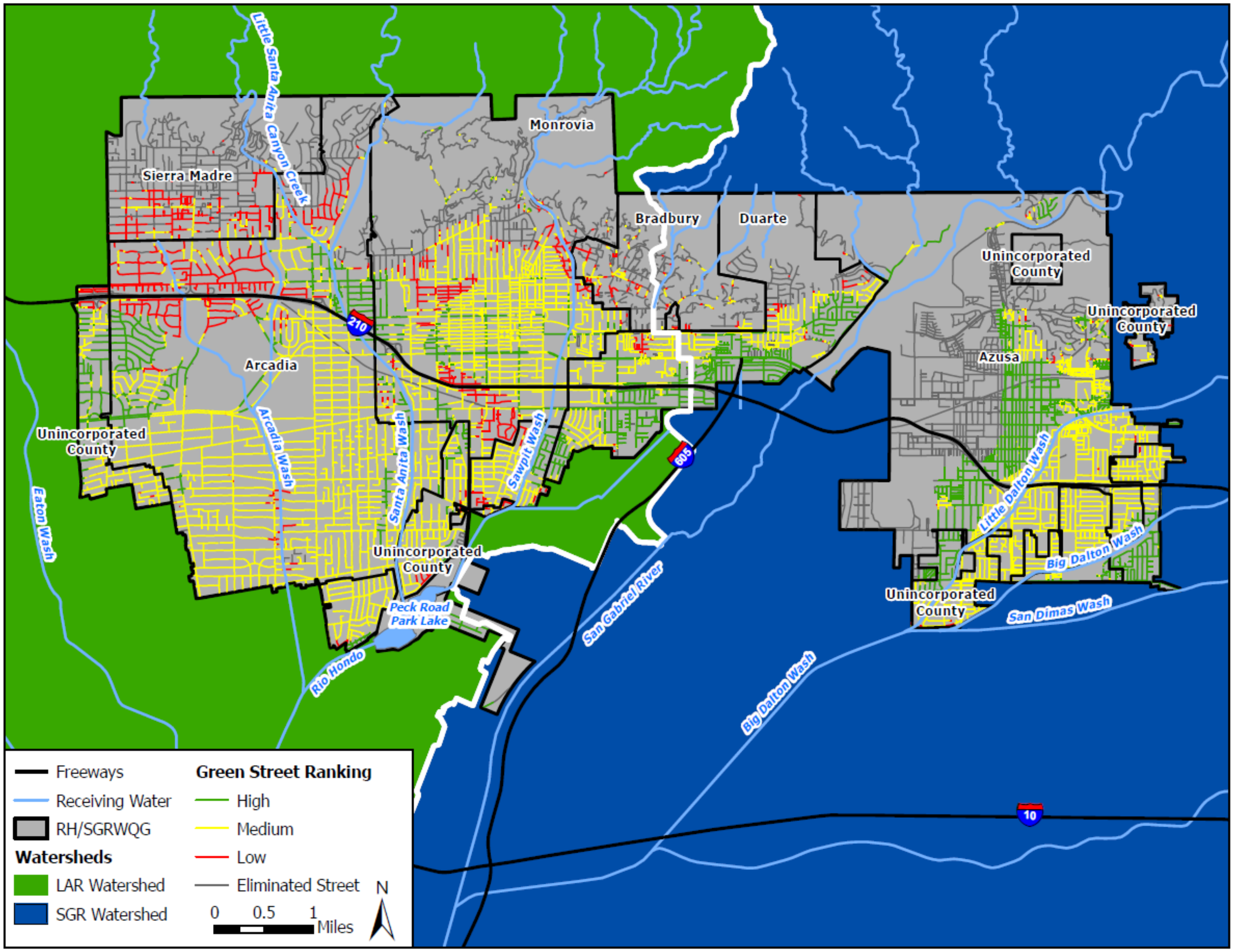

Figure 3-26 RH/SGRWQG Street Rankings for Green Street Analysis

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3.3 Summary of BMP Performance Data

From BMP preferences to the RAA, data regarding performance of BMPs influenced many EWMP-related decisions. A statistical analysis was performed using available BMP performance data relevant to Southern California. The goal was to review and summarize data regarding performance of BMPs for reducing constituents of concern from stormwater flows. The data was reviewed and summarized based on constituents of concern from both stormwater and non-stormwater flows. The compiled dataset is extensive and can be found in **Attachment M** and **Attachment N**. The following sections provide an overview of the data sources, statistical methods, and results of the statistical analysis.

3.3.1 Data Sources

The BMP performance analysis used data collected from the International BMP Database (IBD), the most extensive effort to collect and distribute BMP performance data in the United States. The IBD is sponsored by the USEPA, Water Environment Research Foundation (WERF), the American Society of Civil Engineers (ASCE), the Environmental and Water Resources Institute (EWRI), the American Public Works Association (APWA), and the Federal Highway Administration (FHWA). The stated purpose of the database is “to provide scientifically sound information to improve the design, selection and performance of BMPs” (IBD, 2014).

Figure 3-27 illustrates the sites with available monitoring data in Southern California as of November 2013. There are 44 sites that have data within the mapped area and the sites have a total of 58 BMPs that were sampled. Each of these BMPs in the IBD was categorized to the categories and subcategories established in **Section 3.2.1** (see **Table 3-2**). Many of the BMPs, particularly bioswales, are owned and operated by the California Department of Transportation (Caltrans) and therefore implemented on roadways, maintenance stations, and park and ride facilities.

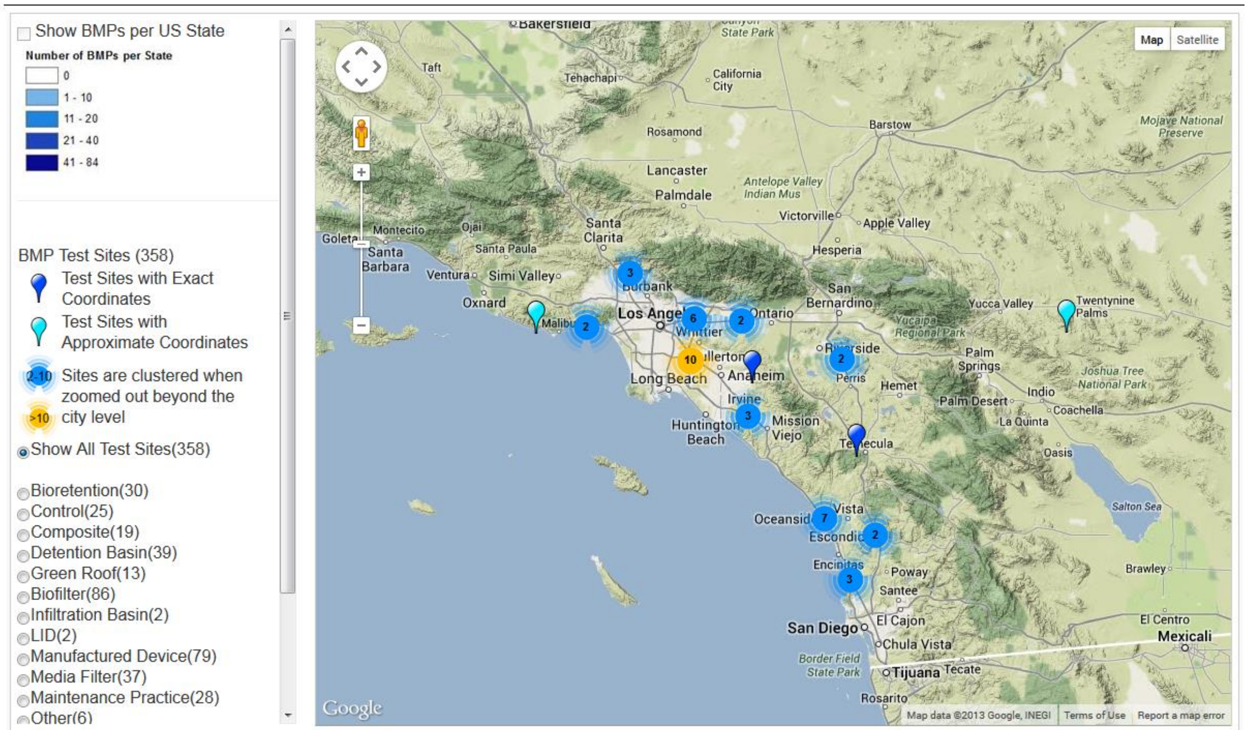

Figure 3-27 Southern California BMPs from the IBD (www.bmpdatabase.org)

3.3.2 Data Analyzed

Analysis of BMP data in the IBD collected from Southern California provides a cross-section of structural BMP results and constituents. The following provides an overview of the data characteristics:

- **BMP types:** the BMPs in the IBD were categorized according to those defined in **Section 3.2.1**, after review of the BMP design details. Five of the BMP subcategories were represented in the IBD within the Southern California region, including:
  - Constructed wetlands
  - Site-scale detention
  - Bioswales
  - Flow-through Treatment BMPs
  - Catch basin inserts

- **Constituents:** the IBD contains sample data for hundreds of constituents ranging from metals to pesticides. The analysis conducted emphasizes a subset of constituents referred to herein as "common constituents of concern," as follows:
  - Total suspended solids (TSS)
  - Fecal coliform
  - Total copper
  - Total lead
  - Total zinc

  Beyond these five constituents, the database was screened for additional constituents with sufficient data to perform analysis and obtain results. Based on this screening, an additional 18 constituents were identified, for a total of 23 constituents. To assist with organization and presentation of the results, each of the 23 constituents was categorized into four groups as follows (demonstrated in **Table 3-13**):
  - Metals
  - Bacteria
  - Solids
  - Nutrients

- **Land uses:** a majority of the BMPs are located within transportation related sites. Other major land use categories such as residential, commercial, and industrial are not heavily represented in the analysis. However, the effluent concentrations and performance metrics are generally considered applicable to non-transportation land uses. Many bioswales were included in the analysis. This allowed for grouping the bioswales into three categories: "all," "Caltrans," and "Non-Caltrans."

- **Monitoring methods:** the majority of the data from the IBD is based on flow-weighted composite (FWC) samples which is the generally preferred practice. FWC samples provide a better measurement of the total load from a storm event and most accurately portray the removal efficiency of BMPs. These types of samples can be used to generate good event mean concentrations (EMCs) that can be used to calibrate water quality models. The analysis emphasizes reduction in concentrations of constituents. Flow reduction is heavily site- and storm-specific (depending on rainfall intensity, soil types, antecedent conditions, etc.) and can be predicted through other means (e.g., modeling during the RAA).

3.3.3 Statistical Analysis

The statistical analysis performed is primarily based on three metrics:

- Tabular summary statistics of inflow and outflow from BMPs (mean, median, percentiles, etc.)
- Graphical presentation of the inflow and outflow using box plots
- Tabular presentation of constituent reductions and tests for statistical significance of differences between inflow and outflow

It is acknowledged that "percent reduction" is a BMP performance metric that deserves caveats (see the article "Voodoo Hydrology" in the July 2006 article of *Stormwater Magazine*). Percent reduction is a readily-understandable BMP performance metric, and it is also convenient for reporting a compact form (as shown in **Table 3-13**). However, BMP performance is ultimately characterized by both the reduction of pollutants from inflow to outflow and the concentration of constituents in the outflow. For this analysis, percent reduction is presented as a simple metric to compare different BMPs across different storm and land use conditions. In addition, inflow and outflow datasets were analyzed separately to characterize the quality of BMP outfalls and allow for future comparison to MS4 Permit limitations.

The approach to handling non-detects can greatly affect estimated summary statistics. For the BMP performance analysis, statistical analyses of measured concentrations were based on regression-on-order statistics (ROS). The primary advantage/purpose of the ROS approach is to account for sample limits of detection (SLODs) in samples that were non-detects (referred to as "censored"). An Excel add-in developed by Caltrans was used to generate ROS, for which the primary references for the statistical procedures are Shumway and Azari (2000) and Helsel (1990).

3.3.4 Results

The analysis performed produced thousands of statistical measures that can be used to evaluate BMPs. These results would support the RAA, by supporting assumptions regarding effluent concentrations from some BMPs. However, volume based BMPs were selected rather than treatment BMPs. The results can be used in future iterations through the adaptive management process if treatment-type BMPs are evaluated. The results are presented in formats that are designed to allow readers to focus on both absolute (inflow and outflow concentrations) and relative performance of BMPs (percent reductions) for individual constituents and groups of constituents. As mentioned previously, extensive datasets were generated and are available in **Attachment M** and **Attachment N**. The results of the analysis are presented as follows:

- **Percent removal:** the results in **Table 3-13** provide mean and median removal percentages for the BMPs and for each of the 23 POC analyzed. The table can be used to evaluate relative performance across constituent and BMP categories.

- **Inflow and outfall concentrations for common POCs:** shown in **Table 3-14** through **Table 3-18** are comparisons of standard statistics for the five available BMP categories across each of the common POCs. The corresponding box plots in **Figure 3-28** through **Figure 3-32** graphically represent the range of inflow versus outflow performance for the BMP categories.

- **Inflow and outflow concentrations for all 23 constituents:** standard statistics, including significance testing of percent reductions, for all constituents are included in **Attachment M**.

- **Performance statistics and box plots for all constituents:** extensive summary statistics and box plots of BMP performance across the BMP categories are included in **Attachment N**.

The presented box plots (**Figure 3-28** through **Figure 3-32**) include whiskers that span from the 10^{th} to 90^{th} percentiles and display outliers, defined as values that are more than 1.5 times the inner quartile range beyond the median. These outliers are included in all the generated summary statistics. This approach is consistent with technical memorandums on the IBD website.

Table 3-13 Mean and Median Percent Removal from Inflow to Outflow for All Pollutants and BMP Categories

Constituent Group	Pollutant	Bioswale (All)		Bioswale (Caltrans)		Bioswale (Non-Caltrans)		Constructed Wetland		Flow-Through Treatment BMP		Site Scale Detention	
		% Change, Mean	% Change, Median	% Change, Mean	% Change, Median	% Change, Mean	% Change, Median	% Change, Mean	% Change, Median	% Change, Mean	% Change, Median	% Change, Mean	% Change, Median
Metals	Total Arsenic	-51.14%	-21.85%	21.19%	29.33%	**-70.90%**	-44.19%	**-64.23%**	-65.00%	-11.57%	-18.52%	-19.56%	-24.00%
	Total Cadmium	**-51.15%**	-58.47%	-15.99%	-49.52%	**-68.14%**	-66.32%	**-74.50%**	-62.40%	1.22%	-48.00%	**-53.72%**	-49.44%
	Total Chromium	-24.85%	-42.03%	-21.11%	-28.38%	-27.37%	-61.06%	**-81.54%**	-88.30%	**-35.10%**	-37.04%	-60.67%	-50.00%
	Total Copper	**-69.02%**	-68.29%	**-59.24%**	-60.98%	**-70.39%**	-60.32%	-98.02%	-85.81%	-55.03%	-38.89%	**-51.83%**	-48.04%
	Total Iron	-57.30%	-61.20%	-48.56%	-47.57%	---	---	---	---	---	---	---	---
	Total Lead	**-75.46%**	-77.05%	**-69.92%**	-75.02%	**-76.11%**	-67.68%	-98.11%	-97.41%	**-63.71%**	-76.15%	**-66.23%**	-59.26%
	Total Nickel	**-59.02%**	-64.38%	-41.24%	-46.58%	**-69.50%**	-72.97%	-48.11%	-36.78%	-21.04%	-28.57%	-62.53%	-45.21%
	Total Zinc	**-74.08%**	-75.66%	**-71.53%**	-76.14%	**-71.42%**	-68.65%	**-84.48%**	-85.56%	**-62.40%**	-74.89%	**-68.98%**	-64.64%
Bacteria	Fecal Coliform	-13.70%	-82.00%	---	---	-13.70%	-82.00%	-94.54%	-92.69%	-26.36%	-91.43%	99.1%	41.7%
	Total Coliform	---	---	---	---	---	---	-0.18%	-62.97%	**-99.91%**	-99.90%	---	---
Solids	Total Suspended Solids	**-50.46%**	-59.21%	-24.21%	-51.28%	-61.37%	**-58.33%**	**-94.55%**	-95.22%	**-65.0%**	-82.28%	**-62.82%**	-62.00%
	Total Dissolved Solids	-3.72%	7.32%	17.58%	12.36%	-17.36%	-2.50%	**+1169%**	1739%	12.12%	16.67%	-0.29%	0.00%
	Turbidity	**-62.65%**	-50.67%	**-62.65%**	-50.67%	---	---	---	---	---	---	---	---
Nutrients	Kjeldahl nitrogen (TKN)	-18.52%	-15.00%	29.02%	16.67%	**-31.74%**	-25.24%	-22.91%	8.33%	-24.22%	-30.97%	-14.86%	-20.21%
	Nitrogen, ammonia as N	15.93%	-25.50%	40.91%	-9.04%	---	---	-61.86%	-57.14%	28.35%	50.00%	---	---
	Nitrogen, Nitrate (NO_3) as N	-12.14%	-21.25%	13.77%	-1.31%	-22.54%	-23.29%	-66.90%	-87.87%	24.13%	41.41%	-13.89%	-10.59%
	Nitrogen, Nitrite (NO_2) as N	89.01%	31.91%	89.01%	31.91%	---	---	**-100%**	-100%	---	---	---	---
	Nitrogen, unionized ammonia (NH_3) as N	---	---	---	---	---	---	---	---	**-56.11%**	-62.50%	---	---
	Organic carbon, Dissolved	-10.96%	7.50%	17.74%	34.02%	-28.27%	-14.14%	-32.54%	-40.91%	-1.43%	-7.14%	6.92%	9.09%
	Organic carbon, Total	-13.17%	0.00%	15.30%	18.18%	-29.70%	-5.56%	-23.90%	-6.67%	-4.78%	-12.79%	0.68%	6.06%
	Phosphorus as P, Dissolved	+263%	+250%	---	---	+263.42%	+250.00%	+186.92%	90.18%	-7.14%	-11.11%	-3.15%	22.22%
	Phosphorus as P, Total	+125%	+100%	+219%	+269%	92.89%	68.18%	-19.33%	-14.29%	**-34.10%**	-25.00%	**-35.61%**	-19.44%
	Phosphorus, orthophosphate as P	+369%	+553%	+531%	+795%	59.09%	31.91%	---	---	---	---	---	---

1 Bolded, orange values indicate statistically different inflow and outflow concentrations based on 95% confidence intervals.
2 If insufficient data were available to calculate the % removal, then --- is shown.
3 Catch basin inserts are not shown because effluent data were insufficient.

Table 3-14 Inflow/Outflow Summary Statistics for TSS (mg/L)

BMP Category	No. of BMP Sampling Locations		No. of Samples Analyzed		25th Percentile		Median (50th Percentile)		75th Percentile	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
Site Scale Detention	5	5	76	69	75	23	100	38	169	59
Bioswales	31	31	159	103	45.0	18.0	76.0	31.0	130	54
Catch Basin Inserts	0	6	---	88	---	20	---	37.5	---	71
Flow-Through Treatment BMPs	13	13	230	218	8.875	2.875	39.5	7.00	89.25	22.25
Constructed Wetlands	1	1	13	14	140	3.50	230	11.0	255	13.5

IN = inflow; OUT = outflow

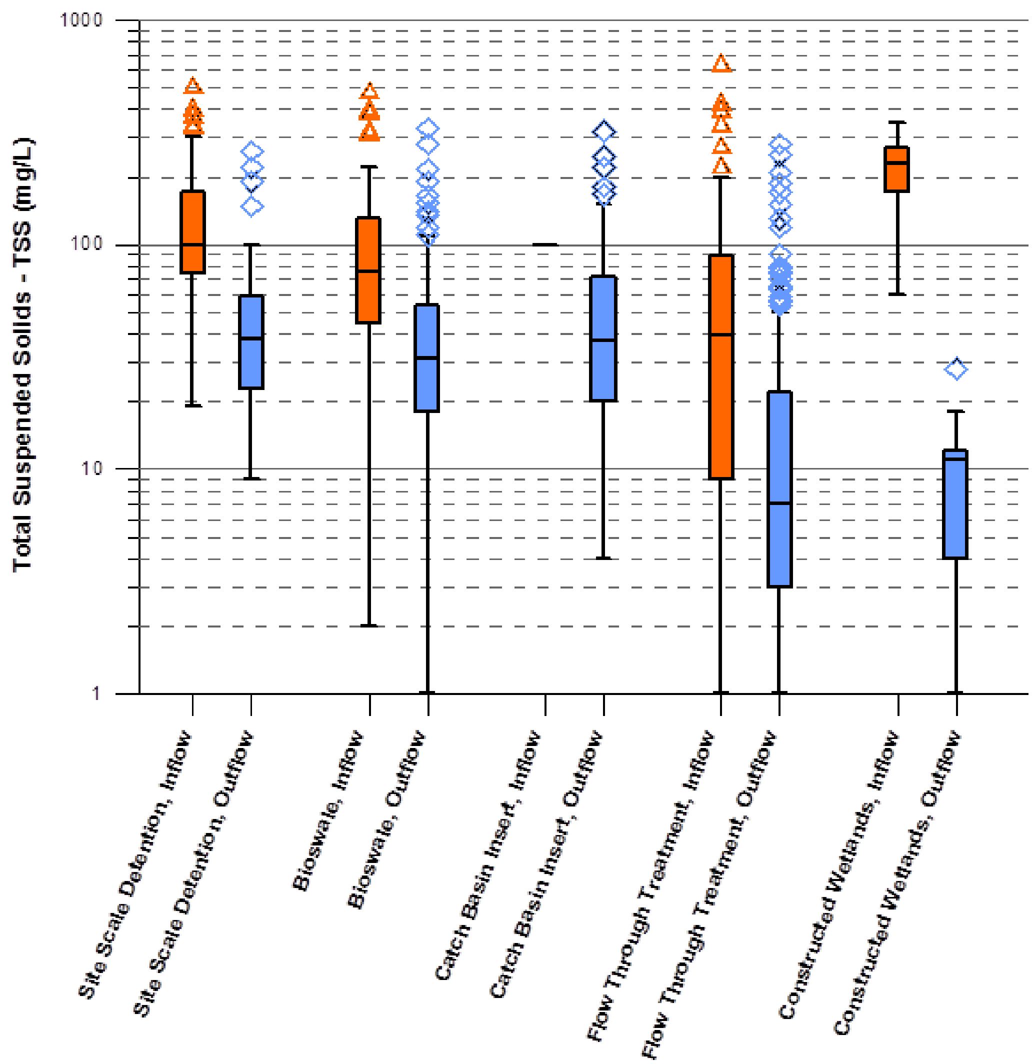

Figure 3-28 Box Plots of Inflow/Outflow TSS Concentrations in Southern California

Table 3-15 Inflow/Outflow Summary Statistics for Fecal Coliform (#/100mL)										
BMP Category	**No. of BMP Sampling Locations**		**No. of Samples Analyzed**		**25th Percentile**		**Median (50th Percentile)**		**75th Percentile**	
	IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**	**IN**	**OUT**	**IN**	**OUT**
Site Scale Detention	9	9	34	30	300	475	600	850	1700	3075
Bioswales	8	8	33	19	500	130	5000	900	16500	5000
Catch Basin Inserts	0	6	---	---	---	---	---	---	---	---
Flow-Through Treatment BMPs	11	11	172	152	300	7.47	900	77.1	3000	797
Constructed Wetlands	2	2	13	14	230	20.0	1300	95.0	3800	255

IN = inflow; OUT = outflow

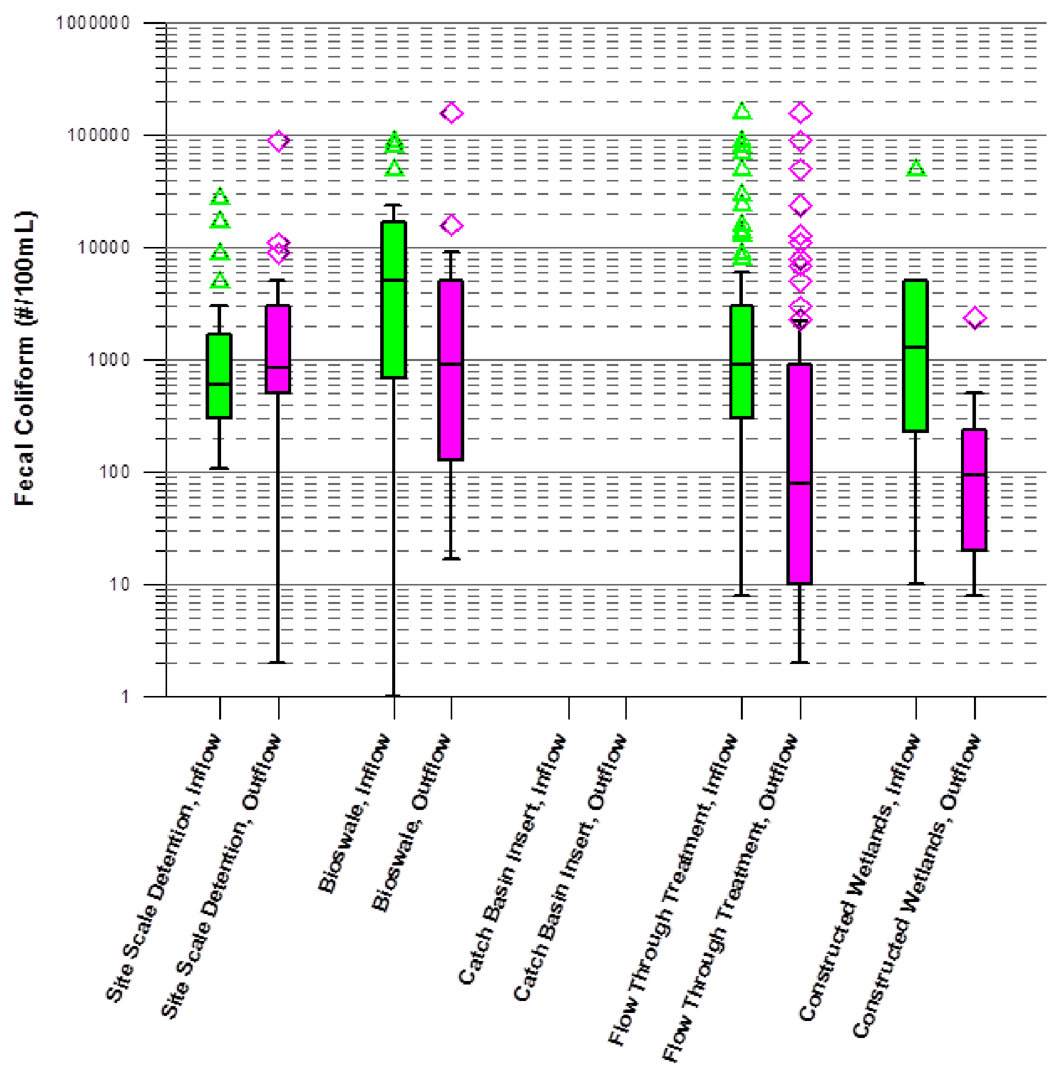

Figure 3-29 Box Plots of Inflow/Outflow Fecal Coliform Concentrations in Southern California

Table 3-16 Inflow/Outflow Summary Statistics for Copper (µg/L)										
BMP Category	**No. of BMP Sampling Locations**		**No. of Samples Analyzed**		**25th Percentile**		**Median (50th Percentile)**		**75th Percentile**	
	IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**	**IN**	**OUT**	**IN**	**OUT**
Site Scale Detention	5	5	76	68	26.25	15.00	39.45	20.50	63.75	28.00
Bioswales	31	31	150	100	22.00	8.23	41.00	13.00	70.50	19.90
Catch Basin Inserts	0	6	---	88	---	5.95	---	13	---	22
Flow-Through Treatment BMPs	11	11	150	146	11.98	6.20	18.00	11.00	33.00	21.25
Constructed Wetlands	2	2	21	22	11.15	5.55	62.00	8.80	110.0	14.75

IN = inflow; OUT = outflow

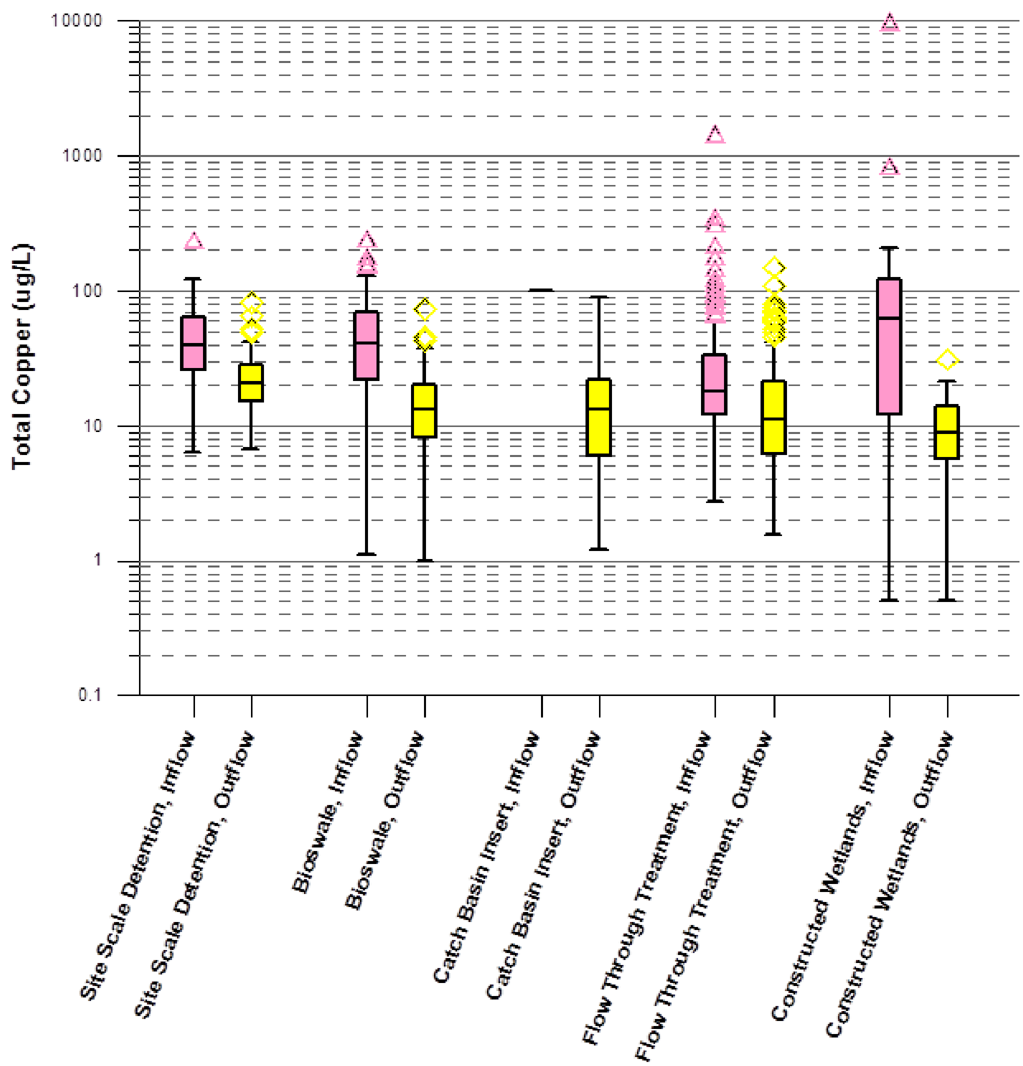

Figure 3-30 Box Plots of Inflow/Outflow Copper Concentrations in Southern California

Table 3-17 Inflow/Outflow Summary Statistics for Lead (µg/L)										
BMP Category	**No. of BMP Sampling Locations**		**No. of Samples Analyzed**		**25th Percentile**		**Median (50th Percentile)**		**75th Percentile**	
	IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**	**IN**	**OUT**	**IN**	**OUT**
Site Scale Detention	5	5	76	69	34.40	13.00	54.00	22.00	108.25	36.50
Bioswales	31	31	150	100	13.92	3.53	32.89	7.55	77.75	21.50
Catch Basin Inserts	0	6	---	88	---	2.3	---	6	---	12.45
Flow-Through Treatment BMPs	11	11	149	146	6.50	1.00	13.00	3.10	25.50	7.10
Constructed Wetlands	2	2	21	22	3.32	2.70	170.0	4.40	315.00	8.32

IN = inflow; OUT = outflow

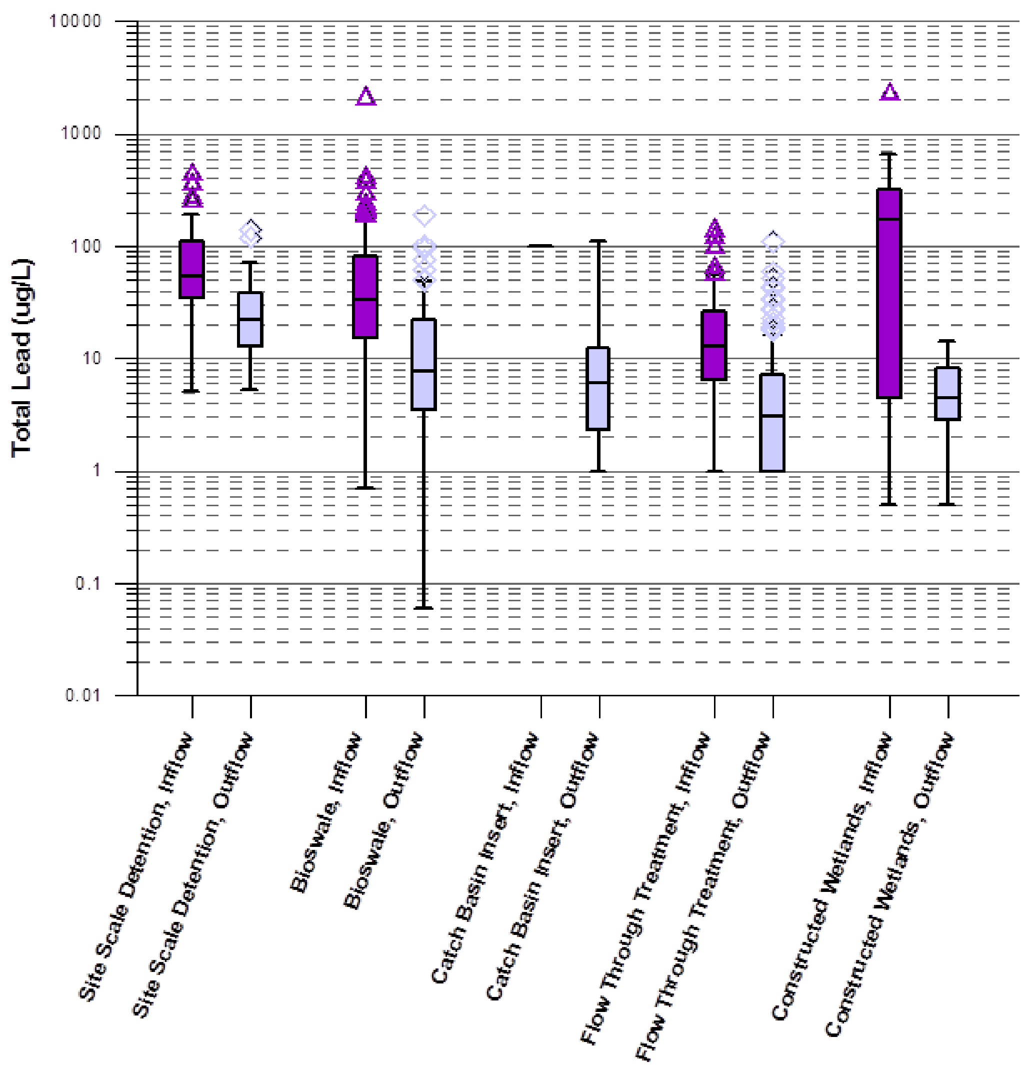

Figure 3-31 Box Plots of Inflow/Outflow Lead Concentrations in Southern California

Table 3-18 Inflow/Outflow Summary Statistics for Zinc (µg/L)										
BMP Category	**No. of BMP Sampling Locations**		**No. of Samples Analyzed**		**25th Percentile**		**Median (50th Percentile)**		**75th Percentile**	
	IN	**OUT**	**IN**	**OUT**	**IN**	**OUT**	**IN**	**OUT**	**IN**	**OUT**
Site Scale Detention	5	5	76	68	152.75	68.25	280.00	99.00	504.75	150.00
Bioswales	31	31	150	100	110	29.5	228	55.5	360	82.5
Catch Basin Inserts	0	6	---	88	---	50.5	---	107	---	220
Flow-Through Treatment BMPs	11	11	150	146	110	23.00	221	55.5	400	131
Constructed Wetlands	2	2	21	22	109.00	28.53	270.00	39.00	450.00	84.35

IN = inflow; OUT = outflow

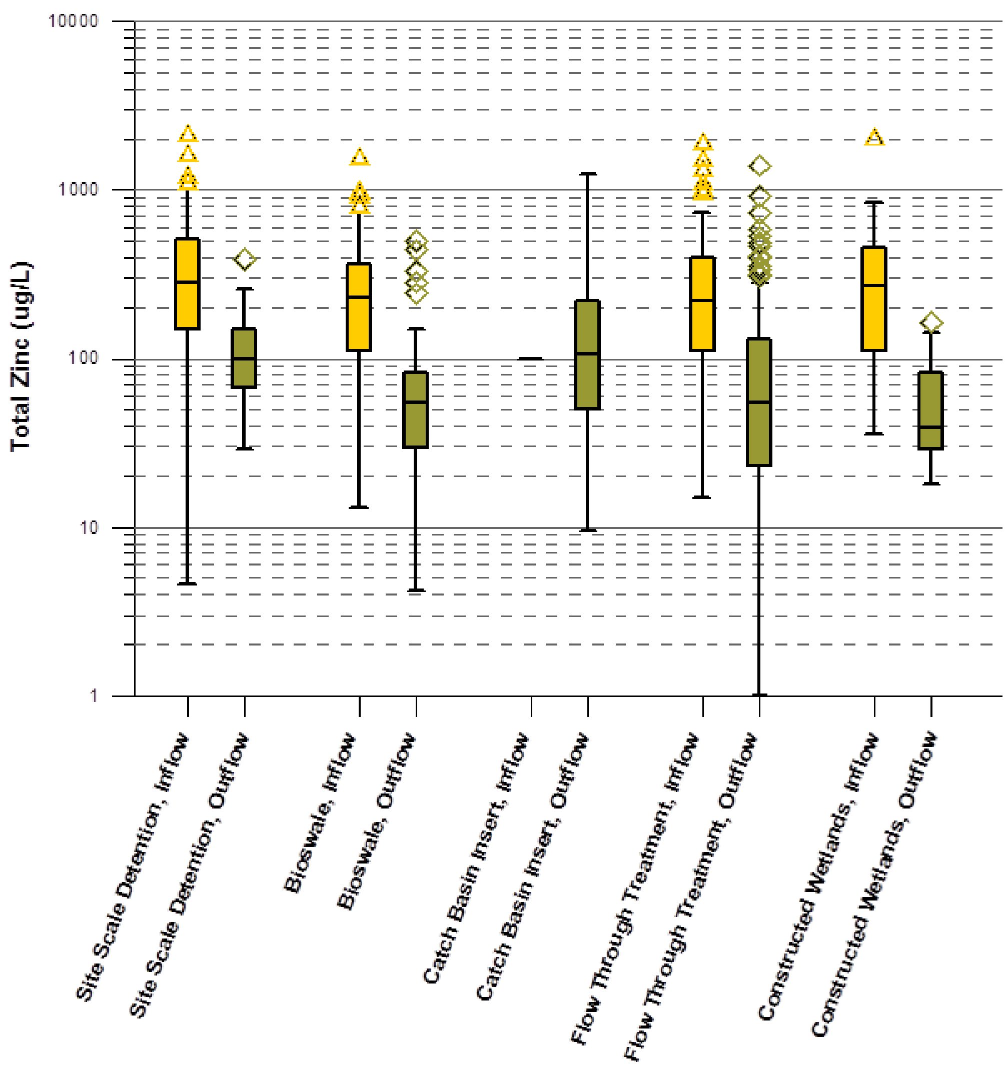

Figure 3-32 Box Plots of Inflow/Outflow Zinc Concentrations in Southern California

3.3.5 Key Observations

The statistical analysis presented has many applications, which include supporting the RAA as needed. As future applications are undertaken, the results can be analyzed in greater detail. The following general observations are highlighted:

- **Comparison of outflow quality among BMPs:** the constructed wetland (n = 2) and flow-through treatment BMPs (n = 31) generally exhibited the highest quality effluent. Reductions of TSS were generally higher compared to other BMPs and concentrations of TSS in outflows were generally lower (see **Table 3-14** and **Figure 3-28**). Elevated performance is also apparent for other constituents. The constructed wetlands exhibited exceptional reductions (>84%) of total copper, lead, and zinc. Constituents were likely reduced in the constructed wetlands by means of sedimentation, chemical and biological conversions, and uptake. The flow-through treatment BMPs in the dataset were mostly Caltrans BMPs including media filters and proprietary cartridge filters with a range of sand/peat and sand/gravel mixes.

- **BMP performance for individual constituents:** among the constituents analyzed, the percent removals were often the highest for total metals, especially lead and zinc (**Table 3-13**). The poorest performance was often for nutrients, with phosphorous concentrations increasing in some cases (likely due to leaching). For bacteria, only the constructed wetlands and flow-through treatment BMPs were able to generate outflows with median fecal coliform concentrations less than 235 MPN per 100mL (which is an applicable MS4 Permit limitation if fecal coliform is assumed equivalent to *E. coli*) (see **Table 3-15** and **Figure 3-29**).

- **Application of the data for the RAA effort:** in general, the majority of pollutant removal associated with potential stormwater BMPs in the RAA will be due to volume reduction (infiltration). The WMMS, which will be used for the RAA, is process-based and thus is able to estimate volume reduction and the proportion of inflow that is infiltrated, treated, and overflowed. Due to the model being dynamic, these proportions change from storm to storm (i.e., overflows are less frequent during small storms than large storms). Future inclusion of BMPs with a treatment component will require some assumptions regarding the quality of treated and discharged outflow (e.g., biofiltration BMPs, which have an underdrain). It is noted that only a subset of the potential BMP categories (defined in **Section 3.2.1**) had sufficient data for data analysis. As such, an important consideration will be whether BMP performance statistics of the BMPs analyzed are relevant to some of the other BMPs. For example, because biofiltration is vegetated filtration, it is reasonable to assume the performance data for the flow-through treatment (filtration) BMPs (and perhaps constructed wetlands) are applicable to biofiltration.

3.4 Proposed Control Measures

Various control measures were used to demonstrate compliance through the RAA including non-structural and structural BMPs. The selected control measures represent the volume and load reduction strategies used in the RAA. Control measures are addressed strategically throughout the compliance period at specific time steps so that the interim and final WQOs are met. The three control measures that are the focus of the volume and load reduction strategy are MCMs, regional projects, and distributed BMPs (green streets). The proposed schedule of implementation is discussed in **Section 5** and represents a feasible timeline, assuming adequate funding is obtained, considering regional BMP design and construction will take a long time while MCMs and distributed BMPs may be implemented with less of a planning, engineering, and design effort.

3.4.1 Non-Structural BMPs

Load reductions that result from non-structural BMP implementation were used in the RH/SGRWQG RAA. This section quantifies and justifies the load reductions included in the analysis. The various types of non-structural BMPs that result in load reductions are as follows:

- MCMs
- Other institutional BMPs
- LID for new and re-development projects

3.4.1.1 Minimum Control Measures

As discussed in **Section 3.1**, MCMs are defined in Part VI.D of the MS4 Permit and are often referred to as institutional BMPs. The MCMs identified in the MS4 Permit include:

- PIPP (VI.D.5)
- Industrial/Commercial Facilities Program (VI.D.6)
- Planning and Land Development Program (VI.D.7)
- Development Construction Program (VI.D.8)
- Public Agency Activities Program (VI.D.9)
- IC/ID Elimination Program (VI.D.10)

The requirements in the 2012 MS4 Permit are more stringent than those previously required, thus it is anticipated that through implementing the required control measures there will be a reduction in pollutant loading as compared to the water quality data used to establish the baseline conditions and calibrate the model, which was collected under the previous MS4 Permit. As previously mentioned, **Attachment P** includes a table outlining the differences between the 2001 and 2012 MS4 Permit requirements. **Table 3-1** in **Section 3.1** identifies potential modifications or enhancements to various MCMs. The enhancements identified in this section are currently being proposed as part of this EWMP. A baseline load reduction of five percent is credited based on the more stringent requirements of the current MS4 Permit as compared to the previous MS4 Permit.

All of the areas within the LAR Watershed will have full capture devices to address the LAR Trash TMDL. Additionally, pursuant to Part VI.D.9.h.vii of the MS4 Permit, the SGR Watershed jurisdictions which do not have a trash TMDL, will install trash excluders or other devices on or in Priority A catch basins or outfalls by December 2016. Once the devices are installed the catch basin cleaning frequency will increase, along with street sweeping implementation. These modifications to the currently implemented MCMs support the five percent load reduction previously discussed for changes in the MS4 Permit requirements.

The County Unincorporated Area plans on implementing an enhanced MCM program that involves switching street sweepers from traditional broom sweepers to regenerative air (or vacuum) sweepers. Regenerative air sweepers have a higher efficiency in terms of pollutant removal based on a study conducted in San Diego (San Diego, 2010). The Cities of Arcadia and Monrovia currently use vacuum sweepers. This is not considered an enhancement in these jurisdictions because they have been using vacuum sweepers since before 2012; therefore, the implementation is considered as part of the baseline. For the County Unincorporated Area, an additional 2 percent load reduction was credited for street sweeping enhancements.

It is difficult to model MCM implementation and other institutional BMPs in Loading Simulation Program in C++ (LSPC) because there is not numerical data to quantify actual load reductions or tools within the model to demonstrate the implementation. These control measures will contribute to some load reduction so an area-weighted reduction will be applied to the system based on enhanced MCM implementation. **Table 3-19** identifies the load reduction in addition to the baseline five percent based on the more stringent MS4 Permit and the area-weighted load reduction based on MCM implementation for both the LAR and SGR Watersheds.

Table 3-19 Load Reductions Based on MCM Implementation

Jurisdiction	LAR Watershed		SGR Watershed	
	Percent Reduction	Reason	Percent Reduction	Reason
Arcadia	5%	MCM changes in Permit	5%	MCM changes in Permit
Azusa	-	-	5%	MCM changes in Permit
Bradbury	5%	MCM changes in Permit	5%	MCM changes in Permit
Duarte	5%	MCM changes in Permit	5%	MCM changes in Permit
Monrovia	5%	MCM changes in Permit	5%	MCM changes in Permit
Sierra Madre	5%	MCM changes in Permit	-	-
Unincorporated County	7%	MCM changes in Permit plus enhanced street sweeping	7%	MCM changes in Permit plus enhanced street sweeping
Weighted Average:	**5.~~2~~%**		**5.~~2~~%**	

3.4.1.2 Other Institutional BMPs

Other institutional control measures will also help reduce pollutant loading such as Senate Bill (SB) 346 which requires incremental reductions in the amount of copper in vehicle brake pads. SB 346 requires most brake pads sold in California to contain less than five percent copper by weight after January 1, 2021, and contain less than 0.5 percent copper by weight after January 1, 2025. This control measure is expected to create a 55 percent reduction in copper loads by 2032. This load reduction was not included in the model since copper is not the limiting priority pollutant in the RH/SGRWQG.

SB 757 is another control measure that will help reduce pollutant loading, as it requires that "no person shall manufacture, sell, or install a wheel weight in California that contains more than 0.1 percent lead by weight." Load reductions based on SB 757 were not modeled since the load reduction associated with implementation is currently unknown.

3.4.1.3 New and Re-Development

Part VI.C.4.c.i.(1) of the MS4 Permit requires Permittees to develop and implement an LID ordinance applicable to new and re-development projects meeting specified thresholds of disturbance to impervious areas. Average annual new/re-development 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. The new/re-development rates are presented as percentages of an area with the specified land use. It can be assumed that the new and re-development projects will implement post-construction BMPs as required by the MS4 Permit, thus providing a load reduction based on the 85th percentile rainfall. **Table 3-20** summarizes the percent of area re-developed at each of the milestone dates. The milestone dates identified include those applicable to the LAR and SGR Watersheds.

Table 3-20 New/Re-Development Rates by Land Use

Land Use	Annual New/ Re-Development Rate (%)	Percent of Area to be Developed by Milestone Year						
		2017	2020	2023	2024	2026	2028	2037
Commercial	0.15	0.30	0.75	1.20	1.35	1.65	1.95	3.30
Education	0.16	0.32	0.80	1.28	1.44	1.76	2.08	3.52
Industrial	0.34	0.68	1.70	2.72	3.06	3.74	4.42	7.48
Residential	0.18	0.36	0.90	1.44	1.62	1.98	2.34	3.96
Transportation	2.70	5.40	13.50	21.60	24.30	29.70	35.10	59.40

Areas being developed as a result of the LID ordinances were modeled using volume reduction BMPs sized for the 85th percentile storm depth. **Table 3-21** and **Table 3-22** summarize the volume reduction associated with the new/re-developed area within each RH/SGRWQG jurisdiction at each of the compliance milestones in the LAR and SGR Watersheds, respectively. The volume identified at each milestone is cumulative starting with 2015. In the following tables, a volume reduction has not been identified based on transportation new/re-development, as it is expected that transportation development will involve green street design. It is not included in the expected volume reduction to avoid double counting of benefits.

Table 3-21 LAR Watershed Volume Reduction based on New and Re-Development

Jurisdiction	Land Use	Volume Reduction by Milestone Year (acre-feet)		
		2024 50% Metals	2028 100% Metals	2037 100% Bacteria
Arcadia	Commercial	1.1	1.6	2.6
	Industrial	0.4	0.6	1.0
	Residential	1.5	9.7	16.4
	Education	0.0	0.3	0.4
Bradbury	Commercial	0.0	0.0	0.0
	Industrial	0.0	0.0	0.0
	Residential	0.2	1.2	2.0
	Education	0.0	0.0	0.0
Duarte	Commercial	0.3	0.5	0.8
	Industrial	0.2	0.3	0.4
	Residential	0.2	1.0	1.7
	Education	0.0	0.1	0.1
Monrovia	Commercial	0.6	0.9	1.5
	Industrial	1.2	1.7	2.9
	Residential	0.9	5.6	9.5
	Education	0.0	0.2	0.4
Sierra Madre	Commercial	0.1	0.1	0.2
	Industrial	0.0	0.1	0.1
	Residential	0.4	2.3	3.9
	Education	0.0	0.1	0.1
Unincorporated County	Commercial	0.1	0.2	0.3
	Industrial	0.0	0.0	0.0
	Residential	0.5	3.0	5.0
	Education	0.0	0.1	0.1
	Total:	**7.7**	**29.6**	**49.4**

TABLE 3-21 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT C OF REVISED EWMP

Table 3-22 SGR Watershed Volume Reduction based on New and Re-Development

Jurisdiction	Land Use	Volume Reduction by Milestone Year (acre-feet)			
		2017 10% Metals	2020 35% Metals	2023 65% Metals	2026 100% Metals
Arcadia	Commercial	0.0	0.0	0.0	0.0
	Industrial	0.1	0.1	0.2	0.3
	Residential	0.0	0.0	0.0	0.0
	Education	0.0	0.0	0.0	0.0
Azusa	Commercial	0.1	0.2	0.4	0.5
	Industrial	0.6	1.5	2.4	3.3
	Residential	0.6	1.5	2.4	3.3
	Education	0.1	0.2	0.3	0.4
Bradbury	Commercial	0.0	0.0	0.0	0.0
	Industrial	0.0	0.0	0.0	0.0
	Residential	0.2	0.4	0.7	1.0
	Education	0.0	0.0	0.0	0.1
Duarte	Commercial	0.0	0.1	0.1	0.1
	Industrial	0.0	0.1	0.1	0.2
	Residential	0.3	0.7	1.1	1.5
	Education	0.0	0.0	0.0	0.0
Monrovia	Commercial	0.0	0.0	0.0	0.0
	Industrial	0.0	0.1	0.1	0.1
	Residential	0.0	0.0	0.0	0.0
	Education	0.0	0.0	0.0	0.0
Unincorporated County	Commercial	0.0	0.0	0.0	0.1
	Industrial	0.0	0.0	0.0	0.0
	Residential	0.3	0.8	1.2	1.7
	Education	0.0	0.0	0.0	0.1
	Total:	**2.3**	**5.7**	**9.0**	**12.7**

TABLE 3-22 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT C OF REVISED EWMP

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3.4.2 Regional BMPs

Potential regional project sites were screened and evaluated in **Section 3.2.4**. The top ranked projects in both the LAR and SGR Watershed are recommended and a preliminary feasibility evaluation was performed. Concept drawings were prepared for the regional projects listed in **Table 3-23** and are provided in **Attachment Q**. **Table 3-23** identifies the jurisdiction responsible for implementation of the project, which is associated with the project location. The responsible jurisdiction does not imply financial responsibility. The table also identifies the contributing jurisdictions, which are those jurisdictions that contribute flow to the project in addition to the responsible jurisdiction. Descriptions of each of the selected projects are provided in **Section 3.4.2.1**

Table 3-23 Regional Project Sites

Recommended Project Site	Rank	Responsible Jurisdiction	Contributing Jurisdiction(s)
LAR Watershed			
Recreation Park	1	Monrovia	-
Arboretum of LAC	2	Arcadia	-
Sierra Vista Park	3	Sierra Madre	-
Royal Oaks Trail (LAR)	3	Duarte/Bradbury	Monrovia and County
L. Garcia Park	5	Monrovia	-
Eisenhower Park	6	Arcadia	Monrovia and Sierra Madre
SGR Watershed			
LADWP Easement	1	Azusa	-
Encanto Park	2	Duarte	Azusa
Memorial Park (Azusa)	3	Azusa	-
Royal Oaks Trail (SGR)	3	Duarte/Bradbury	County

Along with the regional BMP project sites identified in **Table 3-23**, the RH/SGRWQG also prioritizes ongoing inclusion of Peck Road Park Lake Water Conservation project as a multi-use, multi-benefit, facility dedicated primarily to water conservation, but providing valuable incidental backstop services in harvesting coarse sediments and, since the lake outlet and spillway are rarely used, precluding comingling with downstream discharges; allowing those areas to more precisely focus their local MS4 discharge source control efforts. This location is considered a Water of the United States and receiving water body; therefore, it cannot be considered as a treatment site. While the USEPA developed a legacy pesticides, PCBs, and nutrients TMDL for this lake, the TMDL also asserts that nutrient loads appear compliant and that the LACDPW annually diverts an average of 8,737 acre-feet of high quality surface waters to Peck Road Park Lake for groundwater replenishment, primarily through the basin sidewalls and around the basin sediments. Continued lake maintenance, water quality management, flow regulation, and potential future remediation activities will facilitate urban runoff from the Cities of Arcadia, Bradbury, Duarte, Monrovia, and Sierra Madre, along with unincorporated areas of Los Angeles County, to be blended with high quality surface waters, containing very low concentrations of legacy pollutants. Effective operation of Peck Road Park Lake would also allow the RH/SGRWQG to prioritize the implementation of regional BMPs in other areas, such as Arcadia Wash and the SGR, which would otherwise discharge additional runoff to downstream receiving waters. Furthermore, ongoing pollutant source control efforts, urban redevelopment, and green street implementation will have the opportunity to reduce potential runoff pollutant loads within the catchment to the lake, in a more cost-effective manner. Finally, from the public education standpoint, the facility is a large scale demonstrable example of what regional BMPs, LID, and green streets are intended to accomplish, in a far less visible way.

Further discussions with the Regional Board would be required to fully evaluate this potential site for future possible regional projects.

Table 3-24 summarizes the space available, drainage area size, and storage volume associated with the recommended regional projects. **Figure 3-33** illustrates the recommended project sites and their catchment areas along with the subareas used in the RAA. Descriptions of each of the selected projects are provided in **Section 3.4.2.1**.

Table 3-24 Regional Project Site Volume Reduction

Recommended Project Site	Parcel Size (acres)	Project Area[1] (acres)	Drainage Area (acres)	Storage Volume (ac-ft)	Storage Volume (M gal)	Percent of 85th Percentile Volume
LAR Watershed						
Recreation Park	19	0.92	106	7.43	2.42	100
Arboretum of LAC	110	3.44	207	9.32	3.04	100
Sierra Vista Park	17	N/A[2]	120	7.89	2.57	100
Royal Oaks Trail (LAR)	14	4.40	661	41.75	13.60	100
L. Garcia Park	2	1.28	265	18.21	5.93	100
Eisenhower Park	5	1.29	1,425	32.14	10.47	50
SGR Watershed						
LADWP Easement	9	3.17	240	3.93	1.28	28
Encanto Park	11	1.42	190	11.51	3.75	100
Memorial Park (Azusa)	12	3.09	387	30.20	9.84	100
Royal Oaks Trail (SGR)	14	4.12	722	67.01	21.84	100

[1] Area footprint in which infiltration will occur.
[2] Using existing spreading ground facilities.

THE ENTIRETY OF SECTION 3.4.2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT C OF REVISED EWMP

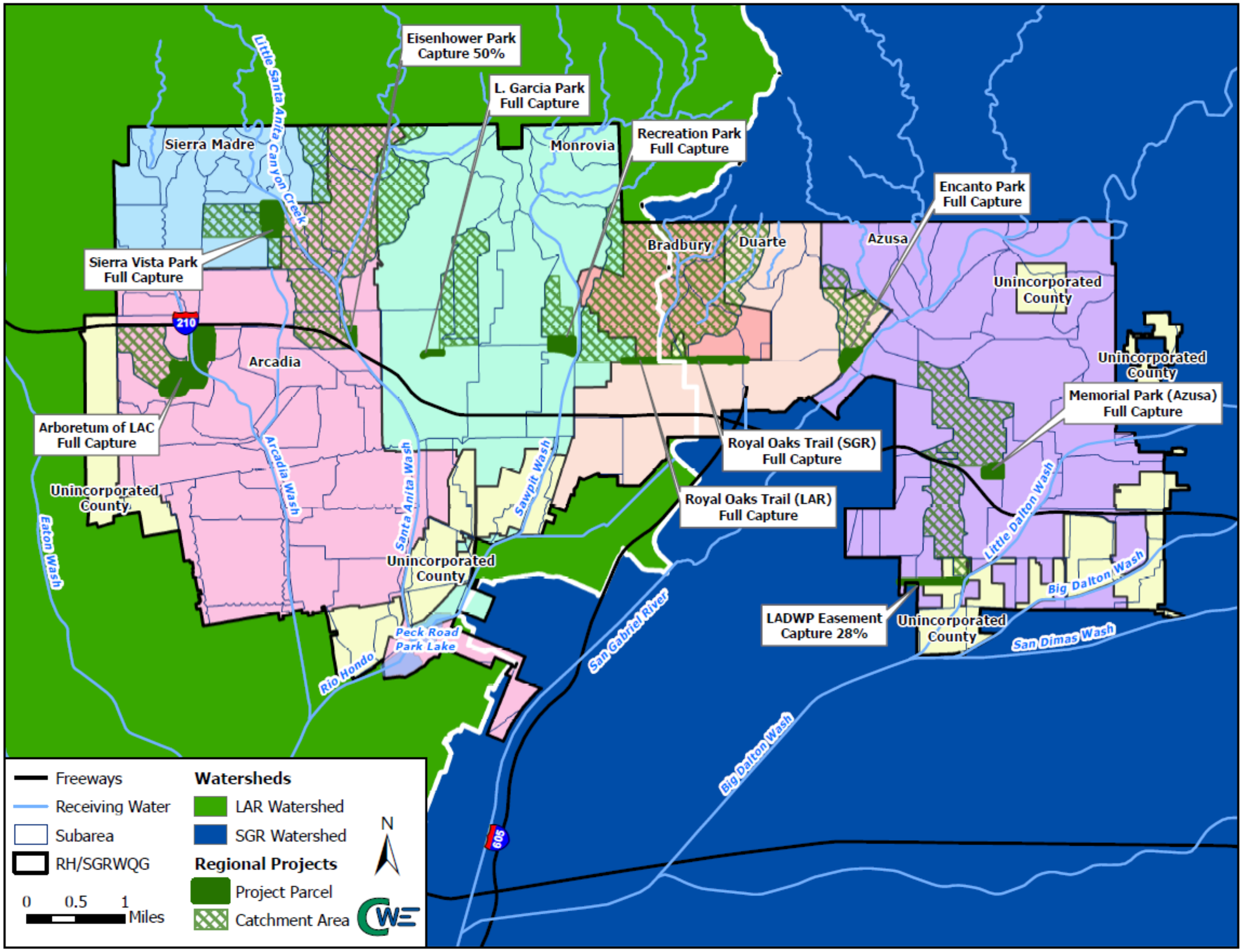

Figure 3-33 Planned Regional Projects and Catchment Areas

THE ENTIRETY OF SECTION 3.4.2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT C OF REVISED EWMP

THE ENTIRETY OF SECTION 3.4.2 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT C OF REVISED EWMP

3.4.2.1 Regional BMP Descriptions

This section summarizes the regional BMPs proposed as part of this EWMP, as identified in **Table 3-23** and illustrated in **Figure 3-33.** These sites were selected based on the screening methodology described in **Section 3.2.4**. Concept drawings for each of the projects described below are provided in **Attachment Q**.

Recreation Park

Recreation Park was ranked the highest in the LAR Watershed and is located in the City of Monrovia near the intersection of Lemon Avenue and Shamrock Avenue. The project will receive drainage from an area of approximately 106 acres, generating a volume close to 7 acre-feet, or 2.4 million gallons. Flows will be diverted from the Canyon Boulevard Relief Drain within Shamrock Avenue, a 45-inch Reinforced Concrete Pipe (RCP). A subsurface storage system made up of 120-inch corrugated metal pipes will be located beneath the grass just north of the tennis courts and will facilitate retention and infiltration. Opportunities for capture and use may exist and will be further evaluated prior to implementation.

Arboretum of LAC

The Arboretum of LAC ranked second highest in the LAR Watershed and is located in the City of Arcadia near the intersection of Baldwin Avenue and Hugo Reid Drive. The project will receive drainage from an area of approximately 207 acres, generating a volume close to 9 acre-feet, or 3 million gallons. The concept for the Arboretum of LAC is based on the Baldwin Lake Planning Study for the Los Angeles County Arboretum and Botanic Garden (Kornrandolph, Inc., 2012) and involves greening some of the lake features, dredging the lake, pumping flows from the lake to the existing waterfall and other water features, and modifications to the lake outlet. This project has received extensive public support, as many stakeholders have a personal connection with the arboretum. This project will help reduce discharges to Santa Anita Wash.

Sierra Vista Park

Sierra Vista Park ranked third highest in the LAR Watershed and is located in the City of Sierra Madre near the intersection of Sierra Madre Boulevard and Coburn Avenue. The project will receive drainage from an area of approximately 120 acres, generating a volume close to 7.9 acre-feet, or 2.5 million gallons. The concept for Sierra Vista Park is to divert stormwater from Bond Issue 7501 – Line C in Sierra Madre Boulevard, an existing 42-inch RCP. Flows will be partially treated and pumped into the existing spreading grounds. The flows will enter the existing spreading grounds at Basin 1, which is a settling basin for inflow from street runoff (Arcadia and Sierra Madre, 2005). Flows will then be stored and infiltrated throughout the existing spreading grounds. This multi-use project emphasizes stormwater quality and water conservation.

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Royal Oaks Trail (LAR)

Royal Oaks Trail (LAR) was ranked the fourth highest in the LAR Watershed and is located along the city boundary between Bradbury and Duarte, parallel to Royal Oaks Drive between Buena Vista Street and Woodlyn Lane. The project will receive drainage from an area of approximately 661 acres, generating a volume just over 40 acre-feet, or 13 million gallons. Flows will be diverted from Bond Issue 0030 – Duarte Drain within Buena Vista Street, an 81-inch RCP. A concrete vault subsurface storage system just over 9 feet deep is proposed beneath the trails and will facilitate retention and infiltration. Opportunities for capture and use may exist and will be further evaluated prior to implementation. This site currently promotes recreational use and presents a great multi-benefit project opportunity that can be used to educate stakeholders.

L. Garcia Park

L. Garcia Park was ranked the fifth highest in the LAR Watershed and is located in the City of Monrovia near the intersection of West Olive Avenue and South Mayflower Avenue. The project will receive drainage from an area of approximately 265 acres, generating a volume just over 18 acre-feet, or just under 6 million gallons. Flows will be diverted from Bond Issue 5601 – Line G within South Mayflower Avenue, a 60-inch RCP. A concrete vault subsurface storage system just over 14 feet deep is proposed beneath the park bounded by Olive Avenue and will facilitate retention and infiltration. Opportunities for capture and use may exist and will be further evaluated prior to implementation.

Eisenhower Park

Eisenhower Park was ranked the sixth highest in the LAR Watershed and is located in the City of Arcadia near the intersection of North 2nd Avenue and Forest Avenue. The project will receive drainage from an area of approximately 1,425 acres, generating a volume just over 64 acre-feet, or 21 million gallons. This project will only be able to capture approximately half of the flow generated within the tributary watershed and is considered a regional project rather than a regional EWMP project. Flows will be diverted from Santa Anita Wash, just north of the 210 freeway. A concrete vault subsurface storage system 25 feet deep is proposed beneath the baseball field and will facilitate retention and infiltration. Opportunities for capture and use may exist and will be further evaluated prior to implementation.

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LADWP Easement

The LADWP Easement was the highest ranked project in the SGR Watershed and is located in the City of Azusa and Unincorporated County area mostly along Newburgh Street between Big Dalton Wash and Vincent Avenue. The project will receive drainage from an area of approximately 240 acres, generating a volume just over 14 acre-feet, or 4.5 million gallons. This project will only be able to capture approximately 28 percent of the flow generated within the tributary watershed (approximately 4 acre-feet or 1.3 million gallons) and is considered a regional project rather than a regional EWMP project. Flows will be diverted from Gladstone Street Drain, a 78-inch RCP, just upstream of the outfall into Big Dalton Wash. The concept for the LADPW Easement involves surface storage in the form of infiltration basins, as this is the preferred implementation strategy by LADWP. A series of four infiltration basins has been conceptualized and the level in each basin is to be controlled by a downstream weir.

Encanto Park

Encanto Park was ranked the second highest in the SGR Watershed and is located in the City of Duarte, adjacent to the San Gabriel River near the intersection of Royal Oaks Drive and Encanto Parkway. The project will receive drainage from an area of approximately 190 acres, generating a volume just over 11 acre-feet, or just under 4 million gallons. Flows will be diverted from the Encanto Park Storm Drain at the confluence with another storm drain within the park. At the diversion point, the Encanto Park Storm Drain is a 72-inch RCP. Flows will be pumped to a subsurface storage system made up of 120-inch corrugated metal pipes located beneath the grass and will facilitate retention and infiltration. Opportunities for capture and use may exist and will be further evaluated prior to implementation.

Memorial Park (Azusa)

Memorial Park (Azusa) was ranked third highest in the SGR Watershed and is located in the City of Azusa near the intersection of Angeleno Avenue and Third Street. The project will receive drainage from an area of approximately 390 acres, generating a volume close to 30 acre-feet, or 10 million gallons. Flows will be diverted from Project Number 1119 – Unit 2 within Orange Avenue, a 78-inch RCP. A subsurface storage system made up of 144-inch corrugated metal pipes will be located beneath the baseball fields and will facilitate retention and infiltration. Opportunities for capture and use may exist and will be further evaluated prior to implementation.

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Royal Oaks Trail (SGR)

Royal Oaks Trail (SGR) was ranked the fourth highest in the SGR Watershed and is located along the city boundary between Bradbury and Duarte, parallel to Royal Oaks Drive between Chimes Avenue and Mount Olive Drive. The project will receive drainage from an area of approximately 722 acres, generating a volume just over 67 acre-feet, or about 22 million gallons. Flows will be diverted from Bradbury Drain, a 14-foot by 9.5-foot reinforced concrete box, just upstream of where it daylights along the trail A concrete vault subsurface storage system just over 16 feet deep is proposed beneath the trails and will facilitate retention and infiltration. Opportunities for capture and use may exist and will be further evaluated prior to implementation. This site currently promotes recreational use and presents a great multi-benefit project opportunity that can be used to educate stakeholders.

3.4.3 Distributed BMPs (Green Streets)

The methodology for evaluating potential green street opportunities is detailed in **Section 3.2.5**. To determine the streets recommended for implementation, a green street subarea analysis was performed. Using the street rankings identified through the green street analysis, each subarea within the RH/SGRWQG was analyzed to determine a combination of streets that would satisfy the 85th percentile, 24-hour storm volume criteria and 90th percentile, 24-hour load criteria as determined by the LSPC and further discussed in **Section 4.7**. Subarea characteristics influenced which criteria controls implementation efforts. Green street implementation was determined based on the criteria that had the greater volume capture or load reduction requirement.

To perform this analysis, the green street rankings were clipped at the subarea level. The streets within the subarea were analyzed to determine the number of lanes, which was then associated with the lane miles provided by each street segment. Streets were then manually selected throughout the subarea until the number of lane miles selected for green streets satisfied the volume and load criterion. The lane mile needs were determined assuming a lane is ten feet wide and three feet of storage with thirty-three percent void space would be provided beneath the street. Using these assumptions, ten cubic feet of storage would be provided per foot of street length within each lane.

Streets were strategically selected throughout each subarea. High ranking streets are always the best alternative and then streets were compared with the existing topography, storm drain, and catch basin alignments. Streets that are ranked low were never selected, as they represent the least feasible options. Streets that run parallel to contours were selected over those that were perpendicular to contours. The streets parallel to the contours collect flows that are running downhill, similar to hillside drainage ditches. Capture on these streets allows infiltration prior to collection in storm drains. In some instances, the topography was not used as the determining factor. Streets that contained storm drains and catch basins were given preference since the drains show that they receive flow from the surrounding areas and would be beneficial as green streets. Also, major streets were preferred over residential streets, as they provide a greater number of lane miles, therefore less streets would be disturbed throughout the implementation process. Streets that are going to be rehabilitated or disturbed in some way in the near future were given preference as these streets offer cost saving solutions. Using ArcGIS and Microsoft Excel, streets were chosen to be implemented as green streets until the 85th percentile volume and 90th percentile load criteria were satisfied.

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Figure 3-34 illustrates one example of an individual subarea analysis, all of which are included in **Attachment R**. **Attachment S** contains summary tables for the LAR and SGR Watersheds demonstrating the streets analyzed and streets selected along with the associated subarea and the jurisdiction they will be implemented by. The streets that are to be implemented as green streets are shown in the figures as bold green lines and are marked "G" in the "Selected?" column in the table. In some instances there were not enough high and/or medium ranked streets within the subarea to satisfy the 85th percentile volume and/or the 90th percentile load criterion. When this was the case, the individual subarea was not analyzed and additional streets were selected in other subareas. These subareas are discussed further in **Section 3.4.3.1**.

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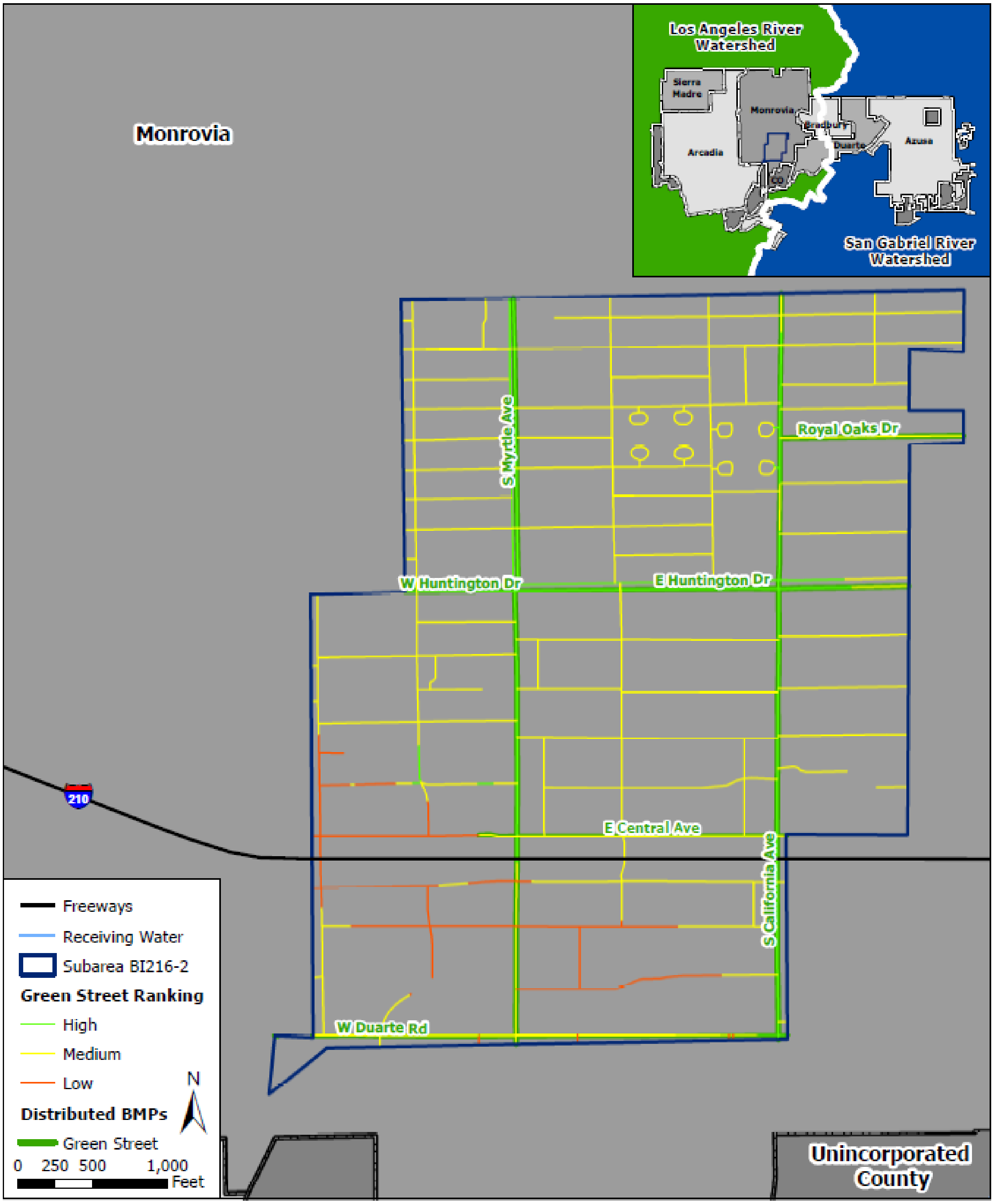

Figure 3-34 Green Street Analysis for Subarea BI216-2

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3.4.3.1 Green Street Implementation Summary

The implementation needs based on the subarea analysis were analyzed to determine the quantity of green streets by jurisdiction and subarea. **Table 3-25** identifies the lane mile needs for each jurisdiction within the RH/SGRWQG.

Table 3-25 Green Street Implementation Summary by Jurisdiction

Jurisdiction	Green Street Lane Miles			
	LAR Watershed	SGR Watershed	Total	Percent by Agency
Arcadia	123	0	123	28%
Azusa	0	112	112	26%
Bradbury	0	0	0	0%
Duarte	38	16	54	12%
Monrovia	68	0	68	16%
Sierra Madre	6	0	6	1%
County Unincorporated	38	35	73	17%
Total:	**273**	**163**	**436**	**100%**

Figure 3-35 illustrates the lane miles needed throughout the RH/SGRWQG, 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 regional project catchments that are full capture, as green streets are not required in these subareas as they are fully mitigated by a regional EWMP project. Additionally, the subareas for which green streets are not selected are shown. The RH/SGRWQG plans to develop a Green Streets Master Plan document that evaluates area Capital Improvement Programs and the projected road repair and rehabilitation projects, street widening, resurfacing, and reconstruction so that green street implementation can be strategically planned and incorporated into upcoming projects. Streets that have been upgraded or rehabilitated in the last few years and selected as green streets will be scheduled for implementation towards the end of the implementation schedule.

Attachment T contains a subarea summary table listing the lane miles provided based on subarea. A figure is also included so that subareas names can be associated spatially. Where it is impractical to implement enough BMPs within a specific subarea, other BMPs are implemented throughout the watershed to provide the estimated volume and load reductions.

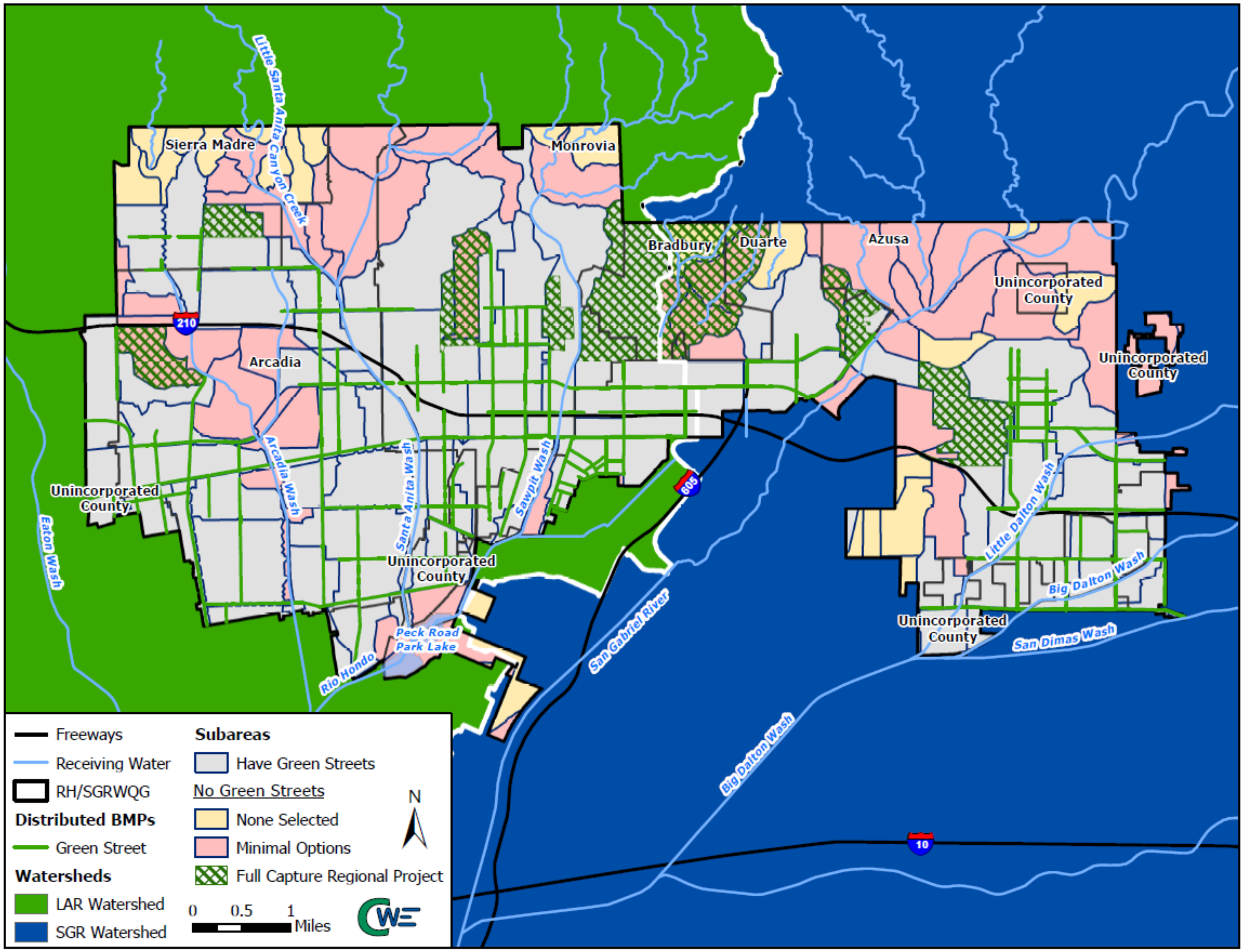

Figure 3-35 Green Street Implementation Summary

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4. Reasonable Assurance Analysis

This section explains the methodology of the RAA for the RH/SGRWQG EWMP as summarized below. The RAA developed for the RH/SGRWQG is in conformance with the RAA Guidelines developed by the Regional Board.

- WMMS, developed by the LACFCD, was calibrated with flow and water quality data specific to the RH/SGRWQG 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 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 helps estimate the implementation levels at various target time periods to demonstrate compliance with MS4 Permit objectives.

Additionally, this section discusses in detail the extensive calibration 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 distributed BMPs (green streets).

The purpose of the RAA is to demonstrate that the implementation scenarios proposed will meet the MS4 Permit effluent and receiving water limits for priority POC. 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 (both the LAR and SGR Watersheds) is not participating as part of the RH/SGRWQG and the approaches they are taking may be different; 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.

4.1 Modeling Software Used for the RAA

The RAA for the RH/SGRWQG uses WMMS, a regional model developed for the LAC region by the LACFCD. WMMS is comprised of two main components, 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 and determines pollutant loading and transport based on point source data, aerial deposition, and non-point source loadings. Additionally, the model determines chemical and transport interactions within stream reaches and provides anticipated water quality data based on the interactions at specific locations. WMMS and the LSPC modeling component are included in the list of approved watershed models for conducting the RAA outlined in Part VI.C.5.b.iv.(5) of the MS4 Permit.

Additional information pertaining to WMMS and LSPC is available from the LACDPW (2008, 2010a, 2010b, 2010c, 2011, 2013) and the USEPA (2003). The documents can be found on the WMMS homepage (http://dpw.lacounty.gov/wmd/wmms) where the model can also be downloaded.

4.2 Dry-Weather Modeling Approach and Results

The approach to the dry-weather portion of the RH/SGRWQG RAA was to evaluate the volume reduction potential provided by proposed regional projects and green streets to determine how much of the

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dry-weather flows would be addressed. The dry-weather flows being analyzed include only non-permitted stormwater discharges. Rising groundwater often contributes to non-stormwater flows and is not prohibited. This approach does not include the use of a model due to data set limitations and significant spatial variation throughout the RH/SGRWQG in terms of anticipated dry-weather flows. Data pertaining to measured dry-weather flow rates throughout Low Angeles County were compiled to estimate daily yields (i.e., gallons per day per acre). Thirty-five data points were used to determine the range of daily yields that can be expected from the RH/SGRWQG area. Three data points were orders of magnitude higher than the average and therefore excluded from the analysis. Based on the remaining 32 data points, the minimum daily yield is four gallons per day per acre, the average is 150 gallons per day per acre, and the maximum is 660 gallons per day per acre. Flows captured through regional BMP implementation and green street implementation were subtracted from the total assumed non-stormwater flows on a subarea-by-subarea basis to quantify pollutant load reductions which are based on the ratio of total flow reduction. The regional BMPs and green streets used for this analysis are discussed in **Section 3.4**.

Rather than using the estimated daily yields discussed above, a percent reduction was determined, which can be applied to applicable daily yields in the area. **Figure 4-1** and **Figure 4-2** illustrate the anticipated dry-weather flow reduction over time due to the implementation of wet-weather controls for the LAR and SGR Watersheds, respectively. The vertical lines shown in the figures represent the dry-weather TMDL compliance milestones. The anticipated dry-weather flow remaining in the LAR Watershed once the proposed wet-weather controls have been implemented (2028) is 20 percent (80 percent reduction). Once proposed control measures have been implemented in the SGR Watershed, 38 percent of dry-weather flows will remain (62 percent reduction). It is important to remember that the dry-weather flows for the RH/SGRWQG are currently captured and infiltrated in the unlined portion of the SGR and Rio Hondo or in one of the many spreading grounds within the watershed. The remaining non-permitted non-stormwater discharges will be addressed through the CIMP non-stormwater discharge source assessment.

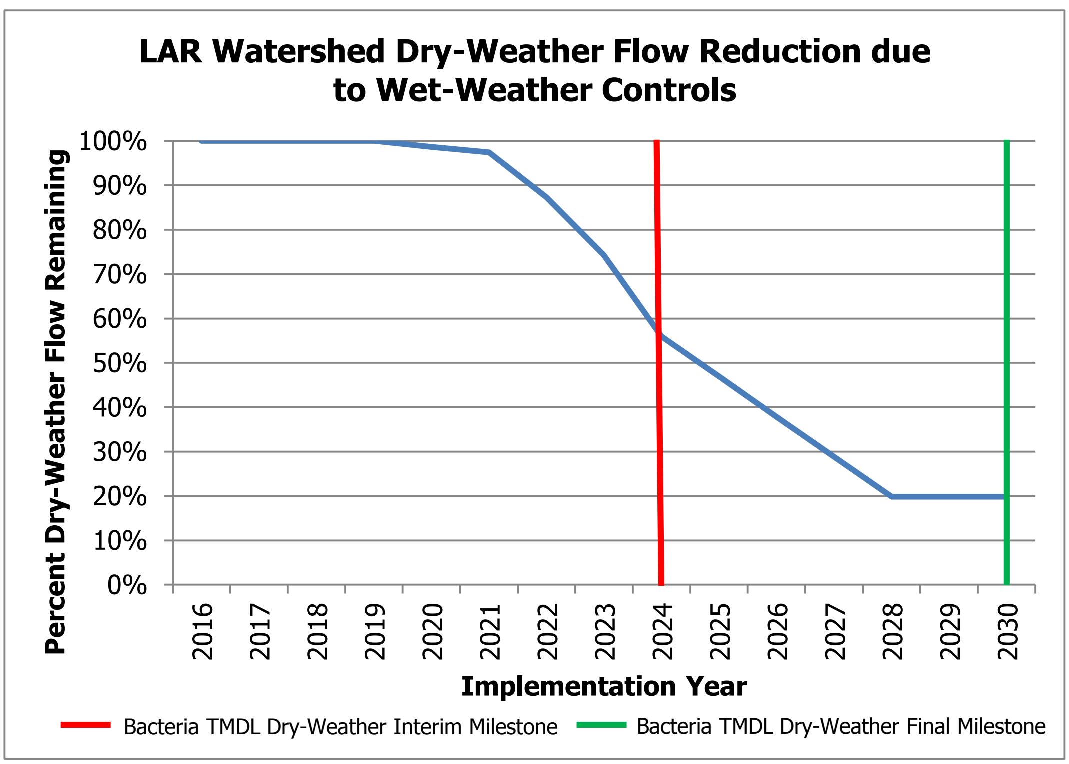

Figure 4-1 LAR Watershed Dry-Weather Flow Reduction due to Wet-Weather Controls

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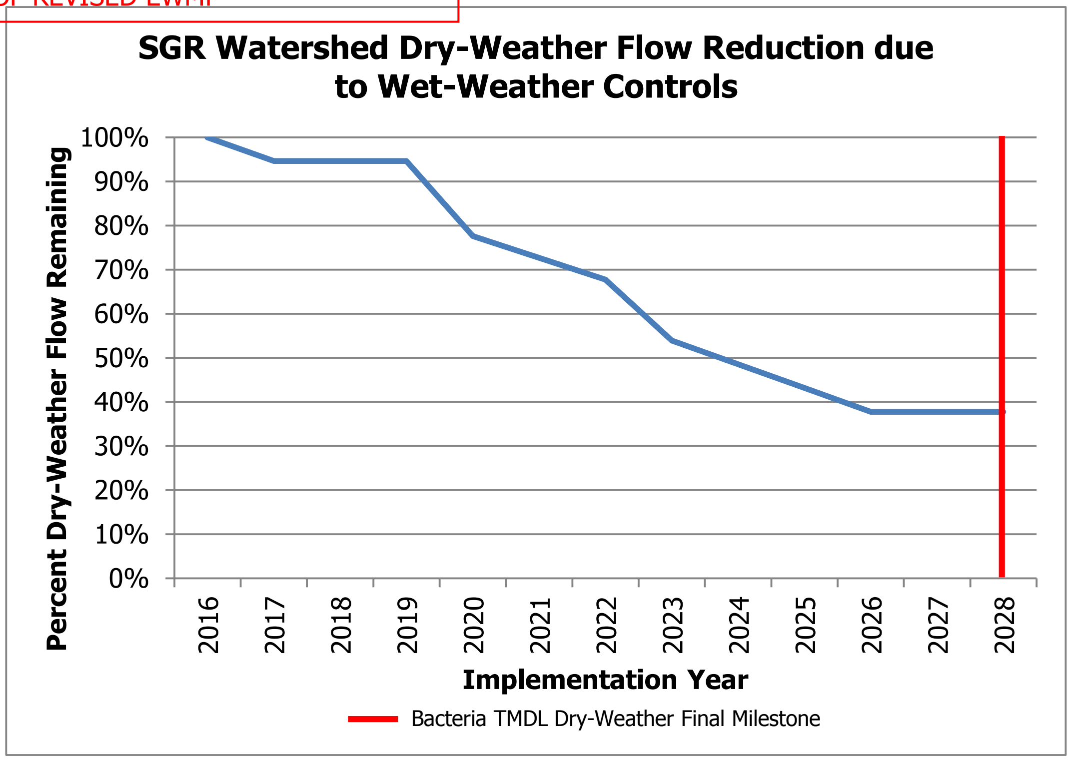

Figure 4-2 SGR Watershed Dry-Weather Flow Reduction due to Wet-Weather Controls

4.3 Wet-Weather Modeling Approach

The wet-weather RAA modeling approach used for the RH/SGRWQG RAA provides an efficient and cost-effective method for determining control measure implementation to meet WQOs. The approach also incorporates the RH/SGRWQG preferences regarding exceedance risk tolerance, pollutant prioritization, and structural BMP implementation scenarios while considering stakeholder input. The end product results in a comprehensive plan that maximizes benefits and minimizes implementation cost. The subareas included in the RAA are those within the group area and those that are tributary to it. The subareas are shown in **Figure 4-3**.

The wet-weather RAA approach involves the determination of both the existing pollutant loads (baseline) and target load reductions as a percentage of the total load. Once the baseline conditions were determined, watershed control measures were implemented over time to meet target WQOs. The selected control measures were then modeled at various stages within the implementation timeframe to determine the quantity, location, and timing of BMP implementation to meet the interim and final WQOs applicable to the RH/SGRWQG. Targets for the RAA are based on interim time steps throughout the MS4 Permit timeframe, which were presented in **Table 1-6** and **Table 2-10**. Control measures such as non-structural BMPs including MCMs and new/re-development programs, regional BMP projects, and distributed BMPs (green streets), were included in the RAA to demonstrate compliance at different time steps.

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 determine the most cost-effective approach that will achieve compliance. The iterative process involved model calibration, model validation, baseline simulation, determination of volume and load reductions, and control measure implementation, all of which are further detailed in this section.

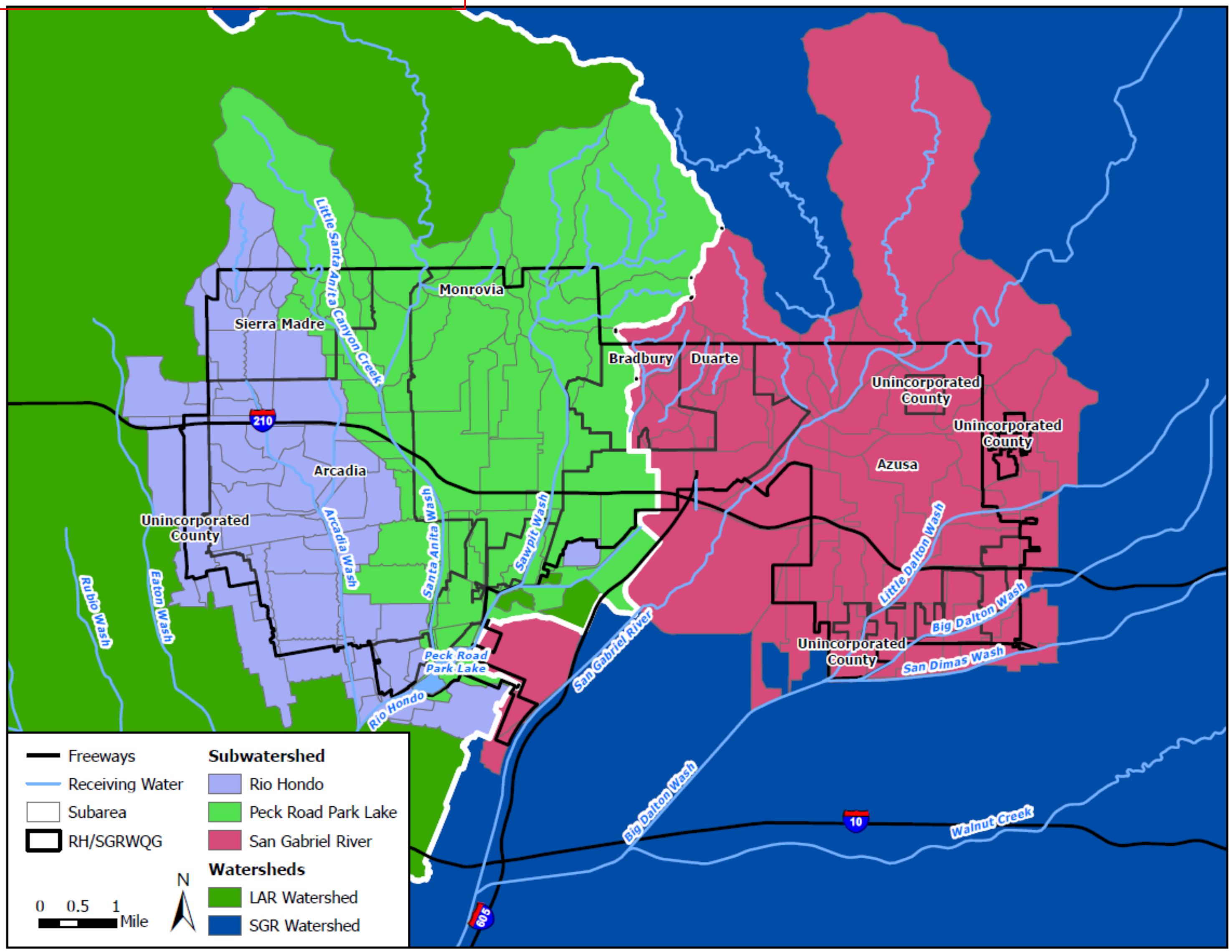

Figure 4-3 RH/SGRWQG Watershed Boundaries

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4.4. LSPC Calibration

Calibration refers to the adjustment or fine-tuning of modeling parameters to reproduce observations on the basis 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 RH/SGRWQG and surrounding area. Spatial and temporal aspects were evaluated through the iterative calibration process. Model calibration was necessary to demonstrate the calibrated model properly assessed all the model parameters and modeling conditions that can affect results for hydrologic and water quality analysis. The Regional Board provided acceptable model calibration criteria in Table 3.0 of the RAA Guidelines. The hydrology (flow) from the RH/SGRWQG was calibrated along with the water quality parameters described in the following subsections.

As part of the iterative calibration process, default parameter values were modified and input into LSPC. The model results were compared with observed data and a statistical analysis was conducted to measure the difference between the two values. The analysis applied linear bias as the general error percentage and added root mean square error (RSME) and coefficient of correlation (C.C.) evaluations to examine statistical variations. The linear bias was performed to find the percent difference between simulated and observed values. Linear bias is a measure of the difference in the sum of all simulated output results and the sum of all observed values divided by the sum of all simulated output results.

$$Linear\ Bias\ (percent) = \frac{\sum LSPC\ Output - \sum Recorded\ Values}{\sum Recorded\ Values}\ x\ 100$$

The RSME is a statistic used to measure the differences between values predicted by a model and the values actually observed. This statistic represents the sample standard deviation of the differences between predicted and observed values. The C.C. is a measure of the linear correlation between two variables where the optimal correlation is equal to one. These three statistical values (linear bias, RSME, and C.C) are presented so that the data can be better understood. The statistics determined for each of the calibration standards are further discussed within each calibration section below.

4.4.1 Hydrologic Calibration

Hydrologic calibration is the process of getting the predicted model flows to match measured flows in the watershed. The hydrologic calibration effort resulted in parameter values that produced the best overall agreement between simulated and observed stream flow volumes and timing throughout the calibration period. The period of calibration was from October 1, 2002 through April 30, 2012 to best fit the most recent flow data. Rainfall data was taken from 16 LACFCD recording rain gauges and one National Climatic Data Center (NCDC) rain gauge located within the watershed. Another component of meteorological input used to simulate evaporation was Pan Evapotranspiration (PET). Eight air temperature stations were used to derive PET values. Calibration included a time series comparison of daily and monthly values. Composite comparisons were also made to evaluate average monthly stream flow values over the period of record.

The basis for distributing hydrologic and water quality parameters in LSPC is provided by the existing land use coverage throughout the subareas shown in **Figure 4-3**. Land unit representation should be sensitive to the parameters that influence hydrology and pollutant transport, including landscape, land use (including impervious area assumptions), soils, and slope. The combination of the land use, hydrologic soil group (HSG), and slope were used to define the Hydrologic Response Units (HRUs). LSPC has 21 different HRUs, nine of which are considered impervious while twelve are predominantly pervious such as vacant or vegetated open space. Mixed land use areas were divided into impervious area and pervious areas based on acceptable regional values. For example, a commercial development is considered to be 90 percent impervious. The Commercial HRU is 100 percent impervious, but the other 10 percent of a commercial parcel is added to the "Urban_Grass_Irrigated" HRU.

The objective for hydrologic calibration was to achieve model results within the defined range specified in Table 3.0 of the RAA Guidelines. Table 3.0 specifies that percent differences less than ten percent are very good, values between 10 and 15 percent are good, and values between 15 and 25 percent are fair for hydrologic calibration.

The following stream gauges throughout the RH/SGRWQG and surrounding areas were used to calibrate the flow and their locations are illustrated in **Figure 4-4** as yellow triangles. Runoff stations outside of the RH/SGRWQG area were used to calibrate the model because the water quality data collection station used for calibration is located downstream of the RH/SGRWQG. Therefore, calibration required that all areas tributary to the water quality monitoring site be calibrated and modeled.

- F190 – SGR at Foothill Boulevard
- F263 – SGR below San Gabriel Parkway
- F274 – Dalton Wash at Merced Avenue
- F304 – Walnut Creek above Puente Avenue
- F312 – San Jose Channel below Seventh Avenue
- F317 – Arcadia Wash below Grand Avenue
- F318 – Eaton Wash at Loftus Drive
- F329 – Bradbury Channel below Central Avenue

The upstream watershed is controlled by several dams that influence flows in the two rivers. The stream gauge stations outside of the RH/SGRWQG were treated as flow point sources for model calibration. These flow sources measured at stream gauge stations upstream of the RH/SGRWQG are shown in orange in **Figure 4-4.** Flow stations within the RH/SGRWQG were calibrated to match measured data. Additionally, the channel flows measured in Whittier Narrows Dam were divided into two portions by adjusting the F-table configuration to comprehensively model the interconnection of the flows between the Rio Hondo and San Gabriel River.

Figure 4-5 illustrates the observed (OBS) and simulated (SIM) daily flow rates associated with the final calibration at stream gauge F190 while **Figure 4-6** illustrates the monthly flow rates. Both of these figures also show the relationship between the simulated and observed flows, which is linearly correlated. The cumulative total flow, as a percent, along with the exceedance probability is shown in **Figure 4-7** for stream gauge F190. The figures and statistical data corresponding to the stream gauges used for calibration are provided in **Attachment U**. The statistical analysis demonstrates that the hydrologic calibration ranges from very good to fair, with most gauges falling in the good calibration range.

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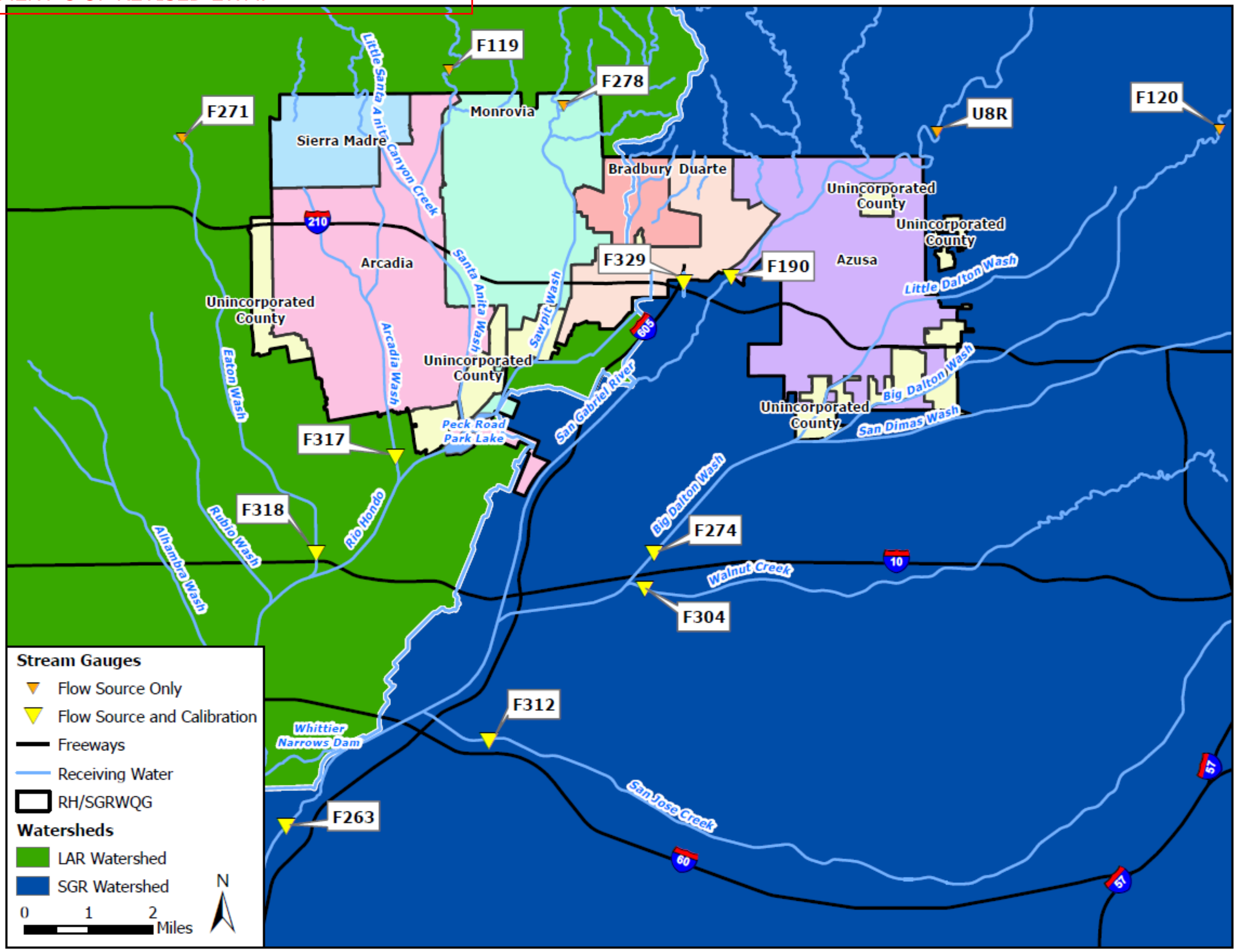

Figure 4-4 Stream Gauges and Water Quality Monitoring Site used for Calibration

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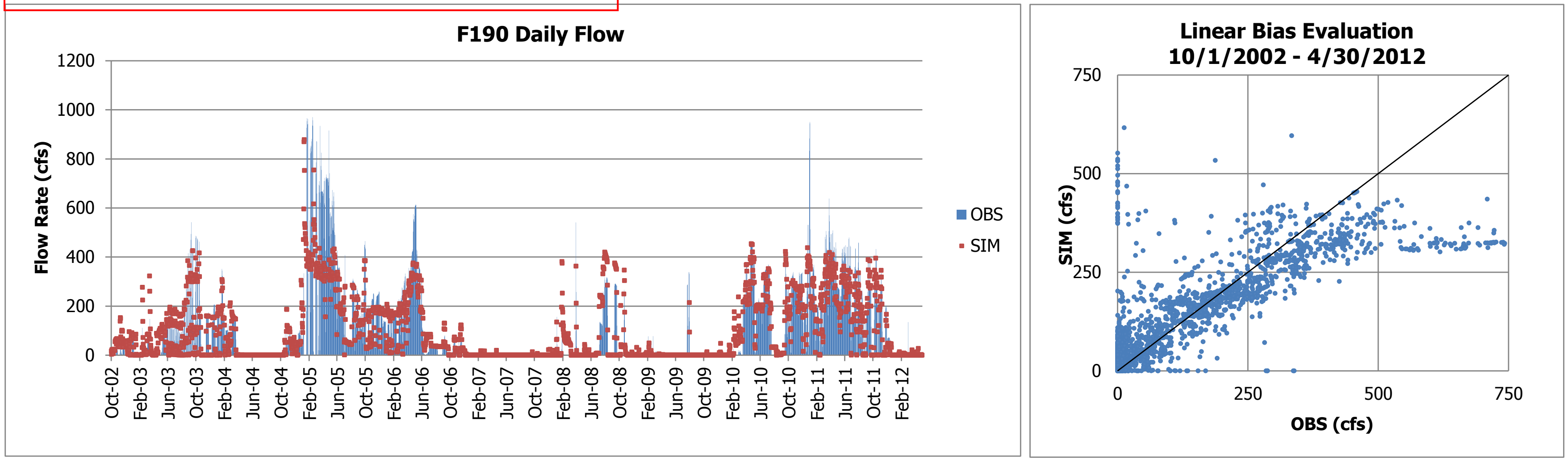

Figure 4-5 Daily Flow Calibration Plot at Stream Gauge F190

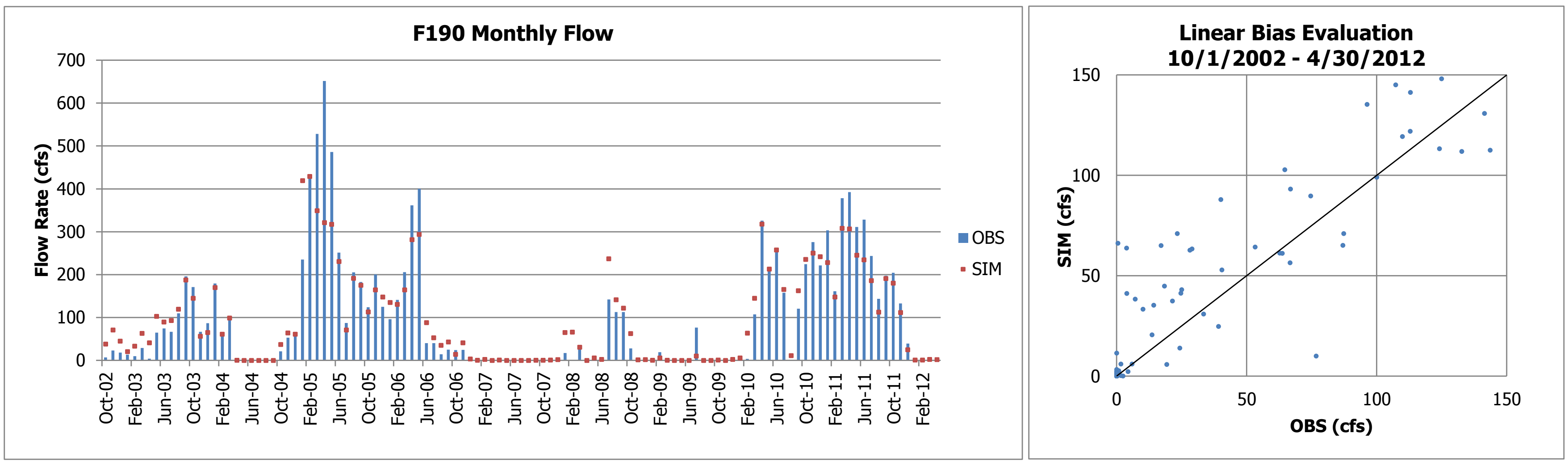

Figure 4-6 Monthly Flow Calibration Plot at Stream Gauge F190

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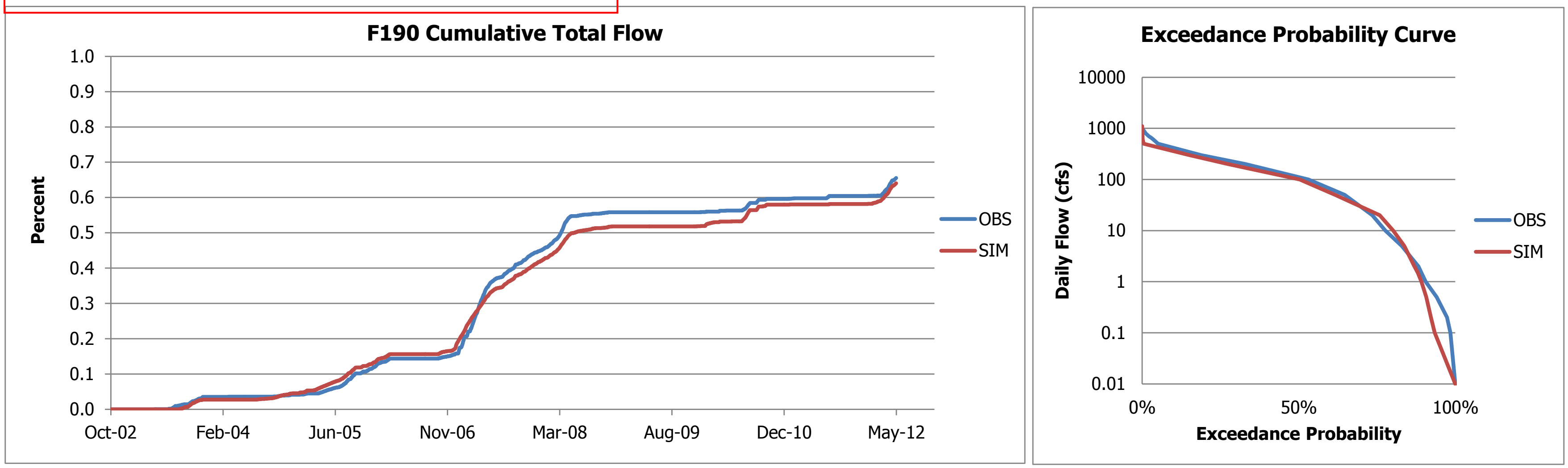

Figure 4-7 Cumulative Total Flow Plot and Exceedance Probability at Stream Gauge F190

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4.4.1.1 Water Budget Parameter Calibration

The model set-up for the RH/SGRWQG RAA has 24 individual modeling parameters for the water budget (PWAT), three of which were selected as calibration parameters. **Table 4-1** summarizes the calibration parameters including their default values (def) and calibration values (cal) used in the model runs associated with all of the stream gauges. The calibrated values are italicized in the table. The table also identifies whether each HRU is pervious (p) or impervious (imp). The definitions for the calibrated parameters are as follows:

- lzsn – lower zone nominal storage (inches)
- uzsn – upper zone nominal soil moisture storage (inches)
- intfw – interflow inflow

Table 4-1 LSPC Calibrated Water Budget Parameter Values

LUID	HRU	p/imp	lzsn		uzsn		intfw	
			def	cal	def	cal	def	cal
1	HD_SF_Residential	imp	0	0	0	0	0	0
2	LD_SF_Res_Moderate	imp	0	0	0	0	0	0
3	LD_SF_Res_Steep	imp	0	0	0	0	0	0
4	MF_Res	imp	0	0	0	0	0	0
5	Commercial	imp	0	0	0	0	0	0
6	Institutional	imp	0	0	0	0	0	0
7	Industrial	imp	0	0	0	0	0	0
8	Transportation	imp	0	0	0	0	0	0
9	Secondary_Roads	imp	0	0	0	0	0	0
10	Urban_Grass_Irrigated	p	7	*4*	0.5	*0.2*	1	*5*
11	Urban_Grass_NonIrrigated	p	7	*4*	0.5	*0.2*	1	*5*
12	Agriculture_Moderate_B	p	7	*4*	0.5	*0.2*	1	*5*
13	Agriculture_Moderate_D	p	7	*4*	0.5	*0.2*	1	*5*
14	Vacant_Moderate_B	p	7	*4*	0.5	*0.2*	1	*5*
15	Vacant_Moderate_D	p	7	*4*	0.5	*0.2*	1	*5*
16	Vacant_Steep_A	p	7	*4*	0.5	*0.2*	1	*5*
17	Vacant_Steep_B	p	7	*4*	0.5	*0.2*	1	*5*
18	Vacant_Steep_C	p	7	*4*	0.5	*0.2*	1	*5*
19	Vacant_Steep_D	p	7	*4*	0.5	*0.2*	1	*5*
20	Water	p	7	*4*	0.5	*0.2*	1	*5*
21	Water_Reuse	p	7	*4*	0.5	*0.2*	1	*5*

HD = High Density, HRU = Hydrologic Response Unit, LD = Low Density, LUID = Land Use Identification, MF = Multi Family, SF = Single Family

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Table 3.1 in the RAA Guidelines identifies the acceptable "Range of Initial Values" for the model parameters based on the USEPA Basins Technical Note 6 (EPA BTN #6). The "Range of Initial Values" specified are as follows and the calibrated values used for the RH/SGRWQG are within the acceptable range:

- lzsn: 2.0 – 15.0
- uzsn: 0.05 – 2.0
- intfw: 1.0 – 10.0

Table 3.0 of the RAA Guidelines states that percent differences between 15 and 25 percent are considered fair, differences between ten and 15 percent are considered good, and differences less than ten percent are considered very good for the hydrology/flow model parameters. **Table 4-2** presents the results from the statistical analysis performed based on the calibrated and recorded values for the water budget parameters at stream gauge F190. The statistics at the other gauges used for model calibration are included in **Attachment U**. The daily and monthly differences are less than ten percent at gauge F190 which demonstrates a very good correlation between observed and modeled flow rates. Additionally, the C.C. is close to one which demonstrates that the relationship between modeled and observed values is linear.

Table 4-2 Water Budget Parameter Statistics at Gauge F190

Parameter	RMSE	Linear Bias	C.C.
Water Budget - Daily	90.8	-6.0%	0.82
Water Budget - Monthly	49.1	-6.0%	0.93

4.4.2 Water Quality Calibration

Mass Emission Station S14 is located directly downstream from East Whittier Narrows Dam, as illustrated in **Figure 4-8**, and provides sufficient water quality monitoring data for calibrating the RH/SGRWQG model. The area tributary to S14 encompasses an area much larger than the RH/SGRWQG. To demonstrate that the model accurately represents water quality parameters within the RH/SGRWQG, the entire watershed upstream was calibrated. As more water quality data is collected through the CIMP, validation and fine tuning of the water quality parameters may be possible. At this time, the data sets available were used to demonstrate the model accurately represents pollutant loading within the upstream watershed.

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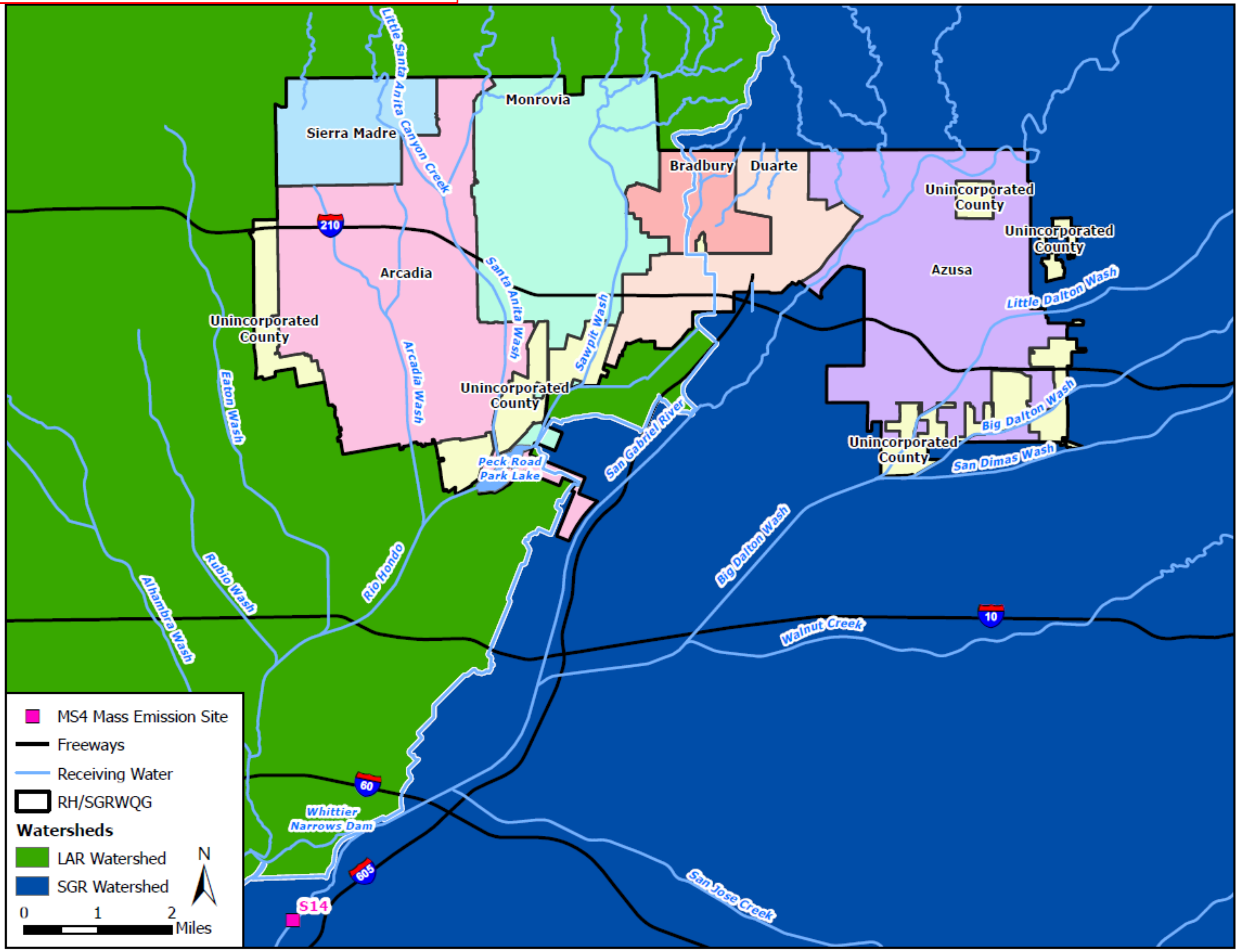

Figure 4-8 Water Quality Monitoring Site used for Water Quality Calibration

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4.4.2.1 Total Suspended Sediment Parameter Calibration

The model set-up for the RH/SGRWQG RAA has 18 individual modeling parameters for the sediment group (SED), five of which were selected as calibration parameters. **Table 4-3** summarizes the calibration parameters including their default values (def) and calibration values (cal) used in the model runs. The calibrated values are italicized in the table. Parameter definitions are as follows:

- kser – coefficient in the detached sediment washoff equation
- accsdp – rate at which solids accumulate on the land surface
- sed_suro – constant surface trace sediment concentration
- sed_ifwo – constant interflow trace sediment concentration
- sed_agwo – constant groundwater trace sediment concentration

Table 4-3 LSPC Calibrated Sediment Parameter Values

LUID	kser		accsdp		sed_suro		sed_ifwo		sed_agwo	
	def	cal	def	cal	def	cal	def	cal	def	cal
1	0.035	*0.21*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
2	0.03	*0.18*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
3	0.03	*0.18*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
4	0.035	*0.21*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
5	0.07	*0.42*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
6	0.065	*0.39*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
7	0.065	*0.39*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
8	0.085	*0.51*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
9	0.085	*0.51*	0.001	*0.1*	0	*250*	0	*250*	0	*250*
10	0.001	*0.006*	0	0	0	*250*	0	*250*	0	*250*
11	0.1	*0.6*	0	0	0	*250*	0	*250*	0	*250*
12	0.1	*0.6*	0	0	0	*250*	0	*250*	0	*250*
13	0.1	*0.6*	0	0	0	*250*	0	*250*	0	*250*
14	0.1	*0.6*	0	0	0	*250*	0	*250*	0	*250*
15	0.1	*0.6*	0	0	0	*250*	0	*250*	0	*250*
16	0.15	*0.9*	0	0	0	*250*	0	*250*	0	*250*
17	0.15	*0.9*	0	0	0	*250*	0	*250*	0	*250*
18	0.15	*0.9*	0	0	0	*250*	0	*250*	0	*250*
19	0.15	*0.9*	0	0	0	*250*	0	*250*	0	*250*
20	0	0	0	0	0	*250*	0	*250*	0	*250*
21	0.1	*0.6*	0	0	0	*250*	0	*250*	0	*250*

LUID = Land Use Identification (defined in **Table 4-1**)

Table 3.0 of the RAA Guidelines states that percent differences between 30 and 45 percent are considered fair, differences between 20 and 30 percent are considered good, and differences less than 20 percent are considered very good for sediment model parameters. **Table 4-4** and **Figure 4-9** summarize the statistical data associated with the calibrated model (SIM) as compared to the recorded values (OBS) for TSS. The RAA Guidelines specify that the model calibration criteria for metals and the simulated results for the sediment calibration falls into the very good ranking with a percent difference less than 20 percent. The RMSE and C.C. will improve with the obtainment of additional data. The model calibration is based on data that was collected two times per year downstream of the RH/SGRWQG

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area. There are a lot of variables that influence stormwater runoff quality that cannot be simulated in a model. As additional data is collected through CIMP efforts in the RH/SGRWQG area, the model will be adjusted and the calibration statistics will demonstrate the simulated values more closely represent the observed values.

Table 4-4 TSS Parameter Statistics

Parameter	RMSE	Linear Bias	C.C.
TSS	308.8	-2.9%	0.68

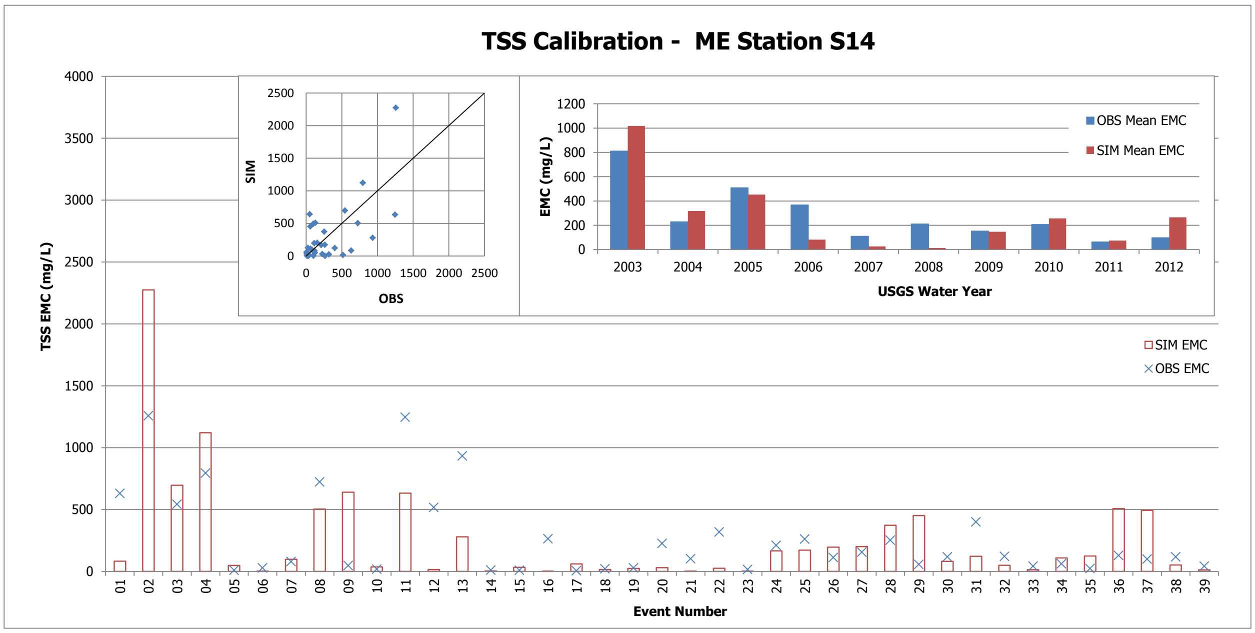

Figure 4-9 TSS Calibration Statistics at Mass Emission Station S14

4.4.2.2 Metal Parameter Calibration

The LSPC model for general water quality parameter (GQUAL) uses three priority metal pollutants, copper, lead, and zinc. This subsection discusses the parameter calibration for the three metal pollutants while the following subsections cover the remaining general water quality parameters. The model set-up for the RH/SGRWQG RAA has 12 individual modeling parameters for each of the general water quality parameters, four of which were selected as calibration parameters. **Table 4-5**, **Table 4-6**, and **Table 4-7** summarize the calibration parameters including their default values (def) and calibration values (cal) used in the model runs for copper, lead, and zinc, respectively. The calibrated values are italicized in the table. The parameter definition is as follows:

- potfw – washoff potency factor
- potfs – scour potency factor
- acqop – accumulation rate on surface
- sqolim – maximum storage on surface

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Table 4-5 LSPC Calibrated Copper Parameter Values

LUID	potfw		potfs		acqop		sqolim	
	def	cal	def	cal	def	cal	def	cal
1	0.800	*0.0145*	0.800	*0.0102*	0	*0.0841*	0.000001	*0.0921*
2	0.600	*0.0108*	0.600	*0.0076*	0	*0.0841*	0.000001	*0.0921*
3	0.600	*0.0108*	0.600	*0.0076*	0	*0.0841*	0.000001	*0.0921*
4	0.800	*0.0145*	0.800	*0.0102*	0	*0.0841*	0.000001	*0.0921*
5	1.140	*0.0206*	1.140	*0.0145*	0	*0.0841*	0.000001	*0.0921*
6	0.400	*0.0072*	0.400	*0.0051*	0	*0.0841*	0.000001	*0.0921*
7	0.400	*0.0072*	0.400	*0.0051*	0	*0.0841*	0.000001	*0.0921*
8	0.800	*0.0145*	0.800	*0.0102*	0	*0.0841*	0.000001	*0.0921*
9	0.800	*0.0145*	0.800	*0.0102*	0	*0.0841*	0.000001	*0.0921*
10	0.600	*0.0108*	0.600	*0.0076*	0	*0.0841*	0.000001	*0.0921*
11	0.600	*0.0108*	0.600	*0.0076*	0	*0.0841*	0.000001	*0.0921*
12	0.300	*0.0054*	0.300	*0.0038*	0	*0.0841*	0.000001	*0.0921*
13	0.300	*0.0054*	0.300	*0.0038*	0	*0.0841*	0.000001	*0.0921*
14	0.012	*0.0002*	0.012	*0.0002*	0	*0.0841*	0.000001	*0.0921*
15	0.012	*0.0002*	0.012	*0.0002*	0	*0.0841*	0.000001	*0.0921*
16	0.012	*0.0002*	0.012	*0.0002*	0	*0.0841*	0.000001	*0.0921*
17	0.012	*0.0002*	0.012	*0.0002*	0	*0.0841*	0.000001	*0.0921*
18	0.012	*0.0002*	0.012	*0.0002*	0	*0.0841*	0.000001	*0.0921*
19	0.012	*0.0002*	0.012	*0.0002*	0	*0.0841*	0.000001	*0.0921*
20	0	0	0	0	0	*0.0841*	0.000001	*0.0921*
21	0.800	*0.0108*	0.800	*0.0076*	0	*0.0841*	0.000001	*0.0921*

LUID = Land Use Identification (defined in **Table 4-1**)

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Table 4-6 LSPC Calibrated Lead Parameter Values

LUID	potfw		potfs		acqop		sqolim	
	def	cal	def	cal	def	cal	def	cal
1	0.800	*0.0095*	0.800	*0.0059*	0	*0.0387*	0.000001	*0.0426*
2	0.600	*0.0024*	0.600	*0.0015*	0	*0.0387*	0.000001	*0.0426*
3	0.600	*0.0024*	0.600	*0.0015*	0	*0.0387*	0.000001	*0.0426*
4	0.800	*0.0095*	0.800	*0.0059*	0	*0.0387*	0.000001	*0.0426*
5	1.140	*0.0119*	1.140	*0.0074*	0	*0.0387*	0.000001	*0.0426*
6	0.400	*0.0021*	0.400	*0.0013*	0	*0.0387*	0.000001	*0.0426*
7	0.400	*0.0021*	0.400	*0.0013*	0	*0.0387*	0.000001	*0.0426*
8	0.800	*0.0095*	0.800	*0.0059*	0	*0.0387*	0.000001	*0.0426*
9	0.800	*0.0095*	0.800	*0.0059*	0	*0.0387*	0.000001	*0.0426*
10	0.600	*0.0024*	0.600	*0.0015*	0	*0.0387*	0.000001	*0.0426*
11	0.600	*0.0024*	0.600	*0.0015*	0	*0.0387*	0.000001	*0.0426*
12	0.300	*0.0012*	0.300	*0.0007*	0	*0.0387*	0.000001	*0.0426*
13	0.300	*0.0012*	0.300	*0.0007*	0	*0.0387*	0.000001	*0.0426*
14	0.012	*0*	0.012	*0*	0	*0.0387*	0.000001	*0.0426*
15	0.012	*0*	0.012	*0*	0	*0.0387*	0.000001	*0.0426*
16	0.012	*0*	0.012	*0*	0	*0.0387*	0.000001	*0.0426*
17	0.012	*0*	0.012	*0*	0	*0.0387*	0.000001	*0.0426*
18	0.012	*0*	0.012	*0*	0	*0.0387*	0.000001	*0.0426*
19	0.012	*0*	0.012	*0*	0	*0.0387*	0.000001	*0.0426*
20	0	0	0	0	0	*0.0387*	0.000001	*0.0426*
21	0.800	*0.0024*	0.800	*0.0015*	0	*0.0387*	0.000001	*0.0426*

LUID = Land Use Identification (defined in **Table 4-1**)

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Table 4-7 LSPC Calibrated Zinc Parameter Values

LUID	potfw		potfs		acqop		sqolim	
	def	cal	def	cal	def	cal	def	cal
1	0.800	*0.0615*	0.800	*0.0390*	0	*0.340*	0.000001	*0.3742*
2	0.600	*0.0098*	0.600	*0.0062*	0	*0.340*	0.000001	*0.3742*
3	0.600	*0.0098*	0.600	*0.0062*	0	*0.340*	0.000001	*0.3742*
4	0.800	*0.0615*	0.800	*0.0390*	0	*0.340*	0.000001	*0.3742*
5	1.140	*0.0836*	1.140	*0.0530*	0	*0.340*	0.000001	*0.3742*
6	0.400	*0.0416*	0.400	*0.0264*	0	*0.340*	0.000001	*0.3742*
7	0.400	*0.0416*	0.400	*0.0264*	0	*0.340*	0.000001	*0.3742*
8	0.800	*0.0615*	0.800	*0.0390*	0	*0.340*	0.000001	*0.3742*
9	0.800	*0.0615*	0.800	*0.0390*	0	*0.340*	0.000001	*0.3742*
10	0.600	*0.0098*	0.600	*0.0062*	0	*0.340*	0.000001	*0.3742*
11	0.600	*0.0098*	0.600	*0.0062*	0	*0.340*	0.000001	*0.3742*
12	0.300	*0.0205*	0.300	*0.0130*	0	*0.340*	0.000001	*0.3742*
13	0.300	*0.0205*	0.300	*0.0130*	0	*0.340*	0.000001	*0.3742*
14	0.012	*0.0004*	0.012	*0.0003*	0	*0.340*	0.000001	*0.3742*
15	0.012	*0.0004*	0.012	*0.0003*	0	*0.340*	0.000001	*0.3742*
16	0.012	*0.0004*	0.012	*0.0003*	0	*0.340*	0.000001	*0.3742*
17	0.012	*0.0004*	0.012	*0.0003*	0	*0.340*	0.000001	*0.3742*
18	0.012	*0.0004*	0.012	*0.0003*	0	*0.340*	0.000001	*0.3742*
19	0.012	*0.0004*	0.012	*0.0003*	0	*0.340*	0.000001	*0.3742*
20	0	0	0	0	0	*0.340*	0.000001	*0.3742*
21	0.800	*0.0098*	0.800	*0.0062*	0	*0.340*	0.000001	*0.3742*

LUID = Land Use Identification (defined in **Table 4-1**)

The default values of potfw, potfs, acqop, and sqolim for each land use was modified by assuming a linear build-up/washoff relationship of the three metal pollutants and adjusting the input parameter accordingly to achieve the best agreement of simulated and observed values. **Table 4-8**, **Figure 4-10**, **Figure 4-11**, and **Figure 4-12** summarize the statistical data associated with the calibrated model (SIM) as compared to the recorded values (OBS) for copper, lead, and zinc. The RAA Guidelines do not specify the model calibration criteria for metals, but it can be assumed the calibration would fall into the very good category for most cases. A few of the values fall into the good category for calibration. The RMSE and C.C. will improve with the obtainment of additional data. The model calibration is based on data that was collected two times per year downstream of the RH/SGRWQG area. There are a lot of variables that influence stormwater runoff quality that cannot be simulated in a model. As additional data is collected through CIMP efforts in the RH/SGRWQG area, the model will be adjusted and the calibration statistics will demonstrate the simulated values more closely represent the observed values.

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Table 4-8 Metal Parameter Statistics

Parameter	Water Year	RMSE	Linear Bias	C.C.
Copper	2003-2012	21.3	-0.7%	-0.05
	2003-2008	26.5	-13.4%	-0.20
	2009-2012	10.4	20.5%	0.62
Lead	2003-2012	12.6	-0.5%	0.22
	2003-2008	15.4	-0.5%	0.07
	2009-2012	8.0	-0.4%	0.56
Zinc	2003-2012	94.6	-0.1%	-0.05
	2003-2008	123.3	-0.6%	-0.20
	2009-2012	43.6	0.4%	0.62

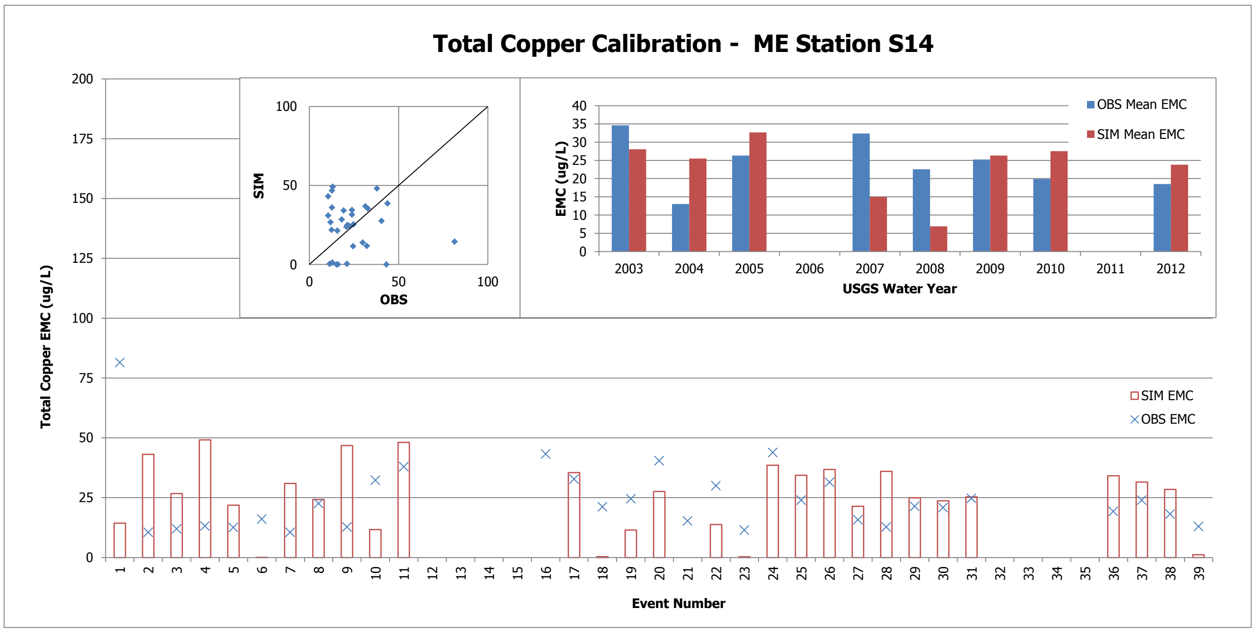

Figure 4-10 Copper Calibration Statistics at Mass Emission Station S14

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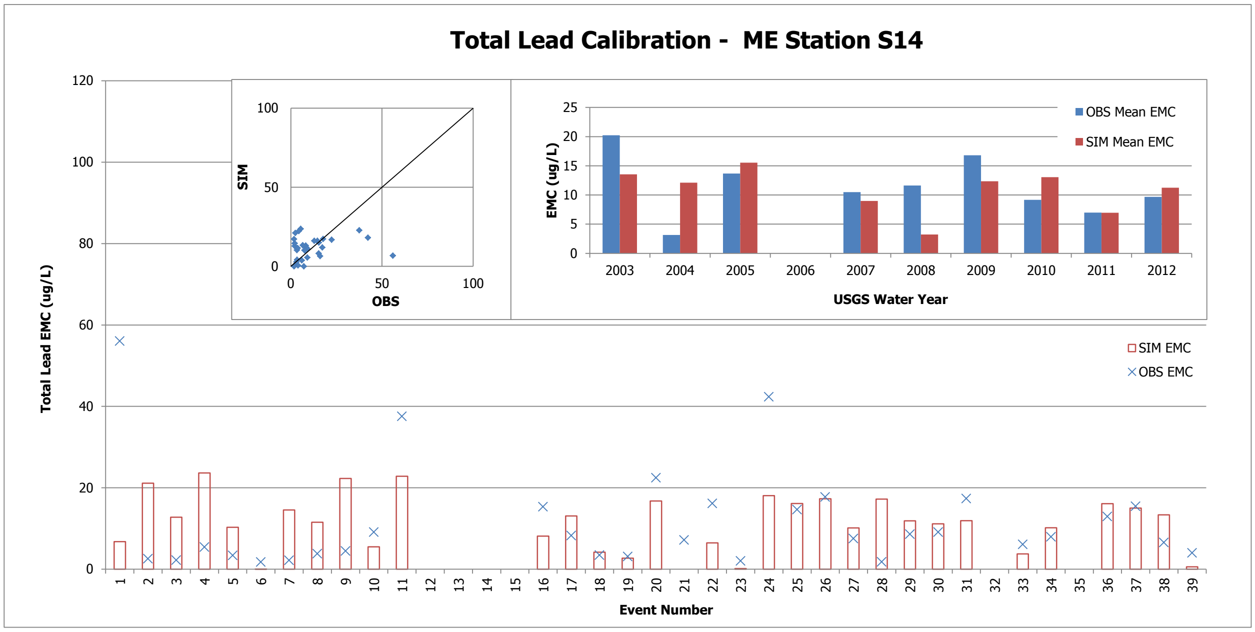

Figure 4-11 Lead Calibration Statistics at Mass Emission Station S14

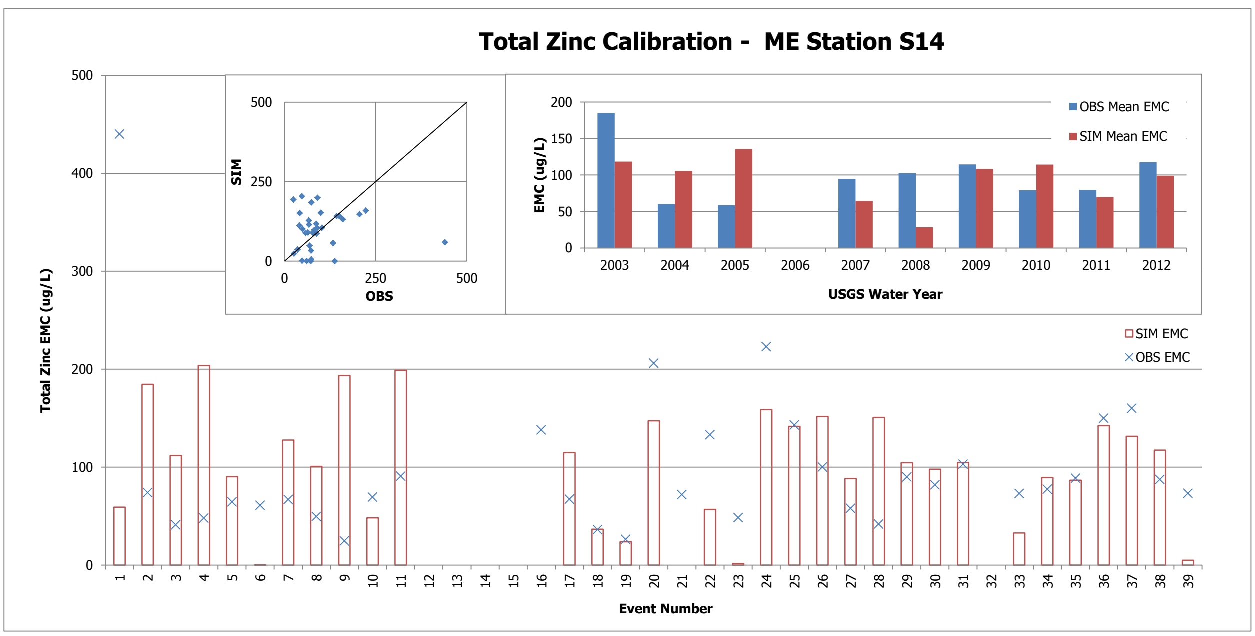

Figure 4-12 Zinc Calibration Statistics at Mass Emission Station S14

4.4.2.3 Fecal Coliform Parameter Calibration

The LSPC model for GQUAL uses fecal coliform (indicator bacteria). The model set-up for the RH/SGRWQG RAA has 12 individual modeling parameters for each of the general water quality parameters, two of which were selected as a calibration parameter. **Table 4-9** summarizes the calibration parameters including their default values (def) and calibration values (cal) used in the model runs. The calibrated values are italicized in the table. The parameter definitions are as follows:

- soqc – surface outflow
- ioqc – inflow concentrations

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Table 4-9 LSPC Calibrated Fecal Coliform Parameter Values

LUID	soqc		ioqc	
	def	cal	def	cal
1	6,600	*1,383,000*	6,600	*1,383,000*
2	19,000	*1,383,000*	19,000	*1,383,000*
3	19,000	*1,383,000*	19,000	*1,383,000*
4	6,600	*525,000*	6,600	*525,000*
5	40,000	*3,553,000*	40,000	*3,553,000*
6	2,300	*3,553,000*	2,300	*3,553,000*
7	2,300	*167,000*	2,300	*167,000*
8	1,000	*75,000*	1,000	*75,000*
9	1,000	*75,000*	1,000	*75,000*
10	3,500	*281,000*	3,500	*281,000*
11	3,500	*281,000*	3,500	*281,000*
12	91,000	*2,681,000*	91,000	*2,681,000*
13	91,000	*2,681,000*	91,000	*2,681,000*
14	1,000	*281,000*	1,000	*281,000*
15	1,000	*281,000*	1,000	*281,000*
16	1,000	*281,000*	1,000	*281,000*
17	1,000	*281,000*	1,000	*281,000*
18	1,000	*281,000*	1,000	*281,000*
19	1,000	*281,000*	1,000	*281,000*
20	0	0	0	0
21	3,500	*156,000*	3,500	*156,000*

LUID = Land Use Identification (defined in **Table 4-1**)

The default values for both soqc and ioqc are identical for each LUID and were calibrated with identical values. **Table 4-10** and **Figure 4-13** summarize the statistical data associated with the calibrated model (SIM) as compared to the recorded values (OBS) for fecal coliform. The RAA Guidelines do not specify the model calibration criteria for bacteria, but it can be assumed the calibration would fall into very good as the percent difference is less than ten percent. The RMSE and C.C. will improve with the obtainment of additional data. The model calibration is based on data that was collected two times per year downstream of the RH/SGRWQG area. There are a lot of variables that influence stormwater runoff quality that cannot be simulated in a model, especially for bacteria. As additional data is collected through CIMP efforts in the RH/SGRWQG area, the model will be adjusted and the calibration statistics will demonstrate the simulated values more closely represent the observed values.

Table 4-10 Fecal Coliform Parameter Statistics

Parameter	RMSE	Linear Bias	C.C.
Fecal Coliform	829,717	8.7%	0.04

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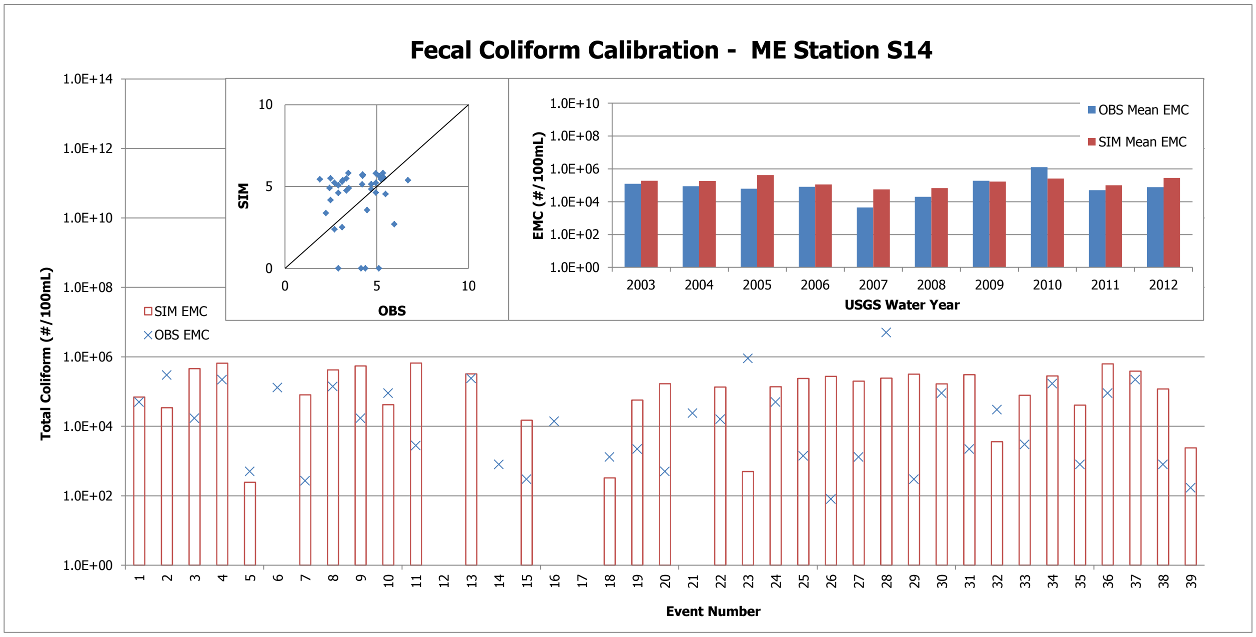

Figure 4-13 Fecal Coliform Calibration Statistics at Mass Emission Station S14

4.4.2.4 Total Nitrogen and Total Phosphorus Parameter Calibration

The LSPC model for GQUAL uses total nitrogen and total phosphorus. The model set-up for the RH/SGRWQG RAA has 12 individual modeling parameters for each of the general water quality parameters, two of which were selected as a calibration parameter. **Table 4-11** and **Table 4-12** summarize the calibration parameters including their default values (def) and calibration values (cal) used in the model runs for total nitrogen and phosphorus, respectively. The calibrated values are italicized in the table. The parameter definitions are as follows:

- acqop – accumulation rate on surface
- sqolim – maximum storage on surface

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Table 4-11 LSPC Calibrated Total Nitrogen Parameter Values

LUID	acqop		sqolim	
	def	cal	def	cal
1	0	*16.8*	0	*20.2*
2	0	*9.6*	0	*11.5*
3	0	*9.6*	0	*11.5*
4	0	*16.8*	0	*20.2*
5	0	*26.5*	0	*31.9*
6	0	*11.1*	0	*13.4*
7	0	*11.1*	0	*13.4*
8	0	*8.8*	0	*10.6*
9	0	*8.8*	0	*10.6*
10	0	*9.6*	0	*11.5*
11	0	*9.6*	0	*11.5*
12	0	*15.6*	0	*18.7*
13	0	*15.6*	0	*18.7*
14	0	*8.8*	0	*10.6*
15	0	*8.8*	0	*10.6*
16	0	*8.8*	0	*10.6*
17	0	*8.8*	0	*10.6*
18	0	*8.8*	0	*10.6*
19	0	*8.8*	0	*10.6*
20	0	0	0	0
21	0	*8.8*	0	*10.6*

LUID = Land Use Identification (defined in **Table 4-1**)

2

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Table 4-12 LSPC Calibrated Total Phosphorus Parameter Values				
LUID	**acqop**		**sqolim**	
	def	**cal**	**def**	**cal**
1	0	*1.23*	0	*1.47*
2	0	*0.70*	0	*0.84*
3	0	*0.70*	0	*0.84*
4	0	*1.23*	0	*1.47*
5	0	*1.94*	0	*2.33*
6	0	*0.82*	0	*0.98*
7	0	*0.82*	0	*0.98*
8	0	*0.65*	0	*0.78*
9	0	*0.65*	0	*0.78*
10	0	*0.70*	0	*0.84*
11	0	*0.70*	0	*0.84*
12	0	*1.14*	0	*1.37*
13	0	*1.14*	0	*1.37*
14	0	*0.65*	0	*0.78*
15	0	*0.65*	0	*0.78*
16	0	*0.65*	0	*0.78*
17	0	*0.65*	0	*0.78*
18	0	*0.65*	0	*0.78*
19	0	*0.65*	0	*0.78*
20	0	0	0	0
21	0	*0.65*	0	*0.78*

LUID = Land Use Identification (defined in **Table 4-1**)

The surface outflow quality concentrations for total nitrogen and total phosphorus were modified for impervious surfaces and were kept zero for the interflow parameters. **Table 4-13**, **Figure 4-14**, and **Figure 4-15** summarize the statistical data associated with the calibrated model (SIM) as compared to the recorded values (OBS) for total nitrogen and total phosphorus. The RAA Guidelines do not specify the model calibration criteria for these pollutants, but it can be assumed the calibration would fall into very good for total nitrogen as the percent differences are less than ten percent and good for total phosphorus as the percent differences are less than 20 percent. The RMSE and C.C. will improve with the obtainment of additional data. The model calibration is based on data that was collected two times per year downstream of the RH/SGRWQG area. There are a lot of variables that influence stormwater runoff quality that cannot be simulated in a model. As additional data is collected through CIMP efforts in the RH/SGRWQG area, the model will be adjusted and the calibration statistics will demonstrate the simulated values more closely represent the observed values.

Table 4-13 Total Nitrogen and Phosphorus Parameter Statistics			
Parameter	**RMSE**	**Linear Bias**	**C.C.**
Total Nitrogen	4.2	0.0%	0.04
Total Phosphorus	3.3	17.3%	-0.11

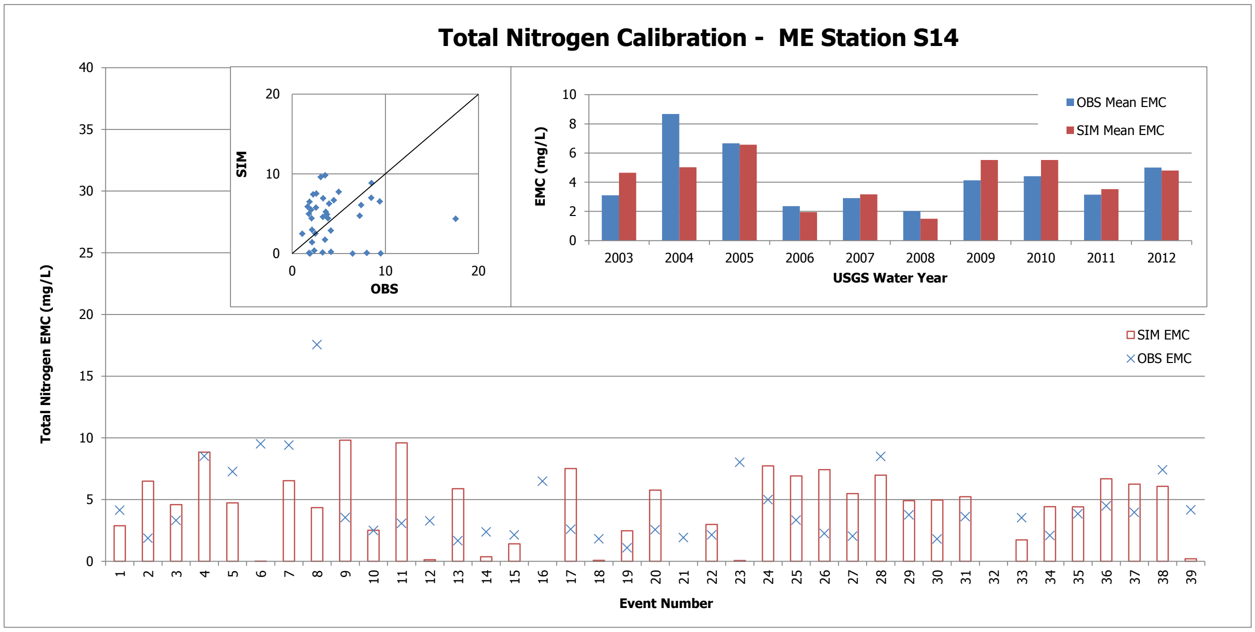

Figure 4-14 Total Nitrogen Calibration Statistics at Mass Emission Station S14

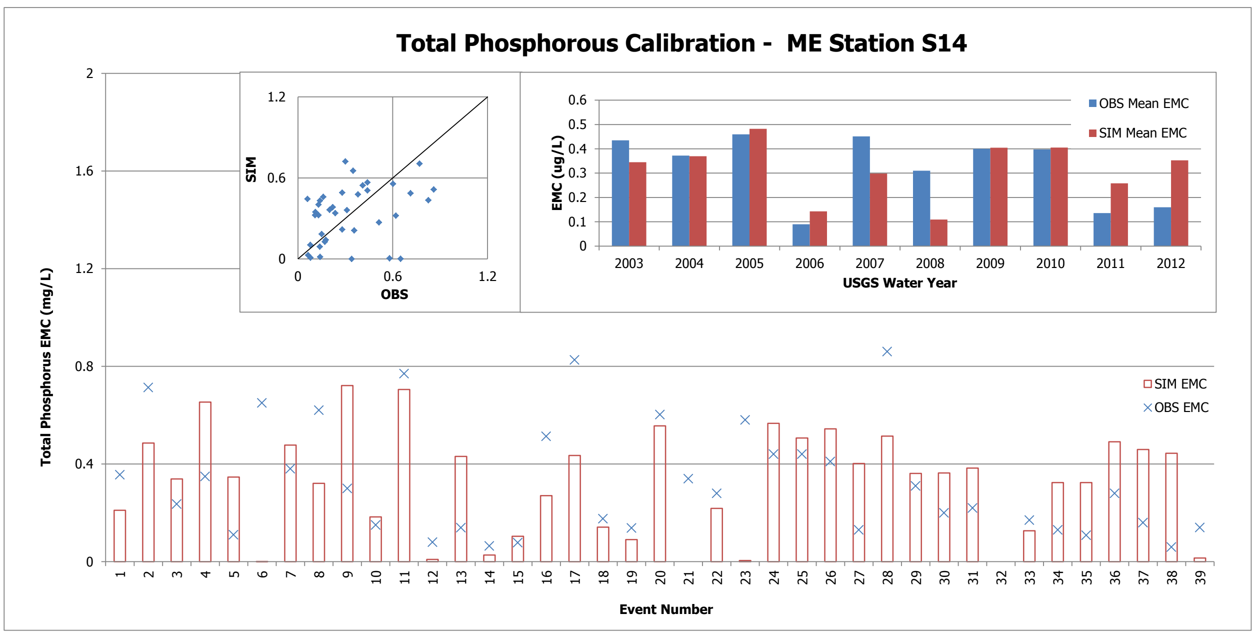

Figure 4-15 Total Phosphorus Calibration Statistics at Mass Emission Station S14

4.5 LSPC Validation

After the model was calibrated, validation of the model is recommended. Typical validation procedures would require water quality data from specific events that can be compared to the values simulated by the calibrated model. Water quality data is not currently available within the RH/SGRWQG; therefore validation was not performed. In future modeling efforts, consistent with the adaptive management process, water quality data collected through the CIMP efforts will be used to validate the model and then recalibrate the model if necessary.

4.6 Baseline Simulation

A baseline analysis was performed as part of the RH/SGRWQG 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 from 2002 to 2012. The water quality constituent mass loading is determined 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 **Attachment V**.

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 the extent that the estimated load reductions are satisfied. The load reductions represent the difference between the baseline conditions and the WQOs. The 85th percentile, 24-hour rainfall event baseline simulation is based on the LACFCD 85th percentile rainfall isohyets and unit hyetograph, consistent with the SUSMP and 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 determined from the LSPC output to be 679 and 392 acre-feet in the LAR and SGR Watersheds, respectively.

The 90th percentile load baseline is determined from the 2002-2012 water years based on the loads generated before any BMPs are implemented. **Table 4-14** and **Table 4-15** summarize the results of the LSPC simulation of the load analysis for the LAR and SGR Watersheds, respectively. The table demonstrates the 90th percentile load exceeds the WQO for most constituents with associated TMDLs. The objective loads are the final target for the simulated constituents. The objective load is equivalent to the objective concentration multiplied by the simulated storm event volume from the 90th percentile date and does not represent measured water quality data.

Table 4-14 90th Percentile Baseline Load Analysis for LAR Watershed

Constituent	Storm Event	P_{90} Load	Objective Load	Objective Conc.
Copper	1/25/2008	177.08 kg	13.94 kg	8.92 µg/L
Lead	1/25/2008	85.48 kg	83.69 kg	53.54 µg/L
Zinc	1/25/2008	696.84 kg	135.85 kg	86.90 µg/L
Fecal Coliform	2/15/2005	1.08E+15 MPN	4.48E+13 MPN	235 MPN/100 mL
Nitrogen	2/18/2005	23,711.81 kg	13,034.86 kg	10.10 mg/L
Phosphorus	2/18/2005	1,738.13 kg	1,273.53 kg	0.80 mg/L

Table 4-15 90th Percentile Baseline Load Analysis for SGR Watershed

Constituent	Storm Event	P_{90} Load	Objective Load	Objective Conc.
Copper[1]	2/27/2010	102.56 kg	61.16 kg	71.12 µg/L
Lead	2/27/2010	49.13 kg	7.17 kg	8.34 µg/L
Zinc[1]	2/27/2010	431.17 kg	551.19 kg	641.00 µg/L

[1] The objective concentration and load are based on Municipal Action Limits, as wet-weather WQOs are not specified in the SGR Metals TMDL.

Table 4-16 summarizes the results of the LSPC simulation for water years beginning the first day of October and ending the final day of September from 2002 to 2012. The table compares the major water quality constituents with adopted TMDLs and 303(d) listings and identifies the annual load and corresponding volume for each year analyzed. The average annual loads are also provided for the simulation period.

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Table 4-16 Annual Loads and Volume for the LAR and SGR Watersheds

Start	End	Volume (ac-ft)	Copper (kg)	Lead (kg)	Zinc (kg)	Fecal Coliform (MPN)	Total Nitrogen (kg)	Total Phosphorus (kg)
LAR Watershed								
10/1/02	9/30/03	13,455.13	2,213.50	1,079.93	8,889.20	9.67E+15	321,110.58	23,552.75
10/1/03	9/30/04	7,947.85	1,397.38	682.32	5,641.82	7.23E+15	213,397.26	15,647.31
10/1/04	9/30/05	49,128.66	5,076.26	2,463.45	20,268.04	3.42E+16	699,191.36	51,291.58
10/1/05	9/30/06	12,448.30	2,030.84	995.67	8,248.96	1.99E+16	323,135.72	23,686.61
10/1/06	9/30/07	3,638.94	805.36	396.27	3,368.67	5.66E+15	156,509.11	11,460.76
10/1/07	9/30/08	13,693.84	1,884.41	922.03	7,716.37	3.89E+15	309,645.23	22,692.74
10/1/08	9/30/09	7,204.75	1,242.49	610.10	5,175.80	4.51E+15	232,630.50	17,036.75
10/1/09	9/30/10	13,717.59	1,968.27	964.26	8,124.14	3.84E+15	342,817.44	25,114.70
10/1/10	9/30/11	21,975.74	2,633.73	1,289.39	10,875.51	2.83E+16	454,322.43	33,283.18
10/1/11	9/30/12	5,126.20	1,239.26	607.59	5,106.35	4.96E+15	220,065.74	16,123.44
	Average Annual:	**15,912.31**	**2,139.14**	**1,044.82**	**8,700.95**	**1.22E+16**	**339,195.52**	**24,862.93**
SGR Watershed								
10/1/02	9/30/03	9,198.04	1,330.42	615.35	5,499.65	-	-	-
10/1/03	9/30/04	5,053.69	794.75	367.18	3,285.80	-	-	-
10/1/04	9/30/05	32,982.35	2,846.76	1,340.38	11,779.96	-	-	-
10/1/05	9/30/06	8,614.78	1,172.57	555.72	4,878.97	-	-	-
10/1/06	9/30/07	1,928.48	385.22	185.70	1,652.00	-	-	-
10/1/07	9/30/08	10,571.09	1,201.83	567.41	4,968.47	-	-	-
10/1/08	9/30/09	5,108.78	715.49	344.23	3,018.69	-	-	-
10/1/09	9/30/10	10,030.35	1,103.61	529.97	4,668.31	-	-	-
10/1/10	9/30/11	14,079.24	1,454.30	695.73	6,127.57	-	-	-
10/1/11	9/30/12	3,460.53	678.13	326.33	2,876.05	-	-	-
	Average Annual:	**10,840.76**	**1,222.77**	**577.96**	**5,097.71**	**-**	**-**	**-**

4.7 Volume and Load Reduction Requirements

The RH/SGRWQG RAA examines the 85th percentile, 24-hour storm event volume and the 90th percentile constituent load to determine the limiting pollutant and the corresponding volumes of treatment. The limiting pollutant is the constituent with the highest mass load associated with a relevant TMDL. This subsection discusses the limiting pollutant determination, 85th percentile, 24-hour storm volume, and the 90th percentile, 24-hour storm load. These factors dictate the control measure implementation requirements. Determination of the limiting pollutant requires determining the volumes and loads associated with the 85th percentile, 24-hour runoff volume and the 90th percentile load for baseline conditions. Once these values are determined, the limiting pollutant can be determined.

4.7.1 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 determine the appropriate rainfall value for each subarea within the RH/SGRWQG. The total rainfall for each subarea was distributed temporally over the 24-hour period using the LAC 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 determine runoff volumes to compare the 90th percentile load volumes on an equal basis. Another analysis was done using the LACDPW T_c (time of concentration) Calculator, developed to simplify use of the modified rational method. The results from LSPC and the T_c 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 4-16** and **Figure 4-17** show the rainfall hyetograph of the 85th percentile, 24-hour storm event, along with the associated runoff hydrograph for the LAR Watershed and SGR Watershed within RH/SGRWQG, respectively. The total runoff volume for the 85th percentile, 24-hour storm event is 679 and 392 acre-feet in the LAR and SGR Watersheds, respectively.

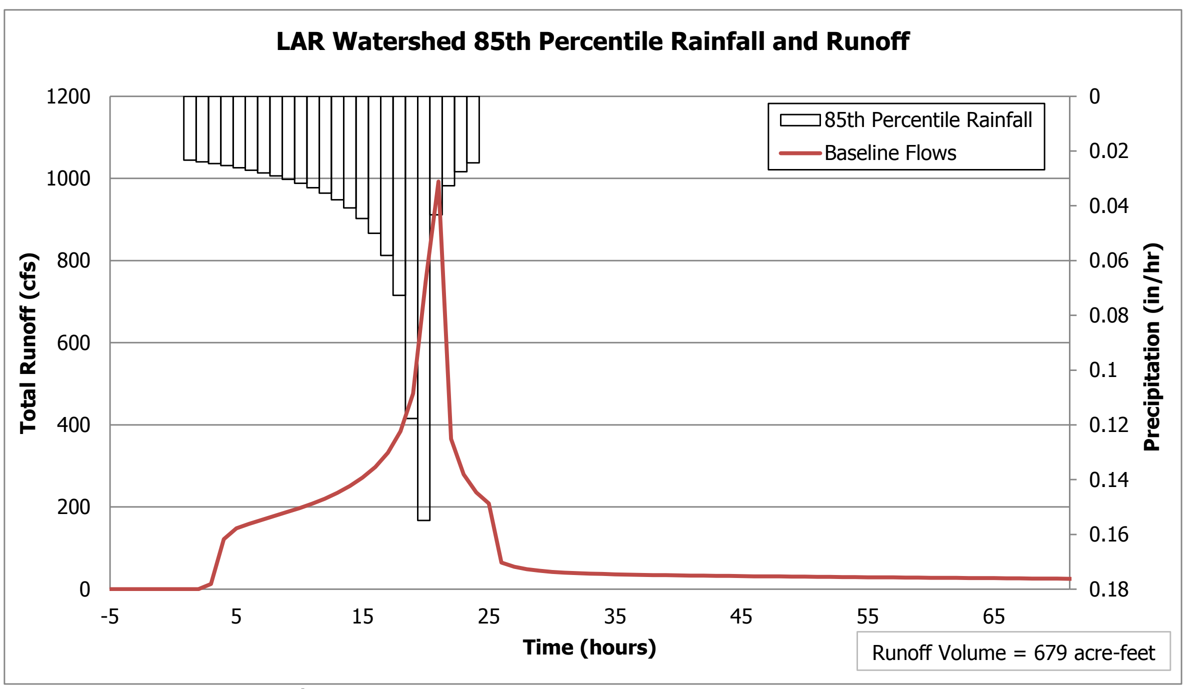

Figure 4-16 LAR 85th Percentile, 24-Hour Storm Hyetograph and Runoff Hydrograph

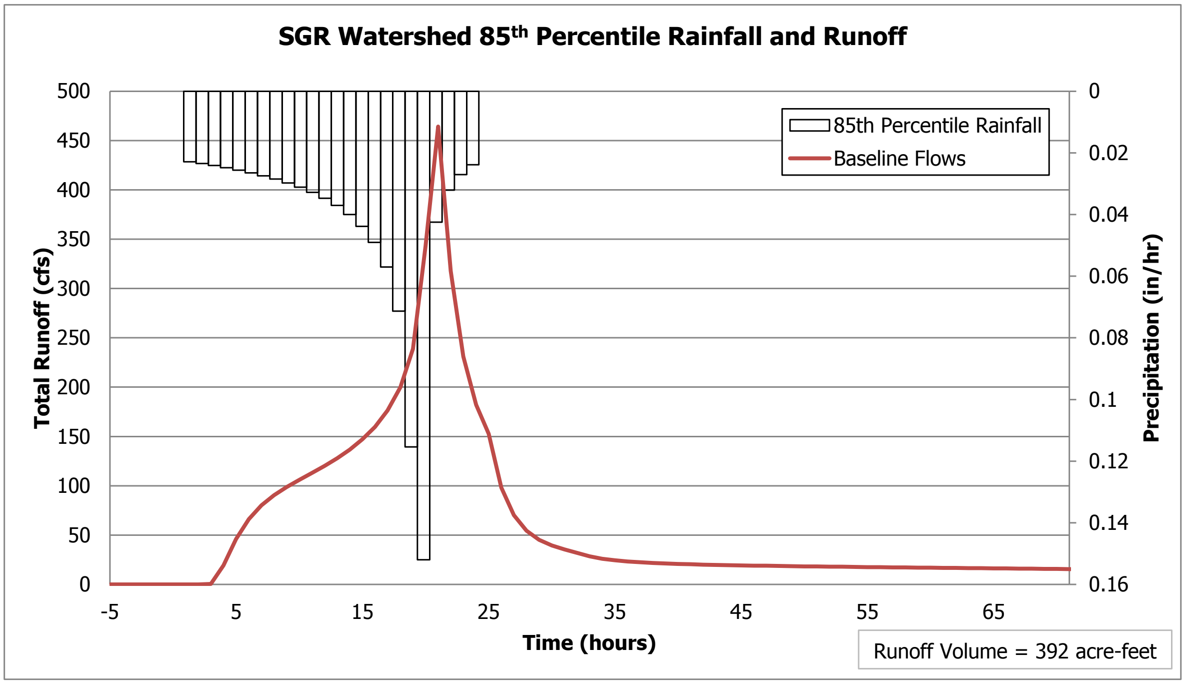

Figure 4-17 SGR 85th Percentile, 24-Hour Storm Hyetograph and Runoff Hydrograph

4.7.2 90th Percentile, 24-Hour Storm Event Constituent Load

Development of the 90th percentile load analysis required analyzing model output following a five step process. The steps in the process are provided below:

1. Evaluated 90th percentile load based on percentile analysis
2. Evaluated 87th through 93rd percentile loads, storm events, volumes, and concentrations
3. Analyzed statistics of these events due to the large range in volume and concentrations providing similar loads
4. Picked storm events for use in determining volumes for capture based on median and mean volumes and concentrations from the 87th through 93rd percentile events
5. Evaluated the 85th percentile, 24-hour volumes and 90th percentile load volumes for similarity

Selection of the storms utilizing this process provides a sound criterion for compliance by evaluating the range in volumes, concentrations, and loads to provide a treatment volume that has the potential to meet the criteria for the 85th percentile, 24-hour event and 90th percentile load reduction. The variability in the data shows that selecting a storm is an important step in the analysis process. By selecting the appropriate storm, flows that exceed the capture volume will mainly have pollutant concentrations below the TMDL concentration limits due to dilution of remaining pollutants. The details of the selection process are provided in the following paragraphs. The results of the analysis are provided later to demonstrate compliance and the reasonableness of the approach.

The 90th percentile, 24-hour constituent load represents the daily water quality constituent load in kilograms that is greater than 89 percent of all simulated loads at the output station. Only one output station was used for both watersheds because there is only one mass emissions station downstream.

The method for determining the 90th percentile load was to sort all flow days greater than 260 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 San Gabriel River Metals and Impaired Tributaries Metals and Selenium TMDL. This same method was used for the

LAR Watershed as the Los Angeles River Metals TMDL only specifies flow criteria at the Wardlow station which is in Long Beach and not included in the calibrated model. Any flow days less than 260 cfs at Station F263 are considered dry-weather flows in the TMDL and were removed from the analysis and treated separately. Flow days greater than 260 cfs have simulated constituent loads in concentration units associated with model storm events and storm volume was determined from the runoff hydrograph. The daily mass loads are the product of the simulated storm volume and simulated hourly constituent concentration for RH/SGRWQG flows. The 90th percentile load is determined from the simulated daily load. Concentration units range from micrograms per liter (µg/L) for metal constituents to milligrams per liter (mg/L) for nitrogen and phosphorus to number per liter (MPN/L) for fecal coliform. The volume capture for the 90th percentile load was determined on the day of the actual event plus the following day if flows were greater than 260 cfs on the second day.

Baseline simulations were run with no storm runoff volume reduction. **Table 4-17** and **Table 4-18** summarize the water quality constituents and the date of the 90th percentile event derived from the simulated model results following the criteria previously outlined for the LAR and SGR Watersheds, respectively. The volume associated with the 90th percentile load is shown along with the expected concentrations and loads.

Table 4-17 90th Percentile Constituent Load Events in the LAR Watershed

Constituent	Date	Volume[1] (ac-ft)	Concentration[2]		Load[3]	
			Units	Expected	Units	Expected
Copper	1/25/2008	1,267.30	µg/L	113.35	kg	177.08
Lead	1/25/2008	1,267.30	µg/L	54.72	kg	85.48
Zinc	1/25/2008	1,267.30	µg/L	446.05	kg	696.84
Fecal Coliform	2/15/2005	154.49	MPN/100 mL	5.64E+06	MPN	1.08E+15
Total Nitrogen	2/18/2005	1,290.58	mg/L	14.90	kg	23,711.81
Total Phosphorus	2/18/2005	1,290.58	mg/L	1.09	kg	1,738.13

[1] 24-hour volume.
[2] Concentration is the LSPC modeled value using the storm runoff hydrograph for the date specified.
[3] Expected loads equal the concentration multiplied by the volume of storm runoff.

Table 4-18 90th Percentile Constituent Load Events in the SGR Watershed

Constituent	Date	Volume[1] (ac-ft)	Concentration[2]		Load[3]	
			Units	Expected	Units	Expected
Copper	2/27/2010	697.12	µg/L	119.27	kg	102.56
Lead	2/27/2010	697.12	µg/L	57.14	kg	49.13
Zinc	2/27/2010	697.12	µg/L	501.43	kg	431.17

[1] 24-hour volume.
[2] Concentration is the LSPC modeled value using the storm runoff hydrograph for the date specified.
[3] Expected loads equal the concentration multiplied by the volume of storm runoff.

4.7.3 Limiting Pollutant Determination

The limiting pollutant idea is the concept that if the constituent with the highest loads or that is most difficult to treat is captured and treated, all other constituent requirements will be achieved. Meeting MS4 Permit WQOs in the RH/SGRWQG 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 required within a limited timeframe.

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The RH/SGRWQG is tributary to three main water bodies, the Rio Hondo, Peck Road Park Lake, and the SGR. Peck Road Park Lake discharges into the Rio Hondo and ultimately into the LAR and is part of the LAR Watershed. The results of the 90th percentile constituent loads presented in **Table 4-17** show that the 90th percentile volume associated with total nitrogen is the greatest. Typically this would be the limiting pollutant; however, total nitrogen is only considered a water quality priority because of the Los Angeles Area Lakes TMDL. The USEPA established total phosphorus and total nitrogen WQOs based on an LSPC model and found that they "are equal to existing loading rates because no reduction in loading is required" (USEPA, 2012). The CIMP monitoring will be used in the future to verify the USEPA findings and until then it is assumed that addressing other pollutants will reduce the nitrogen loading delivered to the lake from the MS4. Zinc is used as the limiting priority pollutant within the RH/SGRWQG and the LAR Watershed based on the Los Angeles River Metals TMDL. The portion of the RH/SGRWQG within the SGR Watershed must address lead as the limiting pollutant, associated with the San Gabriel River Metals and Impaired Tributaries Metals and Selenium TMDL.

The loads in the Rio Hondo and SGR are influenced by both the flow volume and constituent concentrations. A large storm with low concentrations may create a load equal to a small storm with high concentrations. The 87th through 93rd percentile events for zinc and lead were evaluated for the LAR and SGR Watersheds, respectively, to determine the statistical range of volumes and loads at the model outlet to see which events produced regional rainfall and volumes for the watershed. **Table 4-19** and **Table 4-20** show the events analyzed for the LAR and SGR Watersheds, respectively. The tables also show 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 tables show the numerically selected 90th percentile load. Similar tables for metal constituents and fecal coliform are provided in **Attachment W**. The analysis for fecal coliform is slightly different than it was for metals, as bacteria TMDLs allow a specified number of exceedance days and exclude High Flow Suspension (HFS) days. HFS days are days where 0.5-inches of rainfall occur. For the 90th percentile load analysis, the data is sorted as previously described and then the HFS days are removed. The allowable exceedance days are then removed from the data set. The remaining data points are used to determine the 90th percentile load event, which explains why the data ranging from the 87th to 93rd percentile is not as abundant.

Table 4-19 Limiting Pollutant Percentile Loads for LAR Watershed Storm Events

Date	Flow (cfs)	Volume (ac-ft)	Concentration (µg/L)	Zinc Load (kg)	Percentile
1/18/2010	509.82	1,011.22	648.25	808.57	93rd
2/27/2010	569.22	1,129.03	564.32	785.89	↓
4/13/2012	305.79	606.53	1,045.62	782.27	
1/25/2008	**638.93**	**1,267.30**	**445.78**	**696.84**	
2/6/2010	577.22	1,144.89	457.68	646.34	
2/18/2005	650.67	1,290.58	405.27	645.15	
11/26/2008	412.14	817.47	633.24	638.52	
11/8/2002	416.39	825.90	621.77	633.42	87th

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Table 4-20 Limiting Pollutant Percentile Loads for SGR Watershed Storm Events

Date	Flow (cfs)	Volume (ac-ft)	Concentration (µg/L)	Lead Load (kg)	Percentile
12/28/2004	423.47	839.94	52.21	54.06	93^{rd}
11/30/2007	160.15	317.66	137.87	53.99	
1/25/2008	399.13	791.66	53.80	52.50	
3/16/2003	336.26	666.95	63.74	52.41	
2/27/2010	**349.83**	**693.88**	**56.99**	**48.75**	
1/20/2010	292.35	579.87	60.27	43.08	
1/18/2010	279.95	555.27	61.70	42.24	
12/15/2008	234.08	464.30	71.76	41.07	87^{th}

Statistical analysis of the data shown in **Table 4-19** and **Table 4-20** provided the data shown in **Table 4-21** and **Table 4-22**, respectively. **Table 4-21** and **Table 4-22** include statistical values for both loads and volumes which were used in selecting the final modeled storm event for analysis of the 90^{th} percentile load for MS4 Permit compliance evaluation. The statistical analyses for all metal constituents are provided in **Attachment W**.

Table 4-21 Percentile Load Statistics for LAR Watershed Storm Events

Statistical Analysis	Volume (ac-ft)	Zinc Load (kg)
Mean	1,011.62	704.63
Standard Error	85.67	26.68
Median	1,070.13	671.59
Standard Deviation	242.32	75.47
Sample Variance	58,717.41	5,696.04
Kurtosis	-0.89	-2.09
Skewness	-0.51	0.47
Range	684.05	175.15
Minimum	606.53	633.42
Maximum	1,290.58	808.57
95% Confidence Range for Mean	335.83	104.60

Table 4-22 Percentile Load Statistics for SGR Watershed Storm Events

Statistical Analysis	Volume (ac-ft)	Lead Load (kg)
Mean	613.69	48.51
Standard Error	60.74	1.96
Median	623.41	50.58
Standard Deviation	171.81	5.56
Sample Variance	29,519.32	30.87
Kurtosis	-0.23	-2.09
Skewness	-0.44	-0.40
Range	522.28	12.99
Minimum	317.66	41.07
Maximum	839.94	54.06
95% Confidence Range for Mean	238.12	7.70

The values in the tables show the wide range of variability. Based on the results of the statistical analysis and engineering judgement, the storm from January 25, 2008, was chosen to represent the 90th percentile load event in the RH/SGRWQG within the LAR Watershed and the storm from February 27, 2010, was chosen for the SGR Watershed. The storm that generated this volume and load was spatially consistent over the entire watershed. The value for volumes and loads for both the LAR and SGR Watersheds fall well within the 95 percent confidence interval. The volume generated is also greater than the 85th percentile, 24-hour storm volume for both watersheds.

4.8 Volume and Load Reduction Strategies

Various load reduction strategies were used to demonstrate compliance through the RAA including non-structural and structural BMPs. Control measures are implemented strategically throughout the compliance period at specific time steps so that the interim and final WQOs are met. The three control measures that are the focus of the volume and load reduction strategy are MCMs, regional projects, and distributed BMPs (green streets). 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 of a planning, engineering, and design effort. The proposed control measures are detailed in **Section 3.4**.

The MCMs were not modeled; rather a five percent load reduction was distributed throughout the implementation timeframe. The majority of the regional projects are modeled as volume reduction BMPs, which remove the hydrologic and constituent loads that are associated with the volume of stormwater runoff tributary to the BMP before it reaches the receiving water. The simulation reflects the reduced volume and mass loading by removing the area treated by the regional BMPs from the LSPC model when the BMP is designed to capture and retain the 85th percentile, 24-hour storm volume (regional EWMP projects). When the BMP does not retain the entire 85th percentile, 24-hour storm volume it is considered a regional project and modeled by reducing the land use loading in the area tributary to the project. Distributed BMPs (green streets) are modeled using the same methods as regional BMPs.

4.9 Pollutant Load Reductions

This subsection presents the results of the RAA based on the implementation schedule, which is discussed in detail in **Section 5**. To demonstrate compliance, the baseline analysis was used to

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determine the existing water quality conditions. The load reduction was estimated and appropriate control measures were scheduled for implementation so that the WQOs would be satisfied at each of the applicable milestone dates. As discussed in **Section 4. 7.3**, the limiting pollutant for the LAR Watershed is zinc and for the SGR Watershed it is lead. By demonstrating compliance with the limiting pollutant, compliance will be achieved for all other pollutants. **Table 4-23** and **Table 4-24** summarize the load reductions for zinc and lead, in the LAR and SGR Watersheds, respectively, due to control measure implementation based on the schedule defined in **Section 5**. The table demonstrates that compliance will be met at each of the milestones as the load reduction is equal to the target load reduction. The structural control measures to be implemented are illustrated in **Figure 4-18**. The load reductions for all other pollutants are provided in **Attachment X**. The load reductions associated with regional and distributed BMPs assumes an average infiltration rate for the region. The load reductions due to BMP implementation were determined by identifying the volume of flow that would be captured and infiltrated and equating that volume to a load based on the anticipated concentration.

Table 4-23 Zinc Load Reduction Based on Control Measure Implementation in the LAR Watershed

Control Measure Implementation	Zinc Load Reduction (kg)	
	2024 (50% Metals)	**2028 (100% Metals)**
Enhanced MCMs	35.20	35.20
New and Re-Development	4.28	16.44
Green Streets	207.50	543.76
Regional BMPs		
Recreation Park	6.73	6.73
Sierra Vista Park	11.76	11.76
Arboretum of LAC	7.14	7.14
Royal Oaks Trail (LAR)	35.86	35.86
L. Garcia Park	15.07	15.07
Eisenhower Park	24.88	24.88
Target Load Reduction:	348.42	696.84
Total Load Reduction:	348.42	696.84
Percent of Final Target:	50%	100%

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Table 4-24 Lead Load Reduction Based on Control Measure Implementation in the SGR Watershed

Control Measure Implementation	Lead Load Reduction (kg)			
	2017 (10% Metals)	2020 (35% Metals)	2023 (65% Metals)	2026 (100% Metals)
Enhanced MCMs	2.45	2.45	2.45	2.45
New and Re-Development	0.16	0.40	0.63	0.89
Green Streets	2.30	13.53	24.32	41.26
Regional BMPs				
LADWP Easement	-	0.34	0.34	0.34
Encanto Park	-	0.48	0.48	0.48
Memorial Park (Azusa)	-	-	1.21	1.21
Royal Oaks Trail (SGR)	-	-	2.50	2.50
Target Load Reduction:	4.91	17.20	31.93	49.13
Total Load Reduction:	4.91	17.20	31.93	49.13
Percent of Final Target:	10%	35%	65%	100%

The pollutant loads associated with the selected storm events capture the 90th percentile load. The selected event also captures many of the smaller more intense storms with similar loads, but lower volumes. The volumes captured and treated will meet the 85th percentile, 24-hour volume and 90th percentile load criteria. Meeting both criteria provides a reasonable assurance that WQOs will be met. Many of the events that exceed the capture volumes proposed in this plan will have lower concentrations due to the wash-off of pollutants for runoff less than the capture volume and diluted concentrations for the constituents that remain after capturing the volumes related to the 90th percentile load criteria.

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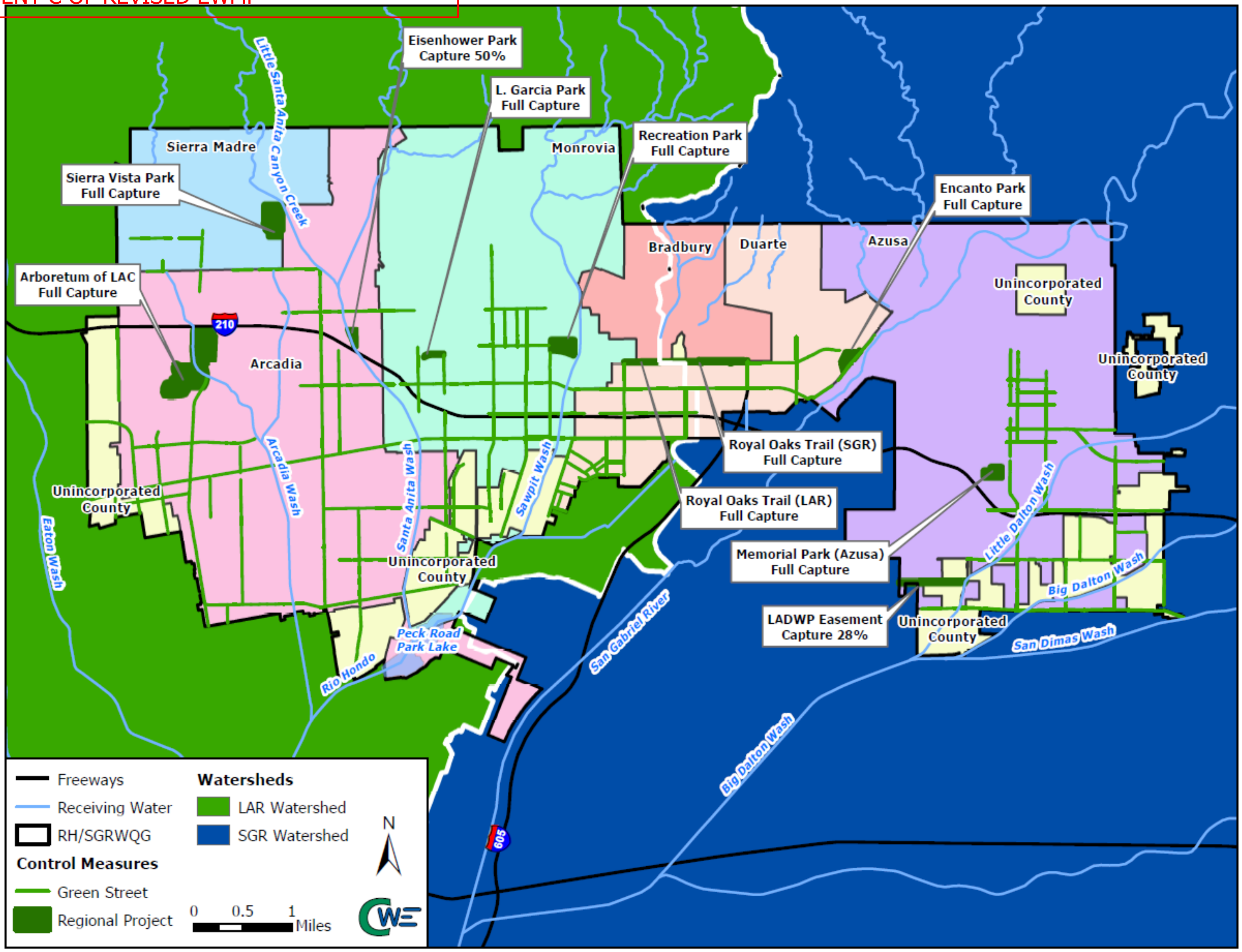

Figure 4-18 Implementation Summary

Figure 4-19, **Figure 4-20**, and **Figure 4-21** illustrate the volume, load, and concentration frequency curves respectively for the LAR Watershed while **Figure 4-22**, **Figure 4-23**, and **Figure 4-24** provide the same illustrations for the SGR Watershed. The curves demonstrate the baseline conditions along with the anticipated volume, load, and concentration once all control measures identified in the EWMP are implemented. These curves demonstrate that less than ten percent of the time the volume, load, and concentration will be in excess of zero. During all other events the flows will be captured and infiltrated and without discharge there is no volume, load, or concentration. In some instances (less than 10 percent of the time) the volume of flow exceeds the volume captured by the proposed projects. These curves demonstrate the model results are based on and meet the 90th percentile critical condition.

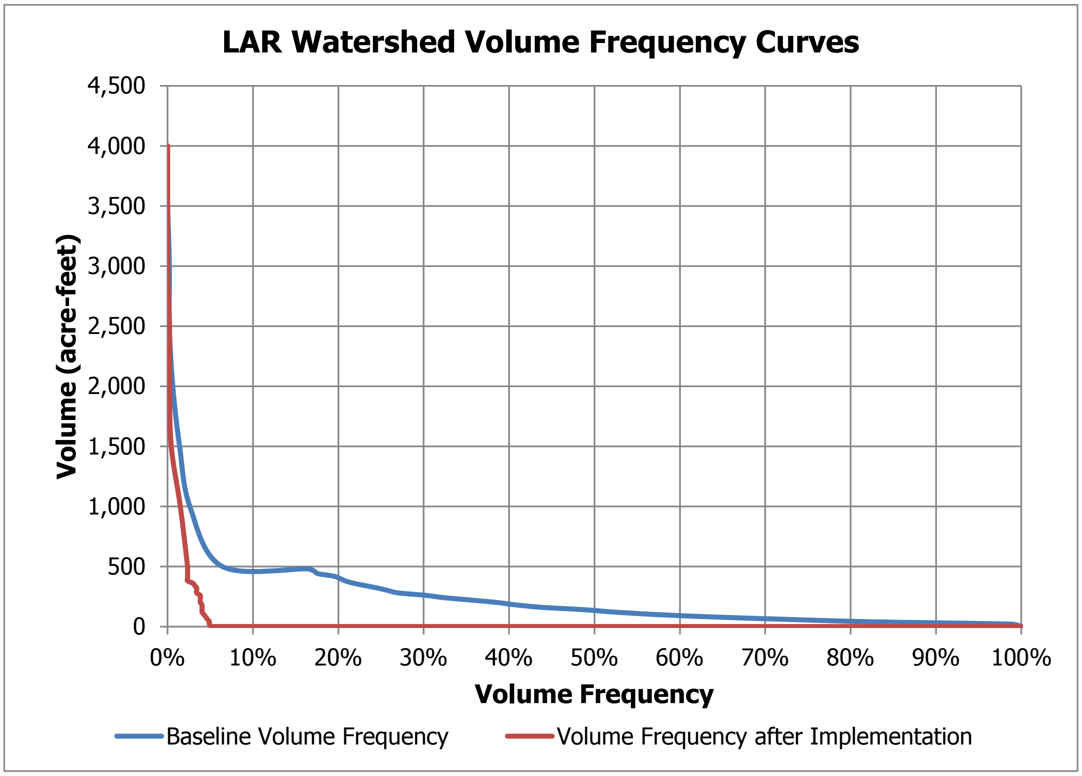

Figure 4-19 LAR Watershed Volume Frequency Curves

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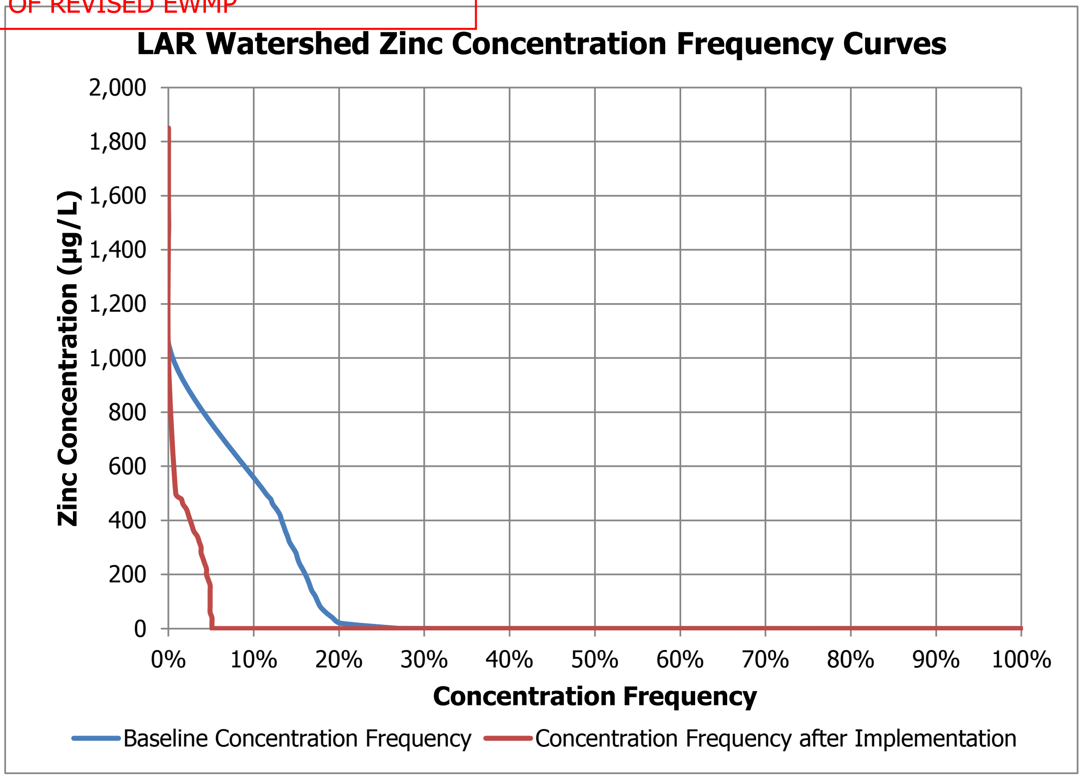

Figure 4-20 LAR Watershed Zinc Concentration Frequency Curves

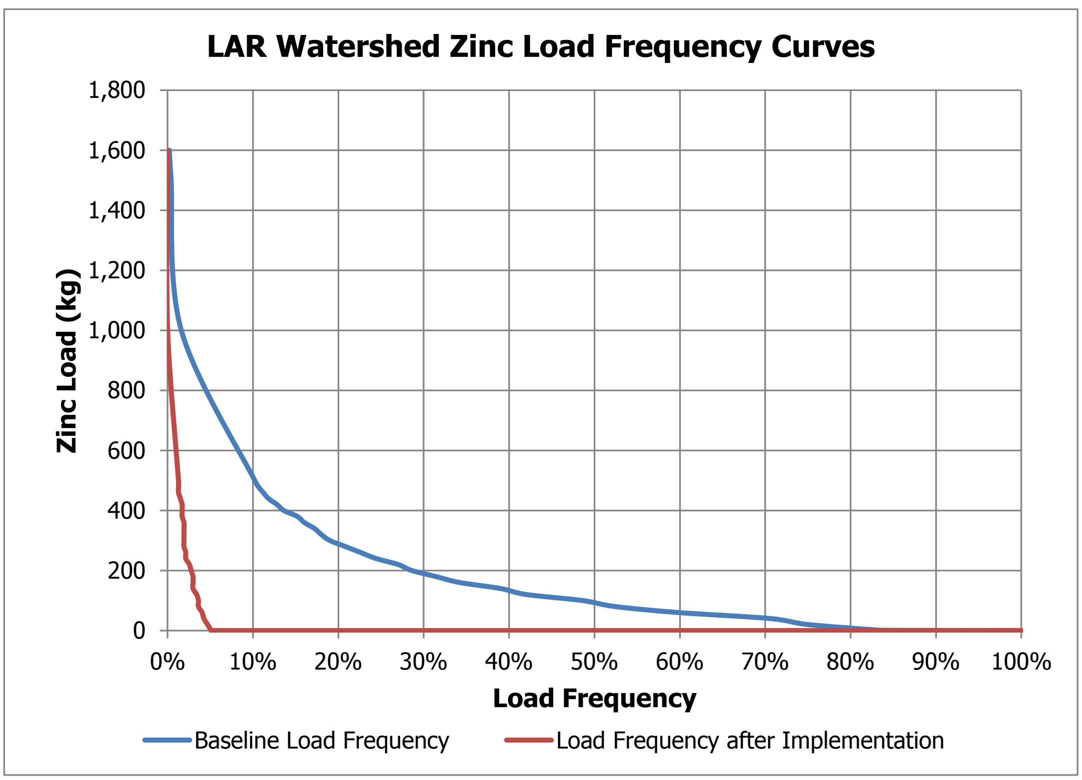

Figure 4-21 LAR Watershed Zinc Load Frequency Curves

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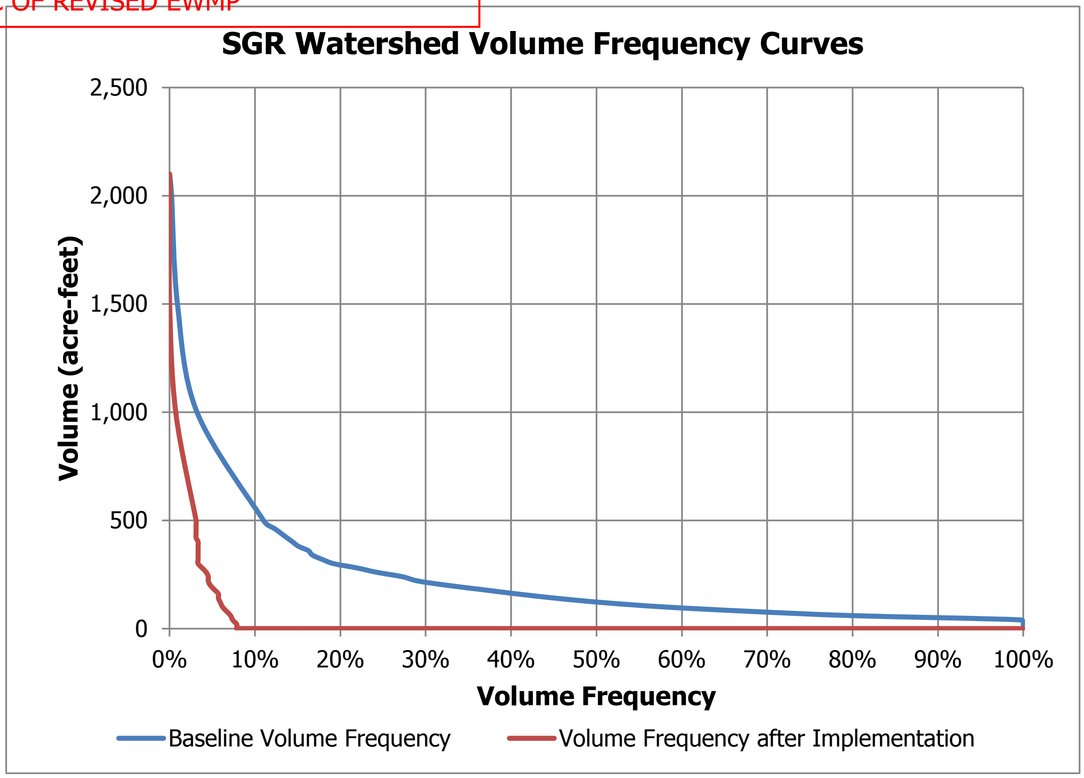

Figure 4-22 SGR Watershed Volume Frequency Curves

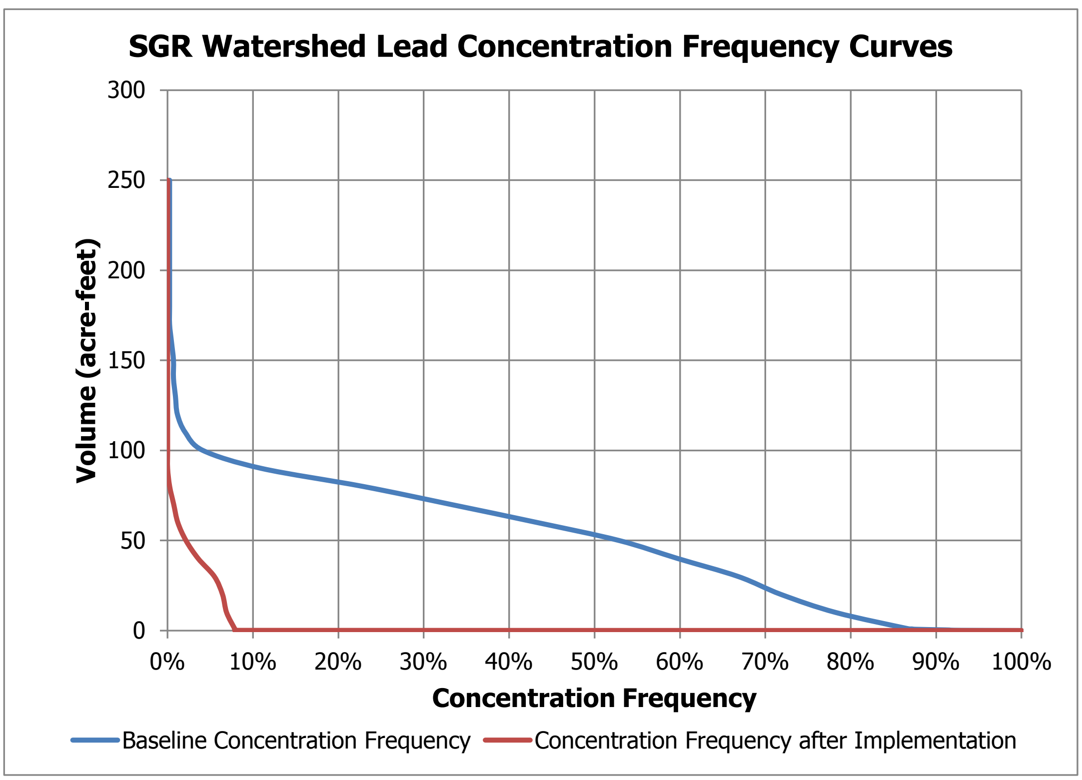

Figure 4-23 SGR Watershed Lead Concentration Frequency Curves

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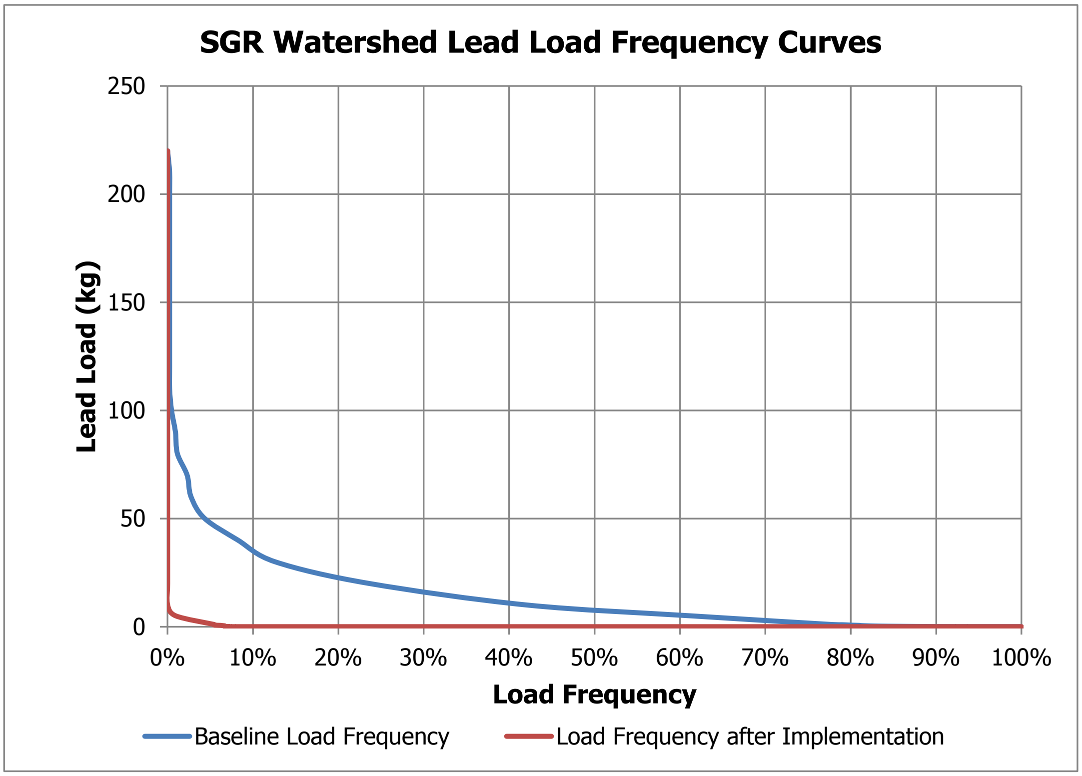

Figure 4-24 SGR Watershed Lead Load Frequency Curves

The average annual stormwater runoff volume based on the model was determined each year between 2002 and 2011. **Table 4-25** and **Table 4-26** summarize the average annual volume each year along with the average annual captured volume based on control measure implementation for the LAR and SGR Watersheds, respectively.

Table 4-25 Average Annual Volume Summary for the LAR Watershed

Start	End	Year	Total Volume (acre-feet)	Captured Volume (acre-feet)			
				Regional Projects	Green Streets	LID	Total
10/1/01	9/30/02	2002	16,317	1,609	7,586	6,242	15,437
10/1/02	9/30/03	2003	13,463	1,395	6,640	4,548	12,583
10/1/03	9/30/04	2004	7,953	888	3,891	3,174	7,953
10/1/04	9/30/05	2005	49,158	5,949	21,551	9,533	37,033
10/1/05	9/30/06	2006	12,456	1,290	6,069	5,097	12,456
10/1/06	9/30/07	2007	3,641	331	1,639	1,671	3,641
10/1/07	9/30/08	2008	13,702	1,459	7,877	4,061	13,397
10/1/08	9/30/09	2009	7,209	670	3,988	2,551	7,209
10/1/09	9/30/10	2010	13,726	1,435	7,614	4,677	13,726
10/1/10	9/30/11	2011	21,989	2,341	9,499	6,309	18,149
		Average:	**15,961**	**1,737**	**7,635**	**4,786**	**14,158**

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Table 4-26 Average Annual Volume Summary for the SGR Watershed

Start	End	Year	Total Volume (acre-feet)	Captured Volume (acre-feet)			
				Regional Projects	Green Streets	LID	Total
10/1/01	9/30/02	2002	11,187	862	5,582	4,213	10,657
10/1/02	9/30/03	2003	9,180	703	4,788	3,160	8,651
10/1/03	9/30/04	2004	5,047	366	2,803	1,878	5,047
10/1/04	9/30/05	2005	32,904	2,686	14,967	6,292	23,945
10/1/05	9/30/06	2006	8,601	590	4,766	3,245	8,601
10/1/06	9/30/07	2007	1,924	152	954	818	1,924
10/1/07	9/30/08	2008	10,540	770	5,700	2,597	9,067
10/1/08	9/30/09	2009	5,098	407	2,899	1,792	5,098
10/1/09	9/30/10	2010	10,004	797	5,983	3,019	9,799
10/1/10	9/30/11	2011	14,036	1,275	6,222	3,431	10,928
		Average:	**10,852**	**861**	**5,466**	**3,045**	**9,372**

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5. Proposed 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, otherwise established as part of this EWMP. The applicable milestone dates are summarized in **Table 1-6** and **Table 2-10**. Zinc is the priority pollutant for the LAR Watershed side of the RH/SGRWQG, while lead is the priority pollutant for the SGR Watershed side. Based on the priority pollutants, the milestone dates are related to the Los Angeles River Metals TMDL and San Gabriel River Metals and Impaired Tributaries Metals and Selenium TMDL. This section outlines the proposed control measure implementation schedule related to the proposed non-structural BMPs, regional projects, and distributed BMPs (green streets) discussed in **Section 3.4**. The actual schedule will depend on the amount and types of funding the group is able to secure.

5.1 Non-Structural BMPs

As discussed in **Section 3.4.1**, non-structural BMPs and the LID programs that will be implemented and were evaluated in the RAA include enhanced MCMs, other non-structural BMPs such as the various senate bills that have been approved, 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 3-20**.

5.2 Regional Projects

The regional projects modeled for the LAR Watershed portion of the RH/SGRWQG RAA are scheduled to be addressed prior to the 2024 interim metals TMDL milestone (50 percent). It is proposed that the SGR Watershed will address two regional projects prior to the 2020 interim metals TMDL milestone (35 percent) and the other two projects before the 2023 interim metals TMDL milestone (65 percent). **Table 5-1** summarizes the anticipated project timeline including the design, environmental permitting, bid, and construction phases for the regional projects in the LAR and SGR Watersheds. Operation and maintenance (O&M) of each of the projects will begin following construction.

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Table 5-1 Proposed Regional Project Timeline

Regional Project	Design (years)	Environmental Permitting[1] (years)	Bid (months)	Construction (years)	Low Range Total Time (years)	High Range Total Time (years)	Completion Year
LAR Watershed							
Recreation Park	1	1	6	1.50	3.00	4.00	2020
Arboretum of LAC	1	1	6	2.25	3.75	4.75	2021
Sierra Vista Park	1	1	6	0.75	2.25	3.25	2020
Royal Oaks Trail (LAR)	2	1	6	5.00	7.50	8.50	2023
L. Garcia Park	2	1	6	3.25	5.75	6.75	2024
Eisenhower Park	2	1	6	5.00	7.50	8.50	2024
SGR Watershed							
LADWP Easement	1	1	6	1.00	2.50	3.50	2020
Encanto Park	1	1	6	2.25	3.75	4.75	2020
Memorial Park (Azusa)	2	1	6	5.00	7.50	8.50	2023
Royal Oaks Trail (SGR)	2	1	6	5.00	7.50	8.50	2023

[1] Environmental permitting may be done before or concurrent with the design phase.

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Additionally, each of the projects will need to be replaced after the end of the expected life cycle. Underground storage systems that utilize Steel Reinforced Polyethylene (SRPE) cisterns will need to be replaced approximately every 30 years, while concrete or aboveground systems can wait approximately 50 years. To minimize the financial burden, the reconstruction dates can be staggered for regional projects. The current schedule and costs do not include the replacement of regional projects.

5.3 Distributed BMPs (Green Streets)

The distribution of proposed green streets implementation is based on the volume/load reductions that are not satisfied by other control measures at each of the TMDL compliance deadlines. Additionally, the green streets were distributed over the years so the cost can be distributed. Like with the regional projects, the green streets will need to be replaced at the end of their expected life, approximately every 30 years. The street replacements can be spread over more time than the initial implementation because they are not constrained with compliance deadlines. The current schedule and costs presented do not include the replacement of green streets. **Figure 5-1** and **Table 5-2** summarize the green street implementation timeline needed to demonstrate compliance.

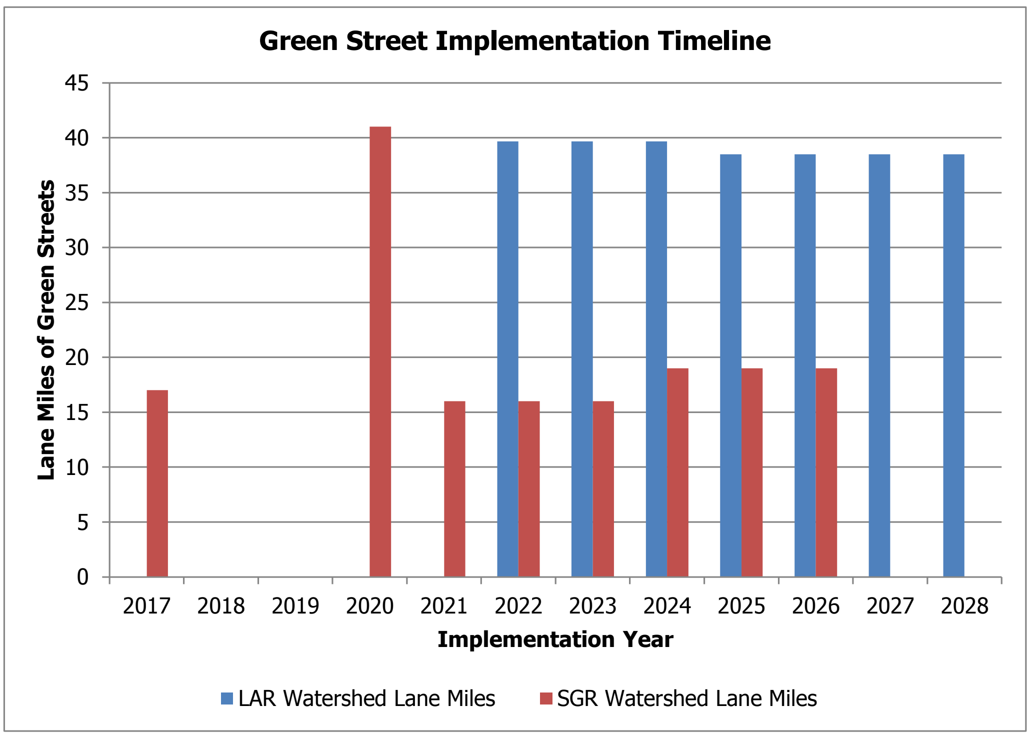

Figure 5-1 Green Street Implementation Timeline

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Table 5-2 Proposed Green Street Implementation Timeline

Implementation Year	Lane Miles of Green Streets	
	LAR Watershed	SGR Watershed
2017	-	17.0
2018	-	-
2019	-	-
2020	-	41.0
2021	-	16.0
2022	39.6	16.0
2023	39.7	16.0
2024	39.7	19.0
2025	38.5	19.0
2026	38.5	19.0
2027	38.5	-
2028	38.5	-
Total:	**273.0**	**163.0**

5.4 Schedule Summary

Figure 5-2 demonstrates that the control measures and associated implementation schedule proposed in this EWMP will address TMDL milestones. The figure shows the required load reduction will be met for the limiting pollutant in both the LAR and SGR Watersheds. Quantification of the anticipated load reductions are presented in **Table 4-23** and **Table 4-24** for the LAR and SGR Watersheds, respectively.

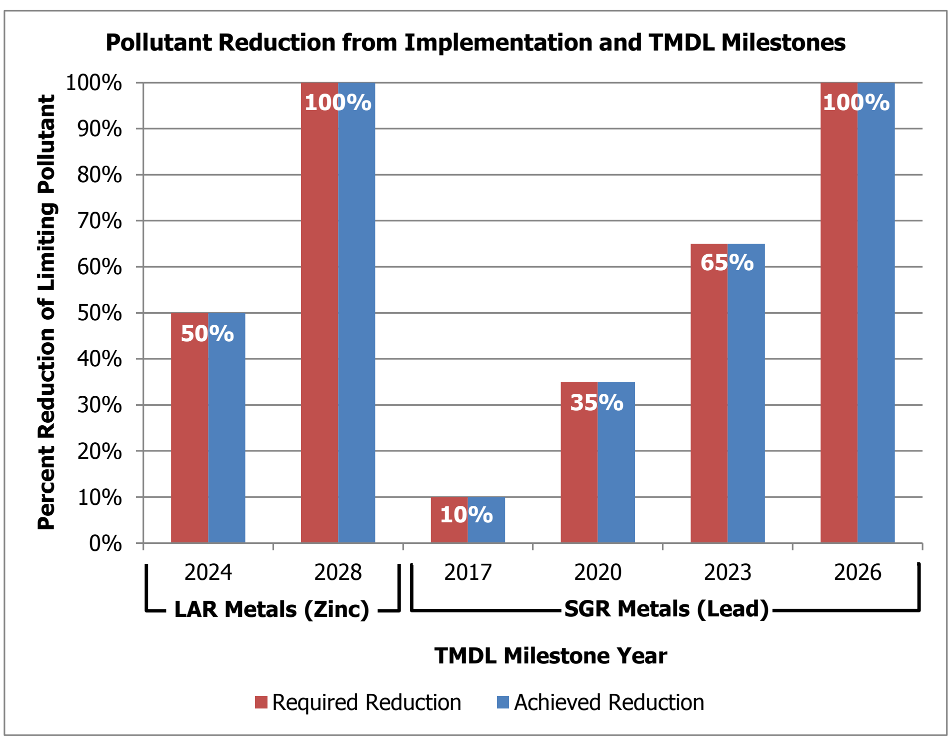

Figure 5-2 Pollutant Load Reduction from Implementation and TMDL Milestones

6. Control Measure Implementation Cost

A preliminary cost analysis has been performed based on the proposed implementation schedule described in **Section 5**, which is based on TMDL milestones. The costs for implementation were spread out when possible keeping in mind that compliance with the WQOs must be demonstrated through the RAA. This section summarizes the cost associated with the implementation of non-structural BMPs, regional projects, and distributed BMPs (green streets) and presents various funding strategies. All costs are in present value and do not account for inflation that may occur prior to implementation.

6.1 Non-Structural BMPs

As discussed in **Section 3.4.1**, non-structural BMPs that will be implemented and were modeled in the RAA include enhanced MCMs, other non-structural BMPs such as the various senate bills that have been approved, and the new and re-development LID program. For the enhanced MCMs there will be some cost associated with implementation; however, the increase in cost is not known at this time. The enhancements being considered will not dramatically increase the cost of program implementation. For SB 346 and SB 757, the RH/SGRWQG will not have to spend any money as the manufacturers are required to modify their materials.

The implementation of the new and re-development LID program will be covered mostly by private developers. The only costs the jurisdictions within the RH/SGRWQG will have to cover are those associated with plan checks and inspections. These costs are covered by plan check fees paid to the agencies by the developers. There will not be significant costs associated with the non-structural BMP implementation modeled in the RAA.

The cost of running the current stormwater program, which mostly entails MCMs/institutional BMPs, is shown in **Table 6-1**. It is anticipated that the cost will increase; however, the increase is not known at this time. The cost increases associated with non-structural BMP implementation represent an extremely small portion of the overall cost of EWMP implementation; therefore, these costs have not been carried into the totals described in subsequent sections.

Table 6-1 Existing Non-Structural BMP Implementation Costs

RH/SGRWQG Member	Stormwater Program Costs	
	2014-15	2013-14
Arcadia	$686,773	$500,772
Azusa	$507,500	$337,375
Bradbury	$162,327	
Duarte	$601,906	$601,906
Monrovia	$981,488	$592,229
Sierra Madre	$418,951	
Los Angeles County[1]		$111,436,000

[1] Cost associated with all Unincorporated County areas and LACFCD, while the portion in the RH/SGRWQG is a small fraction.

6.2 Regional Projects

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Based on the concept drawings provided in **Attachment Q**, preliminary cost estimates were developed for each of the regional projects modeled in the RAA. The cost estimates were developed using various

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sources of information as well as the cost estimator's best judgment. **Table 6-2** summarizes some of the typical line items included in the cost estimates and their associated assumptions. The items included are broken into three categories: engineering, construction support, and construction.

Table 6-2 Regional Project Cost Estimate Assumptions

Description	Assumption(s)
Engineering	
Design Plan and Specifications	10 percent of construction cost
Permits	Does not include California Environmental Quality Act (CEQA). Includes grading permits, connection permits, demolition permits, etc.
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
Pump Station	Pumps peak flow rate and includes the costs associated with materials, installation, and electrical connection. Materials include wet well, valve vault, required valves, piping, and miscellaneous appurtenances

Table 6-3 summarizes the engineering, construction support, construction, and total costs associated with each of the regional projects included in the RAA for both the LAR and SGR Watersheds. The engineering cost presented in the table includes environmental permitting and planning. **Attachment Y** includes a more detailed breakdown of associated costs. The replacement costs for the proposed regional projects are not included in the cost estimate.

Table 6-3 Regional Project Cost Summary

Regional Project	Engineering	Construction Support	Construction	Total
LAR Watershed				
Recreation Park	$1,069,000	$835,000	$8,347,000	$10,251,000
LAC Arboretum	$1,564,000	$1,231,000	$12,302,000	$15,097,000
Sierra Vista Park	$515,000	$392,000	$3,911,000	$4,818,000
Royal Oaks Trail (LAR)	$5,443,000	$4,334,000	$43,332,000	$53,109,000
L. Garcia Park	$2,403,000	$1,902,000	$19,018,000	$23,323,000
Eisenhower Park	$3,942,000	$3,133,000	$31,327,000	$38,402,000
LAR Watershed Subtotal:				**$145,000,000**

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Table 6-3 Regional Project Cost Summary

Regional Project	Engineering	Construction Support	Construction	Total
SGR Watershed				
LADWP Easement	$680,000	$524,000	$5,232,000	$6,436,000
Encanto Park	$1,682,000	$1,325,000	$13,248,000	$16,255,000
Memorial Park (Azusa)	$4,495,000	$3,576,000	$35,759,000	$43,830,000
Royal Oaks Trail (SGR)	$9,010,000	$7,188,000	$71,878,000	$88,076,000
SGR Watershed Subtotal:				**$154,597,000**
Total Cost:				**$299,597,000**

The annual maintenance cost was also determined for the regional projects. Based on the CASQA BMP Handbooks and experience, one to three percent of the construction cost was used as the annual maintenance cost. An annual maintenance cost of 1.5 percent was used for all of the regional projects, with the exception of the Arboretum of LAC, Sierra Vista Park, and LADWP Easement, all of which used three percent due to the systems being aboveground. All annual maintenance costs have a not to exceed cost of $500,000. **Table 6-4** summarizes the annual maintenance costs and maintenance will start once the project is constructed.

Table 6-4 Regional Project Annual Maintenance Costs

Regional Project	Annual Maintenance Cost
LAR Watershed	
Recreation Park	$125,205
LAC Arboretum	$369,060
Sierra Vista Park	$117,330
Royal Oaks Trail (LAR)	$500,000
L. Garcia Park	$285,270
Eisenhower Park	$469,905
SGR Watershed	
LADWP Easement	$156,960
Encanto Park	$198,720
Memorial Park (Azusa)	$500,000
Royal Oaks Trail (SGR)	$500,000

6.3 Distributed BMPs (Green Streets)

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A cost estimate similar to the ones developed for the regional projects was developed for 1,000 linear feet of green streets within one lane (0.19 lane miles) and is provided in **Attachment Z**. The unit cost was then determined to be $486 per linear foot per lane mile of green streets. Based on the proposed implementation schedule summarized in **Section 5.3**, the cost per year of initial green street implementation is shown in **Table 6-5** for the LAR and SGR Watersheds. 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 assumed to be one percent of the construction cost. The maintenance cost will start once the streets have been constructed. Replacement costs associated with green streets are not accounted for in this cost estimate.

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Table 6-5 Green Street Implementation and Maintenance Costs

Year	LAR Watershed			SGR Watershed		
	Lane Miles	Capital Cost	O&M Cost	Lane Miles	Capital Cost	O&M Cost
2017	-	-	-	17.0	$43,596,432	-
2018	-	-	-	-	-	$435,964
2019	-	-	-	-	-	$435,964
2020	-	-	-	41.0	$105,144,336	$435,964
2021	-	-	-	16.0	$41,031,936	$1,487,408
2022	39.6	$101,554,042	-	16.0	$41,031,936	$1,897,727
2023	39.7	$101,810,491	$1,015,540	16.0	$41,031,936	$2,308,046
2024	39.7	$101,810,491	$2,033,645	19.0	$48,725,424	$2,718,366
2025	38.5	$98,733,096	$3,051,750	19.0	$48,725,424	$3,205,620
2026	38.5	$98,733,096	$4,039,081	19.0	$48,725,424	$3,692,874
2027	38.5	$98,733,096	$5,026,412	-	-	$4,180,128
2028	38.5	$98,733,096	$6,013,743	-	-	$4,180,128
2029	-	-	$7,001,074	-	-	$4,180,128

6.4 Cost Estimate Summary

THE ENTIRETY OF SECTION 6.4 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

The costs associated with regional project and distributed BMP implementation was compiled to come up with a cost summary based on implementation year. As mentioned in **Section 6.1**, the cost increase compared to the existing program associated with non-structural BMP implementation is unknown at this time and is not included in the total cost presented in this section. All costs are shown in present value dollars, thus no interest or inflation was assumed for future implementation. **Figure 6-1** demonstrates the capital and O&M costs per year based on the proposed implementation schedule for the RH/SGRWQG collectively. **Figure 6-2** and **Figure 6-3** illustrate the estimated implementation cost for the LAR and SGR Watersheds, respectively.

THE ENTIRETY OF SECTION 6.4 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

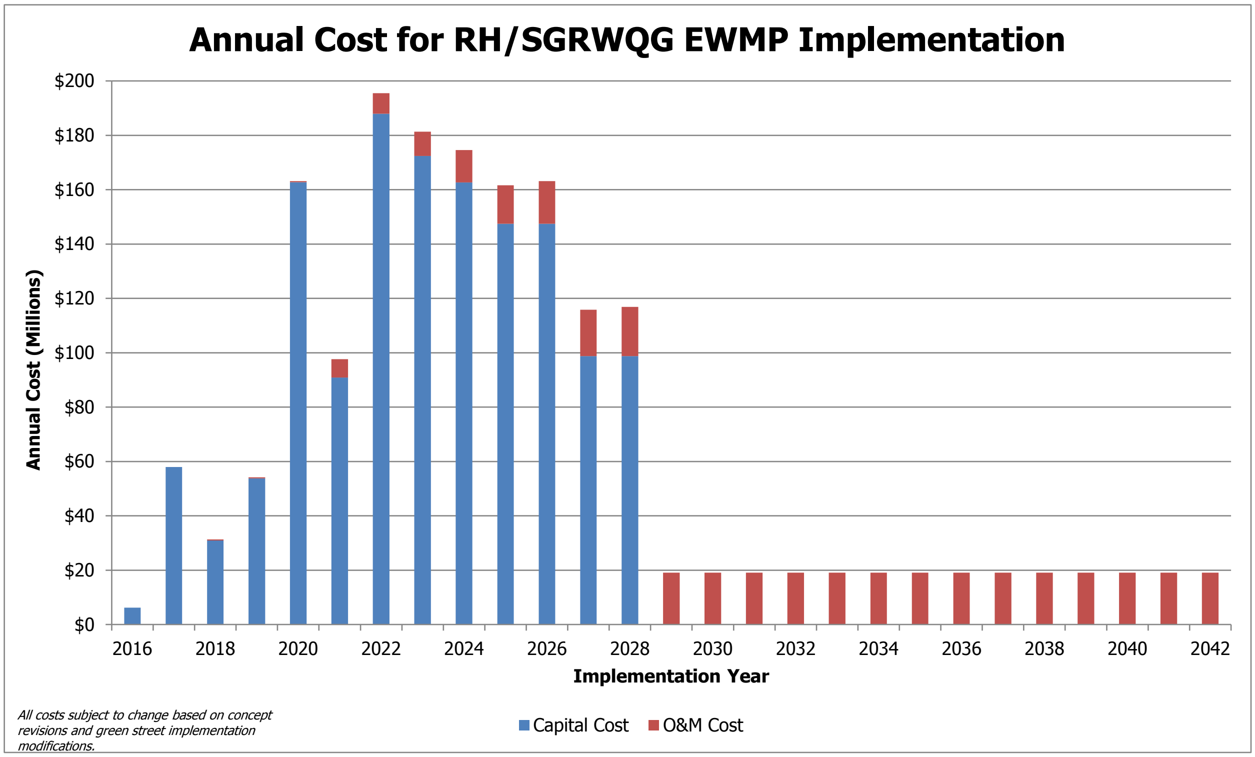

Figure 6-1 Annual Cost for RH/SGRWQG EWMP Implementation

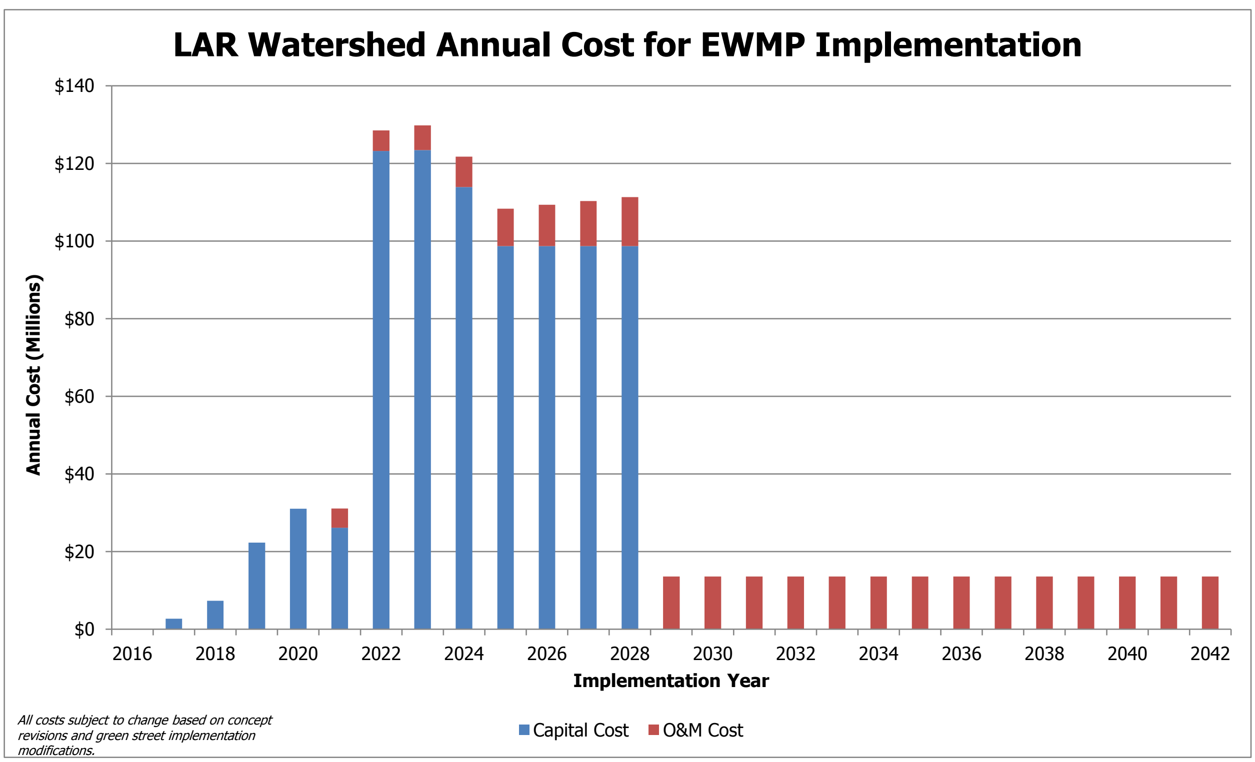

Figure 6-2 Annual Cost for LAR Watershed EWMP Implementation

THE ENTIRETY OF SECTION 6.4 IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

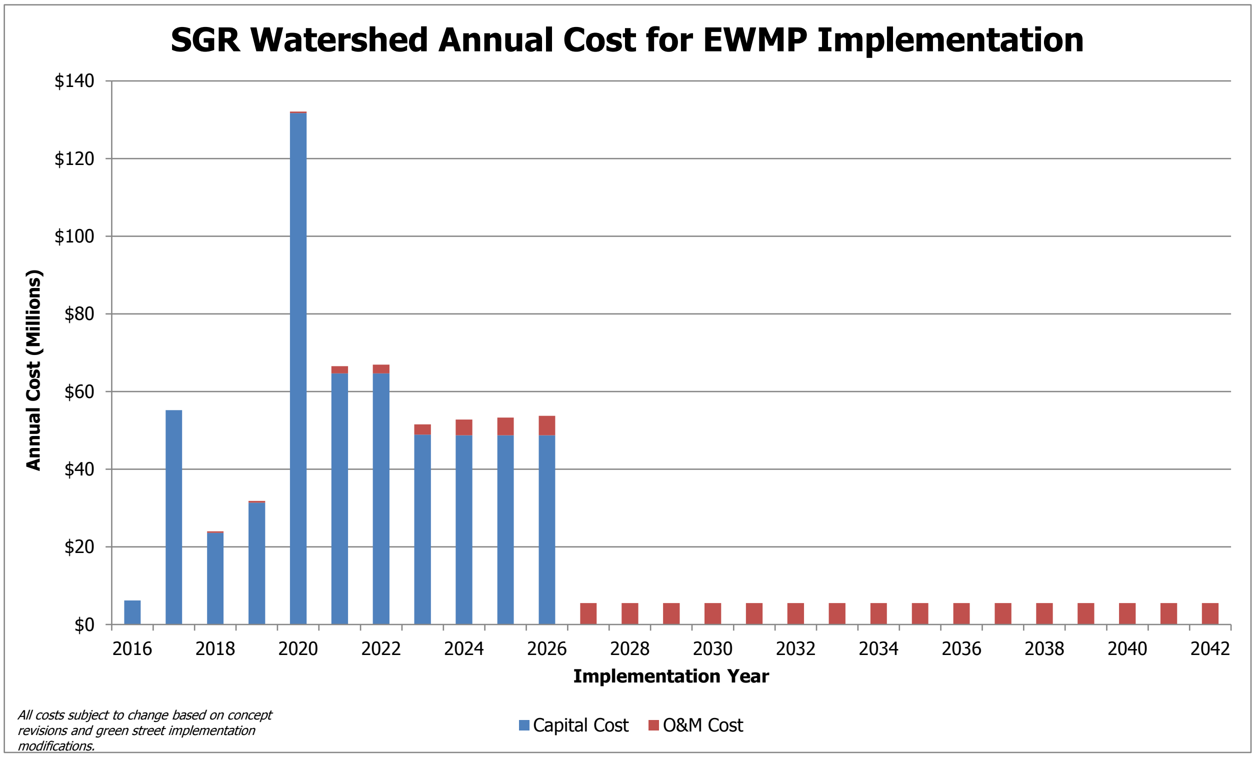

Figure 6-3 Annual Cost for SGR Watershed EWMP Implementation

6.5 Funding Strategies

The regional projects and green streets proposed in this EWMP will require a regional funding strategy, as funding opportunities will need to be identified, sought after, and/or allocated. The capital and operating costs for the proposed control measures ~~are over $1.4 billion and~~ will span over decades. Customizing the financial strategy to the preference of each jurisdiction within the RH/SGRWQG and flexibility in identifying potential funding opportunities will be important for successfully financing EWMP implementation. New revenue sources need to be identified; otherwise revenue sources currently allocated to other programs may need to be used to fund the implementation of this EWMP.

The detailed financial strategy for EWMP costs will be highly dependent on the availability of potential sources of funding, and vary by agency. The agencies within this group have historically utilized general funds to support their respective stormwater programs and may continue to do so. However, the EWMP cost estimates grossly exceed expected available general fund revenue for stormwater programs. Therefore, Group members will individually or collectively pursue funds from multiple additional sources. The financial strategy presented in this EWMP outlines a set of multiple approaches that each RH/SGRWQG Permittee may consider. Each Permittee will pursue those strategies that best fit their specific circumstances.

The annual capital improvement budget for each of the RH/SGRWQG Permittees was evaluated and compared to the amount of money needed each year to fund EWMP implementation. This comparison is presented in **Table 6-6**. The EWMP implementation cost is equal to the total cost for the specified jurisdiction divided by the proposed implementation timeline. This was done for comparison purposes and represents the average annual cost and does not include the cost associated with O&M. The table shows that none of the RH/SGRWQG members have enough money available in their capital improvement funds to cover the proposed EWMP implementation costs. It is also important to recognize that the entire capital improvement fund cannot be used to fund the stormwater program, as other capital improvements such as water and sewer upgrades are necessary to address other community needs. Information relevant to the Unincorporated County areas within the RH/SGRWQG is not readily available for inclusion. Additionally, Bradbury currently does not have a capital improvement fund. Projects in Bradbury are funded through reserves as needed; however, the funds available through reserves are extremely limited.

Table 6-6 Financial Situation Summary

Jurisdiction	LAR Watershed[1] Annual Cost	SGR Watershed[2] Annual Cost	Annual Capital Improvement Fund Budget	Source of Funds
Arcadia	$29,755,539	$0	$2,066,500	2014-15 Capital Improvement Fund Revenue
Azusa	$0	$37,877,210	$507,020	2013-2014 Capital Projects Funds Revenue
Bradbury	$3,042,884	$7,099,899	Unavailable	
Duarte	$8,147,268	$8,358,976	$151,300	2014-15 Capital Improvement Fund Revenue
Monrovia	$19,254,264	$0	$3,600,000[3]	2015-16 Projected Capital Improvement Funds
Sierra Madre	$2,104,759	$0	$60,000	Planned Local and Regional BMP Funds
Unincorporated County	$8,120,904	$10,287,231	Unavailable	County General Fund

[1] Cost between 2017 and 2028
[2] Cost between 2017 and 2026
[3] Proposed funds (not yet approved)

THE ANNUAL IMPLEMENTATION COSTS IN TABLE 6-6 ARE SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA

Project funding knowledge and experience has been used to identify viable funding opportunities to assist the RH/SGRWQG in implementing proposed control measures identified in **Section 3.4**. This section explains the differences between grants and loans, both of which can be utilized as a source of funding, and provides information on current grant and loan opportunities. This section also includes high-level alternatives that can be examined as each jurisdiction moves forward as a group or 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. The following funding strategies are further discussed in this section:

- Grants and loans;
- Fees and charges;
- Legislative and policy;
- Partnerships; and
- Investment opportunities.

The stormwater program coordinators of the RH/SGRWQG plan on evaluating opportunities to integrate EWMP goals and efforts with capital improvement projects led by other departments. For example, the green streets implementation could be incorporated into street improvement projects included in Capital Improvement Plans which would allow the projects to be partially funded.

6.5.1 Grants and Loans

The RH/SGRWQG will actively pursue financial assistance to implement the proposed control measures. Financial assistance programs are available in two common forms, grants and loans. To receive funds through a grant or loan, an application must be completed and specific eligibility requirements must be satisfied. These requirements are different depending on the grant or loan program. All assistance programs also provide a set of conditions and limitations. It is important to fully understand the differences, benefits, and drawbacks of each in order to determine which form of financial assistance is best for a given project.

Grants are awards of financial assistance, meaning the grant awardee is not required to return the money, although they may need to follow specific requirements and produce specific products. On the other hand, loans are awarded as a benefit or assistance, but the awardee is required to pay back the loan, often with interest. **Table 6-7** outlines the major differences between grants and loans.

One of the major points outlined in **Table 6-7** is the application and competition of grant programs versus loan programs. Grants often require extra work in addition to general work related to any project. Grants often require extra reports, and as mentioned, a more complex application process. Loans however have a relatively simple application process, less competition, and limited additional requirements that are often less complex. Grants will require extra work, but in return, free money is awarded.

Table 6-7 Differences Between Grants and Loans

Grants	Loans
➢ No payback required ➢ Typically complex application process ➢ Highly competitive ➢ Extensive reporting and oversight needed ➢ Matching funds generally required ➢ May favor larger/more expensive projects ➢ Some require participation with an IRWM ➢ Funding limits vary ➢ Generally limited application periods ➢ Operate under agency-specific guidelines	➢ Payback required ➢ Relatively simple application process ➢ May require getting on priority list ➢ Repayment terms vary ➢ Threshold eligibility criteria must be met ➢ Tie-in with job creation with some programs ➢ Different agencies have different requirements ➢ Maximum amount financed can be large ➢ Generally continuous application periods

Potential grant and loan financial assistance programs that the group will investigate to fund the control measures proposed in this EWMP as well as a range of stormwater programs are outlined in **Table 6-8** and detailed in **Attachment AA**. The RH/SGRWQG will make reasonable attempts to obtain funds from relevant grants and loans; however, funding is not guaranteed through these programs.

Table 6-8 Existing Grant and Loan Opportunities

Program	Type	Available Funds
Proposition 84 Stormwater Program	Grant	$250,000-$3,000,000
Proposition 84 (Chapter 2 §75026) Integrated Regional Water Management (IRWM)	Grant	Varies
Proposition 84 Urban Streams Restoration	Grant	$1,000,000
Community Action for a Renewed Environment (CARE)	Grant	$75,000-$300,000
Pollution Prevention (P2)	Grant	$20,000-$180,000
Clean Beaches Initiative (CBI)	Grant	$150,000-$5,000,000

Table 6-8 Existing Grant and Loan Opportunities

Program	Type	Available Funds
Urban Waters Small Grant	Grant	$40,000-$60,000
Environmental Education Grant and SubGrant	Grant	$75,000-$200,000
Cooperative Watershed Management Plan	Grant	$22,000-$100,000
State of California Coastal Conservancy Program	Grant	No min or max
Wildlife Conservation Board (WCB)	Grant	No min or max
Habitat Conservation Fund (HCF)	Grant	No min or max request
Land and Water Conservation Fund (LWCF)	Grant	$2,000,000
Recreational Trails Program (RTP)	Grant	No min or max
TIGER Discretionary Grant	Grant	$10,000,000 min
Environmental Solutions for Communities	Grant	$25,000-$100,000
Clean Water Act (CWA) §319(h) Non-Point Source (NPS)	Grant	$75,000-$750,000
2014 Water Bond	Grant	Not specified
Metropolitan Transit Authority (MTA) Call for Projects Program	Grant	Varies
Proposition 1B (Local Streets and Road, Congestion Relief, and Traffic Safety Account of 2006)	Grant	$400,000 min
Proposition 1B (Public Transportation Modernization, Improvement, and Service Enhancement Account [PTMISEA])	Grant	Based on population
Measure R	Grant	Not specified
Proposition A and C (Sales Tax)	Grant	Based on population
Environmental Enhancement and Mitigation (EEM) Program	Grant	$500,000
Highway Safety Improvement Program (HSIP)	Grant	$10,000,000
Active Transportation Program (ATP)	Grant	$250,000
Drought Resiliency	Grant	$300,000
Proposition 1 – Stormwater Grant Program (SWGP)	Grant	$500,000-$5,000,000
Clean Water State Revolving Fund (CWSRF)	Loan	No maximum
Infrastructure State Revolving Fund (ISRF)	Loan	$2,000,000-$10,000,000

The programs listed range from federal to state and can apply to transportation, water supply, water quality, habitat enhancement, recreation, or a range of potential project benefits. As projects are developed, the group will consider incorporating different multi-benefit components to allow the project to be eligible for different grant or loan programs.

6.5.2 Fees and Charges

Fees and charges are payments from internal departments or other external sources that can generate or reallocate funds to cover the costs associated with the proposed control measure implementation. The financial strategies associated with fees and charges are presented below. The group will evaluate these strategies as potential funding sources.

- Use existing revenue streams for stormwater/water supply/flood control projects to support stormwater quality projects as legally allowable.
- Assembly Bill (AB) 2403 – Use new state law to pass rate increases for stormwater projects that have a water supply benefit and minimize the Proposition 218 process as legally allowable.

- Establish a mitigation bank by which private developers can fund downstream control measure implementation in lieu of retaining water on private development. To get sufficient benefit from this, there would have to be a downstream control measure that would get greater water quality benefit than the retention system on the private development.
- Use and/or increase solid waste management fees to cover the cost of enhanced street sweeping and other measures to reduce trash.
- Use water rates to fund programs to reduce irrigated runoff, as legally allowable.
- Pursue a proposition 218 compliant stormwater fee or tax initiative (modified after the 2012 Clean Water Clean Beaches Initiative).

6.5.3 Legislative and Policy

The financial strategies that require legislative or policy changes that RH/SGRWQG Permittees will evaluate are summarized below:

- Lobby the Metropolitan Water District (MWD) of Southern California, or other applicable Water Districts, 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, or other Water Districts, would incorporate the costs into their imported water rates.
- Pursue pollutant source control legislation patterned after SB 346 that either limits pollutants of concern in products (e.g., copper in brake pads, or zinc in tires) or assesses a fee that can be paid for by the users of those products. The money collected through the fee can be used by local governments to mitigate those pollutants. Some examples include addressing zinc in tin roofs and chain link fences.
- Form Special Assessment Districts and tailored fees.
- Explore the use of Enhanced Infrastructure Finance Districts tailored to the RH/SGRWQG, as outlined in recently adopted (2014) California legislation SB 628.
- 2014 Water Resources Reform and Development Act of 2014 (WRRDA). Partner with the USACE to model the watershed impervious surface effects on the federal interests under WRRDA to secure USACE cost sharing for EWMP programs.
- Change legislation to allow the Los Angeles County Sanitation Districts to accept and treat stormwater. Installation of end-of-pipe treatment facilities prior to release to the Pacific Ocean.
- Consideration of the USEPA's Financial Capability Assessment Framework for Municipal Clean Water Act Requirements (**Attachment AB**) and The United States Conference of Mayors Public Water Cost Per Household: Assessing Financial Impacts of EPA Affordability Criteria in California Cities (**Attachment AC**) for assessment prior to pursuing Proposition 218 compliant stormwater fee or tax initiatives.

6.5.4 Partnerships

The RH/SGRWQG will also pursue partnerships, where possible, to identify other groups and agencies who can share the costs. A majority of the control measures proposed in this EWMP are multi-benefit. Reaching out to the community that will benefit whether it is another agency, the public, or non-governmental organizations may result in cost sharing agreements. For example, partnerships with the clubs and organizations that fund the Arboretum of LAC may be used to help fund the proposed project. Another example would be if a commercial establishment was developing or redeveloping and the RH/SGRWQG created a partnership so that during the redevelopment structural control measures could be installed. Partnerships with local water districts could also be established.

The RH/SGRWQG members also plan on evaluating the formation of a Joint Powers Authority (JPA). A JPA is a contract between multiple public agencies to exercise jointly, all powers common to each of them, for the purpose of accomplishing specific goals they may have in common. The group will evaluate this as an opportunity to jointly fund all or some aspects of EWMP implementation. This will allow each RH/SGRWQG member to spread out implementation costs over time. This will be evaluated on the basis that all members will benefit from EWMP implementation, even if their jurisdictional area does not contribute flows, as the EWMP addresses compliance as a group rather than an individual.

6.5.5 Investment Opportunities

Rather than simply finding opportunities for funding, another alternative is to invest in a study, so that future costs can be reduced. Currently, the LAR copper and lead WER SSO BPA has been approved by the Regional Board and is pending additional approvals from the State Board, Office of Administrative Law, and the USEPA. Once approved, the Basin Plan will be amended and the corresponding WQOs will be increased. This will result in a lower load reduction requirement and during the adaptive management process the proposed control measure implementation could be lessened, thus reducing the overall implementation cost.

Currently, there is discussion of a similar study being conducted for zinc in the LAR Watershed. A WER SSO study could also be conducted for the SGR for the metals that control implementation. Due to SB 346, copper loads are expected to decrease; therefore, a study may not be necessary. However, a study for lead and/or copper may be beneficial to members of the RH/SGRWQG and other jurisdictions in the County. This opportunity will be evaluated as a potential "funding strategy."

6.5.6 Future Steps

The RH/SGRWQG as a whole, as well as individual members, will prioritize and select the specific financial strategies that best fit their needs. In the near term (prior to 2017) the RH/SGRWQG members plan on evaluating the formation of a JPA and the associated terms of the agreement. The stormwater coordinators will also identify opportunities to work with other internal departments to align the goals of the EWMP with existing programs such as street improvements included in Capital Improvement Plans. The grant and loan opportunities identified in **Table 6-8** will be further evaluated over the next two years (prior to 2017); however, the RH/SGRWQG (collectively and individually) intends to pursue and further evaluate the following opportunities:

- Proposition 1 – SWGP
- Seek allocation in General Fund
- Proposition 218 stormwater fee

7. Adaptive Management Process

The EWMP is part of an adaptive management process as described in Part VI.C.8 of the MS4 Permit. Through the adaptive management process, the EWMP will be updated two years after the Regional Board Executive Officer approval and every two years thereafter, while the RAA will need to be revised and updated by 2021. 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 RWLs 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 based on more recent water quality data for discharges from the MS4 and receiving water(s) and a reassessment of sources of pollutants;
- Availability of new information and data from sources other than the Permittees' monitoring programs 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 RH/SGRWQG to identify a plan that is successful in improving water quality in the region. The data collected through implementation of the CIMP will be important when revising the EWMP every two years.

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 can be used to update the model calibration and run simulations to see if the EWMP projects need modification or stay the course. **Figure 7-1** illustrates the adaptive management process.

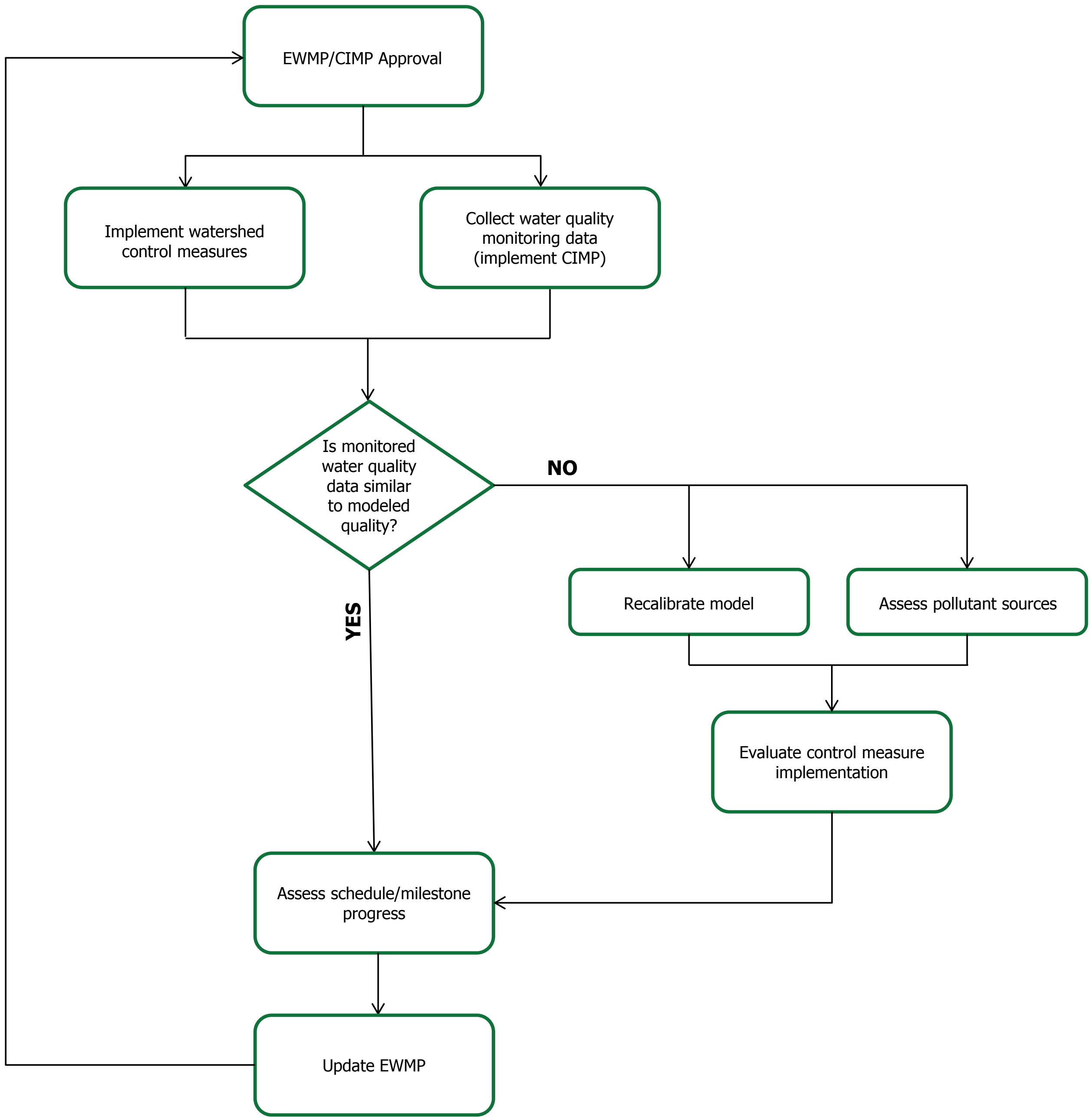

Figure 7-1 Adaptive Management Process

8. References

Amigos de los Rios. http://www.amigosdelosrios.org/about-us/. Accessed December 23, 2013.

Arcadia and Sierra Madre. September 9, 2005. East Raymond Basin Water Resources Plan. Prepared by GEOSCIENCE Support Services, Inc.

Attachment A to Resolution No. R03-009. July 10, 2003. Amendment to the Water Quality Control Plan for the Los Angeles Region to include a TMDL for Nitrogen Compounds and Related Effects in the Los Angeles River.

Attachment A to Resolution No. R07-012. July 27, 2007. Amendment to the Water Quality Control Plan - Los Angeles Region to Incorporate the TMDL for Trash in the Los Angeles River Watershed.

Attachment A to Resolution No. R10-003. March 11, 2010, (2010a). Amendment to the Water Quality Control Plan for the Los Angeles Region to Revise the Los Angeles River and Tributaries Metals TMDL.

Attachment A to Resolution No. R10-007. July 9, 2010, (2010b). Amendment to the Water Quality Control Plan - Los Angeles Region to incorporate the Los Angeles River Bacteria TMDL.

Attachment A to Resolution No. R11-008. May 5, 2011. Amendment to the Water Quality Control Plan - Los Angeles Region to Incorporate the Total Maximum Daily Load for Toxic Pollutants in Dominguez Channel and Greater Los Angeles and Long Beach Harbor Waters.

Attachment A to Resolution No. R12-010. December 6, 2012. Amendment to the Water Quality Control Plan for the Los Angeles Region to amend the Total Maximum Daily Load (TMDL) for Nitrogen Compounds and Related Effects in the Los Angeles River by incorporating site-specific ammonia objectives.

Attachment A to Resolution No. R13-004. June 6, 2013. Amendment to the Water Quality Control Plan - Los Angeles Region to Incorporate the Implementation Plan for the Total Maximum Daily Loads for Metals and Selenium in the San Gabriel River and Impaired Tributaries.

Attachment A to Resolution No. R15-0XX. April 3, 2015, (2015a). Amendment to the Water Quality Control Plan - Los Angeles Region to Incorporate the TMDL for Indicator Bacteria in the San Gabriel River, Estuary, and Tributaries.

Attachment A to Resolution No. R15-0XX. April 9, 2015, (2015b). Amendment to the Water Quality Control Plan - Los Angeles Region to Incorporate the TMDL for Indicator Bacteria in the San Gabriel River, Estuary, and Tributaries.

Attachment A to Resolution No. R15-004 - Revised. June 11, 2015, (2015c). Proposed Changes to Basin Plan (Los Angeles River Metals TMDL).

Azusa Light & Water. July 2011. 2010 Urban Water Management Plan. Prepared by SA Associates. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Azusa, City of/ALW 2010 UWMP 7-11-11 with Appendices.pdf

Bay Area Stormwater Management Agency. April 29, 2011. Bay Area Stormwater Management Agencies Association Feasibility/Infeasibility Criteria Report – NPDES Municipal Regional Permit Provisions

C.3.c.i.(2)(b)(iv) and C.3.c.iii.(1).

Bicknell, B.R., J.C. Imhoff, J.L. Kittle Jr., A.S. Donigian Jr., and R.C. Johanson. 1997. Hydrological Simulation Program–FORTRAN, Users Manual, version 11. EPA/600/R-97/080. U.S. Environmental Protection Agency, National Exposure Research Laboratory. Athens, GA.

California American Water. July 2011. 2010 Urban Water Management Plan for the Southern Division - Los Angeles County District. Prepared under the responsible charge of Jeffery M. Szytel. http://www.amwater.com/files/Ventura County 2010 UWMP Final Draft.pdf.

California Stormwater Quality Association (CASQA). 2003. *California Stormwater BMP Handbooks.* Four Handbooks: New Development and Redevelopment, Construction, Municipal, and Industrial/Commercial. www.cabmphandbooks.org.

California Stormwater Quality Association (CASQA). 2007. *Municipal Stormwater Program Effectiveness Assessment Guidance*.

City of Arcadia. August 2006. Water Supply Assessment for the City of Arcadia "Caruso Affiliated/Magna Entertainment Corp". http://www.ci.arcadia.ca.us/docs/03_appj_watersupplyassessment.pdf.

City of Arcadia. June 2011. City of Arcadia Urban Water Management Plan 2010 Update. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Arcadia, City of/Final 2010 UWMP Update.pdf.

City of Monrovia. Station Square. http://www.cityofmonrovia.org/communitydevelopment/page/station-square. Accessed December 23, 2013.

City of Monrovia, Utilities Division. May 2011. Urban Water Management Plan. Prepared by Mark Carney. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Monrovia, City of/urban_water_plan_2010 - 2011 final 5 17.pdf.

City of San Diego. Prepared by Weston Solutions. June 2010. City of San Diego Targeted Aggressive Street Sweeping Pilot Study Effectiveness Assessment Final Report.

City of Sierra Madre. June 2011. Final 2010 Urban Water Management Plan. Prepared by Stetson Engineers Inc. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Sierra Madre, City of/

Council for Watershed Health. 1996-2013. www.watershedhealth.org. Accessed December 26, 2013.

County of Los Angeles. October 7, 2010. Multi-Pollutant TMDL Implementation Plan for the Unincorporated County Area of Los Angeles River Watershed. Submitted to California Regional Water Quality Control Board - Los Angeles Region.

CREST Consulting Team. 2010. Los Angeles River Watershed Bacteria TMDL – Technical Report Section 3: Numeric Targets. Prepared for CREST (Cleaner Rivers through Effective Stakeholder-Led TMDLs).

Donigian, A.S., and J.T. Love. 2003. Sediment Calibration Procedures and Guidelines for Watershed Modeling. Aqua Terra Consultants, Mountain View, California.

Donigian, A.S., Jr. 2000. HSPF Training Workshop Handbook and CD. Lecture #19: Calibration and Verification Issues. Prepared for and presented to the United States Environmental Protection Agency, Office of Water, Office of Science and Technology, Washington, DC.

Donigian, A.S., Jr., J.C. Imhoff, B.R. Bicknell, and J.L. Kittle, Jr. 1984. Application Guide for Hydrological Simulation Program – FORTRAN (HSPF). EPA-600 / 3-84-965. United States Environmental Protection Agency, Environmental Research Laboratory, Athens, GA.

Environmental Protection Agency (EPA). June 2009. Environmental Assessment: Water Supply Wells for the City of Arcadia, California. *Longley Well No. 3 and Camino Real Well No. 3*. http://www.epa.gov/region9/nepa/epa-generated/arcadia/EpaArcadiaEaFinal.pdf.

Environmental Protection Agency (EPA). Last Updated February 2012. San Gabriel Valley (all Areas) Superfund Site Map. http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dc283e6c5d6056f88257426007417a2/7971d075e328ed3a8825799c0061e1c7!OpenDocument

Hastie, C. 2003. The Benefit of Urban Trees. A summary of the benefits of urban trees accompanied by a selection of research papers and pamphlets. Warwick District Council. http://www.naturewithin.info/UF/TreeBenefitsUK.pdf. Accessed September 2010.

Helsel DR. 2005. Nondectects and Data Analysis; Statistics for Censored Environmental Data. John Wiley and Sons, USA, NJ.

International BMP Database (IBD). July 2012. Pollutant Category Summary Statistical Addendum: TSS, Bacteria, Nutrients, and Metals. http://www.bmpdatabase.org/index.htm. Accessed November 18, 2013.

International BMP Database (IBD). International Stormwater BMP Database. *History*. Accessed April 10, 2014. www.bmpdatabase.org/history.html.

Jurisdictional Group 2 prepared by CDM. October 10, 2011. Los Angeles River and Tributaries Total Maximum Daily Load for Metals. *Final Implementation Plan for Reach 2 and Participating Jurisdictions*.

Kloss, Christopher; Crystal Calarusse. June 2006. Rooftops to Rivers – Green strategies for controlling stormwater and combined sewer overflows. Natural Resource Defense Council. http://www.nrdc.org.

Kou, F., and W. Sullivan. 2001a. Environment and Crime in the Inner City: Does Vegetation Reduce Crime. Environment and Behavior 33(3):343–367.

Kuo, F., and W. Sullivan. 2001b. Aggression and Violence in the Inner City: Effects of Environment via Mental Fatigue. Environment and Behavior 33(4):543–571.

Kuo, F. 2003. The Role of Arboriculture in a Healthy Social Ecology. Journal of Arboriculture 29(3).

Leadership Committee of the Greater Los Angeles County Integrated Regional Water Management Region. July 2013. The Greater Los Angeles County Integrated Regional Water Management Plan. http://dpw.lacounty.gov/wmd/irwmp/index.cfm?fuseaction=TopDocListing&directory=2013_Public_Draft_IRWMP_Update&ttl=2013%20Public%20Draft%20IRWMP%20Update.

Los Angeles County Department of Public Works (LACDPW). Groundwater Wells. http://dpw.lacounty.gov/general/wells/.

Los Angeles County Department of Public Works (LACDPW). January 2006. Hydrology Manual.

Los Angeles County Department of Public Works (LACDPW). May 2009. Stormwater Best Management Practice Design and Maintenance Manual.

Los Angeles County Department of Public Works (LACDPW). September 12, 2013. Green Street. *Rosemead Boulevard Project*. Presented by Voltaire Llana.

Los Angeles County Department of Public Works (LACDPW). October 2013. Doing Business with DPW: Project Summary for San Gabriel Canyon Spreading Grounds Canal Lining and Improvements. http://dpw.lacounty.gov/general/contracts/opportunities/cons/ProjectDetailActive.aspx?project_id =FCC0001191.

Los Angeles County Department of Water and Power (LADWP). July 2011. Urban Water Management Plan 2010. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Los Angeles Department of Water and Power/.

Los Angeles County GIS Data Portal. 2014. http://egis3.lacounty.gov/dataportal.

Los Angeles Regional Water Quality Control Board (LARWQCB). December 12, 2002. Amendment to the Water Quality Control Plan for the Los Angeles Region to Incorporate Implementation Provisions for the Region's Bacteria Objectives and to Incorporate a Wet-Weather Total Maximum Daily Load for Bacteria at Santa Monica Bay Beaches. Resolution No. 2003-10.

Los Angeles Regional Water Quality Control Board (LARWQCB). June 6, 2013. Final Staff Report for the Implementation Plans and Schedules for the Los Cerritos Channel and San Gabriel River Metals TMDL.

Los Angeles Regional Water Quality Control Board (LARWQCB). June 2015. Staff Report: Reconsideration of Certain Technical Matters of the Trash TMDL for the Los Angeles River Watershed and Ballona Creek Watershed.

Los Angeles County. Office of the Assessor. 2013. http://assessormap.co.la.ca.us/mapping/viewer.asp. Accessed December 9, 2013.

Los Angeles County Flood Control District. 2012. Los Angeles County Clean Water, Clean Beaches Measure. http://www.lacountycleanwater.org/.

Low Impact Development Center Inc. April 2010. Low Impact Development Manual for Southern California: Technical Guidance and Site Planning Strategies.

Lumb, A.M., R.B. McCammon, and J.L. Kittle, Jr. 1994. User's Manual for an Expert System (HSPEXP) for Calibration of the Hydrological Simulation Program – FORTRAN. Water-Resources Investigation Report 94-4168. United States Geological Survey, Reston, VA.

Moore Iacofano Goltsman, Inc; prepared for County of Los Angeles Department of Public Works. June 2006. A Common Thread Rediscovered; San Gabriel River Corridor Master Plan. http://dpw.lacounty.gov/wmd/watershed/sg/mp/docs/SGR_MP.pdf.

National Stormwater Quality Database (NSQD) Draft. 2005. Identification of Significant Factors Affecting Stormwater Quality Using the NSQD, http://rpitt.eng.ua.edu/Research/ms4/Paper/CHI 20monograph%20(maestre%20pitt%202005)%20draft.pdf Accessed November 11, 2013

Nguyen, Thanhloan, Lai, C., Ridgeway, I, and Zhu, J. March 25, 2014. Guidelines for Conducting Reasonable Assurance Analysis in a Watershed Management Program, Including an Enhanced Watershed Management Program. Los Angeles Regional Water Quality Control Board (LARWQCB).

Northeastern Illinois Planning Commission (NIPC). 2004. Sourcebook on Natural Landscaping for Local Officials. http://www.nipc.org/environment/sustainable/naturallandscaping/natural%20landscaping%20sourcebook.pdf. Accessed September 2010.

NPDES Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges within the Coastal Watersheds of Los Angeles County, Except Those Discharges Originating from the City of Long Beach. (2012). State Water Resources Control Board; Los Angeles Region. NPDES Permit No. CAS004001; Order No. R4-2012-0175.

Pitt, R, and L. Talebi. 2012. Evaluation and Demonstration of Stormwater Dry Wells and Cisterns in Millburn Township, New Jersey. EPA Contract EP-C-08-016.

Reese, Andrew J. June 30, 2006. Voodoo Hydrology. *Voodoo: Magical practice considered to be a form of black magic, but also considered a religion to some*. From Stormwater: the Journal for Surface Water Quality Professionals. July-August 2006 issue. http://www.stormh2o.com/SW/Editorial/Voodoo_Hydrology_37.aspx.

Regional Water Quality Control Board (RWQCB). Revised July 10, 2003. Total Maximum Daily Load for Nitrogen Compounds and Related Effects in the Los Angeles River. Staff Report.

Regional Water Quality Control Board (RWQCB). August 9, 2007. Trash Total Maximum Daily Loads for the Los Angeles River Watershed. Staff Report.

Regional Water Quality Control Board (RWQCB). Revised April 2008. Machado Lake Eutrophic, Algae, Ammonia, and Odors (Nutrient) TMDL. Staff Report.

Regional Water Quality Control Board (RWQCB). Revised March 11, 2010. Revision of the Total Maximum Daily Load for Metals in the Los Angeles River and its Tributaries. Staff Report.

Regional Water Quality Control Board (RWQCB). September 2, 2010. Machado Lake Pesticides and PCBs TMDL. Staff Report.

Regional Water Quality Control Board (RWQCB). 2012. Water Discharge Requirements for Municipal Separate Storm Sewer Systems (MS4s) Discharges within the Coastal Watersheds of Los Angeles County, Except Those Discharges Originating from the City of Long Beach MS4. Order No. R4-2012-0175. NPDES No. CAS004001. December 6, 2012.

Regional Water Quality Control Board (RWQCB). December 6, 2012. Revision of the Total Maximum Daily Load for Nitrogen Compounds and Related Effects in the Los Angeles River. Staff Report.

Regional Water Quality Control Board (RWQCB). June 10, 2015. Total Maximum Daily Loads for Indicator Bacteria in San Gabriel River, Estuary and Tributaries.

RMC Water and Environmental. Opti, Database in response to the Greater Los Angeles County IRWMP. http://irwm.rmcwater.com/la/login.php.

RMC Water and Environmental and Geosyntec Consultants. October 2013. Greater Los Angeles County Integrated Regional Water Management Upper San Gabriel River and Rio Hondo Subregional Plan. http://dpw.lacounty.gov/wmd/irwmp/index.cfm?fuseaction=TopDocListing&directory=RMC12-10Submittal-FinalPlan&ttl=2014%20Public%20Draft%20IRWMP%20Update

San Gabriel Valley Council of Governments. May 30, 2013. Peck Water Conservation Improvement Project. http://www.sgvcog.org/documents/Item-43-Peck-Water-Project.pdf.

San Gabriel Valley Water Company. July 2011. 2010 Urban Water Management Plan. Prepared by Stetson Engineers Inc. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/San Gabriel Valley Water Company/SGVWC_UWMP(070111).pdf.

Shen, J., A. Parker, and J. Riverson. 2004. *A New Approach for a Windows-based Watershed Modeling System Based on a Database-supporting Architecture*. Environmental Modeling and Software, July 2004.

Shultz, S., and N. Schmitz. 2008. How Water Resources Limit and/or Promote Residential Housing Developments in Douglas County. University of Nebraska-Omaha Research Center, Omaha, NE. http://unorealestate.org/pdf/UNO_Water_Report.pdf. Accessed September 1, 2008.

Shumway RH, Azari RS, Kayhanian M. 2002. Statistical approaches to estimating mean water quality concentrations with detection limits. Environ Sci Technol. 36(15):3345-53.

Stanley BJ, Antonio K. Interlaboratory study of free cyanide methods compared to total cyanide measurements and the effect of preservation with sodium hydroxide for secondary- and tertiary-treated waste water samples. Water Environ Res. 2012 Nov;84(11):2010-6.

State of California, Department of Conservation. 1998. Seismic Hazard Zone Report for the Azusa 7.5-Minute Quadrangle, Los Angeles County, California. Seismic Hazard Zone Report 021. http://gmw.consrv.ca.gov/shmp/download/quad/MOUNT_WILSON/reports/mtwil_eval.pdf.

State of California, Department of Conservation. 2014. Landslide Maps. Copyright 2007. http://www.quake.ca.gov/gmaps/WH/landslidemaps.htm.

State of California, Department of Water Resources. Index of 2010 Urban Water Management Plans. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/.

State of California, State Water Resources Control Board. GeoTracker. http://geotracker.waterboards.ca.gov/.

State Water Resources Control Board. 2010. Impaired Water Bodies. http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml.

Tetra Tech and United States Environmental Protection Agency (USEPA). 2002. *The Loading Simulation Program in C++ (LSPC) Watershed Modeling System – User's Manual*. Tetra Tech, Fairfax, VA, and U.S. Environmental Protection Agency, Washington, DC.

Tetra Tech. 2010a. *Los Angeles County Watershed Model Configuration and Calibration—Part I: Hydrology*. Prepared for County of Los Angeles Department of Public Works, Watershed Management Division, Los Angeles County, CA, by Tetra Tech, Pasadena, CA.

Tetra Tech. 2010b. *Los Angeles County Watershed Model Configuration and Calibration—Part II: Water Quality*. Prepared for County of Los Angeles Department of Public Works, Watershed Management Division, Los Angeles County, CA, by Tetra Tech, Pasadena, CA.

Tetra Tech. 2011. *Evaluation of Water Quality Design Storms*. Prepared for County of Los Angeles Department of Public Works, Watershed Management Division, Los Angeles County, CA, by Tetra Tech, Pasadena, CA.

United States Conference of Mayors. November 2014. Public Water Cost Per Household: Assessing Financial Impacts of EPA Affordability Criteria in California Cities. By Kevin Johnson (Mayor of Sacramento), Stephanie Rawlings-Blake (Mayor of Baltimore), Mick Cornett (Mayor of Oklahoma City), and Tom Cochran (CEO and Executive Director).

United States Environmental Protection Agency (USEPA). 1999. Storm Water Operation and Maintenance Fact Sheet: Catch Basin Cleaning. http://water.epa.gov/scitech/wastetech/upload/2002_06_28_mtb_catchbas.pdf.

United States Environmental Protection Agency (USEPA). 2003. *Fact Sheet: Loading Simulation Program in C++*. USEPA, Watershed and Water Quality Modeling Technical Support Center, Athens, GA. http://www.epa.gov/athens/wwqtsc/LSPC.pdf.

United States Environmental Protection Agency (USEPA). 2009. SUSTAIN—*A Framework for Placement of Best Management Practices in Urban Watersheds to Protect Water Quality*. EPA/600/R-09/095. United States Environmental Protection Agency, Office of Research and Development, Edison, NJ.

United States Environmental Protection Agency (USEPA). Last updated April 3, 2012 (2012a). National Menu of Stormwater Best Management Practices. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/. Accessed February 25, 2014.

United States Environmental Protection Agency (USEPA). Last updated January 10, 2013. Watershed and Water Quality Modeling Technical Support Center. http://www.epa.gov/athens/wwqtsc/index.html. Accessed April 10, 2014.

United States Environmental Protection Agency (USEPA). November 24, 2014. Financial Capability Assessment Framework for Municipal Clean Water Act Requirements. Memorandum from Ken Kopocis and Cynthia Giles to Regional Administrators, Regional Water Division Directors, and Regional Enforcement Division Directors.

United States Environmental Protection Agency (USEPA) Region IX. June 2, 2005. Total Maximum Daily Loads for Metals. Los Angeles River and Tributaries.

United States Environmental Protection Agency (USEPA) Region IX. March 26, 2007. Total Maximum Daily Loads for Metals and Selenium. San Gabriel River and Impaired Tributaries.

United States Environmental Protection Agency (USEPA) Region IX. March 26, 2012 (2012b). Los Angeles Area Lakes Total Maximum Daily Loads for Nitrogen, Phosphorus, Mercury, Trash, Organochlorine Pesticides and PCBs.

United States Environmental Protection Agency (USEPA) Region IX. March 26, 2012 (2012c). Long Beach City Beaches and Los Angeles River Estuary Total Maximum Daily Loads for Indicator Bacteria.

Upper San Gabriel Valley Municipal Water District. June 2011. Urban Water Management Plan. Prepared by Stetson Engineers Inc. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/Upper San Gabriel Valley Municipal Water Disrtict/USGVMWD UWMP.pdf.

Ward, B., E. MacMullan, and S. Reich. 2008. The Effect of Low-impact Development on Property Values. ECONorthwest, Eugene, Oregon.

Water Environment Research Federation. 2000. Tools to Measure Source Control Program Effectiveness. Written by Betsy Elzufon, Larry Walker Associates. Project 98-WSM-2.

West Basin Municipal Water District. May 2011. 2010 Urban Water Management Plan. Prepared by RMC. http://www.water.ca.gov/urbanwatermanagement/2010uwmps/West Basin Municipal Water District/West Basin 2010 complete-final-draft.for-web.pdf.

Wolf, K. 2008. With Plants in Mind: Social Benefits of Civic Nature. www.MasterGardenerOnline.com. Winter 2008.

Wolf, K. 1998. Urban Nature Benefits: Psycho-Social Dimensions of People and Plants. Human Dimension of the Urban Forest. Fact Sheet #1. Center for Urban Horticulture. University of Washington, College of Forest Resources.

Zou, R., Liu, Y., Riverson, J., Parker, A. and S. Carter. August 2010. A nonlinearity interval mapping scheme for efficient waste load allocation simulation-optimization analysis. Water Resources Research.

Attachment A

LACFCD Background

Attachment B

Notice of Intent

Attachment C

MS4 Permit TMDL WQOs

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Attachment D

Supporting Information for Receiving Water Analysis

Attachment E

Regional and Distributed BMP Fact Sheets

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Attachment F

Detailed List of Existing Regional BMPs

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Attachment G

Detailed List of Existing Distributed BMPs

Attachment H

BMPs Reported in 2011-2012 Unified Annual Stormwater Report

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Attachment I

Detailed List of Regional BMP Projects Identified in Planning Documents

Attachment J

Detailed List of Distributed BMP Projects Identified in Planning Documents

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Attachment K

Potential Regional BMP Projects Worksheet

Attachment L

Potential Regional BMP Project Figures

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Attachment M

Detailed Summary Statistics for BMP Inflow and Outflow for all 23 Constituents

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Attachment N

Detailed Performance Metrics for all BMP Categories and Constituents

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Attachment O

Current MCM Implementation based on Unified Annual Stormwater Reports

Attachment P

MCM Implementation and Requirements

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Attachment Q

Regional Project Concepts

THE ENTIRETY OF ATTACHMENT Q IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT B OF REVISED EWMP

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Attachment R

Green Street Subarea Analysis Figures

THE ENTIRETY OF ATTACHMENT R IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT B OF REVISED EWMP

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Attachment S

Green Street Summary Tables

THE ENTIRETY OF ATTACHMENT S IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT B OF REVISED EWMP

Attachment T

Green Street Subarea Summary

THE ENTIRETY OF ATTACHMENT T IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT B OF REVISED EWMP

Attachment U

LSPC Flow Calibration Figures

THE ENTIRETY OF ATTACHMENT U IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT C OF REVISED EWMP

Attachment V

Industrial and Other Permitted Facilities

Attachment W

90th Percentile Load Determination

THE ENTIRETY OF ATTACHMENT W IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT C OF REVISED EWMP

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Attachment X

Load Reduction Summaries

THE ENTIRETY OF ATTACHMENT X IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT C OF REVISED EWMP

Attachment Y

Regional Project Cost Estimates

THE ENTIRETY OF ATTACHMENT Y IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT B OF REVISED EWMP

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Attachment Z

Green Street Cost Estimate

THE ENTIRETY OF ATTACHMENT Z IS SUPERSEDED BY THE 2018 REVISED EWMP, EXCEPT MATERIAL PERTAINING TO THE CITY OF AZUSA – SEE ATTACHMENT B OF REVISED EWMP

Attachment AA

Grant and Loan Opportunities

Attachment AB

USEPA's Financial Capabilities Framework for Municipal Clean Water Act Requirements

Attachment AC

Public Water Cost per Household: Assessing Financial Impacts of EPA Affordability Criteria in California Cities