Marina del Rey
Enhanced Watershed Management Program

Draft Plan

Prepared For:

Marina del Rey Enhanced Watershed Management Program Agencies

County of Los Angeles
Los Angeles County Flood Control District
City of Los Angeles
City of Culver City

April 8, 2015

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Prepared By:

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ABC Laboratories	Aquatic Bioassay and Consulting Laboratories, Inc.
APWA	American Public Works Association
ASCE	American Society of Civil Engineers
AVS	acid volatile sulfide
BMP	best management practice
BSS	City of Los Angeles Bureau of Street Services
Caltrans	California Department of Transportation
CCC	criterion continuous concentration
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CIMP	Coordinated Integrated Monitoring Program
CMP	Coordinated Monitoring Plan
CMC	criterion maximum concentration
CNG	compressed natural gas
County	County of Los Angeles
CSM	continuous simulation model
CTR	California Toxics Rule
CWA	Clean Water Act
DDT	dichlorodiphenyltrichloroethane
EMC	event mean concentration
ER-L	effects range low
EWMP	Enhanced Watershed Management Program
EWRI	Environmental and Water Resources Institute
FCG	fish contaminant goal
FHWA	Federal Highway Administration
GIS	Geographic Information System
HSPF	Hydrologic Simulation Program - FORTRAN
LACDBH	Los Angeles County Department of Beaches and Harbors
LACFCD	Los Angeles County Flood Control District
LADPW	Los Angeles County Department of Public Works
LAUSD	Los Angeles Unified School District
LARWQCB	Los Angeles Regional Water Quality Control Board
LAX	Los Angeles International Airport
LCC	life cycle cost
LDCP	City of Los Angeles Department of City Planning
LDL	low detection limit
LFD	low flow diversion
LID	Low Impact Development
LSPC	Loading Simulation Program in C++
MCM	Minimum Control Measure
MDL	method detection limit
MdR	Marina del Rey
MdRH	Marina del Rey Harbor
MLE	multiple lines of evidence
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
MS4 Permit	Municipal Separate Storm Sewer System Permit
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System

NPV	net present value
O&M	operations and maintenance
OEHHA	Office of Environmental Healy Hazard Assessment
p,p'-DDE	p,p'-dichlorodiphenyldichloroethylene
PCB	polychlorinated biphenyl
PIPP	public information and participation program
POTFW	wash-off potency factor
PVS	Palos Verdes Shelf
RAA	Reasonable Assurance Analysis
RCP	reinforced concrete pipe
ROW	right of way
RV	recreational vehicle
RWL	Receiving Water Limitation
SEM	simultaneously extracted metals
SQO	Sediment Quality Objective
State	State of California
TMDL	Total Maximum Daily Load
TSO	Time Schedule Order
TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
WESTON®	Weston Solutions, Inc.
WLA	waste load allocation
WMA	Watershed Management Area
WMMS	Watershed Management Modeling System
WQBEL	water quality based effluent limitations

ES.0 EXECUTIVE SUMMARY

ES.1 Introduction

On December 28, 2012, the Los Angeles Regional Water Quality Control Board (LARWQCB) adopted the National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Permit (MS4 Permit). This new MS4 Permit establishes the waste discharge requirement for stormwater and non-stormwater discharges within the watersheds of Los Angeles County. The MS4 Permit includes provisions that allow Permittees to voluntarily choose to implement an Enhanced Watershed Management Program (EWMP).

The EWMP for the Marina del Rey (MdR) watershed is a collaborative effort of the EWMP Agencies, comprised of the County of Los Angeles (County), Los Angeles County Flood Control District (LACFCD), and the cities of Los Angeles and Culver City. For the purposes of the MdR EWMP, the MdR watershed management area (WMA) is approximately 1,409 acres and consists of portions of the cities of Culver City and Los Angeles, as well as unincorporated County areas.

The MdR watershed has the one of the most aggressive Total Maximum Daily Load (TMDL) schedules for both Toxics and Bacteria and often leads the way in TMDL implementation for the rest of the County. The MdR watershed is subject to three TMDLs; the Santa Monica Bay Nearshore Debris TMDL (Debris TMDL), the Marina del Rey Harbor Mother's Beach and Back Basin Bacteria TMDL (Bacteria TMDL), and the Toxic Pollutants in Marina del Rey Harbor (MdRH) TMDL (Toxics TMDL). The interim and final compliance dates differ for each of the TMDLs.

ES.2 Water Quality Characterization and Prioritization

In accordance with the MS4 Permit, existing water quality conditions were characterized using data from relevant studies and monitoring completed within the past 10 years. In accordance with the MS4 Permit, Section VI.C.5.a, water-body pollutant combinations were classified into one of the following three categories (Table ES-1):

1. Category 1 (Highest Priority) – Pollutants with receiving water limitation or water-quality-based effluent limits (WQBEL) as established in Part V1.E and Attachments L through R of the MS4 Permit.

2. Category 2 (High Priority) – Pollutants in the receiving water that are listed as §303(d) and for which MS4 discharges may be causing or contributing to the impairment.

3. Category 3 (Medium Priority) – Pollutants with insufficient data to list as §303(d) but which exceed receiving water limitations contained in the MS4 Permit and for which MS4 discharges may be causing or contributing to the exceedance.

Table ES-1: Waterbody Pollutant Categorization

Waterbody	Pollutant	Classification
Marina del Rey Harbor	Dissolved Copper	Category 1
	Copper	Category 1
	Lead	Category 1
	Zinc	Category 1
	Total PCBs	Category 1
	Total DDTs	Category 1
	p,p'-DDE	Category 1
	Chlordane	Category 1
	Fecal coliform	Category 1
	Enterococcus	Category 1
	Total coliform	Category 1
Ballona Lagoon/ Venice Canal	None known	None

Based on the source assessment, priorities within the MdR watershed were assessed and sequenced in accordance with section VI.C.5.a.iv of the MS4 Permit (Table ES-2). As specified in the MS4 Permit, the highest priority (1) is assigned to those pollutants with TMDLs according to the following criteria:

a. Controlling pollutants for which there are established WQBELS, or receiving water limitation with interim or final compliance deadlines within the current MS4 Permit term, or whose TMDL deadlines have passed without achieving the limitations,
b. Controlling pollutants for which there are established WQBELs or receiving water limitations with compliance deadlines (interim or final) between September 6, 2012 and October 25, 2017.

The second highest (2) priorities are established for pollutants for which receiving water limitations are exceeded, or impairment is implicated as a result of discharges from the MS4. For purposes of the prioritization, third priority (3) will be attributed to controlling pollutants with TMDL compliance dates beyond the term of the MS4 Permit.

Table ES-2: Marina del Rey Priorities

Priority	Waterbody	Pollutant	Compliance Deadlines	Priority Sources*
1b	MdRH Back Basins	Bacteria (summer and winter dry weather)	July 10, 2014 interim sediment allocations met. Final Compliance December 28, 2017.	Birds, anthropogenic sources
	MdRH Back Basins	Copper	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Boats, residential, stormwater runoff
		Lead	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, stormwater runoff (suspended sediment)
		Zinc	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Commercial contributions, stormwater runoff
		PCBs	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, boats, stormwater runoff (suspended sediment)
		DDTs	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, stormwater runoff
		p,p'-DDE	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, stormwater runoff
		Chlordane	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, stormwater runoff (suspended sediment)
3	MdRH Back Basins	Bacteria (wet weather)	July 15, 2021 final wet weather and geometric mean.	Birds, stormwater runoff, anthropogenic sources
	MdRH Front Basins	Copper	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Boats, residential, stormwater runoff
		Lead	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, stormwater runoff (suspended sediment)
		Zinc	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Commercial contributions, stormwater runoff
		PCBs	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, boats, stormwater runoff (suspended sediment)
		DDTs	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, stormwater runoff
		p,p'-DDE	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, stormwater runoff
		Chlordane	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, stormwater runoff (suspended sediment)

*Although stormwater is not a primary source of pollutants it is a conveyance mechanism and is treated as a point source for purposes of the Toxicity TMDL.

ES.3 Minimum Control Measures

Section VI.C.5.b of the MS4 Permit requires the identification of control measures, strategies and BMPs within the watershed with the goal of creating an efficient program to focus resources on the watershed priorities identified in above. In accordance with the MS4 Permit "the objectives of the Watershed Control Measures shall include:

1. Prevent or eliminate non-stormwater discharges to the MS4 that are a source of pollutants from the MS4 to the receiving waters.
2. Implement pollutant controls necessary to achieve all applicate interim and final water quality-based effluent limitations and/or receiving water limitations pursuant to corresponding compliance schedules.
3. Ensure that discharges from the MS4 do not cause or contribute to exceedances of receiving water limitations."

The EWMP Agencies have previously implemented numerous structural and non-structural minimum control measures (MCMs) to improve water quality in the MdR watershed. However, in order to address attainment of the stormwater volume and pollutant loading reductions necessary for compliance (97.5% reduction of zinc), a combination of regional, decentralized, and nonstructural MCMs will be required. Proposed Regional Projects include a public-private partnership with Costco in the City of Culver City, Regionally Distributed Green Streets located in Subwatershed 4, and projects at four parks (Triangle, Canal, Via Dolce, and Venice of American Centennial Parks) in the watershed. Other key MCMs include localized green streets and if necessary for compliance, the implementation of diversions to the sanitary sewer system. Table ES-3 below lists the types of Structural MCM planned for each subwatershed as well as the expected load reduction achieved through implementation.

Table ES-3: Structural MCMs by Subwatershed

MCM Type	Cumulative Load Reduction Percent (Zinc)
Subwatershed 1A	
Localized Green Streets	6.27
Development/Redevelopment	2.08
Sanitary Sewer Diversion	2.68
Structural MCMs Sub-Total	**11.04**
Subwatershed 3	
Localized Green Streets	6.47
Development/Redevelopment	0.22
Venice of America Park	0.47
Triangle Park	0.01
Existing MCM - Boone Olive Diversion	0.43
Structural MCMs Sub-Total	**7.59**
Subwatershed 4	
Regional Distributed Green Streets (GW≥20ft)	23.93
Localized Green Streets (20ft>GW)	38.46
Development/Redevelopment	1.75
Costco Parking Lot	5.12
Sanitary Sewer Diversion	4.27
Structural MCMs Sub-Total	**73.53**

Table ES-3: Structural MCMs by Subwatershed

MCM Type	Cumulative Load Reduction Percent (Zinc)
Back Basins Structural MCM Total	**92.16**
Back Basins Non-Structural MCM Total	**6.5**
Back Basins Total	**98.66**
Subwatershed 1B	
Localized Green Streets	50.33
Development/Redevelopment	20.16
Sanitary Sewer Diversion	19.21
Front Basins Structural MCMs Total	**89.70**
Back Basins Non-Structural MCM Total	**6.5**
Front Basins Total	**96.2**
Subwatershed 2	
Localized Green Streets	24.55
Development/Redevelopment	2.54
Canal Park	1.11
Via Dolce Park	0.06
Non-TMDL Area Structural MCMs Total	**28.27**
Non-TMDL Area Non-Structural MCM Total	**6.5**
Non-TMDL Area Total	**34.77**

Multiple non-structural MCMs are planned including modeling updates and other studies, source control, catch basin cleaning, and industry targeted outreach and education, enforcement, and inspection programs. Table ES-4 below illustrates the potential reduction in contaminants expected for each category of non-structural MCMs.

Table ES-4: Nonstructural MCMs

Nonstructural MCM Category	Examples	Potential Contaminant Reduction (%)
Watershed Studies	Pollutant Loading Model and Database; Total Suspended Solids/Pollutant Correlations	
Source Control	Collaborative Environmentally Friendly Alternative Services Program; Product Substitution Campaign	4
Municipal Separate Storm Sewer System (MS4)	Targeted Aggressive MS4 and Catch Basin Cleaning Program	1
Restaurants, Parking Garage, Construction, and Commercial Facilities Compliance	Code Survey and Modification; Targeted inspections; Business-led Voluntary BMP Implementation Program	1
Community Outreach and Education	Outreach and Education; Environmentally Friendly Boating Program; Green Gardening and Runoff Reduction Program	0.5
Total Contaminant Reduction (%)		**6.5**

ES.4 Reasonable Assurance Analysis

Under the MS4 Permit, compliance with the sediment waste load allocations (WLAs) for Cu, Pb, Zn, Chlordane, p'p-DDE and total DDT may be demonstrated via any one of three different means: (a) qualitative sediment condition of unimpacted or likely unimpacted via the interpretation and integration of multiple lines of evidence is met, (b) sediment numeric targets are met in bed sediments, or *(c) final sediment WLAs are met*. Also under the Permit, compliance with the sediment WLAs for PCBs may be demonstrated via any of four different means: (a) fish tissue targets are met in species resident to the waterbody, *(b) final sediment allocations are met*, (c) sediment numeric targets to protect fish tissue are met in bed sediments, or (d) demonstrate that the sediment quality condition protective of fish tissue is achieved per the Statewide Enclosed Bays and Estuaries Plan, as amended to address contaminants in resident finfish and wildlife. This EWMP focuses on demonstrating that compliance may be achieved through meeting final sediment WLAs for the contaminants in the MdR Toxics TMDL.

The MdR EWMP Agencies have selected the Los Angeles County Watershed Management Modeling System (WMMS) as the model to be used for the development of the MdR EWMP. WMMS conforms to the modeling system selection criteria set by the LARWQCB–led RAA committee and is based on a regional modeling approach that was developed to simulate the hydrology and transport of sediment and metals. Based on available data and modeling results, zinc loading requires the largest load reduction and is thus the compliance driver for the Toxics TMDL (i.e., based on available data, if MCMs are implemented to achieve zinc WLA, then other toxic pollutant loads would also be below WLAs). Achieving the required load reductions by the interim and final Toxic TMDL compliance dates will result in achieving compliance with the Bacteria and Trash TMDLs as well.

The Reasonable Assurance Analysis (RAA) delivers a quantitative demonstration that MCMs proposed will achieve interim and final WLAs through stormwater capture, filtration, and diversion, and associated TSS loading reductions.

ES.5 Implementation Plan and Schedule

Given that the compliance schedule for the Toxics TMDL is the most aggressive TMDL schedule applicable to the MdR watershed, the Toxics WLAs were used as the primary scheduling driver for MCM implementation. Once projects were scheduled per the Toxics TMDL goals, Trash TMDL and Bacterial TMDL load reduction goals were evaluated, and additional structural and/or nonstructural controls were identified. As previously mentioned, the MdR EWMP Agencies have elected to demonstrate Toxics TMDL compliance through meeting final sediment WLAs for the contaminants in the TMDL. Final compliance is expected to be achieved in accordance with the compliance points in the Toxics TMDL, in 2018 for the Back Basins of the harbor and in 2021 for the Front Basins.

To meet the compliance milestones, a phased implementation approach using a combination of structural and nonstructural strategies designed specifically to reduce toxic pollutant and bacterial loading to MdR will be implemented. In parallel with the proposed MCMs, the MdR EWMP Agencies will conduct TMDL-required studies, including the stressor identification study, the site specific objective dissolved copper study, and the bacteria source identification study for Marina Beach. These studies are expected to provide additional information, and may lead to TMDL compliance through alternative means of compliance, which would significantly impact the implementation of MCMs proposed in this EWMP.

ES.6 Costs

Total costs for implementation of the structural and nonstructural MCMs proposed in this EWMP are estimated at $391,914,197 (Table ES-5), including costs associated with Subwatershed 2 (a non-TMDL area). If costs associated with Subwatershed 2 are not included in the calculation, the total costs for MCM implementation are estimated at $363,204,205. All costs were translated and are presented in 2015 dollars using the net present worth analysis and an average inflation rate of 3 percent.

Table ES-5: Estimated Implementation Costs by Jurisdiction

MdR Watershed	Structural MCMs	Nonstructural MCMs	Total Cost
City Of Los Angeles	$350,508,387	$2,923,268	$353,431,655
County Of Los Angeles	$15,228,511	$1,190,913	$16,419,424
City Of Culver City	$21,936,109	$127,009	$22,063,118
Total Cost (2015 dollars)	**$387,673,007**	**$4,241,190**	**$391,914,197**

Estimated costs for implementation of structural MCMs are presented by type of MCM in Table ES-6 below. Life cycle costs (LCC) incorporated into structural MCM cost estimates include materials, construction, engineering design, CEQA and permitting, contingency, land acquisition, twenty years of routine operations and maintenance (O&M), and major rehabilitation costs. The cost of administering a stormwater management program for post construction effectiveness assessment during three storm events was also included in this estimate.

Table ES-6: Estimated Structural MCM Implementation Costs by Type

MdR Watershed	Cost
Distributed Regional Green Streets (GW≥20ft)	$2,654,171
Localized Green Streets (20ft>GW)	$12,437,500
Potential Sanitary Sewer Diversions	$1,689,414
Costco	$18,000
Canal Park	$5,625
Via Dolce Park	$30,937
Venice Of America Park	$5,625
Triangle Park	$30,937
Cumulative Cost (2015 dollars, $)	**$387,673,007**

GW – Groundwater level

Estimated costs for implementation of non-structural MCMs are presented in Table ES-7 below.

Table ES-7: Estimated Non-Structural MCM Implementation Costs by Type

Non-Structural Solution Category	Proposed Non-Structural MCMs	Costs (2015 $)
Watershed Studies	Pollutant Loading Model and Database	$218,000

Non-Structural Solution Category	Proposed Non-Structural MCMs	Costs (2015 $)
	Total Suspended Solids/Pollutant Correlations	$109,000
Source Control	Collaborative Environmentally Friendly Alternative Services Program	$643,100
	Product Substitution Campaign	$1,079,100
Municipal Separate Storm Sewer System (MS4)	Targeted Aggressive MS4 and Catch Basin Cleaning Program	$512,300
Restaurants, Parking Garage, Construction, and Commercial Facilities Compliance	Code Survey and Modification	$225,630
	Targeted inspections	$272,500
	Business-led Voluntary BMP Implementation Program	$645,280
Community Outreach and Education	Environmentally Friendly Boating Program	$240,890
	Green Gardening and Runoff Reduction Program	$295,390
Total Cost		**$4,241,190**

ES.7 Adaptive Management

Adaptive management is a key component to the successful implementation, assessment and refinement of the MdR EWMP. Adaptive management is the process by which data are continually assessed in the context of improving and adapting programs to ensure the most effective strategies are implemented. In accordance with the MS4 Permit, every two years as data become available through Coordinated Integrated Monitoring Program (CIMP) monitoring, BMP effectiveness studies, special studies such as the Toxics TMDL required Stressor ID Study, and other scientific studies, it will be integrated and assessed to determine if programs in the EWMP should be altered to enable compliance in the most efficient manner. Additionally, public participation and Regional Board recommendations will also be included in the adaptive management process. The adaptive management framework will allow the EWMP Agencies to develop an overall program consisting of efficient solutions based on evolving watershed priorities.

1.0 INTRODUCTION

The Marina del Rey (MdR) watershed is a small subwatershed located in the larger Santa Monica Bay watershed. The Marina del Rey Harbor (MdRH) was officially opened in 1965 and is the world's largest man-made small craft harbor. The tributary area served by a Municipal Separate Storm Sewer Sysem (MS4) that drains to MdRH is approximately 1,409 acres and consists of portions of the cities of Culver City and Los Angeles, as well as portions of the unincorporated County of Los Angeles (County). The MdR Watershed Management Area (WMA) is one of the smallest WMAs in the County of Los Angeles, but it is also one of the most important and active watersheds.

The MdR watershed has one of the most aggressive Total Maximum Daily Load (TMDL) schedules for both toxics and bacteria and often leads the way in TMDL implementation for the rest of the County (Los Angeles County Department of Public Works [LADPW], 2008; LARWQCB, 2012; LADPW, 2007)..

The extensive ongoing efforts of the County, Los Angeles County Flood Control District (LACFCD), and the cities of Culver City and Los Angeles (collectively known as the MdR Enhanced Watershed Management Program [EWMP] Agencies) to improve water quality in the MdR watershed include implementing best management practices (BMPs) to reduce pollutants from stormwater runoff to the harbor. Over the past 10 years, the responsible agencies in the MdR watershed have spent tens of millions of dollars in special studies, low-flow diversions, non-structural BMPs, structural BMPs, and monitoring efforts. The water quality in the harbor has significantly improved as a result of the cooperative efforts of the MdR EWMP Agencies.

1.1 Enhanced Watershed Management Plan Overview

On December 28, 2012, the Los Angeles Regional Water Quality Control Board (LARWQCB) adopted the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System Permit (MS4 Permit). This new MS4 Permit establishes the waste discharge requirement for stormwater and non-stormwater discharges within the watersheds of Los Angeles County. The MS4 Permit includes provisions that allow Permittees to voluntarily choose to implement an EWMP.

The EWMP for the MdR watershed is a collaborative effort of the EWMP Agencies, comprised of the County, LACFCD, and the cities of Los Angeles and Culver City. The MdR EWMP will cover the areas owned by the MS4 Permittees within the watershed (Figure 1-1). The WMA does not include the area adjacent to the Ballona Wetlands owned by the State of California (State) nor does it include the California Department of Transportation (Caltrans) right-of-way (ROW) areas because these agencies are not members of the MdR EWMP Agencies. The WMA also does not include the water areas within the MdR watershed because they are considered non-point sources and are not covered by the MS4 Permit.

Figure 1-1: Marina del Rey Watershed Jurisdictional Boundaries

Development of the MdR EWMP in accordance with the MS4 Permit includes the following elements:

1. Identification of water quality priorities, including an evaluation the of existing water quality conditions, classification of pollutants, assessment of known and suspected pollutant sources in the watershed, and prioritization of water quality issues in the watershed.
2. Characterization of the existing and potential control measures within the watershed.
3. Addressing the approach to incorporate reasonable assurance analysis (RAA) in the optimization of MdR watershed control measures.
4. Development of an EWMP implementation schedule.
5. Public and stakeholder input.
6. Adaptive management framework.
7. Estimation of implementation costs and financial strategy

1.2 MdR Watershed Land Use and Drainage Characteristics

The MdR watershed is bordered by the Santa Monica Bay Watershed to the west and the Ballona Creek watershed to the north and east. The MdRH is open to the Santa Monica Bay through the main channel and shares a common breakwater with Ballona Creek. The MdR watershed consists of four subwatersheds, referred to as Subwatersheds 1 to 4 (Figure 1-2: MdR Land Use and Subwatersheds). Table 1-1 summarizes the MdR watershed acreage by subwatershed.

The MdRH is an active harbor for pleasure craft, consisting of the main channel and eight basins (A to H). Basins A, B, C, G, and H are known as the Front Basins. Basins D, E, and F are known as the Back Basins and are located in Subwatershed 1. The MdR watershed also includes the Venice Canals and the tributary area to the Ballona Lagoons, which discharge to the MdRH, near the exit to the Santa Monica Bay (Subwatershed 2). The Caltrans ROW areas, which are located mainly within the City of Los Angeles in Subwatersheds 1 and 4, and the portions of the Ballona Wetland (49.3 acres) located on State land in Subwatershed 1 are outside the boundaries of the MdR EWMP MS4 Permit area.

Figure 1-2: MdR Land Use and Subwatersheds

Table 1-1: Summary of Marina del Rey Subwatershed Acreage

Agency	EWMP MS4 Permittee	Sub-watershed 1 (Acres)	Sub-watershed 2 (Acres)	Sub-watershed 3 (Acres)	Sub-watershed 4 (Acres)	EWMP Watershed (Acres)	% EWMP Watershed Area
City of Los Angeles	Yes	32.9	278.1	70.5	589.8	971.3	69%
County of Los Angeles	Yes	336.2	46.8	0.0	12.7	395.7	28%
City of Culver City	Yes	0.0	0.0	0.0	42.2	42.2	3%
Los Angeles County Flood Control District	Yes	N/A	N/A	N/A	N/A	N/A	N/A
Area of EWMP Agencies		**369.1**	**324.9**	**70.5**	**644.7**	**1409**	**100%**
Caltrans	No	5.4	0.0	0.0	26.4	31.8	NA
State of California (Ballona Wetland)	No	49.3	0.0	0.0	0.0	49.3	NA
MdRH Watershed Area		**423.8**	**324.9**	**70.5**	**671.1**	**1490**	-

The following land uses are found in the MdR watershed:

- The MdRH land area in Subwatershed 1 (369.1 acres) is almost entirely composed of unincorporated County land and has many small drains that discharge into all the basins. The MdR Small Drain Survey, completed for the Los Angeles County Department of Beaches and Harbors (LACDBH, 2004a), identified approximately 724 small outfalls that discharge directly into MdRH, the majority of which serve the individual parcels and small roads among the basins. The remaining drains are located in the streets surrounding the basins. The City of Los Angeles, Caltrans, and the City of Culver City are not responsible for any outlets that drain directly to the harbor. The LACFCD owns 20 storm drain outlets and two storm drain inlets that flow into the Oxford Basin. No MS4 Permittee was assigned responsibility for the four storm drain outlets from Oxford Basin.
- Subwatershed 2 (approximately 324.9 acres) does not drain into the MdRH Front or Back Basins, but drains into the Venice Canal and the Ballona Lagoon, which discharge into the MdRH main channel mouth.
- Boone Olive Pump Plant serves Subwatershed 3, a tributary area of 70.5 acres that lies entirely within the boundaries of the City of Los Angeles. The pump station discharges into Basin E.
- Subwatershed 4 lies mainly within the jurisdiction of the City of Los Angeles and the City of Culver City and totals approximately 644.7 acres (excluding Caltrans areas). Its corresponding runoff discharges into the Oxford Basin, a man-made flood control basin occupying approximately 10 acres within the County. Situated north of the Back Basins, Oxford Basin is operated by the LACFCD. It drains into Basin E through two tide gates and storm drain piping. The Oxford Retention Basin Multi-Use Enhancement Project is currently underway. Once completed this project will provide multiple benefits through enhanced water circulation, contaminated soil

removal, bioswale construction as well as native and drought resistant landscaping. An expected outcome of the project is a reduction of pollutants discharged to Marina del Rey Harbor Basin E from Oxford Basin.

Table 1-2 presents the land use acreages by subwatershed and Table 1-3 shows the land use acreages by jurisdiction.

Table 1-2: Land Use Acreages by Subwatershed (Acres)

Land Use Class	Subwatershed Acreage*				Total
	1	2	3	4	
Single-Family Residential	1.8	45.8	22.9	167.2	237.7
Multi-Family Residential	137.1	131.8	21.1	96.3	386.3
Institutional/Public Facilities	8.0	10.1	2.6	67.2	87.9
Commercial and Services	120.0	22.8	1.6	124.2	268.6
Industrial/Mixed with Industrial	0.2	0.2	0.3	27	27.7
Transportation/Road ROW	38.2	83.3	22.0	153.8	297.3
Developed Recreation/Marina Parking	41.6	0.7	0	1.9	44.2
Beach	8.2	0	0	0	8.2
Water**	6.4	30.3	0	7.1	43.8
Vacant	7.6	0	0	0	7.6
Total	369.1	325	70.5	644.7	1409

*Acreage excludes Caltrans and State owned land (Ballona Wetland) not in EWMP Area

**Marina Boat Area and MdRH Water not included in "Water" class acreage provided here. Water class includes Ballona Lagoon (14.4 acres), Venice Canals (15.9acres), Oxford Basin (7.1 acres), and Ballona Shoreline and other water (6.4 acres)

Table 1-3: Land Use Acreages by EWMP Agency Jurisdiction

Land Use Class	EWMP Agencies Jurisdictional Areas (Acres)*			
	City of Culver City	City of Los Angeles	County of Los Angeles	Total
Single-Family Residential	6.8	230.6	0.3	237.7
Multi-Family Residential	0	229.4	156.9	386.3
Institutional/Public Facilities	0	83.7	4.2	87.9
Commercial and Services	24.3	122.3	122.0	268.6
Industrial/Mixed with Industrial	0	27.7		27.7
Transportation/Road ROW	11.1	246.4	39.8	297.3
Developed Recreation/Marina Parking	0	0.9	43.3	44.2
Beach	0	0	8.2	8.2
Water**	0	30.3	13.5	43.8
Vacant	0	0	7.6	7.6
Total	42.2	971.3	395.7	1409

*Acreage excludes Caltrans and State-owned land (Ballona Wetland) not in EWMP Area.

**Marina Boat Area and MdRH Water not included in "Water" class acreage provided here. Water class includes Ballona Lagoon (14.4 acres), Venice Canals (15.9acres), Oxford Basin (7.1 acres), and Ballona Shoreline and other water (6.4 acres)

2.0 LEGAL AUTHORITY

2.1 Section 303(d) List 2010

The federal Clean Water Act (CWA), Section §303(d), requires states to identify waters that do not meet applicable water quality standards despite the treatment of point sources by the minimum required levels of pollution control technology. States are required not only to identify these "water quality limited segments" but also to prioritize such waters for the purpose of developing TMDLs. A TMDL is defined as the "sum of the individual waste load allocations (WLAs) for point sources and load allocations for nonpoint sources and natural background" (40 Code of Federal Regulations [CFR] 130.2), such that the capacity of the waterbody to assimilate constituent loads (the loading capacity) is not exceeded. A TMDL is also required to account for seasonal variations and include a margin of safety to address uncertainty in the analysis (U.S. Environmental Protection Agency [USEPA], 2000).

The §303(d) list, which was last updated in 2010 identified a number of constituents for the MdRH Back Basins and Marina Beach (Table 2-1). Marina Beach is also commonly known as Mother's Beach.

Table 2-1: Summary of Section 303(d) Listings

Water Body	Constituent	Final Listing Decision
Marina del Rey Harbor - Back Basins	Chlordane (tissue and sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Copper (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	DDT* (tissue)	Do Not Delist from §303(d) list (TMDL required list)
	Dieldrin* (tissue)	Do Not Delist from §303(d) list (TMDL required list)
	Fish Consumption Advisory	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Indicator bacteria	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Lead (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	PCBs (tissue and sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
	Sediment toxicity	Do Not Delist from §303(d) list (being addressed with USEPA-approved TMDL)
	Zinc (sediment)	List on §303(d) list (being addressed by USEPA-approved TMDL)
Marina del Rey Harbor Marina Beach	Indicator bacteria	List on §303(d) list (being addressed by USEPA-approved TMDL)

*USEPA-approved TMDL has made a finding of non-impairment for this constituent.
DDT - dichlorodiphenyltrichloroethane

2.2 Existing TMDLs Summary

The Marina del Rey watershed is subject to three TMDLs; the Santa Monica Bay Nearshore Debris TMDL (Debris TMDL), the Marina del Rey Harbor Mother's Beach and Back Basin Bacteria TMDL (Bacteria TMDL), and the Toxic Pollutants in Marina del Rey Harbor TMDL (Toxics TMDL). Each of these TMDLs is briefly summarized below. The compliance schedules for the applicable TMDLs are presented in Table 2-2.

Table 2-2: TMDL Compliance Schedules

<table>
<tr><th>TMDL</th><th>Matrix</th><th>Parameters</th><th>Goal</th><th>Date</th></tr>
<tr><td rowspan="5">Marina del Rey Harbor Toxic Pollutants TMDL</td><td>Harbor Water</td><td>Dissolved Copper (from boats)</td><td>Meet LAs</td><td>3/22/2024</td></tr>
<tr><td rowspan="2">Harbor sediments (Back Basins)</td><td rowspan="4">Copper, lead, zinc, chlordane, PCBs, DDTs, p'p-DDE</td><td>Interim Sediment Allocations</td><td>3/22/2016</td></tr>
<tr><td>Final Compliance</td><td>3/22/2018</td></tr>
<tr><td rowspan="2">Harbor sediments (Front Basins)</td><td>Interim Sediment Allocations</td><td>3/22/2019</td></tr>
<tr><td>Final Compliance</td><td>3/22/2021</td></tr>
<tr><td rowspan="3">Marina del Rey Mother's Beach and Back Basins Bacteria TMDL</td><td rowspan="2">Harbor water</td><td rowspan="3">Total coliform, fecal coliform, Enterococcus</td><td>Interim compliance with allowable exceedance days for summer and winter dry weather</td><td>7/10/2014</td></tr>
<tr><td>Final compliance with allowable exceedance days for summer and winter dry weather</td><td>12/18/2017</td></tr>
<tr><td>Harbor water</td><td>Compliance with allowable exceedance days for wet weather and geometric mean targets</td><td>7/15/2021</td></tr>
<tr><td rowspan="5">Santa Monica Bay Nearshore and Offshore Debris TMDL</td><td colspan="2" rowspan="5">Trash</td><td>20% reduction</td><td>3/20/2016</td></tr>
<tr><td>40% reduction</td><td>3/20/2017</td></tr>
<tr><td>60% reduction</td><td>3/20/2018</td></tr>
<tr><td>80% reduction</td><td>3/20/2019</td></tr>
<tr><td>100% reduction</td><td>3/20/2020</td></tr>
</table>

PCB – polychlorinated biphenyls
p,p'-DDE – p,p'-dichlorodiphenyldichloroethylene

2.2.1 Santa Monica Bay Nearshore Debris TMDL

The Debris TMDL was adopted by the LARWQCB on November 4, 2010 (Resolution No. R10-010 and became effective upon adoption by the USEPA on March 20, 2012. Responsible agencies identified for the Debris TMDL include, among others, the County, the City of Culver City, and the City of Los Angeles. The Debris TMDL established numeric targets and waste load allocations of zero discharge of trash and plastic pellets to waterbodies within the Santa Monica Bay WMA, which includes MdRH. The trash WLA applicable to the MS4 Permittees shall be complied with through the Ballona Creek Trash TMDL (Resolution No. R08-007).

2.2.2 Bacteria TMDL

The Bacteria TMDL was originally adopted by the LARWCQB on August 7, 2003 (Resolution No. 2003-012) and became effective on March 18, 2004 upon approval by the USEPA. The Bacteria TMDL was revised by the LARWQCB on June 7, 2012 (Resolution No. R12-007). The responsible agencies identified for the Bacteria TMDL include the County, LACFCD, City of Los Angeles, the City of Culver City, and Caltrans.

The Bacteria TMDL established numeric bacterial compliance targets based on the acceptable health risk for marine recreational waters as defined by the USEPA. The numeric targets are expressed as both single sample limits and rolling geometric means (Table 2-3).

Table 2-3: Bacteria TMDL Numeric Targets

Indicator	Rolling 30-Day Geometric Mean Limit*	Single Sample Limit
Total coliform	1,000 MPN/100 mL	1,000 MPN/100 mL if fecal > 10% of total, or 10,000 MPN/100 mL**
Fecal coliform	200 MPN/100 mL	400 MPN/100 mL
Enterococcus	35 MPN/100 mL	104 MPN/100 mL

*The geometric mean is calculated weekly as a rolling geometric mean using 5 or more samples, for 6-week periods starting all calculation weeks on Sunday.
** Total coliform single sample limit of 10,000 most probable number (MPN) decreases to 1,000 when the fecal coliform value is greater than 10% of total coliform value.

The TMDL WLAs are expressed as allowable exceedance days, or the number of days on which sampling results can surpass the numeric targets and WLAs. For single sample targets, allowable exceedance days are specified by three defined seasons (summer dry, winter dry, and wet weather) and vary by monitoring site. Each season has its own compliance dates (interim and final), requirements, and limits, as presented on Table 2-4.

Table 2-4: Bacteria TMDL Seasons

Compliance Season	Compliance Season Dates	Goal	Allowable Exceedance Days/Year	Compliance Deadline
Geometric Mean	Year Round	Final Compliance	0 days/year	July 15, 2021
Summer dry	April 1–October 31	Interim Compliance	Daily - 22 days/year	July 10, 2014
			Weekly - varies by station (0-12 days/year)	
		Final Compliance	0 days/year (daily and weekly sampling)	December 28, 2017
Winter dry	November 1–March 31	Interim Compliance	Daily - 60 days/year	July 10, 2014
			Weekly - varies by station (2-19 days/year)	July 10, 2014
		Final Compliance	Daily - 9 days/year	December 28, 2017
			Weekly - 2 days/year	
Wet weather	Rain event ≥ 0.1 inches at LAX rain gauge, and 3 days following the end of the rain event.	Final Compliance	Daily - 17 days/year*	July 15, 2021
			Weekly - 3 days/year*	

*Wet weather allowable exceedance days for MDRH-9 are 8 days/year for daily sampling and 1 day/year for weekly sampling
LAX – Los Angeles International Airport

2.2.3 Toxics TMDL Summary

The Toxics TMDL was adopted by the Regional Board on October 6, 2005 (Resolution No. 2005-012), and was approved by USEPA and became effective on March 22, 2006. The responsible agencies identified for the Toxics TMDL include the County, LACFCD, City of Los Angeles, City of Culver City, and Caltrans. The Toxics TMDL originally addressed certain metals and organics in the Back Basins of MdRH (Basins D, E, and F) but was amended in 2014 to include the Front Basins of MdRH (Basins A, B, C, G, and H). The Toxics TMDL compliance schedule provides for multiple pathways to achieve compliance with the TMDL, including achieving designated WLAs, or alternatively demonstrating attainment of the Sediment Quality Objectives (SQOs) through the use of the multiple lines of evidence (MLE) approach. Interim and Final compliance milestones are provided in the TMDL, and the compliance schedule is included in Table 2-2.

The constituents addressed by the Toxics TMDL are copper, lead, and zinc, chlordane, total polychlorinated biphenyls (PCBs), p,p’-dichlorodiphenyldichloroethylene (p,p’-DDE), and total dichlorodiphenyltrichloroethanes (DDTs).

2.2.3.1 Sediment Numeric Targets

The Toxics TMDL established sediment numeric targets using the effects range low (ER-L) (Long et al., 1995) guidelines for copper, lead, zinc, chlordane, total DDTs, and p,p’-DDE. The sediment numeric target for total PCBs in sediments was selected to protect human health from consumption of contaminated fish (Table 2-5).

Table 2-5: Toxics TMDL Sediment Numeric Targets

Constituent	Numeric Target for Sediment
Chlordane	0.5 µg/kg
Total PCBs	3.2 µg/kg
Total DDTs	1.58 µg/kg
p-p'-DDE	2.2 µg/kg
Copper	34 mg/kg
Lead	46.7 mg/kg
Zinc	150 mg/kg

2.2.3.2 Water Column Numeric Targets

The Toxics TMDL established a final numeric target for PCBs in the water column using the California Toxics Rule (CTR) criterion for the protection of human health from the consumption of aquatic organisms. A numeric target for dissolved copper in the water column was also established based on the CTR Criterion Maximum Concentration (CMC) and Criterion Continuous Concentration (CCC) (Table 2-6).

Table 2-6: Toxics TMDL Water Column Numeric Targets

TMDL Phase	Numeric Target (µg/L)
Total PCBs	0.00017*
Dissolved copper	Acute – 4.8/Chronic – 3.1
*Receiving water quality samples shall be collected monthly and analyzed for total PCBs at detection limits that are at or below the minimum levels. The minimum levels are those published by the State Water Resources Control Board in Appendix 4 of the Policy for the Implementation of Toxic Standards for Inland Surface Water, Enclosed Bays, and Estuaries of California, March 2, 2000. Special emphasis should be placed on achieving detection limits that will allow evaluation relative to the CTR standards.	

2.2.3.3 Fish Tissue Numeric Targets

The Toxics TMDL fish tissue numeric target of 3.6 µg/kg for total PCBs is the Office of Environmental Health Hazard Assessment (OEHHA) Fish Contaminant Goal (FCG).

2.2.3.4 Sediment Waste Load Allocations

Loading capacity was estimated based on the annual average total suspended solids (TSS) loads into MdRH under the assumption that the finer sediments transport the majority of constituents. The Toxics TMDL for sediment was calculated based on the estimated loading capacity and the numeric sediments targets (Table 2-7). The sediment load allocation is the same as the numeric target.

Table 2-7: Toxics TMDL Numeric Targets and Loading Capacity

Metals	Numeric Target (Load Allocation) ER-L(mg/kg)	TMDL Loading Capacity(kg/year)
Copper	34	2.88
Lead	46.7	3.95
Zinc	150	12.69
Organics	**ER-L (µg/kg)**	**Proposed TMDL (g/year)**
Chlordane	0.5	0.04
PCBs	22.7	1.92
Total DDTs	1.58	0.13
p-p'-DDE	2.2	0.19

2.2.3.5 Water Column Load Allocations

The load allocation for dissolved copper from boats is a reduction of 85% from the baseline copper load from boats of 3,609 kg/year.

2.2.3.6 Stormwater Waste Load Allocations

WLAs for stormwater are also included in the Toxics TMDL for each of the MS4 Permittees (Table 2-8).

Table 2-8: Toxics TMDL Stormwater Waste Load Allocations

Permittees	Copper (kg/year)	Lead (kg/year)	Zinc (kg/year)	Chlordane (g/year)	Total PCBs (g/year)	Total DDT (g/year)	p'p-DDE (g/year)
MS4	2.26	3.10	9.96	0.0332	1.51	0.10	0.15
Caltrans	0.036	0.05	0.16	0.0005	0.024	0.0017	0.0024
General construction	0.23	0.32	1.02	0.0034	0.16	0.011	0.015
General industrial	0.012	0.016	0.053	0.0002	0.008	0.0006	0.0008
Total	**2.54**	**3.49**	**11.2**	**0.04**	**1.70**	**0.12**	**0.16**

3.0 IDENTIFICATION OF WATER QUALITY PRIORITIZATION

3.1 Approach to Data Compilation and Analysis

In accordance with the MS4 Permit, existing water quality conditions were characterized using data from relevant studies and monitoring completed within the past 10 years. The EWMP Agencies have conducted extensive monitoring in the harbor Table 3-1 provides a summary of the data and studies used in the evaluation. Additional information and detailed data analysis are presented in the Marina del Rey EWMP Work Plan.

Table 3-1: Summary of Data and Studies Used in the Evaluation

Report	Parameters	Stormwater / MS4	Harbor Water	Sediment	Sediment Cores	Fish Tissue
Toxics TMDL Monitoring (2010-2013)	Organics	x	-	x	-	x
	Metals	x	x	x	-	-
	Conventional	x	-	x	-	-
	Toxicity	-	-	x	-	-
Storm-Borne Sediment Monitoring (2011)	Organics	x	-	-	-	-
	Metals	x	-	-	-	-
	Conventional	x	-	-	-	-
Special Study – Low Detection Limits (2011)	Organics	x	-	x	-	-
Special Study - Partitioning Coefficient (2011)	Organics	x	-	x	-	-
	Metals	x	x	x	-	-
	Conventional	x	x	x	-	-
MdRH Annual Reports (2002-2007)	Organics	-	-	x	-	-
	Metals	-	-	x	-	-
	Conventional	-	x	-	-	-
	Bacteria	-	x	-	-	-
MdRH Sediment Characterization Study (2008)	Organics	-	-	x	x	-
	Metals	-	-	x	x	-
	Conventional	-	x	x	-	-
	Toxicity	-	-	x	-	-
Oxford Basin Study (2010)	Organics	-	x	x	x	-
	Metals	-	x	x	x	-
	Conventional	-	x	x	x	-
	Bacteria	-	x	x	-	-
Bight '03 (2003)	Organics	-	-	x	-	-
	Metals	-	-	x	-	-
	Conventional	-	-	x	-	-
	Toxicity	-	-	x	-	-
Bight '08 (2008)	Organics	-	-	x	-	-
	Metals	-	-	x	-	-
	Conventional	-	-	x	-	-
	Toxicity	-	-	x	-	-
Bacteria TMDL Monitoring (2007-2013)	Bacteria	-	x	-	-	-
Nonpoint Source Bacteria Study (2006)	Bacteria	x	x	x	-	-

3.2 Summary of Findings by Matrix

3.2.1 Stormwater

Stormwater monitoring was conducted as part of the Toxics TMDL coordinated monitoring plan at five stations (Figure 3-1). A total of 23 storms were monitored in accordance with the Toxics TMDL Coordinated Monitoring Plan (CMP) during the 3-year period (2010 to 2013). Two special studies and one pilot study were also conducted: the Partitioning Coefficient Special Study, the Low Detection Limit (LDL) Special Study, and the storm borne sediment pilot study. Because the Toxics TMDL targets for stormwater are sediment based, it is not feasible to make an assessment of water quality exceedances based on water column data. For this report, the data were compared to the CTR water column criteria to provide a general sense of the water quality conditions in the stormwater to help guide the prioritization of water quality issues. Key findings include the following:

- Dissolved copper and dissolved zinc frequently exceeded the CTR CMC in Toxics TMDL monitoring, whereas dissolved lead rarely exceeded the CTR CMC (one sample exceeded at CTR CMC at MdR-C-2 on 3/8/2013).
- Partitioning Coefficient Study results for copper in stormwater showed that concentrations were above background levels and may be contributing to copper in the MdRH.
- Chlordane was not detected in any of the Toxics TMDL monitoring samples above the Method Detection Limit (MDL). The MDLs were below the CTR CMC for acute toxicity for freshwater (2.4 µg/L). The LDL Special Study results for chlordane in stormwater achieved lower MDLs. The low MDL results confirmed that chlordane levels were below the applicable criterion.
- Total PCBs were not detected above the MDL for the first two monitoring years of Toxics TMDL monitoring, and at only two events at all stations during the third year. The field trip blank also had total PCB results above the MDL for each of those events.
- LDL Special Study results for total PCBs achieved lower MDLs. The results showed that all samples exceeded the harbor water numeric target of 0.00017 µg/L by a factor of at least 12.

Figure 3-1: Toxics and Bacteria TMDL Monitoring Locations

3.2.2 Harbor Water

Water quality samples have been collected in MdRH for more than 25 years as part of the Annual Report Monitoring for MdRH (Aquatic Bioassay & Consulting Laboratories, Inc. [ABC Laboratories] 2001 to 2008). Samples were analyzed for indicator bacteria and physical parameters (e.g., temperature, salinity, dissolved oxygen). A bacteria non-point source special study was conducted in 2006 (Weston Solutions, Inc. [WESTON], 2007) and monitoring under the Bacteria TMDL began in 2007, with more frequent sampling and observational data collection. In 2010, copper, lead, zinc, total PCBs, and chlordane were added to the list of constituents and monitored monthly as part of the Toxics TMDL CMP.

Dissolved copper concentrations in the water column exceeded the Toxics TMDL numeric target (4.8 µg/L) at all stations during all years, with the exception of MdRH-F-4 and MdRH-F-5 in 2011. Concentrations were comparable within the Front and Back Basins, particularly between stations MdRH-B-1, MdRH-B-2, MdRH-F-1, and MdRH-F-2 (Basin D, Basin E, Basin A, and Basin B, respectively). The Partitioning Coefficient Special Study collected samples at the same stations as the Toxics TMDL monitoring at surface, mid-depth, and at-depth (Brown and Caldwell, 2011). The results showed that copper concentrations were higher near the surface and lowest at the deepest sample depths.

There were no exceedances of the Toxics TMDL water column PCB numeric target for the Toxics TMDL monitoring. However, as part of the LDL Special Study, lower MDLs were achieved. It was determined that all samples collected as part of the LDL study exceeded the final Toxics TMDL numeric target of 0.00017 µg/L by at least a factor of 12. The highest concentrations were observed in Basin F.

Chlordane results exceeded the saltwater CTR CMC for one sample, MdRH-B-1 in October 2011. Chlordane was also analyzed as part of the LDL Special Study, and lower MDLs were achieved (0.028 ng/L). Only one result was above the CTR for Human Health; however, the trip blank associated with the sample also had a detection greater than the CTR for Human Health. These results are therefore qualified because of the results of the field blank analysis.

Bacteria TMDL monitoring began in 2007 with monitoring of nine compliance stations and five ambient stations. In 2009 monitoring at the ambient stations was discontinued. The Bacteria TMDL requires daily or weekly monitoring at the nine compliance stations within the MdRH, along with samples collected at depth at four stations. Historical bacteria data are also available from monitoring conducted prior to 2007 as part of the MdRH Annual Monitoring conducted by the LACDBH. A Non-Point Source Study was conducted in 2006 to assess the potential sources of bacteria from within the MdRH. The findings of the study showed that birds were a likely source of bacteria to the MdRH.

The Bacteria TMDL is split into three seasons: summer dry, winter dry, and wet weather. Data were analyzed and presented for each season. The highest proportion of exceedance days from the Bacteria TMDL monitoring during dry weather occurred at stations MdRH-5 and MdRH-7. Historically, the greatest proportion of exceedance days during the summer dry season occurred at MdRH-5 and MdRH-6 (MdRH-7 was not monitored prior to 2007). During winter dry weather, the highest proportion of exceedance days occurs at stations MdRH-1, MdRH-2, and MdRH-3, which are different stations from those with the most often exceedances during the summer dry season. Monitoring is no longer conducted at MdRH-10, MdRH-11, MdRH-12, MdRH-13, or MdRH-14.

Observational data are collected as part of the Bacteria TMDL monitoring. These data were assessed for patterns relating to the observed indicator bacteria concentrations. A slight correlation was observed between the animal and/or bird observation data and indicator bacteria results, with slightly higher concentrations of indicator bacteria occurring when the number of birds and/or animals observed was higher.

3.2.3 Sediment

Annual chemistry sediment monitoring has been conducted by the LACDBH for more than 25 years at 20 monitoring stations within the MdRH. In addition to the annual monitoring program, which ended in 2007, Bight ‘03, Bight ‘08, Bight ’13, the Oxford Basin Special Study (2010), the MdRH Sediment Characterization Study (2008), the Toxics TMDL Monitoring (2010-present), and two special studies have been conducted.

In addition to the chemistry monitoring that has been conducted, toxicity and benthic infauna monitoring have also been conducted as part of Bight ‘03, Bight ‘08, the MdRH Sediment Characterization Study (2008), and Toxics TMDL Monitoring (2010 to present). It is important to assess the chemistry along with the toxicity and biological data to gain a broader understanding of the impacts of chemistry results in the environment. During Bight ’08, acid-volatile sulfide (AVS) and simultaneously extracted metals (SEM) analyses were conducted, as well as analysis of total organic carbon. These additional chemistry parameters allowed an assessment of the bioavailability of metals in the samples.

The Bight ’08 monitoring results included AVS:SEM analyses. The bioavailability analysis of the results showed that although these divalent metals occur at high concentrations within the MdRH, they are not likely bioavailable because of the high levels of sulfides and carbon also present in the sediments.

Toxicity results for the Bight ’08 support the AVS:SEM analyses, which indicated non-toxic levels at three of the five stations, low toxicity at one of the five stations, and moderate toxicity at one station. The Toxics TMDL monitoring toxicity results were also low for *E. estuarius* and *M. galloprovincialis;* however, *L. plumulosus* chronic testing showed toxicity to the sediments. The causes of the toxicity are not clear, although they do not appear to be due to metals.

A spatial assessment was completed using all available data for metals (WESTON, 2014a). Based on this assessment, metals concentrations within the MdRH were determined to be higher in the basins and main channel adjacent to the basins. Copper concentrations in MdRH were highest in the Back Basins along the back of Basin G and in the middle portion of Basin B. Lead concentrations were highest in Basin B, the main channel toward the harbor entrance, and in some samples collected near the entrance to the MdRH. Zinc concentrations followed a similar spatial pattern when compared to the copper concentrations, with the highest concentrations in Basin E, the back of Basin D, and Basin B

Total PCBs (Aroclors and congeners separately), DDTs, and p,p’-DDE were also assessed for spatial patterns within the MdRH.. Bight monitoring data, along with the 2008 Sediment Characterization data, used a sum of PCB congeners to calculate total PCBs. The Toxics TMDL monitoring uses a sum of Aroclors to calculate total PCBs. These two methods are not directly comparable; in fact, the total PCB results can be quite different. Therefore, the results were considered separately. The concentrations of Aroclor total PCBs were highest in Basin C and Basin E; however, samples exceeded the TMDL numeric target throughout the MdRH. Congener total PCB concentrations were highest in the main channel between Basins D and F, in Basin E, and at the back of Basin C. Some higher concentrations were also detected near the mouth of the harbor in the main channel; however, several samples near the mouth of the MdRH were below the TMDL numeric target, so the sediments are likely heterogeneous.

The highest single results for total DDTs were from the main channel near the mouth of the harbor and Basin E. Results were also high throughout the main channel and into Basins F and G. p,p'-DDE results follow a pattern similar to that observed for total DDTs. The highest concentrations were in Basin E, Basin G, and near the mouth of MdRH.

3.3 Summary of Findings by Constituent

Copper – Sediment and harbor water copper concentrations are highest in Basin D, Basin E, and to some extent in Basins B and C; and do not meet Toxics TMDL numeric targets. Stormwater is likely contributing to the harbor water concentrations in these locations, as well as paint with copper additives leaching from boat hulls in the MdRH water. However, preliminary AVS:SEM analyses indicate that copper may not be causing toxicity in the sediments. The MS4 waste load allocations for copper are not currently met.

Lead – Sediment concentrations of lead are highest near the mouth of the MdRH, in Basins A, and B, and to some extent, in Basin G. Sediments do not currently meet Toxics TMDL numeric targets. Stormwater runoff concentrations of dissolved lead are low, although storm-borne sediment analysis of stormwater runoff shows that high levels of lead can be found associated with suspended sediments in stormwater runoff. However, the storm borne sediment analysis was based on only one event in 2011 and may not be representative of the annual load.

Zinc – The sediment concentrations of zinc follow a pattern similar to that of copper (highest concentrations in Basins D and E, and to a lesser extent in Basins B and C) and can also be found at high levels in stormwater runoff and storm borne sediment samples. However, the storm borne sediment analysis was based on only one event in 2011 and may not be representative of the annual load. Currently, the zinc concentrations in sediment do not meet Toxics TMDL numeric targets. Preliminary AVS:SEM analyses indicate that zinc is not likely causing toxicity in the sediments. The MS4 waste load allocations for zinc are not currently met.

Total PCBs – Sediment PCB concentrations are highest in the Back Basins, particularly Basin E, and do not currently meet Toxics TMDL numeric targets. Fish tissue concentrations for total PCBs do not currently meet Toxics TMDL numeric targets. Both stormwater and harbor water samples collected as part of the Toxics TMDL CMP monitoring are below MDLs for all samples collected, but the MDLs are above the Toxics TMDL numeric target. The LDL study results, which achieved MDLs below the TMDL numeric targets, show that neither stormwater nor harbor water meet the Toxics TMDL numeric target. During the storm borne sediment monitoring, PCBs were also at high levels at MdR-5 (which drains into Basin E). However, the storm borne sediment analysis was based on only one event in 2011 and may not be representative of the annual load.

Total DDTs – DDTs were recently added to the TMDL; therefore, monitoring as part of the Toxics TMDL has not been conducted. However, assessment of historical sediment data in the MdRH shows that DDTs have been found in levels higher than the Toxics TMDL numeric target. Historical samples of DDT in Oxford Basin have also been above the Toxics TMDL numeric target.

p,p'-DDE – p,p'-DDE was recently added to the TMDL, and follows the same spatial patterns as total DDTs. The Toxics TMDL numeric targets are not currently met for p-p'DDE.

Chlordane – Sediment monitoring conducted as part of the Toxics TMDL CMP resulted in non-detected results for chlordane for all samples. However, the MDL used in the analysis is above the Toxics TMDL numeric target. Historical sediment samples collected in the MdRH such as those collected for the 2008 Sediment Study, Bight '03, and Bight '08, have found chlordane at levels above the Toxics TMDL numeric target. The highest concentrations occurred near the mouth of the MdRH. Stormwater, harbor water, and the initial special studies analyses also resulted in non-detected results for chlordane for all samples. Re-analysis of stormwater and harbor water as part of the LDL Special Study resulted in low detections of chlordane. Methods for estimating total chlordane may vary between studies, and cause discrepancies in the estimation of total chlordane. Findings regarding the sources and amounts of chlordane present in the MdRH remain inconclusive.

Bacteria – Bacteria TMDL monitoring has been conducted in the MdRH since 2007 at nine locations. The TMDL has three compliance seasons; summer dry, winter dry, and wet weather. As of the analysis, the MdRH is not consistently meeting the single sample or geometric mean sample Bacteria TMDL allowable exceedance day compliance targets. Historical source identification studies have indicated birds as the greatest contributor to bacteria concentrations in the MdRH.

3.4 Waterbody – Pollutant Classification

In accordance with the MS4 Permit, Section VI.C.5.a, water-body pollutant combinations were classified into one of the following three categories (Table 3-2):

1. Category 1 (Highest Priority) – Pollutants with receiving water limitations or water-quality-based effluent limits (WQBEL) as established in Part V1.E and Attachments L through R of the MS4 Permit.
2. Category 2 (High Priority) – Pollutants in the receiving water that are listed as §303(d) and for which MS4 discharges may be causing or contributing to the impairment.
3. Category 3 (Medium Priority) – Pollutants with insufficient data to list as §303(d) but which exceed receiving water limitations contained in the MS4 Permit and for which MS4 discharges may be causing or contributing to the exceedance.

3.4.1 MdR WMA Pollutant Classification

Category 1 (highest priority) pollutants are defined by the MS4 Permit as those constituents that have been addressed with receiving water limitations or WQBEs established through a TMDL. The Toxics TMDL, as described in Section 0, establishes waste load allocations for chlordane, total PCBs, total DDTs, p-p'-DDE, copper, lead and zinc. In addition, the TMDL establishes numeric targets for dissolved copper and total PCBs in the water column in MdRH. As a result of the establishment of the TMDL for these constituents, they are classified in accordance with the MS4 Permit as Category 1 pollutants for MdRH (Table 3-2).

The Bacteria TMDL as described in Section 2.2.2 established numeric bacterial compliance targets for fecal coliform, *Enterococcus*, and total coliform in MdRH. As a result of the TMDL, these constituents are classified in accordance with the MS4 Permit as Category 1 pollutants for MdR (Table 3-2).

Table 3-2: Waterbody – Pollutant Classification

Waterbody	Pollutant	Classification
Marina del Rey Harbor	Dissolved Copper	Category 1
	Copper	Category 1
	Lead	Category 1
	Zinc	Category 1
	Total PCBs	Category 1
	Total DDTs	Category 1
	p,p'-DDE	Category 1
	Chlordane	Category 1
	Fecal coliform	Category 1
	Enterococcus	Category 1
	Total coliform	Category 1
Ballona Lagoon/Venice Canal	None known	None

Category 2 constituents are defined in the MS4 Permit as pollutants in the receiving water that are listed as §303(d) and for which MS4 discharges may be causing or contributing to the impairment. Dieldrin is the only §303(d) listed constituent for MdRH that has not already been addressed by a TMDL (Table 2-1), however, the USEPA made a finding of non-impairment for this constituent so it will not be considered a Category 2 pollutant.

Category 3 constituents are those pollutants with insufficient data to list as §303(d) but which exceed receiving water limitations contained in the MS4 Permit and for which MS4 discharges may be causing or contributing to the exceedance. The data evaluation did not result in any constituents being classified as a Category 3 constituent.

The categorizing of constituents is intended for use in guiding the implementation schedule and priority BMPs for the EWMP. If additional data becomes available to indicate additional constituents should be added to the priority list, or if updates are made to the §303(d) list by the SWRCB, the categorization and prioritization may be updated.

The Ballona Lagoon is the only waterbody other than MdRH that falls within the MdR WMA. However, there are no available data concerning the receiving water or discharges to the receiving water.

3.5 Pollutant Source Assessment

A pollutant source assessment was carried out to identify potential sources of Category 1 to 3 pollutants.

3.5.1 Harbor-Based Sources

Likely sources of bacteria, copper, lead, zinc, total PCBs, total DDTs, p,p'-DDE, and total chlordane that have been identified within the MdRH include the following:

- **Boats**: Several studies attributed the higher metal concentrations found in the main channel and in the mouths of each Back Basin as being sourced from maritime activities. Anti-fouling, copper-based hull paint was specifically identified as a source of higher copper in MdRH. This source is being addressed through the Toxics TMDL.
- **Legacy Sediments**: Several studies have characterized the unconsolidated and consolidated sediments of the harbor and found higher concentrations of metals, PCBs, chlordane, and DDT. Disturbance of these sediments could cause re-suspension in the water column and transport to other areas of MdRH.
- **Boone Olive Pump Station**: During wet weather, this station was identified as a source of fecal indicator bacteria contributing to higher bacterial loads to Basin E.
- **Oxford Basin**: This water body was identified as a potential source of metals and bacteria in a number of studies conducted prior to the installation of three dry weather diversions (Oxford Basin Low Flow Diversion (LFD), the Washington LFD, and the Boone Olive LFD. Assessment within Oxford Basin in 2010 during dry and wet weather suggested that the Oxford Basin was not a significant contributor of pollutants (particularly metals). Dry-weather bacteria contributions from Oxford Basin appear to have decreased with the construction of the dry-weather diversions. During wet weather, Oxford Basin has been found to contribute to bacteria concentrations in Basin E. The Oxford Basin Multi-use Enhancement Project is currently underway, which is expected to provide multiple benefits, including improved water quality in the Oxford Basin and reduction of the pollutant contribution to Basin E.
- **Natural Sources**: Birds have been found to be a significant source of fecal indicator bacteria to MdRH. Within the unincorporated areas of the county the impact of this natural source can be limited through structural BMPs such as bird controls, non-structural BMPs, and bird waste management programs.

3.5.2 Watershed-Based Sources

Likely sources of bacteria, copper, lead, zinc, total PCBs, total DDTs, p,p'-DDE, and total chlordane from the watershed to the MdRH include the following:

- **Stormwater Runoff**: Stormwater monitoring conducted under the Toxics TMDL has shown that copper, lead, and zinc are being transported into the MdRH during storm events. Storm borne sediment monitoring has shown that chlordane and PCBs are transported by suspended sediment in stormwater. However, the storm borne sediment analysis was based on only one event in 2011 and may not be representative of the annual load.
- **Residential Contributions**: Use of certain building materials can contribute loads of copper and zinc (from structures such as roofing materials, gutters, and fencing) through urban runoff. Non-stormwater discharges such as over-irrigation and wash water can provide a transport mechanism for pollutants and provide a reservoir for bacteria growth and/or regrowth in soils and the MS4. Control of these sources may include structural solutions, such as aggressive street and parking lot sweeping, covering and containing trash, proper recycling of yard waste, controlled/reduced

pesticide and fertilizer applications, and additional non-structural solutions, such as targeted educational and enforcement programs for irrigation and washing activities and/or facilities.

- **Commercial Contributions**: Certain commercial practices, including poorly managed restaurant wash-down and trash storage, can impact water quality. These facilities may also attract birds, and their waste may contribute to bacterial concentrations in MdRH. Management actions could include targeted trash inspection programs to correct pollutant-loading activities, education to improve housekeeping and trash containment and cover activities, and bird exclusion devices.
- **Atmospheric Deposition**: Atmospheric deposition of metals has been found to be a significant source of copper (brake pads) and zinc (brake pads and tires). Improvements to loads from these sources can be achieved through true source control activities, such as the Brake Pad Partnership and product substitution and structural solutions, such as targeted aggressive street and parking lot sweeping.
- **Anthropogenic Fecal Sources**: Fecal sources can include poorly contained pet waste, bird attractants (e.g., open trash receptacles), and public restrooms. A potential anthropogenic source may be the illegal dumping of boat waste into the harbor. Solutions may include outreach regarding pet waste, recreational vehicles (RV) waste and boat waste disposal, enforcement programs, trash inspection programs, targeted restaurant inspections, and containment of wash-down water used for restroom facility cleaning.

3.5.3 Summary of Sources by Contaminant

Multiple monitoring programs and special studies have been conducted to assess conditions in the MdRH. This section presents the interrelationship of the findings of these multiple studies. A summary of the identified constituent sources from key studies is presented in Table 3-3.

Table 3-3: Key Study Findings – Attributed Sources

Study	Bacteria	Metals	Chlordane, PCBs, and DDTs
Bacteria TMDL Non-Point Source Study	Oxford Basin, birds, and some anthropogenic sources	Not tested	Not tested
MdRH Mother's Beach and Back Basins Bacteria Indicator TMDL Compliance Study	Birds and some anthropogenic sources	Not tested	Not tested
MdRH Annual Reports	Oxford Basin	Copper based boat hull paint, legacy sediments, and stormwater runoff	Boat hull paint, legacy sediments, and stormwater runoff
MdRH Sediment Characterization Study	Not tested	Boats, legacy sediments, and stormwater runoff	Boat hull paint, legacy sediments, and stormwater runoff
Oxford Basin Sediment and Water Quality	Natural levels observed	Low concentrations observed	Low concentrations observed
Bight '03	Not tested	Boats, legacy sediments	Boats, legacy sediments
Bight '08	Not tested	Boats, legacy sediments	Boats, legacy sediments
Toxics TMDL Monitoring	Not tested	Boats, legacy sediments, residential contributions, commercial contributions, and stormwater runoff	Boats, legacy sediments, and stormwater runoff
Toxics TMDL Special Studies	Not tested	Boats, legacy sediments, residential contributions, commercial contributions, and stormwater runoff	Boats, legacy sediments, and stormwater runoff

3.5.3.1 Chlordane, PCBs, and DDTs

The pesticide chlordane was widely used for food crops and lawn care until 1978 when use was limited to termite control. In 1988 chlordane use was banned in the United States. Assessment of sediment in MdRH found concentrations of chlordane to be highest in the main channel, near the mouth of the harbor.

Before DDT was banned in 1972, large DDT releases occurred during agriculture or vector control applications. Emissions could also have resulted during production, transport, and disposal. DDT was released to surface waters for vector control or as a result of dry and wet deposition from the atmosphere or direct gas transfer. DDTs can be released to the soil during spraying operations from direct or indirect releases during manufacturing, formulation, storage, or disposal. Another potential source of DDT contamination in sediment is the Palos Verdes Shelf (PVS), because contaminated sediment near an outfall can act as a source of contamination to a distant part of a water-body. Fish exposed to the PVS sediments may bioaccumulate PCBs and DDTs, and when captured in the MdRH, have high levels of these pollutants even though this exposure may not have occurred in the MdRH. DDT and its metabolites may be transported from one medium to another by the processes of solubilization, adsorption, remobilization, bioaccumulation, and volatilization. It can also be transported by currents, winds, and diffusion.

From 1947 to 1983, Montrose Chemical Corporation manufactured DDT at its plant near Torrance, CA. The plant discharged wastewater containing the now-banned pesticide into Los Angeles sewers that emptied into the Pacific Ocean off White Point on the PVS. The DDT manufacturing process also resulted in groundwater and surface soil contamination on and near the Montrose plant property. It is estimated that more than 800 to 1,000 tons of DDT were discharged between the late 1950s and the early 1970s. Several other industries also discharged PCBs into the Los Angeles sewer system that ended up on the PVS by way of outfall pipes. The PVS location is defined by the large area of DDT- and PCB-contaminated sediment on the ocean floor. The contaminated sediment deposit is thin, 2 inches to 2 feet thick, and covers several square miles. The most contaminated sediment is buried under a layer of cleaner sediment that has surface concentrations of DDT and PCB that have decreased over time.

Prior to the use of copper and tributyltin as anti-fouling paints, PCBs were used in boat hull paint. It is possible that historical contamination from boat hulls may be contributing to high levels of PCBs in the Back Basins.

3.5.3.2 Metals

The results of most sediment studies conducted in the MdRH found copper and zinc concentrations to be highest in the Back Basins. Lead concentrations were highest in the main channel. The sources of these metal were generally identified as maritime activities (e.g., hull leachate), discharge from storm drains into the receiving water, and atmospheric deposition.

The Oxford Retention Basin Sediment and Water Quality Characterization Study (WESTON, 2010a) provided insights into the potential for the Oxford Basin to act as a reservoir and potential source for contaminated sediments entering Basin E. The results of the study indicated low concentrations of metals, except chromium and lead, suggesting that resuspension of sediments in Oxford Basin is not likely to be a source of metals in Basin E.

3.5.3.3 Fecal Indicator Bacteria

Water quality has been comprehensively assessed throughout the MdRH as special studies and as part of continuous monitoring programs. As a result of these studies, a number of constituent sources have been identified.

Assessments of bacterial contributions to Basin E were consistent among the majority of projects, with the Oxford Basin and Boone Olive Pump Station identified as a source of bacterial loads during wet weather. The most recent study did not indicate that the Oxford Basin was a predominant contributor to bacteria concentrations in Basin E during dry-weather flows (the Oxford Retention Basin Sediment and Water Quality Characterization Study [WESTON, 2010a]). This study was undertaken after the installation of a dry-weather diversion into the Oxford Basin.

In the bacterial source identification study (WESTON, 2007), birds were identified as a key contributor throughout MdRH and management actions targeting this source were recommended (Figure 3-2). Anthropogenic sources and transport mechanisms included boat-related maintenance activities, trash and food waste, washing activities (restaurants, restrooms, parking areas, and buildings), landscaping, and the MS4. Another key factor in the presence of bacteria within MDRH is the limited flow through the marina waters. This lack of circulation increases the potential for bacterial reservoirs to be found in locations such as pier supports and boat hulls. These locations are also prone to limited ultraviolet (UV) penetration and subsequently allow increased microbial longevity.

Bacterial concentrations in sediments were found to be very low in all studies, suggesting that marina sediments do not act as a significant reservoir of fecal indicator bacteria.

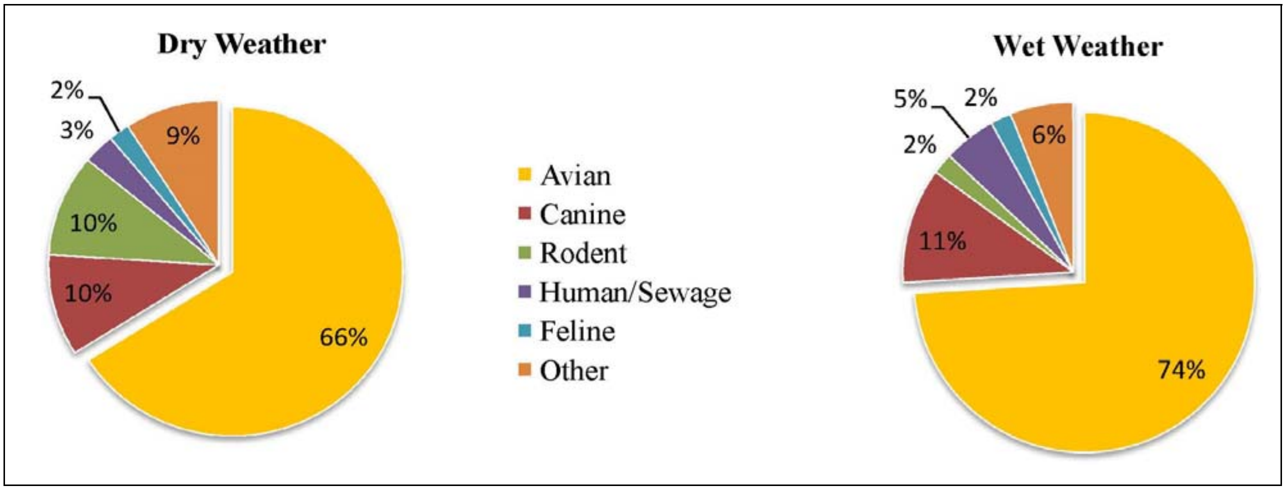

Figure 3-2: Ribotyping Results for Wet Weather and Dry Weather (WESTON, 2007)

3.5.4 Prioritized Sources

Based on the source assessment, priorities within the MdR watershed were assessed and sequenced in accordance with section VI.C.5.a.iv of the MS4 Permit (Table 3-4). As specified in the MS4 Permit, the highest priority (1) is assigned to those pollutants with TMDLs according to the following criteria:

1a) Controlling pollutants for which there are established WQBELS, or receiving water limitation with interim or final compliance deadlines within the current MS4 Permit term, or whose TMDL deadlines have passed without achieving the limitations,

1b) Controlling pollutants for which there are established WQBELs or receiving water limitations with compliance deadlines (interim or final) between September 6, 2012 and October 25, 2017.

The second highest (2) priorities are established for pollutants for which receiving water limitations are exceeded, or impairment is implicated as a result of discharges from the MS4. For purposes of the prioritization, third priority (3) will be attributed to controlling pollutants with TMDL compliance dates beyond the term of the MS4 Permit.

Table 3-4: Marina del Rey Priorities

Priority	Waterbody	Pollutant	Compliance Deadlines	Priority Sources*
1b	MdRH Back Basins	Bacteria (summer and winter dry weather)	July 10, 2014 interim sediment allocations met. Final Compliance December 28, 2017.	Birds, anthropogenic sources
	MdRH Back Basins	Copper	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Boats, residential, stormwater runoff
		Lead	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, stormwater runoff (suspended sediment)
		Zinc	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Commercial contributions, stormwater runoff
		PCBs	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, boats, stormwater runoff (suspended sediment)
		DDTs	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, stormwater runoff
		p,p'-DDE	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, stormwater runoff
		Chlordane	March 22, 2016 interim sediment allocations met. Final compliance March 22, 2018.	Legacy sediment, stormwater runoff (suspended sediment)
3	MdRH Back Basins	Bacteria (wet weather)	July 15, 2021 final wet weather and geometric mean.	Birds, stormwater runoff, anthropogenic sources
	MdRH Front Basins	Copper	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Boats, residential, stormwater runoff
		Lead	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, stormwater runoff (suspended sediment)
		Zinc	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Commercial contributions, stormwater runoff
		PCBs	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, boats, stormwater runoff (suspended sediment)
		DDTs	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, stormwater runoff
		p,p'-DDE	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, stormwater runoff
		Chlordane	March 22, 2019 interim sediment allocations met. Final compliance March 22, 2021.	Legacy sediment, stormwater runoff (suspended sediment)

*Although stormwater is not a primary source of pollutants, it is a conveyance mechanism and is treated as a point source for purposes of the Toxicity TMDL.

4.0 WATERSHED MINIMUM CONTROL MEASURES

Section VI.C.5.b of the MS4 Permit requires the identification of control measures, strategies and BMPs within the watershed with the goal of creating an efficient program to focus resources on the watershed priorities identified in Section 3.0 above. In accordance with the MS4 Permit, "the objectives of the Watershed Control Measures shall include:

1. Prevent or eliminate non-stormwater discharges to the MS4 that are a source of pollutants from the MS4 to the receiving waters.
2. Implement pollutant controls necessary to achieve all applicable interim and final water quality-based effluent limitations and/or receiving water limitations pursuant to corresponding compliance schedules.
3. Ensure that discharges from the MS4 do not cause or contribute to exceedances of receiving water limitations."

The MdR watershed is very different from the other Los Angeles area watersheds because it is small and highly urbanized, with a large portion of the lower watershed within a high groundwater and tidally influenced former estuary. A combination of regional, decentralized regional, and non-structural minimum control measures (MCMs) will be required to address attainment of the stormwater volume and pollutant loading reductions necessary for compliance.

The following section discusses the MCMs necessary and sufficient to be implemented within the MdR WMA to achieve the estimated contaminant load reductions from the MS4 into the receiving water required for the MdR EWMP Agencies' compliance with applicable WQBELs and/or receiving water limitations (RWLs) for each TMDL, §303(d) listing, and receiving water exceedance. The analysis takes into consideration existing and planned MCMs, potential regional MCMs and regional distributed green streets MCMs, localized green streets MCMs, planned development and redevelopment projects, as well as nonstructural MCMs.

4.1 Existing MCMs

The extensive ongoing efforts of the County, LACFCD, and the cities of Culver City and Los Angeles to improve water quality in the MdR watershed include implementing various structural and non-structural MCMs to reduce pollutants from stormwater runoff to the harbor. Over the past 10 years, these responsible agencies in the MdR watershed have spent tens of millions of dollars in special studies, low-flow diversions, non-structural BMPs, structural BMPs, and monitoring efforts. The water quality in the harbor has significantly improved as a result of these cooperative efforts.

This section summarizes the existing structural and non-structural MCMs that are already in effect or are under development within the MdR watershed. This information was compiled from the Notices of Intents (NOIs), Time Schedule Orders (TSOs), MdR Bacteria and Toxics Implementation Plans, and information submitted directly by the MdR EWMP Agencies for the purpose of this EWMP development.

4.1.1 Existing Structural MCMs

Existing MCMs that have already been implemented or are in progress in the MdR watershed include the following:

- Existing sewers in MdR have been lined since 1993 to reduce stormwater sewer overflows. Since 2007, the County has lined and rehabilitated 11 miles of sewer lines and 208 manholes in the MdR watershed. – *Completed*
- Three low-flow diversions (92,000, 20,000, and 288,000 gal/day) were installed in 2007 by LACFCD at three locations to divert dry-weather non-stormwater urban runoff to a sanitary sewer flowing into Hyperion Treatment Plant, to comply with the MdR Dry Weather Bacteria TMDL. The diversions serve 61, 310, and 148 acres, respectively. – *Completed*
- Five bioretention filter tree wells (Filterra) were installed in 2007 by LACFCD as an additional measure to prevent pollutants from entering Back Basin E. Each has a footprint of 6.5 ft by 4 ft to collect and treat dry weather runoff and stormwater, serving three subdrainage areas of 0.3, 14.1, and 16.5 acres, for a total of 30.9 acres. – *Completed*
- In the City of Los Angeles area, 293 catch basins have been retrofitted with trash screens (103 City-owned and 190 LACFCD-owned catch basins with trash screens). Catch basin cleaning has been conducted at a typical frequency of at least 2 times per year. The City of Culver City has retrofitted four catch basins with full capture devices. The County retrofitted 40 catch basins in the MdR with full-capture devices. – *Completed*
- Marina Beach Water Quality Improvement Project – Phase II, a stormwater diversion and collection system was constructed in 2007 to redirect all stormwater sheet flows from impervious areas currently draining into Marina (Mother's) Beach and Back Basin D into Basin C. – *Completed*
- Seven bioretention tree wells were proposed in the TSO Request for MdRH Bacteria TMDL to be implemented across the watershed within 60 months of the TSO adoption. LACFCD is constructing seven bioretention areas on Admiralty Way as part of the Oxford Retention Basin Project Multi-Use Enhancement Project. – *In Progress*
- The retrofitting of four parking lots and the library facility in MdR is underway based on the multi-pollutant implementation plan developed in 2011 for MdR (LADPW, 2012). The retrofitting will incorporate various treatment MCMs such as bioretention planters, biofiltration systems, porous pavement, and rain barrels. – *In Progress*

Locations of existing structural control measures (that can be easily shown on a map), are shown in Figure 4-1 and are listed in Table 4-1. The table includes control measures with their general types, date implemented, status, responsible agency, and a descriptive summary.

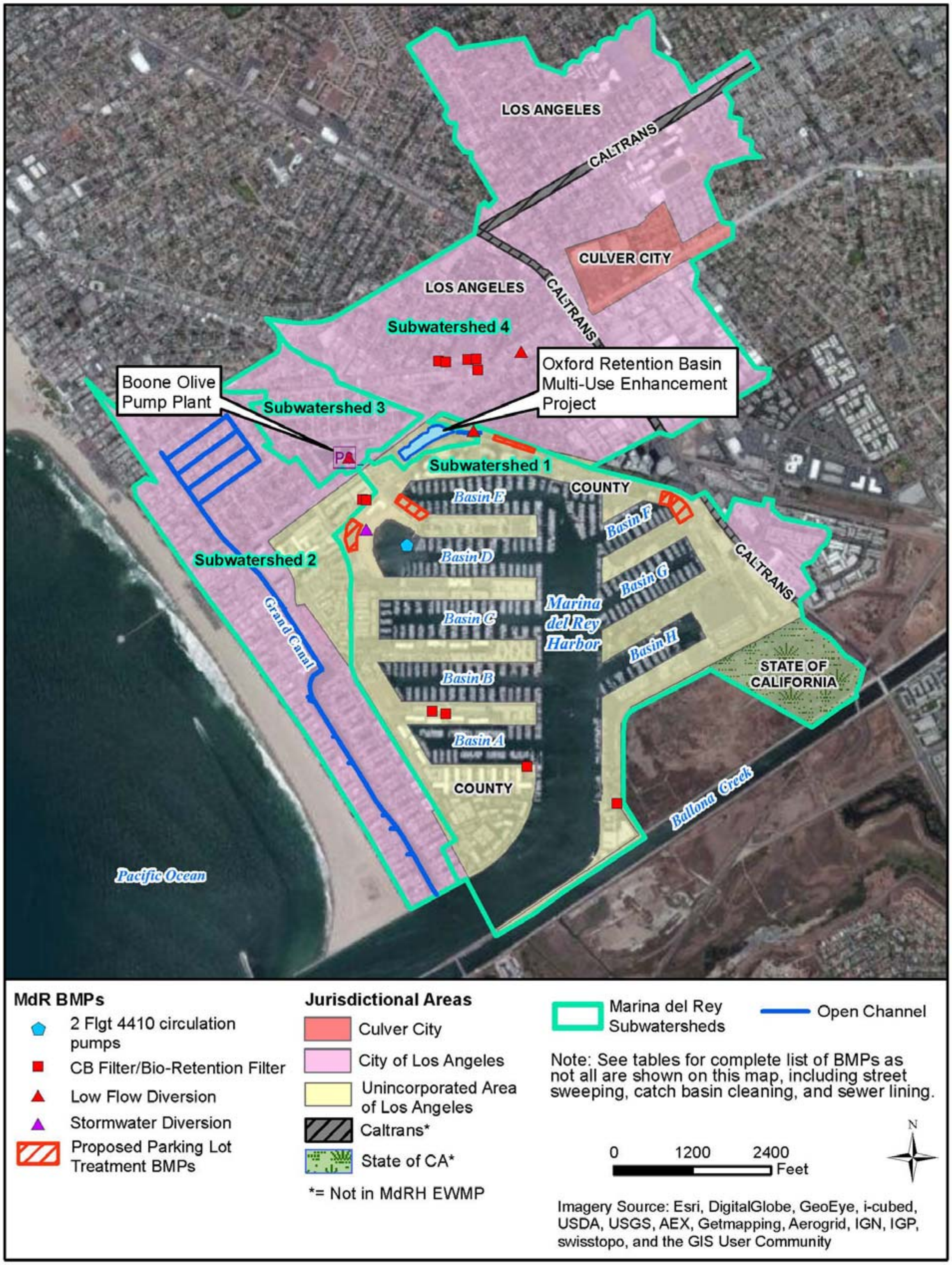

Figure 4-1: Existing Structural MCMs within MdR Watershed

Table 4-1: List of Existing Structural MCMs in the Marina del Rey Harbor EWMP Agencies WMA

Project "Title" // Descriptive Title	BMP Type	Status	Date	Agency	Location	Description
Marina Beach Water Quality Improvement Project – Phase I	Mechanical Circulation Device	Complete	10/2006	County, LACDBH	Basin D / Marina Beach	Two subsurface water circulators (2 Flygt 4410 circulation pumps) with 55-inch-diameter banana propellers were installed in Basin D just offshore from Marina Beach, attached under a special dock at Parcel No. 91. The circulators pump water toward the beach face at a rate of 60,000 gallons per minute (gpm) (30,000 gpm each).
Marina Beach Water Quality Improvement Project – Phase II	Stormwater Diversion	Complete	8/2007	County, LACDBH	Basin D / Marina Beach	A stormwater collection system was constructed to redirect all stormwater sheet flows from impervious areas currently draining into Marina Beach and Back Basin D into Basin C.
Tree Wells (5)	Bio-Retention Filter (Filterra)	Complete	1/2007	LACFCD	West and east side of Garfield Ave West and east side of Coeur D'Alene Abbot Kinney	Five bioretention filters were installed upstream of Project No. 5243 as an additional measure to prevent pollutants from entering Back Basin E. Each has a footprint of 6.5 ft by 4 ft to collect and treat dry weather runoff and stormwater serving three subdrainage areas of 0.3, 14.1, and 16.5 acres, for a total of 30.9 acres.
Project 3874, 5243, 3872	Low Flow Diversion	Complete	3/2007	LACFCD	539 Washington St. 3874 Boone-Olive Pump Station 3872 Oxford Pump Station	Three low-flow diversions (92,000, 20,000 and 288,000 gal/day) were installed at three locations to divert dry-weather non-stormwater urban runoff to a sanitary sewer flowing into Hyperion Treatment Plant, to comply with the MdRH Dry Weather Bacteria TMDL. The diversions serve 61, 310, and 148 acres, respectively.
Sewer and Manhole Lining		Complete	1993	County, City of Los Angeles	Surrounding Basins D, E, and F	Existing sewers in MdRH have been lined since 1993 to reduce Stormwater Sewer Overflows. Since 2007, the County has lined and rehabilitated 11 miles of sewer lines and 208 manholes in the MdRH watershed.
Catch Basin Retrofit		Complete/In Process	2011	County, City of Los Angeles, City of Culver City	Across MdR	In the City of Los Angeles area, 293 catch basins have been retrofitted with trash screens (103 City-owned and 190 LACFCD-owned catch basins with trash screens). Catch basin cleaning has been conducted at a typical frequency of at least 2 times/year. The City of Culver City has retrofitted four catch basins with full capture devices. The County plans to retrofit 40 catch basins in the MdR with full-capture devices.
Parking Lot Retrofits		In Process, Lots 5 and 7 Complete.	Yearly until 2017	County	Parking Lots 5, 7, 9, and Library	The retrofitting of three parking lots and the library facility in MdR is underway based on the multi-pollutant implementation plan developed in 2011 for MdR. The retrofitting will incorporate various BMPs such as bioretention planters, biofiltration systems, porous pavement, and rain barrels. The goal of these parking lot projects is to treat runoff coming from the County facilities before it enters the harbor.
Bird Spikes		Complete		County	Parking Lots 5, 7, 10 and 11.	On all light standards in County owned parking lots including Lots 5, 7, 10, and 11, which discharge into Basin D, E, and F.
Oxford Retention Basin Multi-Use Enhancement Project		In Process	Fall 2015	County, LACFCD	Oxford Retention Basin	This project, scheduled to begin construction in 2014, is designed to enhance flood protection, reduce runoff pollution, and significantly improve the quality of plant and wildlife habitat within the facility, as well as its aesthetic appeal. Diseased trees and non-native plants will be replaced with native, more drought-tolerant species. The project will also provide new recreational and safety amenities, including a walking path, observation areas, wildlife-friendly lighting, and more attractive tubular fencing. The project will improve water quality by increasing circulation and dissolved oxygen levels of the water in the basin by constructing a circulation berm.
Tree Wells		Proposed / In Process	Within 60 months of TSO adoption	City of Los Angeles, LACFCD	To Be Decided	Tree wells were proposed in the TSO Request for MdRH Bacteria TMDL. LACFCD is constructing seven bioretention areas on Admiralty as part of Oxford Retention Basin project.

4.1.2 Existing Non-Structural MCMs

The EWMP Agencies have implemented numerous non-structural MCMs to improve water quality in MdRH. These MCMs are classified as planning, enforcement, monitoring, source control, and Public Information and Participation Program (PIPP) (i.e., education, outreach, and incentives). Existing non-structural MCMs are summarized in detail in Table 4-2.

The EWMP Agencies are continuing to implement MCMs required under the 2001 MS4 Permit and will continue to do so in accordance until the EWMP is approved by the Regional Board.

Table 4-2: List of Existing Non-Structural MCMs in the Marina del Rey Harbor EWMP Agencies WMA

Project Title/ Descriptive Title	MCM Type	Status	Regulatory Driver / TMDL	Date	Agency	Description
PLANNING						
Marina del Rey Bacteria TMDL Implementation Plan (Marina del Rey Watershed Responsible Agencies [MDRWRA], 2007)	Planning Compliance	Complete	Bacteria	01/2007	County, Multiple	The plan includes procedures, plans, programs, and actions to be carried out throughout the MdR watershed to reduce bacteria concentrations at this impaired water body to comply with the Bacteria TMDL requirements.
Marina del Rey Multi-Pollutants Implementation Plan (LADPW, 2012)	Planning Compliance	Complete	Toxics, Trash	03/2011	County	The plan includes procedures, plans, programs, and actions to be carried out throughout the unincorporated area of MdR watershed to reduce toxics and bacteria concentrations at this impaired waterbody to comply with the Toxics and Bacteria TMDL requirements.
Marina del Rey Toxics Implementation Plan (City of Los Angeles, 2011)	Planning Compliance	Complete	Toxics	03/2011	City of Los Angeles, Multiple	The plan includes procedures, plans, programs, and actions to be carried out throughout the MdR watershed within the City of Los Angeles, Caltrans and City of Culver City boundaries to reduce bacteria concentrations at this impaired water body to comply with the Toxics TMDL requirements.
Pollution Prevention Plan	Planning Compliance	Complete	Bacteria	9/2014	County, LACFCD City of Los Angeles	
ENFORCEMENT						
Illegal Connection/ Illicit Discharge (IC/ID) Program	Enforcement IC/ID	Ongoing	MS4 Permit	2001 - present	LACFCD, County, City of Los Angeles, City of Culver City	This program involves coordination of multiple departments to eliminate pollution by IC/IDs to the stormwater system. The County has an active education, response, and enforcement program. The data are tracked for the County region and for the County's Road Maintenance Division (RMD), as part of its annual pre-storm season drainage inspection program. The cities of Los Angeles and Culver City have citywide programs that have also been implemented in the MdR watershed.
Construction Inspections Industrial/Commercial Facility Inspections	Enforcement Inspections (w/ Education)	Ongoing	MS4 Permit		County, City of Los Angeles, City of Culver City	Los Angeles County MS4 Permit Program has been implemented in the MdR watershed as part of a citywide and county wide program. The City of Culver City has a citywide program that has also been implemented in the MdR watershed.
Restaurant Inspections	Enforcement Inspections (w/ Education)	Ongoing	MS4 Permit	2004	County, City of Los Angeles	Annual inspections target restaurants as a potential source of bacteria, trash and other pollutants from waste disposal. This program identifies facilities lacking minimum stormwater BMPs and housekeeping practices - for waste disposal, grease containers, mop sinks, and other housekeeping activities.
Low Impact Development (LID) ordinance	Enforcement Ordinance	Existing	MS4 Permit	Jan 2009 May 2012 November 2014	County, City of Los Angeles, City of Culver City	The City of Los Angeles is currently amending sections of the LID Ordinance, as well as its Stormwater and Urban Runoff Pollution Control Ordinance (L.A.M.C. Chapter VI, Article 4.4) to meet all the MS4 Permit requirements. The County adopted a revised LID ordinance on November 12, 2013 to meet all MS4 Permit requirements. The City of Culver City adopted a similar in November of 2014.
Green Street Policy	Enforcement Ordinance	Existing	MS4 Permit	Jul 2011 November 2014	County, City of Los Angeles, City of Culver City	The City of Los Angeles, the City of Culver City, and the County have adopted a Green Street Policy that is in compliance with the requirements of the MS4 Permit for its portion in the watershed.
Standard Urban Stormwater Mitigation Plan (SUSMP)	Enforcement Ordinance	Existing	MS4 Permit	Ongoing	City of Los Angeles	The City of Los Angeles has several projects in MdR watershed as part of its implementation of the Citywide SUSMP program
SOURCE CONTROL						
Brake Pad Partnership	Source Control Alternative Product	Complete	MS4 Permit, Toxics TMDL	2010	Multiple	MdRH Agencies have supported the Brake Pad Partnership and the adoption process of Senate Bill (SB) 346 (adopted in 2010) through monetary contributions, in-kind technical services, and committee memberships. Caltrans, in conjunction with the State Board, contributed close to $1,000,000 to research on the impacts of brake pads to surface waters. The Brake Pad Partnership is an example of true source control that will remove copper brake pads from the market, and therefore, a source of loading to the environment. SB346 requires that brake pads contain no more than 5% copper by weight by 2021 and no more than 0.5% copper by weight by 2025.
Trash Removal and Control	Source Control	Ongoing	Trash TMDL		City of Los Angeles, County, City of Culver City	The Santa Monica Bay Debris TMDL requires responsible parties to reduce their trash contribution to the Santa Monica Bay by 10% each year for a period of 10 years with the goal of zero trash to waterbodies. The County and City of Los Angeles have achieved every yearly milestone, solely through the implementation of structural measures without having to take credit for implemented institutional measures that are also resulting in a reduction of trash. Other programs are implemented by other entities for trash control. For example, the City of Los Angeles Bureau of Street Services (BSS) offers a reward for information resulting in the identification of persons committing an act of illegal dumping.
Trash Removal	Source Control	Complete	Trash TMDL/ Bacteria TMDL	Ongoing	County	Trash is removed on a daily basis from all County facilities in the Marina.

Table 4-2: List of Existing Non-Structural MCMs in the Marina del Rey Harbor EWMP Agencies WMA

Project Title/ Descriptive Title	MCM Type	Status	Regulatory Driver / TMDL	Date	Agency	Description
MAINTENANCE						
Street Sweeping	Maintenance	Ongoing	Toxics TMDL, Trash TMDL, Bacteria TMDL	2008	County, Multiple	County: Streets are swept 2 times/week on Mondays and Thursdays. Parking lots are swept at least 2 times/week and up to 6 times/week. Ten sweepers are used in MdRH, 4 vacuum and 6 mechanical sweepers stationed with the RMD-3 fleet. One of each is compressed natural gas (CNG) powered versus liquefied petroleum gas (LPG) powered. Lot 15: 6times/week (winter); daily (summer), Lots 11, 13 and 16: 4times/week. City of Los Angeles / Caltrans: BSS conducts sweeping: 130 mechanical broom sweepers, 100 operators, weekly sweeping for posted streets and monthly sweeping for arterial streets. Has a delegated maintenance agreement with Caltrans to sweep Venice and Lincoln/Pacific Coast Highway. The City of Culver City has a street sweeping program that includes weekly sweeping of street in its portion of MdRH. Current schedule is side streets – Monday and Tuesday 8:00 am to 12:00 pm, Washington Boulevard – Monday through Friday 4:00 AM to 6:00 AM. The City of Los Angeles BSS currently sweeps approximately 63 curb miles (some swept weekly and some swept monthly) located within the City of Los Angeles' portion of MdRH. Maintenance responsibility of Lincoln Boulevard (State Route 1) and Venice Boulevard (State Route 187) has been delegated to the City of Los Angeles by a Delegated Maintenance Agreement. Caltrans will be working closely with the City of Los Angeles to achieve optimal maintenance performance that includes sweeping, trash pickup, and drainage cleanup.
Catch Basin Cleaning	Maintenance	Ongoing	Toxics TMDL, Trash TMDL, Bacteria TMDL	2011	City of Los Angeles, County, City of Culver City	The City of Los Angeles catch basin cleaning occurs at a typical frequency of 3 to 4 times per year, targeting trash. Within the County area, catch basins are be cleaned quarterly, semi-annually or every year depending on the prioritization of each catch basin. The City of Culver City cleaning occurs 3 times per year.
County Beaches - Sanitation Program	Maintenance	Ongoing	MS4 Permit, Bacteria TMDL		County	County staff "sanitizes" the beach 7 days a week, provided the sand is not wet. A tractor with rake and screen system is used to collect trash and turn over the beach sand. This process removes solids and debris and allows the sun to "sanitize" the sand during the day. Operations are between 5 am and 1:30 pm daily.
PUBLIC INFORMATION AND PARTICIPATION PROGRAM						
Billboard Educational Campaign	PIPP Outreach, Education	Complete	MS4 Permit, Toxics TMDL	Feb 2012		This program was a countywide, 8-week billboard campaign designed to promote protective waste management practices. A used motor oil educational advertisement was displayed on 20 billboards throughout the County.
Boating Clean and Green Campaign	PIPP Outreach, Incentive	Ongoing	Toxics TMDL, Bacteria TMDL	Apr 1997	County	This statewide educational and outreach program is designed to educate boaters about environmentally sound boating practices. The County held a focus group session to bring boaters together to openly share observations on boater behavior and motivations as they relate to water pollution. The boaters shared their observations on what is needed to better enforce current boater regulations as well as what visual messages would be most effective in influencing boater behavior. Based on the results of the Boater Focus Group, the County started the "Boaters Help Keep Marina del Rey and Santa Monica Bay Clean" campaign. A series of posters were created and posted at strategic sites in the harbor.
Dock Walker Training	PIPP Education, Outreach	Ongoing	Bacteria TMDL		LACDBH	This program consists of volunteers who inspire and educate boaters and other recreational users to be safe and environmentally sound while boating in California. Through this program, general boater educational materials were developed.
Clean LA	PIPP Education, Outreach	Ongoing	Bacteria and Toxics TMDLs	2002	County	County of Los Angeles portal to a number of award-winning programs that help residents, businesses, and government keep the County clean and sustainable.
School Outreach	PIPP Education, Outreach	Ongoing	MS4 Permit, Bacteria TMDL, Toxics TMDL, Trash TMDL		City of Los Angeles, LACFCD	Los Angeles County MS4 Permit and MdRH Bacteria TMDL Implementation Plan Programs: These program includes making targeted phone calls to all public and private K-12 schools within the MdRH to notify them of the availability of environmental education programs offered by the LACFCD and City of Los Angeles, emphasizing to school administrators that these programs comply with State curriculum standards and provide opportunities to fulfill service-learning requirements.
Clean Marinas Program	PIPP Outreach, Incentive	Ongoing	Bacteria TMDL, Trash TMDL	Apr 2006	County	This program is a partnership among private marina owners, government marina operators, and yacht clubs that was developed to provide clean facilities to the boating community.

Table 4-2: List of Existing Non-Structural MCMs in the Marina del Rey Harbor EWMP Agencies WMA

Project Title/ Descriptive Title	MCM Type	Status	Regulatory Driver / TMDL	Date	Agency	Description
Smart Gardening	PIPP Education, Outreach, Incentive	Ongoing	Toxics TMDL, Bacteria TMDL		County	This program targets businesses, schools, and homeowners through outreach and education materials for water-wise gardening. Topics covered include drought-tolerant plants and native plants, irrigation methods and associated water use/savings, irrigation management, and structural BMPs (i.e., rain barrels, cisterns, green roofs). The program includes educational workshops, training events, and the design/build of demonstration gardens targeting local residences and businesses. The County operates 12 Learning Centers throughout the County. They are equipped with educational and demonstration materials designed for program workshops. Each is landscaped with various backyard and drought-tolerant plants. Some of the centers also include grass recycling demonstrations. The County is partnering with the University of California Cooperative Extension “Master Gardeners” volunteers from the community. The volunteers are trained to promote environmentally responsible and sustainable horticultural practices in the home, community, and school landscapes by conducting workshops and demonstrations; speaking to community groups; educating teachers and parents at school gardens; and answering gardening questions at fairs and farmers markets as well as staffing email and phone helplines.
Marina Beach Education and Outreach Plan	PIPP Education, Outreach	Ongoing	Bacteria TMDL	12/2014	County, LACFCD, City of Los Angeles	Education and outreach plan targeting residents and visitors to Marina Beach, informing the targeted audience of potential public health risks associated with elevated levels of bacteria and the overall efforts to address impact to water qualify from bacteria as well as individual actions that can be taken.

4.2 EWMP Structural MCMs

The structural MCMs discussed in this section are green streets (regionally distributed or localized), four regional parks (Triangle, Canal, Via Dolce, and Venice of American Centennial Parks), the regional public-private partnership MCM at the Costco site, and three potential regional sanitary sewer diversion projects designed to capture runoff and divert it to the sanitary sewer (for Subwatersheds 1A, 1B and part of 4). Development and Redevelopment projects are also discussed.

4.2.1 Regional MCMs Selection Criteria

MCM selection involves many factors such as physical site characteristics, water quality objectives, multi-benefits potential, aesthetics, safety, maintenance requirements, and cost that provide opportunities for MCMs or constrain MCM selection. Typically, there is not a single answer but rather multiple solutions ranging from stand-alone regional or localized MCMs to treatment trains that combine multiple MCMs to achieve water quality objectives as well as other benefits such as flood control and recreation.

Many factors were considered during the structural MCM selection process. Five geological and hydrological characteristics were identified as important in determining the feasibility of BMP scenarios in terms of BMP type and site selection evaluation. These characteristics are depth to bedrock, type of bedrock, soil characteristics, depth to water table, and land use. In addition, other factors affecting the implementation of a control measure include compatibility with the surrounding area, health and safety, maintenance considerations, cost feasibility, and performance and risk analysis. The factors are further discussed below. Existing maps of these five characteristics, when applicable, were used whenever possible, along with Geographic Information System (GIS) modeling and aerial photography and/or remote sensing to assist in BMP site and type selection. The integration of surface and subsurface information to map such parameters will provide more data that are directly relevant in the decision-making process of urban and county planners, engineers and developers, and geotechnical investigators.

1. Type of and Depth to Bedrock—Bedrock that is commonly fractured, such as shallow dolomite or limestone, is highly susceptible to contamination. The fractures provide direct and rapid pathways for contaminants to reach the water table. Groundwater within sandstone formations is less susceptible because sandstone contains fewer well-connected fractures. Soil and sediment overlying bedrock slows seepage to the water table. A greater depth to bedrock increases groundwater protection. The depth-to-bedrock value limits capabilities and activities on the surface.

2. Soil Type—Soils are classified by the Natural Resource Conservation Service into the four Hydrologic Soils Groups (A, B, C and D). Soil A, is generally the deepest, has the smallest runoff potential, and highest infiltration rate and Ds generally have the greatest runoff potential and lowest infiltration rate and include soils with a permanent high water table, soils with high swelling potential, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. Soils A and B are well-suited for infiltration-based BMPs such as rain gardens, permeable pavement systems, sand filter, grass swales, and buffers, often without the need for an underdrain system.

3. Depth to the Water Table—Shallow groundwater may limit the ability to infiltrate runoff. In addition, groundwater quality protection is an issue that should be considered for infiltration-based BMPs. For example, infiltration BMPs should be avoided for land uses that involve storage or use of materials that have the potential to contaminate groundwater underlying a site, such as runoff from fueling stations or

materials storage areas. In addition, the deeper the groundwater table, the better the opportunity for contaminants to be filtered or to degrade.

4. Land Use—The land use cover identifies potential areas where regional and localized MCM implementation might be feasible. In addition, it allows the quantification of the degree of urbanization and imperviousness, both important factors affecting BMP type and location selection. Space constraints are frequently cited as feasibility issues for BMPs, especially for high-density, lot-line-to-lot-line development and redevelopment sites, where there is a limited amount of publicly owned land available to implement the larger scale projects that would be necessary to capture and/or reuse runoff. The primary focus will be to identify opportunities to retrofit existing conveyance systems, parks, and other recreational areas with water quality protection measures.

5. Existing Utilities—Utilities are frequently located below ground, which coincides with the feasible locations for stormwater BMPs. Typically, water and sewer piping, natural gas lines, and telephone and electrical conduits are located in the public ROW and on individual parcels. BMPs will require modification to fit into the limited available space without disrupting existing utilities, or utilities will require relocation for BMP installation.

6. Compatibility with Surroundings—Stormwater quality areas can add interest and diversity to a site, serving multiple purposes. Gardens, plazas, rooftops, and parking lots can become amenities and provide visual interest while performing stormwater quality functions and reinforcing urban design goals for the neighborhood and community. The integration of BMPs and associated landforms, walls, landscape, and materials can reflect the standards and patterns of a neighborhood and help to create lively, safe, and pedestrian-oriented districts. The quality and appearance of stormwater quality facilities should reflect the surrounding land use type, the immediate context, and the proximity of the site to important civic spaces. The standard of design and construction should maintain and enhance property values without compromising function. In addition, construction staging should be sited in a way to minimize the effect of construction mobilization and noise to adjacent tenants.

7. Health and Safety—Stormwater quality facilities must be designed and maintained in a manner that does not pose health or safety hazards to the public. The potential for nuisances, odors, and prolonged soggy conditions should be evaluated for BMPs, especially in areas with high pedestrian traffic or visibility. Urban areas are heavily populated, which adds to safety concerns when considering potential BMPs such as ponds, wetlands, and surface sand filters. Open surface systems may require additional measures such as fencing to ensure public safety and reduce vandalism. Often the only feasible location for BMPs in developed areas is underground, which presents more complex maintenance issues that trigger worker safety requirements. The installation of subsurface BMPs may require maintenance activities to be performed in confined spaces. Confined spaces have specific entry requirements to ensure safety that would need to be followed each time BMPs are inspected or maintained.

8. Maintenance—BMPs can be more effectively maintained when they are designed to allow easy access for inspection and maintenance and to take into consideration property ownership, easements, visibility from easily accessible points, slope, vehicle access, and other factors. Clear, legally-binding written agreements assigning maintenance responsibilities and committing adequate funds for maintenance are also critical. Maintenance requirements must be carefully planned and implemented when access to subsurface BMPs is limited to manhole openings or requires the removal of grates and panels. Subsurface

BMPs may be considered confined spaces and require additional measures to ensure safe access for inspection or maintenance. As a result of these potential restrictions and/or additional measures, BMP technologies that require maintenance on an annual or semiannual basis are often preferred to those requiring more frequent maintenance. Difficulty in performing the maintenance (increased level of effort) can increase the cost of the required maintenance.

9. Watershed Characteristics—The contributing drainage area is an important consideration both on the site level and at the regional level. On the site level, there must be a practical minimum size for certain BMPs related to the ability to drain and treat the associated runoff over the required drain time. On the regional level, there must be a limit on the maximum drainage area for a regional facility to assure adequate treatment of rainfall events. In addition, in a highly urbanized setting, small drainage areas and undefined outfalls limit the number of treatment strategies that can be used to treat stormwater runoff.

10. BMP Categories—BMPs can be categorized based on their functionality (storage versus conveyance) and design strategy (stand-alone versus in series; online versus offline). Storage-based BMPs provide volume reduction benefits and include bioretention and/or rain gardens, extended detention or dry basins, sand and/or media filters, constructed wetland ponds, retention or wet ponds, and permeable pavement systems. Conveyance-based BMPs include grass swales, grass buffers, constructed wetlands channels, and other BMPs that improve quality and reduce volume but only provide incidental storage. Ideally, a combination of conveyance-based and storage-based BMPs can be used to allow the implementation of multiple benefits BMPs. Given the natural variability of the volume, rate and quality of stormwater runoff, and the variability in BMP performance, using multiple practices in a treatment train that links complementary processes can expand the range of pollutants that can be treated and increase the overall efficiency of the system for pollutant removal and provide system redundancy. In addition, the land requirements for a combined facility are lower than for two separate facilities. BMPs may be designed to be online such that all of the off-site runoff from the upstream watershed and site runoff is intercepted and treated by the BMP. Locating BMPs offline requires that all on-site catchment areas flow though a BMP prior to combining with flows from the upstream off-site watershed.

11. BMP Performance—BMP performance evaluation is not required for Regional BMPs, except to the extent that they capture the 24-hour 85th percentile storm. Performance of various BMPs depends on numerous factors, such as BMP type, design, site, storm characteristics, monitoring methodology, performance measures, and pollutant loadings. The reported effectiveness data varies widely between and among different BMPs.

12. Cost Estimates—Cost effectiveness is an essential component in BMP planning and selection, especially with the stricter regulations and leaner budgets imposed on stormwater management programs. Life cycle cost (LCC), which refers to all costs that occur during the economic life of a project, should be optimized. Generally, the components of the LCC for a constructed facility include construction, engineering and permitting, contingency, land acquisition, routine operation and maintenance, and major rehabilitation costs minus salvage value. It is also recommended that the cost of administering a stormwater management program be included as a long-term cost for BMPs. One method to assess and compare the LCC of various BMPs is to use the net present value (NPV) of the whole life costs of the BMP(s) implemented, the average annual mass of pollutant removed, and the average annual volume of surface runoff reduced to compute a unit cost per pound of pollutant or cubic feet of runoff removed over the economic life of the BMP.

13. Risk Assessment—A risk assessment was conducted for the selected BMP systems by evaluating estimated reduction efficiencies, treatment capacity, whether or not a BMP can be integrated with other BMPs, likelihood of failure, and ease of adaptive customization.

14. Other Factors—California Environmental Quality Act (CEQA) environmental consideration not listed above include cultural resources, greenhouse gas emissions, air quality, and traffic. These considerations will be preliminarily assessed for potentially significant impact to identify permitting and potential mitigation requirements at this early assessment phase

4.2.2 Regional MCM Selection

A total of 23 potential regional MCM locations within the MdR WMA were identified. These consisted of the Costco site, green streets, parks, sanitary sewer diversions, and public schools. These were further evaluated and ranked based on various criteria, including depth to groundwater, public acceptance, infrastructure disturbance, maintenance factors, as well as others (Section 4.2). The resulting 19 potential regional MCM implementation sites are listed in Table 4-3. The location of the parks and the Costco site are shown in Figure 4-2. The location for the potential sanitary sewer diversion projects in Subwatersheds 1A, 1B, and 4 are unknown and therefore are not shown in the figure.

Table 4-3: Ranking of Potential Regional BMPs within the MdR WMA

Site	Ranking	Land -Use	Subwatershed	Jurisdiction	Agencies	Groundwater Depth (feet)
Costco	1	Private	4	City of Culver City	Costco	10-19
Triangle Park	2	Public	4	City of LA	Parks	10-19
Venice of America Centennial Park	2	Public	3	City of LA	Parks	10-19
Green Streets[b] (high[a])	4	Public/ROW	4	City of LA	LADOT	20-39
Green Streets[b] (medium[a])	5	Public/ROW	4	City of LA / City of Culver	LADOT	10-19
Green Streets[b] (medium[a])	5	Public/ROW	2	City of LA	LADOT	10-19
Green Streets[b] (low[a])	7	Public	1	County	LADOT	<10
Green Streets[b] (medium[a])	8	Public/ROW	3	City of LA	LADOT	10-19
Canal Park	8	Public	2	City of LA	Parks	10-19
Via Dolce Park	8	Public	2	City of LA	Parks	10-19
Twain Middle School	11	Public	4	City of LA	LAUSD	20-39
Green Streets[b] (low[a])	12	Public/ROW	2	City of LA	LADOT	<10
Green Streets[b] (low[a])	13	Public/ROW	4	City of LA	LADOT	<10
Venice High School	14	Public	4	City of LA	LAUSD	20-39
Coeur D'Elene Elementary School	15	Public	4	City of LA	LAUSD	10-19
Westside Leadership Magnet	16	Public	2	City of LA	LAUSD	10-19
Sanitary Sewer Diversion (1a and 1b)	17	Public/Private				
Sanitary Sewer Diversion (4)	17	Public/Private				

Color Code Subwatershed 1 – Subwatershed 2 – Subwatershed 3 – Subwatershed 4
[a] Referring to groundwater depth
[b] For green streets refer to the Green Streets section below
Parks - City of Los Angeles Parks and Recreation

The Costco site, although not a public site, ranked first because of its relatively large drainage area and potential capture volume, potentially the entire City of Culver City portion of the WMA. Venice of America Centennial Park and Triangle Park were the next highest ranked sites. Venice Park ranked high because of its small footprint compared to the percentage potential capture of its corresponding Subwatershed 3 drainage area. Other factors include the apparent lack of potential public opposition, lower infrastructure disturbance potential, and lower implementation cost. Siting a regional MCM in Triangle Park, despite its small drainage area, results in minimal negative impacts based on the ranking criteria.

Distributed regional green streets in the high groundwater depth areas in Subwatershed 4 were ranked next because of their capture and infiltration potential. Although not able to capture and retain the 85^{th} percentile storm, localized green streets in Subwatersheds 4, 2, and 3 ranked high because of the large drainage area they can treat. Green street MCMs throughout the subwatersheds can result in significant volume and load reductions in the WMA, but with the greatest infrastructure disturbance and potentially the highest costs. Canal Park and Via Dolce Park are also in the top 10 MCMs.

Finally, although Twain Middle School may capture a large percentage of the 1.1-inch storm runoff volume corresponding to the drainage area of Subwatershed 4, the potential lack of public acceptance makes it an unfavorable site for a Regional BMP. The same applies to Venice High School

The benefits of the above-mentioned MCMs, when applicable, extend beyond reduction of sediment loads, toxic pollutants, and bacterial loads. Benefits may include community enhancement through beautification, property value increase, improved beach tourism, ecosystem protection, and groundwater recharge.

Figure 4-2: Proposed Structural Control Measures and Regional Projects in MdR Watershed

4.2.3 Costco

The Costco lot is 17.5 acres. It may also be used to capture the drainage from the entire Culver City portion of the MdR watershed, totaling 42 acres. The Costco site is located within Subwatershed 4, in an area with depth to groundwater between 20 and 30 feet. The design of a regional BMP on the site would attempt to maintain at least 10 feet between the bottom of the proposed BMP and groundwater depth, as required by the City of Culver City. This can be accomplished by designing several diversions within the storm drain network at locations closer to the source (catch or inlets) rather than constructing one diversion at the end of the pipe, which is fairly deep. Design considerations will be given to other geotechnical investigation factors, including the potential liquefaction hazard.

The site has a history of contamination as a result of past industrial use. Although the contamination has been mitigated, there is a chance of mobilizing in-place contamination. Further investigation is required to determine whether this is an issue of concern. Infiltration BMPs would be considered only if the soils are found not to be contaminated.

Based on the preliminary geotechnical data, the deep groundwater conditions at Costco Commercial Park are between 20 and 30 feet and therefore are conducive to an infiltration-type design. The geotechnical reports indicate that the top 10 to 13 feet of material directly underneath the parking lot consists of impervious clay. Approximately 3 feet of clay material below the invert of the infiltration gallery would need to be replaced with gravel or an amended soil mixture designed to allow percolation into deeper sandy soils. As a cost-saving measure, it is assumed that a portion of the excavated clay material (approximately 8,000 cubic yards) may be stockpiled on-site and then beneficially reused as backfill above the infiltration gallery. The Costco parking lot infiltration gallery would be designed to infiltrate 100% of the 85th percentile storm event runoff from the City of Culver City (design volume of 115,600 cubic feet, 42-acre drainage area). The preliminary design for this infiltration gallery consists of 757 StormChamber units installed in a rectangular grid consisting of 25 rows of approximately 30 StormChamber units long (33,776 square foot footprint). Runoff from the Costco facility (17.5 acres) would be re-directed from the existing MS4 system to the infiltration gallery. Runoff from off-site would be directed to the Costco infiltration gallery by means of a diversion structure installed at Zanja Road. Approximately 400 feet of 36-inch reinforced concrete pipe (RCP) would direct runoff approximately the infiltration gallery.

4.2.4 Regional Distributed and Localized Green Streets

Green streets sized to capture and infiltrate the 85th percentile storm (Regional Distributed Green Streets) are planned for locations in Subwatershed 4. Additionally, localized green streets (not designed to capture and infiltrate the 85th percentile storm) will be needed throughout large areas of all the subwatersheds to achieve the water quality load reductions required to achieve compliance with the WLAs of the Toxics TMDL.

For the purposes of this analysis, a green street consists of MCMs installed along the driving surface or sidewalk adjacent to the main public thoroughfare (transportation land use). Three main types of MCMs were included in the green street designs: infiltration-type MCMs (infiltration gallery); capture-type MCMs (sidewalk planters and downspout disconnections) and filtration-type MCMs (sidewalk biofiltration and porous pavement with underdrains). Catch basin inserts were also included.

The feasibility of the implementation of these MCMs depends upon separation from the groundwater table, spatial constraints of the project footprint and underlying soil types. Available groundwater data were used to delineate the MdR watershed into areas where infiltration would be feasible or not feasible. Shallow groundwater in some areas limited the feasibility of infiltration-type MCMs (Figure 4-2). Near the harbor groundwater depths are very shallow (less than 10 feet). The depth to groundwater increases as the distance from the harbor increases. North of South Venice Boulevard the depth to groundwater is between 20 to 30 feet. Near the harbor, capture MCMs are limited to rain gardens (e.g., parkway bioretention) and cisterns or rain barrels. Away from the harbor where depths to ground are greater than 10 feet, there are opportunities for capture and infiltration type MCMs. The bottom of the MCM will be designed to have a minimum of 10 feet vertical separation from groundwater.

Preliminary geotechnical investigations were performed in several areas in Subwatershed 4 and Subwatershed 3. Where investigated, the upper 9 to 12 feet of soils consist of clayey soils that exhibit very little to no ability to infiltrate runoff. Below these clayey materials, is an area of course sand to silty-sand materials that exhibits the ability to infiltrate water. In many cases, structural MCM implementation will require the removal of the clay materials and backfilling with sand material beneath the MCM. For example, a location with a depth to groundwater of 15 feet may have the bottom of the MCM located at a depth of 5 feet; however, the clay may extend to 12 feet. Therefore, the 7 feet of clay material beneath the MCM would need to be removed and replaced with sand materials that will allow the runoff captured in the MCM to infiltrate. Filtration MCMs are also possible throughout the watershed (e.g., porous concrete with underdrain and proprietary filter devices such as the modular wetland systems®).

Vegetation-space requirements to beneficially re-use captured stormwater runoff as irrigation also constrains the feasibility and implementation of capture-treat type MCMs. In these shallow groundwater areas, filtration may be the predominant feasible MCM in the public thoroughfare.

Land use was also considered, and the subwatershed areas were classified by groundwater level and landuse combination for selection of MCMs.

Another factor in selecting the MCMs is the assumed associated capture and/or treatment efficiency, ranging from 63% for filtration MCMs to 100% for infiltration MCMs.

The Complete Streets Manual under development by the City of Los Angeles Department of City Planning (LDCP) defines eight street types. The Manual includes complete street cross-sections for each of the street types. Figure 4-3 is an example of a typical street cross-section and sections designations. Sidewalks are typically 12 to 18 feet wide, with parkways 4 to 9 feet wide. A typical median is 7 to 12 feet wide. Many considerations affect the area available for the adaptation of green streets. Crosswalks, street furniture, bike paths, soil conditions, and utilities need to be considered. MCM implementation depends on many factors on an area-by-area basis and involves substantive area-specific analysis.

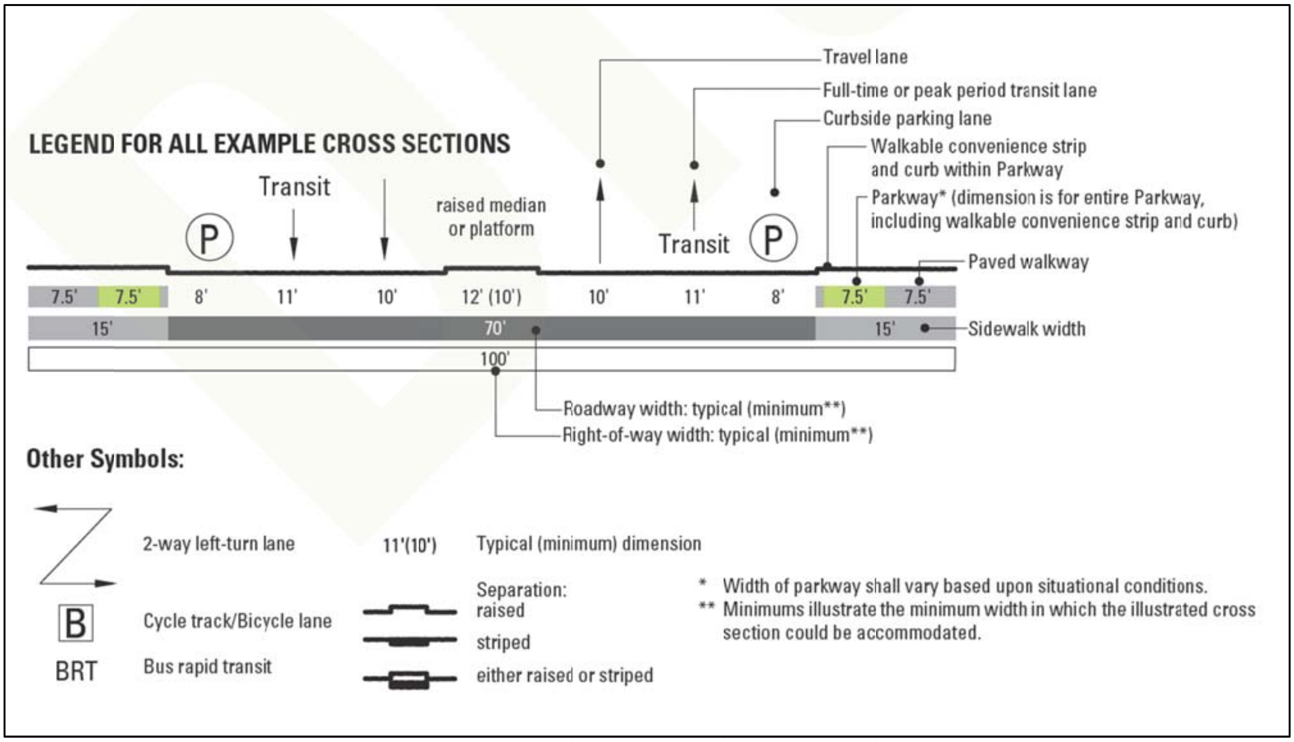

Figure 4-3: Typical Street Cross-Section from the City of Los Angeles Complete Streets Manual

4.2.5 Parks

Four parks were considered for regional infiltration MCMs in the MdR watershed: Canal Park, Venice of America Park, Via Dolce Park, and Triangle Park. The specific design considerations are presented in the following subsections. A summary of the implementation costs is provided in Section 7.2.3. Detailed assumptions and calculations are provided separately in Appendix B.

4.2.5.1 Venice of America Park

Venice of America Park is located between north and south Venice Blvd., at the northern boundary of MdR watershed in Subwatershed 3 (park footprint of approximately 0.76 acres) (Figure 4-2). The groundwater table is 17 feet deep; therefore, this facility could be optimally used as a subsurface infiltration gallery. The proposed design consists of 74 StormChamber infiltration units (8 rows of 9 chambers long) with a 30-inch rock bed (6 inches above the chambers and 24 inches below). The design covers a 3,463 square foot area. The proposed infiltration units will be able to capture 100% of the park drainage area, plus an additional 3.9 acres of tributary drainage area. Although the park has significantly more space available for MCM implementation, the park location limits the extent of the tributary drainage area.

4.2.5.2 Canal Park

Canal Park is located at the intersection of Dell Avenue and Court D in Subwatershed 2 (park footprint of approximately 0.14 acres) (Figure 4-2). The groundwater table is 17 feet deep; therefore, the facility was also designed as a subsurface infiltration gallery. The proposed design consists of 58 StormChamber infiltration units within a 2,739 square foot area (52% of the park footprint) with a 30-inch rock bed. The proposed infiltration units will be designed to capture 100% of the park drainage area, plus an additional 3.3 acres of tributary drainage area. A review of the as-built drawings for the area identified existing porous pavement and infiltration-type BMPs along Carroll Canal Court at Grand Canal Court. A thorough review of existing infrastructure would be recommended as part of the planning stages of this project. Conceptually, stormwater runoff could be directed to Canal Park from the portion of Court D east of Dell Avenue.

4.2.5.3 Via Dolce Park

This vacant lot is located off Via Dolce in Subwatershed 2 (park footprint of approximately 0.21 acre) (Figure 4-2). The groundwater depth is 12 feet. The proposed design consists of a shallow groundwater capture and reuse system. Three 1,000-gallon subsurface cisterns may be installed below grade and plumbed to capture runoff by means of a catch basin insert installed in Via Dolce. Approximately 0.14 acre of the park space (66% of the total park footprint) would be required as landscape in order to use the 85th percentile design storm. The park would be graded to capture its own runoff and may be landscaped with a combination of groundcover and native vegetation.

4.2.5.4 Triangle Park

Triangle Park is located on Marr Road in Subwatershed 4 (Figure 4-2). The park footprint is very small (approximately 0.1 acres) and includes a sand box and basketball court. Because the depth to groundwater is only 11 feet, the only non-filtration MCM option would involve replacing the sandbox area with a 900-gallon subsurface cistern and landscape area of similar design to the Via Dolce Park project). Because of the limited space available for landscaping, this site has the capacity to capture and reuse runoff from only a 0.5-acre tributary drainage area.

4.2.6 Sanitary Sewer Diversion Projects

Sanitary sewer diversion projects were considered as a potential option to ensure the RAA estimated load reductions are achieved for water in both the Back Basins and Front Basins of the harbor.

If after all other regional and localized MCMs are implemented, as described above, and the overall MdR watershed load reductions achieved do not meet the required load reduction goals, the final MCMs necessary to achieve the WLAs may include diversions designed to re-direct stormwater runoff to an above ground storage tank that will slowly discharge to the sanitary sewer. These diversions may be necessary to achieve WLAs in Subwatersheds 1A, 1B, and 4.

For Subwatershed 4, this type of capture-divert design could be implemented at the Boone Olive Pump Station. The existing system, including the existing low-flow diversions, has the capacity to capture and treat the 85th percentile 24-hour storm event from a 3.5-acre tributary drainage area. Runoff from an additional 31.5-acre drainage area may be redirected to the Boone Olive Pump Station to ensure TMDL compliance targets are met. The infrastructure necessary to divert this runoff was not assessed as part of this effort.

For Subwatersheds 1A and 1B, the maximum load reduction potential was assumed for all green street programs. For example, 100% roof runoff capture was assumed through targeted aggressive downspout disconnect programs implemented in single-family residential neighborhoods. The sanitary sewer diversion project was then sized to capture the remaining filtered stormwater runoff volume to achieve TMDL compliance targets.

The project-specific information and design parameters for each of the subwatershed sanitary sewer diversion projects are summarized in Table 4-4. The tank designs assume a 0.05 cubic foot per second discharge rate to the sanitary sewer and a drawdown period of no more than 14 days. Additional capacity was added to the tanks to account for a drawdown period of greater than 14 days. More details are presented in Appendix B.

Table 4-4: Sanitary Sewer Diversion Projects

Design Parameters	1A	1B	4
Design Treatment Area (ac)	22	48	35
Tank Capacity (gallons)	0.49 million	1.60 million	1.04 million
Redevelopment Area (acres)	0.3	0.7	0.5

4.3 Development and Redevelopment

The information presented in this section was compiled from various email communications with the County, City of Los Angeles, and City of Culver City. The projects were researched and those implemented prior to the last monitoring data used for modeling (02/02/2014) were not included in the analysis as they were already accounted for in the modeling.

4.3.1 Subwatersheds 1, 3 and 4

The City of Los Angeles development and redevelopment acreage projections are based on projected growth percentages for each land-use provided by the City. These percentages were used, along with the existing landuse areas for each category, to project development and redevelopment project acreage for each subwatershed where the City of Los Angeles has jurisdiction within the MdR WMA. The results are summarized in Table 4-5. The area of the MdR WMA within the jurisdiction of the City of Los Angeles is projected to assimilate 26.29 acres of development and redevelopment land, corresponding to 1.87 % of the WMA. Although the purpose of the Oxford Retention Basin Rehabilitation Project is flood control, its land area is included under the development/redevelopment projects as it is planned to manage its own stormwater runoff.

Table 4-6 and Figure 4-4 present the development and redevelopment projects planned to be implemented over the timeframe of the EWMP in Subwatershed 1 under the jurisdiction of the County. Under County guidelines, in Subwatershed 1, these projects are required to have the capacity to treat 1.5 times the design volume of the 85th percentile 24-hour storm because stormwater runoff cannot be infiltrated in this subwatershed. The MdR WMA is projected to have development and redevelopment projects on an estimated 108.10 acres within Subwatershed 1, corresponding to approximately 29.29 % of this subwatershed, and 9.97 % of the WMA TMDL compliance area. This area includes the proposed parking lot retrofits previously mentioned in Section 4.1.1.

The City of Culver City does not have planned development and redevelopment projects during the implementation timeframe of this EWMP.

The net development and redevelopment area in the TMDL compliance area of the WMA, (i.e., Subwatershed 1, 3 and 4) is estimated to be 134.39 acres or 12.40 % of that area.

Table 4-5: Subwatersheds 1, 3, and 4 Potential Development and Redevelopment Projects Areas Within the City of Los Angeles

Land Use Class	Yearly Growth (%)	Development / Redevelopment Acreage Increase (Acres) 2015	2016	2018	2021	2022	Net Growth 2015-2022
	Subwatershed 1						
Residential	0.18	12.91	12.93	12.96	12.98	13.00	0.09
Commercial and Services	0.15	9.31	9.32	9.33	9.35	9.36	0.06
Industrial/Mixed with Industrial	0.34	0.18	0.18	0.18	0.18	0.18	0.00
Education	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Transportation	2.7	5.19	5.33	5.47	5.62	5.77	0.58
Total Area (Acres)		27.58	27.76	27.94	28.13	28.32	**0.73**
Percent of Subwatershed 1 (%)		8.49	8.54	8.60	8.66	8.71	**0.23**
Percent of MdR Subwatersheds 1, 3, 4 (%)		2.54	2.56	2.58	2.60	2.61	**0.07**
	Subwatershed 3						
Residential	0.18	44.03	44.11	44.19	44.27	44.35	0.32
Commercial and Services	0.15	1.63	1.63	1.64	1.64	1.64	0.01
Industrial/Mixed with Industrial	0.34	0.24	0.24	0.24	0.24	0.24	0.00
Education	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Transportation	2.7	21.96	22.55	23.16	23.79	24.43	2.47
Total Area (Acres)		67.86	68.54	69.23	69.94	70.66	**2.80**
Percent of Subwatershed 3 (%)		96.26	97.22	98.20	99.20	100.23	**3.97**
Percent of MdR Subwatersheds 1, 3, 4 (%)		6.26	6.32	6.39	6.45	6.52	**0.26**
	Subwatershed 4						
Residential	0.18	256.32	256.78	257.24	257.71	258.17	1.85
Commercial and Services	0.15	98.41	98.56	98.71	98.86	99.00	0.59
Industrial/Mixed with Industrial	0.34	27.03	27.12	27.22	27.31	27.40	0.37
Education	0.16	62.08	62.18	62.28	62.38	62.48	0.40
Transportation	2.7	141.75	145.57	149.51	153.54	157.69	15.94
Oxford Basin Project		0.00	3.60	3.60	3.60	3.60	3.60
Total Area (Acres)		585.60	593.82	598.55	603.39	608.35	**22.75**
Percent of Subwatershed 4 (%)		90.83	92.11	92.84	93.59	94.36	**3.53**
Percent of MdR Subwatersheds 1, 3, 4 (%)		54.02	54.78	55.22	55.66	56.12	**2.10**
Total Area (acres)		**681.04**	**690.12**	**695.73**	**701.46**	**707.33**	**26.29**
Total Area (%)		**62.83**	**63.66**	**64.18**	**64.71**	**65.25**	**2.42**

Table 4-6: Subwatershed 1 Potential Development and Redevelopment Projects

Parcel Number	Area (Acres)*	Project Description
10	7.32	Neptune Apartments. Demolition of existing 136-unit apartment complex and development of a 400-unit complex.
15	10.44	Bar Harbor Apartments. Replace existing 288-unit apartment complex with 585-unit apartment complex.
14 /FF	2.05	Demolition of existing parking lot and development of 126-unit apartment complex.
27	2.80	Jamaica Bay Hotel. Rehabilitation and expansion.
28	8.50	Mariner's Bay. Rehabilitation.
42, 43	3.85, 2.39	Marina del Rey Hotel. Rehabilitation of the hotel and demolition and redevelopment of private boat anchorage.
44	9.72	Commercial Development BEI Project #187-07-003C. Redevelopment will include 85,069 square feet of new buildings with concrete paved parking, driveways and landscape areas.
49M, 49R, 49S, 77	2.52, 11.64, 2.62, 2.92	Mixed Use Development. Retail/commercial complex, food administration building, 255-unit apartment complex, public boat ramp, and dry storage lot
52, GG	2.04, 0.68	Dry stack boat storage facility. Along with appurtenant office space, customer lounge, mast-up storage spaces, and parking. Sheriff's Department / Lifeguard Boatwright facility.
55, 56, W	0.51, 1.21, 4.28	Fisherman's Village. Demolition of Fisherman's village and parking, landscaping, and development of a new mixed use commercial plaza with multi-story parking structure.
64	6.40	Villa Venicia Apartments. Interior and exterior renovation.
7, 8, 9	5.03, 4.51, 3.68	Woodfin Hotel and Wetland Park. Construction of hotel with restaurant and other auxiliary facilities. Development of public wetland and upland park.
95, LLS	1.70, 0.23	Demolition of existing office structures and development of commercial buildings and rehabilitation of existing restaurant.
145	2.08	Marina International Hotel. Interior and exterior renovation.
147/OT	1.62	Demolition of existing landside improvements and construction of 114-unit senior accommodation facility, retail space, parking structure, marine, commercial, and community park (Parcel 21).
21	2.58	Community Park.
UR	1.82	Parking Lot Retrofit. Lot 5 Yearly until 2017.
Q	0.85	Parking Lot Retrofit. Lot 7.
NR	1.58	Parking Lot Retrofit. Lot 9.
40T	0.61	Parking Lot Retrofit. Library.
Total Area	**108.19**	
Percent of Subwatershed 1	**29.291**	
Percent of WMA	**7.7**	

*Land area as provided in leased parcels data set.

Figure 4-4: Subwatershed 1 Potential Redevelopment Parcels

4.3.2 Subwatershed 2

Subwatershed 2 is under the jurisdiction of the City of Los Angeles (278.1 acres) and the County (46.8 acres). The same method presented above using the projected land-use growth rate was used to estimate development and redevelopment within the jurisdiction of the City of Los Angeles. The analysis resulted in a total of 9.95 acres planned for development and/or redevelopment, equating to 3.06% of the subwatershed and 0.71% of the WMA (Table 4-7). The County has two parcels planned for redevelopment, as summarized in Table 4-8. These redevelopment projects equate to 1.92 acres, or 0.59 percent of the subwatershed and 0.14% of the WMA.

Table 4-7: Subwatershed 2 Potential Development and Redevelopment Projects Areas Within the City of Los Angeles

Land Use Class	Yearly Growth (%)	Development / Redevelopment Acreage Increase (acres)					Net Growth
		2015	2016	2018	2021	2022	2015-2022
	Subwatershed 2						
Residential	0.18	146.67	146.94	147.20	147.47	147.73	**1.06**
Commercial and Services	0.15	12.98	13.00	13.02	13.04	13.06	**0.08**
Industrial/Mixed with Industrial	0.34	0.22	0.22	0.22	0.22	0.22	**0.00**
Education	0.16	1.79	1.80	1.80	1.80	1.81	**0.01**
Transportation	2.7	78.21	80.32	82.49	84.72	87.01	**8.80**
Total Area (Acres)		239.88	242.28	244.74	247.26	249.83	**9.95**
Percent of Subwatershed 2 (%)		73.81	74.55	75.30	76.08	76.87	**3.06**
Percent of MdR WMA (%)		17.03	17.20	17.37	17.55	17.73	**0.71**

Table 4-8: Subwatershed 2 Potential Development and Redevelopment Projects

Parcel Number	Area (acres)*	Project Description
95, LLS	1.70, 0.23	Demolition of existing office structures and development of commercial buildings and rehabilitation of existing restaurant.
Total Area (acres)	**1.92**	
Percent of Subwatershed 2 (%)	**0.59**	
Percent of WMA (%)	**0.14**	

*Land area as provided in leased parcels data set.

4.4 MCM Type Summary

The structural MCMs described above represent many different capture, infiltration, and treatment control measure types based on the factors discussed in this section, including landuse and groundwater level. Table 4-9 presents the acreage coverage corresponding to the various MCM types to be implemented within the boundaries of Subwatersheds 1, 3, and 4 to reduce the contaminant loading to the Back Basins and the Front Basins. For Subwatershed 2, which does not drain to the Back or Front Basins, these MCMs are listed Table 4-10. The MCMs in these tables include all the structural measures discussed in this section, with the exception of the sanitary sewer diversions.

Table 4-9: Summary of MCM Types by Subwatershed Area for runoff areas associated with the Toxics TMDL

MCMs by Land Use Area-Acres	Subwatershed Area (ac)				
	1A	1B	3	4	Total
Multi-Family Residential	**17.34**	**119.75**	**21.10**	**96.31**	**254.46**
Infiltration Gallery	-	-	6.8	27.4	34.2
Sidewalk Swale-Capture	0.87	5.99	0.0	25.8	32.7
Porous Pavement-Filtration	11.19	77.84	7.0	8.8	104.8
Sidewalk Filtration Device	1.73	11.98	0.0	13.2	26.9
Downspout Disconnect/Cistern	3.47	23.95	3.5	11.0	41.9
Redevelopment-Filtration	0.09	-	0.16	1.65	1.9
Regional Project-Capture	-	-	3.71	8.40	12.1
Single-Family Residential	**0.43**	**1.41**	**22.93**	**167.16**	**192.00**
Infiltration Gallery	-	-	3.31	63.9	67.2
Sidewalk Swale-Capture	0.02	0.07	4.76	49.1	54.0
Porous Pavement-Filtration	0.19	0.64	1.34	7.1	9.3
Sidewalk Filtration Device	0.04	0.14	2.02	10.6	12.8
Downspout Disconnect/Cistern	0.17	0.57	7.62	26.5	34.9
Redevelopment-Filtration	-	-	0.16	1.65	1.8
Regional Project-Capture	-	-	3.71	8.40	12.1
Commercial and Services	**66.32**	**102.46**	**4.23**	**193.34**	**366.32**
Infiltration Gallery	-	-	1.37	61.2	62.6
Sidewalk Swale-Capture	3.32	5.12	1.27	55.2	64.9
Porous Pavement-Filtration	19.29	1.81	0.63	26.7	48.4
Sidewalk Filtration Device	3.99	2.25	0.95	40.1	47.3
Downspout Disconnect/Cistern	13.26	13.32	-	0.0	26.6
Redevelopment-Filtration	26.46	79.96	0.01	1.71	108.1
Regional Project-Capture	-	-	-	8.40	8.4
Industrial	**0.16**	**0.02**	**0.24**	**27.03**	**28.31**
Infiltration Gallery	-	-	0.08	1.0	1.1
Sidewalk Swale-Capture	0.01	-	0.07	4.7	4.8
Porous Pavement-Filtration	0.10	0.02	0.04	5.1	5.3
Sidewalk Filtration Device	0.02	-	0.05	7.6	7.7
Downspout Disconnect/Cistern	0.03	-	-	-	-
Redevelopment-Filtration	-	-	-	1.09	1.1
Regional Project-Capture	-	-	-	8.40	8.4
Roads and ROW	**11.77**	**26.23**	**21.96**	**154.79**	**213.92**
Infiltration Gallery	-	-	6.33	41.6	47.9
Sidewalk Swale-Capture	0.59	1.57	5.85	38.8	46.8
Porous Pavement-Filtration	10.04	23.09	2.92	19.7	55.8
Sidewalk Filtration Device	0.56	1.57	4.39	28.8	35.3
Downspout Disconnect/Cistern	-	-	-	-	-
Redevelopment-Filtration	0.58	-	2.47	16.66	19.7
Regional Project-Capture	-	-	-	8.40	8.4
Subwatershed Total					
Infiltration Gallery	-	-	17.92	195.10	213.0
Sidewalk Swale-Capture	4.81	12.75	11.95	173.60	203.1
Porous Pavement-Filtration	40.81	103.40	11.89	67.40	223.5
Sidewalk Filtration Device	6.34	15.94	7.41	100.30	130.0
Downspout Disconnect/Cistern	16.93	37.84	11.07	37.50	103.3
Redevelopment-Filtration	27.13	79.96	2.80	22.75	132.6
Regional Project-Capture	-	-	7.41	42.00	49.4
Open Space (Misc.)	**8.20**	**14.67**	**-**	**7.06**	**29.93**
Total	**104.22**	**264.54**	**70.46**	**645.69**	**1,084.9**

Table 4-10: Summary of MCM Types by Area for Subwatershed 2

MCMs by Land Use Area-Acres	Subwatershed 2 (acres)	MCMs by Land Use Area-(acres)	Subwatershed 2 (acres)
Multi-Family Residential	**131.76**	**Industrial**	**0.22**
Infiltration Gallery	-	Infiltration Gallery	-
Sidewalk Swale-Capture	23.00	Sidewalk Swale-Capture	0.04
Porous Pavement-Filtration	25.00	Porous Pavement-Filtration	-
Sidewalk Filtration Device	-	Sidewalk Filtration Device	-
Downspout Disconnect/Cistern	-	Downspout Disconnect/Cistern	-
Redevelopment-Filtration	0.53	Redevelopment-Filtration	-
Regional Project-Capture	3.45	Regional Project-Capture	-
Single-Family Residential	**45.78**	**Roads and ROW**	**83.25**
Infiltration Gallery	-	Infiltration Gallery	-
Sidewalk Swale-Capture	8.15	Sidewalk Swale-Capture	13.40
Porous Pavement-Filtration	5.00	Porous Pavement-Filtration	-
Sidewalk Filtration Device	-	Sidewalk Filtration Device	-
Downspout Disconnect/Cistern	-	Downspout Disconnect/Cistern	-
Redevelopment-Filtration	0.53	Redevelopment-Filtration	8.80
Regional Project-Capture	-	Regional Project-Capture	-
Commercial and Services	**33.34**	**Subwatershed Total**	
Infiltration Gallery	-	Infiltration Gallery	-
Sidewalk Swale-Capture	5.64	Sidewalk Swale-Capture	50.23
Porous Pavement-Filtration	5.00	Porous Pavement-Filtration	35.00
Sidewalk Filtration Device	-	Sidewalk Filtration Device	-
Redevelopment-Filtration	-	Downspout Disconnect/Cistern	-
Regional Project-Capture	2.01	Redevelopment-Filtration	11.87
Downspout Disconnect/Cistern	-	Regional Project-Capture	3.45
Total			**100.55**

4.5 EWMP Non-Structural MCMs

The direct impact of non-structural MCMs, such as aggressive street sweeping, true source control, enhanced inspections, bird exclusion devices, and runoff reduction programs, is challenging to quantify. Supporting evidence and studies do exist, however, justifying the load reduction apportionment for various nonstructural programs that may be implemented within the MdR watershed.

The Toxics TMDL assumed that non-structural BMPs would reduce loads by 30% (LARWQCB, 2005). Based on the estimates presented in the Multi-Pollutant TMDL Implementation Plan for the Unincorporated Area of Marina del Rey Harbor Back Basins (LADPW, 2012), the total reduction that could be achieved from non-structural BMPs was approximated to be 33%; however, the plan used a conservative load reduction of 25%. For the purposes of the MdR EWMP, a more conservative percent reduction, 6.5%, was used and may be modified based on the adaptive management process of BMP observed performance, evaluation, and customization.

The positive impact of some existing programmatic MCMs may continue to increase over the period of the MS4 Permit as awareness increases and enforcement is strengthened. Other programs, such as street sweeping are assumed not to have an additional effect on water quality beyond what was already captured in the monitoring results used in the RAA effort; thus, there are no plans to modify the methods or frequency of such programs over the EWMP planning horizon.

The non-structural MCM programs proposed for the MdR watershed include modeling updates and other studies, source control, catch basin cleaning, and industry targeted outreach and education, enforcement, and inspection programs. These are briefly discussed below and listed in Table 4-11.

True source control by targeting the actual pollutant source is very effective at reducing concentrations and/or loads. One example is product substitution campaigns and enforcement. Product substitution campaigns involve identifying products that contribute to pollutant loading and water quality degradation and substituting products that are less harmful to water quality. One example is legislation that reduced the concentration of copper in brake pads in California through the Brake Pad Partnership. Evaluating alternative types of fencing (i.e., replacing galvanized metal products), prohibiting and/or restricting use of outdoor architectural copper, and the reduction of zinc in tires are other potential programs. Programs can also identify environmentally friendly businesses and services (i.e., waterless, suds-less, organic, recycled materials, nontoxic.) in the MdR WMA. Other potential programs may include targeting specific areas or programs such as trash area maintenance, parking lots, streets, dry dock/boat maintenance areas, landscape management, pest maintenance, or on-land/in-water boat maintenance services in the watershed.

A targeted aggressive MS4 and catch basin cleaning program would evaluate the existing catch basin and MS4 cleaning program within the MdR and coordinate to ensure that a baseline loading pre- and post-standard cleaning is conducted. The cleaning program would then be modified to incorporate aggressive cleaning techniques such as dry-ice freezing, steam cleaning, and other available technologies or increased cleaning frequency to once-per-month frequency, or similar techniques. Targeted cleaning programs may target specific types of catchments (i.e., in parking lots or near restaurant facilities).

Institutional controls, regulatory changes and inspection and enforcement represent important aspects of nonstructural MCMs necessary to achieve reductions in contaminant loading for the MdR watershed. These non-structural solutions may incentivize targeted audiences to proactively modify behaviors and operations to avoid the need for regulatory enforcement. Such measures include code modifications as well as inspection and enforcement measures to ensure restaurants, parking garages, and other commercial facilities comply with the applicable codes. A voluntary-led program may be developed, including incentives, for those facilities that voluntarily install wet-weather and dry-weather runoff BMPs.

Outreach and education activities will have a role in enhancing community practices throughout the watershed. Examples include billboard campaigns to promote protective waste management practices such as recycling used motor oil and batteries, and environmentally sound boating practices, in addition to ordinance development to promote sound irrigation practices.

Table 4-11: Non-Structural MCMs within the MdR WMA

Non-Structural MCM Category		Potential Contaminant Reduction (%)
Watershed Studies	Pollutant Loading Model and Database; Total Suspended Solids/Pollutant Correlations	
Source Control	Collaborative Environmentally Friendly Alternative Services Program; Product Substitution Campaign	4
Municipal Separate Storm Sewer System (MS4)	Targeted Aggressive MS4 and Catch Basin Cleaning Program	1
Restaurants, Parking Garage, Construction, and Commercial Facilities Compliance	Code Survey and Modification; Targeted Inspections; Business-led Voluntary BMP Implementation Program	1
Community Outreach and Education	Outreach and Education; Environmentally Friendly Boating Program; Green Gardening, and Runoff Reduction Program	0.5
Total Contaminant Reduction (%)		**6.5**

5.0 REASONABLE ASSURANCE ANALYSIS

5.1 Reasonable Assurance Analysis Setup

The purpose of the RAA is to quantitatively demonstrate that the proposed control measures included in the EWMP will "achieve applicable WQBELs and/or RWLs with compliance deadlines during the Permit term" (Section C.5.b.iv.(5) of the 2012 MS4 Permit). The RAA requires the development of a modeling process to support the selection of BMPs as well as an adaptive customization and scheduling process to demonstrate and address compliance with the MS4 Permit. The RAA for the MdR watershed complies with the RAA guidelines provided by the LARWQCB to the extent practicable and applicable to the watershed.

The RAA analyses involved multiple steps starting with identification of the watershed modeling tool (Watershed Management Modeling System [WMMS]), characterization of the modeled area (MdR WMA), including land-use and existing BMPs, and evaluation of water and sediment quality monitoring data available for the WMA as of the date of modeling. This information was integrated into the model data inputs and used for calibration of the model to ensure, to the extent reasonable, the accurate representation of simulated watershed conditions. Once calibrated, the model was run for the WMA at a subwatershed level (Figure 1-2).

The results from the RAA analyses were used as guidelines in the identification of BMPs, including regional BMPs, to be implemented throughout the MdR WMA. This analysis incorporates the identification of development and redevelopment project; potential existing BMPs customization; and potential regional, centralized, and distributed BMPs necessary and sufficient for the aforementioned compliance.

The following subsections describe the modeling tool selection justification and model configuration processes.

5.1.1 Modeling Tool Selection

The MdR EWMP Agencies have selected the Los Angeles County WMMS as the model to be used for the development of the MdR EWMP. WMMS conforms to the modeling system selection criteria set by the LARWQCB–led RAA committee and is based on a regional modeling approach that was developed to simulate the hydrology and transport of sediment and metals. The approach is based on the Hydrologic Simulation Program–FORTRAN (HSPF) and Loading Simulation Program C++ (LSPC), a version of HSPF recoded into C++. The regional approach has been used to support metals TMDLs for Ballona Creek and the Los Angeles River. WMMS simulates hydrology, sediment, and general water quality on land and is combined with a stream fate and transport model. Additional detailed information related to the WMMS is available and can be accessed on the WMMS website (http://dpw.lacounty.gov/wmd/wmms/res.aspx).

WMMS was used to estimate the wet weather loading for the MdR WMA for the constituents of concern, including copper, lead, zinc, and TSS. The results are presented in terms of hourly volumes and loads. As part of the RAA, the watershed modeling tool was first used to model the monitored storm events in order to calibrate stormwater runoff volumes and pollutant loads to available measured data. The calibrated model was then used to simulate the critical year, which was determined to be the 2009 wet season

(Section 5.1.4) in order to determine the quantity of load reductions that will be necessary to meet the applicable TMDL requirements.

5.1.2 WMMS Model Calibration

Monitoring data collected as part of the Toxics TMDL CMP were used to calibrate the storm water runoff volumes and pollutant loads generated by WMMS for the MdR WMA. These monitoring data included 27 monitored storm events at 5 sites (MdR-3, MdR-4, MdR-5, MdRU-C-1, MdRU-C-2) (Figure 5-1) over 4 wet seasons (2010 – 2013) (WESTON, 2014a).

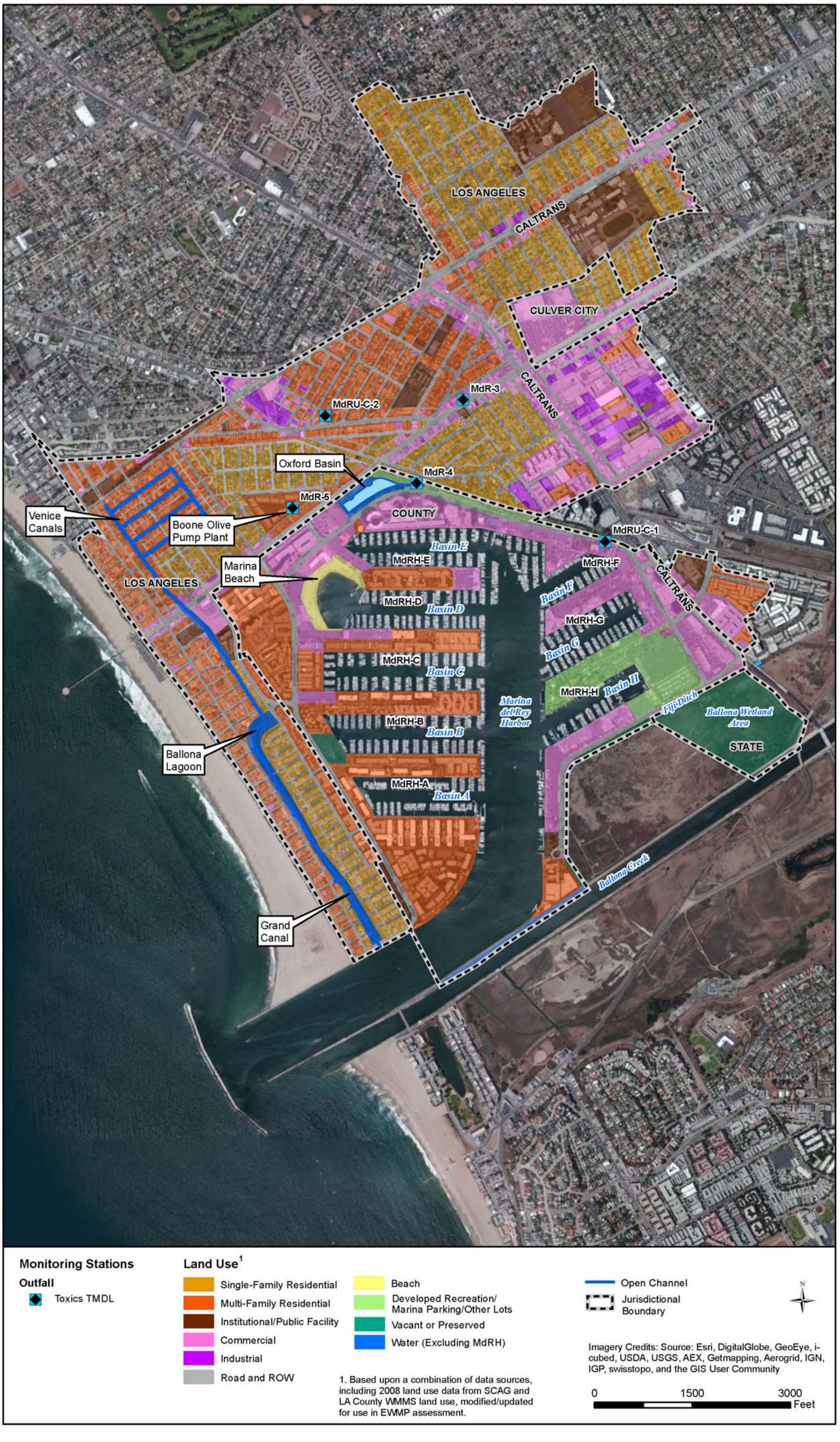

Figure 5-1: Toxics TMDL Outfall Monitoring Locations

At the time of modeling, WMMS rain gauge data were available through April 2012; therefore hourly data recorded at the Electric Avenue Pumping Plan (Gauge AL461) were obtained and incorporated into WMMS. Land use values for the drainage area to each monitored site were also incorporated into the model. The summary of the land use for the drainage area to each monitored location is provided in Table 5-1. Detailed information is presented in the MdR Coordinated Integrated Monitoring Program (CIMP). WMMS model runs were performed for the monitoring periods for each monitored site drainage area.

Table 5-1: Monitoring Locations – Land Use Summary

Land Use Type	MdR-3	MdR-4	MdR-5	MdRU-C-1	MdRU-C-2
High Density Single-Family Residential	114.2	27.8	22.9		
Low Density Single-Family Residential Moderate		0.8			
Multi-Family Residential	54.6	15.1	21.1		4.5
Commercial	42.5	29.8	2.9	0.3	
Institutional	57.8		1.4		
Industrial	0.8	50.1	0.2		
Secondary Roads	106.5	29.2	22.0	2.3	2.0
Vacant		0.6			
Total	**376.4**	**153.4**	**70.5**	**2.6**	**6.5**

5.1.2.1 *Runoff Volume Calibration*

The modeled stormwater runoff volumes were compared to the measured volumes. Calibration of the model was performed by changing the percentages of impervious cover associated with the various land use types for each drainage area (e.g., if the model overestimated runoff, then the overall percent of impervious cover was reduced proportionally for all applicable land use types). Validation of the model was performed by running the models with the new impervious percentages and comparing the model results to the measured results. The summary of the storm water runoff volume calibration is provided in Table 5-2.

Table 5-2: Stormwater Runoff Volume Calibration Summary

Site	Area (acres)	Uncalibrated Results		Impervious Correction Factor	Calibrated Results	
		Impervious Percentage	Runoff Volume Percent Difference		Impervious Percentage	Runoff Volume Percent Difference
MdR-3	376.4	63.4%	24.3%	0.81	51.4%	2.1%
MdR-4	153.4	75.9%	38.8%	0.72	54.6%	-0.5%
MdR-5	70.5	47.2%	-19.0%	1.20	57.4%	-0.2%
MdRU-C-1	2.6	66.6%	-11.6%	0.784	52.2%	1.4%
MdRU-C-2	6.5	56.4%	15.9%	0.863	48.7%	0.7%

5.1.2.2 *Zinc Loading Calibration*

A comparison of CMP chemistry data to the Toxic Pollutants TMDL indicated that zinc is the constituent that requires the largest load reduction percentage; therefore, the model calibration focused on zinc. Modeled flow volumes were combined with CMP measured zinc concentrations to compute the zinc loading for the monitored storm events. Using the modeled flows eliminated the potential to introduce error based on the difference between modeled and measured flow volumes for individual storm events. The measured load was compared to modeled zinc loads for these monitored storm events. A correction factor was computed based on the proportion of measured zinc load to modeled zinc load for each monitored site. This correction factor was used to make adjustments to the WMMS wash-off potency factor (POTFW) constant loading parameter values. Modeling was performed with these new POTFW parameters, and the modeled loads were compared to the measured load to verify that the modeling was calibrated for the key pollutant zinc. The storm water runoff volume calibration is summarized in Table 5-3.

Table 5-3: Stormwater Runoff Zinc Loading Calibration Summary

Site	Area (acres)	Uncalibrated Zinc Loading Percent Difference	Zinc Modeling Correction Factor	Calibrated Zinc Loading Percent Difference
MdR-3	376.4	-29.5%	1.42	0%
MdR-4	153.4	56.3%	0.64	0%
MdR-5	70.5	138.1%	0.42	0%
MdRU-C-1	2.6	20.5%	0.83	0%
MdRU-C-2	6.5	26.3%	0.79	0%

5.1.2.3 TSS Calibration

The Toxic TMDL is a sediment-based TMDL that considers the reduction in TSS equivalent to toxic pollutants reductions. WMMS was, therefore, also calibrated for the constituent TSS. Modeled flow volumes were combined with CMP-measured TSS concentrations to compute the sediment loading for the monitored storm events. The loading was compared to modeled TSS loads for these monitored storm events. A correction factor was computed based on the proportion of measured TSS load to modeled TSS load for each monitored site. The WMMS coding does not have POTFW parameter for TSS; therefore, the computed TSS correction factor for each monitored site was applied to the model output using a spreadsheet (post-process adjustment). The modeling results, with the TSS correction factor applied, were compared to the measured TSS load to verify modeling was calibrated for the TSS. The stormwater runoff volume calibration is summarized in Table 5-4.

Table 5-4: Stormwater Runoff TSS Loading Calibration Summary

Site	Area (acres)	Uncalibrated TSS Loading Percent Difference	TSS Modeling Correction Factor	Calibrated TSS Loading Percent Difference
MdR-3	376.4	-39.2%	1.644	0%
MdR-4	153.4	65.3%	0.605	0%
MdR-5	70.5	136.4%	0.423	0%
MdRU-C-1	2.6	-40.6%	1.685	0%
MdRU-C-2	6.5	-19.2%	1.24	0%

5.1.3 Subwatershed Modeling Parameters

The MdR WMA applicable to the EWMP consists of approximately 1,409 acres divided into four subwatershed areas (Figure 1-2). For more information regarding modeling land-use see Appendix C.

Table 5-5 provides a summary of the land use associated with each subwatershed area. Subwatershed 1 is divided into Subwatershed 1A, which drains to the Back Basins of the harbor (Basins D, E, and F) and Subwatershed 1B, which drains to the Front Basins of the harbor (Basins A, B, C, G, and H).

Table 5-5: Subwatershed Land Use Summary

Land Use Type	Subwatershed 1A		Subwatershed 1B		Subwatershed 2		Subwatershed 3		Subwatershed 4	
	Area (acres)	Imp. %	Area (acres)	Imp. %	Area (acres)	Imp. %	Area (acres)	Imp. %	Area (acres)	Imp. %
High Density Single-Family Residential	-	-	-	-	45.8	42.2%	22.9	49.3%	166.3	33.9%
Low Density Single-Family Res. Moderate	0.4	6.0%	1.4	19.3%	-	-	-	-	0.8	7.9%
Multi-Family Res.	17.3	63.3%	119.8	62.3%	131.8	59.8%	21.1	48.3%	96.3	44.7%
Commercial	65.6	70.6%	94.3	63.8%	23.2	92.6%	2.9	95.0%	129.7	69.3%
Institutional	0.7	71.3%	8.2	63.3%	10.2	85.3%	1.4	95.0%	63.6	64.4%
Industrial	-	-	-	-	0.2	0.0%	0.2	95.0%	27.0	69.8%
Secondary Roads	11.8	59.8%	26.2	53.6%	83.3	67.9%	22.0	67.0%	154.8	53.5%
Vacant/ Open Space	8.2	0%	14.7	0%	33.3	0.0%	0.0	0.0%	7.1	0.0%
Total	**104.2**		**264.5**		**327.7**		**70.5**		**645.7**	

IMP - Impervious

Subwatershed 2 is not included as part of the Toxic TMDL or the Bacteria TMDL, and no CMP monitoring locations were located in the Subwatershed 2 area. Therefore, the Subwatershed 2 area was modeled without changing the calibration parameters established during the development of WMMS. The results of the Subwatershed 2 modeling are presented in this document to provide an approximate estimate of the existing conditions. Future monitoring may allow for calibration of WMMS specific to Subwatershed 2.

The calibration parameters (correction values) determined for the monitoring sites were applied to the respective subwatershed areas. The MdRU-C-1 Site is located within the Subwatershed 1 area (Figure 5-1); therefore, the MdRU-C-1 correction factors were used for Subwatershed 1. Subwatershed 3 corresponds directly to MdR-5. Subwatershed 4 includes MdR-3, MdR-4, and MdRU-C-2, and an additional 126.3 acres of unmonitored area (Figure 5-1). Therefore, modeling for Subwatershed 4 included performing four different models, including one for each of the three monitored drainage areas with the corresponding correction factors determined through the calibration process and a fourth model that included the unmonitored areas with correction factors based on the area-weighted average of the correction factors for the three monitored drainage areas. A summary of the correction factors associated with the monitored locations and subwatershed areas is provided in Table 5-6.

The results of the subwatershed modeling using WMMS were used as the foundation to perform calculations that included the existing pollutant loading, required load reductions, as well as load reductions possible using various types of BMPs. Modeling data (input and output files) are presented in Appendix C.

Table 5-6: Modeling Correction Factor Summary

Site	Area (acres)	Impervious Correction Factor	Zinc Correction Factor	TSS Correction Factor
MdR-3	376.4	0.81	1.42	1.64
MdR-4	153.4	0.72	0.64	0.605
MdR-5	70.5	1.20	0.42	0.423
MdRU-C-1	2.6	0.784	0.83	1.685
MdRU-C-2	6.5	0.863	0.79	1.24
Subwatershed 1A	104.2	0.784	0.83	1.685
Subwatershed 1B	264.5	0.784	0.83	1.685
Subwatershed 2	327.7	1.0	1.0	1.0
Subwatershed 3	70.5	1.195	0.421	0.423
Subwatershed 4	645.7	0.785	1.19	1.338

5.1.4 Toxic Pollutants Critical Period

In accordance with the Toxics TMDL and the RAA Guidance Document, the critical period for toxic pollutants for the MdR WMA was determined to be the 2009 rainfall year (July 1, 2009 to June 30, 2010). An analysis of the Los Angeles International Airport (LAX) rain gauge data spanning from 1948 to 2000 indicates that the average rainfall year is 12.43 inches. Based on the available LAX data (1940 to 2013) the rainfall year closest to this average value is 2009, with rainfall of 12.42 inches. The rain gauge data used by WMMS for 2009 have a total rainfall year value of 14.63 inches. More information on the critical year determination is provided in Appendix C.

5.1.5 Continuous Simulation Model (Toxic Pollutants)

To analyze the load reductions that may be achieved through implementing MCMs other than those designed to capture and infiltrate or reuse runoff associated with the 85th percentile storm event, continuous simulations models (CSMs) of the four watersheds were prepared to simulate how the combination of various types of MCMs would function to reduce pollutant loads during the critical year.

Consistent with the output of WMMS, the CSMs were prepared based on hourly time steps throughout the critical year. The CSMs exclude the portion of the subwatersheds that drain to MCMs designed to capture and infiltrate or reuse the 85th percentile storm event. For the remainder of the subwatershed, the CSMs perform calculations at each time step for different types of MCMs that may be implemented, including filtration (flow through treatment) MCMs, MCMs that capture runoff first and then perform treatment, MCMs that capture and infiltrate or reuse (with varying capture capacity), and areas where no MCMs are proposed, if applicable. These time step calculations include computing the portion of runoff generated in the drainage areas that would be treated or captured, whichever is applicable, by the proposed MCMs, the load remaining in the runoff after treatment, and the runoff and load that would bypass the MCMs (exceed the capacity of the selected MCMs). For MCMs that incorporate runoff capture, the CSM computes the recharge or drawdown volume of the systems that occurs during each time step.

The programing allows the user to vary certain parameters associated with the MCMs, including the drainage area (acres), treatment maximum flow rate if applicable (inches per hour associated with rainfall), MCM load reduction effectiveness, storage capacity if applicable (inches of rainfall), drainage area runoff coefficient, and maximum drawdown time (units of days) for MCMs that include capture. The user is provided a calculation summary that is dynamically linked to the time step calculations. The summary also includes the total modeled zinc load in the subwatershed, the targeted load reduction based on the Toxics TMDL waste load allocation allotted to the subwatershed, and the load reduction achieved through the combination of user-selected MCMs. The user can then make adjustments of the various MCM parameters until the desired load reductions are achieved.

More details including the key parameters used and the calculation methods relating to the CSMs are provided in Appendix C.

5.1.6 Continuous Simulation Model (Bacteria)

A bacteria CSM was prepared to calculate the existing fecal coliform loading into the Back Basins of the harbor. The bacteria CSM performs hourly time step calculations based on WMMS output data. WMMS provides data on fecal coliform loading from modeled watersheds; however, the CMP was focused on toxic pollutants and did not include sampling for and analyzing bacteria. Therefore, data are not currently available to calibrate the WMMS tool. The suggested average event mean concentrations (EMCs) for fecal coliform provided in the RAA Guidance Document were used to calculate a composite (or comingled) EMC for the Back Basin drainage area based on the suggested EMC, land use area, and land use impervious cover percentage. The data used and the results of these composite EMC calculations are provided in Table 5-7. The bacteria CSM used the composite EMC to calculate the bacteria loading being discharged from the subwatersheds based on the modeled runoff volume and composite EMC value. Load reductions were based on the volume of runoff reduction (capture) achieved by the selected MCMs for the bacteria analysis. The target load reduction analysis is discussed in more detail in Section 5.2.3.

Table 5-7: Fecal Coliform Event Mean Concentration Calculation Summary

Land Use Type	Fecal Coliform EMC* (MPN/ 100 ml)	Subwatershed 1A		Subwatershed 3		Subwatershed 4		Back Basin Drainage Area	
		Area (acres)	Imp. Cover	Area (acres)	Imp. Cover	Area (acres)	Imp. Cover	Area (acres)	Imp. Cover
High Density Single-Family Residential	3.11E+04	0.0	32.9%	22.9	49.3%	166.3	33.9%	189.3	35.7%
Low Density Single-Family Residential Moderate	3.11E+04	0.4	6.0%	0.0	0.0%	0.8	7.9%	1.3	7.2%
Multi-Family Residential	1.18E+04	17.3	63.3%	21.1	48.3%	96.3	44.7%	134.7	47.7%
Commercial	7.99E+04	65.6	70.6%	2.9	95.0%	129.7	69.3%	198.2	70.1%
Institutional	7.99E+04	0.7	71.3%	1.4	95.0%	63.6	64.4%	65.7	65.1%
Industrial	3.76E+03	0.2	42.0%	0.2	95.0%	27.0	69.8%	27.4	69.8%
Secondary Roads	1.68E+03	11.8	59.8%	22.0	67.0%	154.8	53.5%	188.6	55.5%
Vacant	6.31E+03	8.2	0.0%	0.0	0.0%	7.1	0.0%	15.3	0.0%
Total		**104.2**	**62.3%**	**70.5**	**57.4%**	**645.7**	**51.4%**	**820.4**	**53.3%**
Composite EMC (MPN/ 100 ml)		**5.98E+04**		**2.02E+4**		**3.89E+4**		**4.03E+4**	

* Source LARWQCB, 2014
IMP = Impervious

5.2 Reasonable Assurance Analysis Existing Conditions and Top Down Estimation of Minimum Control Measures

The calibrated WMMS model and the the CSMs prepared for the MdR subwatersheds were used to estimate the current annual loading and associated required load reductions. Based on the estimated required load reductions, hypothetical quantities of various types of MCMs were selected and incorporated into the CSM. The CSM allowed MCM quantities and capacities to be varied until the required load reductions were achieved in the model. This is considered a top down approach, because it focuses on the volume of storm runoff that is required to be captured or treated and the associated MCMs needed to do so. The top down approach does not consider site constraints, such as geology, depths to groundwater, existing infrastructure, costs, and other important factors. The top-down approach is useful by providing managers an understanding of the types of MCMs that may be used to achieve the required load reductions in an unconstrained environment. There are many site constraints within the MdR watershed, which are discussed in more detail in Section 4and were considered during MCM selection.

5.2.1 Toxics TMDL Existing Conditions Water Quality Modeling

As previously described in more detail, the WMMS tool was calibrated and used to model existing conditions within the MdR WMA. The output data from WMMS were then used in a CSM prepared for each subwatershed to determine the load reduction required to achieve compliance with applicable TMDLs and the various combinations of MCMs (besides those designed to capture and infiltrate or reuse the 85th percentile storm event) that could be used to achieve those load reductions. Scenarios were evaluated for each subwatershed area that included (1) 0% of the area draining to MCMs that capture and infiltrate or reuse and 100% of the area draining to other types of MCMs and (2) 50% of the area draining to MCMs that capture and infiltrate or reuse and 50% of the area draining to other types of MCMs. For each of these scenarios, the amount of drainage area treated by filtration type MCMs was varied to include the following factors: zero filtration, medium amount of area treated by filtration MCMs, and the maximum amount of area that could be treated by filtration MCMs.

5.2.1.1 Subwatershed Area 1A

The Subwatershed 1 area was modeled using the calibrated WMMS tool and the results were used as the foundation to perform additional calculations and analysis, including the preparation of a CSM, as previously described. The summary of the existing pollutant loading and required load reductions is provided in Table 5-8. The WLA for zinc was calculated by allocating in the Toxics TMDL WLA value to Subwatershed 1A proportional to the area of Subwatershed 1A compared to the total area associated with that WLA. The parameters used to calculate the Subwatershed 1A WLA are provided in Table 5-8. Figure 5-2 shows the WMMS tool flow and zinc concentration output parameters.

Table 5-8: Subwatershed 1A Modeled Existing Conditions

Parameter	Value
Modeled Zinc Load	26.6 kg/year
Modeled TSS Load	7,757 kg/year
Modeled Zinc to TSS Correlation	3.43 g Zn/kg TSS
TMDL MS4 WLA	9.96 kg/year
*MS4 Drainage Area	1,055 acres*
*Subwatershed Area	96.0 acres
Subwatershed 1A Zinc WLA	0.91 kg/year
Subwatershed 1A TSS WLA (Zinc)	264 kg/year
Subwatershed 1A Zinc Load Reduction Required	96.6%

*Area excludes subwatershed 2 and permanent open space.

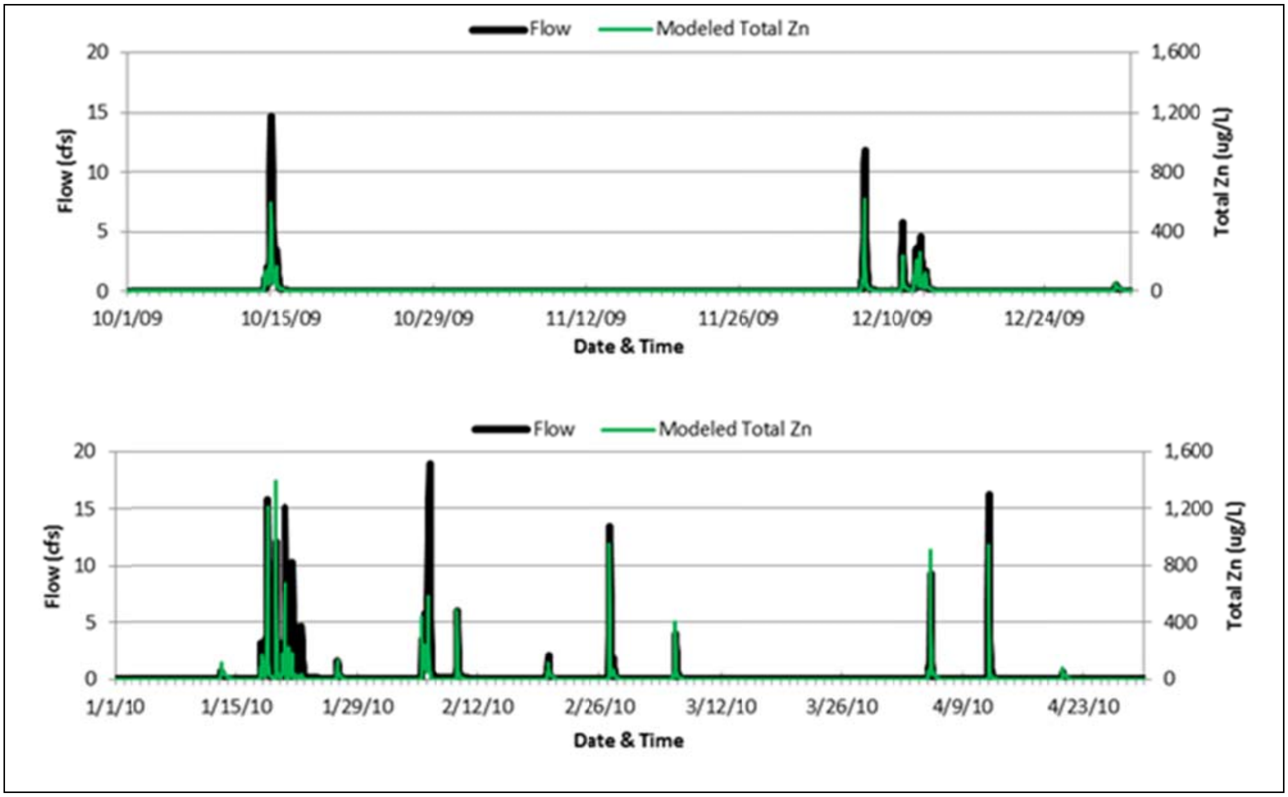

Figure 5-2: Subwatershed 1A Modeled Flow and Zinc Graph

5.2.1.2 Subwatershed Area 1B

The Subwatershed 1B area was modeled using the calibrated WMMS tool. The results were used as the foundation to perform additional calculations and analysis, including the preparation of a CSM as previously described. The summary of the existing pollutant loading and required load reductions is provided in Table 5-9. The WLA for zinc was calculated by allocating the Toxics TMDL WLA value to Subwatershed 1B proportional to the area of Subwatershed 1B compared to the total area associated with the WLA. The parameters used to calculate the Subwatershed 1B WLA are provided in Table 5-9. **Error! Reference source not found.** shows the WMMS tool flow and zinc concentration output parameters.

Table 5-9: Subwatershed 1B Modeled Existing Conditions

Parameter	Value
Modeled Zinc Load	52.1 kg/year
Modeled TSS Load	18,725 kg/year
Modeled Zinc to TSS Correlation	2.78 g Zn/kg TSS
TMDL MS4 WLA	9.96 kg/year
MS4 Drainage Area	1,055 acres
Subwatershed Area	249.9 acres
Subwatershed 1B Zinc WLA	2.36 kg/year
Subwatershed 1B TSS WLA (Zinc)	848 kg/year
Subwatershed 1B Zinc Load Reduction Required	95.5%

*Area excludes subwatershed 2 and permanent open space.

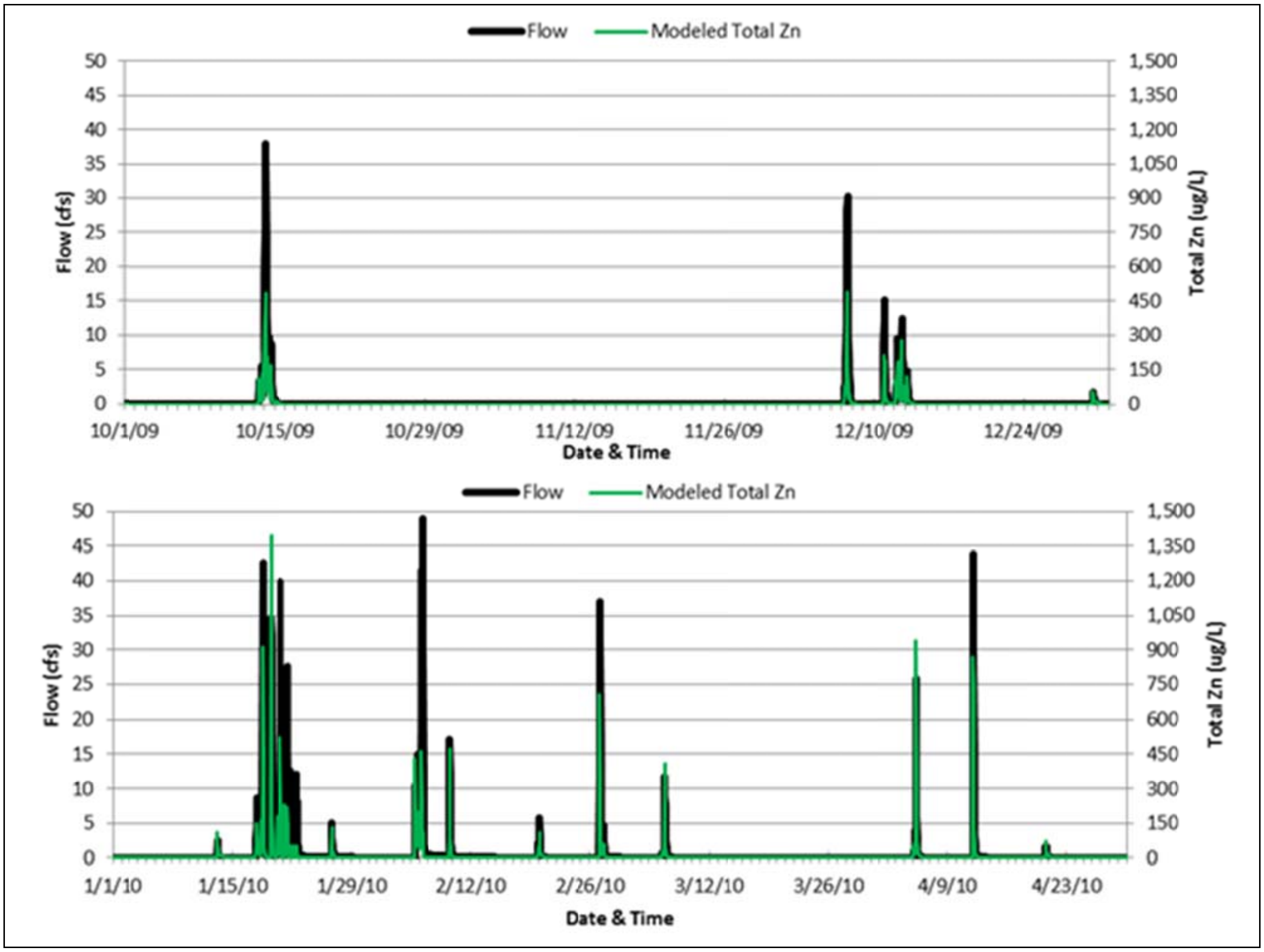

Figure 5-3: Subwatershed 1B Modeled Flow and Zinc Graph

5.2.1.3 Subwatershed Area 3

The Subwatershed 3 area was modeled using the calibrated WMMS tool. The results were used as the foundation to perform additional calculations and analysis, including the preparation of a CSM similar to those previously described with coding to estimate the load reductions achieved by the Boone Olive Pump Station low-flow diversion capacity. The summary of the existing pollutant loading and required load reductions is provided in Table 5-10. The WLA for zinc was calculated by allocating the Toxics TMDL WLA value to Subwatershed 3 proportional to the area of Subwatershed 3 compared to the total area associated with that WLA. The parameters used to calculate the Subwatershed 3 WLA are provided in Table 5-10. Figure 5-4 shows the WMMS tool flow and zinc concentration output parameters.

Table 5-10: Subwatershed 3 Modeled Existing Conditions

Parameter	Value
Modeled Zinc Load	5.3 kg/year
Modeled TSS Load	1,327 kg/year
Modeled Zinc to TSS Correlation	3.99 g Zn/kg TSS
TMDL MS4 WLA	9.96 kg/year
MS4 Drainage Area	1,055 acres
Subwatershed Area	70.5 acres
Subwatershed 3 Zinc WLA	0.67 kg/year
Subwatershed 3 TSS WLA (Zinc)	167 kg/year
Subwatershed 3 Zinc Load Reduction Required	87.4%

*Area excludes subwatershed 2 and permanent open space.

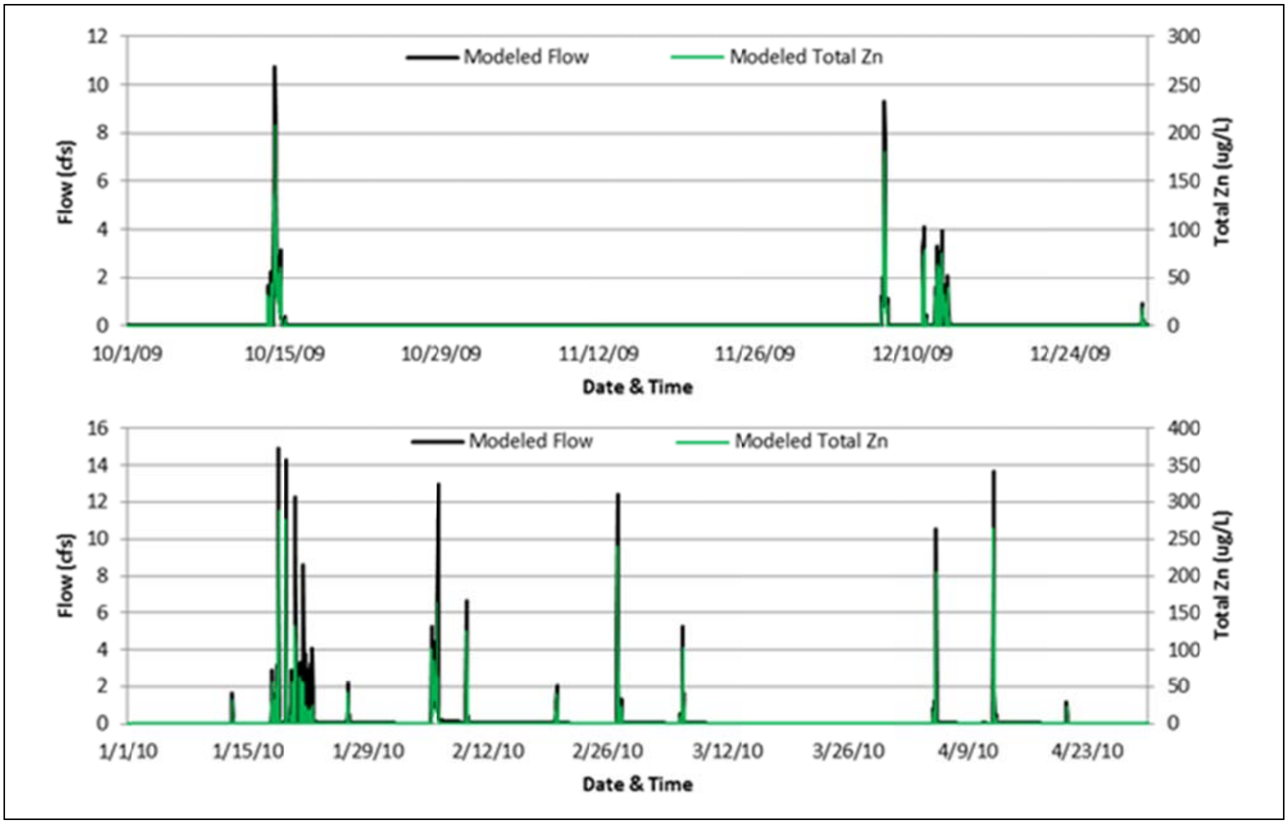

Figure 5-4: Subwatershed 3 Modeled Flow and Zinc Graph

5.2.1.4 Subwatershed Area 4

The Subwatershed 4 area was modeled using the calibrated WMMS tool. The results were used as the foundation to perform additional calculations and analysis, including the preparation of a CSM as previously described. The summary of the existing pollutant loading and required load reductions is provided in Table 5-11. The WLA for zinc was calculated by allocating the Toxics TMDL WLA value to Subwatershed 4 proportional to the area of Subwatershed 4 compared to the total area associated with that WLA. The parameters used to calculate the Subwatershed 4 WLA are provided in Table 5-11. Figure 5-5 shows the WMMS tool flow and zinc concentration output parameters.

Table 5-11: Subwatershed 4 Modeled Existing Conditions

Parameter	Value
Modeled Zinc Load	131.9 kg/year
Modeled TSS Load	36,689 kg/year
Modeled Zinc to TSS Correlation	3.60 g Zn/kg TSS
TMDL MS4 WLA	9.96 kg/year
MS4 Drainage Area	1,055 acres
Subwatershed Area	638.6 acres
Subwatershed 4 Zinc WLA	6.03 kg/year
Subwatershed 4 TSS WLA (Zinc)	1,677 kg/year
Subwatershed 4 Zinc Load Reduction Required	95.4%

*Area excludes subwatershed 2 and permanent open space.

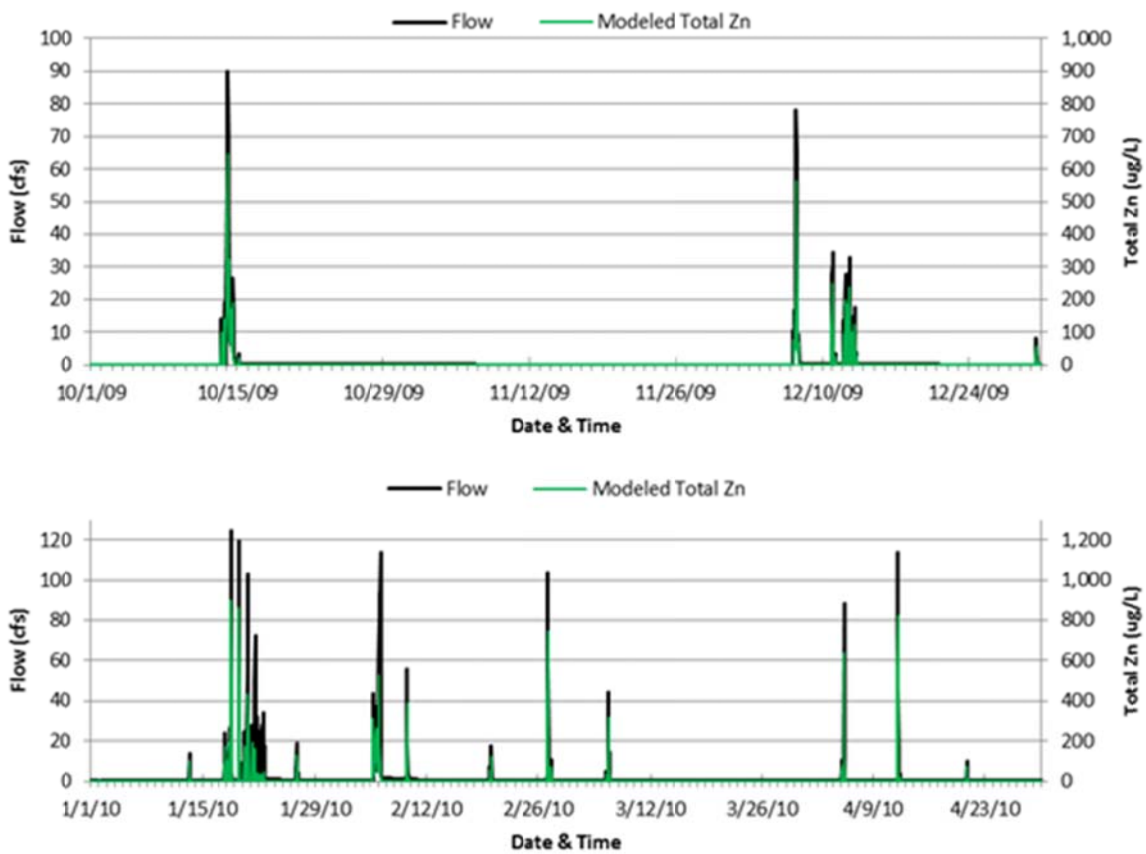

Figure 5-5: Subwatershed 4 Modeled Flow and Zinc Graph

4.3.1.1 Toxic Pollutant Non TMDL Water Quality Modeling Results (Subwatershed 2)

The Subwatershed 2 area was modeled using the WMMS tool. The results were used as the foundation to perform additional calculations and analysis including the preparation of a CSM as previously described. Subwatershed 2 is not part of the Toxics TMDL or Bacteria TMDL. In the absence of TMDL WLAs, for RAA purposes, model results in terms of average concentrations were compared to the Ocean Plan Table 1 instantaneous maximum values for copper, lead, and zinc. This comparison is provided in Table 5-12. Subwatershed 2 monitoring data are not available to allow for calibration of the WMMS tool for this area of the MdR WMA. Using uncalibrated WMMS results, load reductions required to achieve the threshold values, on average, were calculated and presented in Table 5-12. shows the WMMS tool flow and zinc concentration output parameters.

Table 5-12: Subwatershed 2 Modeled Existing Conditions

Parameter	Copper	Lead	Zinc
Load (kg)	7.24	2.759	67.50
Average Concentration[1] (µg/L)	27.3	10.4	254.8
Instantaneous Maximum Value[2] (µg/L)	30	20	200
Required Load Reduction	-	-	21.5%

Note 1: Subwatershed 2 Modeled Runoff = 9,356,904 (2009 rainfall year)
Note 2: Ocean Plan, Table 1 Instantaneous Maximum Value (SWRCB, 2012)

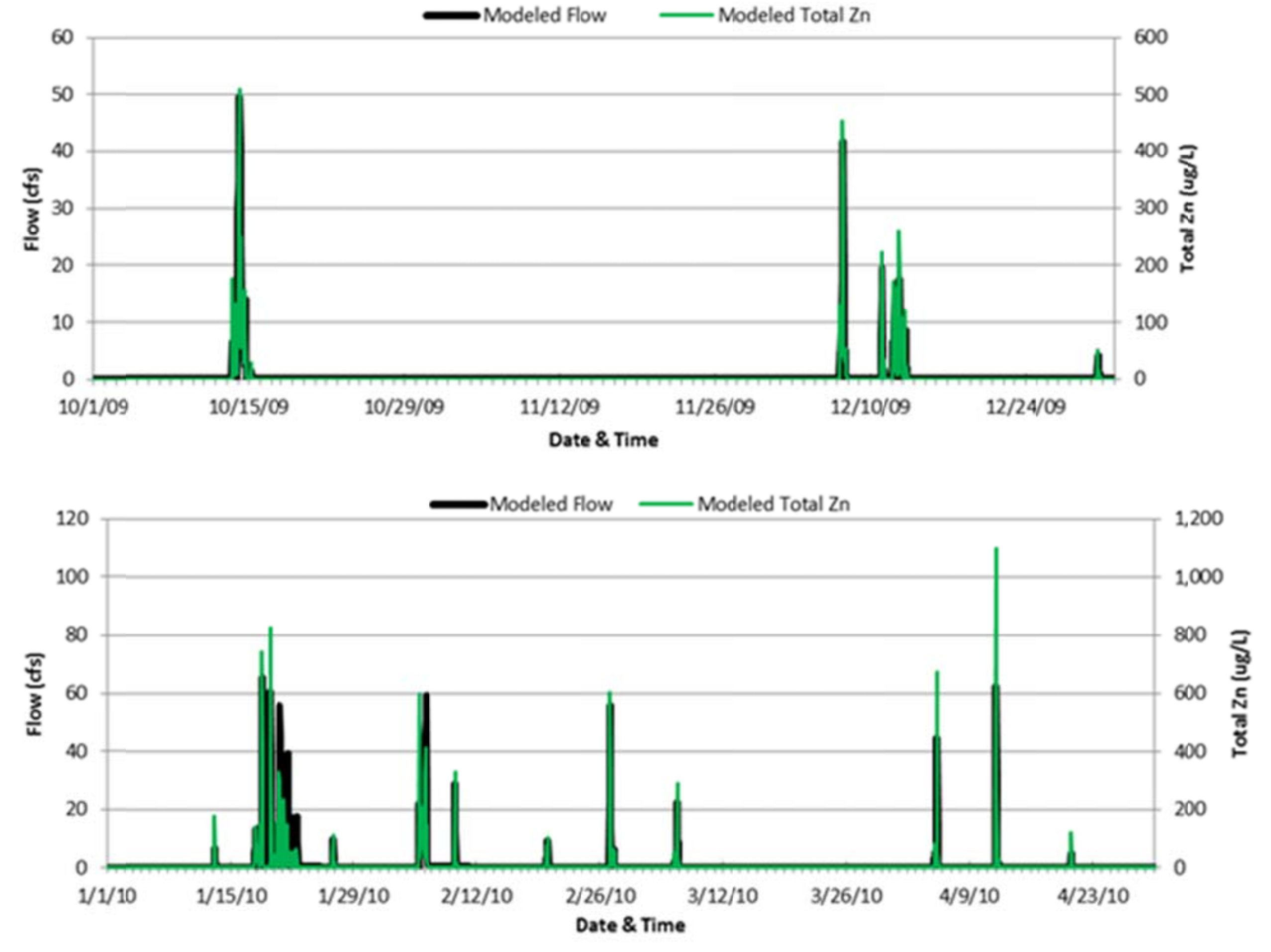

Figure 5-6: Subwatershed 2 Modeled Flow and Zinc Graph

5.2.2 Top-Down Approach Implementation Strategy and Results

The RAA Guidance Document requires 85th percentile design storm sizing be used for capture and infiltration or reuse type MCMs. If capture and infiltration or reuse is not feasible, then analysis shall be performed to demonstrate that proposed MCMs will meet the requirements of applicable WQBELs and/or RWLs for each TMDL. The MdR EWMP implementation strategy is to select locations where large MCMs can be sited to capture and infiltrate the 85th percentile storm. If infiltration is not feasible because of land availability, soil conditions, and/or shallow groundwater, MCMs that use evaporation will be selected to capture and reuse runoff from the 85th percentile storm event.

If capture and infiltration or reuse is not possible, other BMPs, such as filtration, will be considered. The approach to analyze these "other" types of MCMs is documented in this report. Filtration by an MCM with a design effectiveness less than that of the load reduction percentage required is less than optimal for MCM selection; however, implementing a MCM at a given location that achieves a fraction of the load reduction percentage required is better than not implementing a MCM at the location. To offset the implementation of MCMs with relatively low effectiveness, MCMs with high effectiveness must also be implemented, and these higher effectiveness MCMs, such as capture and infiltration or reuse MCMs, may be required to capture runoff for storm events exceeding the 85th percentile storm size. A CSM was prepared for each subwatershed that incorporates the WMMS output data along with adjustable parameters for various MCMs (e.g., treatment rate/capture volume, effectiveness, and recharge rate) in order to determine the appropriate combination of high and low effectiveness MCMs that may be implemented to achieve the required load reductions.

5.2.2.1 Subwatershed 1A Simulation Results

The Subwatershed 1A CSM was prepared to analyze annual load reduction from different combinations of MCMs. For the area of the subwatershed that drains to 85th percentile storm event capture and infiltration or reuse type MCMs, the CSM applies load reductions for that area equal to the load reduction required for the subwatershed area (e.g., if 90% load reduction is required and half the area drains to 85th percentile storm event capture and infiltration or reuse type MCMs, then half the area would be considered to have a 90% load reduction by the CSM). For the areas that do not drain to 85th percentile storm event capture and infiltration or reuse MCMs, the CSM performs time step calculations to estimate the load reductions accomplished by MCMs that differ from those that capture and infiltrate or reuse the runoff from the 85th percentile storm event.

The CSM includes four types of MCMs consisting of three filtration type (treatment) and one infiltration or bioretention type (capture MCMs with storm event capture size selected by the user). The CSM predicts that as more filtration type MCMs, with effectiveness values lower than the load reduction percentage required by the TMDL, are proposed for implementation, the capacity of the capture type MCMs must be increased in order to offset the pollutant loads in the discharge of treated runoff through the filtration MCMs. The CSM also predicts that there are maximum drainage areas that can be treated by filtration type MCMs. If those maximum areas are exceeded, then the annual required load reductions for the area would not be achieved.

CSM results for three hypothetical scenarios analyzed are provided in Table 5-13. These hypothetical scenarios assumed that no area drains to MCMs designed to capture and infiltrate or reuse the 85th percentile storm event and that three different quantities of filtration type MCMs are implemented (none, medium, and maximum quantity of treatment MCMs). The purpose of preparing the three hypothetical scenarios was not to identify the scenario that may be implemented as the final combination of MCMs, but to provide an indication of the proportional quantities of different types of MCMs that may be implemented to achieve the load reductions. This information helped in developing the final combination of MCMs, but other factors were also considered (e.g., soil types, groundwater level, etc.). The final combination of MCMs, which includes 85th percentile storm event capture and infiltration type MCMs, is described in Section 4.0.

Table 5-13: Subwatershed 1A – Model Results Zero 85th Percentile Type MCMs

Scenario: Entire subwatershed area analyzed (no area excluded to account for MCMs designed to capture and infiltration or reuse runoff from the 85th percentile storm event)					
Load Reduction Required = 96.6%					
MCM Type	**Drainage Area (acres)**	**Treatment Capacity (in/hr)**	**Storage Capacity (in of rain)**	**TSS Removal Efficiency***	**Load Reduction Achieved**
85th Percentile Capture	0				-
Distribution of Other MCM Types: No Filtration MCMs					
Tree Box (Filtration)	0.0	0.2		63%	0.0%
Modular Wetland (Filtration)	0.0	0.2		63%	0.0%
Green St. (Filtration)	0.0		1.10	63%	0.0%
Capture & Infiltration or Reuse	96.0		1.32	100%	96.6%
Total	**96.0**				**96.6%**
Distribution of Other MCM Types: Medium Amount of Filtration MCMs					
Tree Box (Filtration)	1.8	0.2		63%	1.1%
Modular Wetland (Filtration)	1.8	0.2		63%	1.1%
Green St. (Filtration Treatment Train)	1.8		1.10	63%	1.1%
Capture & Infiltration or Reuse	90.6		1.60	100%	93.4%
Total	**96.0**				**96.7%**
Distribution of Other MCM Types: Maximum Amount of Filtration MCMs					
Tree Box (Filtration)	2.2	0.2		63%	1.4%
Modular Wetland (Filtration)	2.2	0.2		63%	1.4%
Green St. (Filtration Treatment Train)	2.2		1.10	63%	1.3%
Capture & Infiltration or Reuse	89.4		1.80	100%	92.6%
Total	**96.0**				**96.6%**

*: Source: International Stormwater BMP Data Base (Geosyntec, 2008).

For the scenario of medium distributions of filtration MCMs and zero MCMs designed strictly for the 85th percentile storm event, Figure 5-7 includes graphs of the total modeled runoff, runoff that bypasses the proposed MCMs, total modeled zinc load, zinc load removed, and zinc load discharged.

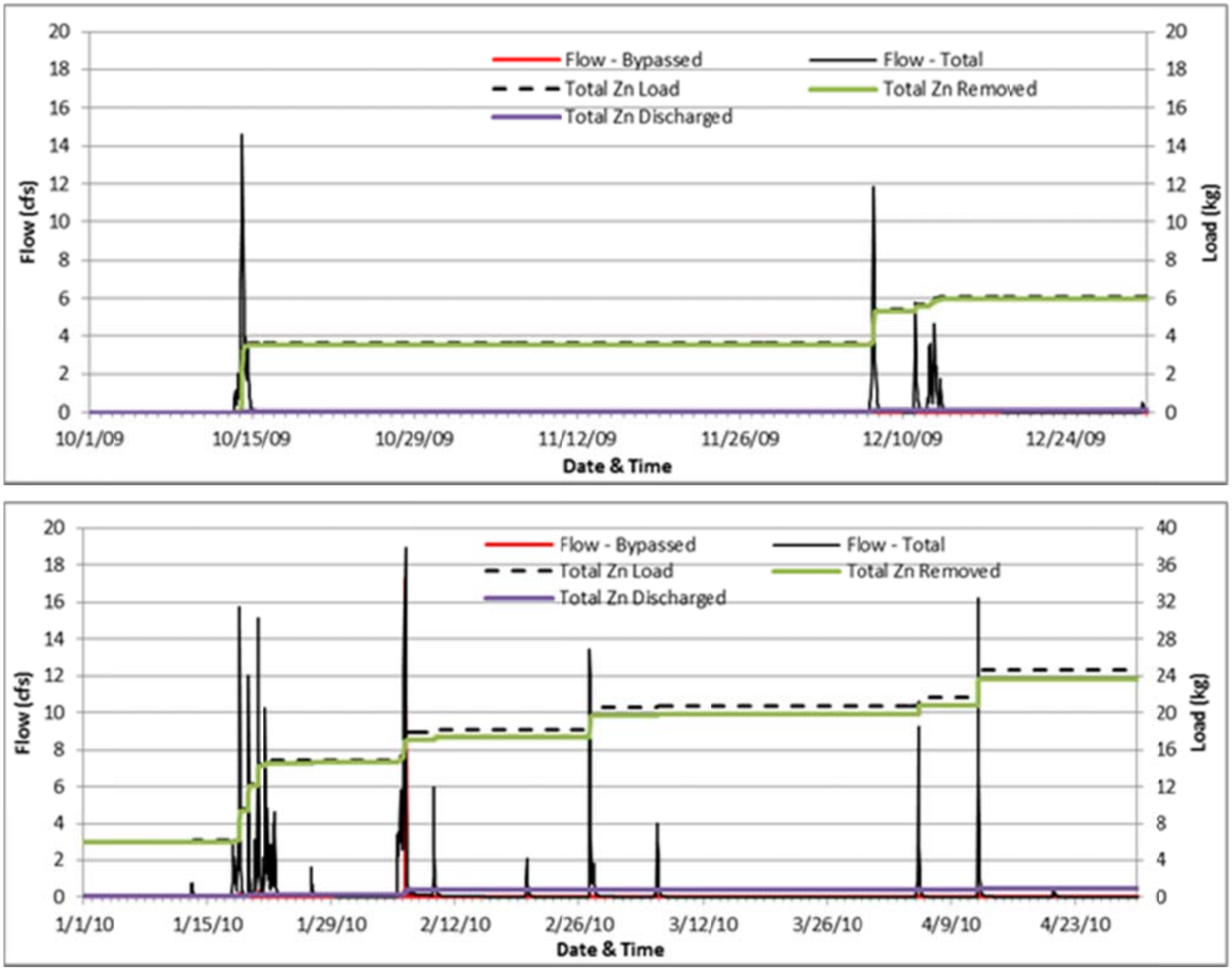

Figure 5-7: Subwatershed 1A Flow and Zinc Load Graphs

5.2.2.2 *Subwatershed 1B Simulation Results*

Similar to the Subwatershed 1A CSM, the Subwatershed 1B CSM was prepared to analyze various types of MCMs that differ from those that capture and infiltrate or reuse the runoff from the 85th percentile storm event. The CSM includes four types of MCMs consisting of three filtration type (treatment) and one infiltration or bioretention type (capture). The CSM shows that as more filtration type MCMs, with effectiveness values lower than the load reduction percentage required by the TMDL, are proposed for implementation, the capacity of the capture type MCMs must be increased in order to make up for, or offset, the pollutant loads in the discharge of treated runoff through the filtration MCMs. The CSM also shows that there are maximum drainage areas that can be treated by filtration type MCMs, and if those maximum areas are exceeded then the annual required load reductions for the area would not be achieved.

The CSM results for three hypothetical scenarios analyzed are provided in Table 5-14. These hypothetical scenarios assumed that no area drains to MCMs designed to capture and infiltrate or reuse the 85th percentile storm event and that three different quantities of filtration type MCMs are implemented (none, medium, and maximum quantity of treatment MCMs). The purpose of preparing the three hypothetical scenarios was not to identify the scenario that may be implemented as the final combination of MCMs, but instead the purpose was to provide an indication on the proportional quantities of different types of MCMs that may be implemented to achieve load reductions. This information helped in developing the final combination of MCMs, but other factors were also considered (e.g., soil types, groundwater level). The final combination of MCMs, which includes 85th percentile storm event capture and infiltration type MCMs, is described in Section 4.0.

Table 5-14: Subwatershed 1B – Model Results Zero 85th Percentile Type MCMs

Scenario: Entire subwatershed area analyzed (no area excluded to account for MCMs designed to capture and infiltration or reuse runoff from the 85th percentile storm event)					
Load Reduction Required = 95.5%					
MCM Type	**Drainage Area (acres)**	**Treatment Capacity (in/hr)**	**Storage Capacity (in of rain)**	**TSS Removal Efficiency***	**Load Reduction Achieved**
85th Percentile Capture	0				-
Distribution of Other MCM Types: No Filtration MCMs					
Tree Box (Filtration)	0	0.2		63%	0.0%
Modular Wetland (Filtration)	0	0.2		63%	0.0%
Green St. (Filtration)	0		1.10	63%	0.0%
Capture & Infiltration or Reuse	249.9		1.39	100%	95.5%
Total	**249.9**				**95.5%**
Distribution of Other MCM Types: Medium Amount of Filtration MCMs					
Tree Box (Filtration)	4	0.2		63%	0.9%
Modular Wetland (Filtration)	4	0.2		63%	0.9%
Green St. (Filtration Treatment Train)	4		1.10	63%	0.9%
Capture & Infiltration or Reuse	237.9		1.60	100%	92.8%
Total	**249.9**				**95.5%**
Distribution of Other MCM Types: Maximum Amount of Filtration MCMs					
Tree Box (Filtration)	6	0.2		63%	1.4%
Modular Wetland (Filtration)	6	0.2		63%	1.4%
Green St. (Filtration Treatment Train)	6		1.10	63%	1.3%
Capture & Infiltration or Reuse	231.9		1.80	100%	91.4%
Total	**249.9**				**95.5%**

* Source: International Stormwater BMP Data Base (Geosyntec, 2008).

For the scenario of medium distributions of filtration MCM and zero MCMs designed strictly for the 85th percentile storm event Figure 5-8 includes graphs of the total modeled runoff, runoff that bypasses the proposed MCMs, total modeled zinc load, zinc load removed, and zinc load discharged.

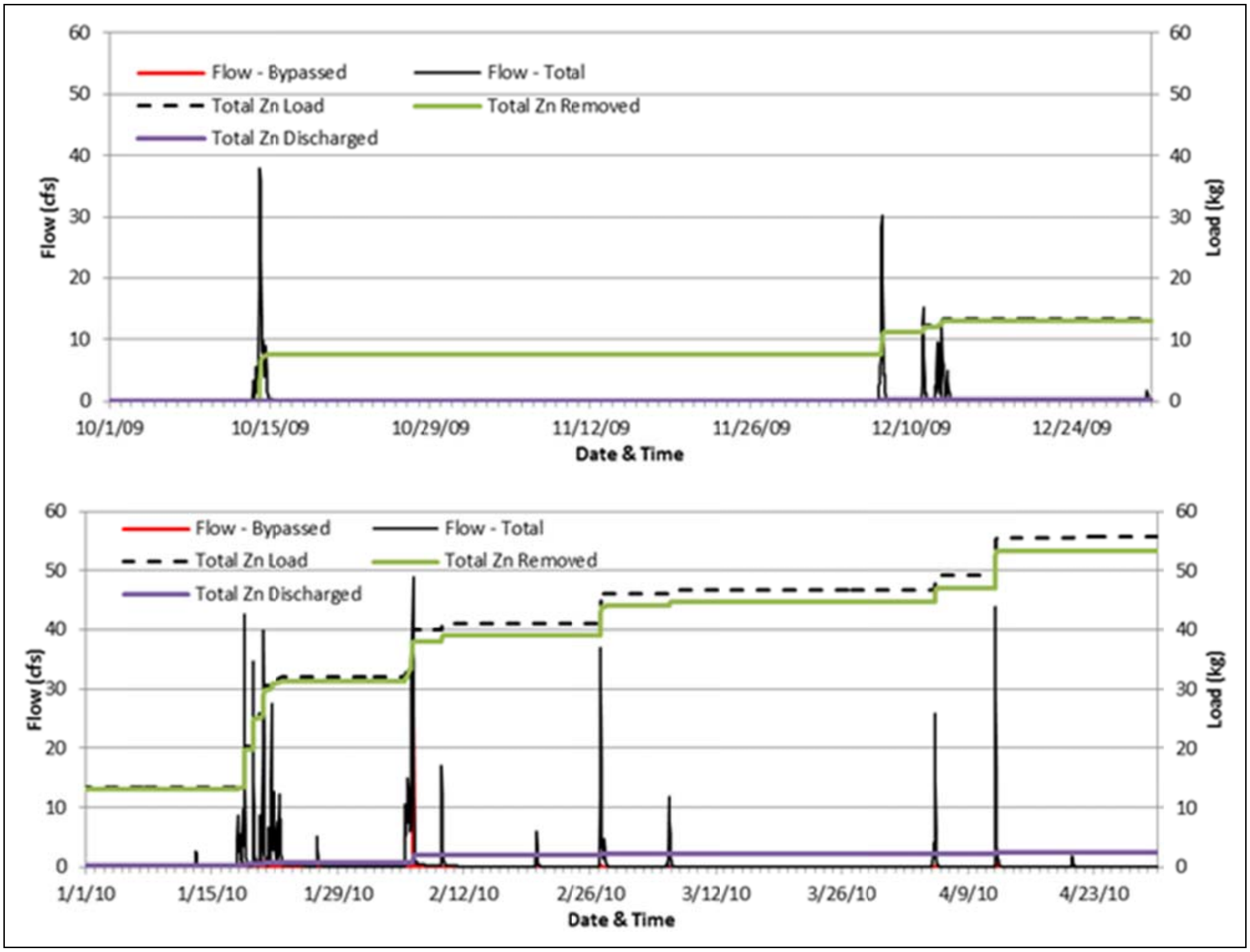

Figure 5-8: Subwatershed 1B Flow and Zinc Load Graphs

5.2.2.3 Subwatershed 3 Simulation Results

The Subwatershed 3 CSM was prepared to analyze various types of MCMs that differ from those that capture and infiltrate or reuse the runoff from the 85th percentile storm event. The CSM includes five types of MCMs consisting of three filtration type (treatment), one infiltration or bioretention type (capture), and the existing Boone Olive Pump Station low-flow diversion system (capture).

The CSM shows that as more filtration type MCMs, with effectiveness values lower than the load reduction percentage required by the TMDL, are proposed for implementation, the capacity of the capture type MCMs must be increased in order to make up for, or offset, the pollutant loads in the discharge of treated runoff through the filtration MCMs. The CSM also shows that there are maximum drainage areas that can be treated by filtration type MCMs. If those maximum areas are exceeded then the annual required load reductions for the area would not be achieved.

CSM results for the three hypothetical scenarios analyzed are provided in Table 5-15. These hypothetical scenarios assumed that no area drains to MCMs designed to capture and infiltrate or reuse the 85th percentile storm event and that three different quantities of filtration type MCMs are implemented (none, medium, and maximum quantity of treatment MCMs). The purpose of preparing the three hypothetical scenarios was not to identify the scenario that may be implemented as the final combination of MCMs, but instead to provide an indication on the proportional quantities of different types of MCMs that may be implemented to achieve load reductions. This information helped in developing the final combination of MCMs, but other factors were also considered (e.g., soil types, groundwater level). The final combination of MCMs, which includes 85th percentile storm event capture and infiltration type MCMs, is described in Section 4.0.

Table 5-15: Subwatershed 3 – Model Results Zero 85th Percentile Type MCMs

Scenario: Entire subwatershed area analyzed (no area excluded to account for MCMs designed to capture and infiltration or reuse runoff from the 85th percentile storm event)					
Load Reduction Required = 87.4%					
MCM Type	**Drainage Area (acres)**	**Treatment Capacity (in/hr)**	**Storage Capacity (in of rain)**	**TSS Removal Efficiency***	**Load Reduction Achieved**
85th Percentile Capture	0				-
Distribution of Other MCM Types: No Filtration MCMs					
Tree Box (Filtration)	0	0.2		63%	0.0%
Modular Wetland (Filtration)	0	0.2		63%	0.0%
Green St. (Filtration)	0		1.10	63%	0.0%
Capture & Infiltration or Reuse	70.5		1.11	100%	84.8%
Boone Olive Low Flow Diversion	70.5			100%	2.6%
Total	**70.5**				**87.4%**
Distribution of Other MCM Types: Medium Amount of Filtration MCMs					
Tree Box (Filtration)	8.6	0.2		63%	6.4%
Modular Wetland (Filtration)	8.6	0.2		63%	6.4%
Green St. (Filtration Treatment Train)	8.6		1.10	63%	5.9%
Capture & Infiltration or Reuse	44.7		1.35	100%	58.8%
Boone Olive Low Flow Diversion	70.5			100%	10.0%
Total	**70.5**				**87.5%**
Distribution of Other MCM Types: Maximum Amount of Filtration MCMs					
Tree Box (Filtration)	10.1	0.2		63%	7.5%
Modular Wetland (Filtration)	10.1	0.2		63%	7.5%
Green St. (Filtration Treatment Train)	10.1		1.10	63%	6.9%
Capture & Infiltration or Reuse	40.2		1.60	100%	55.2%
Boone Olive Low Flow Diversion	70.5			100%	10.4%
Total	**70.5**				**87.5%**

* Source: International Stormwater BMP Data Base (Geosyntec, 2008).

The inclusion of the Boone Olive Pump Station low-flow diversion system resulted in the ability to implement a greater percentage of treatment type BMPs in Subwatershed 3. The green street capture, temporary storage, and then discharge type of BMP in this scenario discharged, captured, and treated flows that were in turn captured and treated by the low-flow diversion system. Similarly, for low intensity rainfall periods, the tree box and modular wetland filtration type BMPs discharged flows that were completely or partially captured by the diversion system thereby providing additional load reductions.

For the scenario of medium distributions of filtration MCMs and zero MCMs designed strictly for the 85th percentile storm event, Figure 5-9 includes graphs of the total modeled runoff, runoff that bypasses the proposed MCMs, total modeled zinc load, zinc load removed, and zinc load discharged.

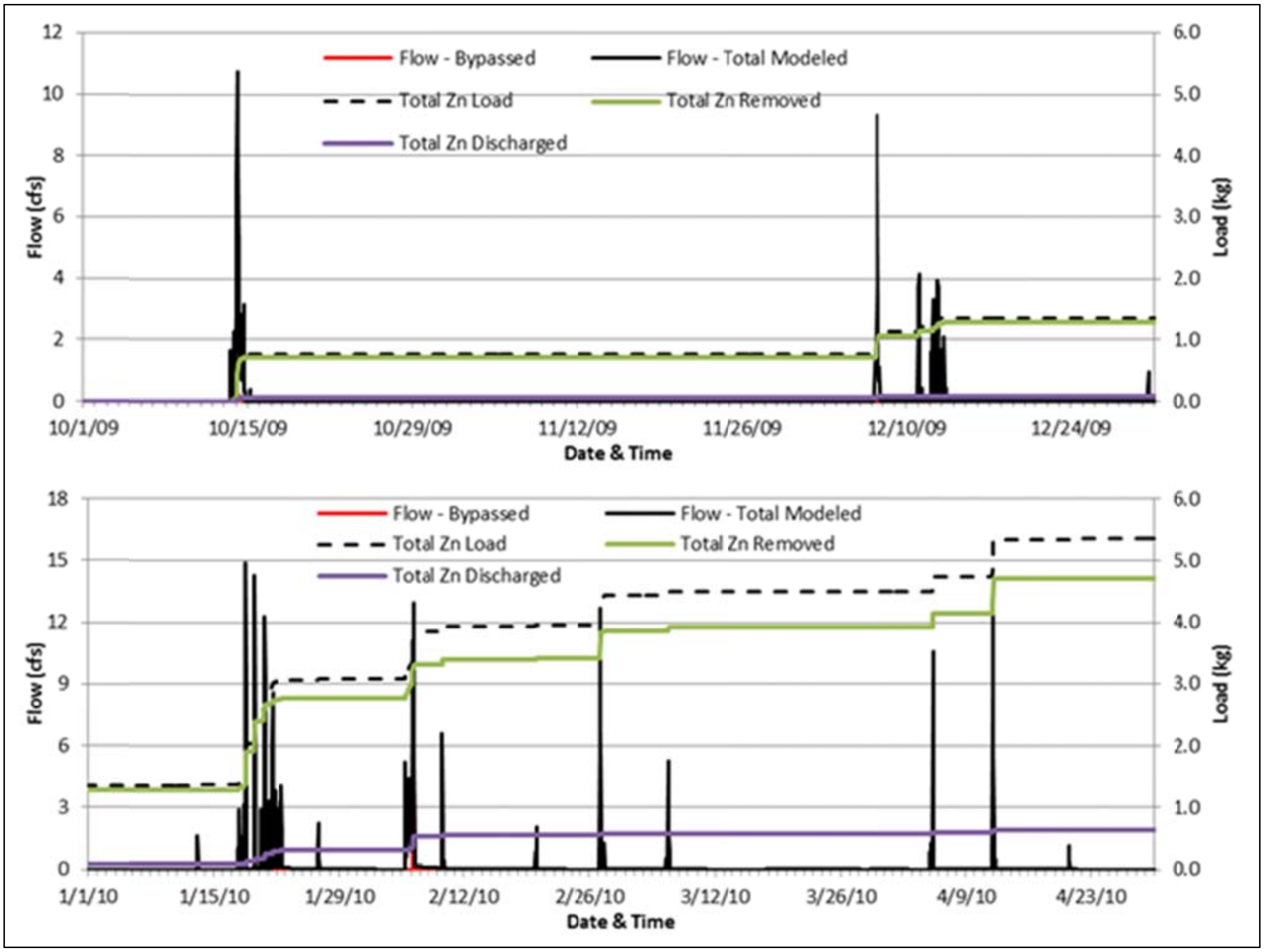

Figure 5-9: Subwatershed 3 Flow and Zinc Load Graphs

5.2.2.4 Subwatershed 4 Simulation Results

The Subwatershed 4 CSM was prepared to analyze various types of MCMs that differ from those that capture and infiltrate or reuse the runoff from the 85th percentile storm event. The CSM includes four types of MCMs consisting of three filtration type (treatment) and one infiltration or bioretention type (capture). The CSM shows that as more filtration type MCMs, with effectiveness values lower than the load reduction percentage required by the TMDL, are proposed for implementation, the capacity of the capture type MCMs must be increased in order to make up for, or offset, the pollutant loads in the discharge of treated runoff through the filtration MCMs. The CSM also shows that there are maximum drainage areas that can be treated by filtration type MCMs. If those maximum areas are exceeded, then the annual required load reductions for the area would not be achieved.

CSM results for the three hypothetical scenarios analyzed are provided in Table 5-16. These hypothetical scenarios assumed that no area drains to MCMs designed to capture and infiltrate or reuse the 8th percentile storm event and that three different quantities of filtration type MCMs are implemented (none, medium, and maximum quantity of treatment MCMs). The purpose of preparing the three hypothetical scenarios was not to identify the scenario that may be implemented as the final combination of MCMs, but instead the purpose was to provide an indication on the proportional quantities of different types of MCMs that may be implemented to achieve load reductions. This information helped in developing the final combination of MCMs, but other factors were also considered (e.g., soil types, groundwater level). The final combination of MCMs, which includes 85th percentile storm event capture and infiltration type MCMs, is described in Section 4.0.

Table 5-16: Subwatershed 4 – Model Results Zero 85th Percentile Type MCMs

Scenario: Entire subwatershed area analyzed (no area excluded to account for MCMs designed to capture and infiltration or reuse runoff from the 85th percentile storm event)					
Load Reduction Required = 95.4%					
MCM Type	**Drainage Area (acres)**	**Treatment Capacity (in/hr)**	**Storage Capacity (in of rain)**	**TSS Removal Efficiency***	**Load Reduction Achieved**
85th Percentile Capture	0				-
Distribution of Other MCM Types: No Filtration MCMs					
Tree Box (Filtration)	0	0.2		63%	0.0%
Modular Wetland (Filtration)	0	0.2		63%	0.0%
Green St. (Filtration)	0		1.10	63%	0.0%
Capture & Infiltration or Reuse	638.6		1.37	100%	95.4%
Total	**638.6**				**95.4%**
Distribution of Other MCM Types: Medium Amount of Filtration MCMs					
Tree Box (Filtration)	13.4	0.2		63%	1.1%
Modular Wetland (Filtration)	13.4	0.2		63%	1.1%
Green St. (Filtration Treatment Train)	13.4		1.10	63%	1.2%
Capture & Infiltration or Reuse	598.4		1.60	100%	92.1%
Total	**638.6**				**95.4%**
Distribution of Other MCM Types: Maximum Amount of Filtration MCMs					
Tree Box (Filtration)	17.2	0.2		63%	1.4%
Modular Wetland (Filtration)	17.2	0.2		63%	1.4%
Green St. (Filtration Treatment Train)	17.2		1.10	63%	1.5%
Capture & Infiltration or Reuse	587.0		1.80	100%	91.1%
Total	**638.6**				**95.4%**

* Source: International Stormwater BMP Data Base (Geosyntec, 2008).

For the scenario of medium distributions of filtration MCMs and zero MCMs designed strictly for the 85th percentile storm event, Figure 5-10 includes graphs of the total modeled runoff, runoff that bypasses the proposed MCMs, total modeled zinc load, zinc load removed, and zinc load discharged.

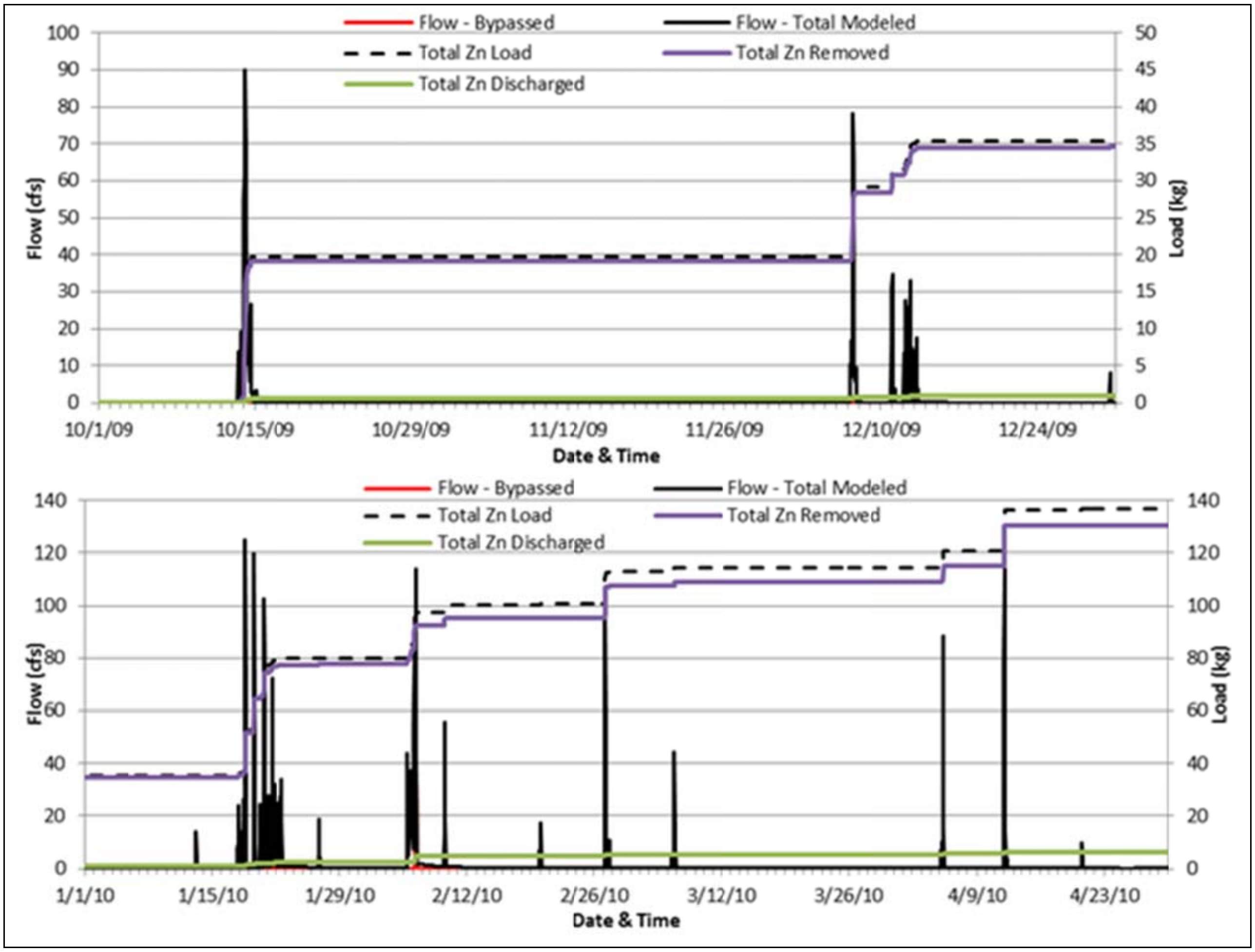

Figure 5-10: Subwatershed 4 Flow and Zinc Load Graphs

5.2.2.5 Subwatershed 2 Simulation Results (Non-TMDL Subwatershed)

The Subwatershed 2 CSM was prepared to analyze various types of MCMs that may be implemented to achieve load reductions. Similar to the other subwatersheds, the CSM was prepared to include four types of MCMs consisting of three filtration type (treatment) and one infiltration or bioretention type (capture). Summaries of the CSM results for the scenarios analyzed are provided in Table 5-17.

Table 5-17: Subwatershed 2 – Model Results Zero 85th Percentile Type MCMs

Scenario: Entire subwatershed area analyzed (no area excluded to account for MCMs designed to capture and infiltration or reuse runoff from the 85th percentile storm event)					
Load Reduction Required = 21.5%					
MCM Type	**Drainage Area (acres)**	**Treatment Capacity (in/hr)**	**Storage Capacity (in of rain)**	**TSS Removal Efficiency***	**Load Reduction Achieved**
85th Percentile Capture	0				-
Distribution of Other MCM Types: No Filtration MCMs					
Tree Box (Filtration)	0	0.2		63%	0.0%
Modular Wetland (Filtration)	0	0.2		63%	0.0%
Green St. (Filtration)	0		1.10	63%	0.0%
Capture & Infiltration or Reuse	74.4		1.00	100%	21.5%
No MCMs	219.9				-
Total	**74.4**				**21.5%**
Distribution of Other MCM Types: Medium Amount of Filtration MCMs					
Tree Box (Filtration)	19	0.2		63%	3.6%
Modular Wetland (Filtration)	19	0.2		63%	3.6%
Green St. (Filtration Treatment Train)	19		1.10	63%	3.6%
Capture & Infiltration or Reuse	37.0		1.00	100%	10.7%
No MCMs	200.3				-
Total	**94.0**				**21.5%**
Distribution of Other MCM Types: Maximum Amount of Filtration MCMs					
Tree Box (Filtration)	37.7	0.2		63%	7.1%
Modular Wetland (Filtration)	37.7	0.2		63%	7.1%
Green St. (Filtration Treatment Train)	37.7		1.10	63%	7.2%
Capture & Infiltration or Reuse	0.0		1.00	100%	0.0%
No MCMs	181.2				-
Total	**113.1**				**21.5%**

* Source: International Stormwater BMP Data Base (Geosyntec, 2008).

For the scenario of medium distributions of filtration MCMs and zero MCMs designed strictly for the 85th percentile storm event, Figure 5-11 shows graphs of the total modeled runoff, runoff that bypasses the proposed MCMs, total modeled zinc load, zinc load removed, and zinc load discharged.

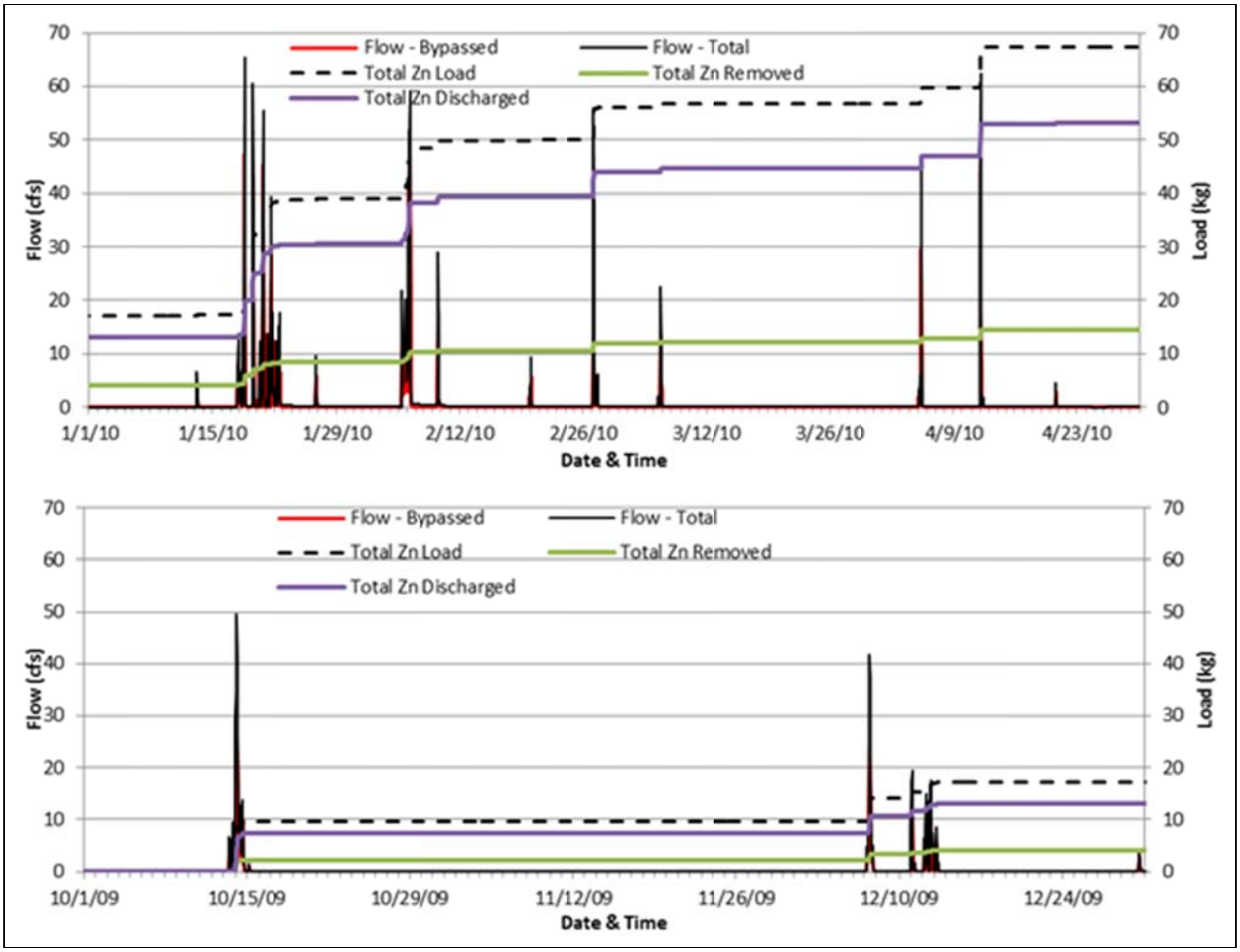

Figure 5-11: Subwatershed 2 Flow and Zinc Load Graphs

5.2.3 Bacteria Water Quality Analysis

The existing understanding of the science that describes bacteria loading in wet weather runoff is complex and continues to evolve as new studies are performed and data are collected. Bacteria wet weather monitoring has shown that bacteria loadings are generally unpredictable. The science is additionally complicated in areas where runoff is discharged into open water, such as the MdRH, where many processes occur (e.g., die off, regrowth, other input sources, etc.). In accordance with the Bacteria TMDL, the compliance stations for bacteria monitoring are located at various points within the Back Basins. The RAA bacterial water quality analysis was performed using available bacteria monitoring data to evaluate how the water quality of the MdRH responded to the wet weather runoff during wet weather monitored events. The numbers of recorded exceedance days compared to the numbers of allowable exceedance days were used to determine the required reduction in the number of exceedance days. Additional calculations and modeling were performed to convert the required reduction into percentages, loads, and MCM capacity.

5.2.3.1 Bacteria Monitoring Data

Monitoring under the Bacteria TMDL within the Back Basins was performed from 2007 through the present. The available monitoring results (2007-2013) are summarized in Table 5-18. Station MdRH-1 requires daily sampling; therefore, 17 wet weather exceedance days are allowed per rainfall year. MdRH-2 is sampled twice a week; therefore, five exceedance days are allowed per rainfall year. Weekly sampling is required at the other stations, and the compliance level is three wet weather exceedance days per rainfall year for each station.

Table 5-18: Historical Bacteria Data Summary (wet days)

	Exceedance Days / Total Days Sampled Each Year						
Station	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**	**2011-2012**	**2012-2013**	**Total**
MdRH-1	23/48	16/46	28/45	33/89	16/43	27/62	143/333
MdRH-2	13/17	6/13	7/15	10/26	6/14	9/17	59/102
MdRH-3	3/9	3/6	3/7	5/15	4/7	5/9	23/53
MdRH-4 Depth	5/9	2/6	1/6	4/15	2/7	1/9	15/52
MdRH-4 Surface	4/9	2/6	2/6	6/15	2/7	4/9	20/52
MdRH-5	4/9	4/6	6/7	11/15	6/7	4/9	25/53
MdRH-6 Depth	4/9	3/6	1/6	6/15	3/7	4/9	21/52
MdRH-6 Surface	6/9	5/6	3/6	10/15	4/7	6/9	25/52
MdRH-7	6/9	5/6	4/6	10/15	4/7	4/9	24/52
MdRH-8 Depth	4/9	2/6	1/6	4/15	1/7	1/9	13/52
MdRH-8 Surface	4/9	2/6	2/6	7/15	1/7	2/9	18/52
MdRH-9 Depth	3/9	2/6	1/6	4/15	1/7	1/9	12/52
MdRH-9 Surface	4/9	3/6	3/6	7/15	2/7	3/9	22/52

5.2.3.2 Bacteria Required Load Reduction (Percentage)

The Bacteria TMDL requires that bacteria compliance be demonstrated for rainfall years up to the 90^{th} percentile rainfall year, which is considered by the TMDL to be 75 wet days. Monitoring at station MdRH-1 indicates that during the monitoring period used in this analysis, there were 333 wet days (days in which a wet weather sample was collected). This equates to an average 55.5 days per year and is below the 90^{th} percentile value of 75 wet days. To adjust the measured values into data representative of the 90^{th} percentile year rainfall the total number of sampled days at each station was increased by a factor of 1.35 (75 / 55.5 = 1.35), and the number of exceedance days was increased based on the measured percentage of exceedances, but the number of allowable exceedance days remained unchanged. This resulted in a reduction in the percentage of allowable exceedance days (e.g., percentage of allowable exceedance days = (3 per year/(1.35 * total sampled days)) and thus an increase in the required reduction percentage. The results of these data adjustments are shown in Table 5-19.

Table 5-19: Required Bacteria Reduction Summary, Historical Data Adjusted to 90^{th} Percentile Wet Days

Station	Allowable Exceedance Days*	Unadjusted Exceedances/ Sample Days	Adjusted** Exceedance Days	Adjusted** Sampled Days	Allowable Exceedance Days	Adjusted Historical Exceedance Days	Adjusted Reduction Required
MdRH-1	102	143/333	193	450	22.7%	42.9%	20.2%
MdRH-2	30	59/102	80	138	21.8%	59.0%	36.2%
MdRH-3	18	23/53	31	72	25.2%	43.1%	17.9%
MdRH-4 Depth	18	15/52	20	70	25.6%	28.6%	2.9%
MdRH-4 Surface	18	20/52	27	70	25.6%	38.6%	12.9%
MdRH-5	18	25/53	34	72	25.2%	47.2%	22.1%
MdRH-6 Depth	18	21/52	28	70	25.6%	40.0%	14.4%
MdRH-6 Surface	18	25/52	34	70	25.6%	48.6%	22.9%

Table 5-19: Required Bacteria Reduction Summary, Historical Data Adjusted to 90th Percentile Wet Days

Station	Allowable Exceedance Days*	Unadjusted Exceedances/ Sample Days	Adjusted** Exceedance Days	Adjusted** Sampled Days	Allowable Exceedance Days	Adjusted Historical Exceedance Days	Adjusted Reduction Required
MdRH-7	18	24/52	32	70	25.6%	45.7%	20.1%
MdRH-8 Depth	18	13/52	18	70	25.6%	25.7%	0.1%
MdRH-8 Surface	18	18/52	24	70	25.6%	34.3%	8.6%
MdRH-9 Depth	18	12/52	16	70	25.6%	22.9%	-2.8%
MdRH-9 Surface	18	22/52	30	70	25.6%	42.9%	17.2%

*Total of all years from 2007/2008 monitoring year through 2012/2013
**Adjusted values based on unadjusted values multiplied by 1.35 (1.35 is based on 75 wet days during 90th percentile year divided by 55.5 wet day per rainfall [average wet days per year during the monitored period of the assessed data])

The adjusted data results (adjusted to represent the 90th percentile year in terms of wet days) indicate that of the stations sampled weekly, station MdRH-6 Surface requires the greatest reduction in the number of exceedance days in order to meet Bacteria TMDL compliance (22.9 percentage reduction required). Therefore, this station was selected to be the controlling station in the analysis. The adjusted sampling data shows that this station may historically be in exceedance approximately 49% of the time for wet weather sample days. In other words, this station may be historically below the exceedance criteria 51% of time, but the TMDL requires this station to be below the exceedance criteria during approximately 74% of wet weather sampling days. To be in compliance, an improvement of approximately 23% of sampling days is needed.

5.2.3.3 *Bacteria Required Load Reduction (Runoff Volume)*

An analysis of historic rainfall data paired with bacteria monitoring results was performed based on the premise that a correlation between storm size and bacterial exceedances existed, and therefore a distinction between storms that exceeded TMDL criteria and storms that did not exceed TMDL criteria could be established. The analysis focused on determining the “cutoff” value between smaller and larger rainfall events for (1) the historical number of exceedances and (2) the allowable number of exceedances. The difference between these two cutoff values was determined to be the amount of rainfall that currently needs to be captured in order to meet bacteria compliance (i.e., the difference is the amount of rainfall that if captured would result in the cutoff rainfall value for the future historical exceedances being in alignment with the allowable exceedance cutoff rainfall value).

The controlling station and associated available sampling data determined if wet days (considered to be days with 0.1 inch or greater per day and the following 72 hours) or rainfall days (considered to be days with 0.1 inch or greater) would be used in the analysis. Sampling at the controlling station occurred weekly. It is assumed that the historic exceedance days correlate to the rainfall days; therefore rainfall days (0.1 inch or greater) data were used instead of wet days. If Station MdRH-1 had been determined to be the controlling station, wet days would have been presented because Station MdRH-1 sampling frequency is daily. To ensure the most conservative path was taken, an analysis of wet days was performed using MdRH-1 data (not presented), and the analysis results were less controlling than the rainfall day analysis (i.e., required less capture).

To determine the daily rainfall values associated with allowable exceedance days, historical exceedance days, and the difference between the two values, WMMS rain gauge data were first compiled into daily rainfall values, and then the daily rainfall values were rounded to the nearest tenth of an inch and plotted.

During the monitoring period, there were a total of 123 rainfall days. By applying the percentage of historical exceedances associated with Station MdRH-6 Surface (controlling station) to the total rainfall days, 59 of 123 rainfall days have bacteria above the TMDL criteria (or 64 rainfall days that were below the criteria). The rainfall cutoff value associated with the 64 rainfall days is 0.29 inch. By applying the adjusted percentage of allowable exceedance days to the total rainfall days, 30 of 123 rainfall days are allowed to be elevated above the bacteria TMDL criteria (or 93 days are required to be below the criteria). The rainfall cutoff value associated with 93 rainfall days was 0.59 inch. Thus, the results indicate that a reduction in volume equivalent to capturing the runoff from 0.3-inch storm event is required to meet compliance at the controlling station. The storm event size distribution and the results of this analysis are presented in graphical form in Figure 5-12.

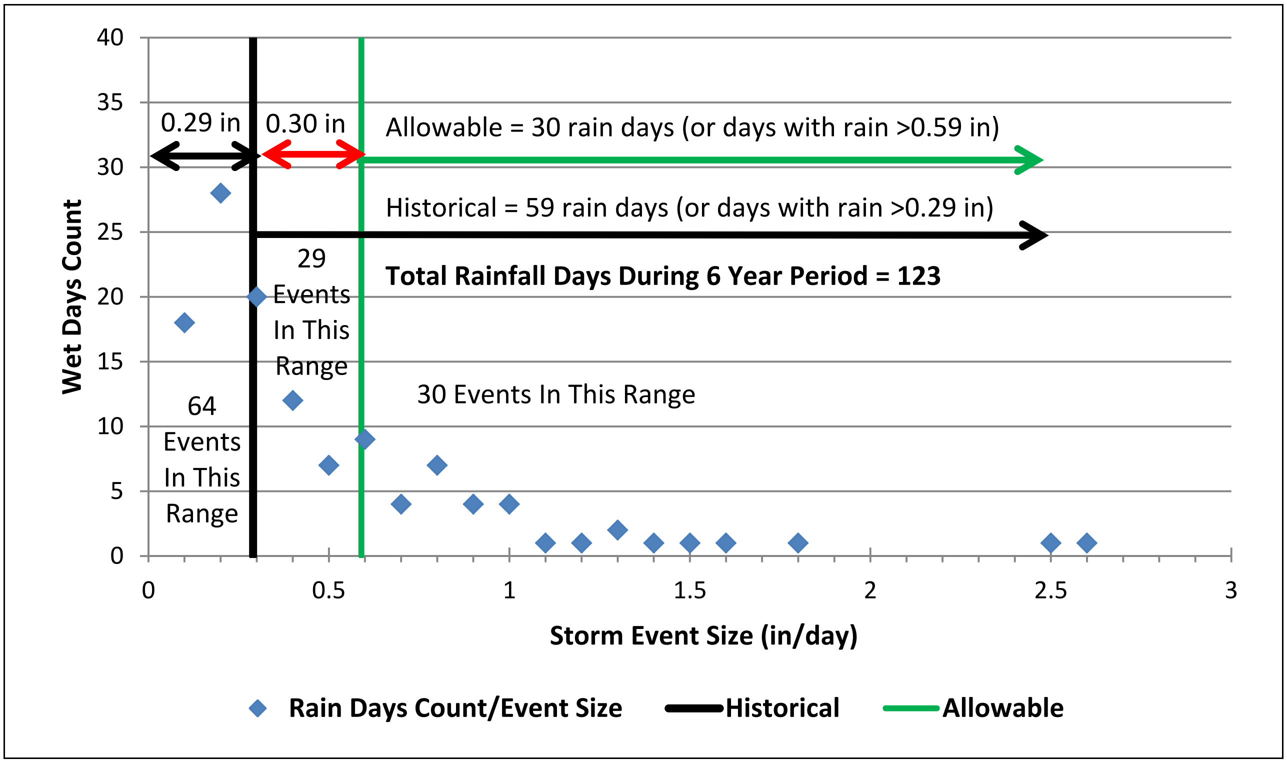

Figure 5-12: Summary of Rainfall Days and Rainfall Cutoff Value Analysis Results

5.2.3.4 Bacteria Required Load Reduction (Bacteria Counts)

The total bacteria load and reduction in bacteria load for MCMs designed to capture the runoff associated with a 0.3-inch storm event were estimated using the prepared CSM. The Back Basin drainage area was modeled using WMMS for the critical year of 1993 (the critical year identified in the TMDL). More information on the input parameters and output results of this modeling are included in Appendix C. The WMMS tool output was used as the foundation to prepare the bacteria CSM. The CSM was used to estimate the flow reduction that would be achieved through the implementation of MCMs designed to capture and infiltrate or reuse the storm water runoff associated with 0.3 inch of rainfall. To calculate the load, the applicable volume was used along with the estimated fecal coliform EMC value for this watershed (see Section 5.1.6). The results of these calculations are provided in Table 5-20. The CSM assumed capture-type MCMs with 100% reduction of the loads for the captured volume. However, the treatment MCMs that achieve the same load reductions could be implemented to meet the TMDL compliance (e.g., treatment MCMs with twice the capacity and a 50% effectiveness would theoretically accomplish the load reduction target).

Table 5-20: Bacteria Loading and Required Reduction

Parameter	Total Modeled	Required Reduction
Volume	55,536,480 cf	13,494,920 cf
Fecal Coliform Load	6.26E+14 MPN	1.52E+14 MPN

5.2.3.5 *Bacteria Required Load Reduction Conclusions*

The results of the analysis of the rainfall data paired with monitoring data indicate that the Bacteria TMDL is less of a driver for the implementation of the structural BMPs than the Toxics TMDL. The load reduction associated with meeting the WLA for zinc requires capture and/or treatment of much greater volumes of runoff than that generated by 0.3 inch of rainfall. Therefore, based on the results of this bacteria load reduction analysis, it is assumed that the implementation of controls to meet the requirements of the Toxics TMDL will result in bacteria load reductions sufficient to meet the wet weather requirements of the Bacteria TMDL. This conclusion will be reassessed as part of the overall watershed adaptive management process, which may include evaluation of collective MCM effectiveness data and bacteria monitoring results.

5.3 Selected MCMs Reasonable Assurance Analysis Results

Under the MS4 Permit, compliance with the sediment WLAs for Cu, Pb, Zn, chlordane, p'p-DDE, and total DDT may be demonstrated by any one of three different means: (a) qualitative sediment condition of unimpacted or likely unimpacted by the interpretation and integration of multiple lines of evidence is met, (b) sediment numeric targets are met in bed sediments, or *(c) final sediment WLAs are met*. Also under the MS4 Permit, compliance with the sediment WLAs for PCBs may be demonstrated by any of four different means: (a) fish tissue targets are met in species resident to the waterbody, *(b) final sediment allocations are met*, (c) sediment numeric targets to protect fish tissue are met in bed sediments, or (d) demonstrate that the sediment quality condition protective of fish tissue is achieved in accordance with the Statewide Enclosed Bays and Estuaries Plan, as amended to address contaminants in resident finfish and wildlife.

This EWMP focuses on demonstrating that compliance may be achieved through meeting final sediment WLAs for the contaminants in the MdR Toxics TMDL. This RAA delivers a quantitative demonstration, in accordance with the MS4 Permit, that the proposed MCMs will achieve interim and final WLAs. This analysis aims to provide reasonable assurance that the MCMs selected for the MdR WMA will be sufficient to meet the interim and final numeric WLAs, through stormwater capture, filtration, and diversion, and associated TSS loading reductions.

The proposed MCMs will be implemented where feasible and within budgetary constraints. As additional data becomes available through monitoring and the completion of applicable special studies, the MdR EWMP Agencies may elect to demonstrate compliance through one of the above-mentioned other means.

The effectiveness of the selected BMPs and control measures will be verified through the monitoring program developed separately under the CIMP. Based on the monitoring data analysis and results, the implemented MCMs will be adjusted as necessary to ensure adequate performance and the overall MCMs implementation schedule will be reassessed.

The diagram presented in Figure 5-13 depicts the iterative multistage nature of the MCM selection process necessary to ensure that optimal MCM strategies combinations are selected while accounting for the complex relational dynamics between the different selection considerations, such as cost, risk, and effectiveness.

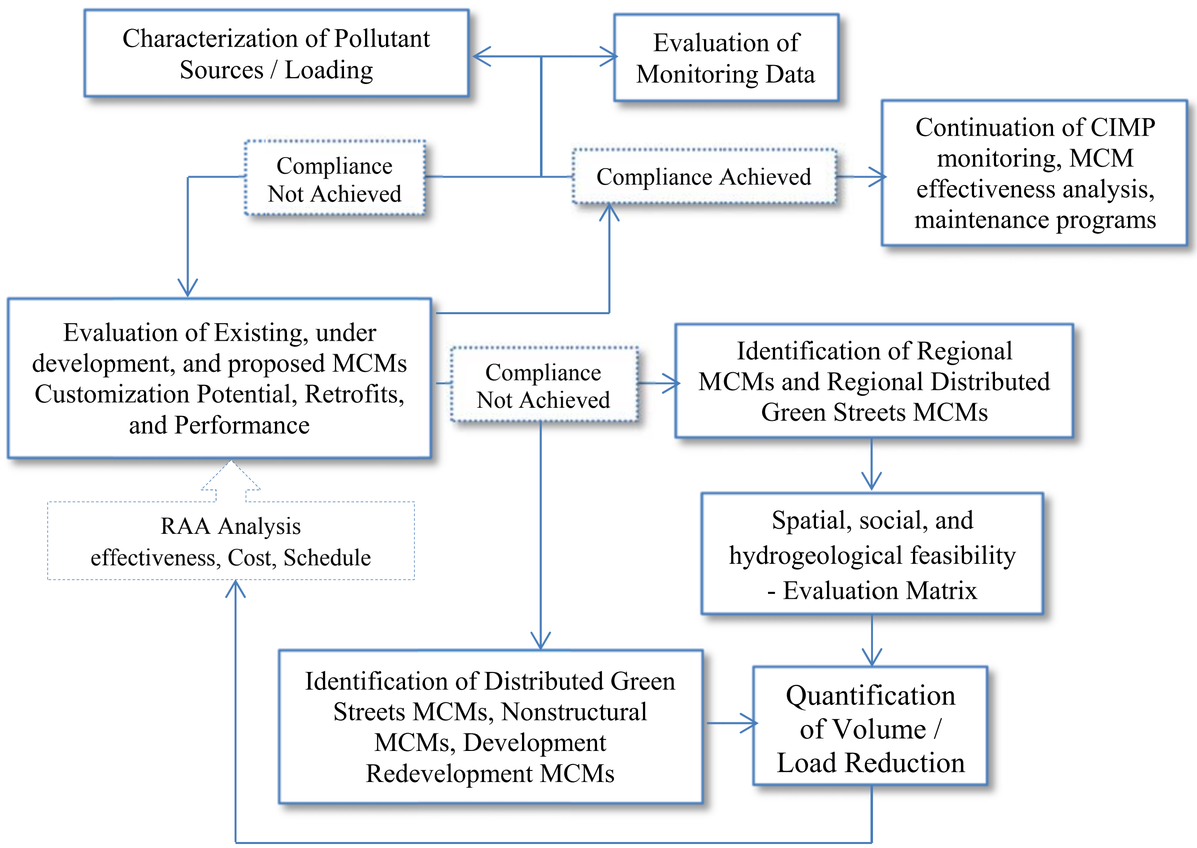

Figure 5-13: Conceptual Diagram of EWMP MCMs Implementation Analysis

The selected MCMs listed in Section 4.0 were modeled to estimate the 85th percentile storm event capture and treatment volumes and load reductions as well as the annual capture and treatment volumes and load reductions for the critical wet year (2009). The WMMS tool was used, and the WMMS output was incorporated into the CSM for each subwatershed (see Section 5.1.5 for CSM details). The 85th percentile storm event and annual results are summarized in Table 5-21 and Table 5-22, respectively. The results do not reflect the use of sanitary sewer diversions for Subwatersheds 1A, 1B, and 4 as discussed in the selection of MCMs section, Section 4.0.

For the non-TMDL applicable Subwatershed 2 the selected MCMs listed in Section 5.3 were modeled to estimate the 85th percentile storm event capture and treatment volumes and load reductions as well as the annual capture and treatment volumes and load reductions for the critical wet year (2009). Similar to the modeling for drainage areas to the Front and Back Basins, Subwatershed 2 was modeled using WMMS, and the output was incorporated into the CSM to estimate MCM volumes and load reductions. The 85th percentile storm event and annual results are summarized in and, respectively.

Table 5-21: Basins Drainage Area Summary of Modeled Volumes and Load Reduction – 85th Percentile Storm Event

Parameter (units)	Sub-Watershed 1A	Sub-Watershed 1B	Sub-Watershed 3	Sub-Watershed 4	Basins Drainage Area Total
Total Area (acres)	104.22	264.54	70.46	645.68	1,084.9
Non Open Space Area (acres)	96.02	249.87	70.46	638.58	1,084.9
Total Rainfall (in)	1.1	1.1	1.1	1.1	1.1
Total Runoff (cf)	251,892	597,312	155,952	1,284,768	2,289,924
Drainage Area TSS Load (kg TSS)	281.9	795.2	149.7	1,776.9	3,003.7
Regional MCMs					
Capture Area (acres)	-	-	7.4	42.0	-
Capture Area (%)	-	-	10.5%	6.6%	-
Volume Capture (cf)	-	-	15,583	83,570	99,153
Volume Capture (%)	-	-	1-	6.5%	4.3%
Capture Load Reduction (kg TSS)	-	-	15.5	116.0	132
Capture Load Reduction	-	-	10.4%	6.5%	4.4%
Distributed Capture MCMs					
Capture Area (acres)	21.7	50.6	40.9	406.2	519.5
Capture Area (%)	22.6%	20.2%	58.1%	63.6%	50.7%
Volume Capture (cf)	52,546	114,227	90,616	806,010	1,063,399
Volume Capture (%)	20.9%	19.1%	58.1%	62.7%	46.4%
Capture Load Reduction (kg TSS)	59.0	152.4	87.1	1,117.8	1,416.3
Capture Load Reduction	20.9%	19.2%	58.2%	62.9%	47.2%
Redevelopment MCMs					
Filtration Area (acres)	27.13	79.96	2.80	22.75	132.64
Filtration Area (%)	28.3%	32.0%	4.0%	3.6%	12.9%
Volume Treated (cf)	60,550	168,823	6,176	45,036	280,585
Volume Treated (%)	24.0%	28.3%	4.0%	3.5%	12.3%
Filtration Load Reduction (kg TSS)	46.9	152.8	4.2	39.9	243.8
Filtration Load Reduction	16.6%	19.2%	2.8%	2.2%	8.1%
Distributed Filtration MCMs					
Filtration Area (acres)	47.2	119.3	19.3	167.7	353.5
Filtration Area (%)	49.1%	47.8%	27.4%	26.3%	34.5%
Volume Treated (cf)	106,406	254,304	42,627	333,001	736,338
Volume Treated (%)	42.2%	42.6%	27.3%	25.9%	32.2%
Filtration Load Reduction (kg TSS)	81.4	228.0	28.2	291.6	629.2
Filtration Load Reduction	28.9%	28.7%	18.8%	16.4%	20.9%
Diversion MCM**					
Diverted Volume (cf)	-	-	29,864	-	29,864
Diverted Volume (%)	-	-	19.1%	-	1.3%
Diverted Load Reduction (kg TSS)	-	-	7.5	-	7.5
Diverted Load Reduction (%)	-	-	5.0%	-	0.2%
Subwatershed Totals					
MCM Area (acres)	96.0	249.9	70.5	638.7	1,055.0
MCM Area (%)	100.0%	100.0%	100.0%	100.0%	100.0%
MCM Volume (cf)	219,502	537,354	133,243	1,267,617	2,157,716
MCM Volume (%)	87.1%	90.0%	85.4%	98.7%	94.2%
MCM Load Reduction (kg TSS)	187.3	533.2	142.5	1,565.3	2,428.3
MCM Load Reduction	**66.4%***	**67.1%***	**95.2%***	**88.1%***	**80.8%***

*Additional load reductions are expected to be achieved through nonstructural MCMs (6.5%)

**Additional reductions necessary to achieve compliance may include diversions, and will be determined based on the adaptive management process results.

Table 5-22: Basins Drainage Area Summary of Modeled Volumes and Load Reduction – Critical Wet Year

Parameter (units)	Sub-Watershed 1A	Sub-Watershed 1B	Sub-Watershed 3	Sub-Watershed 4	Basins Drainage Area Total
Total Area (acres)	104.22	264.54	70.46	645.68	1,084.9
Non Open Space Area (acres)	96.02	249.87	70.46	638.58	1,054.9
Total Rainfall (in)	14.63	14.63	14.63	14.63	14.63
Total Runoff (cf)	3,132,936	7,481,808	1,947,600	16,114,176	28,676,520
Drainage Area TSS Load (kg TSS)	7,759	18,729	1,327	36,698	64,513
Target Load Reduction	96.6%	95.5%	87.4%	95.4%	95.3%
Regional MCMs					
Capture Area (acres)	-	-	7.4	42.0	-
Capture Area (%)	-	-	10.5%	6.6%	-
Volume Capture (cf)	-	-	159,340	824,345	983,686
Volume Capture (%)	-	-	7.4%	5.1%	3.4%
Capture Load Reduction (kg TSS)	-	-	121.9	2,302.6	2,425
Capture Load Reduction	-	-	9.2%	6.3%	3.8%
Distributed Capture MCMs					
Capture Area (acres)	21.7	50.6	40.9	406.2	519.5
Capture Area (%)	22.6%	20.2%	58.1%	63.6%	50.7%
Volume Capture (cf)	544,401	1,221,224	880,350	7,972,596	10,618,571
Volume Capture (%)	17.4%	16.3%	45.2%	49.5%	37.0%
*Capture Load Reduction (kg TSS)	1,697.1	3,621.3	673.7	22,269.7	28,262
Capture Load Reduction	21.9%	19.3%	50.8%	60.7%	43.8%
Redevelopment MCMs					
Filtration Area (acres)	27.13	79.96	2.80	22.75	132.64
Filtration Area (%)	28.3%	32.0%	4.0%	3.6%	12.9%
Volume Treated (cf)	712,093	2,023,692	76,650	558,861	3,371,296
Volume Treated (%)	22.7%	27.0%	3.9%	3.5%	11.8%
Filtration Load Reduction (kg TSS)	1,308.1	3,662.0	31.1	823.3	5,824.5
Filtration Load Reduction	16.9%	19.6%	2.3%	2.2%	9.0%
Distributed Filtration MCMs					
Filtration Area (acres)	47.2	119.3	19.3	167.7	353
Filtration Area (%)	49.1%	47.8%	27.4%	26.3%	34.5%
Volume Treated (cf)	1,250,351	3,039,086	510,760	3,953,929	8,754,126
Volume Treated (%)	39.9%	40.6%	26.2%	24.5%	30.5%
Filtration Load Reduction (kg TSS)	2,248.9	5,388.0	203.3	5,394.1	13,234
Filtration Load Reduction	29.0%	28.8%	15.3%	14.7%	20.5%
Diversion MCM					
Diverted Volume (cf)	-	-	357,311	-	
Diverted Volume (%)	-	-	18.3%	-	
Diverted Load Reduction (kg TSS)	1,736.8**	3,997.5**-	103.1	1834.8**	103.1
Diverted Load Reduction (%)	-	-	7.8%	-	
Non-Structural MCMs					
Load Reduction (kg TSS)	504.3-	1217.4-	86.3	2385.4-	4,193.3
Subwatershed Totals					
MCM Area (acres)	96.0	249.9	70.5	638.7	1,055.0
MCM Area (%)	100.0%	100.0%	100.0%	100.0%	100.0%
MCM Volume (cf)	2,506,845	6,284,002	1,627,100	13,309,731	19,372,697
MCM Volume (%)	80.0%	84.0%	83.5%	82.6%	67.6%
MCM Load Reduction (kg TSS)	7,495.2†	17,886.2†	1219.4	35,009.9†	61610.7†
MCM Load Reduction	**96.6%†**	**95.5%†**	**91.9%**	**95.4%†**	**95.5%†**

*In accordance with the RAA Guidance document, capture load reduction calculations are based on the drainage area achieving annual load reduction targets (i.e., designed for the 85^{th} percentile event and thus in compliance with guidance).

**These additional reductions necessary to achieve compliance may include diversions, and will be determined based on the adaptive management process results.

†Includes additional reductions through diversions that will be determined based on adaptive management process.

Table 5-23: Subwatershed 2 Summary of Modeled Volumes and Load Reduction – 85th Percentile Storm Event

Parameter (units)	Subwatershed 2
Total Area (acres)	327.68
Non Open Space Area (acres)	294.35
Total Rainfall (in)	1.1
Total Runoff (cf)	713,196
Drainage Area TSS Load (kg TSS)	672.5
Regional MCMs	
Capture Area (acres)	3.5
Capture Area (%)	1.2%
Volume Capture (cf)	7,509
Volume Capture (%)	1.1%
Capture Load Reduction (kg TSS)	7.2
Capture Load Reduction	1.1%
Distributed Capture MCMs	
Capture Area (acres)	50.2
Capture Area (acres)	16.9%
Capture Area (%)	109,327
Volume Capture (cf)	15.3%
Volume Capture (%)	103.2
Capture Load Reduction (kg TSS)	15.3%
Capture Load Reduction	50.2
Redevelopment Filtration MCMs	
Filtration Area (acres)	11.87
Filtration Area (%)	4.0%
Volume Treated (cf)	24,915
Volume Treated (%)	3.5%
Filtration Load Reduction (kg TSS)	15.6
Filtration Load Reduction	2.3%
Distributed Filtration MCMs	
Filtration Area (acres)	35.0
Filtration Area (%)	11.8%
Volume Treated (cf)	73,464
Volume Treated (%)	10.3%
Filtration Load Reduction (kg TSS)	45.8
Filtration Load Reduction	6.8%
Subwatershed Totals	
MCM Area (acres)	100.6
MCM Area (%)	33.8%
MCM Volume (cf)	215,215
MCM Volume (%)	30.2%
MCM Load Reduction (kg TSS)	171.8
MCM Load Reduction	**25.5%**

Table 5-24. Subwatershed 2 Summary of Modeled Volumes and Load Reduction – Critical Wet Year

Parameter (units)	Subwatershed 2
Total Area (acres)	327.68
Non Open Space Area (acres)	294.35
Total Rainfall (in)	14.63
Total Runoff (cf)	8,883,072
Drainage Area TSS Load (kg TSS)	14,194
Target Load Reduction	21.5%
Regional MCMs	
Capture Area (acres)	3.5
Capture Area (%)	1.2%
Volume Capture (cf)	60,008
Volume Capture (%)	0.7%
Capture Load Reduction (kg TSS)	112.8
Capture Load Reduction	0.8%
Distributed Capture MCMs	
Capture Area (acres)	50.2
Capture Area (%)	16.9%
Volume Capture (cf)	908,751
Volume Capture (%)	10.2%
Capture Load Reduction (kg TSS)	1,665.9
Capture Load Reduction	11.7%
Redevelopment Filtration MCMs	
Filtration Area (acres)	11.87
Filtration Area (%)	4.0%
Volume Treated (cf)	313,241
Volume Treated (%)	3.5%
Filtration Load Reduction (kg TSS)	328.5
Filtration Load Reduction	2.3%
Distributed Filtration MCMs	
Filtration Area (acres)	35.0
Filtration Area (%)	11.8%
Volume Treated (cf)	919,630
Volume Treated (%)	10.4%
Filtration Load Reduction (kg TSS)	960.3
Filtration Load Reduction	6.8%
Subwatershed Totals	
MCM Area (acres)	100.6
MCM Area (%)	33.8%
MCM Volume (cf)	2,201,630
MCM Volume (%)	24.8%
MCM Load Reduction (kg TSS)	3,067.5
MCM Load Reduction	**21.6%**

6.0 MdR EWMP IMPLEMENTATION PLAN AND SCHEDULE

As previously mentioned, the MdR watershed is subject to three TMDLs; the Santa Monica Bay Nearshore Debris TMDL, the Marina del Rey Harbor Mother's Beach and Back Basin Bacteria TMDL, and the Toxic Pollutants in Marina del Rey Harbor TMDL. Because the compliance schedule for the Toxics TMDL is the most aggressive, the Toxics WLAs were used as the primary scheduling driver for MCM implementation. Once projects were scheduled in accordance with the Toxics TMDL goals (Table 6-1), Trash TMDL and Bacterial TMDL load reduction goals were evaluated, and additional structural and/or non-structural controls, were identified. It is worth noting that MdR EWMP Agencies have elected to demonstrate Toxics TMDL compliance through meeting final sediment WLAs for the contaminants in the TMDL. Further studies, including a planned Stressor ID Study in 2016, may indicate Toxics TMDL compliance through alternative means and may impact the implementation schedule.

To meet the compliance milestones, a phased implementation approach using a combination of structural and non-structural strategies designed specifically to reduce toxic pollutant and bacterial loading to MdR will be implemented. As detailed in the RAA section, zinc loading requires the largest load reduction and is thus the compliance driver for the Toxics TMDL (i.e., based on available data, if MCMs are implemented to achieve zinc WLA, then other toxic pollutant loads would also be below WLAs).

Table 6-1: Summary of Marina del Rey Subwatershed RAA-Required Zinc Load Reductions

	Subwatershed					EWMP Watershed[1]	
	1A	1B	2	3	4	Back Basins[2]	Front Basins[3]
Required Zinc Percent Load Reduction	96.2	95.8	21.5	88.0	95.6	95.1	95.8
Interim / Final Toxics TMDL Compliance Date	2016/2018	2019/2021	NA	2016/2018	2016/2018	2016/2018	2019/2021

[1]Excludes Subwatershed 2 area since it is outside the geographical area of MdR subject to TMDL compliance
[2]Tributary drainage area of Subwatersheds 1A, 3, and 4
[3]Tributary drainage area of Subwatershed 1B

6.1 Load Reduction Schedule

The requirements under the Toxics TMDL vary for the four subwatersheds constituting the MdR watershed. Subwatershed 1 is divided into two areas, Subwatershed 1A (area draining into back basins E, D, and F) and Subwatershed 1B (area draining into front basins A, B, C, G, H) because they have different target compliance dates in the Toxics TMDL. Subwatershed 2 is considered separately in this EWMP as it is outside the boundaries of the TMDL compliance area of the MdR WMA.

Table 6-1 lists the target Zinc load reductions and Toxics TMDL compliance dates for the various subwatersheds. The Toxics TMDL WLA compliance schedule uses a phased approach, where interim compliance is achieved through either demonstrating that 50% of the total drainage area served by the MS4 is meeting the WLA for sediment or alternatively, a 50% load reduction is achieved. Final compliance is demonstrated through 100% of the total area served by the MS4 meeting the WLA for sediment. The final compliance point occurs in 2018 for the Back Basins of the harbor and in 2021 for the Front Basins.

Under the Bacteria TMDL, the final compliance date for single sample summer and winter dry weather WLAs, expressed as allowable exceedance days (Section 2.2.2), is December 28, 2017. The final compliance point for wet weather and geometric mean bacteria WLAs is July 15, 2021

6.2 Structural MCM Schedule

Attaining the TMDLs' water quality goals will require significant infrastructure throughout the MdR watershed. This section presents the implementation schedules required for regional and localized structural MCMs to meet the WLA by the specified interim and final compliance dates. The Toxics TMDL compliance points for the Back Basins are on a more accelerated schedule than the Front Basins, therefore projects within the subwatersheds that drain to the Back Basins (Subwatersheds 1A, 3 and 4) are given priority in the implementation schedule.

Based on the existing pollutant loads, estimated by the WMMS model, a total zinc load reduction of approximately 95.1% and 95.8% will be required to meet the zinc WLA for the Back Basins (Subwatersheds 1A, 3, and 4) and Front Basins (Subwatershed 1B), respectively. These load reductions modeled through the RAA are used in the selection, design, scheduling, and costing, of the structural and nonstructural MCMs. A detailed description of design, load reduction, implementation, and cost methodology and results are found in Appendix A and Appendix B.

The expected load reduction schedule is shown as well as the applicable TMDL compliance points (both interim and final) are shown in Table 6-2. Expected load reductions from non-structural MCMs are also included in Table 6-2.

The actual implementation schedule may vary depending on the results of monitoring efforts currently underway (i.e., Coordinated Monitoring Plan), planned monitoring (Coordinated Integrated Monitoring Plan), future special studies, and future MCM effectiveness analysis, and funding availability. Based upon an adaptive management strategy, as more watershed-specific information relating to pollutant loads is available, more detailed schedules may be developed using this basic framework.

2015 -Planning and design work will begin for the Costco site, Venice of America Park, and the distributed regional green streets in Subwatershed 4.

2016 – Design work is estimated to be finished for the Costco site, Venice of America Park the distributed regional green streets in Subwatershed 4 and construction is planned to commence. Planning and design work is planned to begin for Triangle Park.

2017- Construction is expected to finish for the Costco site and the distributed regional green streets in Subwatershed 4. Planning and design work is proposed to begin for and Canal Park. Effectiveness monitoring will begin upon completion of construction of each proposed project.

2018 –Construction is expected to begin on Triangle Park.

2019 and beyond – Construction will begin for Canal Park. Effectiveness monitoring will continue to be carried out to provide data on the pollutant removal efficiency for each of the MCMs. Operations and Maintenance will continue.

Table 6-2: Load Reduction Schedule for MdR Watershed Back Basins and Front Basins MCMs

Area	Existing	2015	2016	2017	2018	2019	2020	2021
Back Basins								
Back Basins (Subwatersheds 1A, 3, 4)			**Interim**		**Final**			
Non-Structural Programs				1.50	1.50	1.50	2.00	
Regional Distributed Green Streets (GW≥20ft)			14.89	9.04				
Localized Green Streets (20ft>GW)			25.43	19.10	6.67			
Development/Redevelopment		1.01	1.01	1.01	1.01			
Regional Projects			0.47	5.12	0.01			
Sanitary Sewer Diversions	0.43		4.27	2.68				
Annual Load Reduction	**0.43**	**1.01**	**46.08**	**38.45**	**9.19**	**1.50**	**2.00**	**0.00**
Toxics TMDL Load Reduction-Cumulative Goal = 95.1%	**0.43**	**1.44**	**47.51**	**85.97**	**95.16**	**96.66**	**98.66**	**98.66**
Subwatershed 1A								
Non-Structural Programs				1.50	1.50	1.50	2.00	
Localized Green Streets			40.24	13.33				
Development/Redevelopment		4.45	4.45	4.45	4.45			
Sanitary Sewer Diversion				22.91				
Annual Load Reduction	**0.00**	**4.45**	**44.70**	**42.20**	**5.95**	**1.50**	**2.00**	**0.00**
Toxics TMDL Load Reduction-Cumulative Goal = 96.2%	**0.00**	**4.45**	**49.15**	**91.34**	**97.29**	**98.79**	**100.00**	**100.00**
Subwatershed 3								
Non-Structural Programs				1.50	1.50	1.50	2.00	
Localized Green Streets			37.01	28.87	9.48			
Development/Redevelopment		0.63	0.63	0.63	0.63			
Venice of America Park			5.48					
Triangle Park					0.08			
Existing MCM - Boone Olive Diversion	4.97							
Annual Load Reduction	**4.97**	**0.63**	**43.11**	**30.99**	**11.69**	**1.50**	**2.00**	**0.00**
Toxics TMDL Load Reduction-Cumulative Goal = 88%	**4.97**	**5.59**	**48.70**	**79.70**	**91.38**	**92.88**	**94.88**	**94.88**
Subwatershed 4								
Non-Structural Programs				1.50	1.50	1.50	2.00	
Regional Distributed Green Streets (GW≥20ft)			19.13	11.61				
Localized Green Streets (20ft>GW)			22.54	19.35	7.52			
Development/Redevelopment		0.56	0.56	0.56	0.56			
Costco Parking Lot				6.58				
Sanitary Sewer Diversion			5.48					
Annual Total	**0.00**	**0.56**	**47.71**	**39.60**	**9.58**	**1.50**	**2.00**	**0.00**
Toxics TMDL Load Reduction-Cumulative Goal = 95.7%	**0.00**	**0.56**	**48.27**	**87.87**	**97.45**	**98.95**	**100.00**	**100.00**
Front Basins								
Subwatershed 1B						**Interim**		**Final**
Non-Structural Programs				1.50	1.50	1.50	2.00	
Localized Green Streets				7.85	12.97	16.07	13.01	0.43
Development/Redevelopment		3.36	3.36	3.36	3.36	3.36	3.36	
Sanitary Sewer Diversion						8.80	10.40	
Annual Total	**0.00**	**3.36**	**3.36**	**12.71**	**17.83**	**29.73**	**28.78**	**0.43**
Toxics TMDL Load Reduction-Cumulative Goal = 95.8%	**0.00**	**3.36**	**6.72**	**19.43**	**37.25**	**66.99**	**95.77**	**96.20**
Non TMDL Area								
Subwatershed 2								
Non-Structural Programs				1.50	1.50	1.50	2.00	
Localized Green Streets					8.18	8.18	8.18	
Development/Redevelopment		0.42	0.42	0.42	0.42	0.42	0.42	
Canal Park						1.11		
Via Dolce Park							0.06	
Annual Total	**0.00**	**0.42**	**0.42**	**1.92**	**10.11**	**11.22**	**10.67**	**0.00**
Toxics TMDL Load Reduction-Cumulative Goal = 21.5%*	**0.00**	**0.42**	**0.85**	**2.77**	**12.88**	**24.10**	**34.77**	**34.77**

This table is based on the percent watershed area treated by MCMs (proportional load reduction for 85th percentile storm event).
*Additional load reduction is required to meet the TMDL WLA for the critical year and/or the interim target
GW = groundwater

6.3 Non –Structural BMP Implementation

The combined non-structural programs/projects proposed are assumed to reduce up to 6.5% of the pollutant loading to MdR. The non-structural programs/projects proposed will be implemented early to maximize the cumulative pollutant load removals throughout the implementation period. Generally, it is assumed that a program/project will capture the full load reduction after 2 years of implementation.

The non-structural MCM programs proposed for the MdR watershed include modeling updates and other studies, source control, catch basin cleaning, and industry targeted outreach and education, enforcement, and inspection programs. The EWMP proposed implementation schedule for these MCMs is shown in Table 6-3.

Table 6-3: Implementation Schedule for Non-Structural BMPs within the MdR WMA

Category	Non-Structural Solution	Potential Contaminant Reduction (%)					
		2015	2016	2017	2018	2019	2020 - 2025
Watershed Studies	**Pollutant Loading Model and Database**						
	Long-Term Implementation and Updates						
	Total Suspended Solids/Pollutant Correlations						
Source Control	**Collaborative Environmentally Friendly Alternative Services Program**				0.5	1	2
	Planning & Assessment						
	Long-Term Implementation						
	Product Substitution Campaign				0.5	1	2
	Planning & Assessment						
	Long-Term Implementation						
Municipal Separate Storm Sewer System (MS4)	**Targeted Aggressive MS4 and Catch Basin Cleaning Program**				0.5	1	1
	Planning & Assessment						
	Long-Term Implementation						
Restaurants, Parking Garage, Construction, and Commercial Facilities Compliance	**Code Survey and Modification**						
	Targeted inspections			0.5	0.5	0.5	0.5
	Evaluation/Assessment/Modification						
	Business-led Voluntary BMP Implementation Program			0.5	0.5	0.5	0.5
	Feasibility Evaluation						
	Incentive Program						
Community Outreach and Education	**Outreach and Education**			0.5	0.5	0.5	0.5
	Environmentally Friendly Boating Program						
	Green Gardening and Runoff Reduction Program						
Total Contaminant Reduction (%)				**1.5**	**3**	**4.5**	**6.5**
(dark blue)	Represents overall project schedule.						
(light blue)	Provides additional information regarding project implementation schedule.						

7.0 IMPLEMENTATION COSTS AND FINANCIAL STRATEGY

As mentioned in the previous sections, the Toxics TMDL compliance schedule is used in the selection and scheduling of MCMs in the MdR WMA. The Toxics TMDL compliance schedule provides for multiple pathways to achieve compliance with the sediment TMDL, including achieving designated WLAs, or alternatively demonstrating attainment of the SQOs. For the purpose of this EWMP, compliance with WLAs is used for costing and scheduling but further studies, including a planned Stressor ID Study in 2016, may show TMDL compliance through SQOs.

Life cycle costs (LCC) incorporated into project cost estimates include materials, construction, engineering design, CEQA and permitting, contingency, land acquisition, 20 years of routine operations and maintenance (O&M), and major rehabilitation costs. The cost of administering a stormwater management program for post-construction effectiveness assessment during 3 storm events was also included in this estimate. Construction costs were applied to the year in which a load reduction credit was assigned. Planning and engineering design costs were assumed to require up to 2 years of lead-time prior to the start of construction. The cost of post-construction stormwater monitoring was distributed over 3 years following project completion. The annual O&M cost was equally distributed over the remaining project schedule following project completion. All costs were translated into 2015 dollars using net present worth analysis and an average inflation rate of 3%.. These values were used based on a similar methodology employed to develop the San Diego Quality of Life Initiative (SANDAG Equinox Center, 2008) and the Multi-Pollutant TMDL Implementation Plan for the Unincorporated Area of MdR Harbor Back Basins (LADPW, 2012). Additional information regarding green street project designs, design areas, cost estimates, and this methodology is presented in Appendix A. The costs shown in this EWMP are estimates only and will change based on site-specific conditions and refinement of parameters as the EWMP is implemented.

7.1 MCM Implementation Cost Summary

The cumulative costs associated with the implementation of the MCMs discussed in 4.0 based on the schedule presented in 6.0 are summarized in Table 7-1. The results are presented by jurisdiction and type of MCM (structural versus nonstructural). Total costs for implementation of the MCMs proposed in this EWMP are estimated at $391,914,197. In Table 7-2 implementation costs are broken out by drainage area (Back Basins, Front Basins and non-TMDL area) separately because they follow different TMDL compliance schedules. Costs associated Subwatersheds 1A, 3, and 4 are presented under the Back Basins and those for Subwatershed 1B are shown under Front Basins. Subwatershed 2 does not drain to either the Back Basins or the Front Basins, and is therefore not subject to the TMDL compliance schedule; its MCMs associated costs are presented separately.

Table 7-2 also shows the cumulative load reduction associated for each MCM type discussed in the EWMP for each of the subwatersheds, including nonstructural MCMs.

Table 7-1: MdR Watershed MCMs Cost Estimate Schedule by Jurisdiction

MdR Watershed	Structural MCMs	Nonstructural MCMs	Total Cost
City Of Los Angeles	$350,508,387	2,923,268	$353,431,655
County Of Los Angeles	$15,228,511	1,190,913	$16,419,424
City Of Culver City	$21,936,109	127,009	$22,063,118
Total Cost (2015 dollars)	**$387,673,007**	**$4,241,190**	**$391,914,197**

The annual breakdown of the costs for the whole WMA by MCM type and by jurisdiction are summarized in Table 7-7 and Table 7-8, for structural MCMs, and Table 7-9 and Table 7-10, for nonstructural MCMs.

Table 7-2: Load Reduction and Cost for Required Load Reductions for Back Basins and Front Basins

MCM Type	Cumulative Load Reduction	Cumulative Cost*
Back Basins (Subwatersheds 1A, 3, 4)		
Structural MCMs Total	**92.16**	**$290,406,761**
Nonstructural MCMs Total	**6.5**	**$2,524,452**
Subwatershed 1A		
Localized Green Streets	6.27	$22,526,910
Development/Redevelopment	2.08	-
Potential Sanitary Sewer Diversion	2.68	$7,443,462
Structural MCMs Total	**11.04**	**$29,970,372**
Subwatershed 3		
Localized Green Streets	6.47	$21,482,683
Development/Redevelopment	0.22	-
Venice of America Park	0.47	$681,486
Triangle Park	0.01	$195,464
Existing MCM - Boone Olive Diversion	0.43	-
Structural MCMs Total	**7.59**	**$22,359,634**
Subwatershed 4		
Regional Distributed Green Streets (GW≥20ft)	23.93	$90,699,592
Localized Green Streets (20ft>GW)	38.46	$127,753,965
Development/Redevelopment	1.75	-
Costco Parking Lot	5.12	$6,707,597
Sanitary Sewer Diversion	4.27	$12,915,601
Structural MCMs Total	**73.53**	**$238,076,755**
Front Basins (Subwatershed 1B)		
Subwatershed 1B		
Localized Green Streets	50.33	$51,278,322
Development/Redevelopment	20.16	-
Sanitary Sewer Diversion	19.21	$18,194,233
Structural MCMs Total	**89.70**	**$69,472,555**
Nonstructural MCMs Total	**6.5**	**$800,437**
Non TMDL Compliance Area		
Subwatershed 2		
Localized Green Streets	24.55	$26,980,294
Development/Redevelopment	2.54	-
Canal Park	1.11	$492,869
Via Dolce Park	0.06	$320,529
Structural MCMs Total	**28.27**	**$27,793,692**
Nonstructural MCMs Total	**6.5**	**$916,301**

*Cost includes planning, design, O&M, and MCM effectiveness monitoring through 2034.

7.2 Structural MCMs Implementation Cost

7.2.1 Green Streets MCMs

Regional Distributed and Localized Green Street MCMs implementation, along with public facilities, is constrained to the limited regions within the public domain available for implementation of structural MCM projects. Many considerations affect the extent of area available for the implementation of these MCMs within the public ROW (e.g., utilities, crosswalks, soil conditions); therefore, the design areas used to develop example MCM implementation scenarios and design were also used to test feasibility of implementation (e.g., adequate space for implementation, sufficient utility separation). The costs are based on the implementation of various MCMs by land use and subwatershed. The results of this analysis are provided in more detail in Appendix A.

The cost of implementation for these design area MCM projects was normalized by acreage treated in order to obtain a value (cost per acre treated) that could be scaled watershed-wide. This normalized value was used to apportion cost by land use and groundwater depth. Table 7-3 summarizes these costs for each of the subwatersheds in MdR.

Table 7-3: Green Streets MCMs Costs for the MdR Watershed

MCM Type	Cumulative Cost (2015 dollars)
REGIONAL PROJECTS	$90,699,592
Regional Distributed Green Streets (GW≥20ft, Subwatershed 4)	$90,699,592
LOCALIZED GREEN STREETS	$250,022,174
Subwatershed 1A	$22,526,910
Subwatershed 1B	$51,278,322
Subwatershed 2	$26,980,294
Subwatershed 3	$21,482,683
Subwatershed 4	$127,753,965
CUMULATIVE COST (2015 $)	**$340,914,197**

7.2.2 Costco

The estimated implementation cost for the Costco regional MCM is presented in Table 7-4. The design assumptions and cost estimates for the Costco Parking Lot Infiltration Project Design are presented in Appendix B.

Table 7-4: Costco Parking Lot Implementation Cost

MCM Design	Regional Project ID	Treatment Area (ac)	Planning/ Design Cost	Construction Cost	20-Year O&M Cost	Monitoring Cost
Storm Chamber Infiltration Gallery	Costco Parking Lot	42	$1,546,000	$5,533,429	$64,000	$120,000

7.2.3 Parks

Four parks were considered for Regional MCMs in the MdR watershed: Canal Park, Venice of America Park, Via Dolce Park, and Triangle Park. The specific design considerations are presented in the following subsections. A summary of the implementation costs is provided in Table 7-5 below. Detailed assumptions and calculations are provided separately in Appendix B.

Table 7-5: Implementation Costs for Regional Projects - Parks

MCM Design	Regional Project ID	Treatment Area (ac)	Planning/ Design Cost	Construction Cost	20-Year O&M Cost	Monitoring Cost
Storm Chamber Infiltration Gallery	Canal Park	3.3	$139,000	$397,143	$20,000	$18,000
	Venice of America Park	3.9	$168,000	$502,176	$20,000	$36,000
Subsurface Cistern w/ Capture/Reuse	Via Dolce Park	0.18	$88,000	$214,308	$110,000	$18,000
	Triangle Park	0.05	$51,000	$80,621	$110,000	$18,000

7.2.4 Potential Sanitary Sewer Diversion Projects

The costs and project specific information for the design parameters of each of the potential subwatershed sanitary sewer diversion projects are summarized in Table 7-6. More details are presented in Appendix B.

Table 7-6: Sanitary Sewer Diversion Projects Implementation Cost

Subwatershed	1a	1b	4
Design Treatment Area (ac)	22	48	35
Tank Capacity (gallons)	0.49 million	1.60 million	1.04 million
Redevelopment Area (acres)	0.3	0.7	0.5
Planning/ Design Cost	$354,000	$998,000	$338,000
Construction Cost	$7,309,020	$17,899,145	$12,604,729
20-Year O&M Cost	$596,010	$4,295,301	$1,115,655
Monitoring Cost	$60,000	$60,000	$60,000

Because of the exact drainage areas to be diverted and the tank locations are significant unknown variables, the sanitary sewer diversion project costs are limited in scope to the above ground concrete tank (rectangular), with 5-foot perimeter beyond the edge of the tank foundation, and one controller pump/diversion to connect to the sanitary sewer and a limited suite of construction BMPs. The O&M costs include inspection and maintenance of the tank, as well as an average annual sewer discharge fee (assuming 7 storms per year).

This type of project is expensive as a result of the redevelopment costs associated with obtaining property to site the tank. The lower reaches of the MdR watershed consist mainly of high-density multi-family residential land uses. These properties range in size from 0.15 acre lots with 2-3 story condominiums, to skyscrapers with hundreds of individual units and the average cost per acre is above $20,000,000. The tank design assumptions and cost estimates are presented with the regional projects designs in in Appendix B.

7.3 Non-Structural MCMs Implementation Cost

The non-structural cost estimates consist of a one-year initial pilot study cost, including project start-up and assessment, and if applicable given the type of project/program ongoing O&M costs. An inflation rate of 3% per year was used. These values were used based on a similar methodology employed for the MdR Multi-Pollutant Implementation Plan (LADPW, 2012). All non-structural costs are reported in 2015 dollars. The total cost of implementing the nonstructural programs is approximately $4.24 million, as summarized in Table 7-10.

Table 7-7: MdR Watershed Structural MCMs Cost Estimate Schedule by MCM Type

MdR Watershed	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	O&M 2026-2034	Total Cost
Distributed Regional Green Streets (GW≥20 ft)	$11,276,106	$47,900,775	$24,011,959	$1,328,876	$1,322,717	$395,180	$383,669	$372,495	$361,645	$351,112	$340,885	$2,654,171	**$90,699,590**
Localized Green Streets (20 ft>GW)	$21,392,161	$72,313,721	$60,838,013	$36,646,653	$22,426,618	$14,011,168	$2,913,191	$2,105,757	$1,694,678	$1,645,318	$1,597,396	$12,437,500	**$250,022,174**
Potential Sanitary Sewer Diversions	$515,000	$485,437	$18,680,557	$554,934	$7,828,309	$7,600,300	$260,472	$252,886	$245,520	$223,487	$216,978	$1,689,414	**$38,553,294**
Costco	$773,000	$728,627	$5,063,871	$38,383	$37,265	$36,179	$2,602	$2,526	$2,453	$2,381	$2,312	$18,000	**$6,707,599**
Canal Park	$0	$0	$63,602	$61,750	$342,579	$5,862	$5,692	$5,526	$766	$744	$722	$5,625	**$492,868**
Via Dolce Park	$0	$0	$0	$0	$37,955	$216,329	$9,351	$9,078	$8,814	$4,093	$3,973	$30,937	**$320,530**
Venice of America Park	$84,000	$552,527	$11,897	$11,550	$11,214	$837	$813	$789	$766	$744	$722	$5,625	**$681,484**
Triangle Park	$0	$24,036	$23,336	$71,631	$9,920	$9,631	$9,351	$4,342	$4,215	$4,093	$3,973	$30,937	**$195,465**
Annual Cost (2015 dollars, $)	$34,040,268	$122,005,124	$108,693,236	$38,713,777	$32,016,577	$22,275,487	$3,585,141	$2,753,399	$2,318,858	$2,231,972	$2,166,963	$16,872,208	
Cumulative Cost (2015 dollars, $)	**$34,040,268**	**$156,045,392**	**$264,738,627**	**$303,452,404**	**$335,468,981**	**$357,744,468**	**$361,329,609**	**$364,083,008**	**$366,401,865**	**$368,633,837**	**$370,800,799**		**$387,673,007**

Table 7-8: MdR Watershed Structural MCMs Cost Estimate Schedule by Jurisdiction

MdR Watershed	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	O&M 2026-2034	Total Cost
City of Los Angeles	$30,607,651	$111,580,810	$95,344,513	$35,583,414	$29,422,664	$20,461,343	$3,296,126	$2,530,949	$2,131,216	$2,051,342	$1,991,594	$15,506,765	**$350,508,387**
County of Los Angeles	$1,329,808	$4,847,843	$4,142,426	$1,545,990	$1,278,324	$888,982	$143,207	$109,962	$92,595	$89,124	$86,529	$673,721	**$15,228,511**
City of Culver City	$2,102,808	$5,576,470	$9,206,297	$1,584,373	$1,315,589	$925,162	$145,808	$112,488	$95,047	$91,506	$88,840	$691,721	**$21,936,109**
Annual Cost (2015 dollars, $)	$34,040,268	$122,005,124	$108,693,236	$38,713,777	$32,016,577	$22,275,487	$3,585,141	$2,753,399	$2,318,858	$2,231,972	$2,166,963	$16,872,208	
Cumulative Cost (2015 dollars, $)	$34,040,268	$156,045,392	$264,738,627	$303,452,404	$335,468,981	$357,744,468	$361,329,609	$364,083,008	$366,401,865	$368,633,837	$370,800,799		**$387,673,007**

Table 7-9: MdR Watershed Non-Structural MCMs Cost Estimate Schedule by Jurisdiction

MdR Watershed	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Total Cost
City of Los Angeles	1,156,986	597,275	424,479	195,335	129,973	69,870	69,870	69,870	69,870	69,870	69,870	**2,923,268**
County of Los Angeles	471,347	243,325	172,929	79,578	52,950	28,464	28,464	28,464	28,464	28,464	28,464	**1,190,913**
City of Culver City	50,267	25,950	18,442	8,487	5,647	3,036	3,036	3,036	3,036	3,036	3,036	**127,009**
Annual Cost (2015 dollars, $)	1,678,600	866,550	615,850	283,400	188,570	101,370	101,370	101,370	101,370	101,370	101,370	
Cumulative Cost (2015 dollars, $)	**1,678,600**	**2,545,150**	**3,161,000**	**3,444,400**	**3,632,970**	**3,734,340**	**3,835,710**	**3,937,080**	**4,038,450**	**4,139,820**		**4,241,190**

Table 7-10: Cost Schedule for Non-Structural MCM s within the MdR WMA by MCM Type

Non-Structural Solution Category	Proposed Non-Structural MCM	Cost (2015 $)							
		2015	2016	2017	2018	2019	2020	2021	2022-2025
Watershed Studies	Pollutant Loading Model and Database	0	21,800	21,800	21,800	21,800	21,800	21,800	87,200
	Total Suspended Solids/Pollutant Correlations	0	0	54,500	0	54,500	0	0	0
Source Control	Collaborative Environmentally Friendly Alternative Services Program	327,000	136,250	109,000	32,700	5,450	5,450	5,450	21,800
	Product Substitution Campaign	408,750	147,150	152,600	109,000	65,400	32,700	32,700	130,800
Municipal Separate Storm Sewer System (MS4)	Targeted Aggressive MS4 and Catch Basin Cleaning Program	218,000	109,000	81,750	27,250	10,900	10,900	10,900	43,600
Restaurants, Parking Garage, Construction, and Commercial Facilities Compliance	Code Survey and Modification	109,000	81,750	21,800	5,450	1,090	1,090	1,090	4,360
	Targeted inspections	70,850	49,050	21,800	16,350	16,350	16,350	16,350	65,400
	Business-led Voluntary BMP Implementation Program	299,750	179,850	87,200	32,700	6,540	6,540	6,540	26,160
Community Outreach and Education	Environmentally Friendly Boating Program	109,000	54,500	27,250	27,250	3,270	3,270	3,270	13,080
	Green Gardening and Runoff Reduction Program	136,250	87,200	38,150	10,900	3,270	3,270	3,270	13,080
Total Cost		1,678,600	866,550	615,850	283,400	188,570	101,370	101,370	405,480
Cumulative Cost		1,678,600	2,545,150	3,161,000	3,444,400	3,632,970	3,734,340	3,835,710	4,241,190

7.4 Financial Strategy

Estimated costs for compliance with the 2012 MS4 Permit through the implementation of the Marina del Rey Watershed EWMP are approximated at $400 million. Funding is not secured for the projects included in the EWMP. The EWMP Agencies will follow a multi-pronged financial strategy to maximize potential funding opportunities in support of EWMP implementation. The California Contract Cities Association and the League of California Cities, Los Angeles Division City Managers Committees commissioned a report on stormwater funding options in the Los Angeles region in response to the failure to move forward of the “Clean Water, Clean Beaches Measure” which would have assessed a parcel fee to fund clean water programs. The resulting report, “Stormwater Funding Options – Providing Sustainable Water Quality Finding in Los Angeles County” (Farfsing and Watson, 2014) provided a useful framework for potential funding options, which is incorporated in this section.

7.4.1 Grant Programs

The financial strategy for the EWMP includes pursuing available grant programs that potentially may be used for project implementation. These grants may include (but are not limited to) those outlined in the Table 7-11.

Table 7-11: Potential Grant Programs

Grant Program
Prop 1 Water Bond (2014)
Integrated Regional Water Management Plan
USEPA 319 Grants
Clean Beaches Initiative
Federal or State Transportation Grants
Federal or State Solid Waste Grants
Federal Emergency Management Agency (FEMA) Grants
National Institute of Health (NIH) or Public Health Related Grants

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7.4.2 Fees and Charges

The Farfsing and Watson report also identified potential strategies to fund stormwater programs through fees and charges assessed on either a local, regional or state level. These potential fees and charges are summarized in Table 7-12.

Table 7-12: Potential Fees and Charges

Potential Fees and Charges
Local Stormwater Fees
Incorporate Fees for Street Sweeping and Trash TMDLs into Solid Waste Management Fees
Local Water Conservation Fees
Stormwater Impact Fee in LID Ordinances
Car Rental Fees
District-wide Sales Tax
Continue to Pursue Passage of County-wide Parcel Tax (Clean Water, Clean Beaches Measure)

7.4.3 Legislative Strategies:

Potential legislative or policy strategies that the EWMP Agencies may pursue are outlined in Table 7-13 below.

Table 7-13: Potential Legislative Strategies

Potential Legislative Strategies
Amend Prop 218 to Define Stormwater as a Traditional Utility
Formation of Water Conservation Districts
Special Assessment District for the Watershed Management Areas
Source Control Measures Modeled after SB 346
Support the California Green Chemistry Initiative Program
Pursue rate increase for projects based on Assembly Bill (AB) 2403 to avoid triggering Proposition 218 requirements.
Monetize Stormwater Capture and Infiltration
Explore Funding Through Cap and Trade Revenues

7.4.4 Financial Strategies Moving Forward

The potential financial strategies described in this EWMP serve as a general framework for the EWMP Agencies to follow moving forward. These strategies, among others yet to be defined, will be adopted collaboratively by the member agencies and based on outcomes from the strategies described; a more detailed financial plan will be developed as the program moves forward.

8.0 ASSESSMENT AND ADAPTIVE MANAGEMENT FRAMEWORK

Adaptive management is a key component to the successful implementation, assessment and refinement of the MdR EWMP. Adaptive management is the process by which data are continually assessed in the context of improving and adapting programs to ensure the most effective strategies are implemented. In accordance with the MS4 Permit, every two years from the date of EWMP approval an adaptive management process will be implemented. The process will include consideration of the progress for the following elements as described in Part V1.C.8 of the MS4 Permit:

1. "Progress toward achieving interim and/or final WQBELS or RW limitations …according to established schedules;
2. Progress toward achieving improved water quality in MS4 discharges and achieving RW limitations through implementation of the watershed control measures based on an evaluation of outfall based monitoring data and RW monitoring data;
3. Achievement of interim milestones;
4. Re-evaluation of the water quality priorities identified for the WMA based on more recent water quality data for discharges from the MS4 and the receiving water(s) and a reassessment of sources of pollutants in MS4 discharges;
5. Availability of new information and data from sources other than the Permittees' monitoring program(s) within the WMA that informs the effectiveness of the actions implemented by the Permittees;
6. Regional Water Board recommendations; and
7. Recommendations for modifications to the Watershed Management Program solicited through a public participation process."

As additional data become available through CIMP monitoring, BMP effectiveness studies, special studies such as the Toxics TMDL required Stressor ID Study, and other scientific studies, they will be integrated and assessed to determine whether programs in the EWMP should be altered to enable compliance in the most efficient manner.

The adaptive management framework will allow the EWMP Agencies to develop an overall program consisting of efficient solutions based on evolving watershed priorities.

8.1 BMP Effectiveness Monitoring

BMP effectiveness monitoring will be conducted for 3 years following BMP implementation. Monitoring will be tailored to the type of BMP and will include inflow versus outflow stormwater volume assessments as well as inflow and outflow constituent concentrations (or TSS) where applicable. Data collected will be compared to the effectiveness assumptions used in the RAA analysis and if actual effectiveness differs from effectiveness used in the model, the model will be re-run using the actual effectiveness data gathered. This will enable the adaptation of BMP strategies as they are being implemented to address TMDL compliance milestones.

8.2 CIMP Monitoring and Assessment Program

The EWMP Agencies submitted the MdR Watershed CIMP to the LARWQCB in June 2014. One of the main objectives of the CIMP is to leverage resources and create a regionally efficient and effective monitoring program.

The integrated review of existing monitoring programs, TMDL implementation plans, the Regional Board-approved Bacteria TMDL CMP, Toxics TMDL CMPs, and the monitoring data that were used in the development of the 2014 MdR Watershed CIMP represent the "Initial Assessment" of existing conditions in the MdR Watershed.

Lessons learned during planning and implementation of Year 1 of the MdR Watershed CIMP (i.e., monitoring station appropriateness and safety considerations for wet weather receiving water monitoring) will be tracked and integrated into the overall program assessment during the quality assurance/quality control review of monitoring data and annual reporting. Each annual report will present a summary of TMDL and Permit compliance and will provide an opportunity to identify, as appropriate, modifications to the MdR Watershed CIMP protocols based on lessons learned and monitoring data. A formal programmatic review will occur during Years 1 and 2 of the program and will be integrated into the Year 3 implementation. A more comprehensive review and update of the MdR Watershed CIMP monitoring protocols may also become necessary, especially when preparing for the Triad Sampling for SQO analysis (required once during the 5-year Permit Order period in accordance with the SQO guidance).

8.3 CIMP Monitoring Reports and Revision Process

Every 2 years, hence during Year 3 of the implementation of the CIMP monitoring program, available monitoring information will be reviewed in the context of the receiving water monitoring program and outfall-based monitoring objectives.

If changes are needed, at any stage of the CIMP implementation, they will be made to the CIMP, incorporated into monitoring practice, and described in the next Monitoring Annual Report. Identified changes will be discussed in the annual report and implemented starting no later than the first CIMP monitoring event of the next monitoring year. Such changes include, but are not limited to, adding/removing monitored constituents, modifying laboratories/analytical methods, or amending sampling protocols. Should major changes to the approach be required (e.g., moving or removing a stormwater outfall or receiving water monitoring station location), the modifications will be proposed in the annual report and in a separate letter to the Regional Board requesting Executive Officer approval of the change.

Annual monitoring reports for MS4 Permit compliance are required to be submitted by December 15 of every year. These annual monitoring reports will cover the monitoring period of July 1 through June 30. These reports shall clearly identify all data collected during the monitoring year, as well as strategies, control measures, and assessments implemented by each Permittee within its jurisdiction. Annual Reports will also present watershed-scale efforts implemented by multiple Permittees. Discussion shall be provided in accordance with the requirements laid out in MRP Section XVIII. The annual monitoring reports will include the following:

- Annual Assessment and Reporting
    - Stormwater Control Measures
    - Effectiveness Assessment of Storm Water Control Measures
    - Non-Stormwater Control Measures
    - Effectiveness Assessment of Non-Stormwater Control Measures
    - Integrated Monitoring Compliance Report
    - Adaptive Management Strategies
    - Supporting Data and Information

Additionally, semi-annual annual data reports will be submitted with the annual monitoring report, and 6 months prior to the annual report (June of each year). The June 15 data submittal will include data for the monitoring period of July 1 through December 31, and the December 15 data submittal will include data for the monitoring period of January 1 through June 30. These semi-annual analytical data reports detail exceedances applicable to WQBELs, RWLs, action levels, or aquatic toxicity thresholds, with corresponding sample dates and monitoring locations.

Monthly monitoring reports are required for Bacteria TMDL compliance and annual monitoring reports are also required for Toxics TMDL compliance. These data reports will be submitted as an attachment to MS4 Permit required annual reports.

8.4 Special Studies

Special studies carried out in support of TMDL implementation will be used to assess compliance strategies in the MdR EWMP. A Stressor ID Study is required under the Toxics TMDL and is planned to be conducted in the MdR Harbor in the year 2016. This study will identify stressors causing toxicity to biological organisms in the harbor. Results from this study may impact compliance strategies and programs specified in this EWMP and will be evaluated upon completion. The EWMP will be adapted, if necessary, to enable compliance through the most efficient means possible.

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